DRAFT INTERIM REMEDIAL INVESTIGATION REPORT

MARINE CORPS BASE
Camp Lejeune, North Carolina

Contract No. N62470-83-B-6101

Prepared for:

Naval Facilities Engineering Command
Atlantic Division

Prepared by:

Hunter/ESE, Inc.
Plymouth Meeting, Pennsylvania

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TABLE OF CONTENTS
(CONT'D PAGE 2 OF 5)

TABLE OF CONTENTS
(CONT'D PAGE 3 OF 5)

TABLE OF CONTENTS
(CONT'D PAGE 4 OF 5)

TABLE OF CONTENTS
(CONT'D PAGE 5 OF 5)

LIST OF TABLES

LIST OF TABLES
(CONT'D PAGE 2 OF 3)

LIST OF TABLES
(CONT'D PAGE 3 OF 3)

LIST OF FIGURES

LIST OF FIGURES
(CONT'D PAGE 2 of 6)

LIST OF FIGURES
(CONT'D PAGE 3 of 6)

LIST OF FIGURES
(CONT'D PAGE 4 of 6)

LIST OF FIGURES
(Cont'd Page 5 of 6)

LIST OF FIGURES
(CONT'D PAGE 6 of 6)

LIST OF ACRONYMS

AOC	Area of Concern
FMF	Fleet Marine Force
HOLF	Helicopter Outlying Landing Field
HPIA	Hadnot Point Industrial Area
IAS	Initial Assessment Study
LANTDIV	Atlantic Division of the Naval Facilities Engineering Command
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCOLF	Marine Corps Outlying Landing Field
MSL	Mean Sea Level
NACIP	Navy Assessment and Control of Installation Pollutants
O&G	Oil and grease
POL	Petroleum, oil and lubricants
RI	Remedial Investigation
SE	Sediment
SW	Surface water
VOC	Volatile Organic Compounds

1.0 INTRODUCTION

1.1 PURPOSE OF REPORT

The Atlantic Division of the Naval Facilities Engineering Command (LANTDIV) issued a modification to Contract No. N62470-83-B-6101 to Hunter/ESE to prepare a Interim Remedial Investigation (RI) report consolidating all documents produced to date concerning 22 potentially contaminated sites at Marine Corps Base (MCB) Camp Lejeune, North Carolina. The Interim RI report will describe the contamination assessments performed at the areas of concern (AOC), indicate potential migration pathways, summarize all rounds of analytical data collected, and provide recommendations for further action.

The initial stage of the Navy Assessment and Control of Installation Pollutants (NACIP) Program was the Initial Assessment Study (IAS) conducted by Water and Air Research, Inc in 1983. Based on the results of the IAS, LANTDIV issued a contract to perform a Confirmation Study to Environmental Science and Engineering, Inc. in 1983. Efforts on this contract were initiated and data reports were generated in 1984 and 1987. At the Hadnot Point Industrial Area (HPIA), a Characterization Step Report was prepared in 1988. To further characterize the groundwater quality of the ~~Hadnot Point Industrial Area~~, a Contaminated Groundwater Study was conducted by O'Brien and Gere Engineers in December 1988.

This report presents a summary of the environmental data generated by the various field investigations conducted at 22 AOCs within Camp Lejeune since initiation of the Confirmation Study. All nomenclature from the Confirmation Study has been adapted to conform to USEPA (spell out) guidance for conducting CERCLA (spell out) investigations.

1.2 RI OBJECTIVES

The objectives of this report are to:

- Describe the geohydrologic setting at 22 AOCs currently included in the RI/~~FS~~ at Camp Lejeune;

- Determine, to the extent possible using available data, the degree of environmental contamination in the groundwater, surface water, sediment, soils, and fish tissues;

- Determine the rate and direction of groundwater flow and consequent contaminant migration; and

- Identify data gaps in the existing data base and make recommendations regarding the required next steps to proceed efficiently through the RI/FS process.

Spell out

1.3 SITE BACKGROUND

1.3.1 GENERAL

Marine Corps Base (MCB) Camp Lejeune is located in Onslow County, North Carolina (Figure 1). The facility currently covers approximately 170 square miles and is bisected by the New River. The Atlantic Ocean forms the southeastern boundary of the base. The western and northeastern boundaries are U.S. 17 and State Road 24, respectively.

NEED LOCATION MAP

There are five major areas of development at Camp Lejeune: Camp Geiger, Montford Point, Mainside, Courthouse Bay, and the Rifle Range area. Marine Corps Air Station (MCAS) New River, a helicopter base, is a separate command on the west side of the New River. Helicopter Outlying Landing Field (HOLF) Oak Grove, approximately 25 miles to the north, and Outlying Landing Field Camp Davis, 10 miles to the southwest are also under the command of MCAS New River. HOLF Oak Grove is no longer active and is under caretaker status. The property has some camping facilities and occasionally is used for recreation by scouting groups.

SHOW ON MAP

SHOW ON MAP

Camp Davis is no longer MC property -

~~HAVE~~ THESE AREAS BEEN ADDRESSED IN THE IAS - 3 SITES I.D @ HOLF Ø @ OLF NONE REC. FOR C.S.

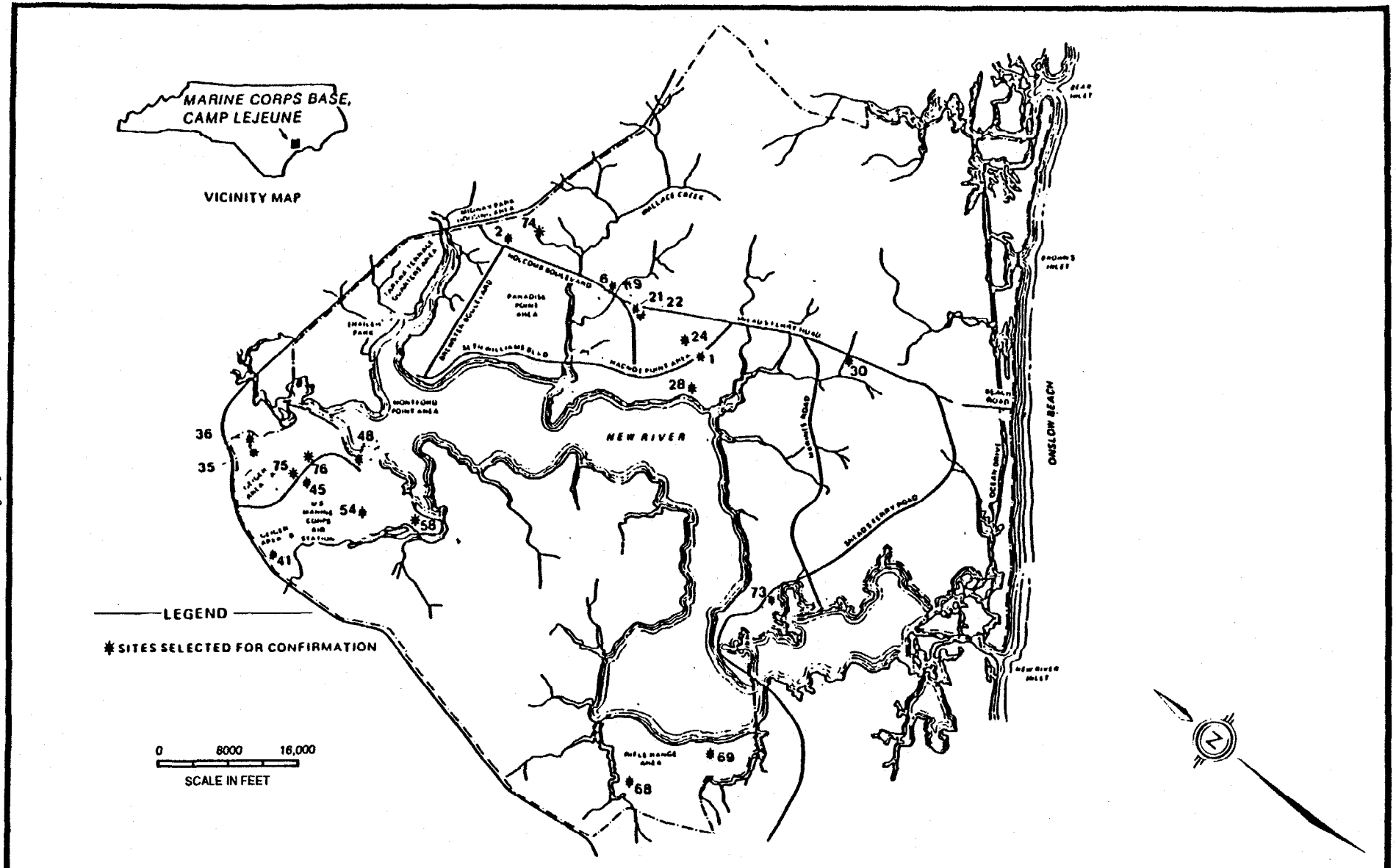


Figure 1
SITE LOCATION MAP
MARINE CORPS BASE, CAMP LEJEUNE

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1984.

MARINE CORPS BASE
CAMP LEJEUNE

Within 15 miles of Camp Lejeune are three large, publicly owned tracts of land; Croatan National Forest, Hofmann Forest, and Camp Davis Forest. In addition to the forested areas, the low elevations of the coastal plain have created vast acreages of inland and coastal wetlands. SHOW ON LOCATION MAP

1.3.2 SITE HISTORY

Construction of MCB Camp Lejeune began in 1941 at Hadnot Point where functions were centered. During construction, 9 million board feet of timber were harvested from the reservation. From 1944 to 1954 a sawmill was operated by base personnel.

During World War II, and the Korean and Vietnam conflicts, Camp Lejeune was used as a training area to prepare Marines for combat. The base serves as the home base for the Second Marine Division, and Fleet Marine Force (FMF) units have also been stationed as tenant commands.

Construction in the Montford Point, Camp Geiger, and Courthouse Bay areas was completed by 1945. Montford Point, originally developed for training of troops is now used for Marine Corps Service Support Schools. Courthouse Bay hosts amphibious training, while Paradise Point is the site of housing for commissioned personnel. Noncommissioned housing is provided at such locations as Tarawa Terrace I and II and Midway Park.

The U.S. Naval Hospital opened in 1943 and has served military personnel during World War II and the Korean War. In addition, the hospital provides medical services for all assigned military personnel and their dependents.

MCAS New River was set up as a separate command in 1951. At that time it was called Peterfield Point, but the name was changed to New River in 1968. In 1942 three new runways were added and the station came under the jurisdiction of MCAS Cherry Point. During this time PBJ squadron was based here and the facility was also used for glider training. During the Korean Conflict, it

SPELL OUT

was used as a helicopter training base and for touch-and-go training for jet fighters.

In 1968, Marine Corps Outlying Landing Field (MCOLF) Oak Grove was placed under the jurisdiction of MCAS New River. The field was used as a helicopter base and renamed HOLF Oak Grove. During World War II, the field was under the command of MCAS Cherry Point. At the end of the war, all structures were destroyed with the exception of the runways.

1.3.3 PREVIOUS INVESTIGATIONS

An Initial Assessment Study (IAS) was conducted by Water and Air Research, Inc. of Gainesville, Florida in 1983. The purpose of the report was to identify and assess sites posing a potential threat to human health or the environment due to contamination from past hazardous materials operations.

Based on information from historical records, aerial photographs, field operations, and personnel interviews, a total of 76 potentially contaminated sites were identified. The IAS ~~initial assessment~~ evaluated each site with regard to contamination characteristics, migration pathways, and pollutant receptors.

The results of the study indicated that while none of the sites posed an immediate threat to human health or the environment, 21 areas warranted further investigation to assess long-term impacts. During the initial investigation at the 21 AOCs, an additional AOC was identified and included in the RI effort. ~~Identify~~ ↑

Based on the recommendations of the ~~Initial Assessment Study~~ IAS, the RI/FS at MCB, Camp Lejeune was begun in 1984. The first round of sample collection and analysis was conducted by Environmental Science and Engineering, Inc. beginning in July 1984. During the investigation, 55 shallow groundwater monitoring wells were installed and a total of 75 groundwater samples were

collected for analyses. In addition to the groundwater samples, 56 soil samples, 7 surface water samples, 8 sediment samples, and 2 fish tissue samples were collected and chemically analyzed. A ~~Final~~ evaluation Report presenting the data generated by this round of sample collection was prepared in January 1985. The report recommended additional monitoring for all of the investigated sites, except #48 which was recommended for characterization — not further verification.

An additional round of sample collection and analysis was conducted by Environmental Science and Engineering, Inc. in 1986/87. In this sampling episode, 29 additional monitoring wells were installed and a total of 113 new and existing monitoring wells were sampled. In addition, 54 soil samples, 44 surface water, and 41 sediment samples were collected and analyzed. A ~~Final~~ evaluation Report was submitted ~~to LANTDIV~~ in July 1987 which ~~evaluated~~ documented the data generated during the second round of sampling.

In 1988 O'Brien and Gere Engineers was retained by LANTDIV under its Underground Storage Tank Program to provide necessary hydrogeologic services to investigate the hydrogeology and evaluate the extent of fuel leakage from the underground storage tanks and associated transfer lines at the Hadnot Point Fuel Farm (Site 22). The purpose of the investigation was to determine the presence of any product pool or soluble hydrocarbons in the groundwater in the vicinity of the fuel farm. The site investigation included the installation of monitoring wells, product thickness measurements, and groundwater sampling and analysis. The results of the Contaminated Groundwater Study were presented in report form to LANTDIV in December 1988.

None of the previous investigations at the AOCs have included activities to determine the site-specific values of aquifer parameters such as horizontal and vertical hydraulic conductivity, storage coefficient, transmissivity, and leakage. These parameters are required to quantify the rate of potential groundwater movement and contaminant transport. All future field efforts

should include the determination of these parameters by the performance of slug tests and/or pumping tests.

1.4 REPORT ORGANIZATION

The RI report is organized into four sections. The purpose of this first section is to provide an overall description of the area under investigation and briefly describe previous activities undertaken to date.

Section 2.0 provides a description of the physical characteristics of the study area. This section provides a description for Camp Lejeune as a whole since there has been a limited amount of specific data generated with respect to hydrology, geology, or soils, in particular.

A summary of the sampling and analytical results of the 22 AOCs at Camp LeJeune are presented in Section 3.0. Site-specific geology along with groundwater contour information is presented for each AOC where monitoring wells were installed. Recommendations for further investigations are also included at the conclusion of each AOC discussion.

Section 4.0 summarizes the work accomplished to date and suggests where further efforts should be expended.

2.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

2.1 SURFACE FEATURES

The Camp Lejeune facility is located in the coastal plain of North Carolina. This coastal plain is characterized by generally flat topography. Specifically, the topography in Camp Lejeune varies from sea level to an elevation of 72 feet above mean sea level (msl), however, the average elevations lie between 20 and 40 feet msl. Along the coast lies a 200 to 500 foot barrier island complex. The dune field located on this barrier island complex ranges in elevation from 10 to 40 feet msl.

Approximately 70 percent of Camp Lejeune is located in the broad, flat interstream areas where drainage is poor and soils are often wet (Atlantic Division, Bureau of Yards and Docks, 1965).

2.2 SURFACE WATER HYDROLOGY

The drainage at Camp Lejeune is predominantly toward the New River, although the coastal areas tend to drain directly into the Atlantic Ocean through the Intercoastal Waterway. The natural drainage has been changed in developed areas by drainage ditches, stormsewers, and extensive asphalt and concrete areas. Drainage sub-basins for the Hadnot Point area and MCAS New River are shown in Figures 2 and 3. Most of the study AOCs are in these two areas.

NEED MORE DESCRIPTION OF WHAT IS SHOWN IN FIGS 2 & 3.

Flooding is a potential problem for areas of the base within the 100-year floodplain. The U.S. Army Corps of Engineers has mapped the limits of the 100-year floodplain at Camp Lejeune at 7.0 feet msl in the upper reaches of the New River and increases to 11.0 feet msl on the open coast (Natural Resources Management Plan, 1975).

for MCB Camp Lejeune

2.3 GEOLOGY

Camp Lejeune is located in the Atlantic Coastal Plain physiographic province. The Coastal Plain is underlain by unconsolidated deposits of sand, and clay

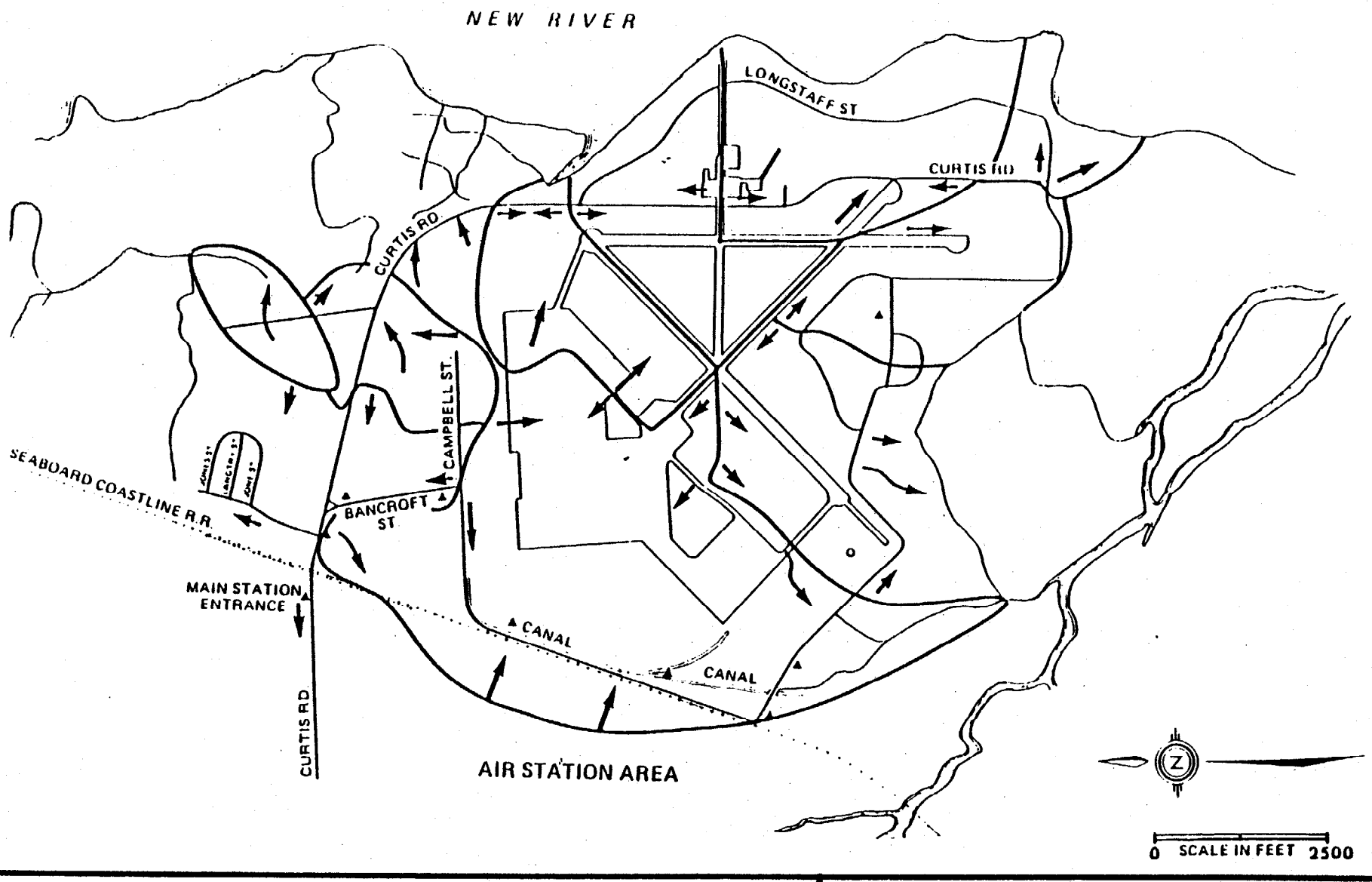


Figure 2
SURFACE WATER DRAINAGE SUB-BASIN AT MCAS NEW RIVER, MCB CAMP LEJEUNE

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1990.

MARINE CORPS BASE CAMP LEJEUNE

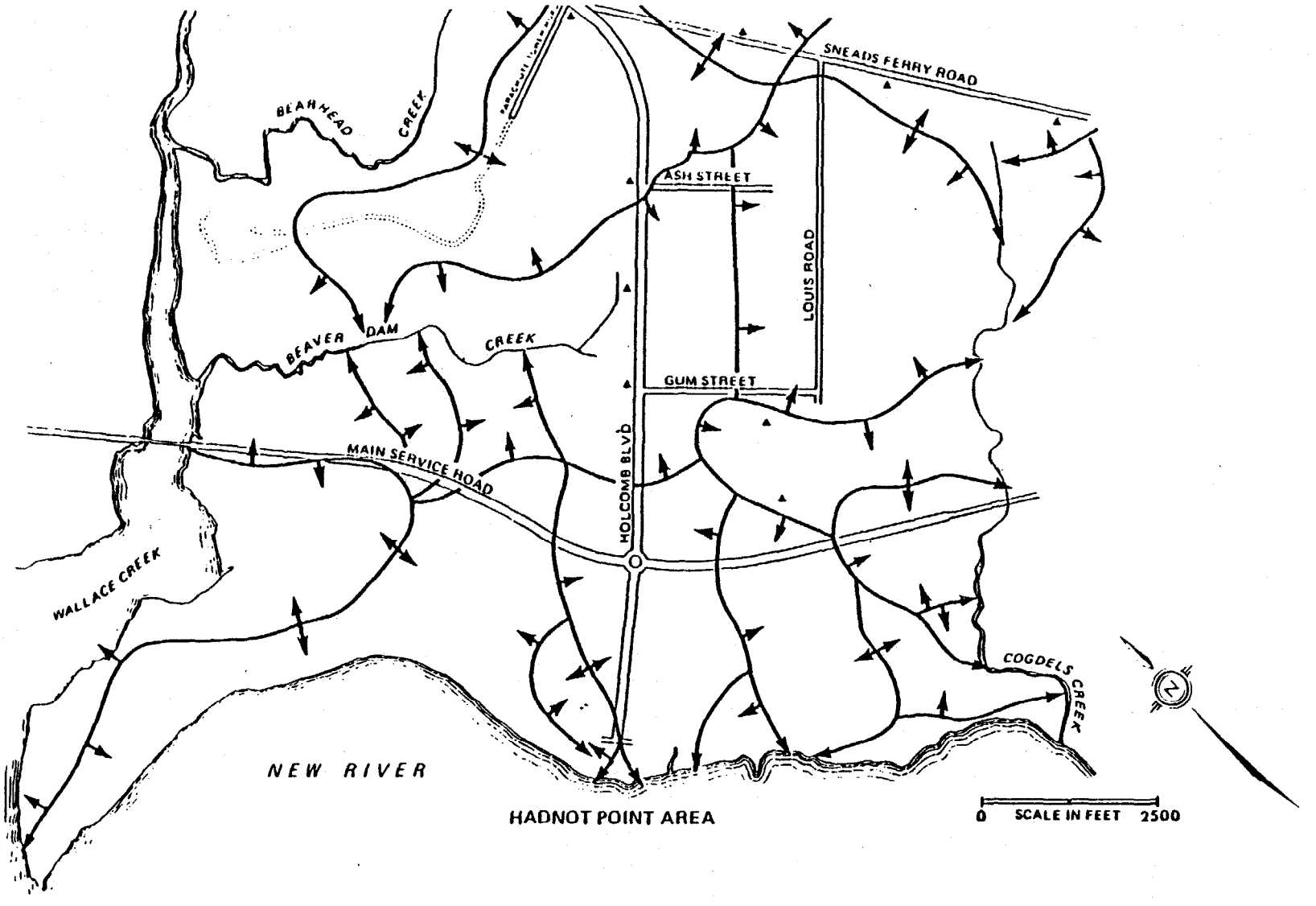


Figure 3
SURFACE WATER DRAINAGE SUB-BASINS AT HADNOT POINT, MCB CAMP LEJEUNE

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1990.

MARINE CORPS BASE CAMP LEJEUNE

LEJEUNE 1990c

with minor amounts of gravel. Also noted are minor amounts of marl shell rock. Regionally, these deposits are gently dipping to the southeast in a thickening wedge that overlies the bedrock (Todd, 1983). These shallow deposits constitute the unconfined aquifer (water table) of the coastal plain. Due to the permeable nature of these sediments, they are vulnerable to both saline encroachment and surface contaminants.

Beneath the area of Camp Lejeune, a sequence of unconsolidated sedimentary deposits approximately 1400 to 1700 feet thick exists. The following discussion involves only the uppermost 300 feet of the sequence which represents the source of fresh water for the base (NCDNR & CD, 1980; Water and Air Research, 1983).

At the top of the sequence, undifferentiated Pleistocene and Recent sands and clays form the seaward thickening band of sediments. These deposits can reach a thickness of 35 feet (NCDNR & CD, 1980; Water and Air Research, 1983).

MCB Camp Lejeune is underlain by seven sand and limestone aquifers separated by confining units of silt and clay (Harned etal, 1989). The seven aquifers are the surficial, Castle Hayne, Beaufort, Peedee, Black Creek, and Upper and Lower Cape Fear. Less permeable clay and silt beds separate the aquifers and serve as confining or semi-confining units which impede the flow of groundwater from one aquifer to another.

WHAT INFO DO WE HAVE TO SUPPORT THIS STATEMENT

Fresh water is present in the surficial and Castle Hayne aquifers at MCB Camp Lejeune. Fresh water extends to a depth of 300 feet (Harned etal, 1989). Aquifers below this depth have been affected by saltwater intrusion.

The surficial aquifer at MCB Camp Lejeune is composed of Quaternary and Miocene sand, silt, and clay. The aquifer ranges in thickness from 0 feet in

the channels of the New River and its tributaries to 75 feet in the southwestern portion of Camp Lejeune (Harned etal, 1989).

The Castle Hayne aquifer is composed of sand and limestone of Oligocene and Middle Eocene age. The upper portion of the aquifer is primarily unconsolidated sand. The lower portion is partially consolidated sand and limestone. Thin clay layers are found throughout the unit. The Castle Hayne aquifer thickens toward the southeast, from 175 feet in the northern portion of the base to 375 feet at the coast. The Castle Hayne aquifer is approximately 340 feet thick in the Hadnot Point Area (Harned etal, 1989).

2.4 HYDROGEOLOGY

Some of the formations in the Coastal Plain are permeable, can be defined as aquifers, and are of wide areal extent. Hydraulic connections between these aquifers are common through complex interbedding creating a complex hydrologic system, which is a common characteristic of Coastal Plain sediments. This complex system may include streams and lakes where the aquifers are at or near the land surface.

In general, the hydrologic system at Camp Lejeune consists of an unconfined (water table) aquifer and semi-confined aquifer. The unconfined aquifer extends from the water table to the first significant confining unit.

The water table at HPIA is found at depths ranging from 6.17 to 22.36 feet below land surface (bls) (ESE, May 1988). Water levels fluctuations in the area range from 1 to 4 feet and are attributed to seasonal variations (Harned etal, 1989).

In general, shallow groundwater flows toward the New River. The direction of flow actually ranges from south-southwest in the northern corner of HPIA to west-southwest in the southwest. Groundwater mounding appears to occur in the west-central and southeastern areas. This may be due to increased

surface infiltration and a drainage ditch in the west-central and southern sections respectively (ESE, May 1988). The horizontal flow gradient over most of the area is approximately 0.003 feet/ft, but does increase to 0.02 feet/ft in the southwest corner of the site.

Water levels measured in deep and intermediate wells are similar to those observed in nearby shallow wells. Additional data is required before a potentiometric surface map can be generated for the deep aquifer, however, it is expected that deep groundwater flows to the east-southeast, towards the Atlantic Ocean (ESE, May 1988). Small-scale regional changes in groundwater flow may occur in the deep aquifer due to local pumping of water supply wells. The USGS (Harned etal, 1989) notes that flow gradients may range from 15 feet/mile (0.0028 feet/ft) in areas unaffected by pumping to 150-200 feet/mile (0.0284-0.0378 feet/ft) in areas near active water supply wells.

A 72 hour pumping test performed at HPIA by ESE in 1987 indicates average transmissivity and storage coefficient values of 9.6×10^{-3} gpd/ft and 8×10^{-4}, respectively for the limestone portion of the deep (Castle Hayne) aquifer. These values are in general agreement with those reported by the USGS (Harned etal, 1989). Hydraulic conductivity for the Castle Hayne is reported at an average of 35 ft/day with a range between 19-82 ft/day by the USGS (Harned etal, 1989).

Further analysis of the Hunter/ESE deep pumping test data indicates that the limestone portion of the deep aquifer is semi-confined. Recharge occurs through a clayey layer overlying the aquifer. Hydraulic conductivity for this layer is estimated at 4.6×10^{-3} ft/day, typical of silty sands and silty clays.

2.5 LAND USE

Within 15 miles of Camp Lejeune are three large, publically owned tracts of land; The Croatan National Forest, The Hofman Forest, and Camp Davis Forest.

land use section should address both on-station & off-station land uses.

Because of the low elevations in the Coastal Plain the majority of the area is composed of wetlands. In addition these areas to some extent have been exploited by agriculture and silvaculture interests. There is a growing concern on a state and national level that these ecosystems, unique to the Coastal Plain, require a protected status to survive.

The remaining land use is agriculture with typical crops of soybean, small grains, and tobacco.

3.0 NATURE AND EXTENT OF CONTAMINATION

3.1 SITE 1 - FRENCH CREEK LIQUIDS DISPOSAL AREA

3.1.1 SITE BACKGROUND

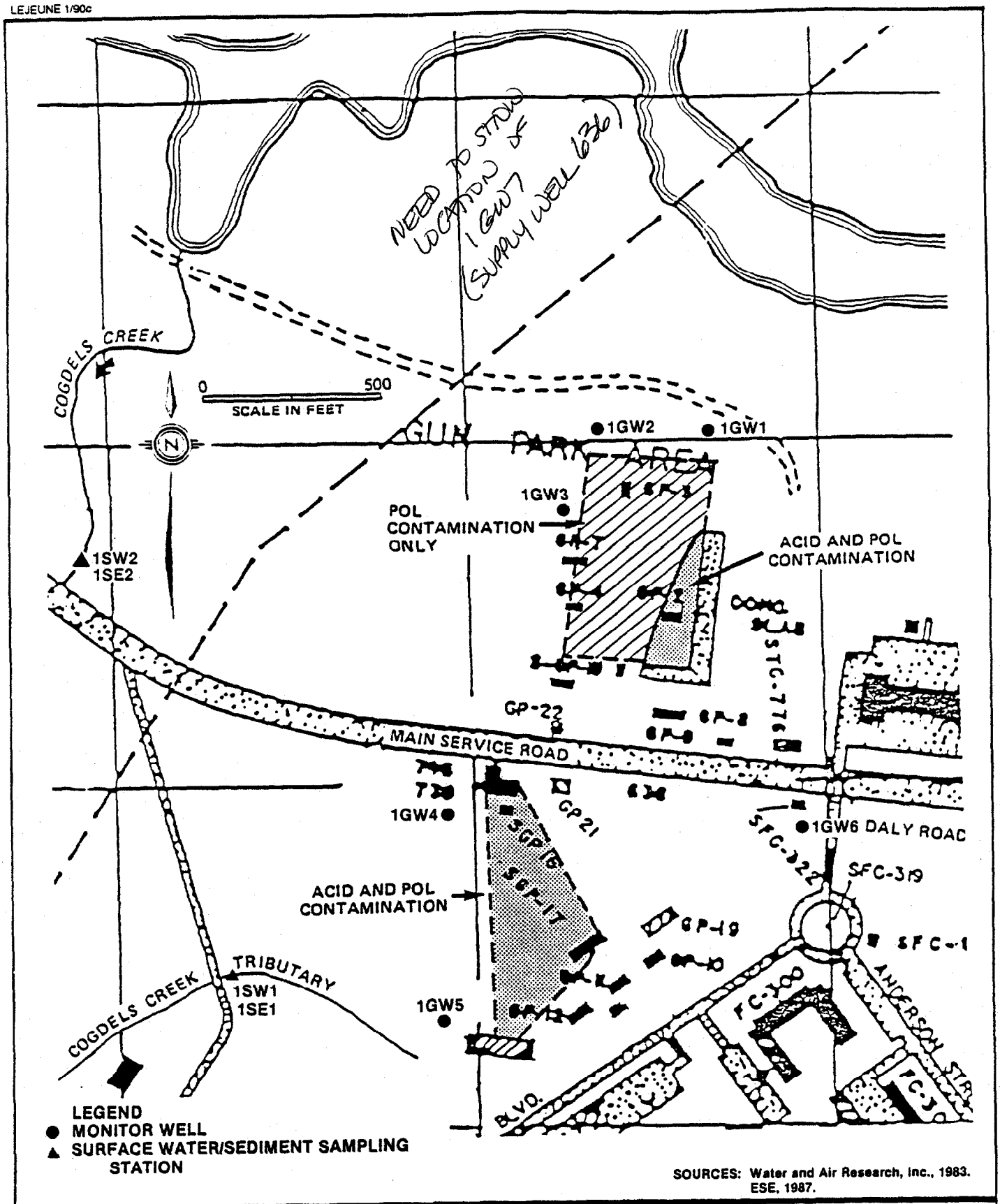
This AOC is located on both the north and south sides of Main Service Road at the western edge of the Gun Park Area and Force Troops Complex (PWDM Coordinates 11, C7/D7). The total area for the AOC is approximately 7 to 8 acres (Figure 1-1). Site 1 has been used by many different Marine organizations since the 1940's. Liquid wastes from vehicle maintenance activities were poured on the ground as part of routine operations. Batteries and used battery acid were also disposed of at this location. Suspected quantities of waste are estimated to be: 5,000 to 20,000 gallons of waste petroleum, oil, and lubricants (POL) and 1,000 to 10,000 gallons of battery acid.

The area is underlain by silty and clayey sand. Gravelly sand and a limestone marl were also encountered during previous drilling efforts. A geologic cross section (Figure 1-2) has been drawn on a north-south line (Figure 1-3). The surface of the shallow groundwater lies within the silty sand at a depth of 7 to 17 feet below land surface. Groundwater flow is generally to the west towards Cogdels Creek at a dip of approximately 1/2 degrees (Figure 1-4).

3.1.2 SITE INVESTIGATION

GROUNDWATER

Six shallow monitoring wells were installed to characterize the groundwater at this site (Figure 1-1); 5 of the wells were installed downgradient and one upgradient. Groundwater from the six wells was sampled in July 1984 and again in November 1986. An onsite water supply well, 1GW7 (No. 636) was also sampled in July 1984. The groundwater samples were analyzed for the following analytes:



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 1-1
SAMPLING LOCATIONS, SITE 1—
FRENCH CREEK LIQUIDS DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE

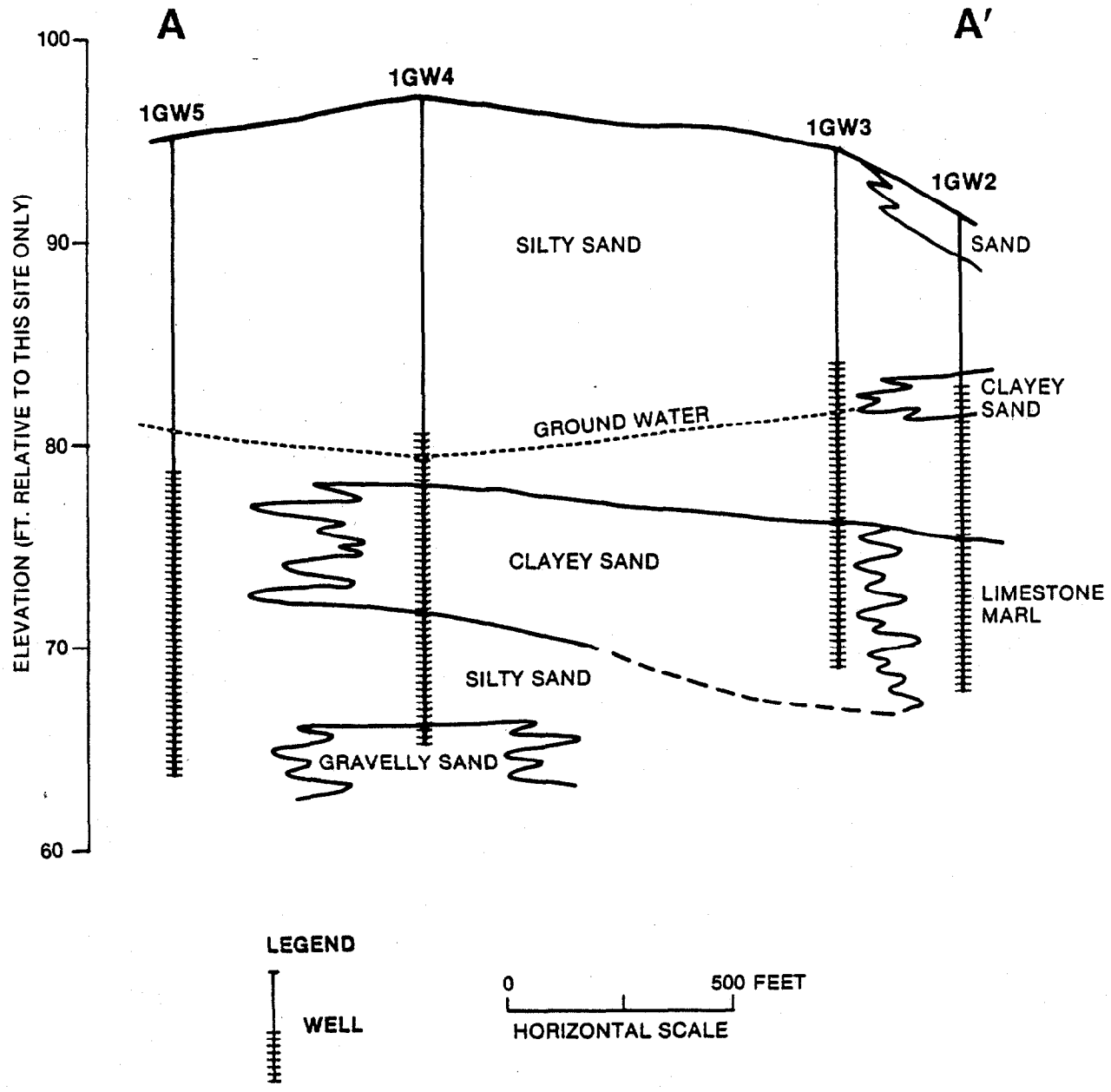
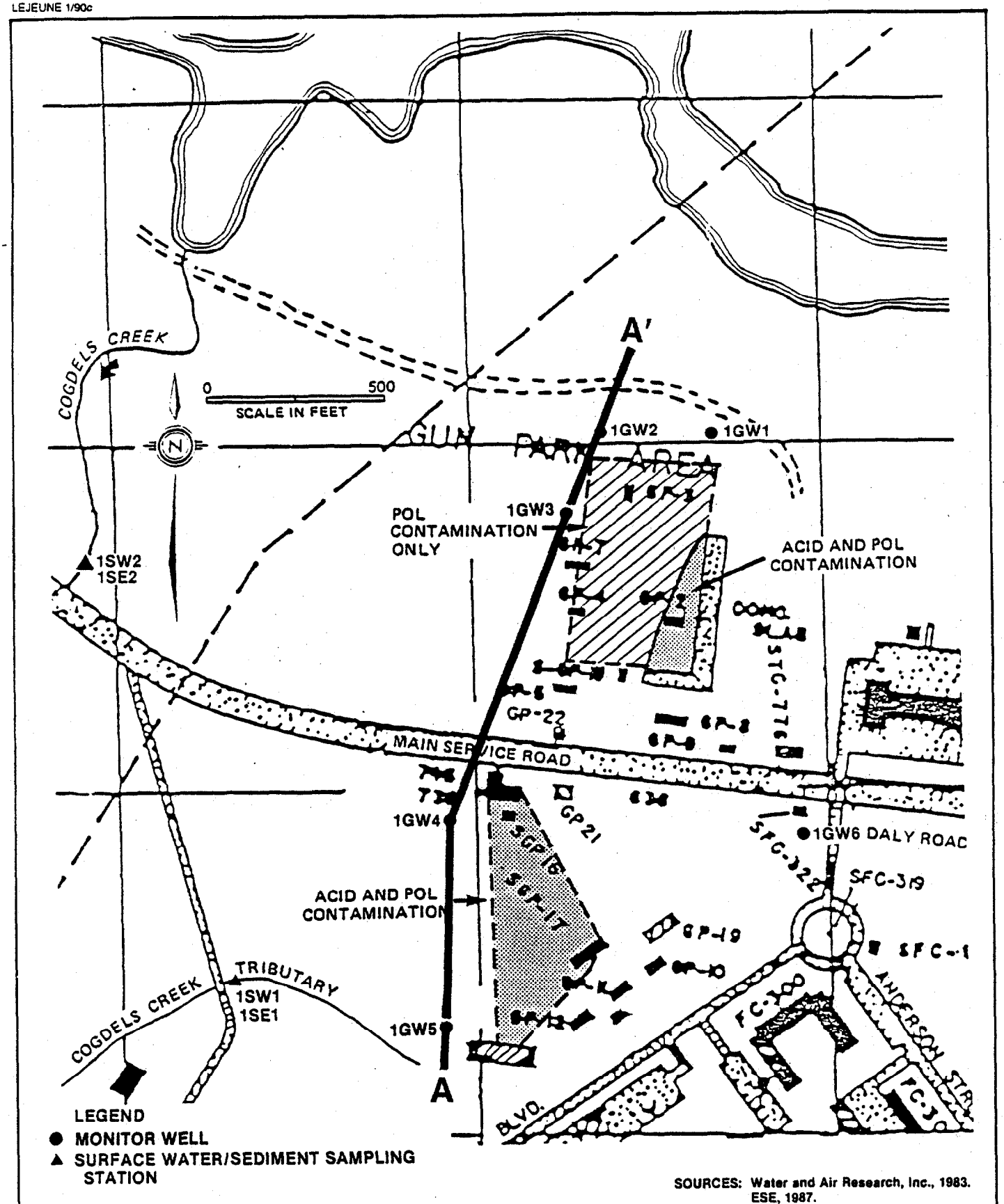


Figure 1-2
GEOLOGIC CROSS SECTION, SITE 1—
FRENCH CREEK LIQUIDS DISPOSAL AREA

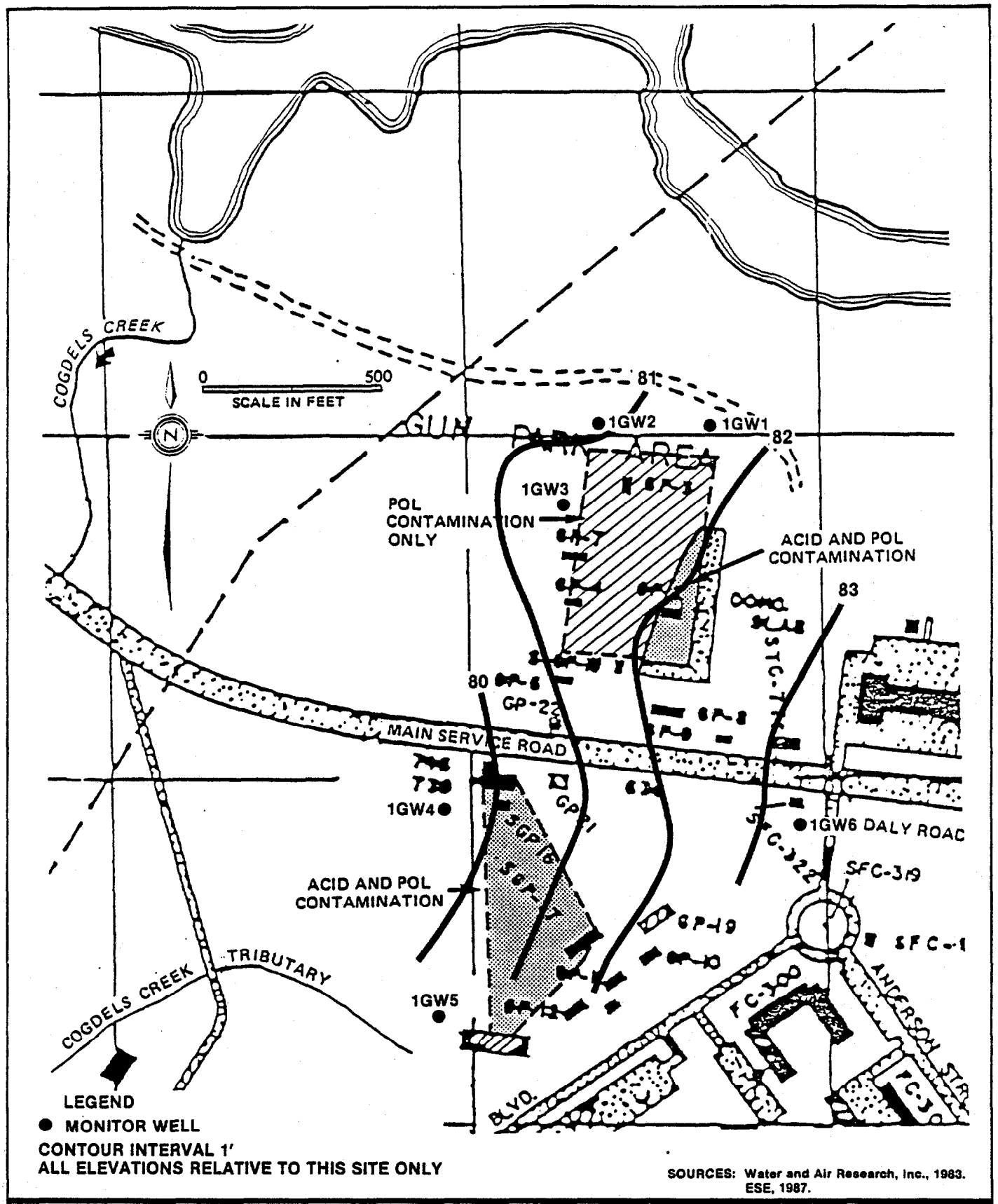
MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 1-3
GEOLOGIC CROSS SECTION LOCATION, SITE 1—FRENCH CREEK LIQUIDS DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 1-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 1—
FRENCH CREEK LIQUIDS DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE

- Cadmium
- Chromium
- Hexavalent Chromium (1986 only)
- Lead
- Antimony
- Oil & Grease (O&G)
- Volatile organics (VOC)
- Total Phenols
- Xylene (1986 only)
- Methylethyl ketone (MEK) (1986 only)
- Methyl isobutyl ketone (MIBK) (1986 only)
- Ethylene dibromide (EDB) (1986 only)

Appendix A presents a complete listing of all target analytes and their abbreviations.

Table 1-1 presents the analytical data from both rounds of sampling. Only those target analytes that were detected above the method detection limit are reported on the table.

As shown in Table 1-1, several VOCs were detected in samples collected from Well 1GW5 during both rounds of sampling. This well is located on the southernmost portion (farthest downgradient) of the site. Wells 1GW1, 1GW2, and 1GW6 all had trace levels of VOCs, including phenols detected in samples collected in July 1984 and November 1986.

All of the groundwater samples from the six monitoring wells contained quantifiable amounts of cadmium, chromium and lead. The sample collected from the water supply well (1GW7) did not contain VOCs or metals above detection limits.

TABLE 1-1. SITE 1 – FRENCH CREEK LIQUIDS DISPOSAL AREA
DETECTED TARGET ANALYTES
GROUNDWATER SAMPLES

UPGRADIENT WELL — SUPPLY WELL

DATE / PARAMETER	1GW1 7/5/84	1GW1 11/18/86	1GW2 7/5/84	1GW2 11/18/86	1GW3 7/5/84	1GW3 11/19/86	1GW4 7/5/84	1GW4 11/18/86	1GW5 7/7/84	1GW5 11/18/86	1GW6 7/5/84	1GW6 11/18/86	1GW7 7/5/84	STANDARD OR ARAR
BENZENE	0.5	<4.4	<0.3	<4.4	<0.3	<1.0	<0.3	<4.4	<0.3	<4.4	<0.3	<4.4	<0.3	
1,1-DICHLOROETHANE	<0.5	<4.7	<0.5	<4.7	<0.5	<4.7	<0.5	<4.7	2.7	6.7	<0.6	<4.7	<0.5	
1,1-DICHLOROETHYLENE	<1.0	<2.8	<1.0	<2.8	<1.1	<2.8	<1.0	<2.8	1.1	2.8	<1.2	<2.8	<1.1	
T-1,2-DICHLOROETHENE	1.0	3.4	<1.0	2.0	<1.0	<1.6	<1.0	<1.6	2.4	2.4	<1.2	<1.6	<1.0	
1,1,2,2-TETRACHLORO ETHANE	<0.7	<4.1	<0.7	<4.1	<0.8	<4.1	<0.7	<4.1	4	<4.1	<0.8	<4.1	<0.8	
TETRACHLOROETHENE	<1.5	<4.1	<1.5	<4.1	<1.5	<3.0	<1.5	<4.1	6.8	<4.1	<1.7	<4.1	<1.5	0.7
1,1,1-TRICHLOROETHANE	<1.0	<3.8	<1.0	<3.8	<1.0	<3.8	<1.0	<3.8	<1.0	<3.8	14	<3.8	<1.0	
TRICHLOROETHENE	2	4.6	1.3	3.2	<1.2	<3.0	<1.1	<1.9	5.2	2.2	<1.3	<1.9	<1.2	
TOLUENE	<0.5	<6.0	<0.5	<6.0	0.6	<6.0	<0.5	<6.0	0.9	<6.0	<0.6	<6.0	<0.5	
CADMIUM	<6.0	<6.0	7	<6.0	10	<6.0	7	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	5.0
CHROMIUM	94	23.6	160	110	29	26.6	49	54.3	7	<15	34	28.8	<6.0	50.0
LEAD	43	<36	136	49.1	55	48.7	<40	<36	<40	<36	51	<36	<40	50.0
OIL & GREASE	2	<0.2	2	<0.2	3	0.4	2	<0.2	<0.7	<0.2	<0.8	<0.2	<0.8	
PHENOLS	2	4	<1	4	2	3	2	<2	2	6	<6	19	<5	

All units are in micrograms per liter (ug/L).

Source: Hunter/ESE, 1990.

Oil & grease (O&G) was identified in samples collected from Wells 1GW1, 1GW2, 1GW3, and 1GW4. This target analyte was detected more often in the samples collect in July 1984 than in samples collected in November 1986.

SURFACE WATER/SEDIMENT

Two surface water and sediment samples were collected from Cogdels Creek and a tributary to the creek. These samples were collected only during the November 1986 round of sampling. The surface water samples were analyzed for the same parameters as the groundwater samples. Sediment samples were analyzed for the following:

- o Cadmium
- o Chromium
- o Hexavalent Chromium
- o Lead
- o Antimony
- o Oil & Grease (O&G)
- o Total Phenols
- o Ethylene dibromide (EDB)

Table 1-2 presents the analytes detected for the surface water samples. Detected target analytes in the sediment samples are presented in Table 1-3. All of the samples contained total chromium, phenols and O&G.

3.1.3 SUMMARY AND CONCLUSIONS

The groundwater contour map (Figure 1-4) indicates that flow in the shallow aquifer is from Site 1 toward Cogdels Creek. The measured gradient suggests that the site is characterized by low natural groundwater gradients. Based on site maps, it appears that the shallow aquifer eventually discharges into the New River. Organic contaminants and several metals were detected in samples collected from the shallow aquifer. These contaminants however were not noted in the deeper aquifer sample; thus the data suggest that vertical migration is not occurring.

DISCUSS FINDINGS IN UPGRADIENT WELL (ALL WELLS CONTAIN METALS)

IF 1GW6 IS AS CONTAM. AS 1GW1-5 DO WE REALLY KNOW SOURCE OF CONTAMINATION HERE?

ADD DISCUSSION OF DETECTION LIMITS VS STANDARDS.

TABLE 1-2. SITE 1 - FRENCH CREEK LIQUIDS DISPOSAL AREA
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES

IF NONE SO STATE

ARAR

DATE	1SW1 11/18/86	1SW2 11/18/86
PARAMETER		
CHROMIUM	7.3	<5.4
OIL & GREASE	0.8	0.2
PHENOLS	13	3

All units are in micrograms per liter (ug/L).

Source: Hunter/ESE, 1990.

Combine Tables 1-2 and 1-3 onto one page

TABLE 1-3. SITE 1 - FRENCH CREEK LIQUIDS DISPOSAL AREA
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

IF NONE SO STATE

ARAR

DATE / PARAMETER	1SE1 11/18/86	1SE2 11/18/86
CHROMIUM	20.8	3.69
OIL & GREASE	712	1460
PHENOLS	116	<90

All units are in micrograms per gram (ug/g).

Source: Hunter/ESE, 1990.

The levels of cadmium found in the samples collected from Wells 1GW2 and 1GW4 (7 ug/1) and 1GW3 (10 ug/1) were above the North Carolina groundwater standard established for this metal (5 ug/1). The groundwater standard for chromium (50 ug/1) was exceeded in samples collected from Wells 1GW1 (94 ug/1), 1GW2 (160 ug/1), and 1GW4 (54.3 ug/1). Groundwater samples from Wells 1GW2 and 1GW3 were also above the established standard for lead (50 mg/1).

O&G has been found in all media sampled at this AOC. This is not surprising since waste petroleum, oil and lubricants (POL) were known to be disposed of at this location. The O&G identified in the surface water and sediment samples seem to be associated with the past activities at this site. These contaminants may be impacting Site 28 located further downstream on Cogdels Creek.

3.1.4 RECOMMENDATIONS

The existing monitor well network at Site 1 has identified low levels of VOCs and metals. Of special concern is the presence of tetrachloroethane (1GW5) at a concentration of 6.8 micrograms per liter (ug/1) which is in excess of the state standard of 0.7 ug/1. In addition, cadmium, chromium, and lead were detected at levels greater than the applicable state groundwater standards. It should be noted that all existing monitor wells are located on the downgradient edge of the suspected center of contamination. It is possible that greater concentrations of detected contamination are present within the former disposal features. Although contamination of the shallow aquifer has been documented, sampling of adjacent deep water supply wells indicate that this contamination has not migrated vertically.

In order to provide an adequate database for completion of the RI/FS at this AOC, additional groundwater quality characterization is required within the specific disposal features identified by the IAS effort. This characterization may be difficult to accomplish because of the presence of a large building and concrete paving over most of the area. Additional data

needs of the RI/FS include chemical characterization of any affected unsaturated soils. To date, no chemical sampling of the soils have been conducted. Following adequate characterization of the affected environmental media, a Risk Assessment should be conducted to determine if the detected contamination represents a unacceptable risk to health and/or the environment.

3.2 SITE 2 - FORMER NURSERY/DAY-CARE CENTER

3.2.1 SITE BACKGROUND

From 1945 to 1958 this building (PWDM Coordinates 5, K10) was used for the storing, handling, and dispensing of pesticides. The building at this location was later used as a children's day-care center. Chemicals known to have been used include: chlordane, DDT, diazinon, and 2,4-D. Chemicals known to have been stored onsite include dieldrin, lindane, malathion, silvex, and 2,4,5-T. Areas of suspected contamination are the fenced playground, the mixing pad, the wash pad, and railroad drainage ditch (Figure 2-1). Contamination is believed to have occurred as a result of small spills, washout and excess disposal. A preliminary soil sampling investigation conducted at this AOC in 1982 indicated the presence of DDE, DDD, DDT, and chlordane. Based on these results, the day care activities were moved to another location.

A geologic cross section (Figure 2-2) was drawn on a northwest-southeast line (Figure 2-3) and shows the site to be underlain by a sequence of clayey silt, silty sand, clay and clayey sand, and silty sand and sand. These units overlie a layer of clay found at a depth ranging from 24 to 28 ft. Depth to groundwater ranges from 7 to 20 ft below land surface. The groundwater contour map (Figure 2-4) shows the groundwater flow to be generally to the southeast with a gradient approximately 0.14 foot per foot (ft/ft).

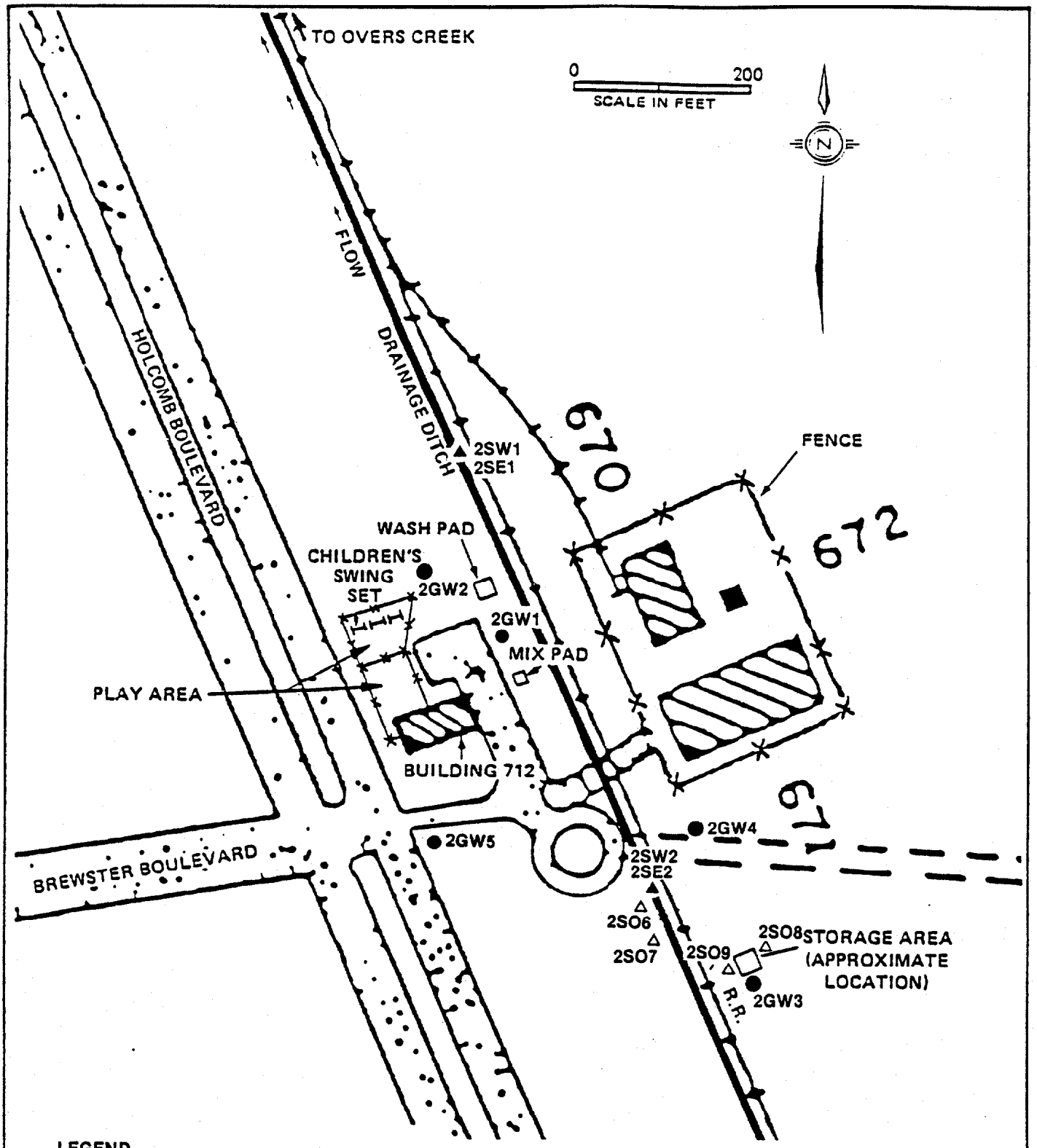
3.2.2 SITE INVESTIGATION— NEED TO IDENTIFY ARAR'S FOR EACH MEDIA, IF AVAILABLE

GROUNDWATER

Five shallow monitoring wells were installed and sampled in July 1984, December 1986 and March 1987 to determine the presence or absence of contaminants in the shallow aquifer. In addition four water supply wells were sampled in July 1984 to characterize the deeper aquifer.

The shallow well locations are identified in Figure 2-1. The water supply wells are not identified in Figure 2-1 since they are on average 1000 ft

LEJEUNE 1/90c



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 2-1
SAMPLING LOCATIONS, SITE 2–
FORMER NURSERY/DAY CARE CENTER

MARINE CORPS BASE
CAMP LEJEUNE

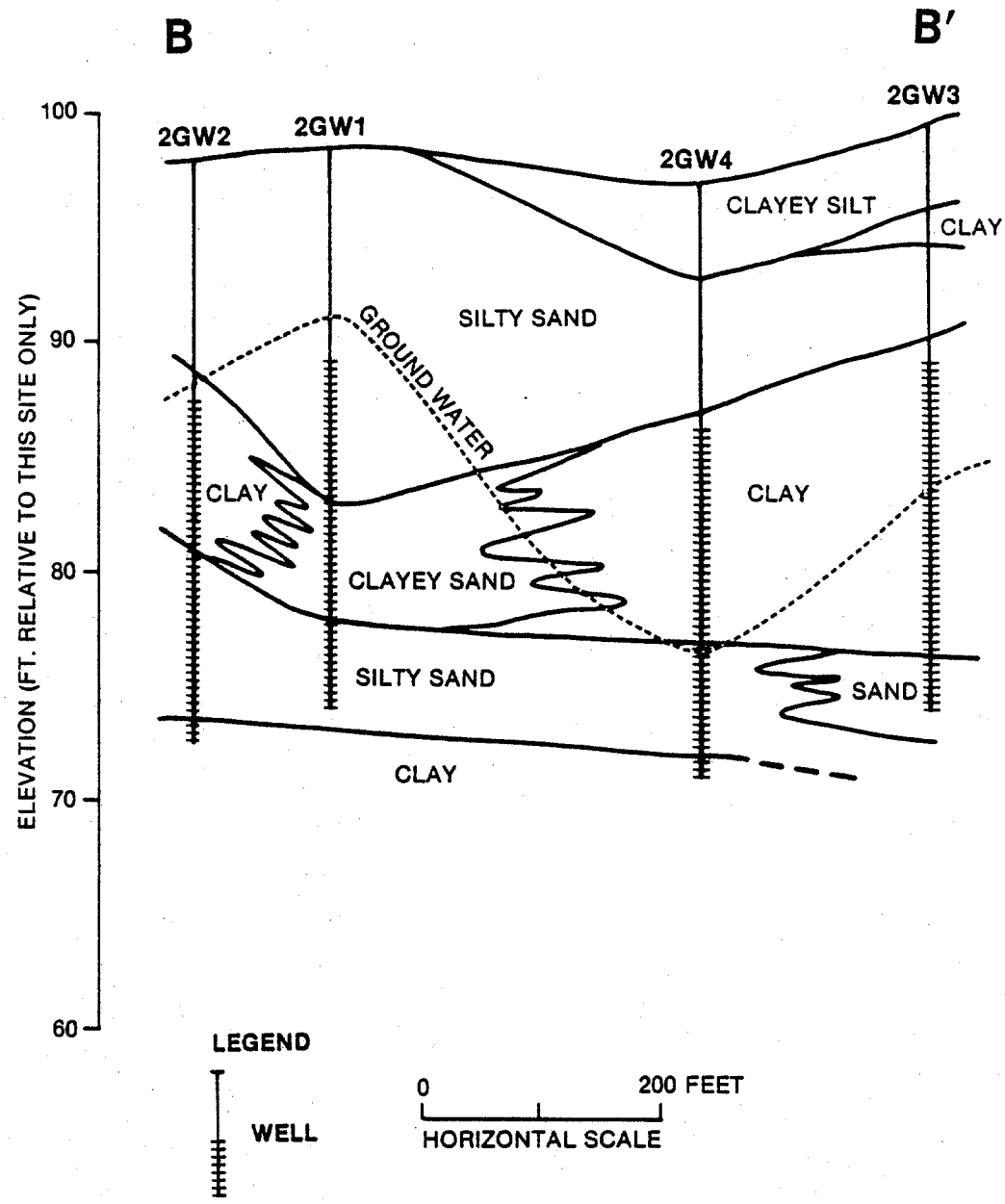


Figure 2-2
GEOLOGIC CROSS SECTION, SITE 2—
FORMER NURSERY/DAY CARE CENTER

MARINE CORPS BASE
CAMP LEJEUNE

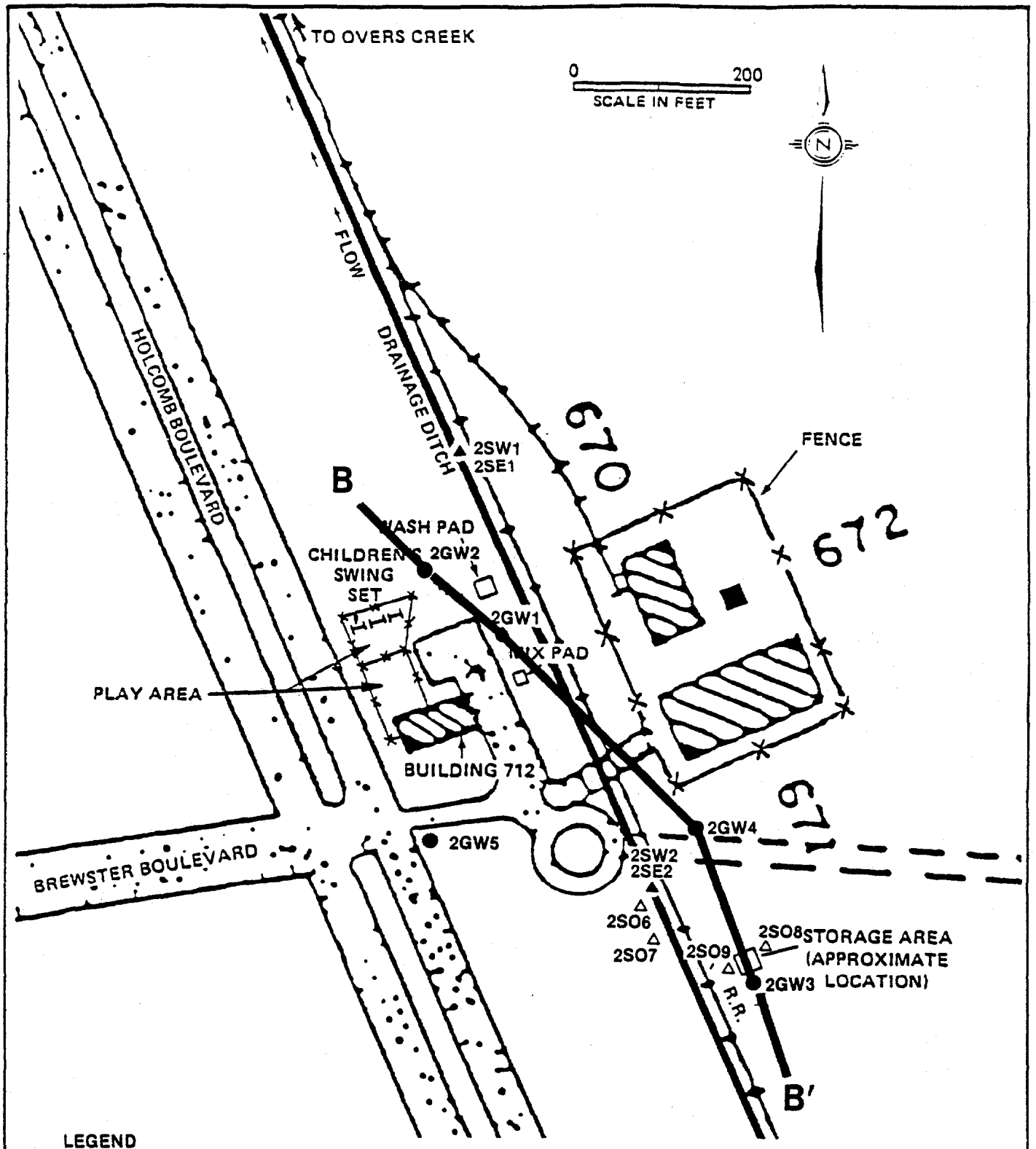
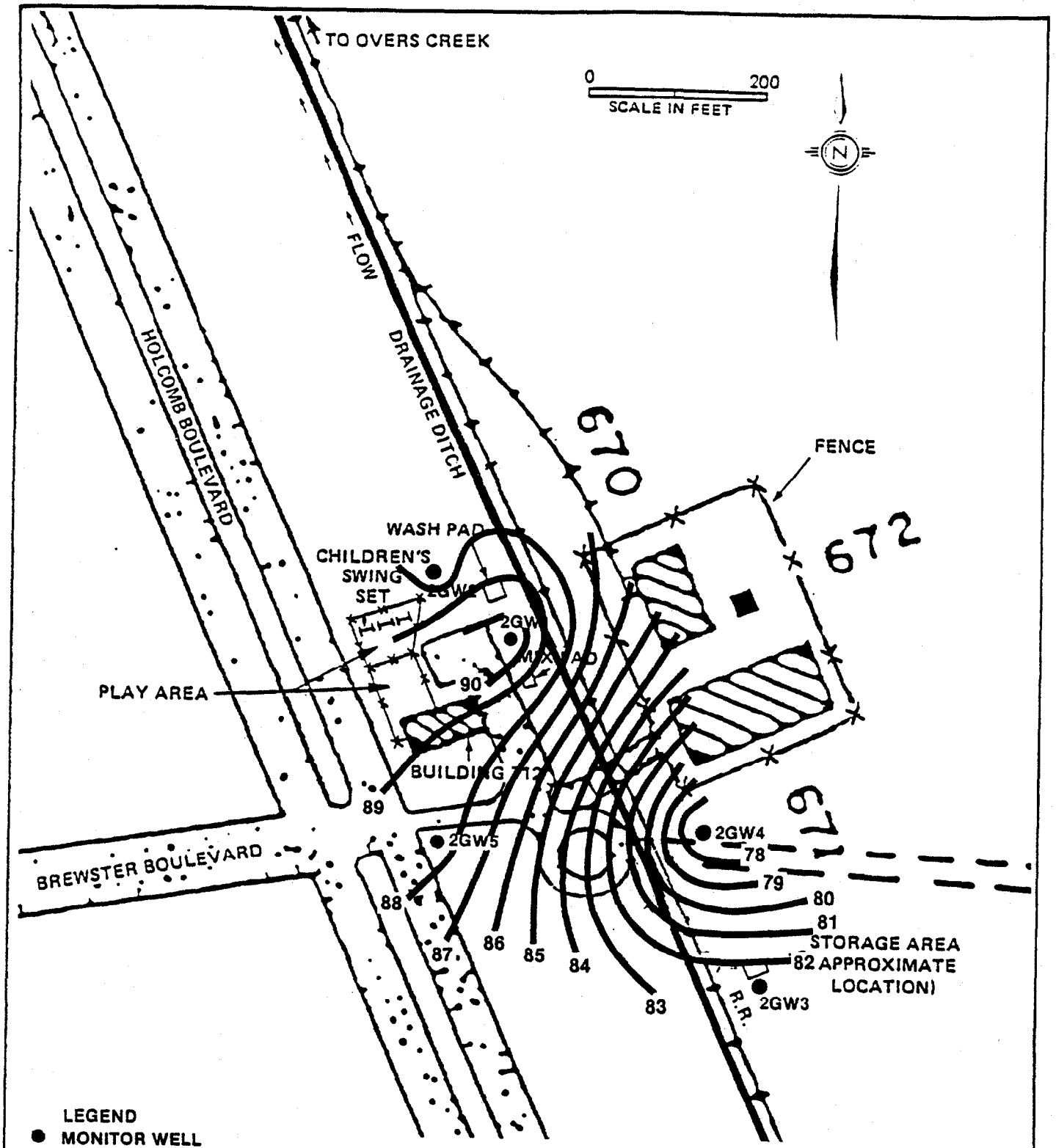


Figure 2-3
GEOLOGIC CROSS SECTION LOCATION, SITE 2—FORMER NURSERY/DAY CARE CENTER

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 2-4
GROUND WATER CONTOUR MAP— SHALLOW AQUIFER, SITE 2— FORMER NURSERY/DAY CARE CENTER

MARINE CORPS BASE CAMP LEJEUNE

north (Building 646), south (Building 616), east (Building 647), and west (Building 645) of the site. The monitoring and water supply wells were analyzed for the following target compounds:

- o Organochlorine pesticides
- o Organochlorine herbicides
- o Tetrachlorodioxin (1986 only)
- o Volatile organics (1986 only)

Appendix A presents a complete listing of the target analytes and their abbreviations.

The groundwater samples collected from the four water supply wells did not contain any VOCs above method detection levels.

Table 2-1 presents the analytical results of the groundwater samples collected from the five shallow monitoring wells. Trace amounts of DDD, DDE, and DDT were identified in Wells 2GW1 (July 1984 sampling event) and 2GW3 (1986 sampling event). Well 2GW3 also contained two VOCs, ethylbenzene and toluene.

SURFACE WATER/SEDIMENT

Two surface water samples were collected in December 1986 from the drainage ditch which parallels the railroad tracks along the eastern boundary of Site 2 (Figure 2-1). The ditch drains in a north-northwest direction towards Overs Creek. The surface water samples were analyzed for the same target compounds as the groundwater.

Table 2-2 indicates that DDD was identified in both surface water samples; DDT was detected in the downstream sample (2SW1) but not in the upstream sample (2SW2).

TABLE 2-1. SITE 2 - FORMER NURSERY/DAY CARE CENTER (BLDG. 712)
DETECTED TARGET ANALYTES
GROUNDWATER SAMPLES

	2GW1	2GW1	2GW2	2GW2	2GW2	2GW3	2GW3	2GW3	2GW4	2GW4	2GW4	2GW5	2GW5	2GW5
DATE	7/5/84	12/02/86	7/5/84	12/02/86	3/03/87	7/5/84	12/02/86	3/03/87	7/5/84	12/02/86	3/03/87	7/7/84	12/02/86	3/03/87
PARAMETER														
DDD,PP'	0.029	0.03	<0.003	<0.013	<0.012	<0.003	0.097	<0.012	<0.003	<0.013	<0.012	<0.003	<0.013	<0.012
DDE,PP'	0.016	<0.013	<0.0008	<0.013	<0.012	<0.0008	0.057	0.02	<0.0008	<0.013	<0.012	<0.0008	<0.013	<0.012
DDT,PP'	0.15	<0.013	<0.005	<0.013	<0.012	<0.005	0.544	<0.012	<0.005	<0.013	<0.012	<0.005	<0.013	<0.012
ETHYLBENZENE	NRQ	<7.2	NRQ	<7.2	<7.2	NRQ	330	510	NRQ	<7.2	<7.2	NRQ	<7.2	<7.2
TOLUENE	NRQ	<6.0	NRQ	<6.0	<6.0	NRQ	12	<60	NRQ	<6.0	<6.0	NRQ	<6.0	<6.0

NRQ:

All units in micrograms per liter (ug/L), ppb.

Source: Hunter/ESE, 1990.

ARAR

TABLE 2-2. SITE 2 - FORMER NURSERY/DAY CARE CENTER (BLDG. 712)
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES

	2SW1	2SW2
DATE	12/02/86	12/02/86
PARAMETER		
DDD,PP'	0.742	0.027
DDT,PP'	0.560	<0.013

ARAR

All units in micrograms per liter (ug/L).

Source: Hunter/ESE, 1990.

In August 1984 two sediment samples were collected from the drainage ditch, up- and downstream of the building. In December 1986 two sediment samples were collected from the same locations as the surface water samples. The sediment samples were analyzed for organochlorine pesticides and herbicides and for tetrachlorodioxin (1986 only). Table 2-3 presents the analytical results for the four sediment samples. DDD, DDE, and DDT were identified in the upstream samples in both 1984 and 1986. The concentrations of these compounds increased considerably in 1986. The upstream sediment sample also contained 2,4,5-T in the 1986 sampling event. As Table 2-3 indicates the three metabolites of DDT were also detected in the downstream sediment sample. The concentrations of DDD and DDT were significantly higher than the upstream samples.

SOIL

Three soil borings were hand augered in the former play area during the August 1984 sampling investigation. Three composite soil samples (0-1'(A), 1-2'(B), 2-3'(C)) were collected from each boring and analyzed for organochlorine pesticides and herbicides. Table 2-4 indicates that all three of the shallow samples (0-1'(A)) contained DDD, DDE, and DDT. DDE was also detected in all of the intermediate depth samples (1-2'(B)) and deepest (2-3'(C)) samples. The concentrations of all metabolites appeared to decrease with depth.

In the November 1986 sampling event, two soil samples were collected adjacent to the upstream surface water/sediment sampling location. These locations (2SO6 and 2SO7) are shown in Figure 2-1. Table 2-3 presents the analytical data and indicates that the sample farthest upstream (2SO7) contained the most contaminants. The herbicide 2,4-D was identified in both of these soil samples, however it was not identified in the sediment sample which was in close proximity.

THIS SHOULD NEEDS FURTHER EXPLANATION

TABLE 2-3. SITE 2 - FORMER NURSERY/DAY CARE CENTER (BLDG. 712)
DETECTED TARGET ANALYTES
SOIL/SEDIMENT SAMPLES

	2S4	2S0-6	2S0-7	2SE2	2S5	2SE1	2S0-8	2S0-9
DATE	8/3/84	11/11/86	11/11/86	12/02/86	8/3/84	12/02/86	11/11/86	11/11/86
PARAMETER								
DDD,PP'	11	<11.4	<11.8	1570	<0.7	4160	<11.5	1320
DDE,PP'	56	<11.4	50.2	861	<0.3	805	25.9	138
DDT,PP'	150	<17.2	115	168	<1.6	3530	87.4	147000
2,4-D	<4.2	49.1	48.9	<34.3	<4.3	<33.2	131	<10.1
2,4,5-T	<1.4	<39.9	<44.3	24	<1.4	<19.7	<44.5	<40.4

All units in micrograms per kilogram (ug/kg), ppb

Source: Hunter/ESE, 1990.

TABLE 2-4. SITE 2 - FORMER NURSERY/DAY CARE CENTER (BLDG. 712)
DETECTED TARGET ANALYTES
SOIL SAMPLES

DATE	2S1A 8/3/84	2S1B 8/3/84	2S1C 8/3/84	2S2A 8/3/84	2S2B 8/3/84	2S2C 8/3/84	2S3A 8/3/84	2S3B 8/3/84	2S3C 8/3/84
PARAMETER									
DDD,PP'	2.2	0.6	<0.5	1.2	<0.6	<0.6	3.8	<0.6	<0.6
DDE,PP'	15	2.3	1.5	42	2.6	0.3	35	23	1.2
DDT,PP'	9.5	5.0	<1.2	18	<1.4	<1.4	57	3.1	<1.4

All units in micrograms per kilogram (ug/kg), ppb.

Source: Hunter/ESE, 1990.

HOW DO CONCENTRATIONS STACK UP TO ANAL. STANDARDS & ARARS.

3.2.3 SUMMARY AND CONCLUSIONS

Organochlorine pesticides, particularly DDD, DDE, and DDT are still of major concern at this site. These compounds were found in groundwater, surface water, sediment and soil samples collected during 1984 and 1986 sampling events. In the soil samples, the contamination appears to decrease with depth with DDT and DDE at much higher concentrations than DDD. The concentrations of these same metabolites were much higher in the sediment samples relative to the soil samples, with the downstream sample having the highest detected concentrations. Unlike the soils, however, the DDD was found at higher concentrations than DDE or DDT.

3.2.4 RECOMMENDATIONS

The existing data indicates that soil, groundwater, sediment and surface water has been contaminated by DDT and its metabolites. Soils at several of the pesticide mixing/handling areas have not be adequately characterized. Additional soil sampling is required prior to initiation of a Risk Assessment and FS. In addition, soil contamination by VOCs may have occurred in the southern portion of this AOC as a result of storage of construction equipment. Soils in this area should also be characterized. To date, the water supply wells in the vicinity of Site 2 are unaffected by the detected contamination. Additional geohydrological investigation to determine the potential for interconnection of the shallow and deep aquifers should be performed.

3.3 SITE 6 - STORAGE LOTS 201 AND 203

3.3.1 SITE BACKGROUND

Storage Lots 201 and 203 are located on Holcomb Boulevard between Wallace and Bearhead Creeks (PWDM Coordinates 6, F3-4/G3-4/H2-4/I2-4/J3). Lot 201 is estimated to be approximately 25 acres in size, and Lot 203 is approximately 46 total acres (Figure 6-1). These lots have a long history of various uses, including disposal and storage. The land surface is flat and unpaved, and surface soils have been moved about as a result of regrading and equipment movement. The site was and still is used to store hazardous materials. DDT is reported to have been disposed of at Lot 203 when it served as a waste disposal area in the 1940's. Transformers containing PCBs have also been stored at this site; no spills or leaks have been reported.

A geologic cross-section (Figure 6-2) drawn on a northwest-southeast line (Figure 6-3) shows the site to be underlain by silty sand, sand, and coarse sand. The surface of the shallow groundwater at this site lies within the silty sand at depths ranging from 2 to 15 feet below land surface. The groundwater contour map (Figure 6-4) indicates that the groundwater flows radially toward Wallace Creek and Bearhead Creek at a gradient of approximately 0.009 foot per foot (ft/ft).

3.3.2 SITE INVESTIGATION

GROUNDWATER

Eight shallow monitoring wells were installed during the November 1986 sampling effort. Two sets of groundwater samples were collected in November 1986 and January 1987 and analyzed for VOCs and the o,p- and p,p-isomers of DDD, DDE, and DDT. Table 6-1 presents the analytical results of the sampling events. None of the groundwater samples contained DDT or its metabolites. Only three VOCs were detected in the samples. Benzene and 1,1,2,2-tetrachloroethane were detected in the sample from Well 6GW1 located in the northwest corner of Lot 203 and chloromethane was detected in the sample from Well 6GW6 located just east of lot 201.

Discuss Standards in ARARs

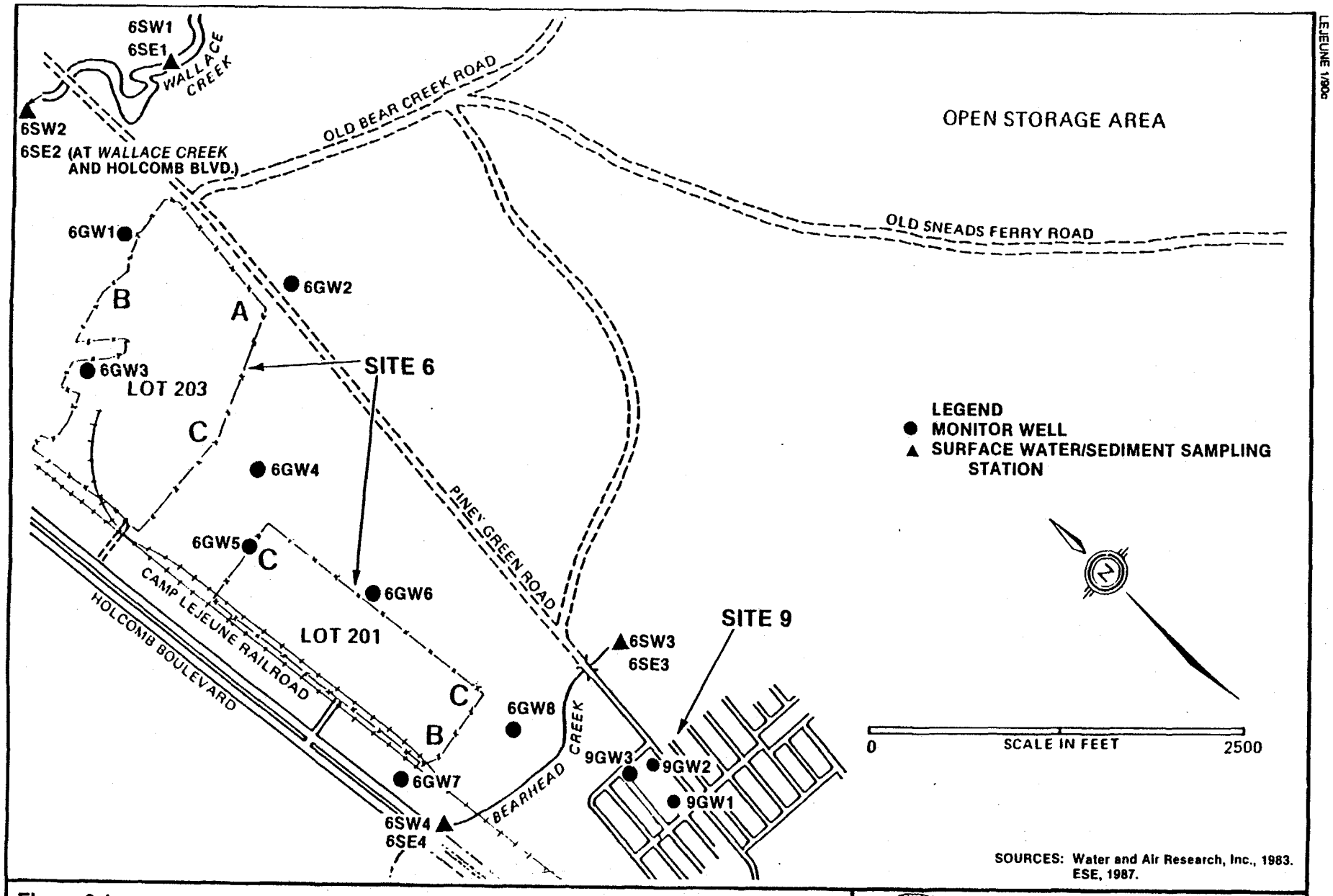


Figure 6-1
SAMPLING LOCATIONS, SITES 6 AND 9—
STORAGE LOTS 201 AND 203 AND FIRE FIGHTING TRAINING PIT

MARINE CORPS BASE
CAMP LEJEUNE

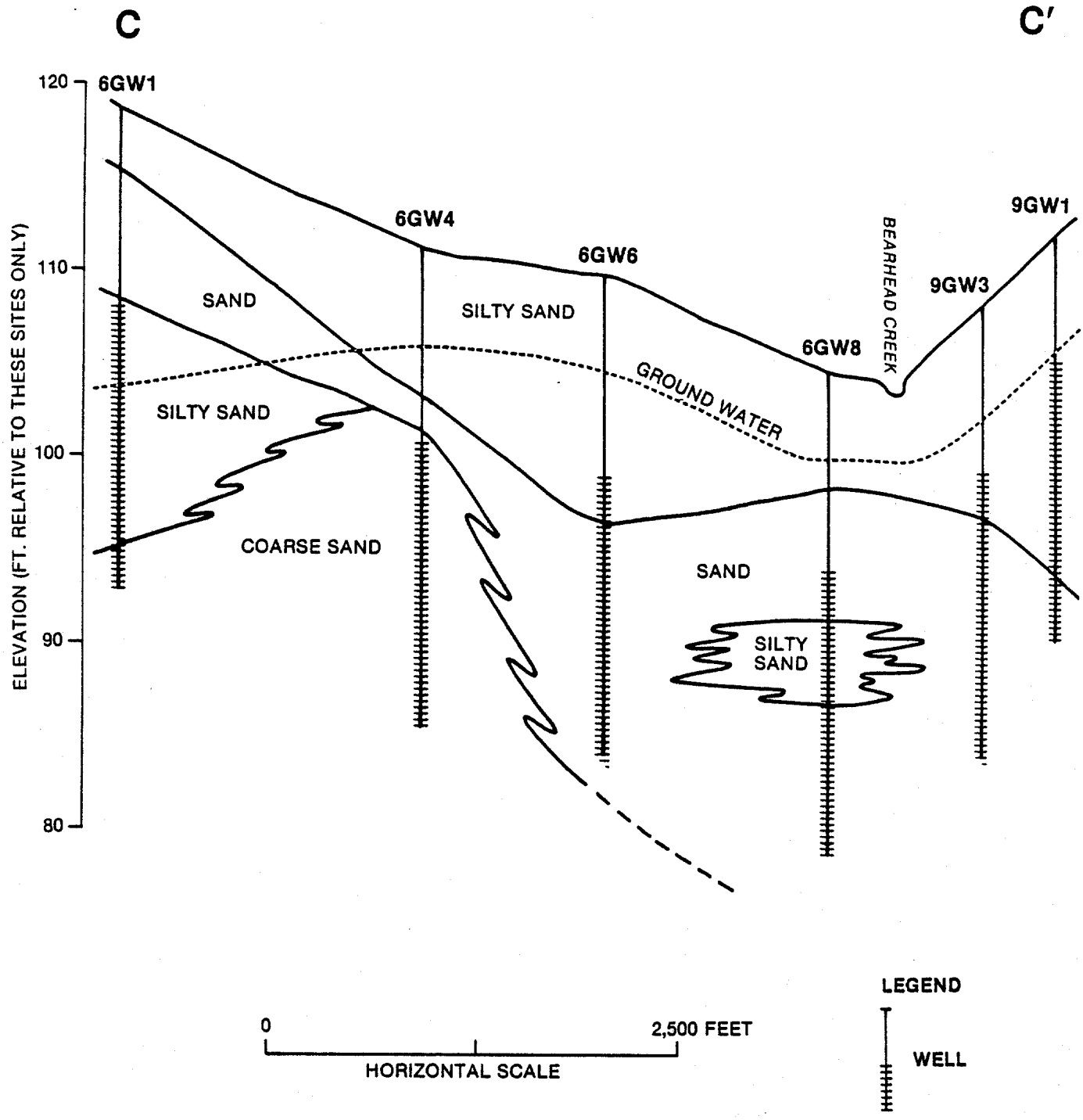


Figure 6-2
GEOLOGIC CROSS SECTION, SITES 6 AND 9—STORAGE LOTS 201 AND 203 AND FIRE FIGHTING TRAINING PIT

MARINE CORPS BASE CAMP LEJEUNE

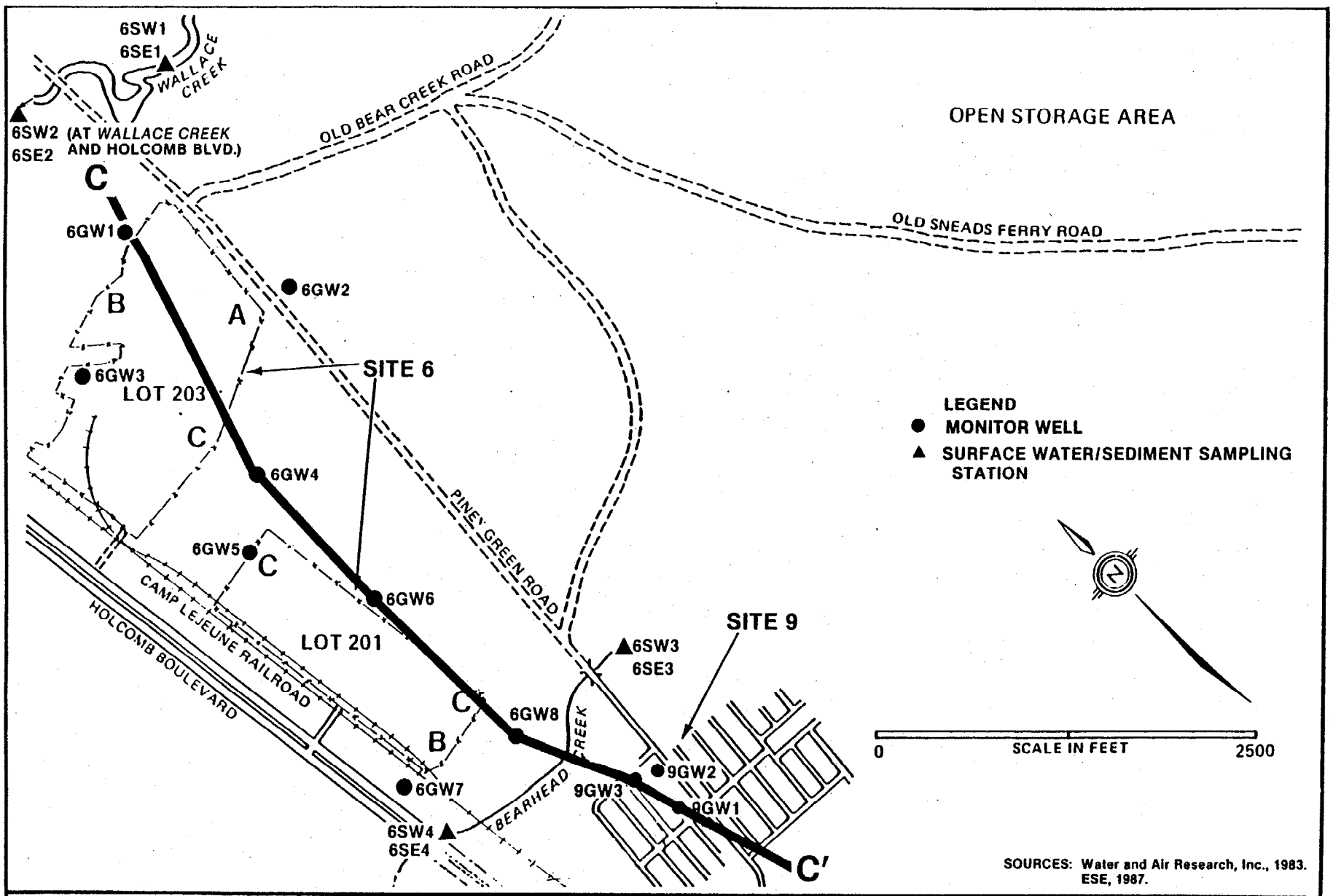


Figure 6-3
GEOLOGIC CROSS SECTION LOCATION, SITES 6 AND 9—
STORAGE LOTS 201 AND 203 AND FIRE FIGHTING TRAINING PIT

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c

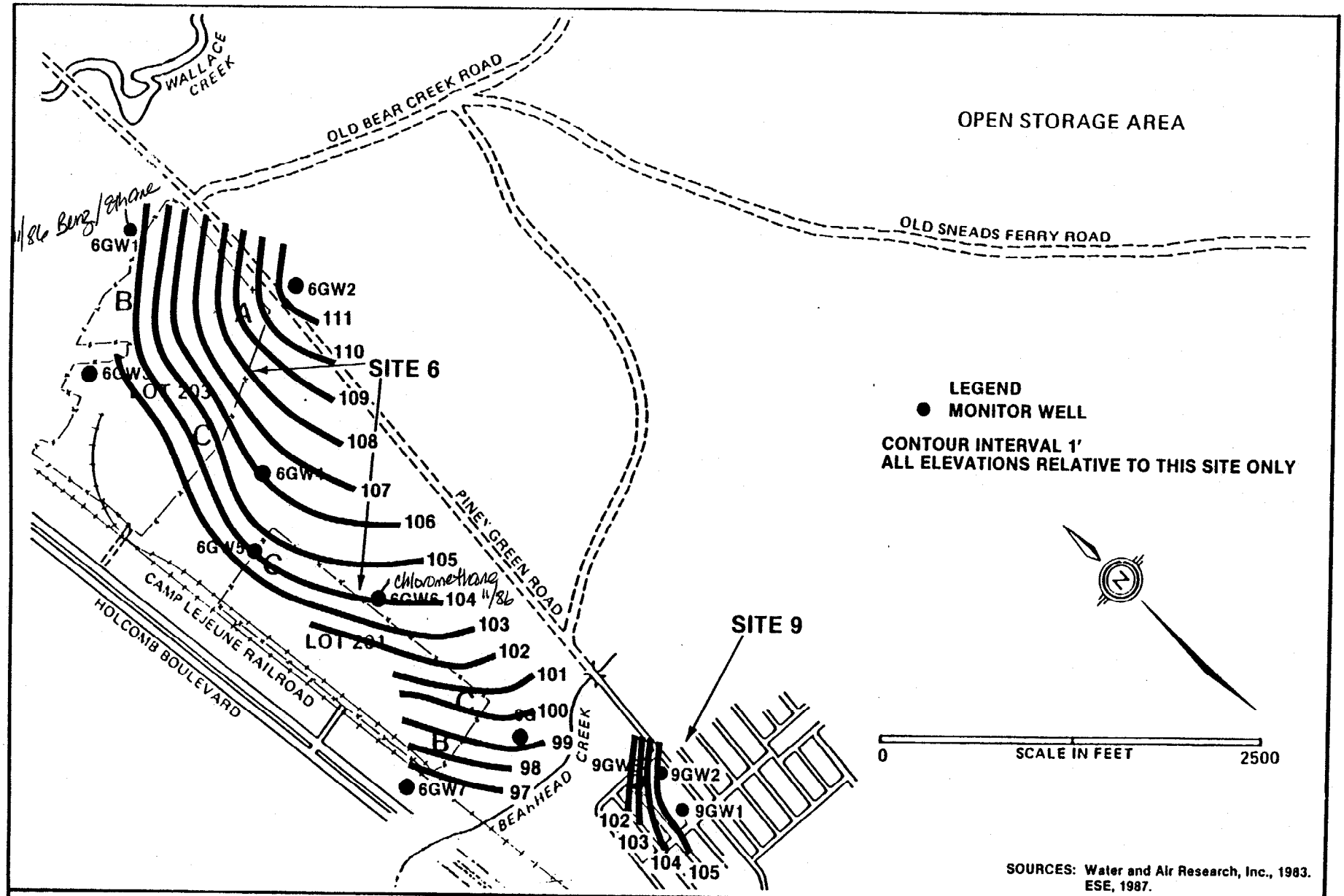


Figure 6-4
GROUND WATER CONTOUR MAP—SHALLOW AQUIFER, SITES 6 AND 9—STORAGE LOTS 201 AND 203 AND FIRE FIGHTING TRAINING PIT

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1990c

TABLE 6-1. SITE 6 - STORAGE LOTS 201 AND 203
DETECTED TARGET ANALYTES
GROUNDWATER SAMPLES

DATE	6GW1 11/19/86	6GW1 1/21/87	6GW2 11/20/86	6GW2 1/21/87	6GW3 11/20/86	6GW3 1/22/87	6GW4 11/19/86	6GW4 1/21/87	6GW5 11/19/86	6GW5 1/21/87	6GW6 11/19/86	6GW6 1/22/87	6GW7 11/20/86	6GW7 1/22/87	6GW8 11/20/86	6GW8 1/22/87
PARAMETER																
BENZENE	3.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
CHLOROMETHANE	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	6.5	<4.3	<4.3	<4.3	<4.3	<4.3
1,1,2,2-TETRACHLORO																
ETHANE	63	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1

ARARS.

All units in micrograms per liter (ug/L), ppb.

Source: Hunter/ESE, 1990.

SURFACE WATER/SEDIMENT

Surface water samples were collected in November 1986 from upstream and downstream locations in Wallace Creek and Bearhead Creek, which are adjacent to this AOC on the northwest and southeast, respectively (Figure 6-1). The samples were analyzed for VOCs and the o,p- and p,p-isomers of DDD, DDE, and DDT.

The surface water samples from Wallace Creek contained three VOCs: trichloroethene, vinyl chloride, and trans-1,2-dichloroethene (Table 6-2). Concentrations of these constituents were higher in the downstream (6SW2) sample than in the upstream (6SW1) sample. Neither of the samples contained DDT or its metabolites. The two surface water samples from Bearhead Creek contained no target compounds above method detection limits. ? do method detection limits meet ARAR

Sediment samples were collected from the same locations as the surface water samples and analyzed for the same target compounds. Table 6-3 shows that the two Wallace Creek samples did not contain any target analytes above method detection limits. The upstream sediment sample from Bearhead Creek contained both DDE and DDT while the downstream sediment sample contained only DDE.

SOIL

In August 1984 four locations within the two lot boundaries were identified as the most likely areas of contamination. Five soil borings were drilled at each of the four locations and a composite soil sample was collected from the 0-3 foot depth. These samples were analyzed for the o,p- and p,p-isomers of DDD, DDE, and DDT. Table 6-4 presents the analytical results for the soil samples collected during the 1984 investigation.

WHAT ABOUT ARARS?

Borings 6S1 through 6S10 were drilled in Lot 203, borings 6S11 through 6S20 in Lot 201. Three of the five samples collected from the five borings drilled in the northern portion of Lot 203 contained isomers of DDD, DDE and/or DDT. No sample had all six isomers. All of the samples collected

TABLE 6-2. SITE 6 - STORAGE LOTS 201 AND 203
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES

DATE / PARAMETER	6SW1 11/19/86	6SW2 11/19/86	6SW3 11/19/86	6SW4 11/19/86
TRANS-1,2-DICHLORO				
ETHENE	6.4	35	<1.6	<1.6
TRICHLOROETHENE	<3.0	26	<3.0	<3.0
VINYL CHLORIDE	1.9	3.6	<1.0	<1.0

ARAR

All units in micrograms per liter (ug/L), ppb

Source: Hunter/ESE, 1990.

TABLE 6-3. SITE 6 - STORAGE LOTS 201 AND 203
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	6SE1	6SE2	6S33	6SE4
DATE	11/19/86	11/19/86	11/19/86	11/19/86
PARAMETER				
DDE,PP'	<14.2	<13.7	75.8	13.1
DDT,PP'	<71.1	<68.5	219	<65.4

All units in micrograms per kilogram (ug/kg). ppb

Source: Hunter/ESE, 1990.

TABLE 6-4. SITE 6 - STORAGE LOTS 201 AND 203 (Page 1 of 3)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	6S1	6S1	6S2	6S2	6S3	6S4	6S5	6S6	6S7	6S8
DATE	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84
PARAMETER										
DDD,OP'	<0.426	<0.427	<0.420	0.657	<0.535	<0.419	<0.418	<0.430	<0.432	<0.437
DDE,OP'	<0.319	<0.321	<0.315	<0.323	<0.401	<0.314	<0.313	<0.322	<0.324	<0.323
DDT,OP'	1.17	<1.18	2.31	<1.19	<1.47	<1.15	1.78	<1.18	<1.19	4.8
DDD,PP'	<0.5	0.5	<0.5	<0.2	<0.7	<0.5	1.7	0.6	0.6	0.9
DDE,PP'	1.2	0.6	1.4	1.3	<0.3	0.5	<0.2	1.0	1.6	1.0
DDT,PP'	<1.2	1.0	<1.2	<0.6	<1.5	<1.2	7.3	2.7	3.5	14

All units in micrograms per kilogram (ug/kg), ppb.

Source: Hunter/ESE, 1990.

TABLE 6-4. SITE 6 - STORAGE LOTS 201 AND 203 (Page 2 of 3)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	6S9	6S10	6S11	6S12	6S13	6S14	6S15	6S16	6S17	6S18
DATE	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84
PARAMETER										
DDD,OP'	<0.439	1.37	36.4	<0.426	13.6	4.15	<0.436	1.34	3.25	1.25
DDE,OP'	<0.329	<0.316	32	<0.32	5.12	7.73	<0.327	1.11	1.36	<0.342
DDT,OP'	<1.21	15.8	324	<1.17	426	120	<1.20	47.1	77.4	28.7
DDD,PP'	<0.5	4.8	160	<0.5	25	12	<0.5	11	4.7	3.5
DDE,PP'	1.6	1.5	<1.2	<1.2	770	310	1.2	300	120	73
DDT,PP'	<1.2	49	10	6.2	8.2	13.3	8.2	10.1	4.36	12.2

All units in micrograms per kilogram (ug/kg), ppb

Source: Hunter/ESE, 1990.

TABLE 6-4. SITE 6 - STORAGE LOTS 201 AND 203 (Page 3 of 3)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	6S19	6S20
DATE	8/06/84	8/06/84
PARAMETER		
DDD,OP'	1.95	0.442
DDE,OP'	2.28	<0.332
DDT,OP'	41.3	12.4
DDD,PP'	6.1	1.9
DDE,PP'	18	1.1
DDT,PP'	140	41

ARAR

All units in micrograms per kilogram (ug/kg), ppb

Source: Hunter/ESE, 1990.

from the borings drilled in the southeastern quadrant of Lot 203 contained one of the target analytes, and the p,p-isomers were predominant.

All of the soil samples collected from the borings drilled in Lot 201 contained at least one of the target isomers. In general, these samples contained more contaminants than those in Lot 203 and at higher concentrations. Five of the samples contained all six isomers, three soil samples contained 5 of the 6 isomers.

IDENTIFY BY #

3.3.3 SUMMARY AND CONCLUSION

None of the groundwater samples collected from the 8 monitoring wells contained DDT or its metabolites. These target compounds were also not detected in the surface water samples collected from the two creeks bordering the site. However, concentrations of DDT and DDE were noted in sediment samples collected from Bearhead Creek on the south side of the site. The concentrations of DDE and DDT were greater in the upstream sample than in the downstream sample suggesting an additional source of the contaminants may be east of Piney Green Road. Migration of contaminants from Lot 201 may also be occurring resulting in the accumulation of DDT and DDE in the creek sediments.

Three VOCs were detected in the downstream surface water sample collected from Wallace Creek which is located to the northeast of Lot 203. The source of these contaminants is unknown at this time. The VOCs detected in the well located in Lot 203 (6GW1) are different than the VOCs detected in the surface water samples. Based on this limited amount of data it appears that the contaminants detected are originating from different sources.

3.3.4 RECOMMENDATIONS

DDT, DDD, and DDE contamination is widespread in Lots 201 and 203. A detailed soil sampling investigation should be conducted to determine the vertical and areal extent of contamination; previous sampling has occurred

to a depth of only 3 feet. The data indicate that contamination has not reached the shallow groundwater as of January 1987. It is possible that the contaminants may be tightly adsorbed to soil particles and thus are unlikely to reach the groundwater.

The source of VOCs in the surface water of Wallace Creek needs further investigation. It appears unlikely that Lot 203 as currently defined is the source of the three VOCs detected in the upstream and downstream water samples.

A forested area between Lot 203 and Wallace Creek appears to have been used as a disposal area at some point in the past. Currently there is surface evidence of debris piles and small depressions. This areas is bounded on the northwest by Wallace Creek and is therefore a reasonable source of the observed VOCs in Wallace. A site investigation consisting of geophysics, soil gas, and subsequent installation of monitor wells and collection of soil samples is recommended in this area.

Following characterization of the environmental contamination at this AOC, a Risk Assessment should be conducted to the determine the risk levels represented by the detected contamination and to determine clean up levels for the FS.

3.4 SITE 9 - FIRE FIGHTING TRAINING PIT

3.4.1 SITE BACKGROUND

This two acre site is located between Piney Green Road and Holcomb Boulevard, south of Bearhead Creek (PWDM coordinates 6, K3/L3). This AOC has been used for fire fighting training exercises from the 1960's to the present. Until 1981 the fire training activities were carried out in an unlined pit. Flammable liquids including used oil, solvents, and contaminated fuels (non-leaded) were burned in the pit. An oil-water separator has been installed at the site as a means of pollution control.

The geology underlying the site is similar to that of Site 6 (Figure 6-2) and consists of sand and silty sand. The groundwater contour map (Figure 6-4) indicates that shallow groundwater from the area of the pit flows to the northwest toward Bearhead Creek at a gradient of approximately 0.026 ft/ft.

3.4.2 SITE INVESTIGATION

GROUNDWATER

Two shallow monitoring wells were installed in 1984 to characterize the groundwater below the fire training pit (Figure 6-1). These two wells along with a water supply Well (639) located just east of Piney Green Road were sampled in July 1984 and analyzed for:

- Cadmium
- Chromium
- Lead
- Oil & Grease (O&G)
- Volatile organics
- Total Phenols

Table 9-1 presents the analytical results of the 1984 sampling event. The data indicate that chromium, lead, and phenols were detected in both Wells 9GW1 and Well 9GW2. The analytical results for the well sample listed as

TABLE 9-1. SITE 9 - FIRE FIGHTING TRAINING PIT
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

PARAMETER / DATE	9GW1 7/5/84	9GW1 11/19/86	9GW2 7/5/84	9GW2 11/19/86	9GW3 7/5/84	9GW3 11/18/86	9GW3 1/21/87
CHROMIUM	45	36.2	86	79	<6.0	<5.4	30
LEAD	80	41.6	94	<22	<40	<22	31
OIL & GREASE	3	<0.2	<0.7	<0.2	<0.8	<0.2	0.2
PHENOLS	3	6	4	6	<1	5	<2
1,2-DIBROMO-							
ETHANE	NRQ	<0.020	NRQ	<0.020	NRQ	0.157	<0.01

ARAR

All units in micrograms per liter (ug/L), ppb

Source: Hunter/ESE, 1990.

9GW3 sampled in 1984 represents the data for water supply Well 639. No target analytes were detected in this supply well.

In November 1986 a third monitoring well was installed downgradient of the pit and sampled along with the two previously installed monitoring wells. The 1986 water samples were analyzed for the constituents listed above with the following additions:

- o Xylene
- o Methylethyl ketone
- o Methyl isobutyl ketone
- o Ethylene dibromide
- o Hexavalent Chromium

NEED DISCUSSION W/ DF CANCER AFFAIRS

Table 9-1 indicates that chromium, lead, and phenols were again detected in Well 9GW1. In Well 9GW2, chromium and phenols were again detected but lead was not detected. Two sets of samples were collected from monitoring well 9GW3 (this designation now represents a shallow monitor well, not the water supply well 639). The November 1986 data detected the presence of phenols and 1,2-dibromoethane (ethylene dibromide) while the January 1987 indicated the presence of chromium and lead.

3.4.3 SUMMARY AND CONCLUSIONS

The chemical data and groundwater contour map suggest that the potential for contamination and/or contaminant migration at this AOC site is low. The analysis of the samples collected from Well 9GW1, located immediately adjacent to the pit, has detected low levels of contamination. The samples from Well 9GW3, located hydraulically downgradient from the pit, likewise contained only trace levels of contamination. No target analytes were detected in water supply Well 639.

3.4.4 RECOMMENDATIONS

Because trace levels of contamination were detected in the immediate vicinity of the pit, it is unlikely that this AOC presents a substantial risk to health and the environment. However, it is recommended that a Risk Assessment be conducted to document the lack of risk. Prior to initiation of the Risk Assessment, an additional set of groundwater samples should be collected and analyzed to provide a current data base.

3.5 SITE 21 - TRANSFORMER STORAGE LOT 140

3.5.1 SITE BACKGROUND

This AOC is located between Ash Street and Sneads Ferry Road on Center Road (PWDM coordinates 10,I15). A transformer oil pit was located in the northeastern end of Lot 140 across the railroad tracks from Building 702 (Figure 21-1). The entire lot is approximately 220 feet by 890 feet with the dimensions of the pit measuring 25 to 30 feet long by 6 feet wide by 8 feet deep.

Lot 140 was used from 1958 to 1977 for pesticide mixing and as a cleaning area for pesticide application equipment. The mixing area for the pesticides is believed to have been the southeast corner of the lot. Pesticide contamination possibly occurred as a result of small spills, washout, and excess disposal. In 1977, before activities were moved to a different location, washout was estimated to be about 350 gallons per week of overland discharge.

In 1950-51 an onsite pit was used as a drainage receptor for oil from transformers. Sand was occasionally placed in the pit when oil was found standing in the pit bottom. The total quantity of oil drained in this manner is unknown.

Since only one monitoring well has been installed at this AOC, a geologic cross-section of the site has not been prepared. The boring log for the well indicates that the site is underlain by sandy gravel (fill material), sandy silt, and sandy clay. The surface of the shallow groundwater at the site was measured at nine feet below land surface and lies within a sandy silt interval.

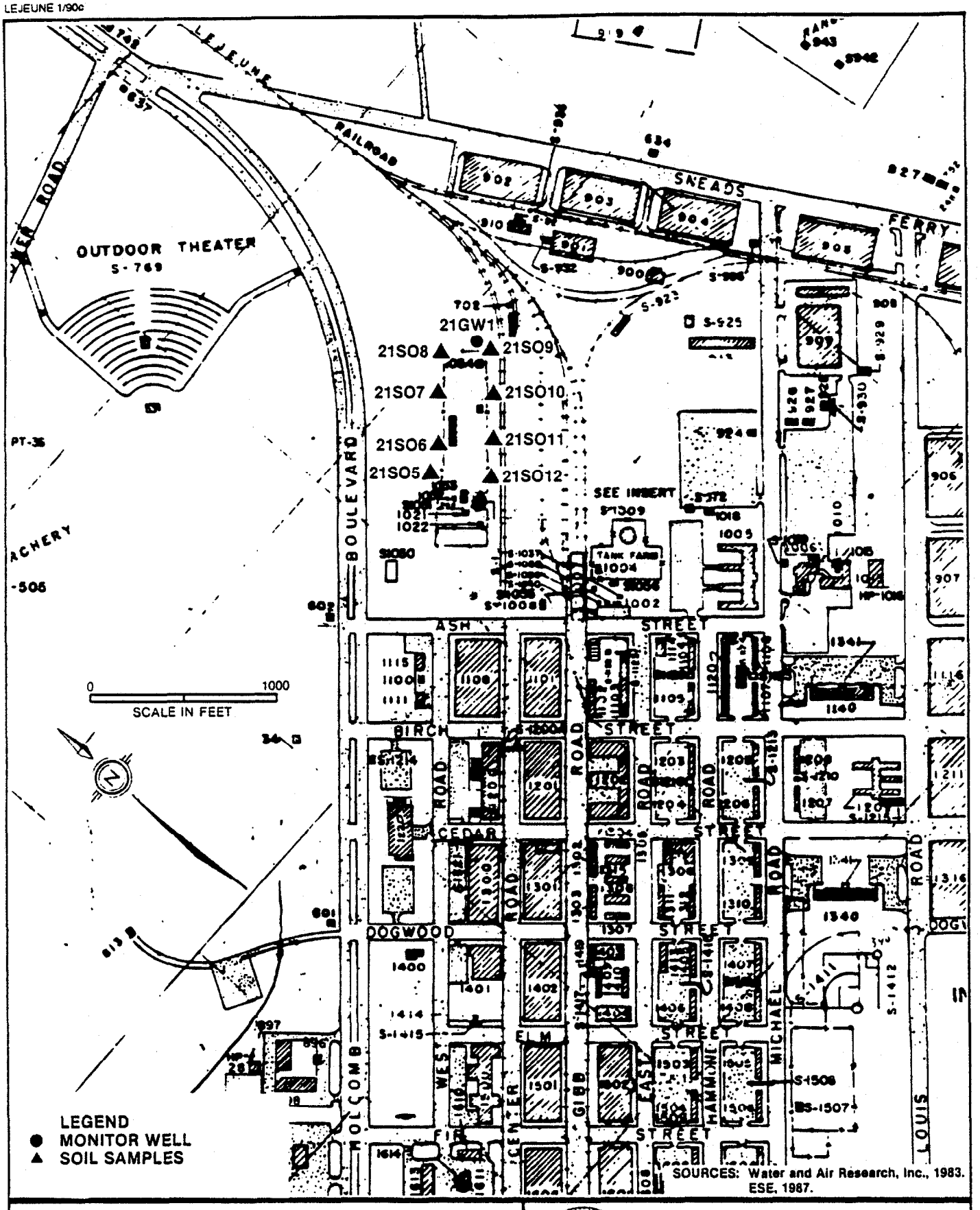


Figure 21-1
SAMPLING LOCATIONS,
SITE 21—TRANSFORMER STORAGE LOT 140

MARINE CORPS BASE
CAMP LEJEUNE

3.5.2 SITE INVESTIGATION

GROUNDWATER

One shallow monitoring well was installed at this site in 1984. Groundwater samples were collected in both July 1984 and November 1986 and analyzed for the following parameters:

- o Organochlorine pesticides
- o Organochlorine herbicides
- o Polychlorinated biphenyls
- o Volatile organics (1986 only)
- o Tetrachlorodioxin (1986 only)
- o Xylene (1986 only)
- o Methylethyl ketone (1986 only)
- o Methyl isobutyl ketone (1986 only)
- o Ethylene dibromide (1986 only)
- o Oil & grease (1986 only)

Appendix A presents a complete listing of all target analytes and their abbreviations.

Table 21-1 indicates that no target analytes were identified in the July 1984 sample collected from 21GW1. Only two parameters, 2,4-D (an organochlorine herbicide) and O&G were detected in the November 1986 sample.

SOIL

In August 1984, 10 soil borings were hand augered at this AOC, four borings inside the fenced area and six borings outside the fenced area. A total of six samples were collected from the four borings located inside the fenced area. These samples were analyzed for organochlorine pesticides and herbicides and polychlorinated biphenyls. Table 21-2 presents the analytical data for these soil samples. The analytical results of several duplicate samples collected from these borings are also presented. Detectable amounts of DDD, DDE, and DDT were found in all the samples collected from the

TABLE 21-1 SITE 21 - TRANSFORMER STORAGE LOT 140
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE / PARAMETER	21GW1 7/4/84	21GW1 11/26/86
OIL & GREASE	NRQ	400
2,4-D	<0.08	1.17

ARAR

NRQ = not requested

All units are in micrograms per liter (ug/L) ppb

Source: Hunter/ESE, 1990

TABLE 21-2. SITE 21 - TRANSFORMER STORAGE LOT 140
DETECTED TARGET ANALYTES
SOIL SAMPLES

	21S1A	21S1A	21S1B	21S1B	21S1C	21S1C	21S2C	21S2A	21S2A	21S2B
DATE	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
PARAMETER										
ALDRIN	1.1	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.07	<0.08
DDD,PP'	5.1	4.0	<0.5	0.6	<0.5	<0.6	<0.6	7.4	4.7	4.4
DDE,PP'	46	4.3	<0.2	5.6	<0.2	3.1	26	74	6.7	48
DDT,PP'	52	14	<1.2	5.8	<1.2	<1.2	87	37	5.7	40
HEPTACHLOR	<0.06	<0.06	<0.07	<0.06	<0.07	<0.07	<0.07	<0.07	<0.06	<0.06

All units in micrograms per kilogram (ug/kg), ppb

Source: Hunter/ESE, 1990.

borings. These contaminants were identified in both surface samples as well as soil samples collected from the 1-2 foot range. PCBs were not detected in any of these samples.

Six soil samples were collected from six borings augered in the area outside of the fenced compound. These samples were analyzed for organochlorine pesticides and herbicides. The results as shown in Table 21-3 indicate the presence of DDD, DDE, and DDT in all of the surface soil samples collected.

In November 1986 eight additional soil borings were augered outside the fenced area in an attempt to further define the extent of soil contamination. Soil samples were collected from four depths at each of the borings. The 32 soil samples were analyzed for:

- o Organochlorine pesticides
- o Organochlorine herbicides
- o Polychlorinated biphenyls
- o Tetrachlorodioxin

The analytical results for the November 1986 sampling effort are presented in Table 21-4. The most prevalent compounds detected were 2,4-D, DDD, DDE, and DDT. Thirty out of the 32 samples collected contained the herbicide 2,4-D. This compound was evenly distributed at all depths. DDD was likewise found in the soils down to a depth of five feet; DDE and DDT were detected down to the 3-5 foot range. Polychlorinated biphenyls were detected in two soil samples collected from Boring 21SO9 which is located on the northeast corner of the fenced area. This boring is close to the location of the former transformer oil pit.

3.5.3 SUMMARY AND CONCLUSIONS

The two rounds of sampling data indicate that pesticide compounds are present in the shallow soils as well as to a depth of at least five feet. The organochlorine herbicides and DDT and its derivatives were detected most

TABLE 21-3. SITE 21 - TRANSFORMER STORAGE LOT 140
DETECTED TARGET ANALYTES
SOIL SAMPLES

	21S3A	21S3B	21S3C	21S4A	21S4B	21S4C
DATE	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
PARAMETER						
ALDRIN	<0.08	<0.08	<0.08	<0.07	<0.08	<0.07
DDD,PP'	4.4	3.6	7.0	<0.5	<0.5	23
DDE,PP'	53	42	40	160	220	7.9
DDT,PP'	20	14	30	780	2100	74
HEPTACHLOR	<0.07	<0.07	<0.06	<0.06	<0.06	2.7

ARAR

All units in micrograms per kilogram (ug/kg), ppb

Source: Hunter/ESE, 1990

TABLE 21-4. SITE 21 - TRANSFORMER STORAGE LOT 140 (Page 1 of 4)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	21S05A	21S05B	21S05C	21S05D	21S06A	21S06B	21S06C	21S06D
DATE	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86
PARAMETER								
BHC,D	<26.7	<26.7	<29.2	<31.1	<23.3	<27.6	<27.9	<26.5
CHLORDANE	76700	1290	<76.1	118	<60.7	<72	203	<69.2
DDD,PP'	<11.6	<11.6	<12.7	<13.5	<10.1	<12	<12.1	<11.5
DDE,PP'	1980	<11.6	<12.7	<13.5	<10.1	<12	<12.1	<11.5
DDT,PP'	5080	<17.4	<19	<20.3	<15.2	<18	<18.2	<17.3
PCBS,TOTAL	<545	<547	<596	<635	<475	<564	<571	<542
2,4-D	57.4	661	298	369	401	394	148	118

ARAR

All units in micrograms per kilogram (ug/kg), ppb

Source: Hunter/ESE, 1990

TABLE 21-4. SITE 21 - TRANSFORMER STORAGE LOT 140 (Page 2 of 4)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	21S07A	21S07B	21S07C	21S07D	21S08A	21S08B	21S08C	21S08D
DATE	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86
PARAMETER								
BHC,D	<27.1	<27.2	<30.2	<28.6	<26.3	<27	<27.6	<28.2
CHLORDANE	<70.7	<71	<78.9	<74.6	<82.4	<70.4	<72	<73.5
DDD,PP'	<11.8	<11.8	282	<12.4	<11.4	<11.7	<12	<12.2
DDE,PP'	47	<11.8	228	<12.4	28	<11.7	<12	<12.2
DDT,PP'	<11.8	<17.8	461	<18.6	<11.4	<17.6	<18	<18.4
PCBS,TOTAL	<554	<556	<618	<584	<538	<551	<564	<575
2,4-D	618	287	312	166	151	109	248	486

ARAR

All units in micrograms per kilogram (ug/kg), ppb

Source: Hunter/ESE, 1990

TABLE 21-4. SITE 21 - TRANSFORMER STORAGE LOT 140 (Page 3 of 4)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	21S09A	21S09B	21S09C	21S09D	21S010A	21S010B	21S010C	21S010D
DATE	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86
PARAMETER								
BHC,D	29.7	<24.5	<24.7	<25.7	<25.1	<25.1	<26.3	<27.9
CHLORDANE	<63.6	<63.9	<64.3	<66.9	<65.5	<65.4	<68.6	<72.8
DDD,PP'	95.5	174	218	57.9	<10.9	<10.9	<11.4	<12.1
DDE,PP'	<53	<10.6	<10.7	<11.2	<10.9	<10.9	<11.4	<12.1
DDT,PP'	<265	<10.6	<10.7	<11.2	<10.9	<10.9	<11.4	<12.1
PCBS,TOTAL	17100	1430	<510	954	<520	<519	<537	<571
2,4-D	151	152	<79.3	15	109	268	195	<95.6

ARAR

All units in micrograms per kilogram (ug/kg), ppb

Source: Hunter/ESE, 1990

THIS INDICATES THAT 2,4-D MAY BE PRESENT AT THE TWO NON-DETECTS AS WELL

TABLE 21-4. SITE 21 - TRANSFORMER STORAGE LOT 140 (Page 4 of 4)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	21S11A	21S11B	21S11C	21S11D	21S012A	21S012B	21S012C	21S012D
DATE	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86
PARAMETER								
BHC,D	<24.7	<25.3	<28.4	28.6	<25.8	<26.6	<27	<28.2
CHLORDANE	<64.5	<66.1	<74.1	<74.7	<67.4	<69.4	<70.4	<73.5
DDD,PP'	<10.8	<11	<12.4	<12.4	143	32	44.5	12.6
DDE,PP'	<10.8	<11	<12.4	<12.4	53.1	32	<11.7	<12.3
DDT,PP'	<10.8	<11	<12.4	<12.4	556	150	143	<12.3
PCBS,TOTAL	<505	<518	<581	<585	<534	<550	<558	<576
2,4-D	190	166	490	345	306	302	484	685

ARAR

All units in micrograms per kilogram (ug/kg), ppb

Source: Hunter/ESE, 1990.

NEED DISCUSSION OF AREAS AND IF IDENTIFIED DETECTION LIMITS CAN REACH THE ARAR.

often in the soil samples. Chlordane and aldrin, organochlorine pesticides, have also been identified in the soils.

The information generated from the one monitoring well installed at this site suggests that the majority of the organic compounds identified in the soils have not migrated to the shallow groundwater. However 2,4-D was identified in the 1986 groundwater sample and was detected in 30 of the 32 soil samples. This limited amount of data does indicate that vertical migration can occur.

3.5.4 RECOMMENDATIONS

Soil contamination was noted in several borings down to a depth of five feet. A further characterization of the extent of vertical contamination should be conducted at this AOC.

The contamination detected to date suggests that waste pesticides and PCBs are present at this AOC. In order to determine the risk represented by this contamination, a more detailed delineation of the soils and groundwater should be conducted. Following this additional characterization, a Risk Assessment should be conducted. An FS should then be conducted if the Risk Assessment identifies an unacceptable risk to health and/or the environment.

3.6 SITE 22 - INDUSTRIAL AREA TANK FARM

3.6.1 SITE BACKGROUND

The Industrial Area Tank Farm is located east of the intersection of Gibb Road and Ash Streets (PWDM coordinates 10, J15). Figure 22-1 identifies the location of the tank farm which covers an area of approximately 4 acres; the insert depicts 14 underground storage tanks and one above ground tank. The fuel farm was constructed in the 1940s and several fuel leaks have occurred throughout the years, the latest being a 100-gallon leak of diesel fuel in 1981. In 1979, a fuel leak of an estimated 20,000 to 30,000 gallons of diesel and unleaded fuel occurred in an underground line near the tank truck loading facility.

The soils encountered at this site consist primarily of fine and medium sands, mixed with lesser amounts of silt. Clay stringers were found consistently throughout the silty sand mixtures with an occasional thin layer of clay (up to 2 feet thick). Up to 4 feet of miscellaneous fill material was found adjacent to buildings and developed roads.

3.6.2 SITE INVESTIGATIONS

GROUNDWATER

Two shallow monitoring wells were installed and sampled during the July 1984 sampling investigation to characterize the shallow aquifer underneath the site. In addition, an existing water supply well (602) was also sampled. The three water samples were analyzed for lead, VOCs, and O&G. Appendix A presents a full listing of all target analytes and their abbreviations.

Table 22-1 presents the analytical results for the three groundwater samples. Six VOCs and lead were detected in the sample from the well installed in the tank farm area (22GW1). Several of the compounds identified are associated with fuel components. The other VOCs reported in the water sample suggest other possible sources of contamination. The concentration of benzene (17000 ug/1) detected in the groundwater at Well 22GW1 was substantially greater

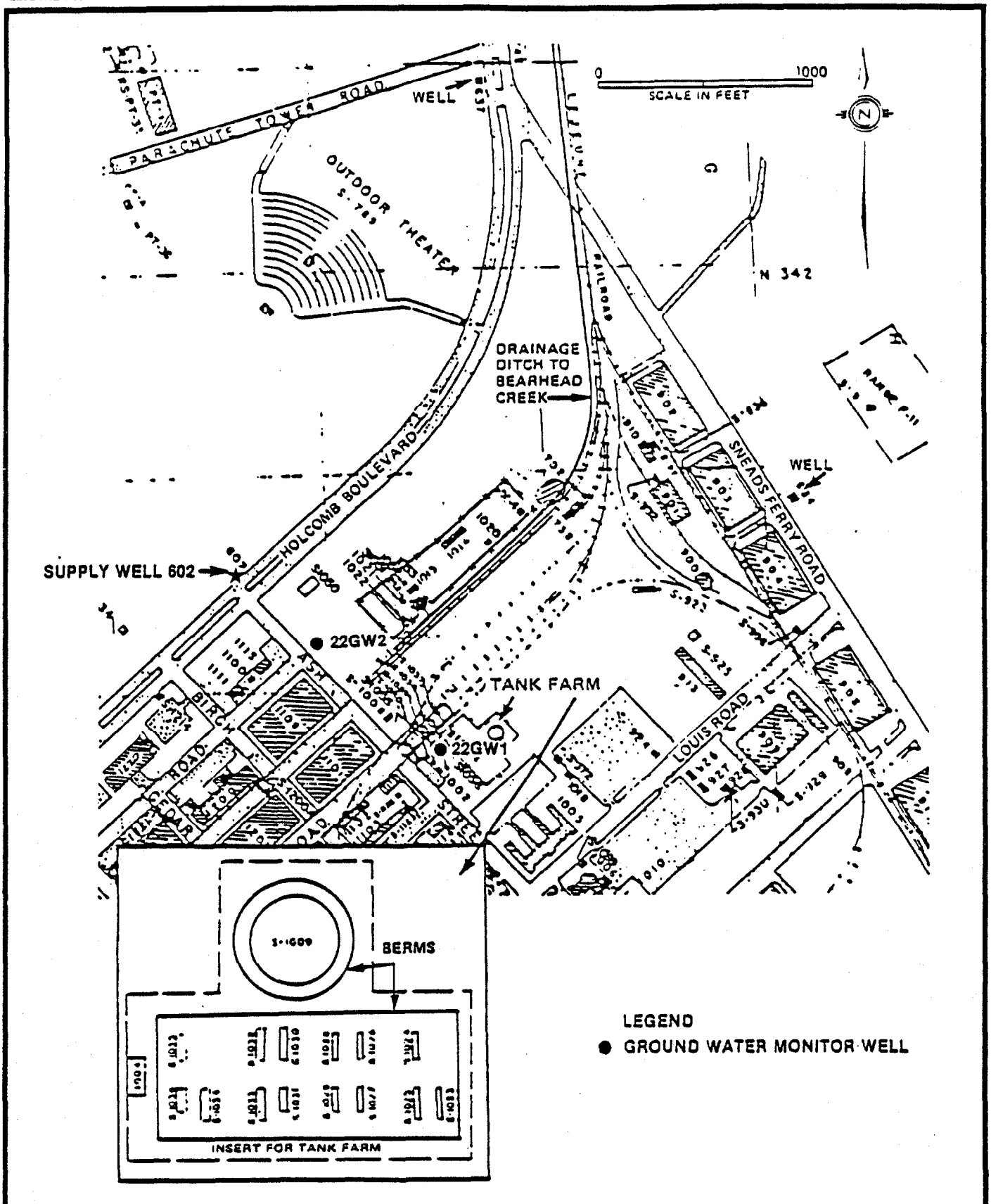


Figure 22-1
SAMPLING LOCATIONS, SITE 22—
HADNOT POINT INDUSTRIAL AREA TANK FARM

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1987.

MARINE CORPS BASE
CAMP LEJEUNE

TABLE 22-1. SITE 22 - INDUSTRIAL AREA TANK FARM
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	22GW1 7/6/84	22GW1 1/9/87	22GW1 3/8/87	22GW1 5/27/87	22GW2 7/6/84	22GW2 1/9/87	22GW2 3/8/87	22GW2 5/27/87	22GW3 7/6/84	ARAR
PARAMETER										
BENZENE	17000	12000	10000	13000	<0.3	<1	<1	<1	380	0.70
CHLOROFORM	0.70	<16	<1600	<1600	<0.70	<1.6	<1.6	<1.6	<0.70	
1,2-DICHLOROETHANE	52	<28	<2800	<2800	<1.0	<2.8	<2.8	<2.8	46	
T-1,2-DICHLOROETHENE	<0.80	<16	<1600	<1600	<1.3	<1.6	<1.6	<1.6	7.8	
1,2-DICHLOROPROPANE	18	<60	<6000	<6000	<0.7	<6	<6	<6	<0.7	
ETHYLBENZENE	2800	1800	<7200	<7200	<1	<7.2	<7.2	<7.2	8	
TRICHLORO-										
FLUOROMETHANE	<0.9	<32	<3200	<3200	<1	<3.2	<3.2	<3.2	3	
TOLUENE	27000	15000	18000	24000	<0.6	<6	<6	<6	10	
XYLENE	NA	9000	<12000	<12000	NA	<12	<12	<12	NA	400
METHYLENE CHLORIDE	<0.8	<28	<2800	<50000	<1	7.3	<2.8	<50	<1	
LEAD	807	33	29	78	<40	28	<27	<49.2	40	
OIL & GREASE	<900	7000	11000	9000	1000	800	<100	<200	<800	

NA ?

All units in micrograms per liter (ug/L), ppb.

Source: Hunter/ESE, 1990.

WHAT IS STANDARD?

than the North Carolina groundwater standard of 0.70 ug/l. The concentrations recorded for chloroform, ethylbenzene, and toluene likewise exceed groundwater standards. O&G was the only target compound identified in the sample collected from Well 22GW2 installed between the tank farm and the Supply Well 602 located approximately 1,200 feet to the west of the tank farm.

The sample from Supply Well 602 (22GW3) contained six VOCs and lead. Benzene was detected at a concentration of 380 ug/l which is in excess of the North Carolina groundwater standard for this compound.

Since the 1984 sampling effort at Site 22 had identified contamination of the deep potable aquifer in the vicinity of the Hadnot Point Industrial Area (HPIA), a more intensive effort was recommended within the HPIA. This effort included a resampling of the monitor wells at Site 22.

A second round of sampling was performed on the two monitoring wells at this AOC in January, March and May 1987. The two groundwater samples were analyzed for the same parameters as the 1984 sampling. Table 22-1 presents the analytical data for the three sets of samples collected during this sampling event. As in 1984, several VOCs and lead were detected in the water samples collected from Well 22GW1. The levels of benzene were consistently above the 10,000 parts per billion (ppb) range. The concentrations recorded for ethylbenzene and toluene were similar to those found during the 1984 sampling effort. Lead was detected at lower concentrations than previously recorded in the earlier round of sampling. Xylene was identified in the January 1987 investigation at a concentration of 9,000 ug/l which is greater than the North Carolina groundwater standard for this compound (400 ug/l). O&G, which was not detected in the July 1984 sample from 22GW1 was found in all three samples collected in 1987.

Again: do method detection limits meet ARARs?

Two of the three samples collected from 22GW2 in 1987 contained no target analytes above method detection limits. The groundwater sample collected in January 1987 from this same well did contain lead, methylene chloride and O&G. Only O&G was identified in the July 1984 sample collected from 22GW2.

O'Brien & Gere Engineers conducted a field investigation at this AOC in 1988. Among the activities conducted were floating product determination and the characterization of contaminant plume(s). Their study concluded that a 15 foot layer of floating product was noted in a monitoring well drilled on the western edge of the tank farm (approximately 75 ft northwest of 22GW1). The study was also able to characterize a benzene contaminant plume in the vicinity of the tank farm. The extent of the plume has not been fully defined beyond the maximum contaminant level (MCL) of 5 ug/1.

3.6.3 SUMMARY AND CONCLUSIONS

Groundwater movement in the shallow aquifer in this area is generally to the south-southwest toward the New River. Several VOCs have been identified at elevated concentrations in groundwater samples collected from two onsite monitoring wells. The concentrations of the compounds detected during the various sampling efforts have been consistent and in most cases are orders of magnitude greater than established groundwater standards.

→ Again need to discuss ARARs vs. level detect

An attempt has been made to characterize the contaminant plume(s) using benzene as the indicator compound. The boundaries of the plume have only been identified to a concentration of 5 ug/1 which represents the drinking water standard. However North Carolina has established 0.7 ug/1 as the groundwater standard for benzene. Of particular concern is the presence of benzene in the Supply Well 602 (22GW3) sampled in July 1984. The concentration of benzene (380 ug/1) was well above the drinking water regulation of 5 ug/1.

As in many other areas of the base, O&G has been identified in several of the groundwater samples collected from the shallow aquifer.

3.6.4 RECOMMENDATIONS

The investigation at Site 22 had identified contamination of the deep potable aquifer in the vicinity of the Hadnot Point Industrial Area (HPIA). A more intensive effort was, therefore, recommended within the HPIA, and this effort included a resampling of the monitor wells at Site 22.

This report should direct the reader to the RI/FS reports and discuss the details of the current Work Plan for HPIA.

3.7 SITE 24 - INDUSTRIAL AREA FLY ASH DUMP

3.7.1 SITE BACKGROUND

This AOC is located south and east of the intersection of Birch and Duncan Streets (PWDM coordinates 10, L16-17/M16-17). As shown in Figure 24-1, four separate disposal locations were investigated as potential areas of contamination. Site 24 was used for the disposal of fly ash, cinders, solvents, used paint stripping compounds, sewage sludge, and water treatment spiractor sludge from the late 1940s to 1980. Approximately 20 to 25 acres in size, the site lies adjacent to upstream portions of Codgels Creek.

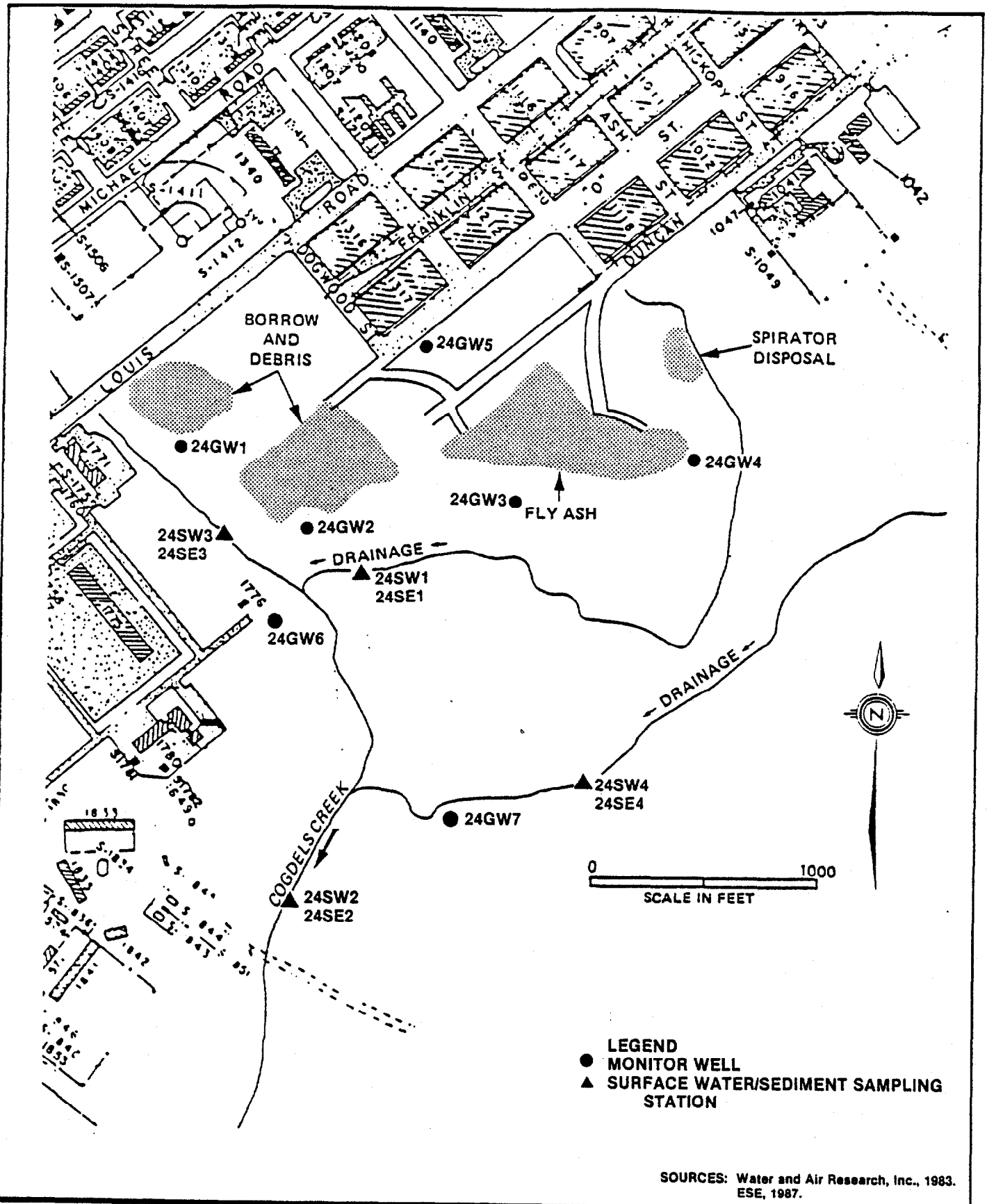
A geologic cross-section (Figure 24-2) was drawn on a line oriented approximately east-west (Figure 24-3) and shows the site to be underlain by layers of sand and silty sand, with limited amounts of sandy gravel. The surface of the shallow groundwater ranges in depth from 2 to 10 feet below land surface. The groundwater contour map (Figure 24-4) shows the groundwater flow to be generally toward the drainage ditches on the south and southwest sides of the filled area at a gradient of approximately 0.009 ft/ft.

3.7.2 SITE INVESTIGATION

GROUNDWATER

Five shallow monitoring wells were installed and sampled in July 1984 to determine the presence or absence of contaminants in the groundwater beneath this site. Two of the wells were installed on the downgradient side of the borrow and debris disposal area, two wells on the downgradient side of the fly ash area, and one well upgradient of the AOC (Figure 24-1). The five groundwater samples were analyzed for Metals A and VOCs. Appendix A presents a full listing of all target analytes and their abbreviations.

Table 24-1 presents the analytical data for the groundwater samples collected and analyzed during the July 1984 round of sampling. The results indicate that chromium, copper, and zinc were found in both samples collected



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 24-1
SAMPLING LOCATIONS, SITE 24—
INDUSTRIAL AREA FLY ASH DUMP

MARINE CORPS BASE
CAMP LEJEUNE

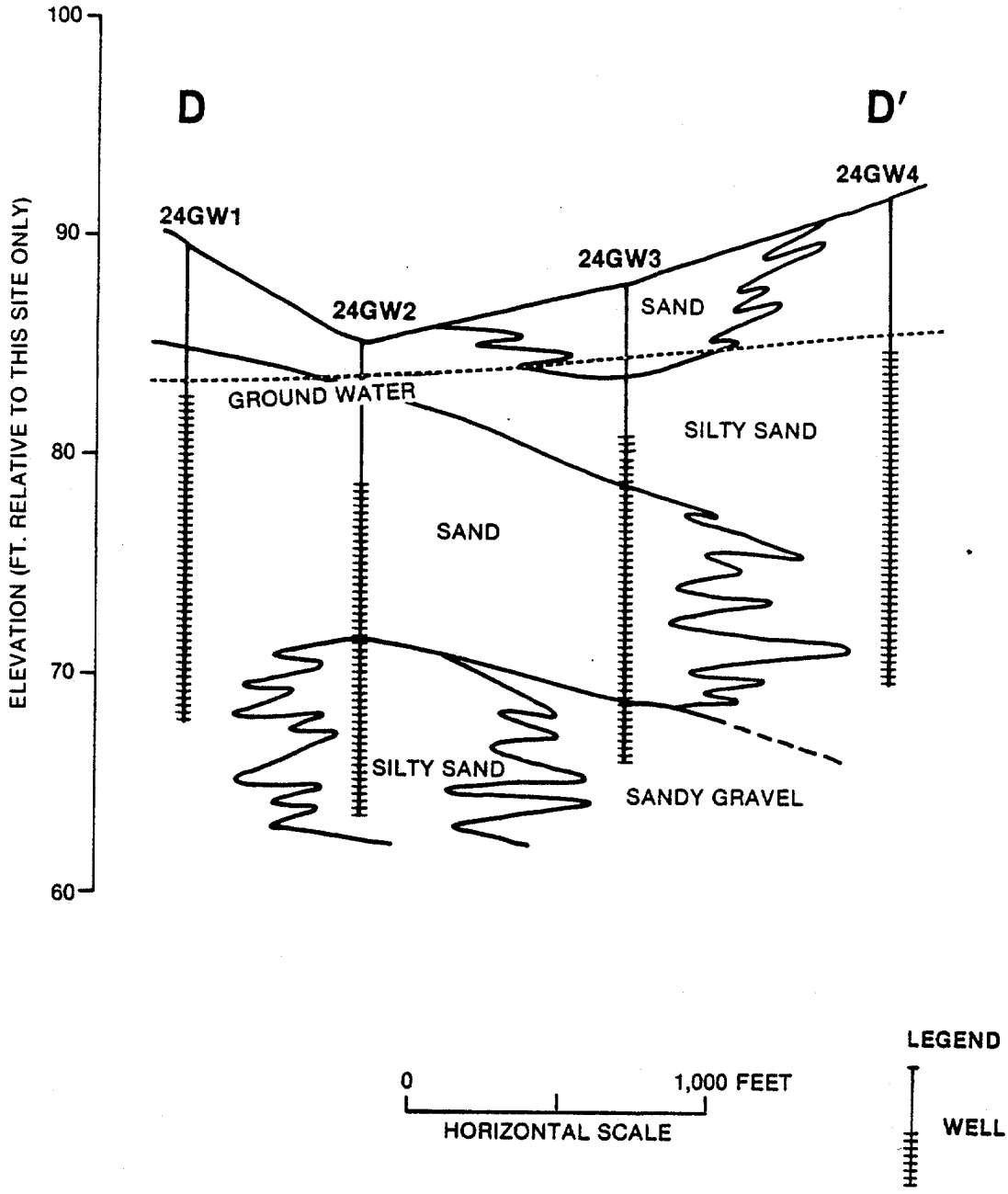
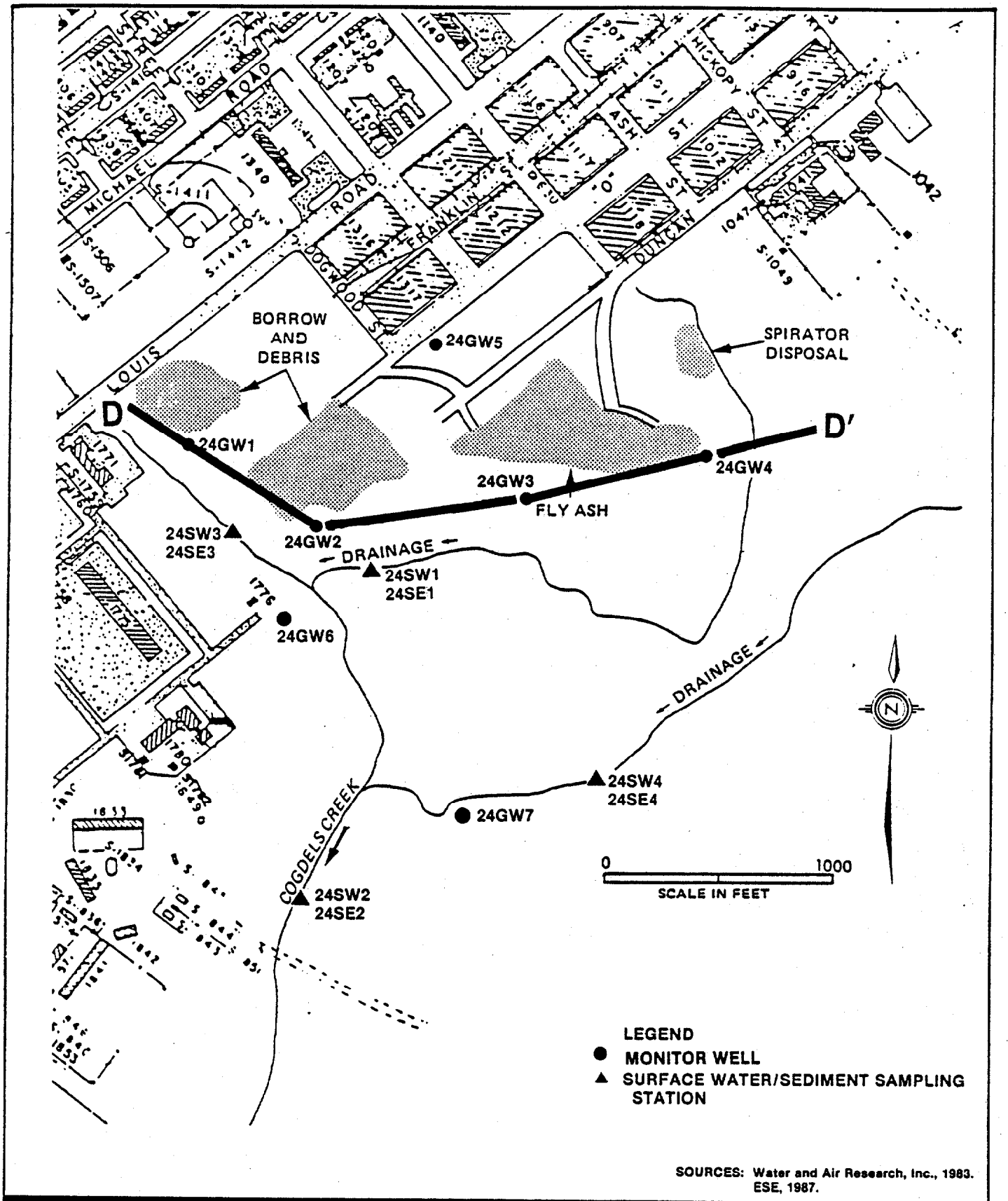


Figure 24-2
GEOLOGIC CROSS SECTION, SITE 24—INDUSTRIAL AREA FLY ASH DUMP

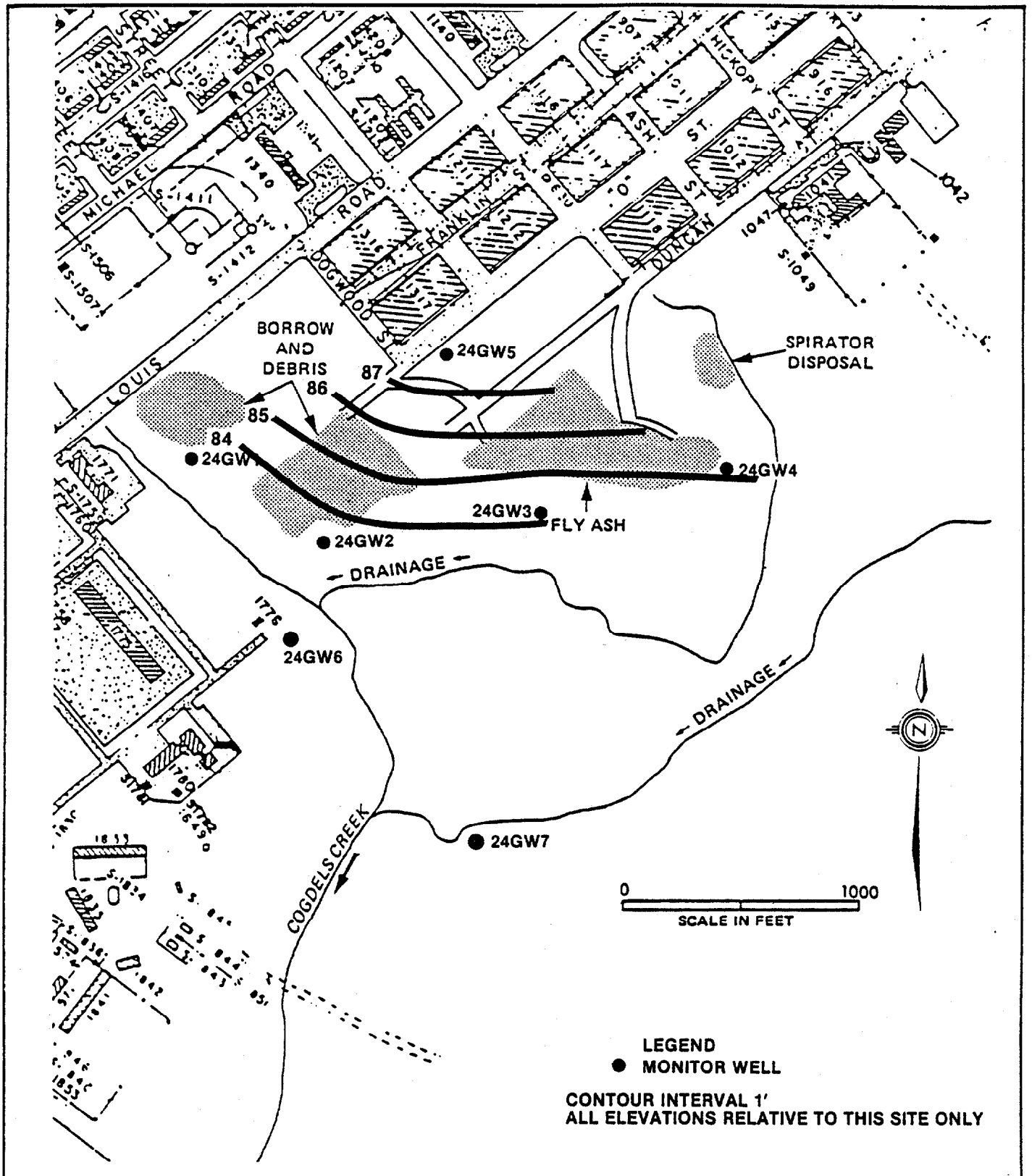
MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 24-3
GEOLOGIC CROSS SECTION LOCATION, SITE 24—INDUSTRIAL AREA FLY ASH DUMP

MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 24-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 24—
INDUSTRIAL AREA FLY ASH DUMP

MARINE CORPS BASE
CAMP LEJEUNE

TABLE 24-1. SITE 24 - INDUSTRIAL AREA FLY ASH DUMP
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

	24GW1	24GW1	24GW2	24GW2	24GW3	24GW3	24GW4	24GW4	24GW5 (UPGRAD.)	24GW5	24GW6	24GW6	24GW7	24GW7
DATE	7/7/84	12/3/86	7/7/84	12/3/86	7/7/84	12/3/86	7/7/84	12/3/86	7/7/84	12/3/86	12/4/86	3/4/87	12/4/86	3/4/87
PARAMETER														
BENZENE	<0.4	<1	<0.4	<1	<0.4	<1	<0.6	<1	3	<1	<1	<1	<1	<1
CHLOROFORM	1	<1.6	<0.8	<1.6	<0.7	<1.6	<1.2	<1.6	<0.7	<1.6	<1.6	<1.6	<1.6	<1.6
METHYLENE CHLORIDE	<1	<2.8	2	<2.8	<1	<2.8	<2	<2.8	<1	<2.8	<2.8	<2.8	<2.8	<2.8
ARSENIC	<1	<3.1	3	<3.1	7.1	9.3	16	47.3	5.6	9.3	<2.1	5.3	INTF	7.5
CHROMIUM	6.6	<9.4	24	<9.4	130	98	<6	37	<6	<9.4	<9.4	14	62	52
CHROMIUM(+6)	NA	<10	NA	<10	NA	<10	NA	<10	NA	14.2	<10	<10	<10	<10
COPPER	4	<2.8	8.6	<2.8	17.4	16	3	7	3	<2.8	<2.8	<2.1	<2.8	3
LEAD	<40	<27	<40	<27	58	<27	<40	<27	<40	<27	<27	<27	<27	<27
NICKEL	<15	<22	<15	<22	61	66	<15	<22	<15	<22	<22	<12	<22	<12
SELENIUM	<1	<3.1	<1	<3.1	7.6	5.2	2.2	<3.1	<1	<3.1	<3.1	<1	<1.6	<1
ZINC	26	<5.9	87	<5.9	341	502	<3	8	<3	<5.9	20	62	80	69

ARAR

50

50

NA: INTF:

All units in micrograms per liter (ug/L), ppb.

Source: Hunter/ESE, 1990.

* NEED DISCUSSION OF SIGNIFICANCE OF DETECTION LIMITS W/ LEVELS FOUND — VERY CLOSE

downgradient of the borrow and debris disposal areas. The sample from well 24GW2 also contained arsenic. Each well sample also contained one VOC. The sample from Well 24GW3 located on the southwestern edge of the fly ash disposal area contained seven metals. The sample from Well 24GW4, which is near the southeastern boundary of the same disposal area, contained only three metals. Well 24GW5, the well designed to be upgradient contained arsenic and copper as well as benzene.

In 1986 two additional shallow monitoring wells were installed downgradient of the filled areas. Figure 24-1 illustrates the locations of these newer wells. All of the existing and newly installed monitoring wells were resampled in December 1986 and analyzed for: Metals A, VOCs and hexavalent chromium. The results are presented in Table 24-1. The two groundwater samples collected in December 1986 from the wells downgradient of the borrow and debris areas (24GW1 and 24GW2) did not contain any target analytes above method detection limits. The results from the 1986 samples collected from Wells 24GW3 and 24GW4, downgradient of the fly ash disposal area, were for the most part consistent with the earlier sampling results. The upgradient well sample (24GW5) had fewer detected target compounds in the 1986 data and no detected VOCs.

The two new monitoring wells, 24GW6 and 24GW7, were sampled twice, in December 1986 and in March 1987. The results indicate that the samples from the well southwest of the disposal areas (24GW6) contained only limited amounts of metals, none of which were above groundwater standards. Well 24GW7, south of the disposal areas, contained only three metals. However, chromium was detected slightly above the groundwater standard of 50 ug/l in both Well 24GW7 samples.

SURFACE WATER/SEDIMENT

Two surface water (SW) and sediment (SE) samples were collected downstream of the Site 24 disposal areas in 1984. Samples from station 24SW1/SE1 were

collected from the drainage ditch immediately south of the filled areas. Samples from sampling stations 24SW2/SE2 were collected from Cogdels Creek, approximately 1000 ft downstream of Site 24 (refer to Figure 24-1). The surface water samples were analyzed for Metals A and VOCs, and the sediment samples for Metals A only. Appendix A presents a full listing of all target analytes and their abbreviations. Tables 24-2 and 24-3 present the analytical data for the surface water and sediment samples, respectively.

The surface water sample (24SW1) collected from the downgradient edge of the disposal locations contained two VOCs and copper and zinc. The concentrations for the metals were below North Carolina's standards for freshwater. The water sample collected in August 1984 from the downstream location (24SW2) contained the same two metals also at levels below established standards.

In December 1986, these two sampling stations were resampled and two additional stations were established. The samples were analyzed for Metals A, VOCs, and hexavalent chromium. The results are presented in Table 24-2. The samples collected in 1986 from stations 24SW1 and 24SW2 contained the same metals at concentrations similar to these in the 1984 data. The two VOCs that were identified at station 24SW1 during the 1984 sampling effort were not found above method detection limits in 1986. The surface water sample collected from station 24SW3, which is located to the southwest of the disposal areas, contained lead and zinc. The concentration identified for lead (27.4 ug/l) is slightly above North Carolina's freshwater standard (25 ug/l). The water sample collected from station 24SW4 contained concentrations of arsenic and zinc which were both below the freshwater standards established for these metals.

Sediment samples were collected from each of the four surface water sampling locations at the same sampling frequency. The analytical results, as presented in Table 24-3, indicate that as many as seven metals were detected in the samples. The lowest concentrations of metals were identified in the

TABLE 24-2. SITE 24 - INDUSTRIAL AREA FLY ASH DUMP
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES

	24SW1	24SW1	24SW1	24SW2	24SW2	24SW3	24SW4
DATE	8/4/84	8/4/84	12/3/86	8/4/84	12/3/86	12/3/86	12/3/86
PARAMETER							
T-1,2-DICHLOROETHENE	2.7	NA	<1.6	<0.6	<1.6	<1.6	<1.6
TRICHLOROETHENE	7.1	NA	<1	<0.8	<1	<1	<1
ARSENIC	<30	<30	<2.1	<30	<3.1	<3.1	4
CHROMIUM	<3	<3	<9.4	<3	9.7	<9.4	<9.4
CHROMIUM(+6)	NA	NA	<10	NA	20.6	<10	<10
COPPER	4.7	5.4	4.5	2.8	<2.8	<2.8	<2.8
LEAD	<33	<33	<27	<33	<27	27.4	<27
ZINC	28	25	11.7	20	<5.9	14.8	6.8

APAR

25

NA

All units in micrograms per liter (ug/L), ppb.

Source: Hunter/ESE, 1990

TABLE 24-3. SITE 24 - INDUSTRIAL AREA FLY ASH DUMP
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	24SE1	24SE1	24SE2	24SE2	24SE3	24SE4
DATE	8/3/84	12/3/86	8/3/84	12/3/86	12/3/86	12/3/86
PARAMETER						
ARSENIC	<0.05	1.2	0.3	<0.798	0.968	5.15
CADMIUM	0.3	<0.804	1.9	<0.715	<0.761	2.16
CHROMIUM	1.6	5.68	29.3	3.87	3.36	33.8
LEAD	4	13.2	180	12.14	10.1	162
COPPER	1	4.19	7	2	2.94	21.6
NICKEL	0.3	<6.10	1	<5.43	<5.77	<12.9
ZINC	6	13.1	95	14.7	19.5	155

ARAR.

All units in milligrams per kilogram (mg/kg), ppm !?

Source: Hunter/ESE, 1990.

sample collected from the station immediately downgradient of the disposal areas (24SE1). The sample from location 24SE4, which is located on a tributary to Cogdels Creek, contained the highest concentrations of metals.

3.7.3 SUMMARY AND CONCLUSIONS

Although several metals were detected in the groundwater samples collected at this site, North Carolina groundwater standards were only exceeded in two samples. The concentrations for chromium (130 and 98 ug/1) and lead (58 ug/1) in the samples collected from Well 24GW3 downgradient of the fly ash disposal area are greater than North Carolina's standards for chromium (50 ug/1) and lead (50 ug/1). The samples collected from 24GW7, which is located south of the disposal areas, also slightly exceeded the groundwater standard for chromium.

The concentrations of benzene detected in the sample from Well 24GW5 and chloroform which was detected at Well 24GW1 were both above North Carolina's groundwater standards for those compounds.

Of the surface water samples collected during the two sampling efforts, only one sample (24SW3) contained a parameter (lead) above North Carolina's standards established for freshwaters.

All of the sediment samples contained at least four metals, and the sample collected at station 24SE2 contained seven.

3.7.4 RECOMMENDATIONS

The existing monitor wells at Site 24 are located along the margins of the filled areas. No sampling of groundwater or soil has been conducted within the filled areas, and therefore, the strength of the contamination within Site 24 has not yet been determined. Additional monitor wells should be installed and a detailed soil sampling effort should be conducted at this

AOC. When these efforts have been completed, a Risk Assessment should be initiated. The Risk Assessment will determine the need for an FS.

3.8 SITE 28 - HADNOT POINT BURN DUMP

3.8.1 SITE BACKGROUND

The Hadnot Point Burn Dump (Figure 28-1) is located east of the Mainside Sewage Treatment Plant and is on both sides of Cogdels Creek (PWDM Coordinates 10,Q13-14/R13-14). A variety of solid wastes including mixed industrial waste, trash, garbage, oil-based paint, and refuse was burned and subsequently covered with dirt on this 23 acre disposal area which was in operation from 1946 to 1971. Upon its closure in 1971, the surface was graded and grass was planted. The volume of fill is estimated at 185,000 to 379,000 cubic yards. Since the waste was burned, no approximation of the remaining amount of specific substances can reasonably be made. The site is currently used as a recreational area including a stocked fishing pond.

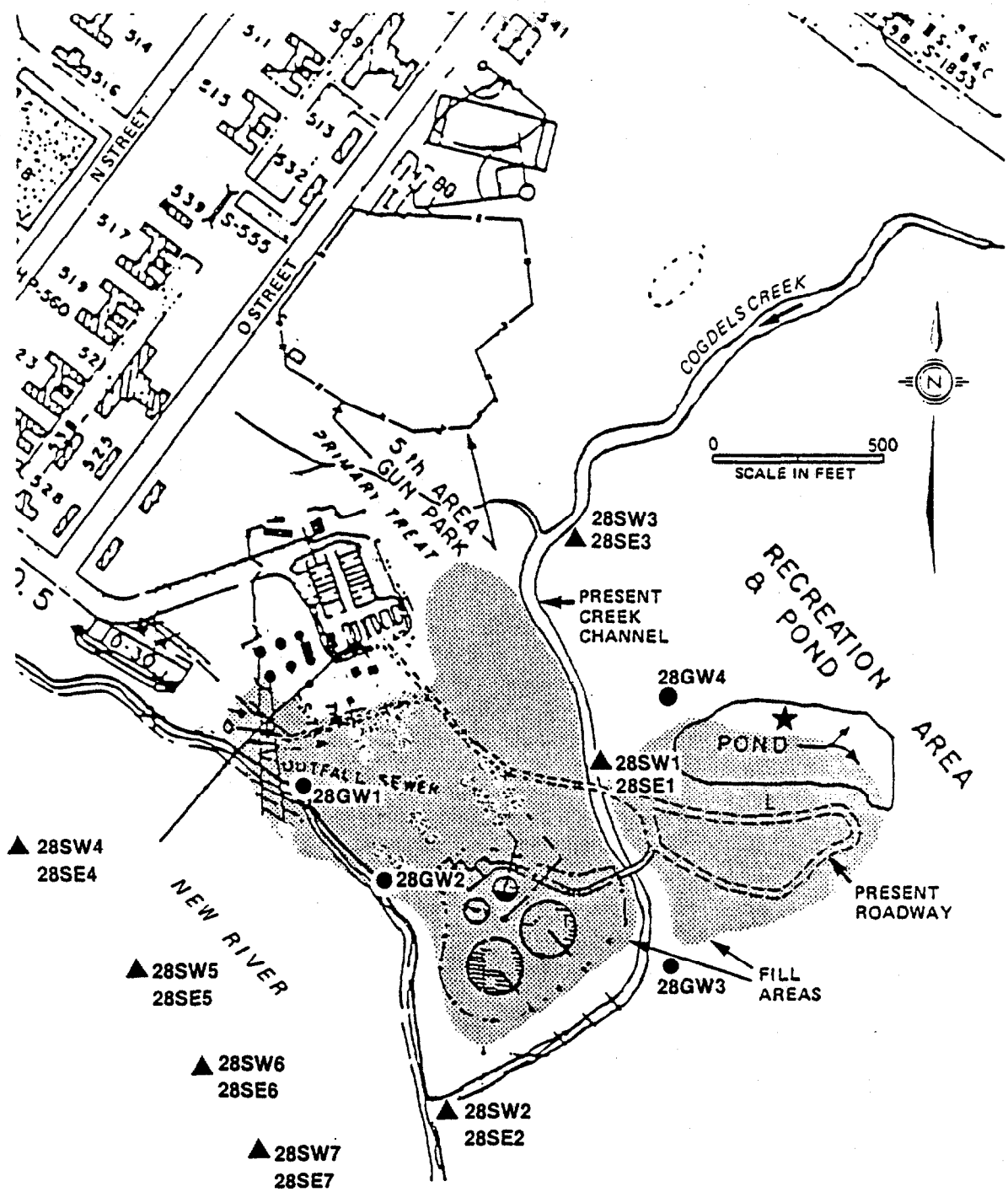
Site 28 is underlain primarily by silty sand, however sandy, gravelly fill material and debris from the former disposal activities were encountered during drilling activities. Figure 28-2 presents a geologic cross section of the area drawn on a northwest-southwest line (Figure 28-3).

The surface of the shallow groundwater at this site ranges in depth from 1.48 to 3.35 feet below land surface and lies within the silty sand and the debris. The cross section and groundwater contour map (Figure 28-4) show the pond and Cogdels Creek to be potential sources of recharge at this site. Groundwater flow is to the west toward the New River at a gradient of approximately 0.002 ft/ft.

3.8.2 SITE INVESTIGATION

GROUNDWATER

Four shallow monitoring wells were installed (Figure 28-1) and sampled as part of the 1984 groundwater investigation. Three wells were installed in 1984; Well 28GW1 and Well 28GW2 on the downgradient side of the site at the shoreline of the New River, and Well 28GW3 on the downgradient side of the eastern portion of the site, east of Cogdels Creek. One monitoring well



LEGEND
- ● MONITOR WELL
- ▲ SURFACE WATER/SEDIMENT SAMPLING STATION

SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 28-1
SAMPLING LOCATIONS, SITE 28—
HADNOT POINT BURN DUMP

MARINE CORPS BASE
CAMP LEJEUNE

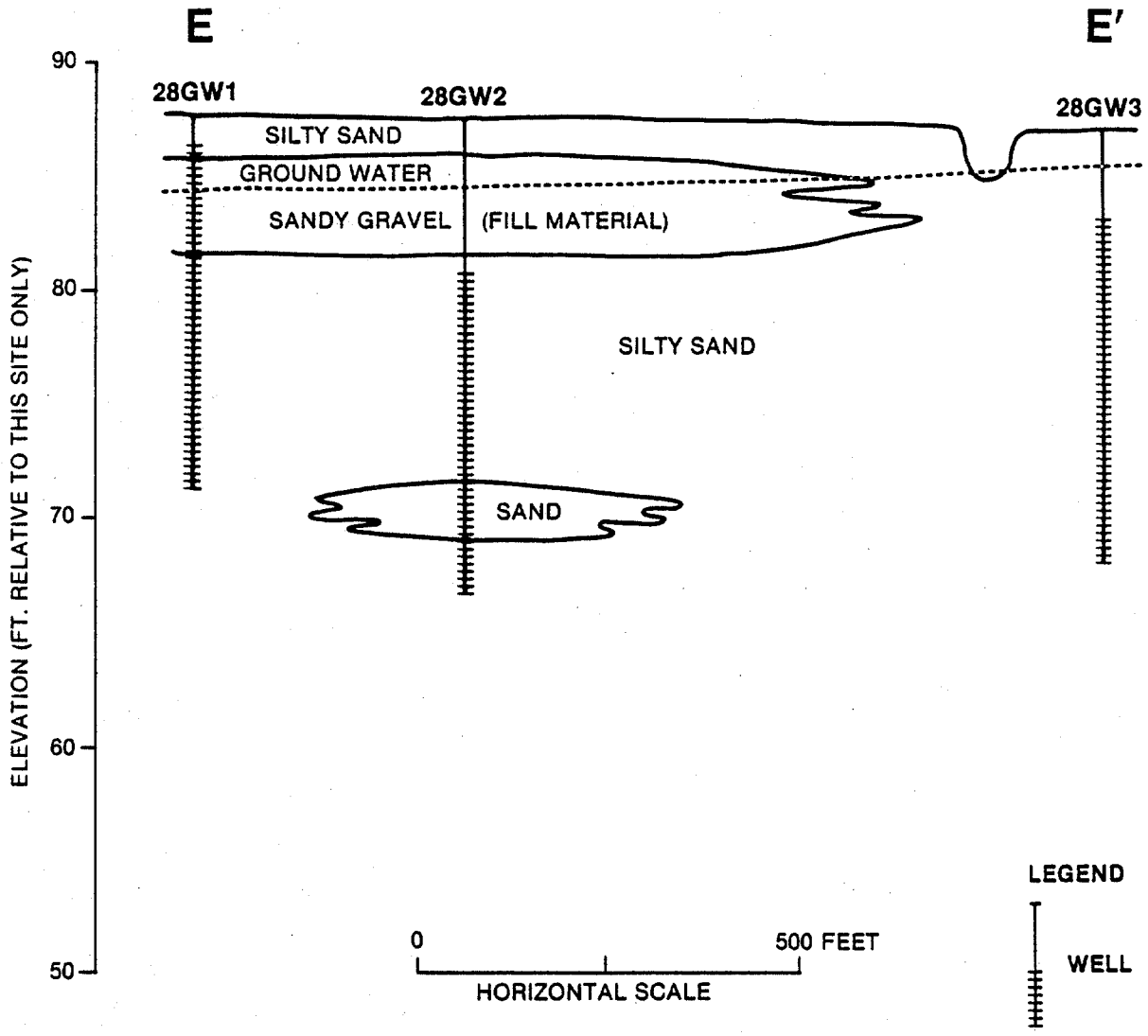
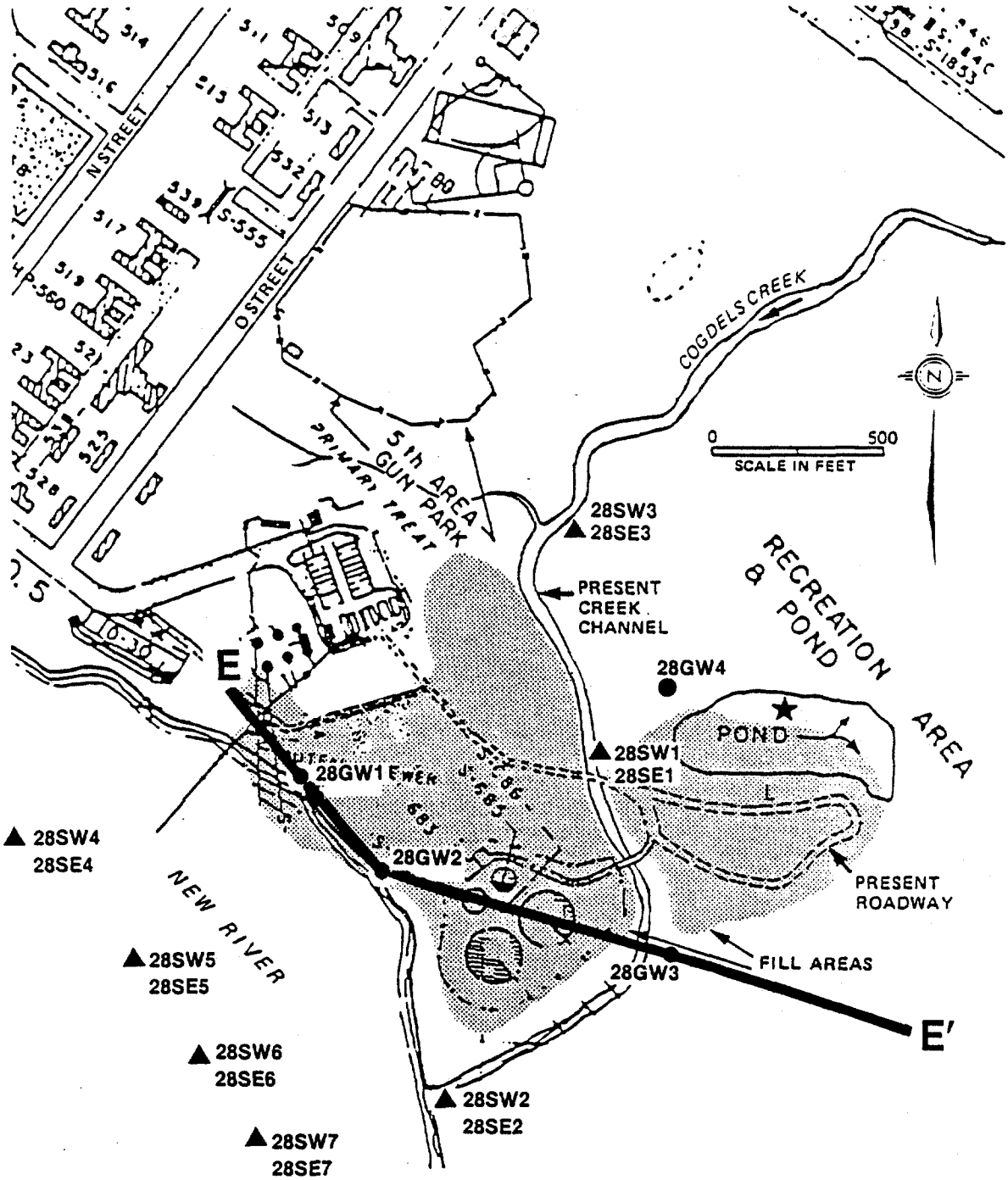


Figure 28-2
GEOLOGIC CROSS SECTION, SITE 28—
HADNOT POINT BURN DUMP

MARINE CORPS BASE
CAMP LEJEUNE



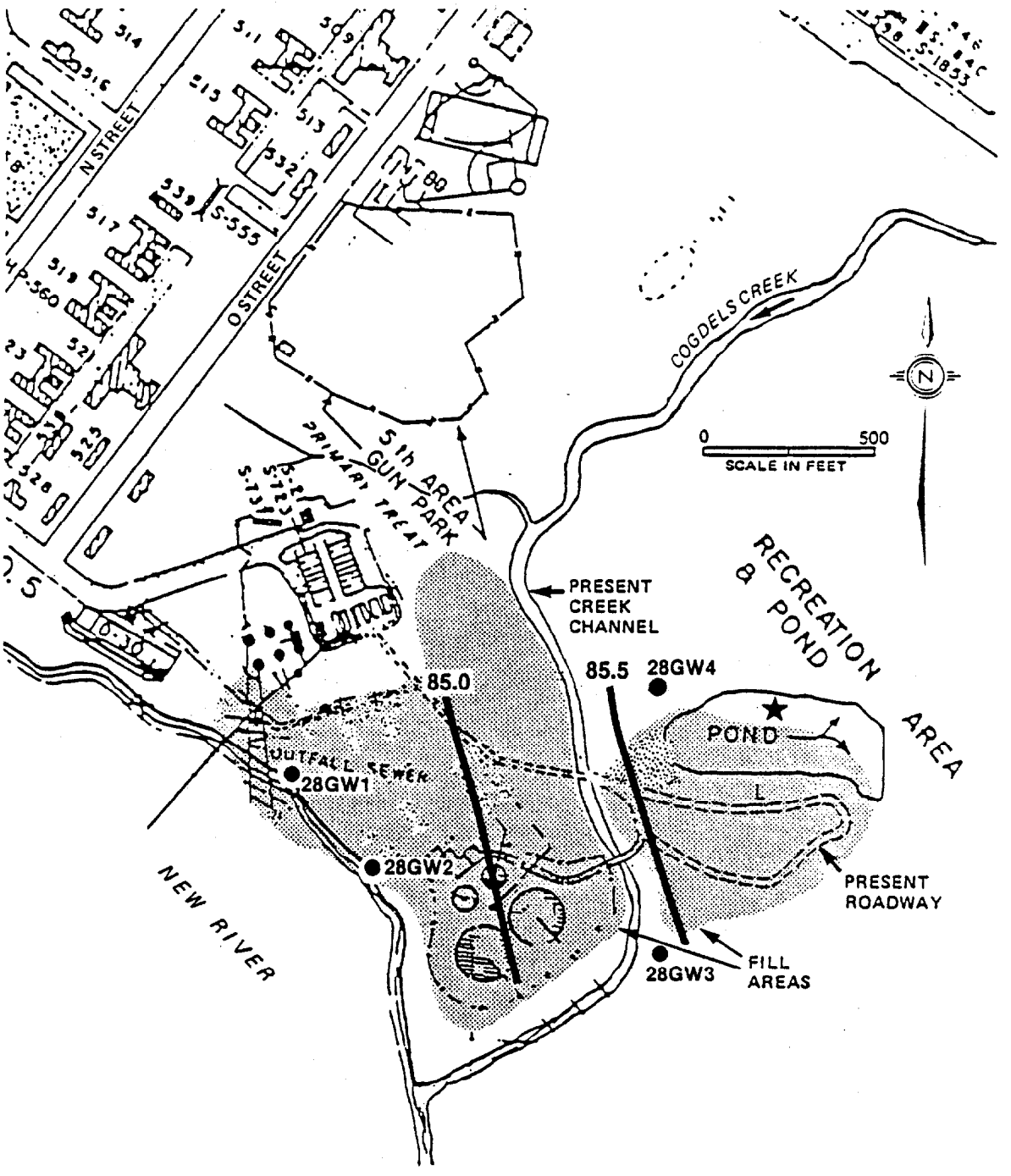
LEGEND

- ● MONITOR WELL
- ▲ SURFACE WATER/SEDIMENT SAMPLING STATION

SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 28-3
GEOLOGIC CROSS SECTION LOCATION, SITE 28—HADNOT POINT BURN DUMP

MARINE CORPS BASE CAMP LEJEUNE



LEGEND

● MONITOR WELL

CONTOUR INTERVAL 0.5'

ALL ELEVATIONS RELATIVE TO THIS SITE ONLY

SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 28-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 28—
HADNOT POINT BURN DUMP

MARINE CORPS BASE
CAMP LEJEUNE

(28GW4) was installed in 1986 upgradient of the filled areas and the recreational pond. Table 28-1 presents the analytical data from the July 1984, December 1986 and March 1987 sampling efforts. Only those parameters that were detected above the method detection limits are reported in the table. The groundwater samples were analyzed for the following analytes:

- o Metals B
- o Hexavalent chromium (Cr^{+6})
- o Organochlorine pesticides (OCP)
- o Polychlorinated Biphenols (PCB)
- o Oil and Grease (O&G)
- o Volatile organic compounds (VOC)
- o Tetrachlorodioxin (TCDD) (1986/87 only)
- o Xylene (1986/87 only)
- o Methylethyl ketone (MEK) (1986/87 only)
- o Methyl isobutyl ketone (MIBK) (1986/87 only)

Appendix A presents a full listing of all target analytes and their abbreviations. In July 1984 detectable levels of DDD and DDE were identified in all three monitoring well samples. No pesticides were detected in the 1986 or 1987 samples.

Trace levels of VOCs were detected in the 1984 sample from Well 28GW1 located at the New River shore line downgradient of the filled area in the western portion of Site 28. Vinyl chloride was also detected in this well at a level which exceeded the 10^{-5} risk level. What is this figure? Three VOCs (trans-1,2-dichloroethene, vinyl chloride, and trichloroethene) were also detected in Well 28GW1 in December 1986. The levels of trans-1,2-dichloroethene detected in 1984 and 1986 were below the groundwater standard of 70 ug/L. The levels of trichloroethene are above the N.C. Groundwater Standard of 2.8 ug/L.

Metals were detected in the July 1984 samples from Wells 28GW1 and 28GW3. The highest concentration of metals found were in Well 28GW3; chromium and

TABLE 28-1. SITE 28 - HADNOT POINT BURN DUMP
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

	28GW1	28GW1	28GW2	28GW2	28GW3	28GW3	28GW4	28GW4
DATE	7/7/84	12/16/86	7/7/84	12/16/86	7/7/84	12/11/86	12/11/86	3/4/87
PARAMETER								
T-1,2-DICHLORO								
ETHENE	38	14	<1.3	<1.6	<1.5	<1.6	<1.6	<1.6
TRICHLOROETHENE	15	4.9	<1.4	<1.0	<1.7	<3.0	<3.0	<3.0
VINYL CHLORIDE	22	13	<1	<1.0	<1	<1.0	<1.0	<1.0
DDD,PP'	0.12	<0.013	0.093	0.018	0.22	<0.013	<0.013	<0.006
DDE,PP'	0.015	<0.013	0.028	<0.013	0.007	<0.013	<0.013	<0.006
DIELDRIN	0.003	<0.013	<0.001	<0.013	<0.001	<0.013	<0.013	<0.006
OIL & GREASE	5	8	2	0.4	0.8	<0.3	<0.09	9
ARSENIC	18	9.5	<1	<2.1	21	INTF	INTF	12.1
CHROMIUM	<6	12	<6	<9.4	330	15.8	92.6	54
CHROMIUM(+6)	NA	<10	NA	<10	NA	<10	46.4	<10
LEAD	<40	140	<40	38	336	<27	<27	<27
MERCURY	0.3	0.2	<0.2	0.3	<0.2	0.8	0.7	0.5
NICKEL	<15	<22	<15	<22	39	<22	43.1	16
ZINC	<3	58	<3	39	143	12.3	142	77

INTF - Interference
NA - not analyzed

Units are in micrograms per liter (ug/L),

Source: Hunter/ESE, 1990.

lead exceeded the applicable groundwater standards. Mercury was detected in Well 28GW1 at concentrations below the N.C. Groundwater Standard of 1.1 ug/L. A number of metals were detected in all four monitoring wells in the 1986 and 1987 samples, suggesting a relatively uniform disposal pattern throughout the site. Of the detected metals, total chromium was detected above the groundwater standard in Wells 28GW3 and 28GW4. Hexavalent chromium was detected in the 1986 sample from Well 28GW4, but not in the March 1987 sample. Arsenic was detected in Wells 28GW1, 28GW3, and 28GW4 in the July 1984, December 1986 and March 1987 samples where the analysis did not encounter matrix interference.

Low levels of O&G were detected in all three monitoring well samples collected in 1984, and in all four well samples collected in 1986 and 1987 except for Well 28GW3 in 1986.

The levels and mix of detected analytes in the two rounds of sampling are somewhat different. Of the greatest significance is the lack of pesticides detected in the 1986 and 1987 samples suggesting that the occurrence of these analytes in the groundwater is subject to time variance. The levels of VOCs detected in Well 28GW1 in 1986 are in similar proportion to those detected in 1984, but are slightly reduced. The levels of metals detected in all 1986/87 samples are generally similar to the 1984 samples, although there appears to be a general lowering of metal concentrations in the 1986/87 samples overall.

SURFACE WATER

Seven surface water sampling stations (Figure 28-1) were sampled as part of the investigation. Two of the seven sampling locations were sampled in August 1984; 28SW1 in the north central portion of the filled area where Cogdels Creek passes through the landfill and 28SW2 in Cogdels Creek downstream of the filled area near the intersection with the New River. During the December 1986 investigation, five new sampling locations were added, four in the New River and one in Cogdels Creek upstream of the filled

area. The surface water samples were analyzed for the same parameters as the groundwater samples. Table 28-2 presents the analytical data for all analytes that were detected over the method detection limit.

The water chemistry data for the surface water differed significantly from the groundwater data indicating that the analytes detected in the surface water may be attributed to activities upstream of the site or of a unique disposal at the far northern portion of the site. BHC,A, BHC,B and BHC,D were present in the December 1984 samples from 28SW1 and 28SW2 but were not identified in the groundwater during that same time. These pesticides were not detected in any of the December 1986 samples.

Trichloroethene was detected in both of the Cogdels Creek surface water samples in 1984 but were not detected in any of the 1986 samples. This VOC was also detected in the samples collected from Well 28GW1 in both 1984 and 1986.

Did detection limits change?

Zinc was detected in surface water samples collected in 1984 from 28SW1 and 28SW2. It was not detected at 28SW1 or 28SW2 in the 1986 samples and was present in only 28SW4 in 1986. Mercury was not detected in 1984 samples but was present in the 1986 samples for all three locations in Cogdels Creek at levels greater than the water quality standard of 0.2 ug/L. Since mercury was present upstream of the site (28SW3), this may indicate that the source is upstream of the Hadnot Point Burn Dump. Chromium was not detected in Cogdels Creek but was present in two of the four samples taken from the New River. Cadmium was detected at sampling station 28SW2 in August 1986 but was not detected in December 1986.

SEDIMENT

Seven sediment locations corresponding to the surface water sampling locations were sampled as part of the investigation (Figure 28-1). The sediment samples were analyzed for the following parameters:

TABLE 28-2. SITE 28 - HADNOT POINT BURN DUMP
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES

	28SW1	28SW1	28SW1	28SW2	28SW2	28SW2	28SW3	28SW4	28SW5	28SW6	28SW7
DATE	8/3/84	8/4/86	12/11/86	8/3/84	8/4/86	12/11/86	12/11/86	12/15/86	12/15/86	12/15/86	12/15/86
PARAMETER											
BHC,A	0.01	<0.001	<0.035	<0.001	<0.001	<0.035	<0.035	<0.013	<0.025	<0.013	<0.013
BHC,B	0.0009	<0.0001	<0.013	0.002	<0.0001	<0.013	<0.013	<0.013	<0.025	<0.013	<0.013
BHC,D	0.004	<0.0003	NR	<0.0003	<0.0003	NR	NR	<0.013	<0.025	<0.013	<0.013
CADMIUM	<4	NA	<2.9	<4	8.4	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9
CHROMIUM	<3	NA	<9.4	<3	<5	<9.4	<9.4	17.8	<9.4	10.7	<9.4
MERCURY	<0.2	NA	0.8	<0.2	<0.2	0.5	0.6	<0.2	<0.2	<0.2	<0.2
ZINC	32	NA	<5.9	20	29	<5.9	<5.9	8.9	<5.9	<5.9	<5.9
TRICHLOROETHENE	1.3	NA	<3	1.1	NA	<3	<3	<3	<3	<3	<3

NA - not analyzed
NR - not reported

Units are in micrograms per liter (ug/L), ppb.

Source: Hunter/ESE, 1990.

- o Metals B
- o Organochlorine pesticides (OCP)
- o Polychlorinated Biphenols (PCB)
- o Oil and Grease (O&G)
- o Tetrachlorodioxion (TCDD) (1986 only)
- o Hexavalent Chromium

Appendix A lists the individual target analytes and their abbreviations. Analytical results for the sediment samples are presented in Table 28-3. Only those parameters detected above method detection limits were reported. Chlordane was the only parameter detected in the sediment that was not detected in either the groundwater or the surface water. Chlordane was detected in all three samples from Cogdels Creek during the December 1986 sampling effort. In addition DDE was detected in 1984 and 1986 in both 28SE1 and 28SE2.

O&G levels were higher in 1986 than in 1984 within Cogdels Creek. Similar concentrations were identified in the New River samples.

Detectable levels of arsenic, cadmium, chromium, lead, nickel and zinc were identified in most of the samples in both Cogdels Creek and the New River. Nickel was the only metal of those listed above that was not present in all four of the New River samples.

TISSUE

Two samples from fish tissue were obtained from the fresh water pond at the north terminus of Site 28 in 1984 only. The tissue samples were analyzed for OCP and PCB. Listed below are the analytical results of the sampling effort performed on July 17, 1984:

TABLE 28-3. SITE 28 - HADNOT POINT BURN DUMP
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	28SE1	28SE1	28SE2	28SE2	28SE3	28SE4	28SE5	28SE6	28SE7
DATE	8/3/84	12/11/86	8/3/84	12/11/86	12/11/86	12/15/86	12/15/86	12/15/86	12/15/86
PARAMETER									
CHLORDANE	<2.3	298	<4.1	347	595	<63.9	<64.5	<66.1	<64.5
DDD,PP'	84	<15.9	2.2	<35.1	<45.9	<12.8	<12.9	<13.2	<12.9
DDE,PP'	1.2	243	0.5	61.9	<59.7	<155	<156	<160	<156
OIL & GREASE	474000	1520000	1440000	2750000	4630000	238000	177000	<176000	144000
ARSENIC	1500	6860	<100	10300	10400	<561	<757	1320	645
CADMIUM	100	3150	<100	<1940	4470	<617	<459	<473	<452
CHROMIUM	10000	22500	400	18200	27400	2380	3530	2690	2770
LEAD	46000	190000	2000	42100	135000	<5750	<4270	4520	4750
NICKEL	2000	13400	800	<14700	<20100	<4680	<3480	<3590	<3430
ZINC	16000	675000	1000	79100	167000	4380	3730	6060	4980

ARAR

detection limits don't help!

were able to detect some levels below detection limit & others!

'84 #'s too close to det. limit

again det. limit above other levels found.

Units are in micrograms per kilogram (ug/kg), ppb

Source: Hunter/ESE, 1990.

Parameter	Concentration (ug/L) 28TI1	28TI2
PCBs, Total	11	8
BCH,A	0.10	0.1

PCBs were not detected elsewhere in the investigation. PCBs are bioaccumulated in the foodchain and may or may not have originated from the site depending on the origin of the fish in the pond. The BHC,A data for tissue indicate that this compound was present in this area of Site 28 and may be discharging to Cogdels Creek, as indicated by the surface water chemical data. Levels of PCB and BHC,A were below acute toxicity levels.

3.8.3 SUMMARY AND CONCLUSIONS

The groundwater contour map (Figure 28-4) strongly indicates that groundwater from the shallow aquifer directly discharges to the New River and discharges indirectly through Cogdels Creek. Target analytes in the shallow groundwater have been detected in excess of applicable groundwater standards. This indicates that contaminants from Site 28, are discharging to the New River. The surface waters and sediments of Cogdels Creek were also found to contain contaminants at concentrations greater than applicable freshwater standards. By the continuous discharge of surface waters into the New River and through the episodic sediment scour of the creek bottom during high flow conditions, contaminated waters and sediments are migrating to the New River from Site 28.

Metals appear to be the most prevalent contaminant group encountered since they were detected during both rounds of sampling in the groundwater, surface water and sediment samples. All detected metals appear to have their source within the site except for possibly mercury. Groundwater concentrations of the metals appear to be generally lower as time progressed from one round of sampling to the next. Concentrations in sediment samples from Cogdels Creek, however, seemed to have increased with time. Cadmium concentrations in the

surface water (28SW2) exceed the state water quality standards for freshwater classes (2.0 ug/L). Mercury levels in the surface water (28SW1, 28SW2, and 28SW3) exceed the standard of 0.20 ug/L.

An upstream sampling station (28SW3 and 28SE3) was sampled in December 1986. Mercury was detected in the surface water at this location and also in Wells 28GW1, 28GW3, and 28GW4. This may indicate that mercury contamination is not only present at the site but is also migrating from an upstream location. Chlordane was detected in only sediment samples from Cogdels Creek during 1986. This may also be migrating from an upstream location since it was only detected in the sediments of Cogdels Creek with the highest concentrations upstream of the site.

Pesticides (BHC,A, BHC,B, BHC,D) were detected in the surface water in Cogdels Creek in 1984 but were not detected in the groundwater at that time. This suggests that these analytes may have originated from activities upstream of the site or from a unique disposal operation at the far northern portion of the site. These pesticides were not detected in the December 1986 sampling effort.

O&G appear to be a consistent contaminant throughout the site. It was detected in both rounds of sampling in the groundwater and sediment samples.

VOCs were detected in 28GW1 in both rounds of sampling but were not detected elsewhere in the site. This may suggest that the disposal of volatiles was limited to the area around 28GW1.

Tissue samples were taken from fish from the recreational pond and concentrations of BHC,A, and PCBs were detected. This suggests that pesticides may be present in the northern reaches of the site, or migrated from upgradient of the site. No conclusion can be drawn from the PCB levels

found in the tissue. PCBs were not detected in any other samples taken from Site 28.

3.8.4 RECOMMENDATIONS

The surface water and sediment of the recreational pond have not been sampled to date. It is recommended that analysis for the same parameters as the other surface water and sediment samples be performed. This will provide more data for the origin of PCB in the tissue samples. It will also provide data on the other analytes that are not bioaccumulated and may be originating from the far northern portion of the site, such as BHC,A, BHC,B, and BHC,D.

Chlordane and mercury were detected at the upstream sampling location within Cogdels Creek. These parameters were not detected at Site 24, the nearest site upstream of the Hadnot Point Burn Dump. Additional sampling of surface water and sediments should be performed within Cogdels Creek between Sites 28 and 24. These results will provide data which can be used to determine the source of these contaminants. Metals were also detected in the upstream samples from Cogdels Creek, and in the groundwater and other surface water and sediment samples of Site 28. It is apparent that metals are a concern at this AOC. Metal analyses should be added to any upstream samples to better evaluate migration from an upstream source.

A grid of soil sampling stations should be installed throughout the filled area of Site 28 to determine the volume of contaminated soil, and to determine the strength of the contamination in the soil matrix. Additional monitor wells should be installed in the shallow aquifer to determine if contaminant strength is greater than that identified in the existing monitor wells. Installation of deep monitor wells is also warranted to determine is the water supply aquifer is impacted by the shallow contamination detected to date.

When characterization of the contamination has been completed, a Risk Assessment should be conducted to determine remedials goals to be utilized by the FS.

3.9 SITE 30 - SNEADS FERRY ROAD FUEL TANK SLUDGE AREA

3.9.1 SITE BACKGROUND

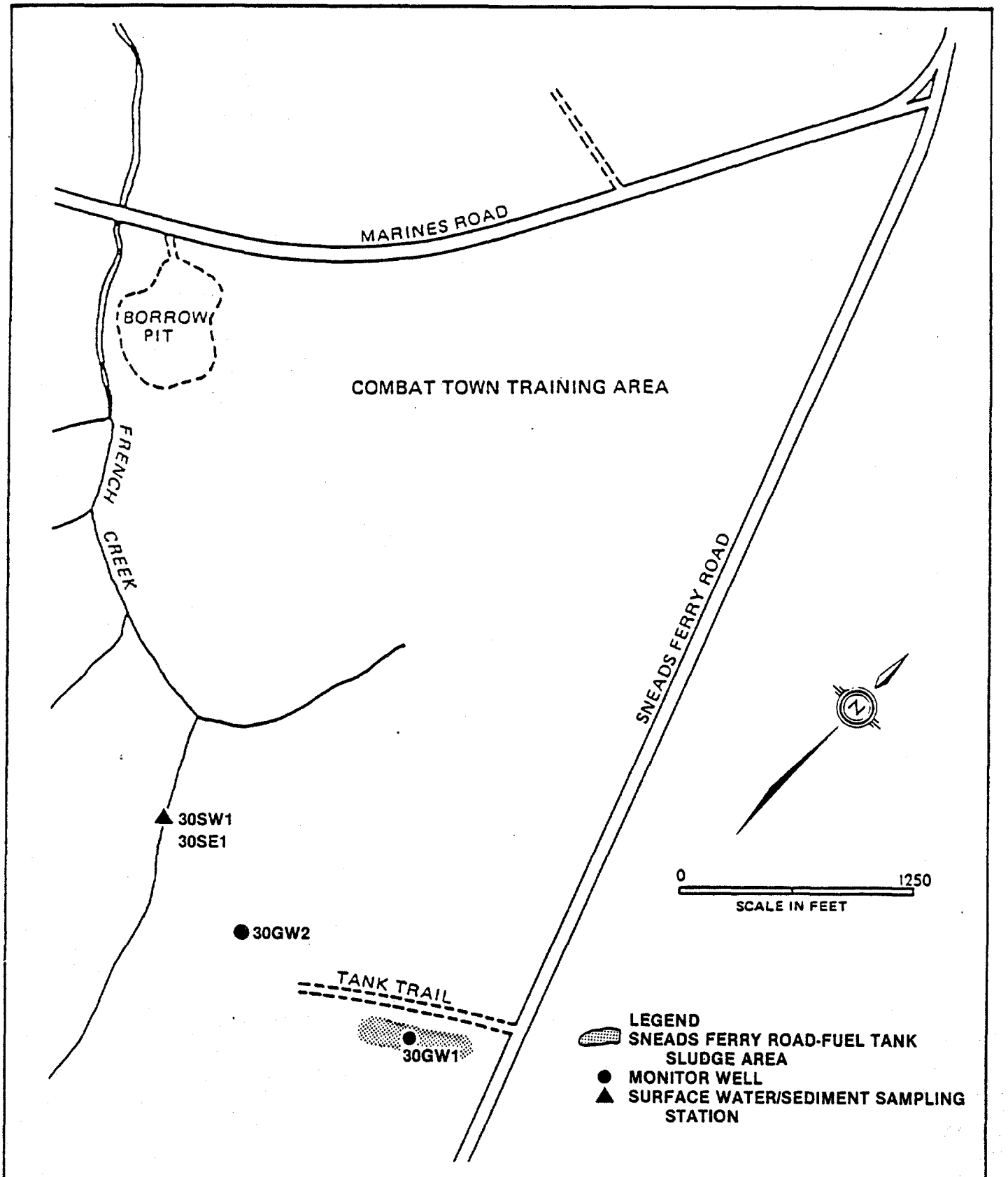
The Sneads Ferry Road Fuel Tank Sludge Area (Figure 30-1) located along a tank trail which intersects Sneads Ferry Road from the west, about 6,000 feet south of the intersection with Marines Road (PWDM Coordinates 18,GW12). The site is located approximately 1500 feet east of French Creek. In 1970, sludge from fuel storage tanks storing leaded gasoline containing tetraethyl lead and related compounds, and tank washout waters were disposed of at the site by a private contractor. It is estimated that at a minimum, 600 gallons of sludge or tank bottom deposits were dumped at the site. Two 12,000-gallon tanks were pumped out while the type of fuel stored was changed. The 600 gallon estimate is based on tank capacity below the tank outflow ports. Additional washout water may also have been present. Additional information suggests that the site had also been used for similar wastes from other tanks. Composition of the sludge and/or washout is unknown and may vary from containing substantial amounts of tetraethyl lead to containing mostly cleaning compounds.

Site 30 is underlain by layers of sand, silty sand, and gravelly sand. Figure 30-2 presents the geologic cross section of the area drawn on a east-west line (Figure 30-3). The surface of the shallow groundwater at this site lies within the upper layer of silty sand at depths ranging from 4.32 to 8.06 feet below land surface. The groundwater contour map (Figure 30-4) indicates that groundwater flow is to the northwest towards the unnamed tributary of French Creek at a gradient of approximately 0.004 ft/ft.

3.9.2 SITE INVESTIGATION

GROUNDWATER

Two shallow groundwater monitoring wells were installed as part of the 1984 and 1986 site investigations. Well 30GW1 was installed in 1984 and Well 30GW2 was installed in 1986 topographically downhill from the suspected



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 30-1
ROUND TWO SAMPLING LOCATIONS, SITE 30—COMBAT TOWN TRAINING AREA

MARINE CORPS BASE
CAMP LEJEUNE

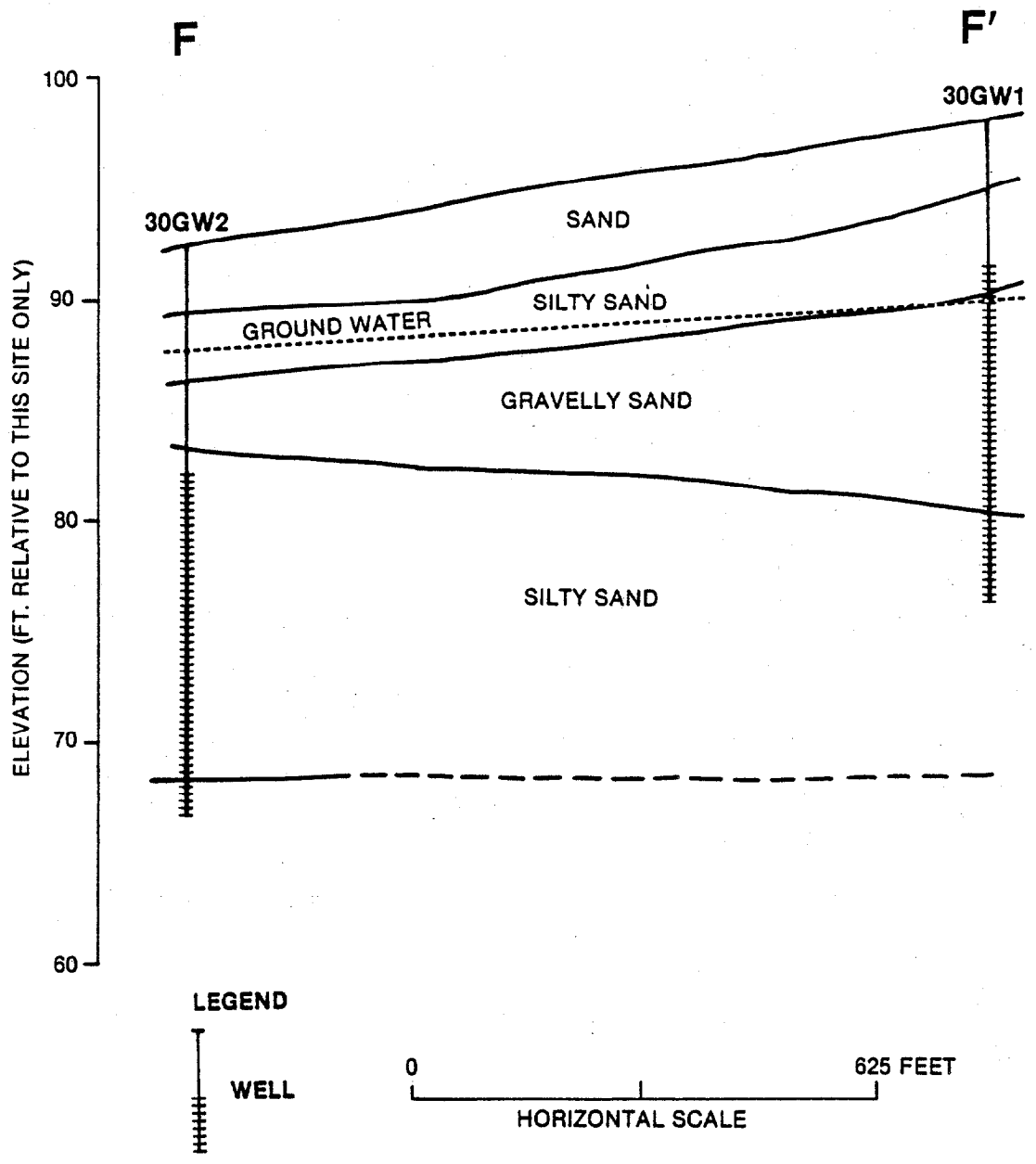
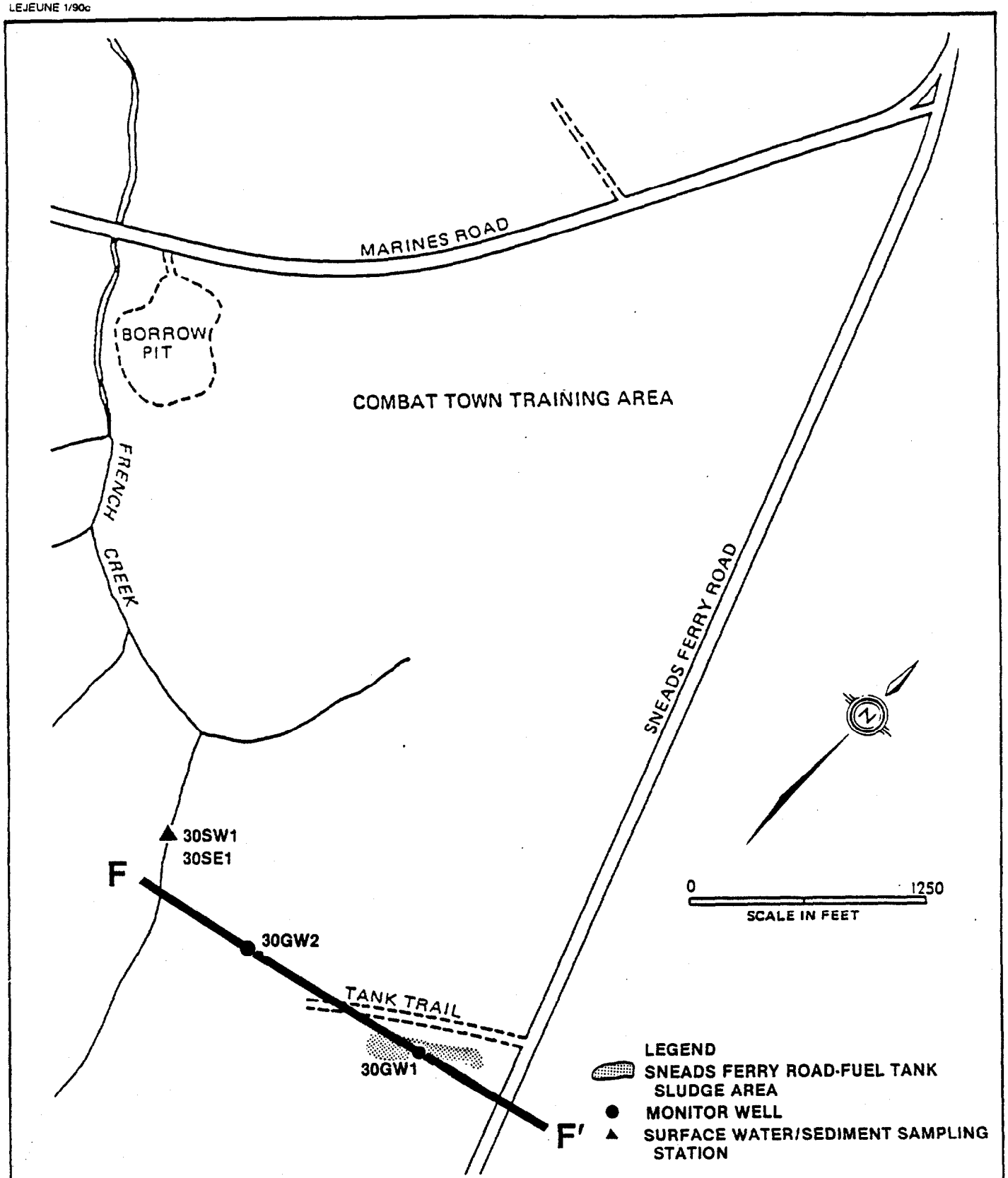


Figure 30-2
GEOLOGIC CROSS SECTION, SITE 30—
COMBAT TOWN TRAINING AREA

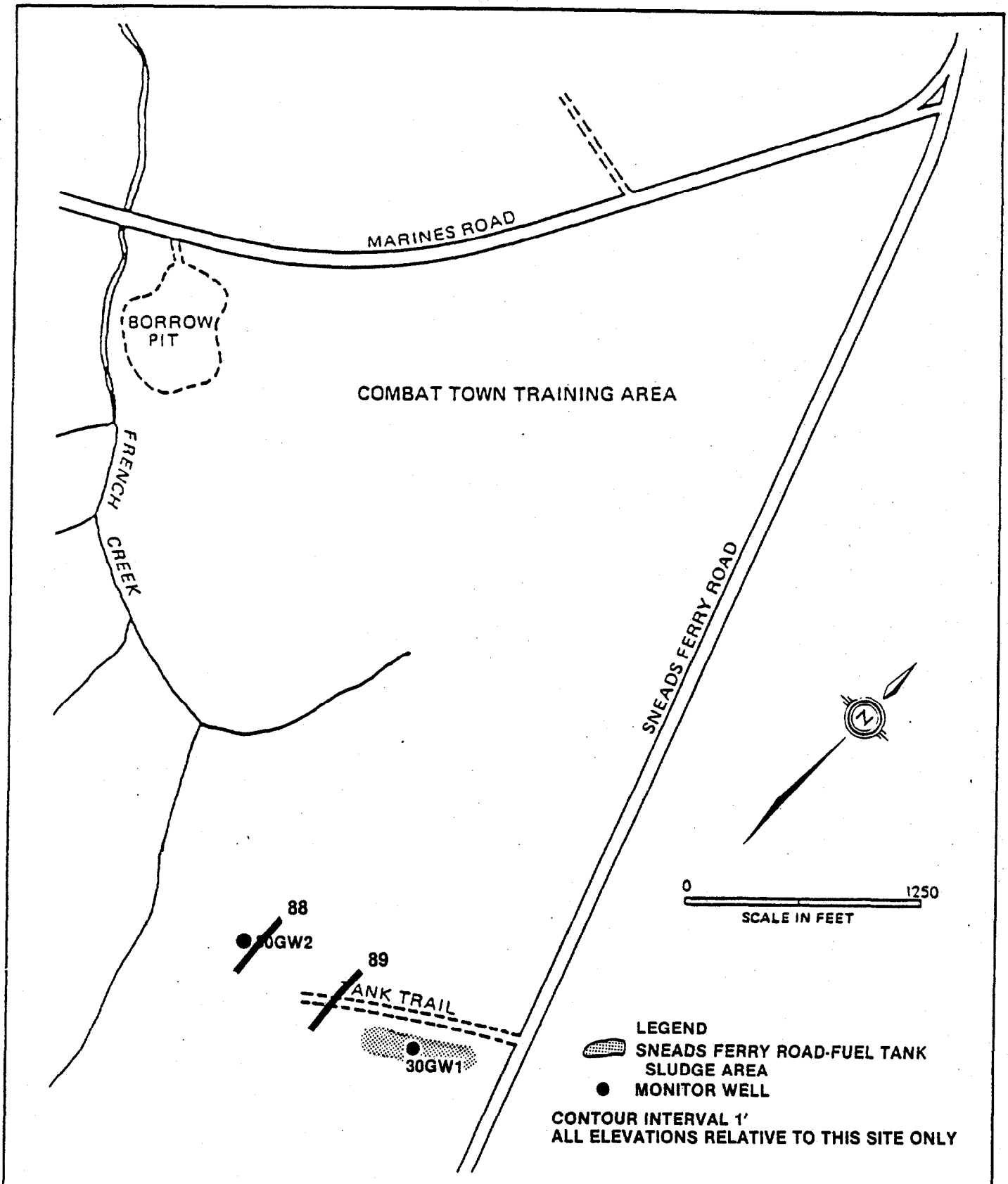
MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 30-3
GEOLOGIC CROSS SECTION LOCATION, SITE 30—COMBAT TOWN TRAINING AREA

MARINE CORPS BASE CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 30-4
GROUND WATER CONTOUR MAP— SHALLOW AQUIFER, SITE 30— COMBAT TOWN TRAINING AREA

MARINE CORPS BASE CAMP LEJEUNE

disposal site. Figure 30-1 illustrates the locations of these wells. The wells were sampled and analyzed for the following target compounds:

- Lead
- Volatile Organics (VOC)
- Oil and Grease (O&G)
- Xylene (1986/87 only)
- Methylethyl ketone (MEK) (1986/87 only)
- Ethylene dibromide (EDB) (1986/87 only)
- Methyl isobutyl ketone (MIBK) (1986/87 only)

Appendix A contains a full list of all target analytes and their abbreviations. Table 30-1 presents the analytical data for those analytes that had concentrations above the applicable method detection limits. Trace levels of chloroform were detected in Well 30GW1 and methylene chloride was detected in Well 30GW2 in 1986. Since neither analyte was detected in the 1984 sampling it is possible that these levels were laboratory artifacts and do not represent environmental contamination. This does not eliminate the potential presence of VOCs in the groundwater. However, if VOCs are present, it is estimated that the concentrations are very low.

Lead was detected in Well 30GW1 in 1984 and Well 30GW2 in 1986. O&G was detected in both monitoring wells in 1986 but was not detected in 30GW1 in 1984. This may be attributed to a lowering of detection limits in the 1986/87 analyses. The presence of O&G in the groundwater may suggest low levels of contamination resulting from the alleged disposal of gasoline and washwaters at this AOC. However, O&G appears to be ubiquitous at Camp Lejeune so a determination that Site 30 is a point source for O&G can not be definitely determined based on existing data.

SURFACE WATER

A single surface water sample was taken in December 1986 from the unnamed tributary to French Creek (Figure 30-1). The sample was analyzed for the

TABLE 30-1. SITE 30 - SNEADS FERRY ROAD FUEL TANK SLUDGE AREA
(COMBAT TOWN TRAINING AREA)
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

	30GW1	30GW1	30GW2	30GW2
DATE	7/6/84	12/4/86	12/4/86	3/6/87
PARAMETER				
LEAD	58	<27	30	<27
OIL & GREASE	<700	600	100	9000
CHLOROFORM	<1.2	2.6	<1.6	<1.6
METHYLENE CHLORIDE	<1	<2.8	3.3	<2.8

ARAR

Units in micrograms per liter (ug/L), ppb

Source: Hunter/ESE, 1990.

same parameters as the groundwater samples from this site. No detectable levels of any target compounds were identified in the sample.

SEDIMENT

A single sediment sample was taken from the unnamed tributary to French Creek in 1986 (Figure 30-1). The sample was analyzed for lead, O&G, and ethylene dibromide. Only O&G was detected at a concentration of 373 ug/g.

3.9.3 SUMMARY AND CONCLUSIONS

Site 30 is located on the edge of a small stream valley and the groundwater contour map (Figure 30-4) indicates that flow in the shallow aquifer is to the southeast, toward the channel of the stream (unnamed tributary to French Creek). The geochemical data indicate that O&G is present in both the estimated central area of the site (30GW1) and downgradient (30GW2), and in the stream bed sediment. Because the Combat Town Training Area which borders the Sneads Ferry Road Fuel Tank Sludge Area, is subject to heavy vehicular traffic, it is not clear whether the presence of O&G in the environment is attributed to the disposal area or the result of emergency vehicle maintenance in the Combat Town Training Area.

The one-time presence of common laboratory VOCs in one set of groundwater samples does not support the conclusion that the disposal practices at Site 30 contributed VOCs to the site contamination. Lead was detected in Well 30GW1 in the estimated central area in 1984, and Well 30GW2 downgradient of the disposal area in 1986. This may be attributed to the disposal practices but sufficient data are not available to make this conclusion.

3.9.4 RECOMMENDATIONS

At this time, it is unclear if the location of the alleged spill/disposal at Site 30 has been accurately determined. There are no surface indicators of the specific disposal site. Unless additional information can be identified which will more accurately locate the disposal area, it is recommended that

an additional set of samples be collected, and that a Risk Assessment be initiated to determine if the trace levels of contamination detected to date represent an unreasonable risk to health or the environment.

3.10 SITE 35 - CAMP GEIGER AREA FUEL FARM

3.10.1 SITE BACKGROUND

Camp Geiger Area Fuel Farm (Figure 35-1) is located north of the intersection of G and Fourth Streets, approximately 400 feet southwest of Brinson Creek (PWDM Coordinates 12, C11). This 2,500 square feet AOC was used in 1957 and 1958 for storing and pumping fuel. Mogas was released to the soil through a leak in an underground line near an above-ground storage tank and tank pad. The Camp Lejeune Fire Department has estimated the amount of fuel released to be in the thousands of gallons. Exact quantities released can not be determined since the records were destroyed. The spill migrated east and northeast towards and into Brinson Creek. Fuel at the surface of the shallow aquifer was disposed of by digging holes to the water table and igniting the fuel. Fuel which contaminated Brinson Creek was also ignited and burned.

Site 35 is underlain by layers of silty sand with interbedded layers of clayey sand, coarse sand, and sandy gravel. A geologic cross section of Site 35 is presented in Figure 35-2. The cross section is drawn on an east-west line (Figure 35-3). The surface of the shallow groundwater lies within the interbedded silty sand and clayey sand at depths ranging from 7.02 to 11.05 feet below land surface. The groundwater contour map presented in Figure 35-4 indicates that the shallow groundwater flows to the northeast toward Brinson Creek with a gradient of approximately 0.014 ft/ft.

3.10.2 SITE INVESTIGATION

GROUNDWATER

Three hand-augered borings to the groundwater surface were dug at the downgradient side of the facility in 1984 and three groundwater samples were collected (35GW1, 35GW2, and 35GW3). The samples were analyzed for lead, O&G, and VOCs. Appendix A lists the individual target analytes and their abbreviations. Table 35-1 presents the analytical results for those analytes that were above the appropriate method detection limits. Levels of lead (above N.C. Groundwater Standards) were identified in all three samples which

→ give value

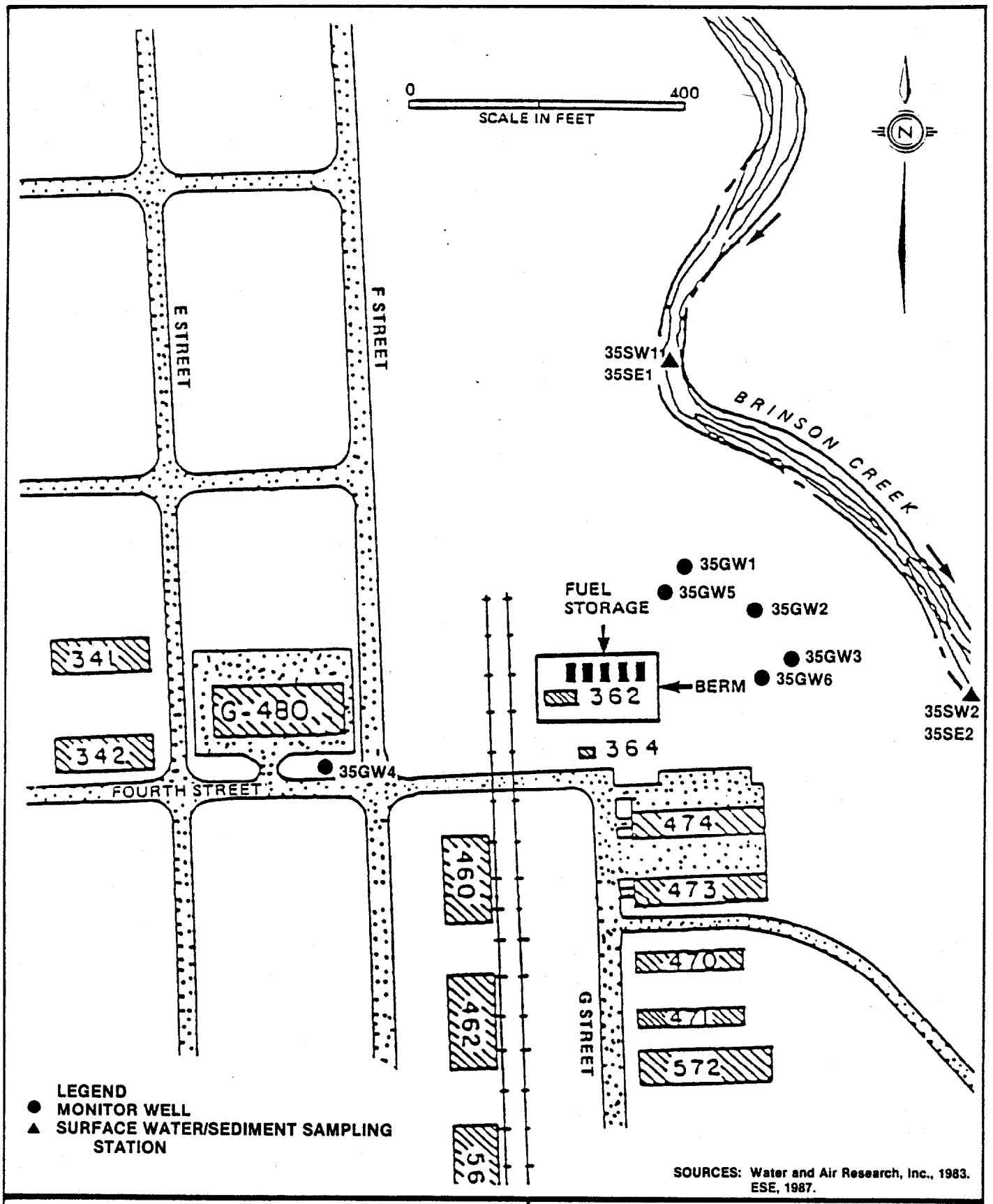


Figure 35-1
SAMPLING LOCATIONS, SITE 35—
CAMP GEIGER AREA FUEL FARM

MARINE CORPS BASE
CAMP LEJEUNE

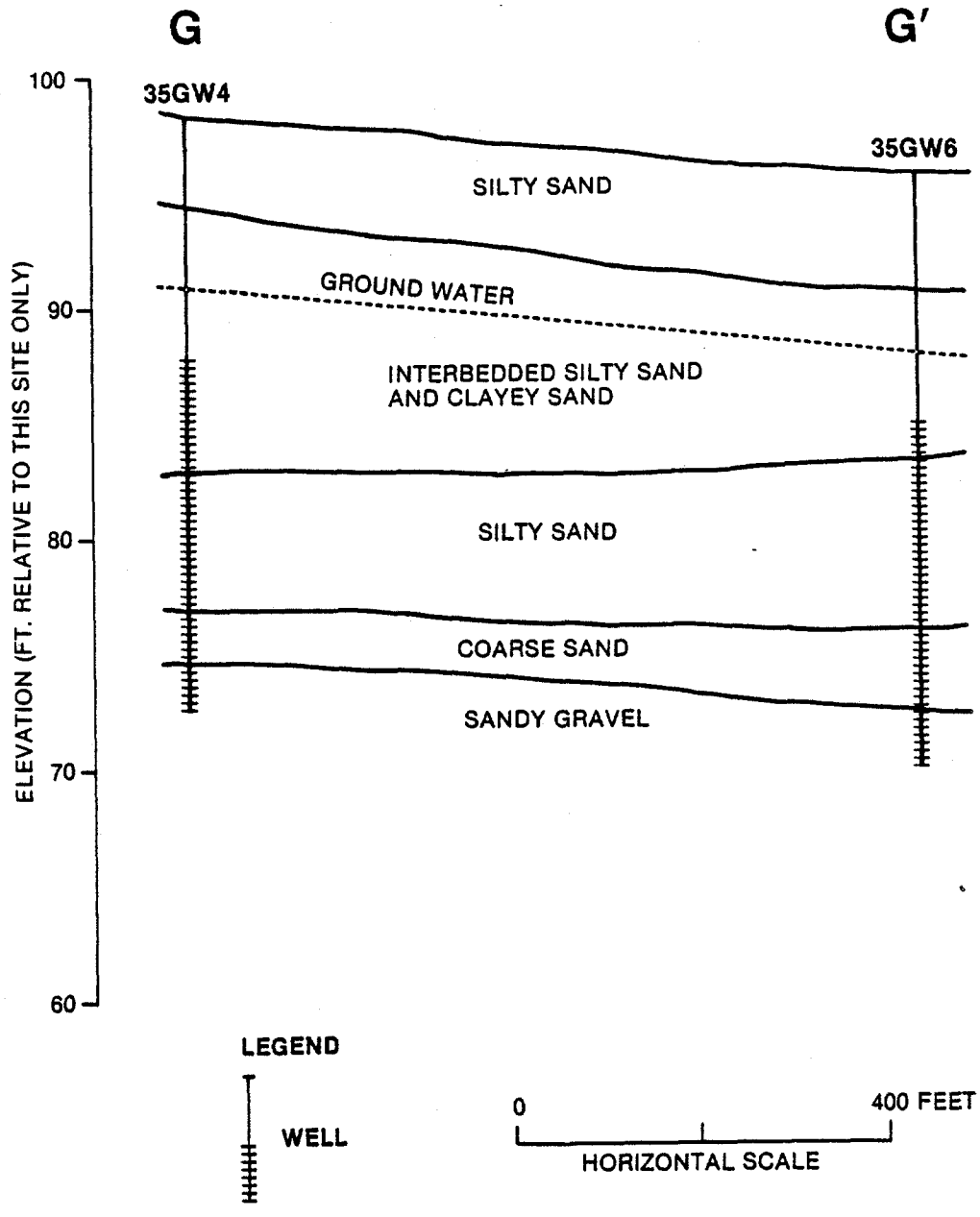


Figure 35-2
GEOLOGIC CROSS SECTION, SITE 35—
CAMP GEIGER AREA FUEL FARM

MARINE CORPS BASE
CAMP LEJEUNE

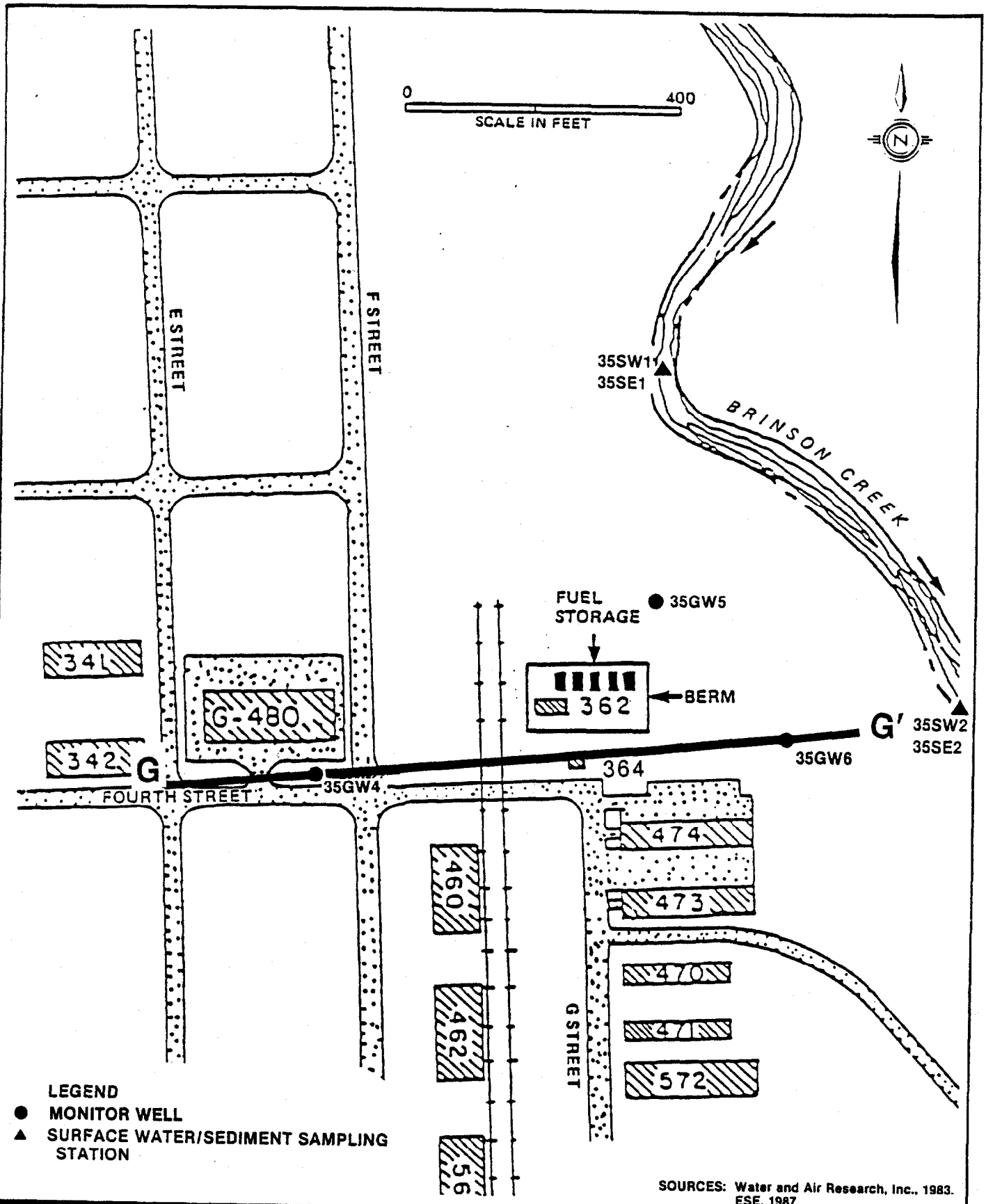
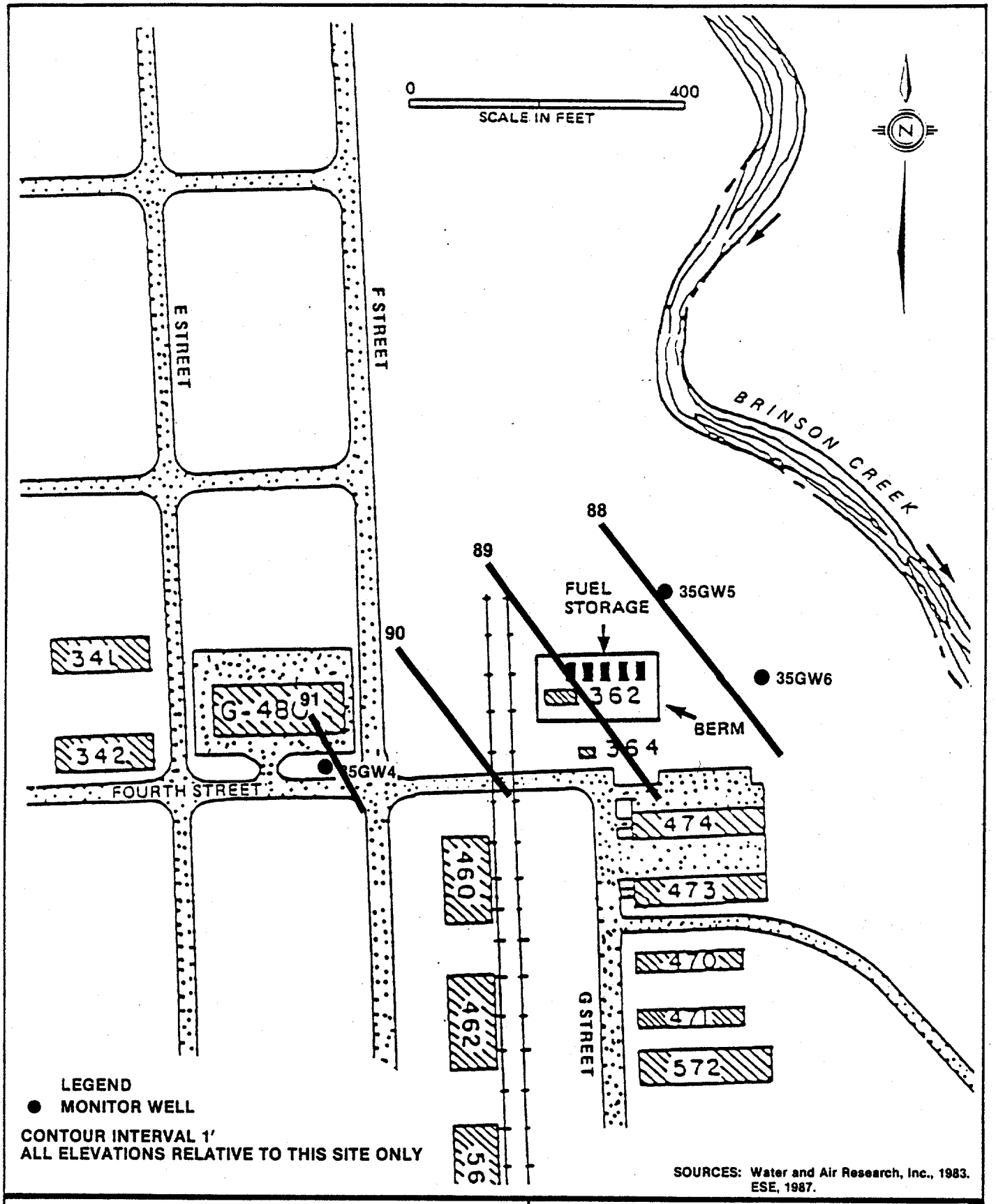


Figure 35-3
GEOLOGIC CROSS SECTION LOCATION, SITE 35—CAMP GEIGER AREA FUEL FARM

MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 35-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 35—
CAMP GEIGER AREA FUEL FARM

MARINE CORPS BASE
CAMP LEJEUNE

TABLE 35-1. SITE 35 - CAMP GEIGER AREA FUEL FARM
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	35GW1 8/7/84	35GW2 8/6/84	35GW3 8/7/84	35GW4 12/4/86	35GW4 3/6/87	35GW5 12/4/86	35GW5 3/6/87	35GW6 12/4/86	35GW6 3/6/87
PARAMETER									
BENZENE	<0.2	<0.2	<0.2	<1	<1	30	17	<1	1.3
T-1,2-DICHLORO									
ETHENE	<0.7	<0.7	<0.7	<1.6	3.2	<1.6	<1.6	28	29
TRICHLOROETHENE	<0.8	<0.9	<0.9	<1.0	<3	<1.0	<3	11	11
METHYLENE CHLORIDE	4	<0.7	<0.7	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8
LEAD	1063	1102	3659	<27	<27	33	<27	<27	<27
OIL & GREASE	<1000	46000	<1000	200	12000	2000	2000	200	1000

ARAR

All units in micrograms per liter (ug/L), ppb

Source: Hunter/ESE, 1990.

indicates that the shallow groundwater was contaminated from the release of fuel into the soils. The VOC components of the fuel were not detected.

Three permanent groundwater monitoring wells were installed in 1986 to allow for more representative samples of the groundwater (Figure 35-1). Well 35GW4 was installed upgradient of the spill area and Wells 35GW5 and 35GW6 were installed downgradient. The groundwater samples taken from these wells were analyzed for lead, O&G, and VOCs, as well as xylene and ethylene dibromide (EDB). Table 35-1 presents the analytical results of the December 1986 and March 1987 sampling efforts. In the upgradient well (35GW4), no analytes were detected except for O&G in 1986. In 1987, O&G and trans-1,2-dichloroethene were detected. The source of these two analytes in the upgradient well is not clearly defined in the current database.

Wells 35GW5 and 35GW6 were found to contain sporadic distributions of fuel-derived compounds and VOCs. Benzene, lead and O&G were detected in Well 35GW5, which is located northeast of the tanks. This suggests that the detected analytes are a result of the recorded fuel spillage at the site. Well 35GW6 is located east of the tanks and was found to contain O&G, trans-1,2-dichloroethene, trichloroethene and benzene. The presence of VOCs in this well suggests that widespread low level contamination of the shallow aquifer may be present as a result of the fuel release or other as yet unidentified sources. Well 35GW6 is in a generally cross gradient position of the tanks and is located approximately 200 feet downgradient of an automobile maintenance (hobby) shop. Due to the distance of the well from the tanks, VOCs in the recorded fuel release may not be a sole contributor to VOCs in the groundwater at Well 35GW6. The automobile maintenance shop represents a potential source of waste solvents detected in this well.

SOILS

Three soil samples were analyzed from the three hand-augered borings in 1984. Lead and O&G were detected in all three samples. The analytical results are listed below.

ARAR

	Concentration (ug/g)		
Parameter	35GW1	35GW2	35GW3
Lead	8	6	6
Oil and grease	67	2200	40

SURFACE WATER

Two surface water samples were collected from Brinson Creek in 1986, one upstream and one downstream of the site (Figure 35-1). These samples were analyzed for lead, O&G, and ethylene dibromide. No target analytes were detected in either sample.

SEDIMENT

Two sediment samples from Brinson Creek were taken in 1986 at the same locations as the surface water samples. These samples were analyzed for lead, O&G, and ethylene dibromide. Both sediment samples were found to contain lead and O&G, suggesting that episodic contamination of the creek has occurred or is occurring. Levels of both these analytes were higher in the upstream sample, suggesting that the discharge of contaminated groundwater to the creek is occurring at the far northern section of site and that the sample was not taken far enough upstream to truly represent upstream conditions. Another possibility is that the source of O&G and lead may be located upstream of Site 35.

3.10.3 SUMMARY AND CONCLUSIONS

The 1986/87 analytical data indicate that widespread contamination of the shallow aquifer with fuel derived contaminants and VOCs may exist at Site 35. The migration mechanisms by which contaminants have migrated to the

upgradient well have not been identified. However, due to the nature of hydrocarbon fuel, a spill would tend to widely disperse on the surface of groundwater in a sandy medium. This would explain the concentrations of fuel related compounds in Well 35GW4. A second separate source of observed contaminants may be present at the automobile maintenance shop located upgradient of Well 35GW6.

The groundwater contour map (Figure 35-4) indicates that groundwater flow is towards Brinson Creek. Surface water samples contained no detectable target analytes. Sediment samples, however, contained lead and O&G. Because at the time of the fuel release to the environment, fuel reached the creek, it can be assumed that contaminants may be currently discharging to the creek via the groundwater.

3.10.4 RECOMMENDATIONS

The work efforts to date at this AOC have identified the presence of fuel derived contamination in the soils, shallow groundwater, surface water, and sediments. Further investigations should be designed to determine the extent (horizontal and vertical) of the contamination within the soils and groundwater and within Brinson Creek. In addition, investigation of the adjacent automobile hobby shop should be initiated to determine if that facility is a source of VOC contamination. A Risk Assessment should be conducted upon completion of the environmental characterization.

3.11 SITE 36 - CAMP GEIGER AREA DUMP NEAR SEWAGE TREATMENT PLANT (STP)

3.11.1 SITE BACKGROUND

The Camp Geiger Area Dump (Figure 36-1) is located east of the Camp Geiger STP approximately 200 feet on the south side of Brinson Creek, downstream of Site 35 (PWDM Coordinates 12, D13, E13). An unnamed ditch is located less than 100 feet southeast of the filled area. Site 36 was used for the disposal of municipal wastes and mixed industrial wastes including garbage, trash, waste oils, solvents, and hydraulic fluids from the air station from the late 1940's to the late 1950's. Most of the material was first burned and then buried. However, some unburned material was buried. According to interviews conducted during the IAS process, less than five percent of all hydrocarbons used at the air station were disposed of at the site. The rest was used for dust control on roads or went directly into storm drains. A conservative estimate of the quantities used for dust control is 700 to 1,000 gallon per week. A smaller but undetermined amount was washed down the storm drains. Using a 5-percent estimate for dumping over the nine years of operation, approximately 25,000 gallons of material could have been disposed of in the landfill areas. If it is assumed that this amount was split between this AOC and the trailer park dump (Site 41), 10,000 to 15,000 gallons of solvents and oils may have been placed into Site 36. The records state that all waste solvents and oils were burned after disposal at this AOC.

The site covers about 25,000 square feet and rises about 10 to 12 feet above grade. Based on an average depth of fill of 15 feet, the estimated volume of the disposal area is 14,000 cubic yards. These estimates are based on map and photographic information only. No field measurements have been performed for this purpose.

The site is underlain primarily by silty sand, with layers of silty clayey sand, clay, and coarse sand. A geologic cross section (Figure 36-2) is drawn on a east west line (Figure 36-3). The surface of the shallow groundwater

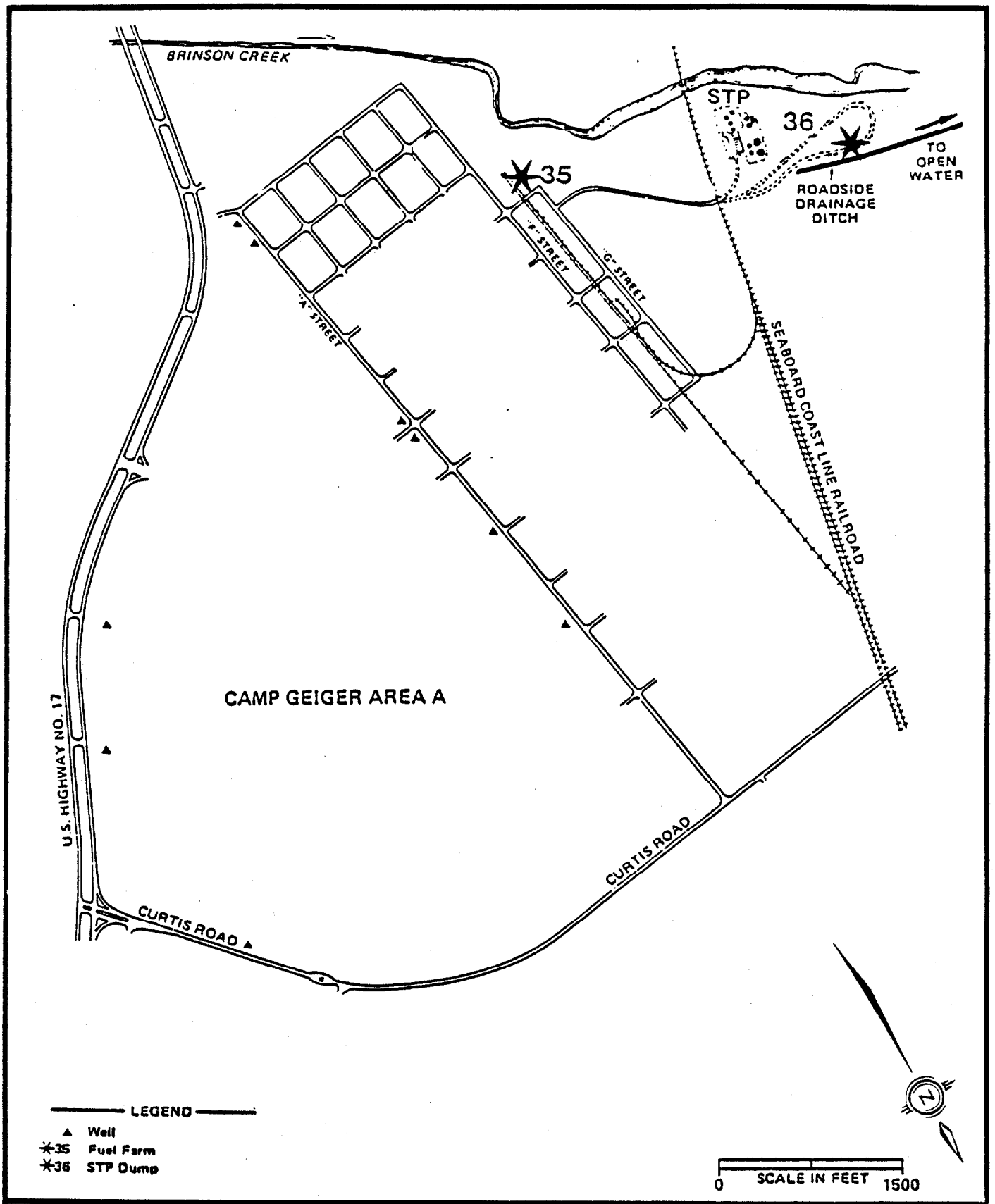


Figure 36-1
SITE LOCATION, SITE 36
CAMP GEIGER AREA DUMP (NEAR STP)

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1990.

MARINE CORPS BASE
CAMP LEJEUNE

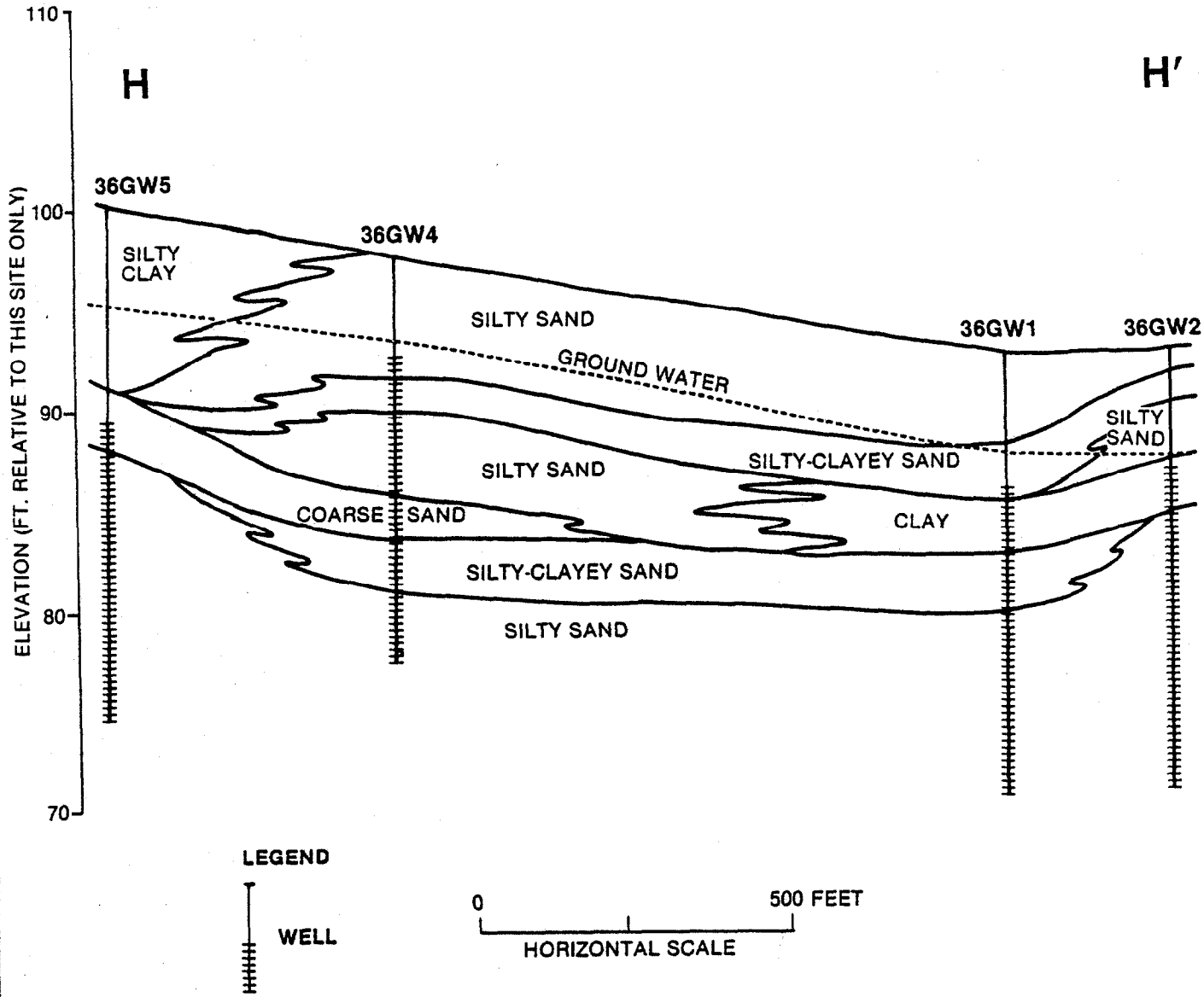
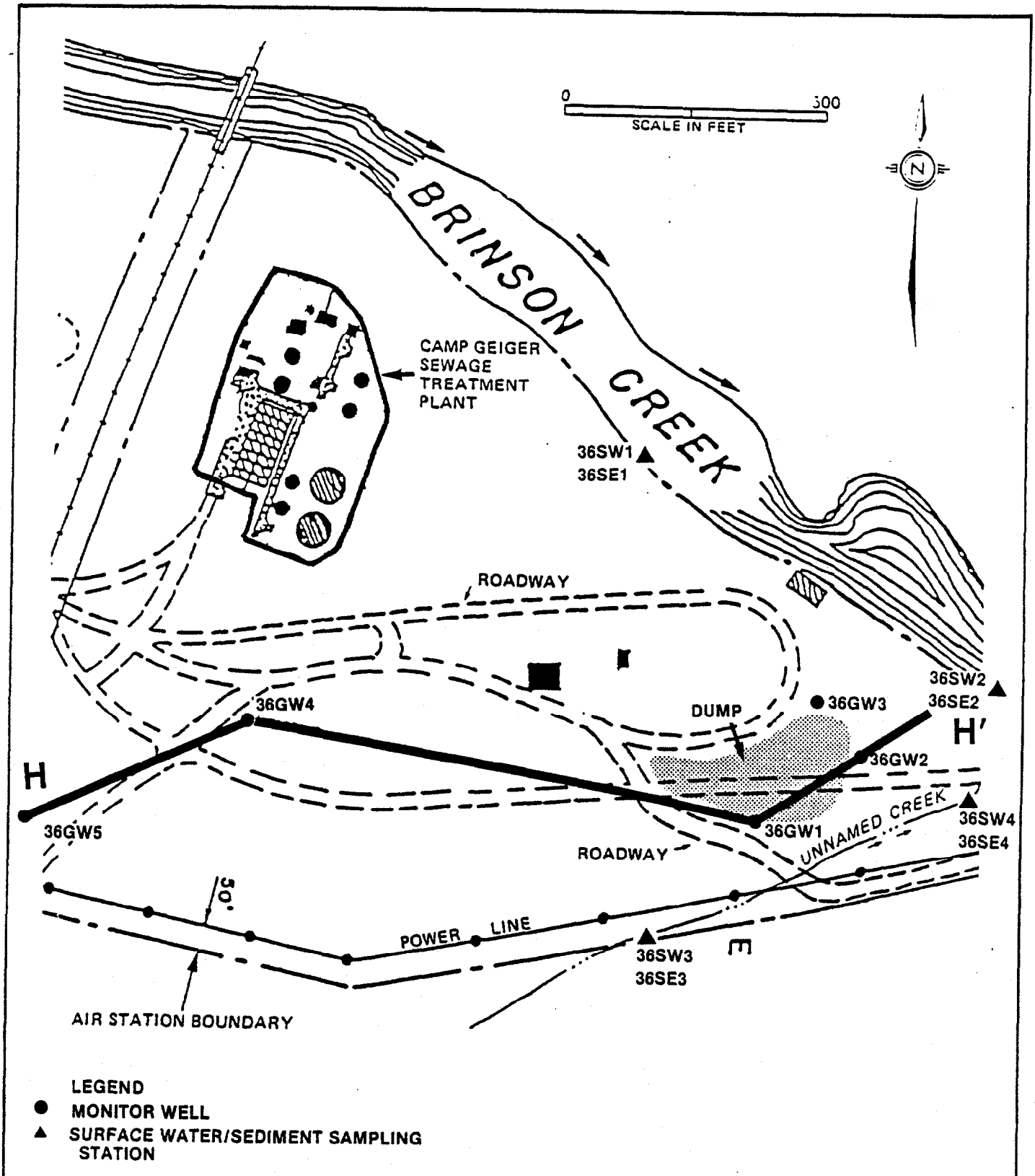


Figure 36-2
GEOLOGIC CROSS SECTION, SITE 36—
CAMP GEIGER AREA DUMP (NEAR STP)

MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 36-3
GEOLOGIC CROSS SECTION LOCATION, SITE 36—CAMP GEIGER AREA DUMP (NEAR STP)

MARINE CORPS BASE
CAMP LEJEUNE

lies within the silty sand at depths ranging from 4.23 to 5.02 feet below land surface. The groundwater contour map (Figure 36-4) indicates that shallow groundwater flows east towards the unnamed creek and Brinson Creek, with a gradient of approximately 0.018 ft/ft.

3.11.2 SITE INVESTIGATION

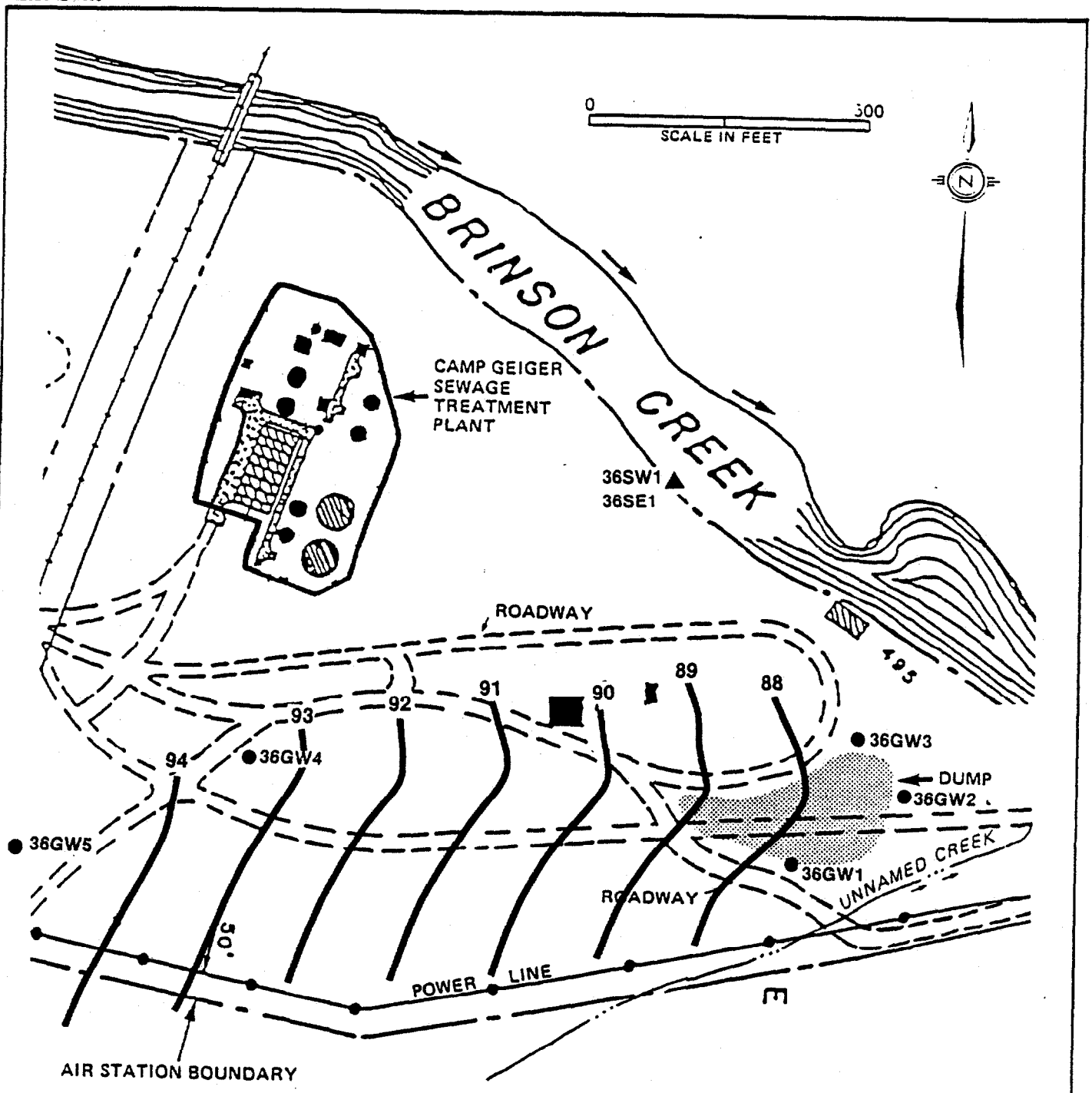
GROUNDWATER

Five shallow groundwater monitoring wells were installed at Site 36, four in 1984 and one in 1986. Well 36GW1 was placed on the southern side of the disposal area. Wells 36GW2 and 36GW3 were placed on the east and northeast sides of the disposal area between the disposal area and Brinson Creek. Well 36GW4 was installed as a background well approximately 300 feet to the west (upgradient) of the disposal area. Well 36GW5 was placed to the west of the site as an additional upgradient monitoring point. Figure 36-5 presents the location of each well. The samples from these monitoring wells were analyzed for the following target compounds:

- Cadmium
- Chromium
- Hexavalent chromium (1986/87 only)
- Lead
- Volatile organics (VOC)
- Oil and grease (O&G)
- Total phenol
- Ethylene dibromide (EDB) (1986/87 only)
- Xylene (1986/87 only)
- Methyl ethyl ketone (MEK) (1986/87 only)
- Methyl isobutyl ketone (MIBK) (1986/87 only)

Appendix A lists all individual target analytes and their abbreviations. Table 36-1 presents the analytical results for those analytes that were detected above the applicable method detection limits. Cadmium, chromium, lead, and phenols were detected in all four monitoring wells in July 1984.

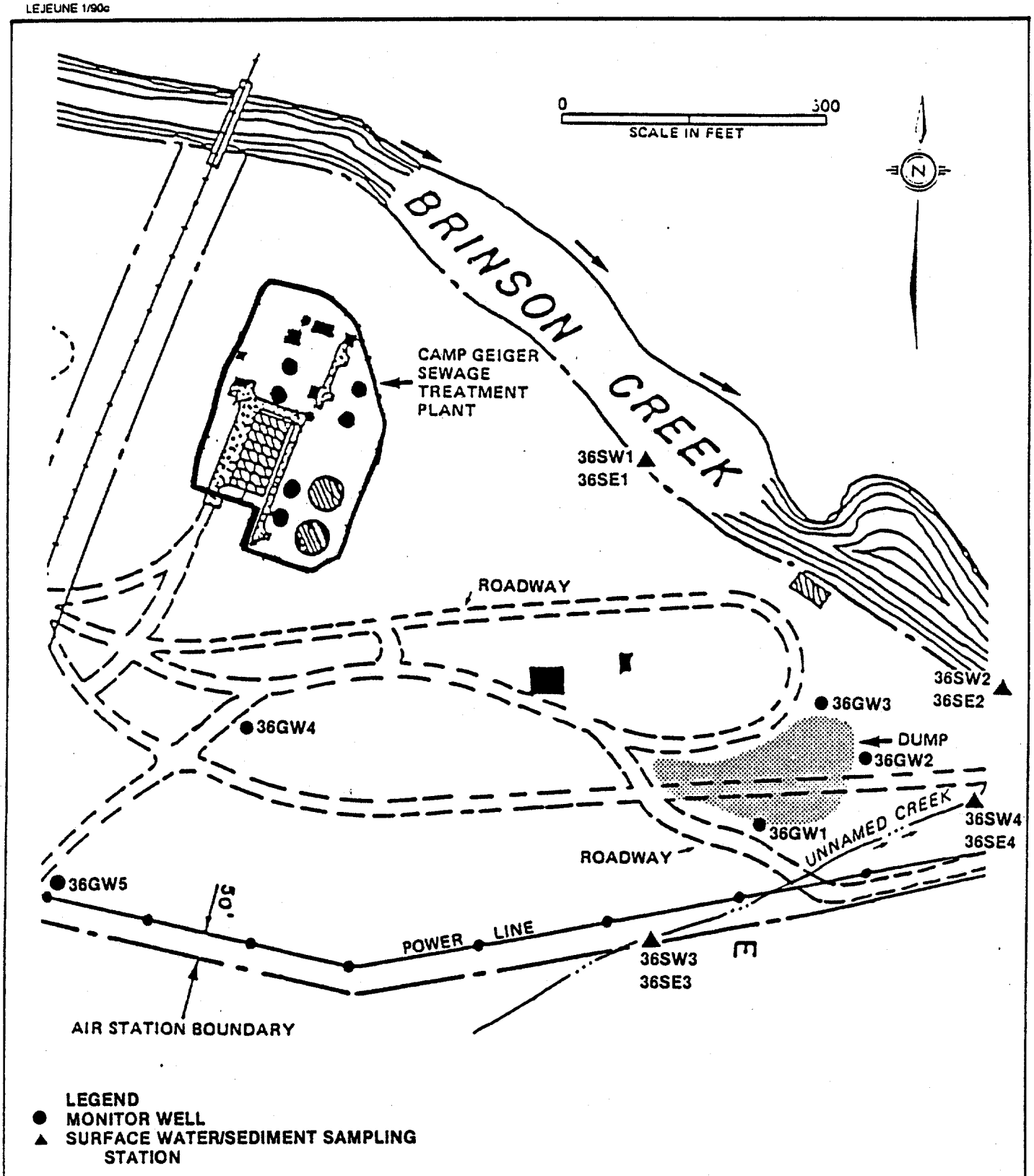
LEJEUNE 1/90c



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 36-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 36—
CAMP GEIGER AREA DUMP (NEAR STP)

MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 36-5
SAMPLING LOCATIONS, SITE 36—
CAMP GEIGER AREA DUMP (NEAR STP)

MARINE CORPS BASE
CAMP LEJEUNE

TABLE 36-1. SITE 36 - CAMP GEIGER DUMP AREA NEAR SEWAGE TREATMENT PLANT (STP) (Page 1 of 2)
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	36GW1 7/31/84	36GW1 7/31/84	36GW1 12/9/86	36GW2 7/31/84	36GW2 7/31/84	36GW2 12/9/89	36GW3 7/31/84	36GW3 7/31/84	36GW3 12/9/86
PARAMETER									
T-1,2-DICHLORO-									
ETHENE	<0.7	<0.7	<1.6	<0.7	<0.7	<1.6	<0.7	<0.7	<1.6
METHYLENE CHLORIDE	<0.6	<0.7	<2.8	<0.6	<0.7	<2.8	<0.6	<0.7	<2.8
1,1,2,2-TETRA-									
CHLOROETHANE	<0.5	<0.5	<4.1	<0.5	<0.5	<4.1	<0.5	<0.5	<4.1
CADMIUM	12	8	3	14	19	4	7	NA	<2.9
CHROMIUM	480	510	130	420	680	142	280	NA	12
LEAD	324	265	45	249	346	73	104	NA	29
PHENOLS	3	2	4	2	6	7	3	3	3
OIL & GREASE	<900	<1000	2000	<900	<900	2000	<1000	<1000	2000

NA - not analyzed

All units in micrograms per liter (ug/L).

Source: Hunter/ESE, 1990.

TABLE 36-1. SITE 36 - CAMP GEIGER DUMP AREA NEAR SEWAGE TREATMENT PLANT (STP) (Page 2 of 2)
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

	36GW4	36GW4	36GW4	36GW5	36GW5
DATE	7/31/84	7/31/84	12/9/86	12/9/86	3/5/87
PARAMETER					
T-1,2-DICHLORO-					
ETHENE	2	1.2	<1.6	<1.6	<1.6
METHYLENE CHLORIDE	<0.7	7	<2.8	<2.8	<2.8
1,1,2,2-TETRA-					
CHLOROETHANE	4	3	<4.1	<4.1	<4.1
CADMIUM	9	NA	<2.9	<2.9	<3.5
CHROMIUM	510	NA	103	18.2	51
LEAD	217	NA	<27	<27	<27
PHENOLS	2	1	<2	<2	<2
OIL & GREASE	<900	<900	2000	1000	1000

NA - not analyzed

All units in micrograms per liter (ug/L).

Source: Hunter/ESE, 1990.

The detected concentrations in all four monitoring wells were similar, including Well 36GW4, the upgradient well. Well 36GW4 was the only well that indicated detectable levels of VOCs. These chemical data support the burning/burial of metallic objects throughout the dump and the probable disposal of waste solvents in the western side of the disposal area. The presence of contamination in Well 36GW4 suggests that the disposal area extends farther to the west than first thought.

These four wells were resampled in December 1986 and an additional well was installed farther west of Well 36GW4. The analytical results of the December 1986 sampling effort were relatively consistent with 1984 results (Table 36-1). Most detected levels in 1986 were slightly lower relative to 1984. O&G was detected in all wells in 1986 and 1,1,2,2-tetrachloroethane was detected only in Well 36GW4. Chromium and O&G were detected in the new upgradient well 36GW5 which was sampled in March 1987.

SURFACE WATER

Four surface water samples were collected in 1986, two from Brinson Creek, one upstream and one downstream, and two from the unnamed creek, one upstream and one downstream. The sample locations are indicated on Figure 36-5. These samples were analyzed for the same target compounds as the groundwater. Detectable levels of trans-1,2-dichloroethane (2.5 ug/L), lead (39 ug/L), and total phenols (4 ug/L) were detected in the unnamed creek upstream sample (36SW3). This small stream passes through the southern portion of the filled area. The chemical data corroborate the widespread but low-level contamination of the groundwater. Lead (33.1 ug/L) was also detected in the upstream sample 36SW1 from Brinson creek at a concentration which is slightly above the freshwater standard of 25 ug/L.

SEDIMENT

Four sediment samples were collected in 1986 at the same locations as the

surface water samples (Figure 36-5). The sediment samples were analyzed for the following parameters:

- o Cadmium
- o Chromium
- o Lead
- o Oil & Grease (O&G)
- o Total Phenols
- o Ethylene dibromide (EDB)
- o Hexavalent chromium

Table 36-2 presents the analytical results for those target analytes that were detected above the applicable method detection limits. Chromium, lead, O&G, and phenols were detected in all four sediment samples. This suggests that accumulation of these analytes from either the continuous or episodic contamination of Brinson Creek and the unnamed stream has occurred. Cadmium was detected in trace levels in only one sample (36SE4).

3.11.3 SUMMARY AND CONCLUSIONS

The groundwater contour map (Figure 36-4) indicates that the shallow groundwater passing through the disposal area travels to and presumably discharges to Brinson Creek. This suggests that contamination detected adjacent to the fill area can migrate to Brinson Creek. Analytical results identified contaminants in the creek bed sediments but none in the associated surface waters. This may be attributed to the substantial dilution which may occur when the relatively low groundwater discharge encounters the relatively large surface water flow.

Metal and O&G contamination was identified in all groundwater samples. The concentrations of metals displayed a decrease over time. This could be the result of the continual leaching of metals into the groundwater over time. O&G was identified only in the 1986/87 samples. This may be the result of lower detection levels utilized in the 1986/87 analyses, or to the overall O&G levels identified throughout the Camp LeJeune complex. VOCs were identified in one well (36GW4).

TABLE 36-2 SITE 36 - CAMP GEIGER DUMP AREA NEAR SEWAGE TREATMENT PLANT (STP)
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	36SE1	36SE2	36SE3	36SE4
DATE	12/9/86	12/10/86	12/10/86	12/10/86
PARAMETER				
CADMIUM	<0.879	<1.94	<0.59	0.722
CHROMIUM	8.49	14.2	5.29	5.44
LEAD	77.5	42.5	15.3	10.7
OIL & GREASE	1480	2410	1200	185
PHENOLS	2030	1950	1080	464

All units are in micrograms per gram (ug/g).

Source: Hunter/ESE, 1990.

3.11.4 RECOMMENDATIONS

The existing monitoring well network has detected low levels of VOC and metal contamination along the margins of this AOC. Additional information regarding contaminant strength and distribution within the filled area is required for both the shallow and deep groundwater as well as the soil. When these data are available, a Risk Assessment should be conducted to properly evaluate the risk to health and the environment.

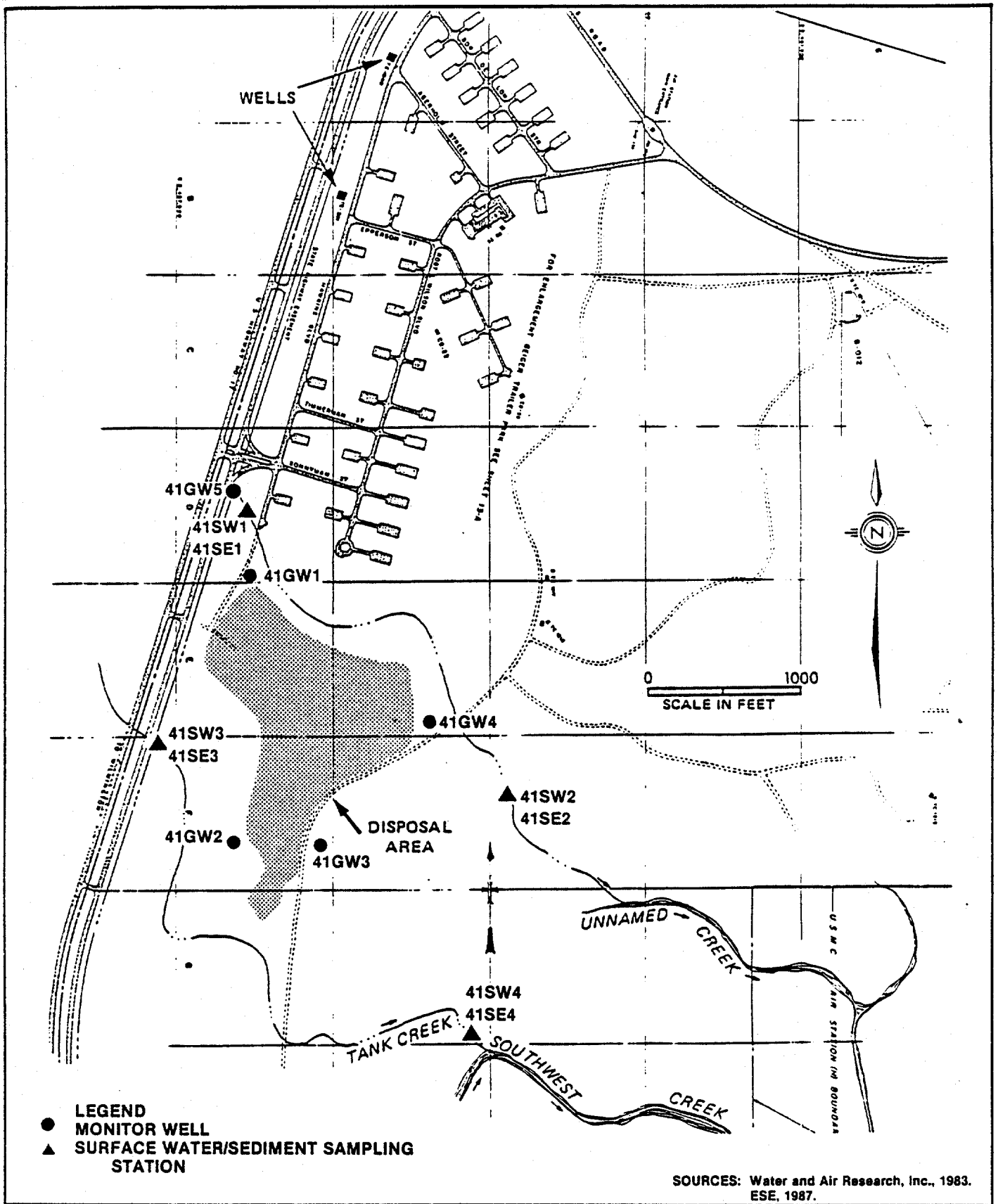
3.12 SITE 41 - CAMP GEIGER DUMP NEAR FORMER TRAILER PARK

3.12.1 SITE BACKGROUND

The Camp Geiger Dump (Figure 41-1) is located south of the terminus of Robert L. Wilson Boulevard and south of the abandoned trailer park (PWDM Coordinates 13, E2-3). The area lies between an unnamed creek and Tank Creek. This 30 acre disposal area was operated from 1946 to 1970 and was used as an open burn dump which received mixed industrial waste, commercial waste, and construction debris including waste oils, solvents from the air station, garbage, trash, asphalt, concrete, old batteries, Mirex, and ordnance. The size estimate for Site 41 is based on map and photographic information. Field estimates have been made but no field measurements were performed.

Based on interviews with MCAS New River and Camp Lejeune personnel, it is estimated that 10,000 to 15,000 gallons of waste oils and solvents were disposed at this AOC (See Section 3.11.1, Site 36). Most of these wastes were probably burned. The number of old batteries containing lead disposed of is assumed to be relatively small. Tons of Mirex in bags were disposed of in 1964. The disposed quantity of ordnance is estimated to include thousands of mortar shells. At least one case of grenades and one 105mm cannon shell were also reported to have been disposed of within the filled area. In the mid-1960's over a 1- to 2- year period, at least two waste disposal incidents occurred during which two truckloads of drummed wastes were unloaded at the site. These wastes were described as being similar to those disposed at the Rifle Range Chemical Dump (See Section 3.17.1, Site 69). No other information concerning drum content was obtained. Based on an estimated fill depth of 5 feet, the total estimated volume of the site is about 110,000 cubic yards.

A geologic cross section (Figure 41-2) was drawn on a generally north-south line (Figure 41-3) and indicated that the site is underlain primarily by silty sand, with discontinuous layers of shelley sand, silty-clayey sand, silt, and clay. The surface of the shallow groundwater lies within the silty



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 41-1
SAMPLING LOCATIONS, SITE 41—CAMP GEIGER DUMP (NEAR FORMER TRAILER PARK)

MARINE CORPS BASE
CAMP LEJEUNE

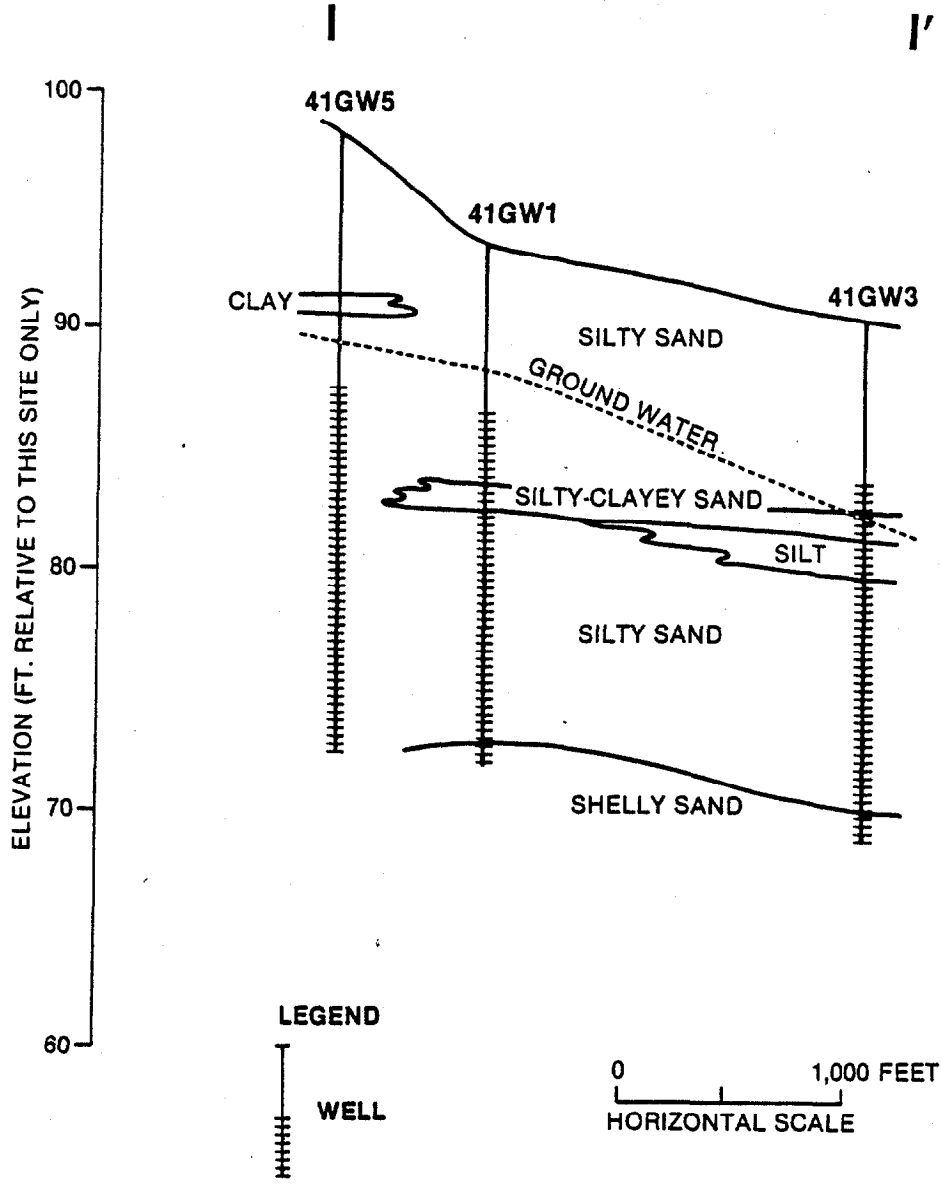
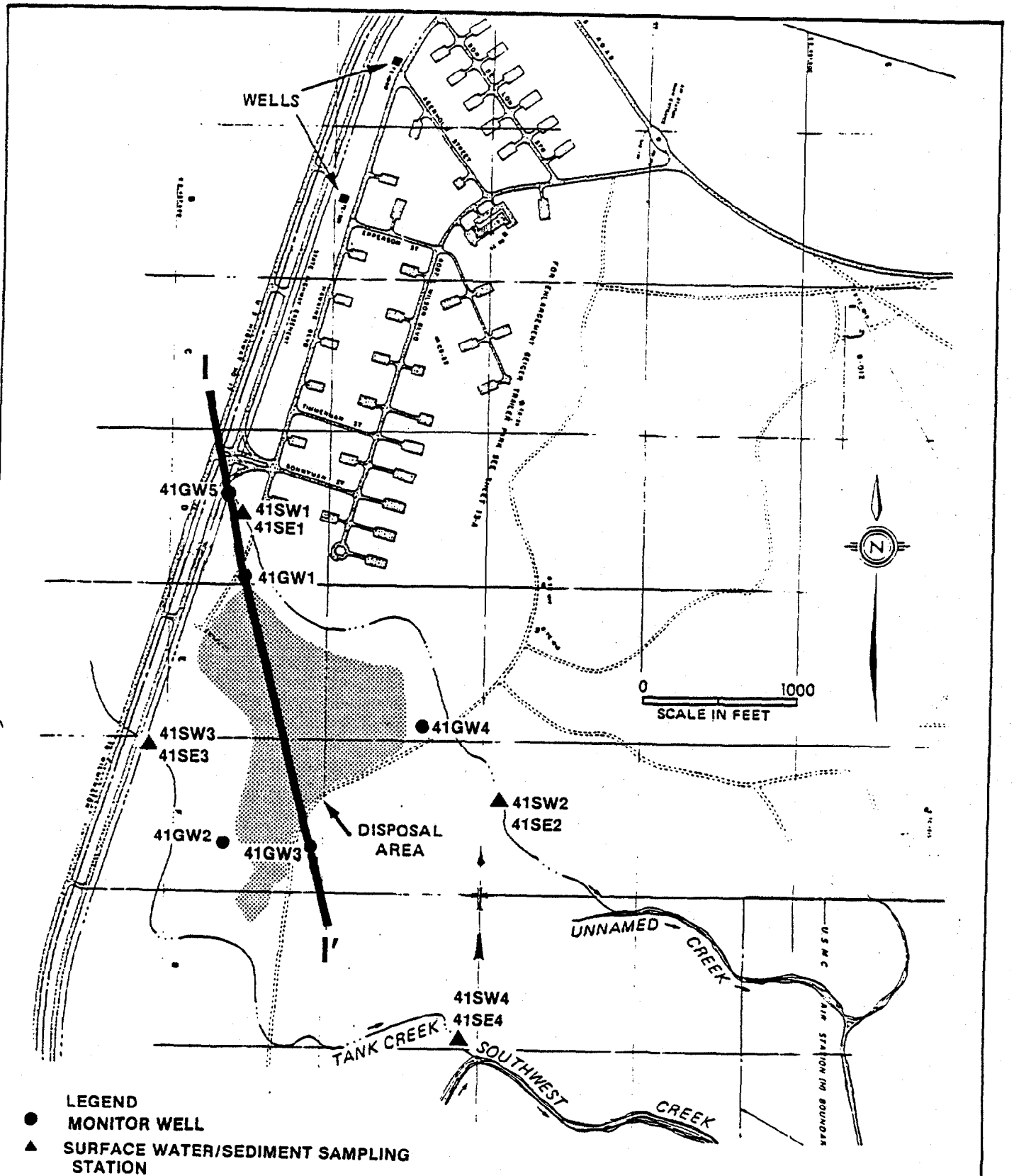


Figure 41-2
GEOLOGIC CROSS SECTION, SITE 41— CAMP GEIGER DUMP (NEAR FORMER TRAILER PARK)

MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 41-3
GEOLOGIC CROSS SECTION LOCATION, SITE 41—CAMP GEIGER DUMP (NEAR FORMER TRAILER PARK)

MARINE CORPS BASE
CAMP LEJEUNE

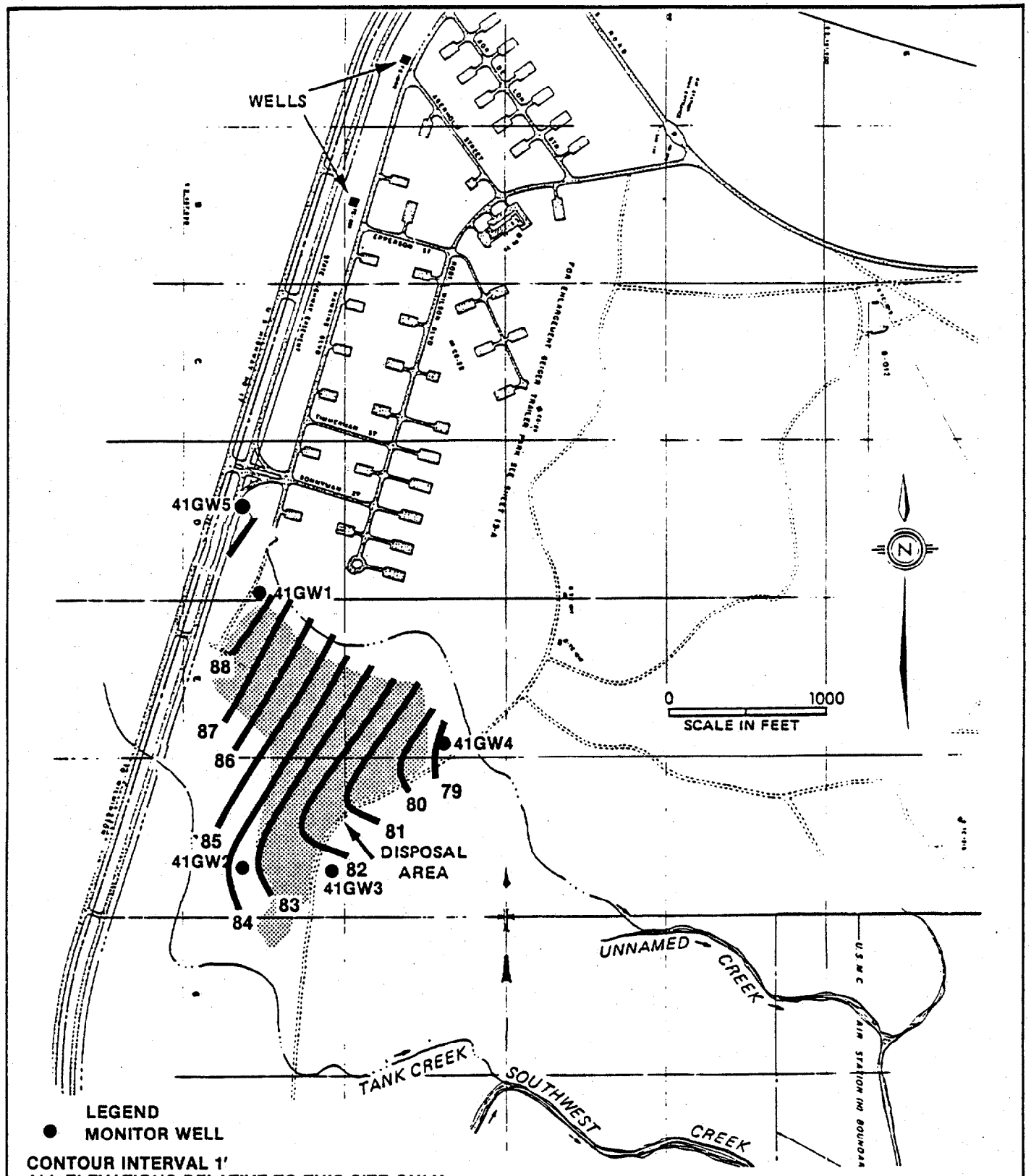
sand at depths ranging from 2.56 to 10.75 feet below land surface. The groundwater contour map shown in Figure 41-4 indicates that the shallow groundwater flows to the southeast towards Tank Creek, Southwest Creek, and the unnamed creek with a gradient of approximately 0.011 ft/ft.

3.12.2 SITE INVESTIGATION

GROUNDWATER

Five shallow groundwater monitoring wells were installed as part of the investigation, four in 1984 and one in 1986. Well 41GW1 was placed at the northern (upgradient) end of the disposal area. Wells 41GW2 and 41GW3 were installed at the southern (downgradient) end of the disposal area between the filled area and Tank Creek. Well 41GW4 was placed east (downgradient) of the disposal area between the site and an unnamed tributary to Southwest Creek. Well 41GW5 was installed in 1986 and was placed upgradient of the filled area and Well 41GW1, north of the disposal area. The groundwater samples collected from these wells were analyzed for the following target compounds:

- Cadmium
- Chromium
- Hexavalent Chromium (1987 only)
- Lead
- Volatile Organic Compounds (VOC)
- Total Phenols
- Organochloride pesticides (OCP)
- Oil & Grease (O&G)
- Mirex
- Ordnance compounds
- Tetrachlorodioxion (TCDD) (1987 only)
- Xylene (1987 only)
- Methyl ethyl Ketone (MEK) (1987 only)
- Methyl isobutyl ketone (MIBK) (1987 only)



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 41-4
GROUND WATER CONTOUR MAP— SHALLOW AQUIFER, SITE 41— CAMP GEIGER DUMP (NEAR FORMER TRAILER PARK)

MARINE CORPS BASE CAMP LEJEUNE

Appendix A lists all target analytes and their abbreviations. Table 41-1 presents the analytical data from both the 1984 and 1987 sampling efforts. Only those compounds which exceeded the method detection limits are reported in the table. Metals were detected in all wells in both 1984 and 1987. Cadmium, chromium, and lead were detected at concentrations above N.C. Groundwater Standards. O&G was also detected in all wells.

VOCs were present in Well 41GW2 in 1984. Benzene, dichlorodifluoromethane, trans-1,2-dichloroethene and vinyl chloride were detected at trace levels. In the 1987 sampling effort only one VOC, methylene chloride, in wells 41GW1 and 41GW2 was detected. The variability of the VOC data with time may reflect the effects of varying amounts of rainfall, infiltration, and groundwater movement.

A single nitroaromatic compound (RDX) was detected in Well 41GW3 in 1987. This data point represents an indication that the groundwater may have been contaminated by ordnance disposed of at the site.

Phenols were detected in four out of the five monitoring wells. The highest level of phenol (18 ug/L) was detected in Well 41GW5, the farthest upgradient well. Heptachlor was also identified in Well 41GW5. This compound was not detected in any other well.

SURFACE WATER

Four surface water samples were collected and analyzed in January 1987; two from Tank Creek and two from the unnamed tributary to Southwest Creek. Both creeks flow adjacent to Site 41 (Figure 41-1). The samples were analyzed for the same parameters as the groundwater samples. The following target analytes were detected in all of the surface water samples: O&G, phenols, and methylene chloride. Aldrin was detected in all samples except for 41SW1, and BHC,D was detected only in 41SW2 (Table 41-2).

TABLE 41-1. SITE 41 - CAMP GEIGER DUMP
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	41GW1 7/16/84	41GW1 1/8/87	41GW2 7/16/84	41GW2 1/8/87	41GW3 7/16/84	41GW3 1/13/87	41GW4 7/16/84	41GW4 1/13/87	41GW5 1/13/87	41GW5 3/5/87
PARAMETER										
BENZENE	<0.3	<1	0.3	<1	<0.3	<1	<0.3	<1	<1	<1
DICHLORODIFLUORO-										
METHANE	<1	<10	8	<10	<1	<10	<1	<10	<10	<10
T-1,2-DICHLORO-										
ETHENE	<1	<1.6	1.1	<1.6	<1.1	<1.6	<1.1	<1.6	<1.6	<1.6
METHYLENE CHLORIDE	<1	7.4	<1	10	<1	<2.8	<1	<2.8	<2.8	<2.8
VINYL CHLORIDE	<0.7	<1	1	<1	<0.9	<1	<0.9	<1	<1	<1
ALDRIN	<0.0008	<0.013	<0.0008	0.017	<0.0008	<0.013	<0.0008	<0.013	<0.013	<0.006
HEPTACHLOR	<0.0007	<0.013	<0.0007	<0.013	<0.0007	<0.013	<0.0007	<0,013	<0.013	0.007
CADMIUM	<6	<2.9	<6	<2.9	7.1	<2.9	<6	<2.9	4	<3.5
CHROMIUM	76	10	530	43	230	28	32	<9.4	117	17
LEAD	74.6	<27	196.3	52	119.4	<27	<40	<27	<27	<27
OIL & GREASE	2000	1000	2000	1000	2000	900	48000	2000	1000	3000
PHENOLS	<1	11	4	11	1	<2	2	6	18	<2
RDX	<3.42	<0.745	<3.23	<7.45	<3.3	1.28	<3.3	<0.745	<0.745	<0.745

All units in micrograms per liter (ug/L).

Source: Hunter/ESE, 1990.

TABLE 41-2. SITE 41 - CAMP GEIGER DUMP
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES

	41SW1	41SW2	41SW3	41SW4
DATE	1/8/87	1/8/87	1/8/87	1/8/87
PARAMETER				
OIL & GREASE	1000	500	200	300
PHENOLS	4	7	6	10
ALDRIN	<0.013	0.013	0.015	0.014
BHC,D	<0.026	0.047	<0.026	<0.026
METHYLENE CHLORIDE	8.7	5.5	9.7	6.8

All units in micrograms per liter (ug/L).

Source: Hunter/ESE, 1990.

SEDIMENT

Four sediment samples were collected from the same locations as the surface water samples (Figure 41-2). The sediment samples were analyzed for the following target compounds:

- Cadmium
- Chromium
- Lead
- Hexavalent chromium
- Oil and Grease (O&G)
- Total phenols
- Mirex
- Organochloride pesticides (OCP)
- Tetrachlorodioxion (TCDD)
- Ordnance

Appendix A contains a detailed listing of all the individual target analytes. Table 41-3 presents the analytical results for those detected target analytes. The samples were found to contain low levels of total chromium, hexavalent chromium, lead, O&G, and phenols. In addition, both samples from Tank Creek were found to contain 2,4,6-TNT, with the downstream sample showing almost a 2 order-of-magnitude increase over the upstream sample. These data were the first indication that munition compounds have been disposed of at this AOC.

3.12.3 SUMMARY AND CONCLUSIONS

The flow direction of the shallow aquifer at Site 41 is toward the surface water network. This strongly suggests that contaminants within the disposal area are able to migrate into the surface water. The chemical data are in agreement with this scenario, as metals, VOCs, and ordnance compounds have been detected in the sediments and/or surface waters.

The analytical data confirm that disposal practices at the site have contributed to groundwater and surface water/sediment contamination. Metals and O&G have been detected in all samples. VOCs were identified in groundwater and surface water samples. Pesticides were identified in two groundwater samples and three surface water samples. Two explosive compounds

TABLE 41-3. SITE 41 - CAMP GEIGER DUMP
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	41SE1	41SE2	41SE3	41SE4
DATE	1/8/87	1/8/87	1/8/87	1/8/87
PARAMETER				
CHROMIUM	2.66	1.77	1.86	5.09
CHROMIUM(+6)	<1.31	1.36	1.57	3.74
LEAD	12.1	4.89	<3.49	<4.63
OIL & GREASE	208	111	40	159
PHENOLS	<0.066	<0.066	0.081	0.118
2,4,6 TNT	<0.00341	<0.00345	0.00459	0.357

All units in micrograms per gram (ug/g).

Source: Hunter/ESE, 1990.

were also identified during the investigation. This confirms that ordnance compounds were disposed of at the site and may be impacting the environment.

3.12.4 RECOMMENDATIONS

The existing monitoring well network is located along the margins of this disposal area and have identified a wide range of contamination (low level) directly related to the variety of materials which have been deposited in this landfill. At this time, it is recommended that this AOC be investigated in detail utilizing the following techniques: review of available aerial photography, geophysical surveys to determine specific disposal features within the landfill, soil gas to preliminary map VOC or petroleum hydrocarbon contamination, soil sampling in and around specific disposal features (possibly including installation of test trenches/pits), installation of additional monitor wells, and collection and analysis of extensive soil and sediment samples. All these data are required to adequately characterize the contaminant status so that a Risk Assessment can be conducted to evaluate the potential risk to health and the environment. In addition, the FS must have detailed information to evaluate the most effective remedial alternative required to treat the wide variety of wastes present at this AOC. Explosive Ordnance Demolition (EOD) activities must be included in any proposed effort as records show that unexploded grenades and mortar shells are buried in the filled areas.

3.13 SITE 45 - CAMPBELL STREET UNDERGROUND FUEL STORAGE AREA

3.13.1 SITE BACKGROUND

The Campbell Street underground aviation gas (Avgas) and adjacent JP fuel farm at the air station is located at the intersection of Campbell and White Streets (JP fuel farm) and approximately 250 feet east of White Street (Avgas) (PWDM Coordinates 23, 013-14/P13-14). The two storage areas are close together and are considered one site AOC (Figure 45-1). The underground Avgas storage area is approximately 40,000 square feet; the JP fuel farm covers approximately 6 acres. The underground tank or tanks leaked at the Avgas storage area during 1978. At the JP fuel farm, extensive leakage from underground connecting lines was discovered in approximately 1981. The southeastern one-third of the area (approximately 2 acres) was affected by the leak in the connecting lines. The most recent leaks from the underground pipes involved JP-4 and JP-5 fuel. These pipes have been replaced with an above-ground system in which leaks can be readily detected. Spill estimates of JP fuel are more than 100,000 gallons and possibly up to 600,000 gallons. This estimate is based on the assumption that the soils overlaying the groundwater were saturated with fuel over approximately 2 acres. Using approximately 20 percent porosity and 5 feet to groundwater, 600,000 gallons of fuel may have been involved. An oil-water separator has been installed on the south boundary of the fuel farm, which typically contains a substantial amount of fuel. It is estimated that approximately 200 to 300 gallons of Avgas were involved in the underground tank(s) leakage.

A geologic cross section of Site 45 is presented in Figure 45-2. The cross section is drawn on an east-west line (Figure 45-3). The site is underlain by dipping layers of silty sand, clayey silt, clay, and sand. The surface of the shallow groundwater at this AOC cuts across these dipping strata at depths ranging from 2.64 to 6.96 feet below land surface. The groundwater contour map (Figure 45-4) indicates that shallow groundwater flows to the southeast, with a gradient of approximately 0.004 ft/ft.

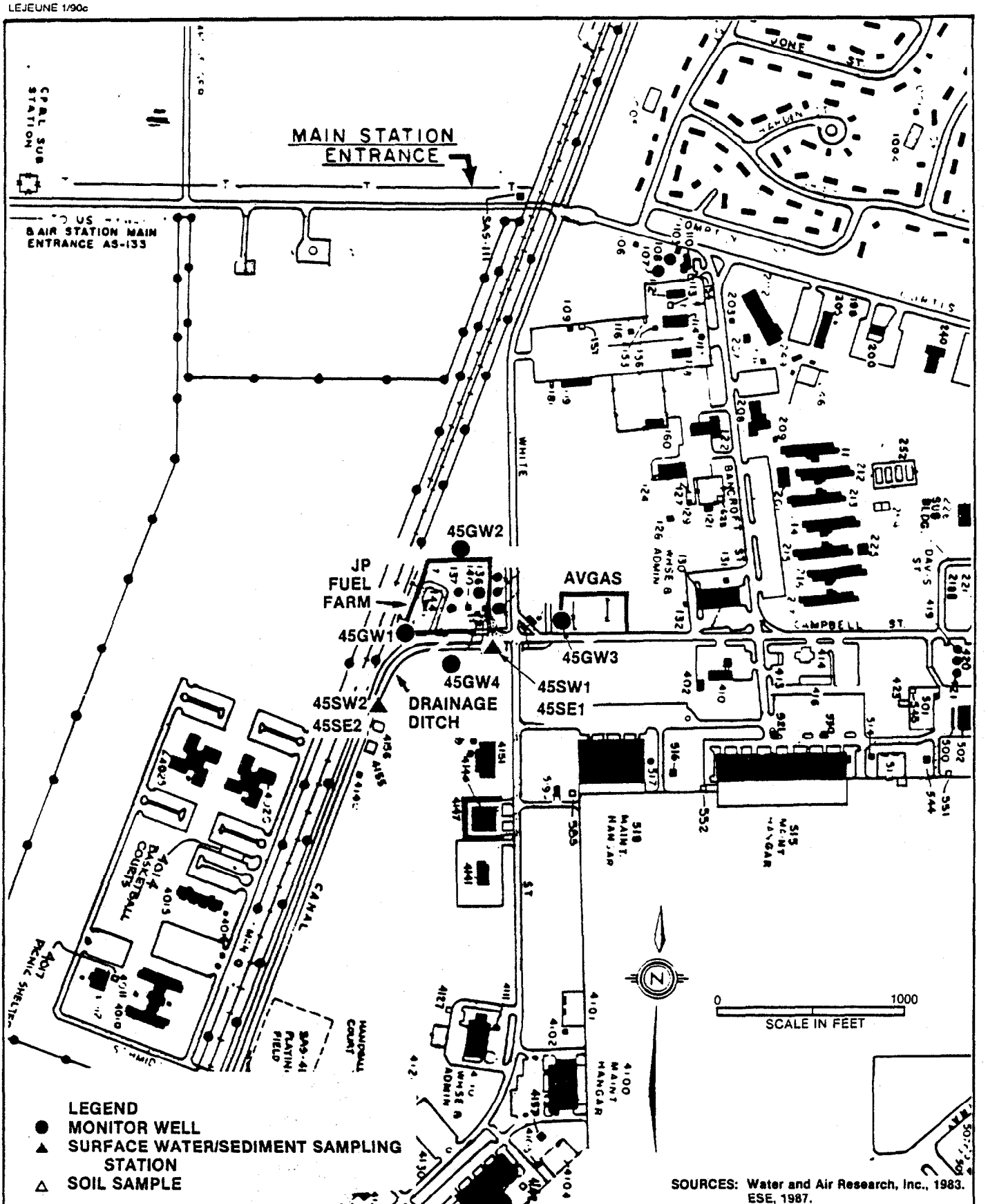


Figure 45-1
SAMPLING LOCATIONS, SITE 45—
CAMPBELL STREET UNDERGROUND FUEL STORAGE AREA

MARINE CORPS BASE
CAMP LEJEUNE

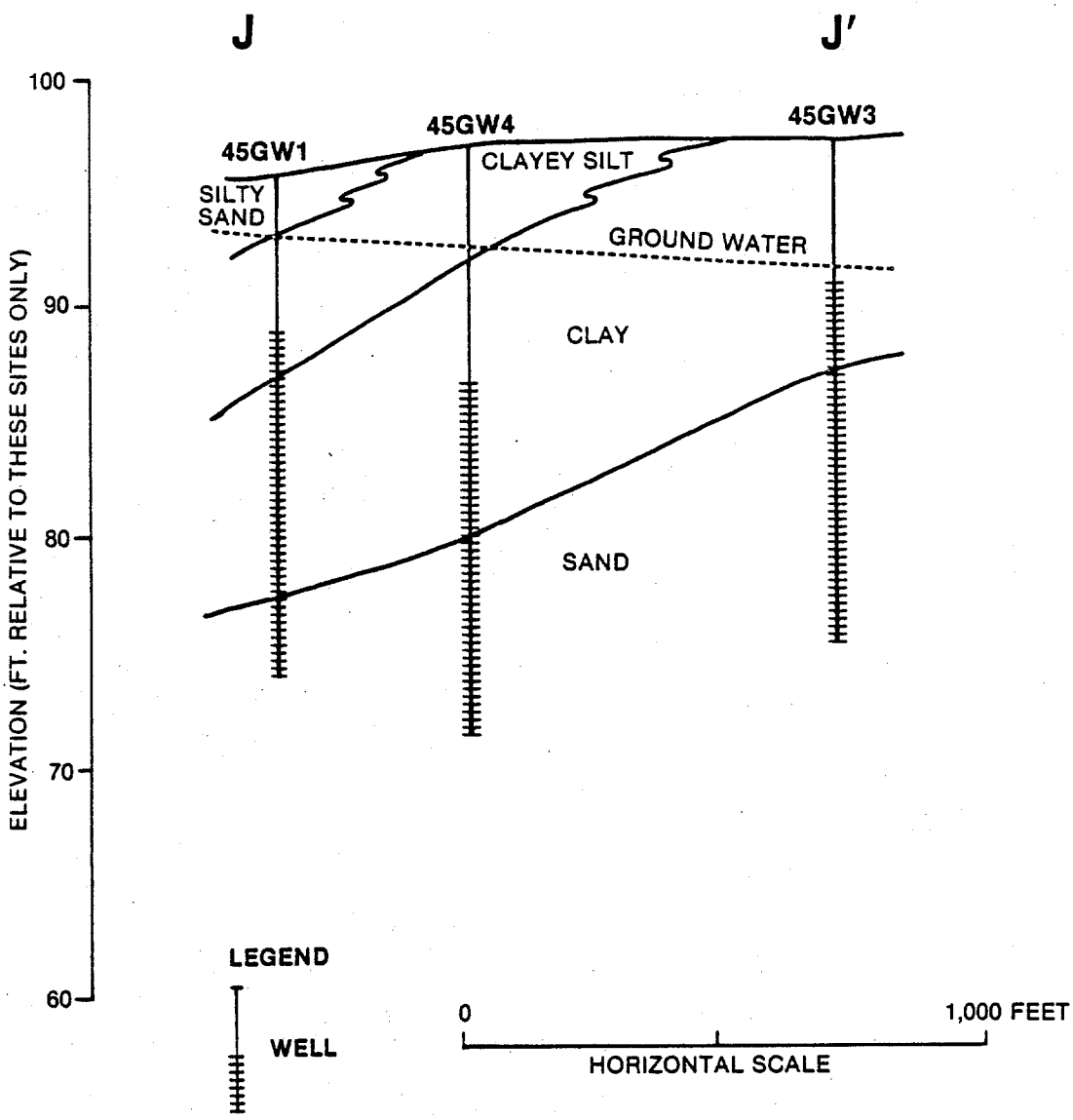


Figure 45-2
GEOLOGIC CROSS SECTION, SITE 45—CAMPBELL STREET UNDERGROUND FUEL STORAGE AREA

MARINE CORPS BASE
CAMP LEJEUNE

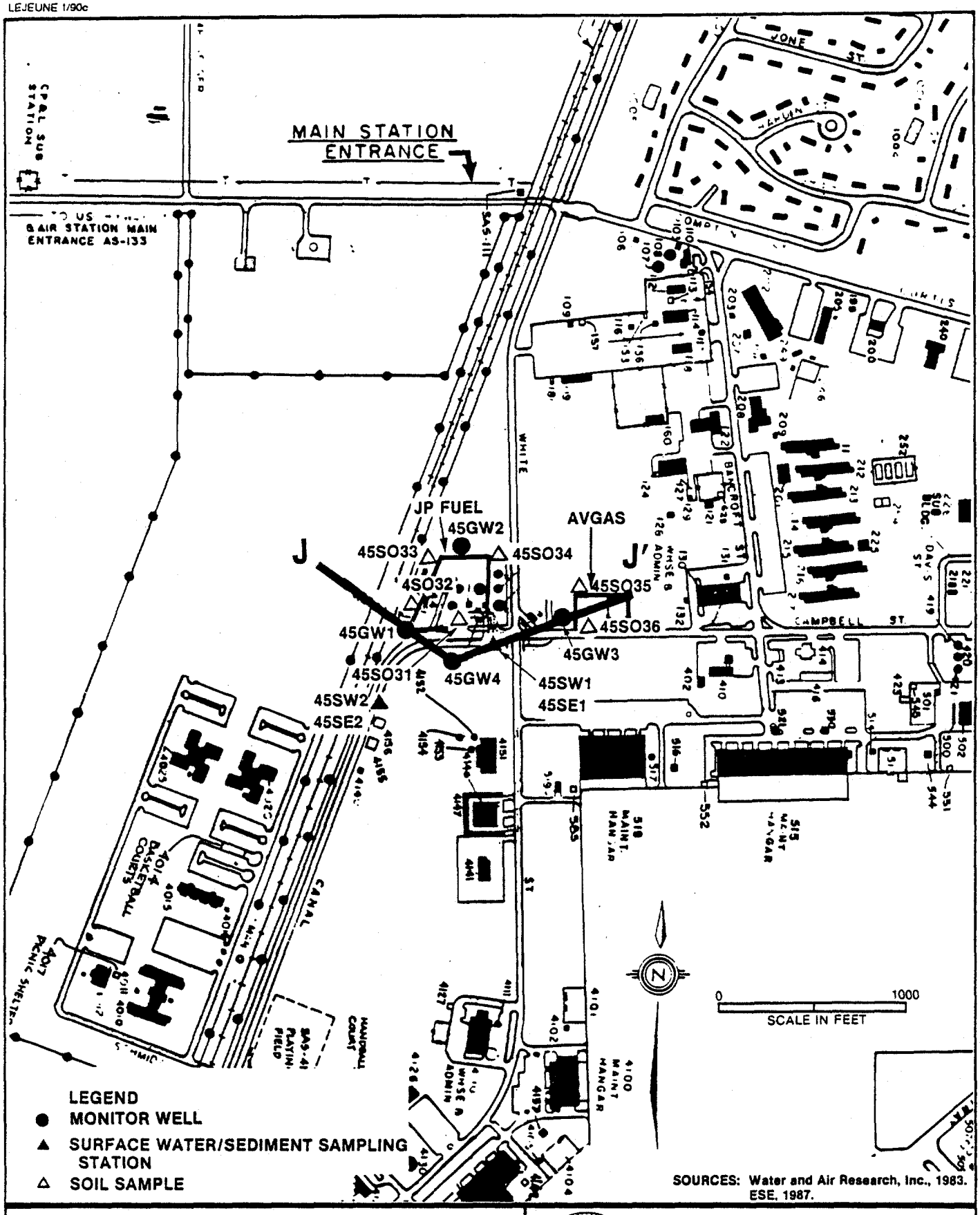


Figure 45-3
GEOLOGIC CROSS SECTION LOCATION, SITE 45—CAMPBELL STREET UNDERGROUND FUEL STORAGE AREA

MARINE CORPS BASE
CAMP LEJEUNE

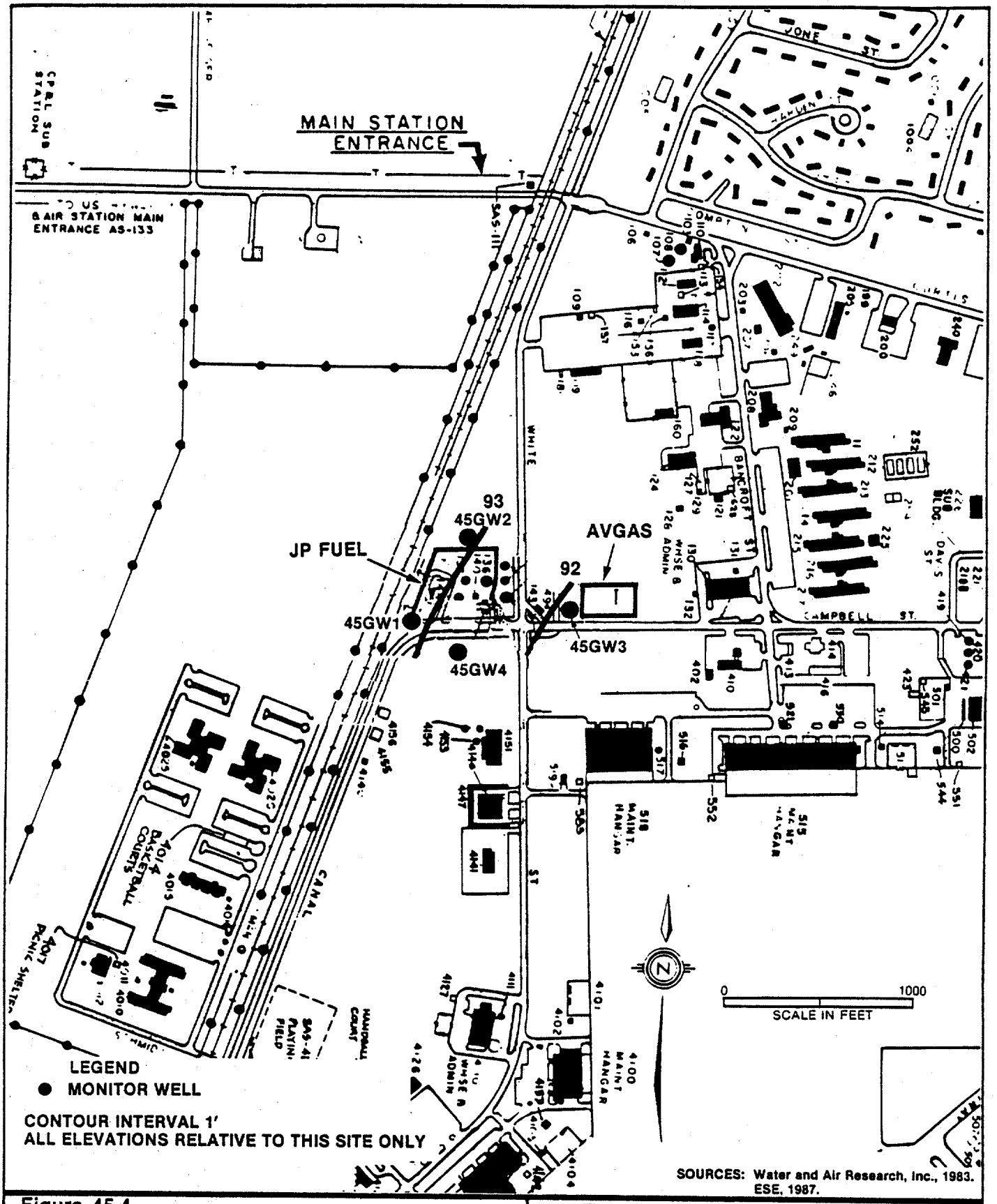


Figure 45-4
GROUND WATER CONTOUR MAP— SHALLOW AQUIFER, SITE 45— CAMPBELL STREET UNDERGROUND FUEL STORAGE AREA

MARINE CORPS BASE CAMP LEJEUNE

3.13.2 SITE INVESTIGATION

GROUNDWATER

Four shallow groundwater monitoring wells were installed as part of the groundwater investigation at Site 45. Three wells were installed in 1984 and one new well was installed in 1986. Well 45GW1 was placed in the southwest corner of the site in an area known to contain POL seeps. Well 45GW2 was placed on the north side of the site. Well 45GW3 was located east of the site and Water Supply Well 131 (45GW4). In addition to the three monitoring wells, Supply Wells 131 (45GW4) and 4140 (45GW5) were sampled in 1984. In 1986 a fourth monitoring well was installed south of the fuel farm. When this monitoring well was sampled in 1986 and 1987, it was designated as 45GW4. In the table that presents the analytical results, the 45GW4 August 1984 sample was collected from Supply Well 131; the 45GW4 1986 and 1987 samples were collected from the new monitoring well. The groundwater samples were analyzed for the following target analytes:

- o Lead
- o Oil & Grease (O&G)
- o Volatile organic compounds (VOC)
- o Ethylene dibromide (EDB) (1986/87 only)
- o Xylene (1986/87 only)

Appendix A contains a complete listing of all target analytes. Table 45-1 presents the analytical results for all those target compounds identified over the applicable method detection limits. Of the target analytes, only O&G was detected in all four wells. O&G was also detected in the water well samples collected in 1984. This confirms that O&G is a contaminant of concern at Site 45 as well as throughout all of Camp Lejeune.

Lead was detected in one well (45GW1) located west of the JP fuel farm. Two VOCs were detected: chloroform (45GW2) and Trans-1,2-dichloroethene (45GW1 and 45GW4). The occurrence of these compounds may be attributed to the use of decreasing solvents at the tank farm.

TABLE 45-1. SITE 45 - CAMPBELL STREET FUEL FARM AND MCAS (Page 1 of 2).
AIR FIELD RAPID REFUELING AREA
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

	45GW1	45GW1	45GW1	45GW2	45GW2	45GW2	45GW3	45GW3	45GW3
DATE	7/16/84	8/1/84	12/8/86	8/1/84	8/1/84	12/8/86	8/1/84	8/1/84	12/8/86
PARAMETER									
LEAD	73.6	<50	<27	<50	NA	<27	<50	NA	<27
OIL & GREASE	2000	4000	2000	22000	<900	2000	2000	1000	2000
CHLOROFORM	<0.5	NA	<1.6	<0.4	NA	1.9	<0.5	NA	<1.6
T-1,2-DICHLORO-									
ETHENE	<0.8	NA	2.2	<0.6	NA	<1.6	<0.8	NA	<1.6

NA - not analyzed

All units in micrograms per liter (ug/L).

Source: Hunter/ESE, 1990.

TABLE 45-1. SITE 45 - CAMPBELL STREET FUEL FARM AND MCAS (Page 2 of 2).
AIR FIELD RAPID REFUELING AREA
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

	45GW4	45GW4	45GW4	45GW4	45GW5
DATE	8/1/84	8/1/84	12/8/86	3/5/87	8/1/84
PARAMETER					
LEAD	<50	NA	<27	<27	<50
OIL & GREASE	2000	<1000	2000	2000	1000
CHLOROFORM	<0.5	NA	<1.6	<1.6	<0.5
T-1,2-DICHLORO-					
ETHENE	<0.8	NA	1.9	<1.6	<0.8

NA - not analyzed

All units in micrograms per liter (ug/L).

Source: Hunter/ESE, 1990.

SURFACE WATER

Two surface water samples were collected (Figure 45-1) from the drainage ditch on the south side of Site 45 in December 1986. The samples were analyzed for the same target compounds as the groundwater samples. Listed below are those target compounds that were identified above detection limits.

	Concentration (ug/L)	
Parameter	45SW1	45SW2
O&G	600	1000
Benzene	1.4	<1

Low levels of benzene were detected in the sample taken hydraulically downstream at the JP fuel farm. This may be attributed to fuel related compounds leaching out of the soils around the fuel farm.

SEDIMENT

Two sediment samples were collected from the drainage ditch on the south side of the site (Figure 45-1) in December 1986. These samples were analyzed for lead and O&G. Listed below are the analytical results.

	Concentration (ug/g)	
Parameter	45SE1	45SE2
O&G	12000	1810
Lead	234	36.1

Lead was detected in sample 45SE1 directly adjacent to the JP fuel farm, and also in the other sediment sample. Relatively high levels of O&G were identified in both samples. These data suggest that the discharge of fuel into the ditch has occurred.

3.13.3 SUMMARY AND CONCLUSIONS

The gradient for the shallow groundwater is one of the lowest recorded at any of the Camp Lejeune AOCs. As a result, the potential for horizontal

migration of contaminants is low. The groundwater has shown evidence of the presence of lead, O&G, and VOCs. These contaminants are more likely attributed to the large quantity of fuel spilled rather than the migration of contaminants. Periodic discharge of contamination from the shallow groundwater into the surface drainage ditch has been documented by the chemical character of the surface water and sediment samples. The O&G identified in the supply wells may or may not be attributed to the release of fuels into the environment of Site 45 because O&G seems to be a facility wide problem.

3.13.4 RECOMMENDATIONS

Documented releases of various fuels at Site 45 strongly suggest that free product may be floating on the groundwater surface. Prior to initiation of detailed field investigations to determine the extent (vertical and horizontal) of the dissolved contamination within the groundwater and soils, a free product recovery system should be installed. In order to provide adequate data to allow a Risk Assessment to be conducted, a program consisting of wells (shallow and deep) and soil samples should be initiated. Following determination of potential risk to health and the environment, an FS should be conducted to select the appropriate remedial technology.

3.14 SITE 48 - MCAS MERCURY DUMP

3.14.1 SITE BACKGROUND

The MCAS Mercury Dump (Figure 48-1) is located on Longstaff Road next to Building 804 (PWDM Coordinates 23, D17/E17). The disposal area was utilized from 1956 to 1966 and covers a 100- to 200- foot wide corridor extending from the rear of Building 804 (photo lab) to the edge of the New River. These dimensions correlate with an area of approximately 20,000 square feet. Metallic mercury was periodically drained from the delay lines of the radar units and disposed of at this AOC. Approximately one gallon per year of mercury was deposited over a 10 year period, amounting to more than 1,000 pounds total. The best information available indicates that the material was carried by hand and dumped or buried in small quantities at randomly selected spots.

3.14.2 SITE INVESTIGATION

SOIL

Four hand-augered soil borings to the water table were performed in August 1984. Five soil samples were collected from materials at the soil and groundwater interface (Samples 48S1 through 48S4, 2 samples from 48S1) and analyzed for mercury. Mercury was found in all five soil samples at the following concentrations:

Sample	Concentration (ppm)
48S1	0.02, 0.03
48S2	0.02
48S3	0.02
48S4	0.009

SEDIMENT

Four sediment samples were collected in the marsh area to the north of Building 804 (48SE1 through 48SE4) in August 1984. Mercury was found in all four sediment samples in the following concentrations:

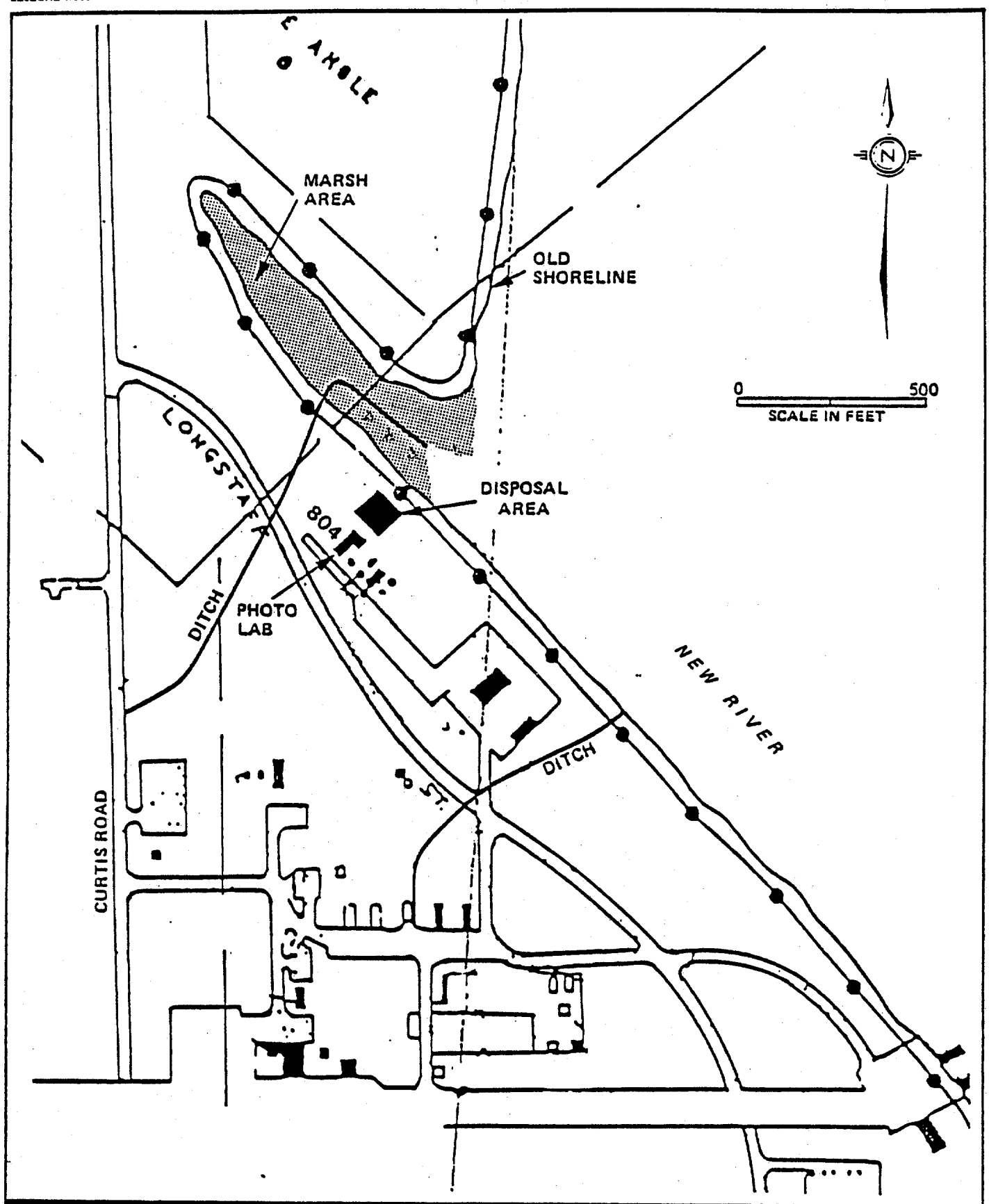


Figure 48-1
SITE LOCATION, SITE 48, - MCAS NEW RIVER MERCURY DUMP

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1984.

MARINE CORPS BASE CAMP LEJEUNE

Sample	Concentration (ppm)
48SE1	0.02
48SE2	0.02
48SE3	0.03
48SE4	0.02

3.14.3 SUMMARY AND CONCLUSIONS

The presence of mercury in the soil and in the sediments of the marsh suggests that mercury has migrated to the surface water system via the shallow groundwater. Correlation between mercury levels in solid media and levels in the groundwater and surface waters can not be made with existing data. The solubility of metallic mercury is approximately 25 ug/L, at 25°C, although this may increase due to chlorine or hydride complex formation under the proper environmental conditions. The biological transformations of mercury in the aquatic environment (water and sediment) are complex and can enhance bioaccumulation in the food chain.

No additional sampling took place at Site 48 in 1986 or 1987 since the presence of mercury attributable to prior disposal practices at this AOC was confirmed in the 1984 investigation.

3.14.4 RECOMMENDATIONS

Although low levels of mercury were detected in the solid environmental media at this AOC, the toxicity of mercury and its tendency to bioaccumulate indicate that Site 48 represents an environmental hazard. Recommended efforts should include detailed soil sampling and analysis within and adjacent to the corridor of disposal. Similarly detailed sediment sampling should be conducted in the adjacent marsh. Groundwater monitoring wells should be installed to determine if mercury has affected the groundwater. Because of potential bioaccumulation effects, sampling of aquatic and benthic organisms within the New River adjacent to Site 48 is warranted. All environmental data collected should be utilized in a Risk Assessment, followed by an FS.

3.15 SITE 54 - CRASH CREW FIRE TRAINING BURN PIT

3.15.1 SITE BACKGROUND

This 1.5 acre site within MCAS New River is located adjacent to the southwest end of Runway 5-23 near Building 3614 (PWDM coordinates 23, 024-25/P24-25) (Figure 54-1). This AOC is believed to have been used in the mid-1950s for crash crew training. Contaminated fuels (principally JP-type and possibly leaded fuels) and waste fuels were used in the training exercises. Originally the training was conducted on the ground surface with the area surrounded by a berm. Later a burn pit was used which was lined in approximately 1975.

A geologic cross section (Figure 54-2) was drawn on a northwest-southeast line (Figure 54-3) and shows the site to be underlain primarily by silty sand and silty gravelly sand, with discontinuous layers of coarse sand and clay. The surface of the shallow groundwater lies within the silty sand and coarse sand units at depths ranging from 0.8 to 10 ft below land surface. The groundwater contour map (Figure 54-4) shows that shallow groundwater flow is toward the drainage ditch along the southwest side of the site, with a gradient of approximately 0.037 ft/ft.

3.15.2 SITE INVESTIGATION

GROUNDWATER

One shallow monitoring well was installed during the initial site investigation in 1984. Groundwater samples from the shallow well (54GW1) and Supply Well 5009 (54GW2) were collected and analyzed for: cadmium, chromium, lead, O&G, VOCs, and total phenols. Appendix A presents a detailed listing of all target analytes and their abbreviations. Analytical results for the target analytes detected above method detection limits are presented in Table 54-1. The July 1984 results indicate that chromium, O&G, and phenols were detected in Well 54GW1, but only phenols were detected in the Supply Well 5009 (54GW2). No VOCs were detected in either of the 1984 samples.

LEJEUNE 1/90c

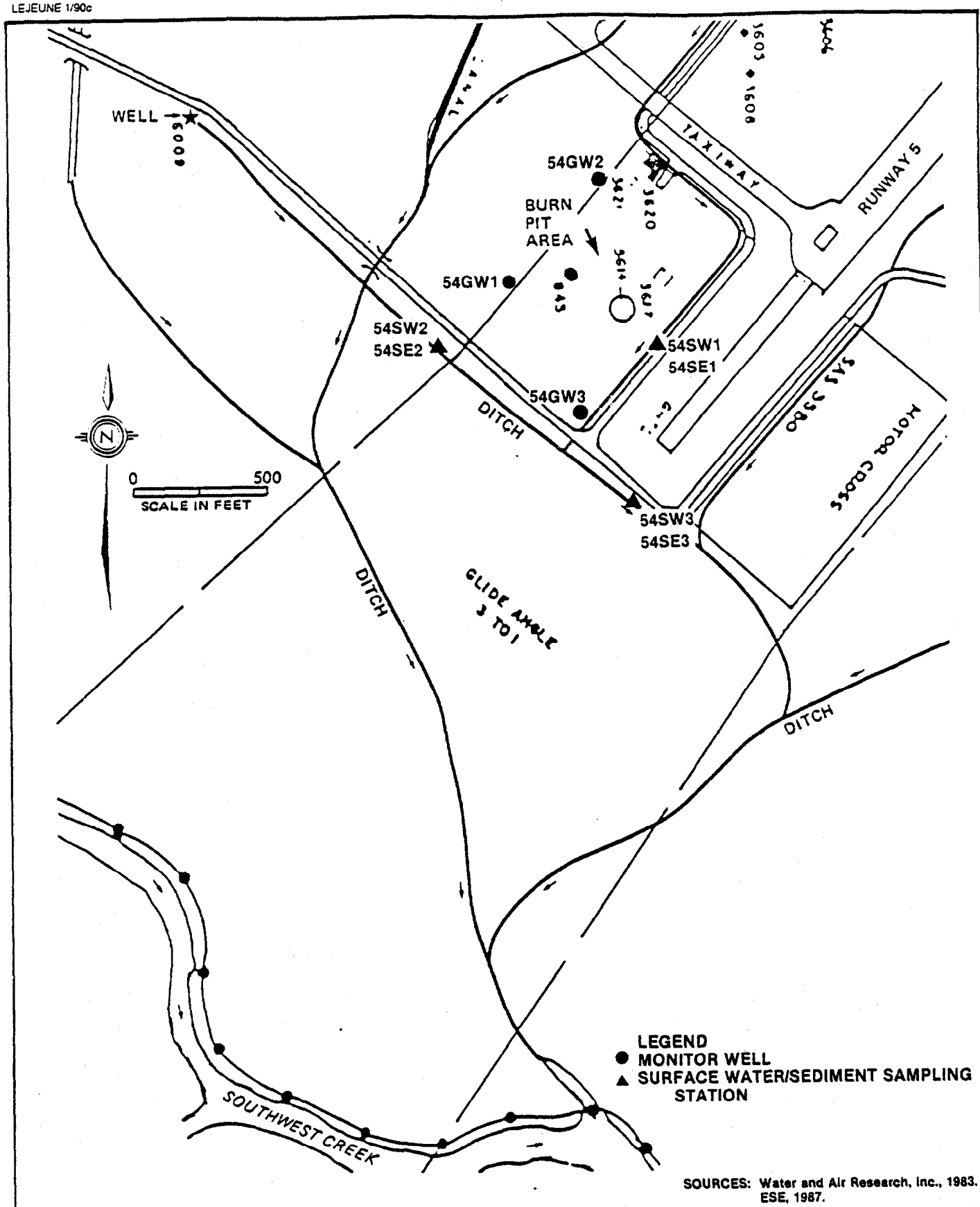


Figure 54-1
SAMPLING LOCATIONS, SITE 54—
CRASH CREW FIRE TRAINING BURN PIT

MARINE CORPS BASE
CAMP LEJEUNE

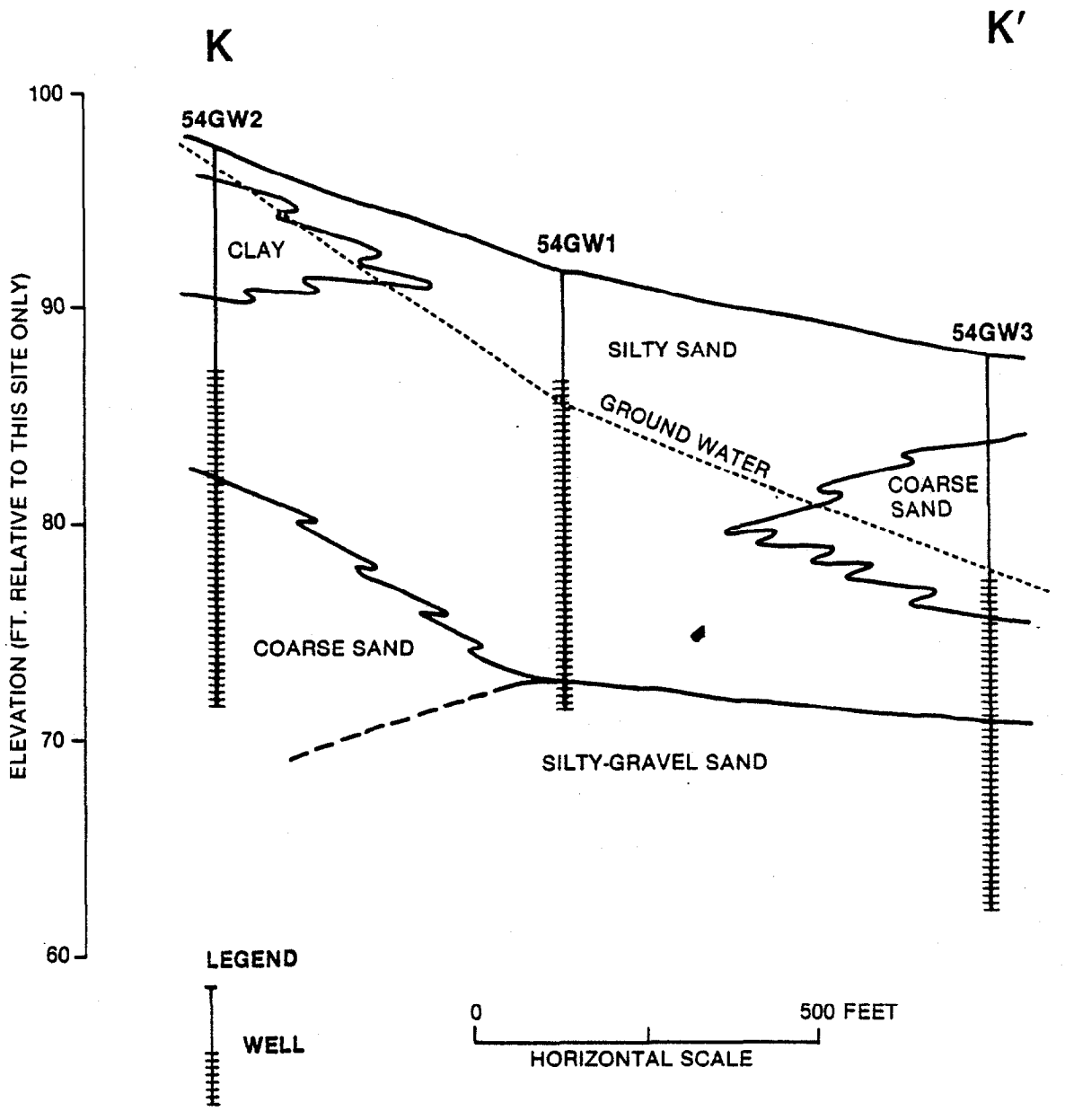


Figure 54-2
GEOLOGIC CROSS SECTION, SITE 54—
CRASH CREW FIRE TRAINING BURN PIT

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c

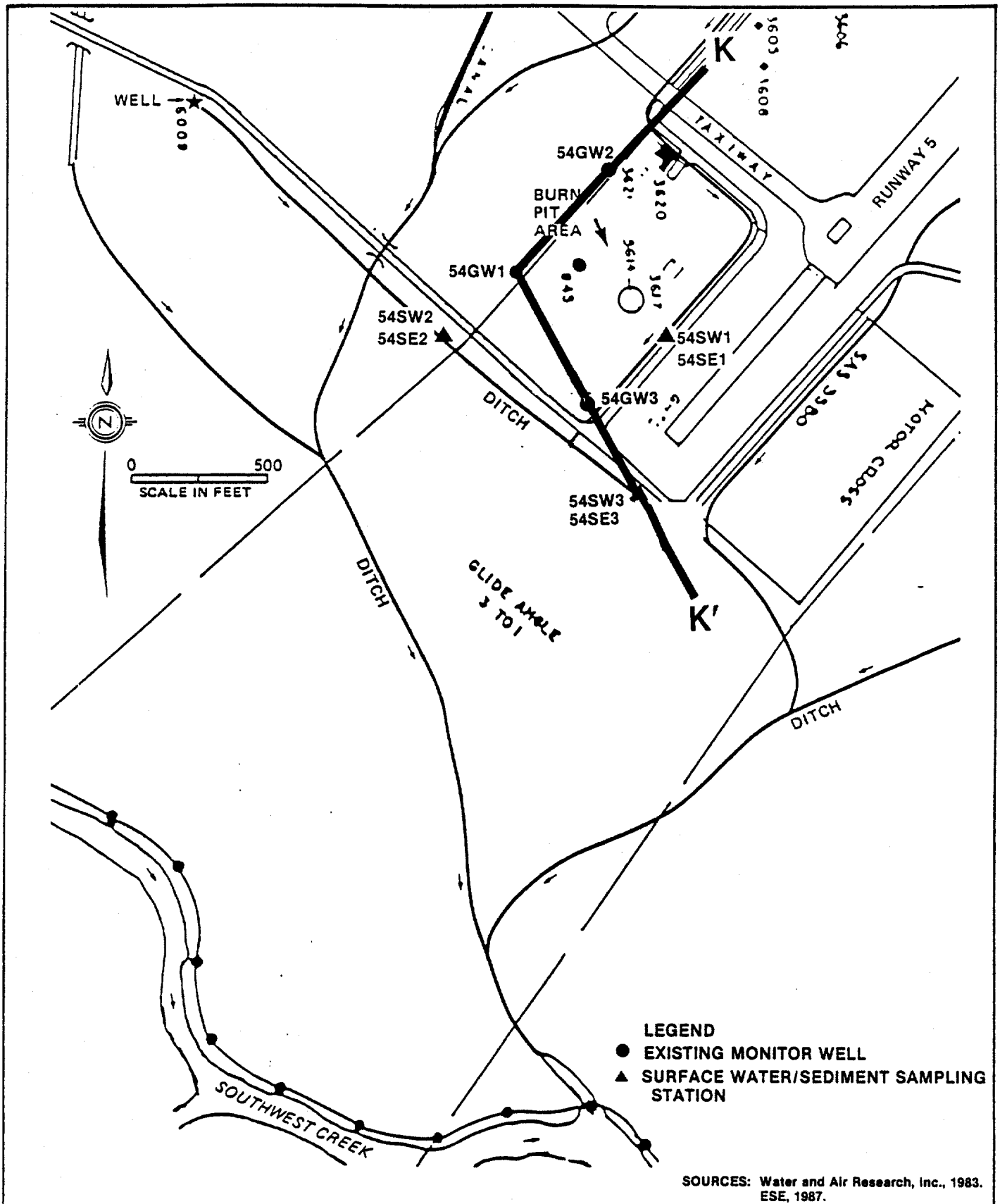
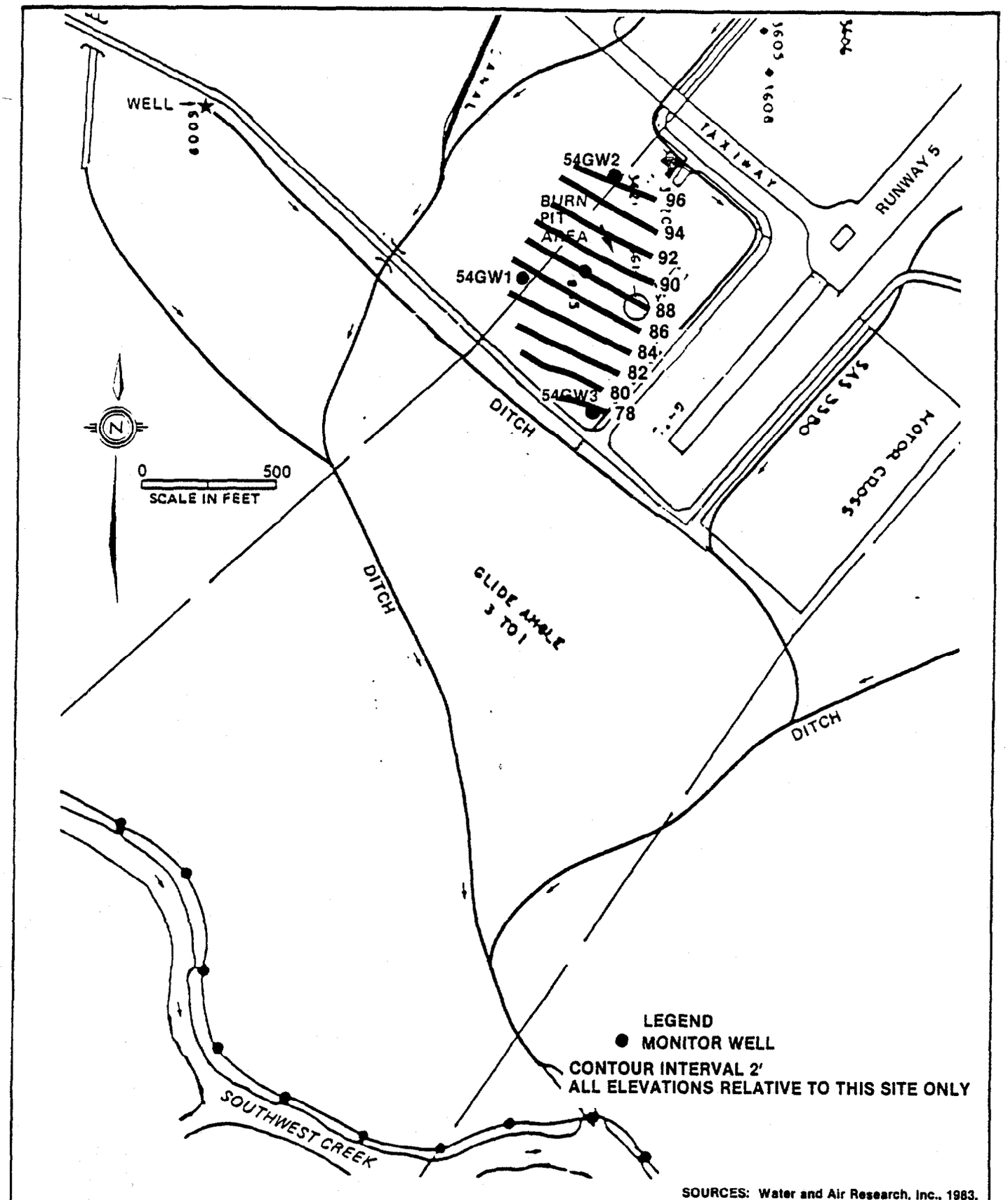


Figure 54-3
GEOLOGIC CROSS SECTION LOCATION, SITE 54—CRASH CREW FIRE TRAINING BURN PIT

MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 54-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 54—
CRASH CREW FIRE TRAINING BURN PIT

MARINE CORPS BASE
CAMP LEJEUNE

TABLE 54-1. SITE 54 - CRASH CREW FIRE TRAINING BURN PIT
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

	54GW1	54GW1	54GW2	54GW2	54GW2	54GW3	54GW3
DATE	7/16/84	12/11/86	7/16/84	12/10/86	3/5/87	12/10/86	3/5/87
PARAMETER							
CHROMIUM	60	10.7	<8	67.9	28	23.9	32
CHROMIUM(+6)	NA	<10	NA	14.6	45.9	<10	12.1
LEAD	<40	<27	<40	<27	27	<27	<27
OIL & GREASE	1000	3000	<900	<300	1000	2000	2000
PHENOLS	3	4	2	<2	<2	6	<2

All units in micrograms per liter (ug/L).

Source: Hunter/ESE, 1990.

Two additional shallow monitoring wells (54GW2 and 54GW3) were installed during the 1986 investigation, one upgradient and one downgradient of the existing monitoring well. Samples were collected from these two new wells and the existing shallow well and analyzed for the following target compounds:

- o Cadmium
- o Chromium
- o Hexavalent Chromium
- o Lead
- o Oil & grease (O&G)
- o Volatile organics (VOC)
- o Total phenols
- o Xylene
- o Methylethyl ketone
- o Methyl isobutyl ketone
- o Ethylene dibromide

Appendix A presents a detailed listing of all target compounds and their abbreviations.

Table 54-1 presents the analytical results from the December 1986 and March 1987 sampling effort. It should be noted that the 1986 and 1987 analytical results for Monitoring Well 54GW2 represents the upgradient shallow monitoring well and not Supply Well 5009 which was sampled in 1984.

The December 1986 and March 1987 results indicate that the samples collected from upgradient Well 54GW2 contained both total chromium and hexavalent chromium. The sample collected in March 1987 also contained a quantifiable amount of lead (27 ug/L), below North Carolina's Groundwater Standard. At least one of the samples collected from downgradient monitoring well 54GW3 also contained levels of chromium and hexavalent chromium. O&G was

documented in each of the samples collected with concentrations ranging from 1000 to 3000 ug/L.

The groundwater sample collected from Well 54GW1 contained the same compounds as in the 1984 sampling effort, chromium, O&G and phenols. None of the groundwater samples collected during the 1986/87 sampling investigation contained VOCs.

SURFACE WATER/SEDIMENT

Three surface water and sediment locations along the drainage ditch southeast and southwest of the pit were sampled during the December 1986 sampling effort (Figure 54-1). The surface water samples were analyzed for the same target compounds as the groundwater samples. The sediment samples were analyzed for the following analytes:

- o Cadmium
- o Chromium
- o Hexavalent Chromium
- o Lead
- o Oil & grease (O&G)
- o Total phenols
- o Ethylene dibromide

The analytical results indicate that total phenols at a concentration of 3 ug/L were detected in the surface water sample (54SW1) collected from the ditch along the southeast side of the site. Because this was the only target analyte detected in any of the surface water samples, a separate table has not been prepared.

Analytical results for the three sediment samples are presented in Table 54-2. All three of the samples contained chromium, O&G, and total phenols. The two upstream samples also contained lead. None of the samples contained VOCs.

TABLE 54-2. SITE 54 - CRASH CREW FIRE TRAINING BURN PIT
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	54SE1	54SE2	54SE3
DATE	12/10/86	12/10/86	12/10/86
PARAMETER			
CHROMIUM	19.3	6.45	6.48
LEAD	28.2	9.36	<6.73
OIL & GREASE	998	884	1560
PHENOLS	0.443	0.334	2.01

All units in micrograms per gram (ug/g).

Source: Hunter/ESE, 1990.

SOILS

During the 1984 investigation, nine soil borings were hand augered around the burn pit area to visually determine if contamination of the shallow groundwater underlying the site had occurred. The results of the soil boring investigation indicate that contamination by waste POL underlies the site to the east and southeast of the burn pit, as evidenced by a fuel odor detected during augering in these areas. In addition during periods of high rainfall, quantities of waste POL have been observed to seep from the ground into the drainage ditches.

3.15.3 SUMMARY AND CONCLUSIONS

The samples collected from Wells 54GW1 and 54GW2 contained concentrations of chromium in excess of North Carolina's Groundwater Standards for this metal. The state does not have a separate standard for hexavalent chromium.

Although the surface water samples did not contain any significant concentrations of the target analytes, the sediment samples did contain two metals, phenols, and O&G. The presence of O&G is consistent with the findings of the groundwater samples.

The immediate human health concern at this site is the status of the nearby Water Supply Well 5009. The existing data do not indicate that degradation of this potable supply has occurred as a result of the activities at the fire training pit. However the existing database does suggest that low-level contamination does exist in the shallow groundwater, soils, and sediments.

3.15.5 RECOMMENDATIONS

Detectable levels of contamination have been identified at Site 54. However, most of the contaminants are of low toxicity. Rather than expending considerable resources to accurately define the volumes of contaminated soil, sediment, and groundwater, it may be more productive to conduct a Risk Assessment to determine if low levels of low toxicity substances pose a

threat to health and the environment. If an unacceptable risk is identified, additional environmental sampling to support the FS process would be required.

3.16 SITE 68 - RIFLE RANGE DUMP

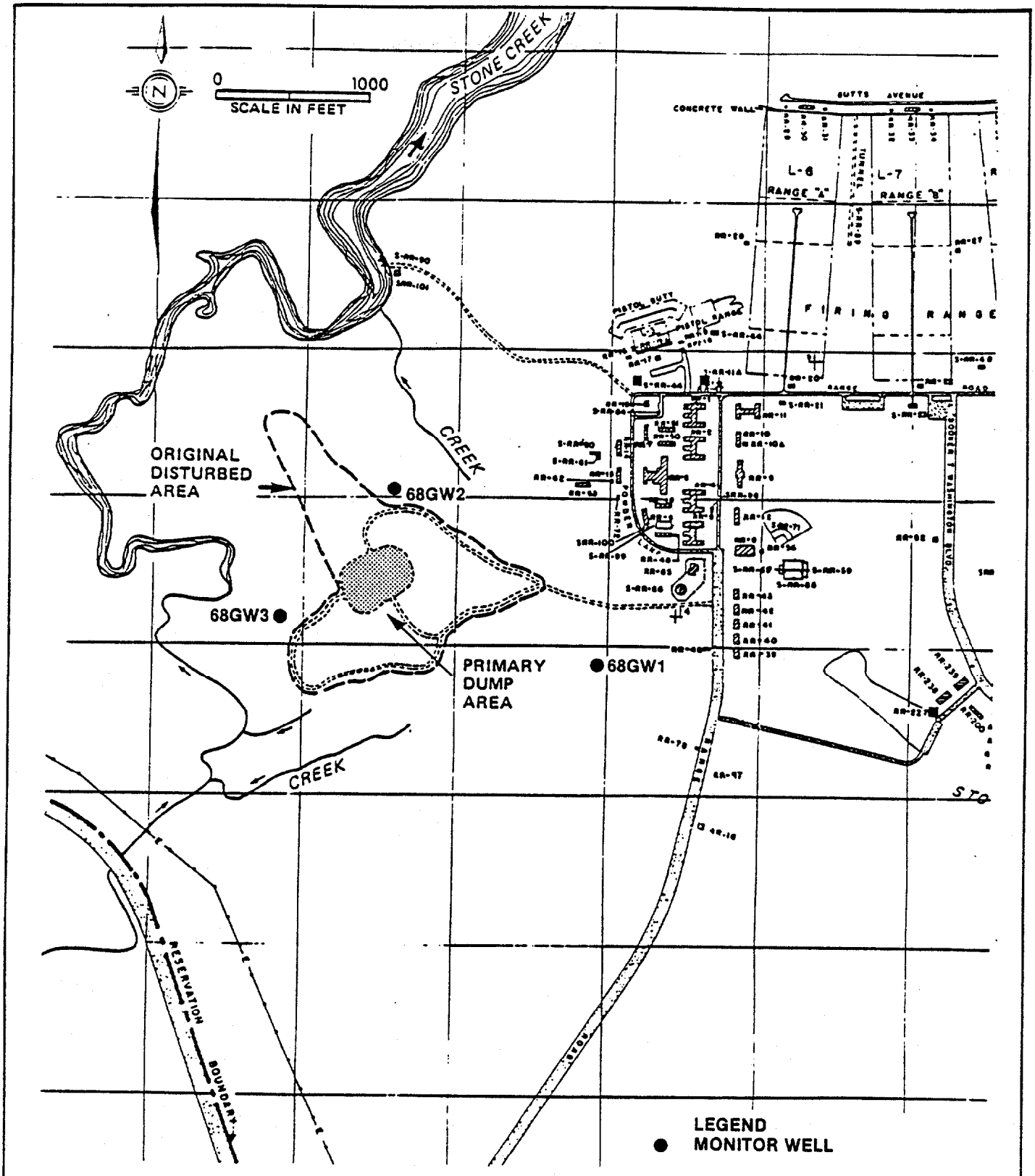
3.16.1 SITE BACKGROUND

The Rifle Range Dump (Figure 68-1) is located west of Range Road approximately 2,000 feet west of the Rifle Range water treatment plant, and 800 feet east of Stone Creek (PWDM Coordinates 16, H6-8/ 16-7). This 3 to 4 acre area was used as a disposal site for various types of wastes including: garbage, building debris, waste treatment sludge, and solvents. The fill lies within a 30 to 40 acre area that showed, in aerial photographs, signs of previous disturbance. However this disturbance may be related to logging activities. The depth of the fill area is approximately 10 feet, and the amount of material deposited has been estimated to be 100,000 cubic yards. An estimated 2,000 gallons of waste solvents were reportedly deposited.

This currently inactive landfill was utilized as a disposal facility for a period of thirty years from 1942 to 1972. The major concern is the potential for waste solvents to affect the groundwater quality beneath the site and stems from the appearance of organic compounds identified in the potable supply wells RR-45 and RR-97. Even though these wells are located upgradient from the site it was suspected that continuous pumping of the well may have drawn contaminants to the wells.

The site topography is variable with elevations ranging from 50 feet msl to the east to 5 feet msl to the northwest. The slope of the site is to the northwest toward Stone Creek. The soils at the Rifle Range Dump are primarily sandy and favor rapid infiltration of surface precipitation. There is however, evidence that surface water runoff does occur in a northwest direction toward Stone Creek.

The site is underlain by sharply dipping layers of silty sand, silty clayey sand, sand, and sandy clay (Figures 68-2 and 68-3). The surface of the shallow groundwater lies within the silty sand at depths ranging from 4.83 ft and 16 ft below ground surface. Groundwater occurs through primary



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 68-1
SAMPLING LOCATIONS, SITE 68—
RIFLE RANGE DUMP

MARINE CORPS BASE
CAMP LEJEUNE

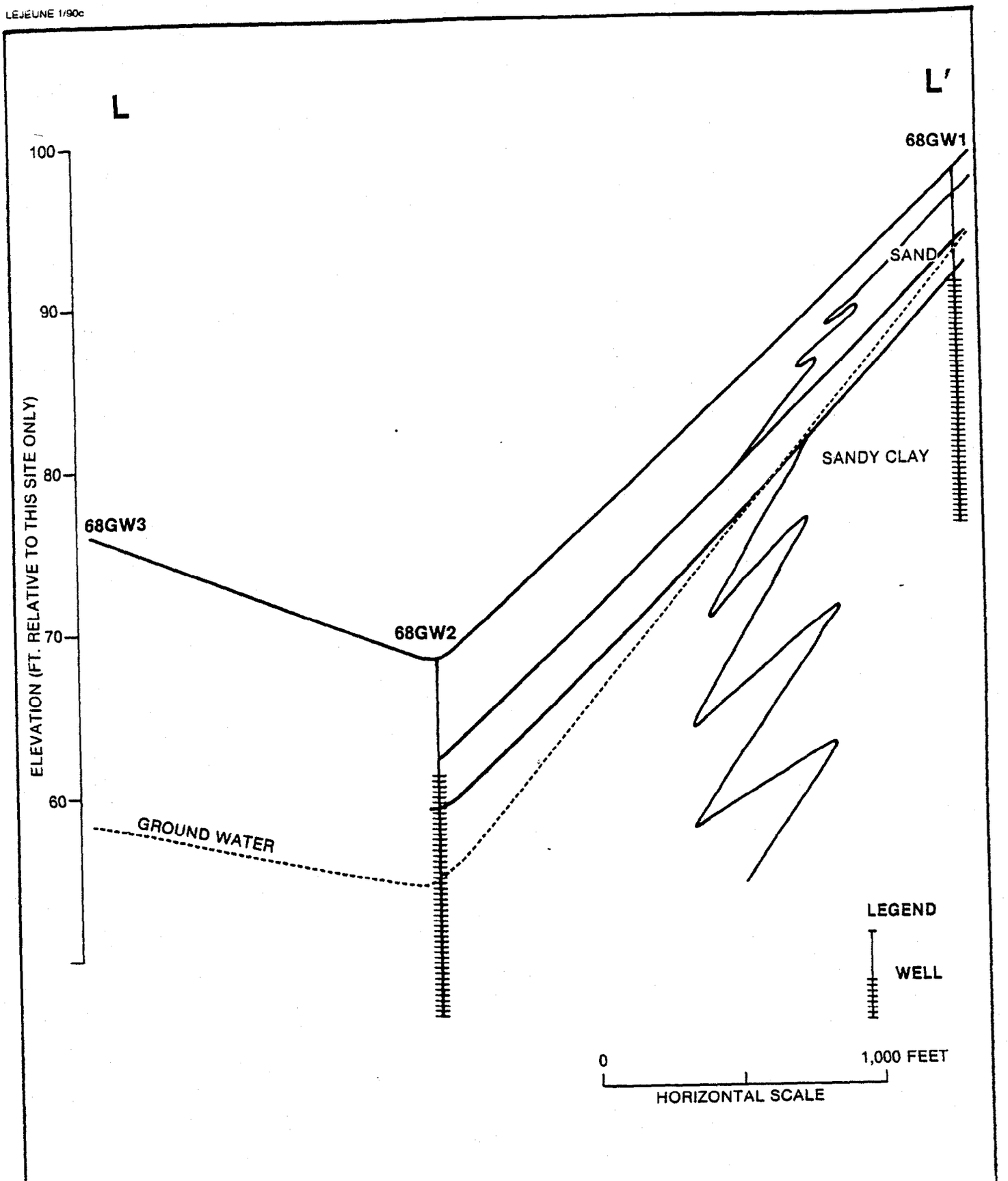
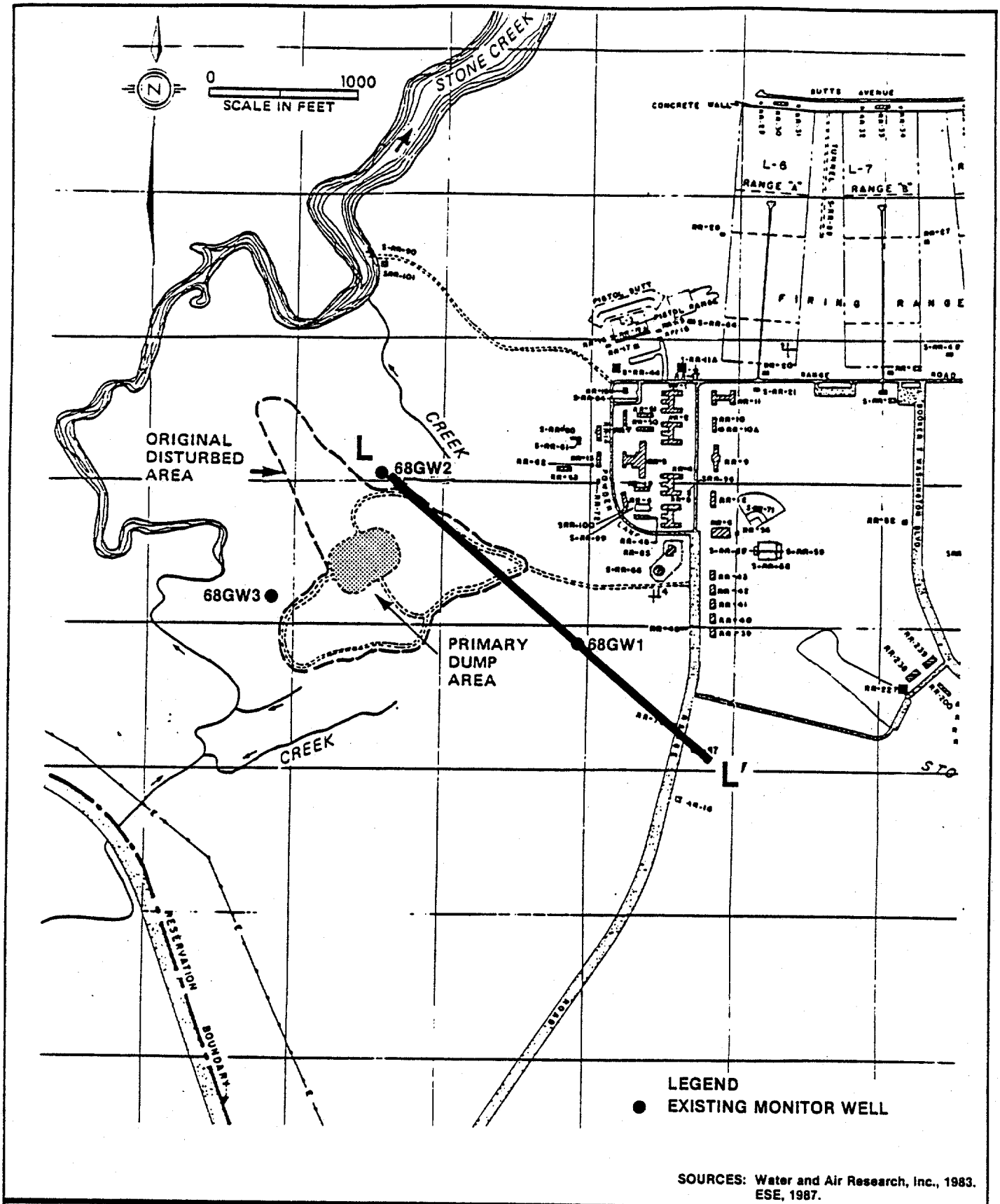


Figure 68-2
GEOLOGIC CROSS SECTION, SITE 68—
RIFLE RANGE DUMP

MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 68-3
GEOLOGIC CROSS SECTION LOCATION, SITE 68–RIFLE RANGE DUMP

MARINE CORPS BASE
CAMP LEJEUNE

features such as pore spaces between the sand particles. The shallow groundwater flow is in the direction of the topographic slope (northwest) toward Stone Creek (Figure 68-4). The groundwater flow gradient has been measured to be approximately 0.016 ft/ft to the northwest.

3.16.2 SITE INVESTIGATION

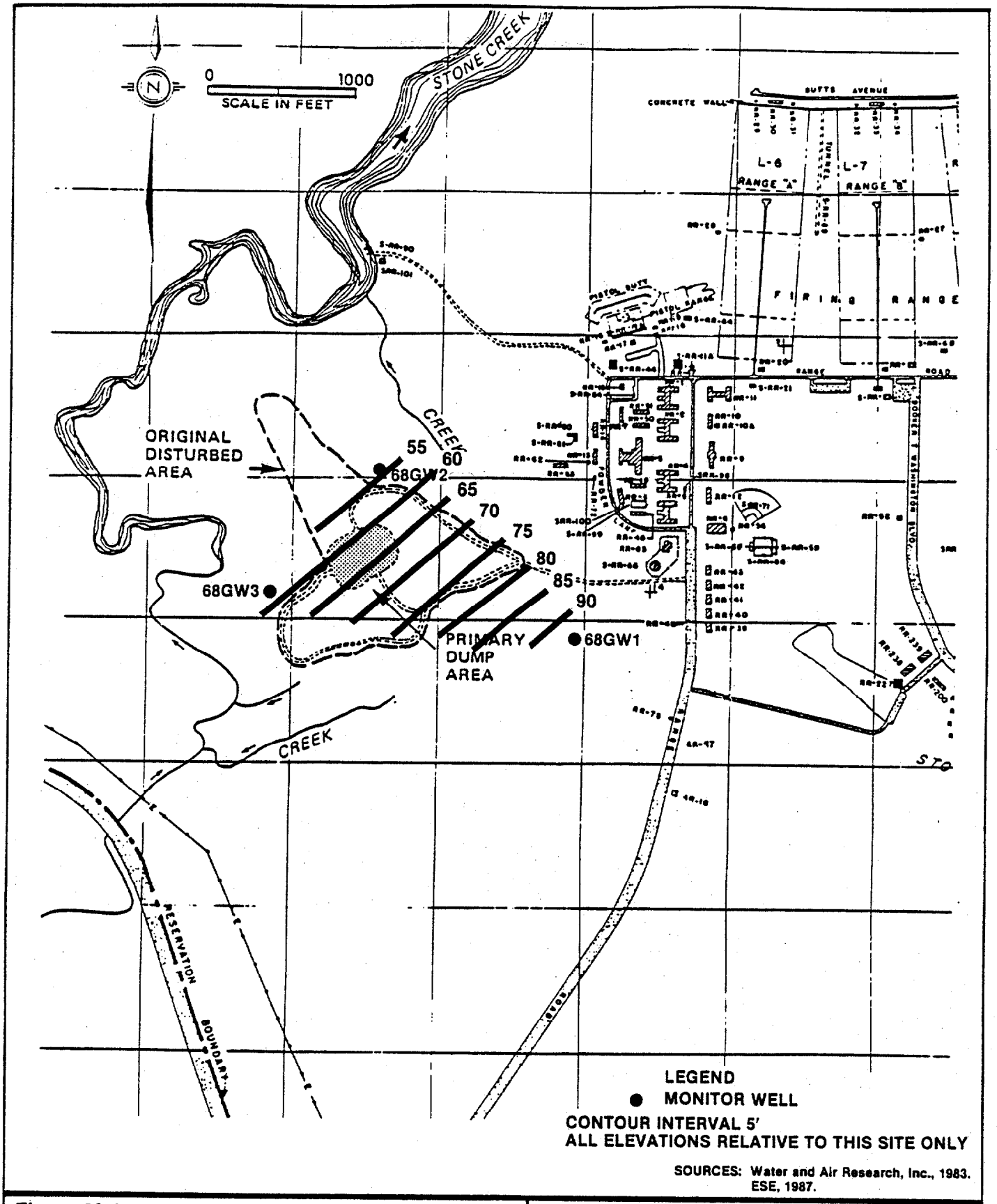
GROUNDWATER

Three monitoring wells (Figure 68-1) were installed around the landfill in 1984. Well 68GW1 is located on the upgradient side of the disposal area between the filled area and Supply Wells RR-45 and RR-97. Well 68GW2 is located on the downgradient (northern) side of the fill area between the fill and Stone Creek. Well 68GW3 is also located downgradient of the fill area (west) between the fill area and Stone Creek. These monitoring wells and the Supply Wells RR-45 (68GW4) and RR-97 (68GW5) were sampled as part of the 1984 investigation. The groundwater samples were analyzed for VOCs. Appendix A presents a detailed listing of all target analytes and their abbreviations. The analysis of these samples did not identify any of the compounds of concern in any of the five wells that were sampled.

The shallow monitoring wells (68GW1, 68GW2 and 68GW3) were resampled as part of the investigation performed in November 1986. These samples were analyzed for the same analytes as in the 1984 sampling effort. The 1986 sampling effort did not detect any of the compounds of concern.

3.16.3 SUMMARY AND CONCLUSIONS

The results of the two rounds of sampling indicate that contaminants, if present, are not migrating from the fill area via the shallow aquifer. This information would also indicate that the VOCs identified in the supply wells are no longer present at detectable levels. The source of the VOCs detected in 1981 has not been identified. The fact that the shallow monitor wells do not contain any of the target analytes may suggest that the one time presence of the VOCs in the deep supply wells may be related to laboratory artifacts



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 68-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 68—
RIFLE RANGE DUMP

MARINE CORPS BASE
CAMP LEJEUNE

or use of minor quantities of degreasing solvents in the immediate vicinity of the wells.

3.16.4 RECOMMENDATIONS

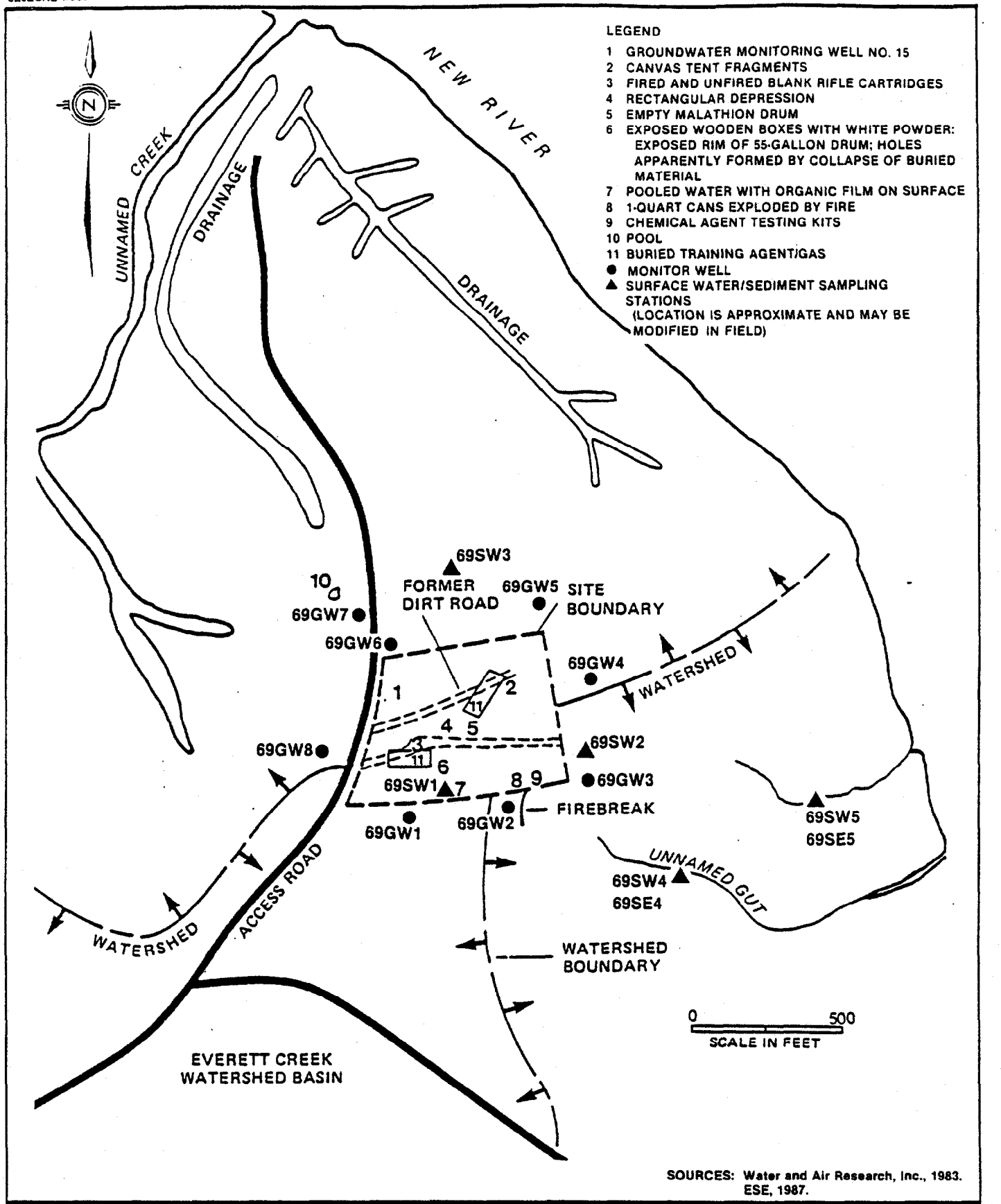
It is recommended that the supply wells be monitored on a quarterly basis to ensure acceptable water quality is maintained. Additionally the shallow monitoring wells should be sampled on a yearly basis to insure that contaminants do not begin to migrate from the fill area. No other investigative efforts are warranted.

3.17 SITE 69 - RIFLE RANGE CHEMICAL DUMP

3.17.1 SITE BACKGROUND

The Rifle Range Chemical Dump (Figure 69-1) is located approximately 9,000 feet east of the intersection of Range Road and Sneads Ferry Road, north of Everett Creek (PWDM coordinates 16, L14- 15/ M14- 15). The site is an estimated six acres in size, containing approximately 93,000 cubic yards of material. Available records indicate the site was active from the early 1950's until 1976. It is reported that the site was utilized as a disposal area for all chemical wastes generated on the base. The list of materials disposed of at the site include the following materials: pentachlorophenol, DDT, Trichloroethylene, malathion, diazinon, lindane, gas cylinders, HTH, PCB's, drums that appeared to contain training agent consisting of chloroacetophenone (CN) gas, all other hazardous materials generated or used on the base, and chemical agent test kits for chemical warfare, which contain no agent substances. The disposal of material was conducted in trenches or pits which were between 6 to 20 feet deep. At least twelve different disposal events have been documented.

The AOC is primarily underlain by silty sand and sandy clay, with discontinuous layers of clayey sand, sand, sandy silt, and clayey silt. Figures 69-2 and 69-3 are geologic cross sections of the site. Figure 69-4 depicts the areas through which these cross sections were drawn. The shallow groundwater occurs primarily within the silty sand at depths ranging from 2.11 to 20.24 feet below land surface. The groundwater contour map (Figure 69-5) indicates that groundwater flow beneath the site is broken by watershed boundaries. Groundwater northwest of Wells 69GW1 and 69GW4 flows to the northwest and the groundwater south of these wells flows to the southeast. Additionally, a water shed boundary exists between Wells 69GW1 and 69GW2. This divide runs in a northerly direction causing groundwater flow to move in an easterly direction east of 69GW2 and a westerly direction west of this well. Typical groundwater gradients beneath this site average 0.032 ft/ft.



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 69-1
SAMPLING LOCATIONS, SITE 69—
RIFLE RANGE CHEMICAL DUMP

MARINE CORPS BASE
CAMP LEJEUNE

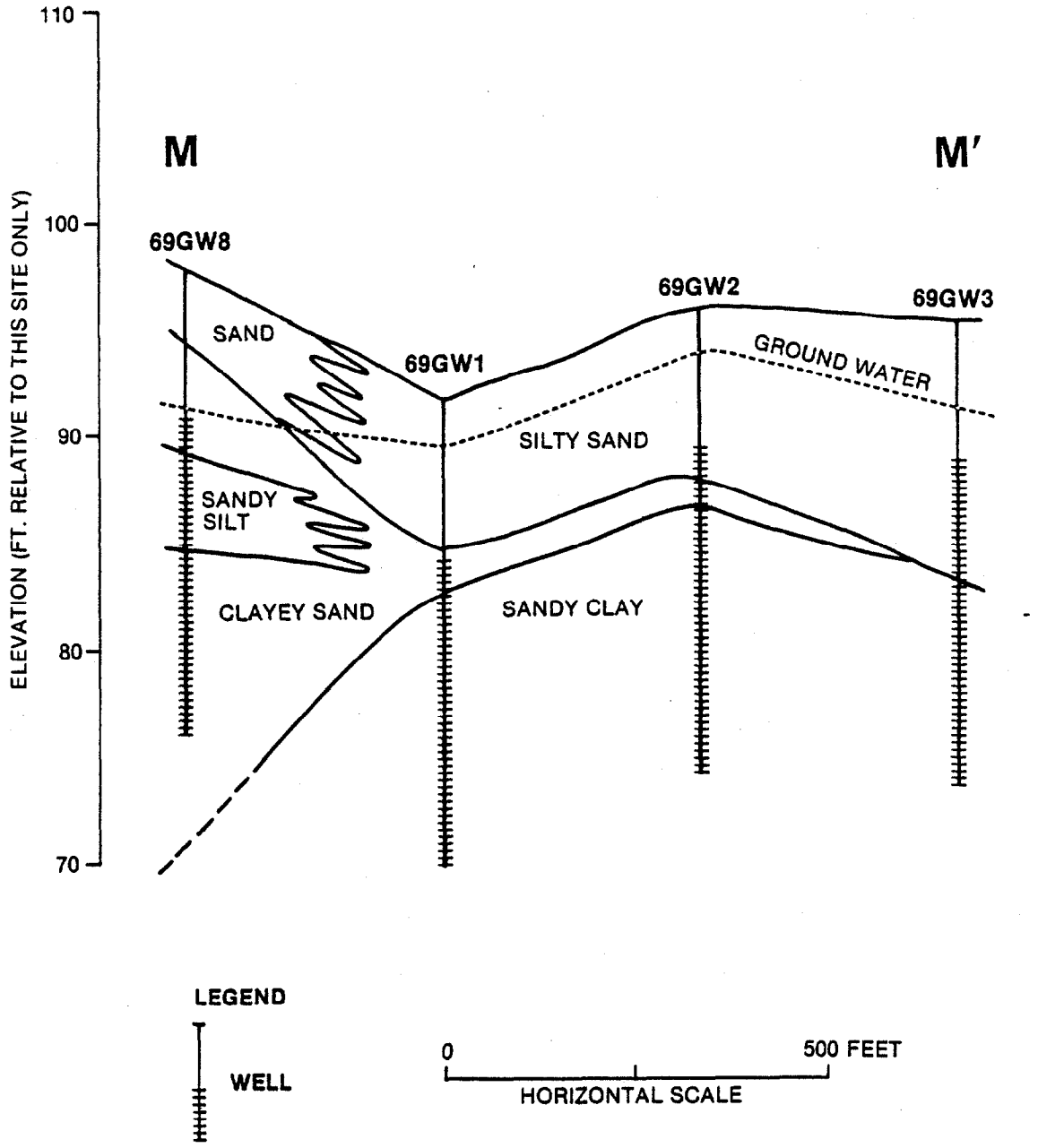


Figure 69-2
GEOLOGIC CROSS SECTION M—M', SITE 69—RIFLE RANGE CHEMICAL DUMP

MARINE CORPS BASE CAMP LEJEUNE

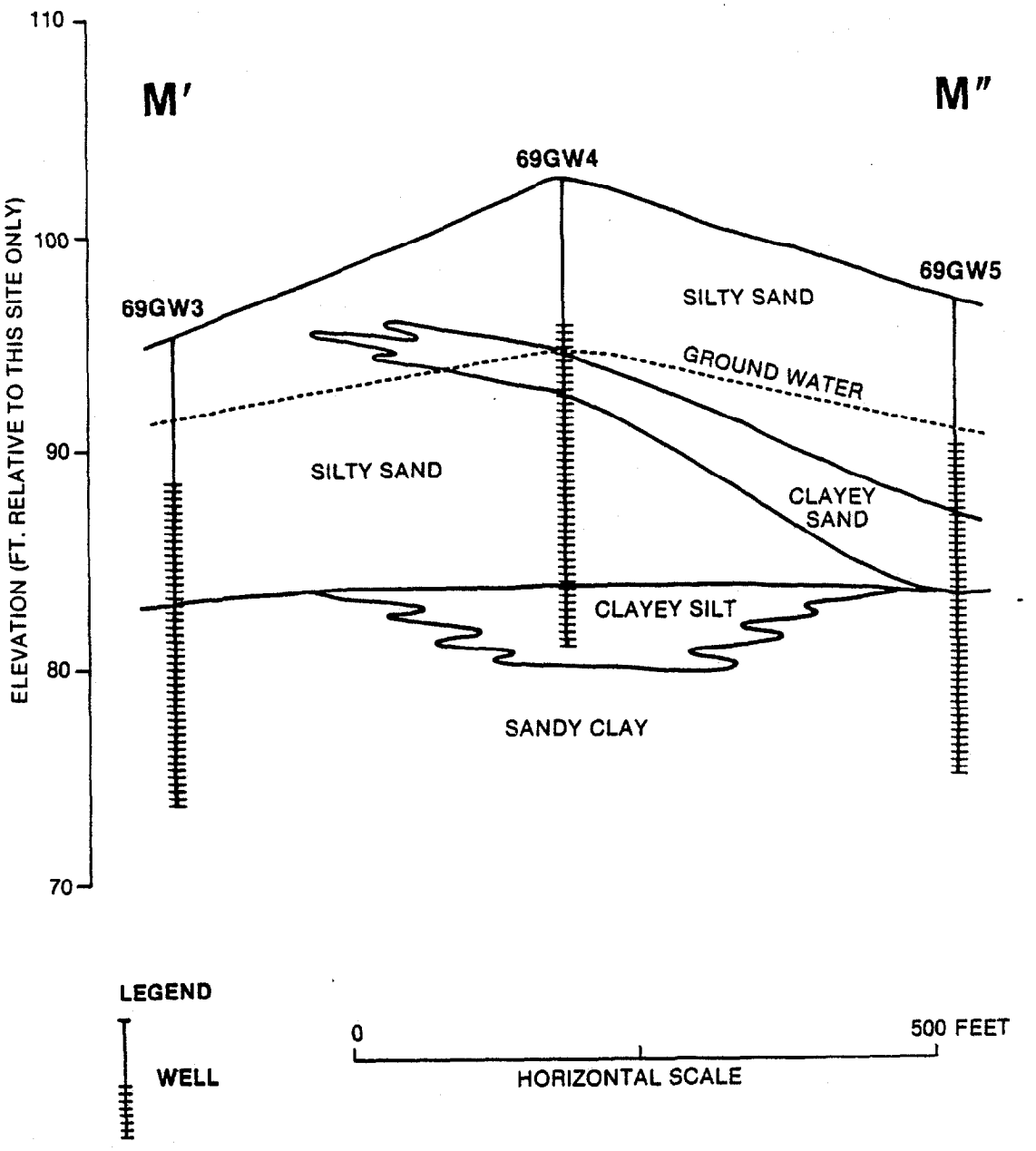
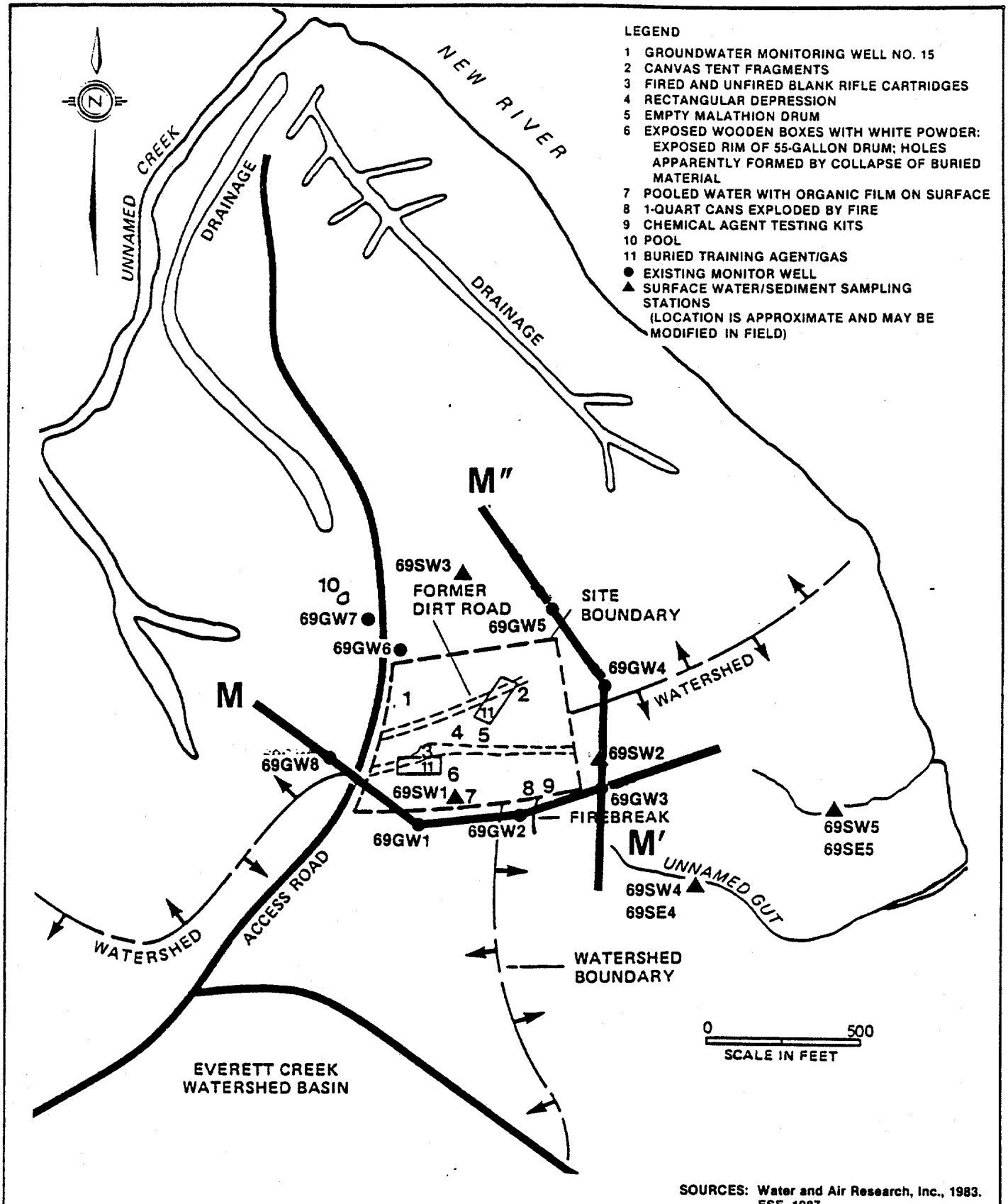


Figure 69-3
GEOLOGIC CROSS SECTION M′—M″, SITE 69—RIFLE RANGE CHEMICAL DUMP

MARINE CORPS BASE
CAMP LEJEUNE

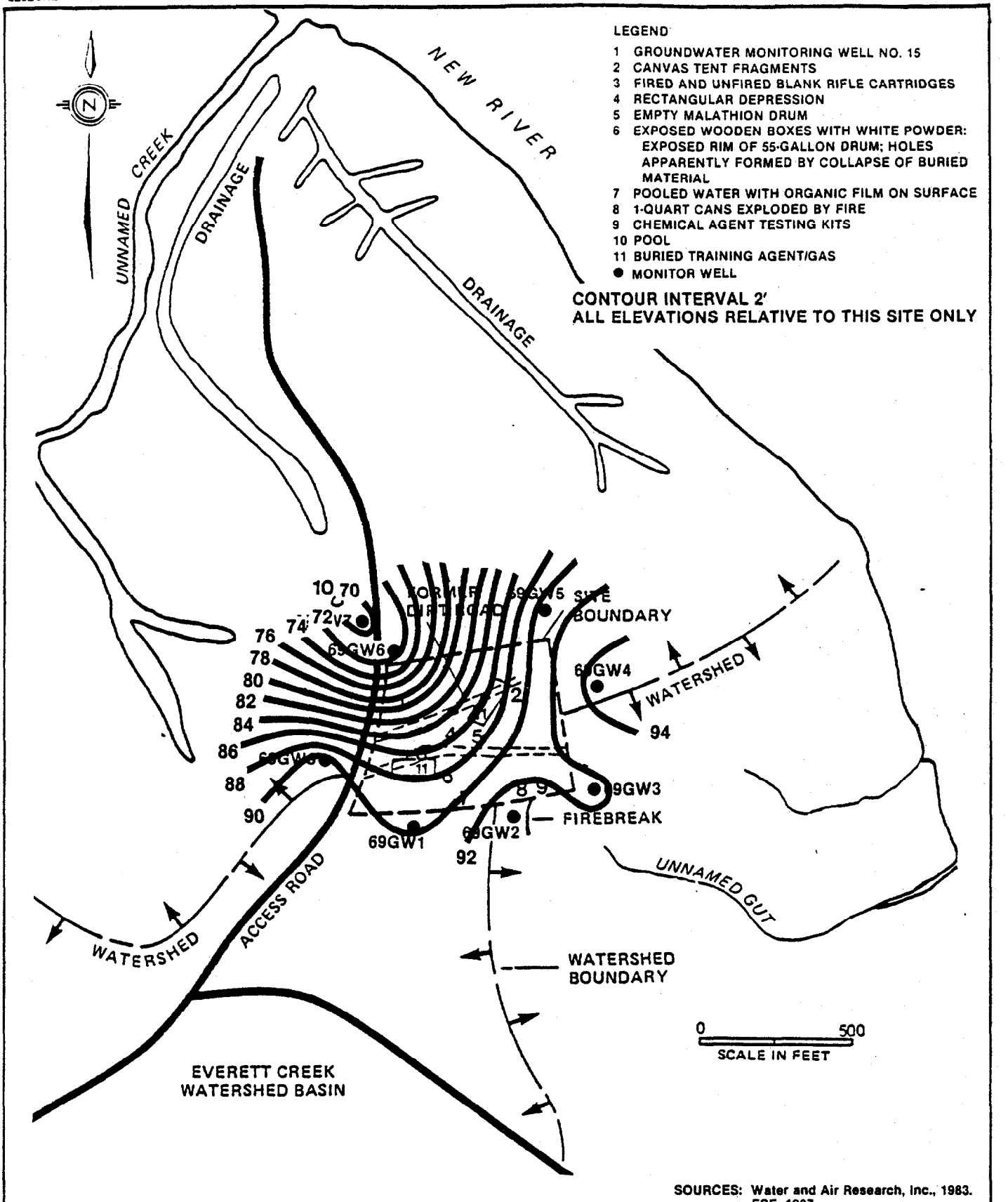


SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 69-4
GEOLOGIC CROSS SECTION LOCATION, SITE 69–RIFLE RANGE CHEMICAL DUMP

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 69-5
GROUND WATER CONTOUR MAP—SHALLOW AQUIFER, SITE 69—RIFLE RANGE CHEMICAL DUMP

MARINE CORPS BASE
CAMP LEJEUNE

3.17.2 SITE INVESTIGATION

GROUNDWATER

Eight groundwater monitoring wells were installed as part of the investigation in 1984. Figure 69-1 shows the location of these wells. Wells 69GW1 and 69GW2 are located south and down gradient of the disposal area. Wells 69GW3 and 69GW4 are located east of the disposal area. Wells 69GW5, 69GW6, and 69GW7 are located north of the disposal area. Well 69GW8 is located west of the site. The groundwater samples collected during July and August 1984 were analyzed for the following target compounds: organochlorine pesticides, PCB's, pentachlorophenol, VOCs, mercury, and residual chlorine. Table 69-1 lists those analytes that were detected at levels greater than the method detection limit.

The samples collected during December 1986 were analyzed for the same target analytes plus the following additional compounds: tetrachlorodioxin, xylene, methylethyl ketone, methyl isobutyl ketone, and ethylene dibromide. The results of these investigations show that the groundwater contains high levels of VOCs (Table 69-1).

SURFACE WATER AND SEDIMENTS

Samples of surface water and sediments were collected in the vicinity of the disposal area. These samples contained detectable concentrations of the same compounds identified in the groundwater. Tables 69-2 and 69-3 list those compounds detected in the surface water and sediment samples collected from Site 69. These data indicate that the contaminants within the filled areas periodically discharge into the surface water network.

3.17.3 SUMMARY AND CONCLUSIONS

Contamination at the Rifle Range Chemical Dump is extensive. VOCs have been identified in all media sampled. In addition pesticides and pentachlorophenol have been identified in the surface water and sediment at this AOC. It appears that the contamination detected is concentrated at the

TABLE 69-1. SITE 69 - RIFLE RANGE CHEMICAL DUMP (Page 2 of 2)
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	69GW5 7/18/84	69GW5 12/18/86	69GW6 7/18/84	69GW6 12/18/86	69GW7 7/18/84	69GW7 12/18/86	69GW8 7/18/84	69GW8 12/18/86
PARAMETER								
MERCURY	<0.2	<0.2	<0.2	0.2	<0.2	0.2	<0.2	0.2
BHC,B	<0.0001	<0.017	<0.0001	<0.013	<0.0001	<0.013	<0.0001	<0.013
BHC,D	<0.0003	<0.017	<0.0003	<0.013	<0.0003	<0.013	<0.0003	<0.013
1,2-DIBROMOETHANE	NA	<0.02	NA	<0.02	NA	<0.02	NA	<0.02
BENZENE	<0.3	<1	<0.3	<1	<0.3	<1	<0.3	<1
CHLOROBENZENE	<0.5	<6	<0.5	<6	<0.5	<6	<0.5	<6
CHLOROFORM	<0.7	<1.6	<0.6	<1.6	<0.7	<1.6	<0.7	<1.6
1,2-DICHLOROETHANE	<1	<2.8	<0.9	<2.8	<1	<2.8	<1	<2.8
1,1-DICHLOROETHYLENE	<1.2	<2.8	<1.2	<2.8	<1.2	<2.8	<1.3	<2.8
T-1,2-DICHLORO-								
ETHENE	<1.2	4.2	<1.2	<1.6	<1.2	<1.6	<1.2	<1.6
METHYLENE CHLORIDE	<1	<2.8	<1	<2.8	<1	<2.8	<1	<2.8
1,1,2,2-TETRACHLORO-								
ETHANE	<0.9	<4.1	<0.8	<4.1	<0.9	<4.1	<0.9	<4.1
TETRACHLOROETHENE	<1.7	<3	<1.6	<3	<1.7	<3	<1.7	<3
1,1,2-TRICHLORO-								
ETHANE	<1.2	<5	<1.2	<5	<1.2	<5	<1.2	<5
TRICHLOROETHENE	<1.3	<3	<1.3	<3	<1.3	<3	<1.3	<3
TOLUENE	<0.6	<6	<0.6	<6	<0.6	<6	<0.6	<6
VINYL CHLORIDE	<1	<1	<0.9	<1	<1	<1	<0.9	<1

NA - not analyzed
All units in micrograms per liter (ug/L).
Source: Hunter/ESE, 1990.

3-162

SUITE PAGES W/ 3-163

ARAR

TABLE 69-1. SITE 69 - RIFLE RANGE CHEMICAL DUMP (Page 1 of 2)
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	69GW1 7/18/84	69GW1 12/12/86	69GW2 7/18/84	69GW2 12/17/86	69GW3 7/18/84	69GW3 12/17/86	69GW4 7/18/84	69GW4 12/18/86
PARAMETER								
MERCURY	0.2	0.2	<0.2	0.2	<0.2	0.2	<0.2	0.2
BHC,B	<0.0001	<0.013	<0.0001	<0.013	<0.0001	0.087	<0.0001	<0.013
BHC,D	<0.0003	NR	<0.0003	0.034	<0.0003	2.44	<0.0003	<0.013
1,2-DIBROMOETHANE	NA	<0.02	NA	4.74	NA	0.363	NA	<0.02
BENZENE	<0.3	<1	0.7	<25 ?	4	4	<0.6	<1
CHLOROBENZENE	<0.5	<6	<0.5	<150 ?	49	55	<0.9	<6
CHLOROFORM	<0.7	<1.6	<0.6	<40 ?	<0.6	<1.6	1.3	14
1,2-DICHLOROETHANE	<1	<2.8	5.9	<70 ?	1.9 → ?	<2.8	<1.8	<2.8
1,1-DICHLOROETHYLENE	<1.2	<2.8	1.6	<70 ?	2.7	<2.8	<2.4	<2.8
T-1,2-DICHLORO-								
ETHENE	<1.2	<1.6	9700	37000	4000	830	410	91
METHYLENE CHLORIDE	10	<2.8	<1	<70	<1	<2.8	<2	<2.8
1,1,2,2-TETRACHLORO-								
ETHANE	<0.9	<4.1	44	<100	<0.8	<4.1	2	5.4
TETRACHLOROETHENE	<1.7	<3	20	<75	<1.6	<3	<3.3	<3
1,1,2-TRICHLORO-								
ETHANE	<1.2	<5	7.9	<130	<1.2	<5	3.1	<5
TRICHLOROETHENE	<1.3	<3	340	710	4.9	<3	<2.5	<3
TOLUENE	0.7	<6	5	<150	14	10	<1	<6
VINYL CHLORIDE	<0.9	<1	80	440	2	1.6	<2	<1

NR
NA - not analyzed
All units in micrograms per liter (ug/L).
Source: Hunter/ESE, 1990.

TABLE 69-2. SITE 69 - RIFLE RANGE CHEMICAL DUMP
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES

	69SW1	69SW1	69SW1	69SW2	69SW2	69SW3
DATE	8/4/84	8/4/84	12/12/86	8/4/84	12/12/86	12/12/86
PARAMETER						
BHC,A	<0.001	<0.001	0.043	<0.001	0.056	<0.035
BHC,B	0.03	<0.0001	0.043	0.005	0.18	<0.013
BHC,D	0.2	<0.0003	NR	0.02	NR	NR
PENTACHLOROPHENOL	10	4	<0.89	<0.9	1.24	<0.89
BENZENE	0.4	NA	<1	<0.2	<1	<1
CHLOROBENZENE	2.1	NA	<6	<0.3	<6	<6
CHLOROFORM	6	NA	<1.6	<0.5	<1.6	<1.6
1,2-DICHLOROETHANE	0.9	NA	<2.8	<0.8	<2.8	<2.8
T-1,2-DICHLORO-						
ETHENE	410	NA	310	10	170	<1.6
ETHYLBENZENE	3	NA	<7.2	<0.6	<7.2	<7.2
METHYLENE CHLORIDE	<0.6	NA	<2.8	8	<2.8	<2.8
1,1,2,2-TETRACHLORO-						
ETHANE	59	NA	<4.1	<0.5	<4.1	<4.1
1,1,2-TRICHLORO-						
ETHANE	6	NA	<5	<0.8	<5	<5
TRICHLOROETHENE	55	NA	63	1.3	12	<3
TOLUENE	11	NA	<6	<0.4	<6	<6
VINYL CHLORIDE	15	NA	41	<0.6	<1	<1
MERCURY	<0.2	<0.2	<0.2	<0.2	<0.2	0.2

NA - not analyzed
All units in micrograms per liter (ug/L).
Source: Hunter/ESE, 1990.

TABLE 69-3. SITE 69 - RIFLE RANGE CHEMICAL DUMP
DETECTED TARGET ANALTYES
SEDIMENT SAMPLES

	69SE4	69SE5
DATE	12/12/86	12/12/86
PARAMETER		
DDD,PP'	<12.9	113
DDE,PP'	18.8	<22.4
PENTACHLOROPHENOL	1190	<51.3

ARAR

All units in micrograms per kilogram (ug/kg).

Source: Hunter/ESE, 1990.

southern portion of the filled area. This would indicate that most of the disposal activity may have been conducted in this area. Evidence of the contaminants in surface water bodies and sediments would indicate that the some of the buried material is near the surface. If this is the case any disturbance of the soils may expose these materials to the atmosphere. This presents a high risk for direct contact exposure to the contaminants.

Further Explain this statement

3.17.4 RECOMMENDATIONS

The mixed wastes present at this AOC and its proximity to significant aquatic environments, represent a high risk to human health and the environment. Extensive field investigations in elevated levels of protection are required to determine the location and exact nature of the various waste materials. It is recommended that this AOC be separated from the remainder of the AOCs at Camp Lajeune and that a separate RI/FS be conducted.

//

FAST TRACK

3.18 SITE 73 - COURTHOUSE BAY LIQUIDS DISPOSAL AREA

3.18.1 SITE BACKGROUND

The Courthouse Bay Liquids Disposal Area (Figure 73-1) is located on either side of Courthouse Road approximately 200 feet northwest of Courthouse Bay (PWDM coordinates 17, I 11-12). This AOC was used from 1946 until 1977. Available information indicates that disposal activities occurred within a 13 acre area. An estimated 400,000 gallons of waste oil was deposited of in this area. The waste oil was generated during routine vehicle maintenance. The oil drained directly onto the ground surface. In addition, approximately 20,000 gallons of waste battery acid was reportedly disposed of in this area. Waste battery acid was poured into shallow hand-shoveled holes which were backfilled after disposal.

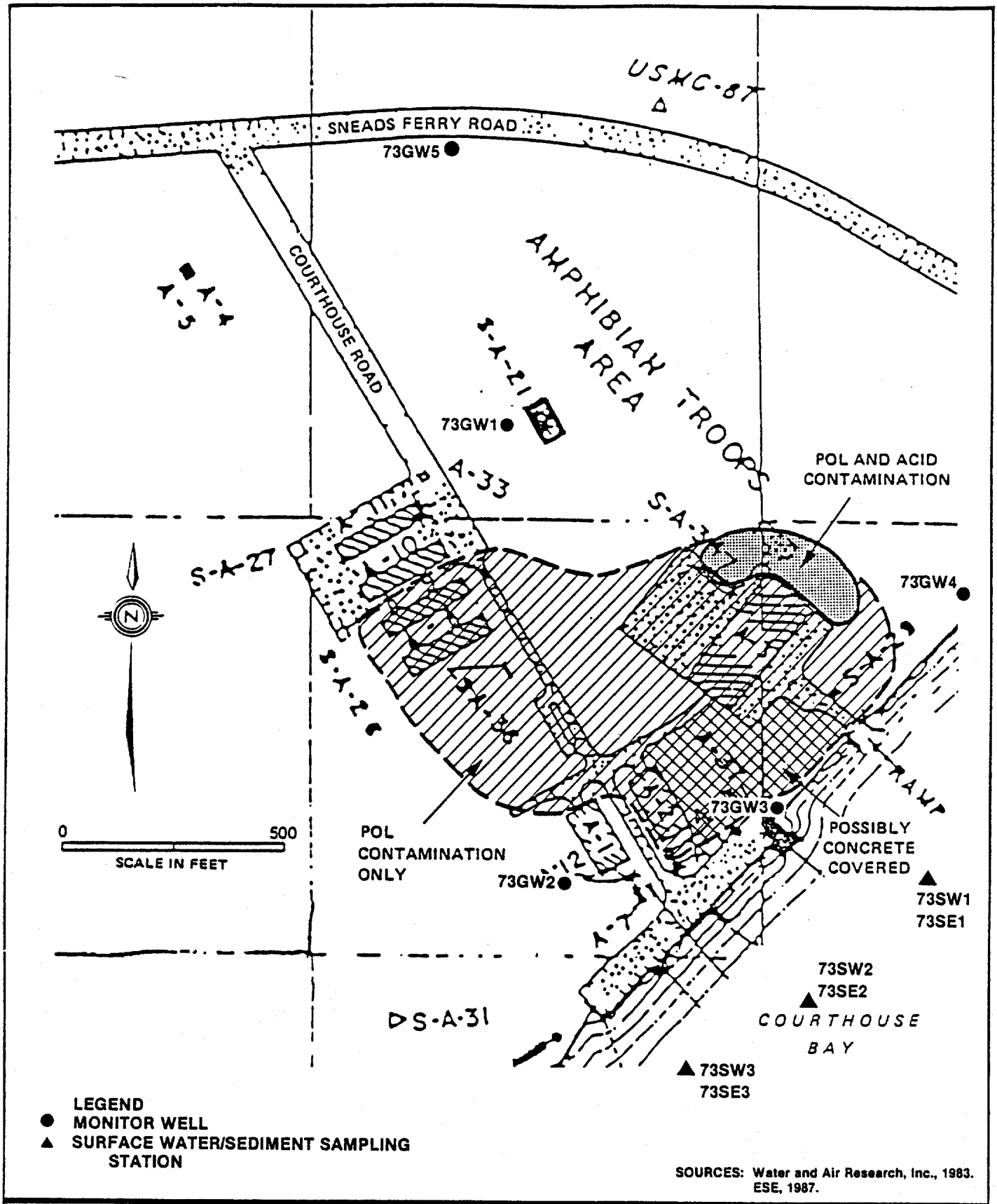
The area is underlain primarily by silty sand overlying sand and clay with discontinuous clay and silty clay lenses (Figure 73-2). Figure 73-2 is a geologic cross section representing the shallow geology of Site 73. This cross section is drawn in a north-south direction (Figure 73-3).

The surface of the shallow groundwater lies within the silty sand at depths ranging from 2.38 to 6.58 feet below land surface. The groundwater contour map (Figure 73-4) indicates that the groundwater flows to the east-southeast towards Courthouse Bay and a drainage ditch along the eastern side of the AOC. The groundwater flow gradient is estimated to be 0.012 ft/ft.

3.18.2 SITE INVESTIGATION

GROUNDWATER

Four shallow groundwater monitoring wells were installed as part of the investigation conducted in 1984. The location of these wells is shown in Figure 73-1. Well 73GW1 is located north of the disposal areas. This well is situated upgradient and between the disposal area and Water Supply Well A-5. Well 73GW2 is located south (downgradient) of the disposal area and upgradient of Courthouse Bay. Wells 73GW3 and 73GW4 are east (downgradient)



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 73-1
SAMPLING LOCATIONS, SITE 73—
COURTHOUSE BAY LIQUID DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE

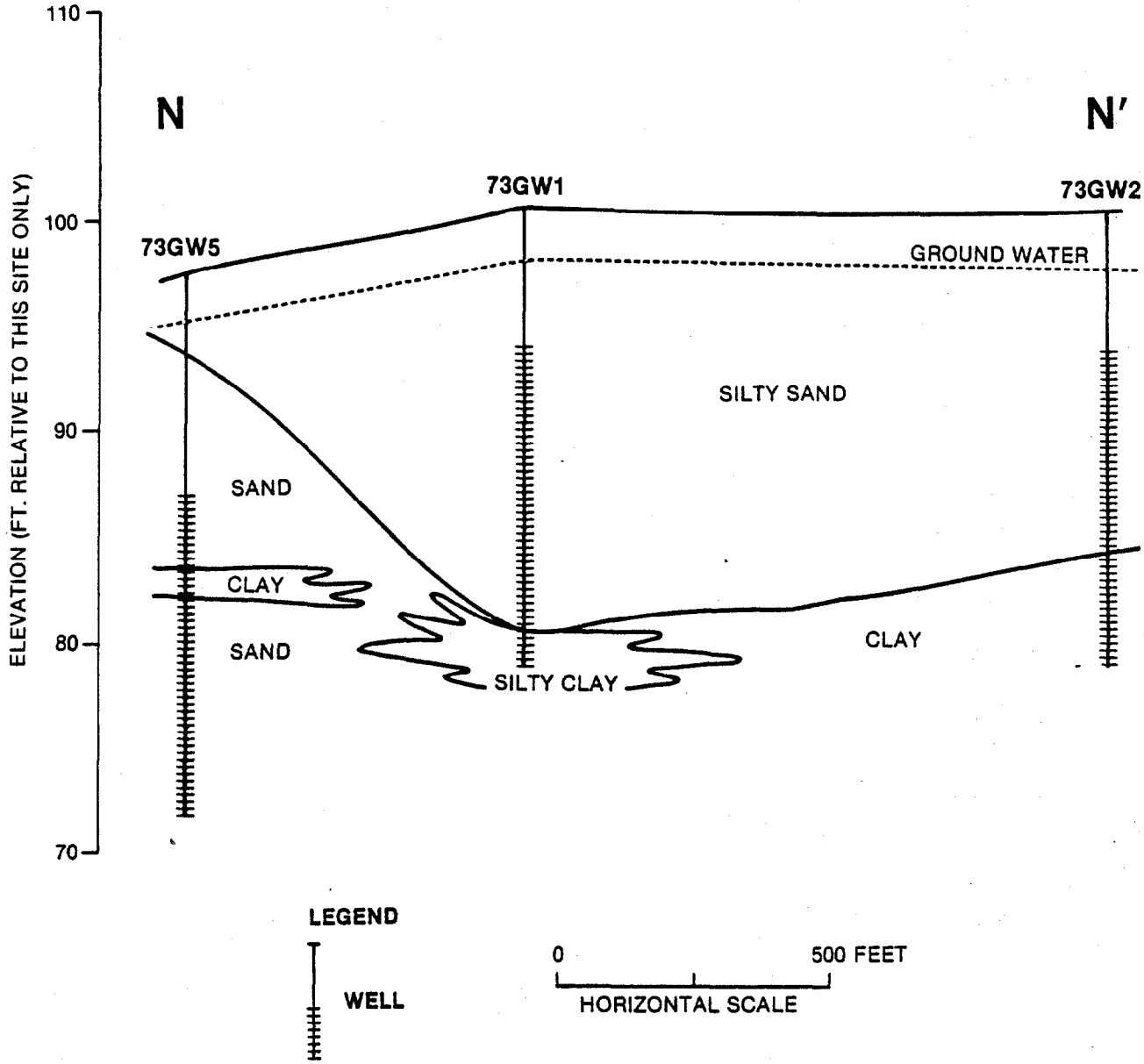


Figure 73-2
GEOLOGIC CROSS SECTION, SITE 73—
COURTHOUSE BAY LIQUID DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE

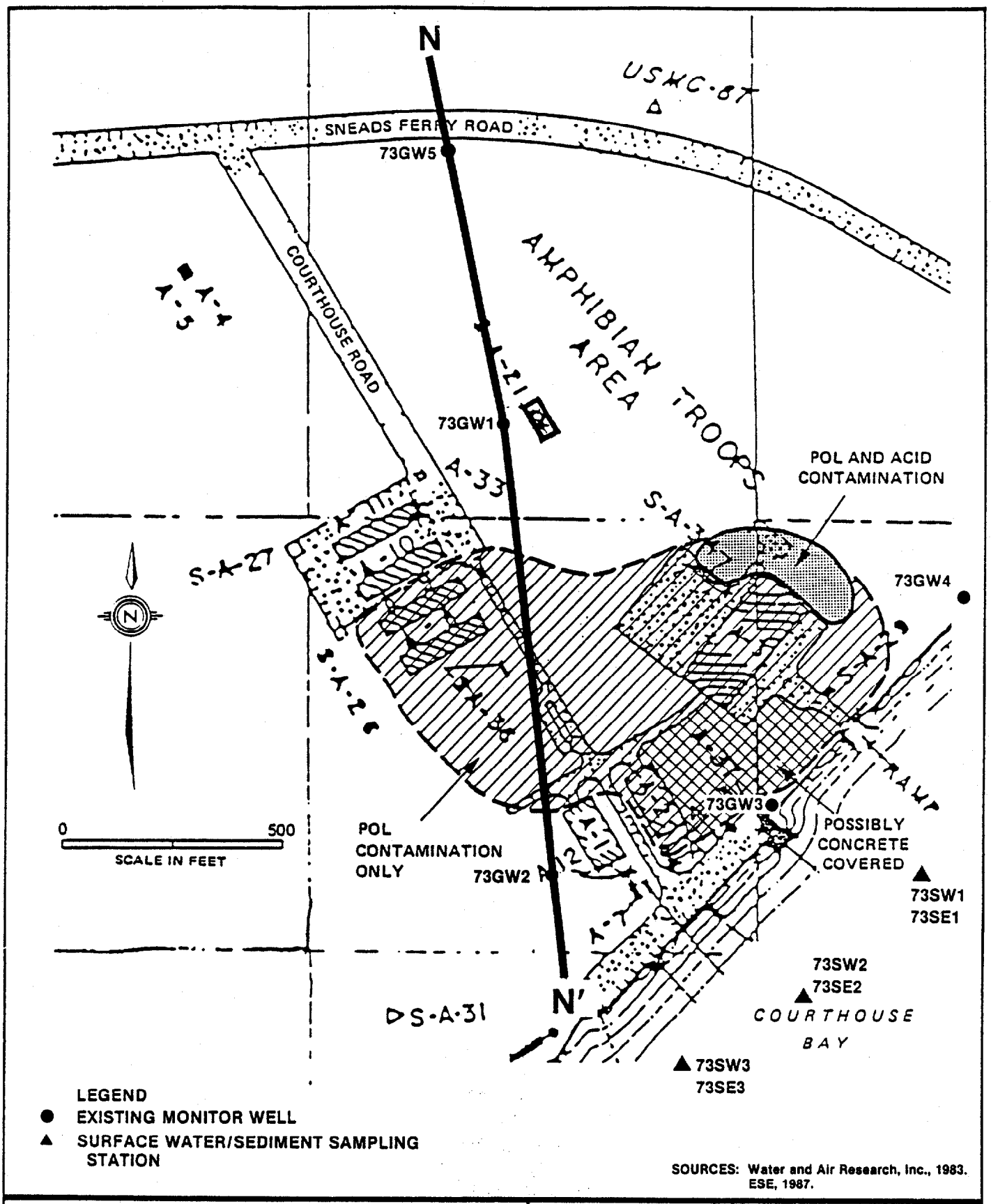
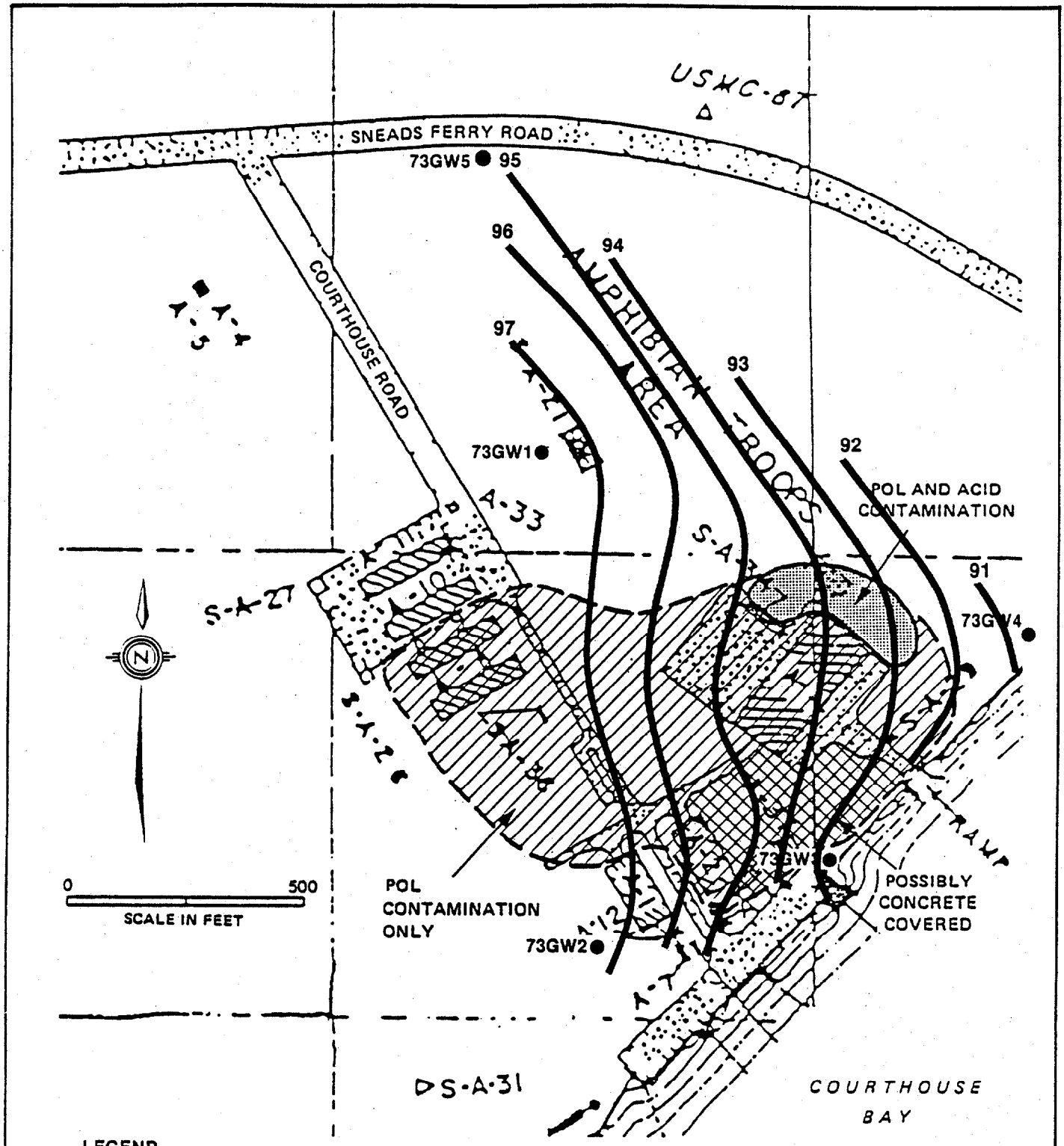


Figure 73-3
GEOLOGIC CROSS SECTION LOCATION, SITE 73—COURTHOUSE BAY LIQUID DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 73-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 73—
COURTHOUSE BAY LIQUID DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE

of the disposal area. A fifth monitoring well (73GW5) was installed during the investigation conducted in 1986/87. This well is located north of the disposal area. The well was installed to provide a background data point within the shallow aquifer zone. On Table 73-1, Supply Well A-5 is designated as 73GW5 for the July 1984 sampling effort only. The monitoring well installed in 1986 and sampled in both January and March, 1987 is also listed as 73GW5 on Table 73-1. The 1984 analytical results are not comparable to the 1987 data.

where is discussion of Contam. for the Supply well ? why ? for the GW well.

Groundwater samples collected from these wells in July 1984 were analyzed for the following target compounds:

- o Cadmium
- o Chromium
- o Lead
- o Antimony
- o Oil and Grease (O&G)
- o Volatile Organics (VOC)
- o Total Phenols

Appendix A lists all individual target analytes and their abbreviations. Table 73-1 presents those compounds that were detected above the method detection limits in groundwater samples collected from Site 73.

A second round of sampling was performed in January and March 1987. The same locations were sampled with the addition of Monitoring Well 73GW5. The previous set of target compounds were analyzed with the addition of the following:

- o Xylene
- o Methyl ethyl ketone
- o Methyl isobutyl ketone
- o Ethylene dibromide
- o Hexavalent chromium

Designate as GW5 A5 for thought this well installed in 86/87?

TABLE 73-1.

SITE 73 - COURTHOUSE BAY LIQUIDS DISPOSAL AREA
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	73GW1 7/6/84	73GW1 1/7/87	73GW2 7/6/84	73GW2 1/7/87	73GW3 7/6/84	73GW3 1/7/87	73GW4 7/6/84	73GW4 1/7/87	73GW5 7/6/84	73GW5 1/7/87	73GW5 3/4/87

ARAR

PARAMETER											
BENZENE	<0.4	<1	<0.4	<1	0.9	<1	17	<1	<0.4	<1	<1
BROMODICHLOROMETHANE	<0.8	<2.2	<0.8	<2.2	<0.8	<2.2	<0.9	<2.2	20	<2.2	<2.2
CHLOROFORM	<0.7	<1.6	<0.8	<1.6	<0.7	<1.6	<0.9	<1.6	38	<1.6	<1.6
DIBROMOCHLOROMETHANE	<1.3	<3.1	<1.4	<3.1	<1.3	<3.1	<1.6	<3.1	10	<3.1	<3.1
1,1-DICHLOROETHYLENE	<1.4	<2.8	<1.5	<2.8	<1.4	<2.8	2.3	<2.8	<1.5	<2.8	<2.8
TRANS-1,2-DICHLORO-											
ETHENE	<1.3	<1.6	<1.4	<1.6	1.3	<1.6	360	<1.6	<1.4	<1.6	<1.6
METHYLENE CHLORIDE	<1	12	<1	<2.8	<1	<2.8	<1	<2.8	<1	<2.8	<2.8
TOLUENE	0.7	<6	<0.7	<6	<0.6	<6	4	<6	<0.7	<6	<6
VINYL CHLORIDE	<1	<1	<1	<1	<1	<1	74	<1	<1	<1	<1
PHENOLS	10	14	5	13	10	9	15	4	<1	<2	<2
CADMIUM	<6	<2.9	<6	10	<6	3	<6	<2.9	<6	<2.9	<3.5
CHROMIUM	95	<9.4	46	<9.4	62	<9.4	43	30	<6	<9.4	<9.8
LEAD	109	<27	63	<27	89	<27	57	<27	<40	<27	<27
OIL & GREASE	2000	500	2000	500	<700	1000	<700	1000	<700	800	1000

All units in micrograms per liter (ug/L).

Source: Hunter/ESE, 1990.

The sample analyses identified greater concentrations of metals in 1984 than were found in 1987. The concentrations of VOCs appear to have changed significantly from 1984 to 1987. Well 73GW4 contained high levels of VOCs in 1984; these levels decreased in the samples collected in 1987. This change may be related in part to the relocation of this well. Well 73GW4 was moved from its original location to allow construction to take place in the area. It is possible that this well is now located at the limits of the contaminant plume.

SURFACE WATER/ SEDIMENTS

Surface water and sediments were collected during the investigation in 1986/87. These samples were collected from three locations (Figure 73-1) offshore in Courthouse Bay. The samples were analyzed for the same target compounds as the groundwater samples. The results of this sampling effort identified the presence of cadmium, chromium, lead, phenols, and O&G in the sediment. Table 73-2 lists the analytical results for the sediment samples. Chromium was the only compound identified above detection limits in the surface water. The levels of chromium detected in the surface water are below the freshwater standard of 50 ug/L and are therefore not of concern. The target analytes identified in the sediments are similar to those identified in the groundwater samples.

3.18.3 SUMMARY AND CONCLUSIONS

Disposal activities at this AOC have impacted the groundwater beneath the site, and may have also affected the surface water and sediments in Courthouse Bay. Contaminants may have migrated off-site via groundwater movement, surface water drainage during periods of high flow, and sediment transport during periods of erosion. Past disposal activities at Site 73 may not be the only source of the contaminants detected in the surface water and sediments within the bay. It is possible that other potential sources in the bay area have contributed to the detected contamination.

TABLE 73-2. SITE 73 - COURTHOUSE BAY LIQUIDS DISPOSAL ARE DETECTED TARGET ANALYTES SEDIMENT SAMPLES

	73SE1	73SE2	73SE3
DATE	12/15/86	12/15/86	12/15/86
PARAMETER			
CADMIUM	<0.406	<1.01	0.694
CHROMIUM	11.8	53	35.9
LEAD	8.51	22.2	15.8
OIL & GREASE	675	1510	314
PHENOLS	0.207	1.56	0.9

All units in micrograms per gram (ug/g).

Source: Hunter/ESE, 1990.

The shallow groundwater beneath the site flows in an easterly direction toward Courthouse Bay. The groundwater contour map (Figure 73-4) illustrates the direction of flow in this area. The shallow aquifer discharges directly into Courthouse Bay. Metals and O&G were the most prevalent contaminants detected. At least one of these analytes were identified in the surface water, sediment, and groundwater in both rounds of sampling. The concentrations of contaminants in the groundwater are attributable to past disposal activities conducted at the site.

The concentrations of metals and VOCs detected in the groundwater decrease dramatically from 1984 to 1987. While it is possible that this reduction in the concentrations of metals may be due to natural processes such as migration and dilution, it is not likely. It is more likely that varying groundwater levels effect the mobility of the detected analytes.

3.18.4 RECOMMENDATIONS

The current monitoring well network is located at the margins of the area of know disposal. The low levels of detected contamination may be attributable to distance to the source areas. The volume of waste liquids known to exist at this AOC strongly suggest that significant soil and groundwater contamination exist. Future efforts should include installation of monitoring wells within known or suspected disposal pits. In addition, a closely-spaced grid of soil sampling stations should be established to accurately measure the volume of contaminated soil for Risk Assessment and FS purposes. The presence of buildings, concrete paving, and parked vehicles may severely restrict the ability to conduct a detailed environmental characterization.

3.19 SITE 74 - MESS HALL GREASE DISPOSAL AREA

3.19.1 SITE BACKGROUND

The Mess Hall Grease Disposal Area (Figure 74-1) is located in a wooded area approximately 1/2 mile east of Holcomb Boulevard in the northeast portion of Camp Lejeune. The Pest Control Area is located approximately 20 to 50 yards south of the grease pit and 75 yards east of Supply Well 654. Site 74 is located at PWDM coordinates 5, N13/O14. The disposal area north of the dirt access road is approximately three acres in size. The grease pit measures 135 feet long, 30 feet wide, and 12 feet deep. The total size of the Pest Control Area, has been estimated at 100 feet by 100 feet. Available information indicates the site was active from the early 1950's until 1960. Disposal activities at the site include the placement of mess hall grease and some waste food into a pit. Records indicate that there was at least one unsuccessful attempt to burn the grease using a more volatile substance. The material was washed out of the pit in 1954 when Hurricane Hazel passed through the area. Use of the pit was discontinued at this time. No estimates regarding the quantity of grease disposed of at the site have been made.

Drums and pesticide soaked bags were dumped near the grease pit. Detailed information regarding the contents of the drums is not available. Personnel involved with disposal of the drums were not informed of the drum's contents or origin. It is speculated that the drums may have contained pesticides and/or transformer oil containing PCB's. Best estimates indicate that approximately 500 gallons of pesticides were released from the deposition of the bags. Approximately 2,200 gallons of pesticides, contained in drums, were deposited at the site. It is estimated that 1,100 gallons of PCB containing oil was buried at the site.

Site 74 is underlain primarily by sand and silty sand. The geologic cross section, presented in Figure 74-2, illustrates the shallow geology underlying this site. Figure 74-3 shows the area through which the cross section was

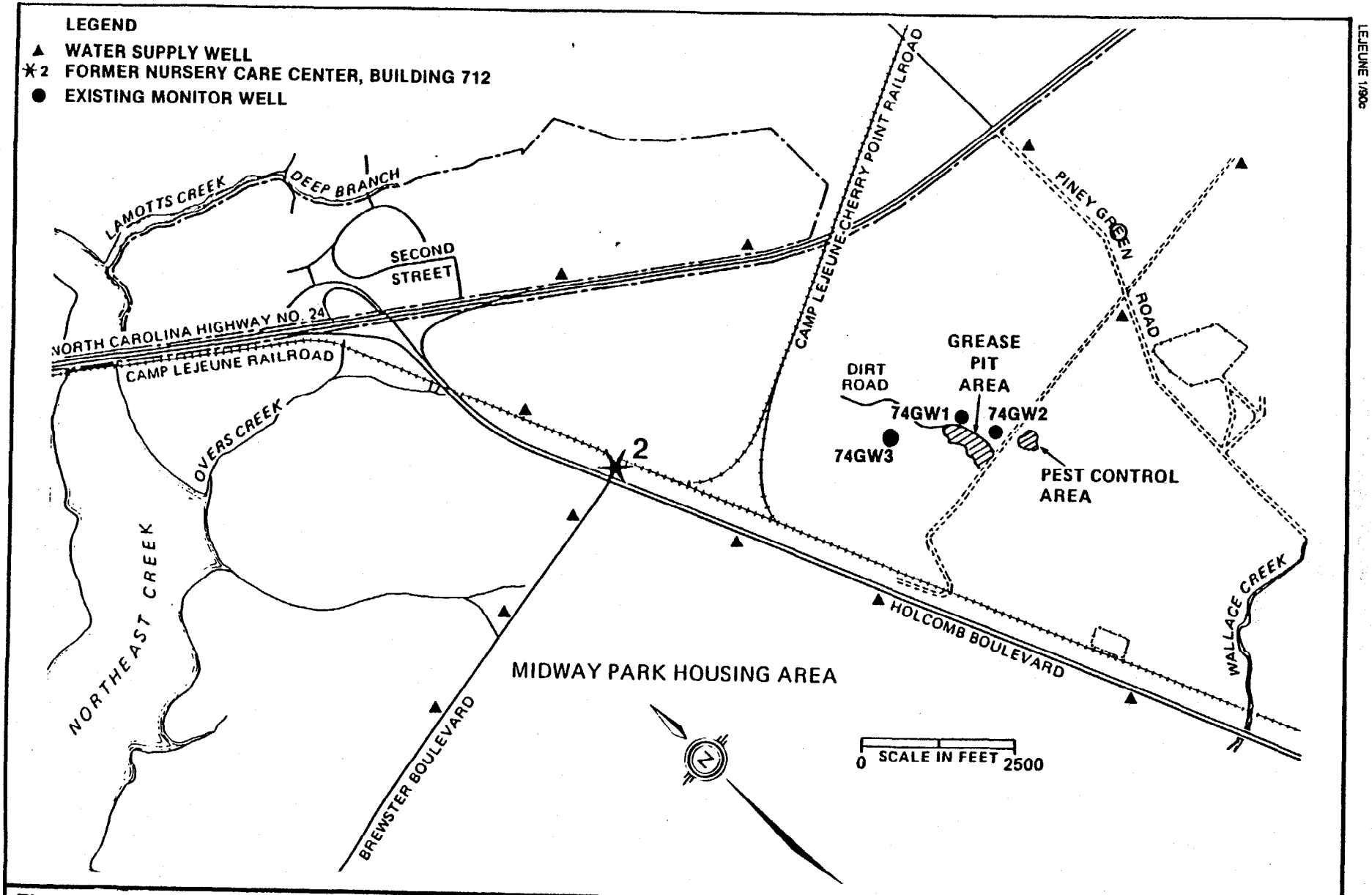


Figure 74-1
SAMPLING LOCATIONS, SITE 74—
GREASE PIT AND PEST CONTROL AREA

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1986.

MARINE CORPS BASE
CAMP LEJEUNE

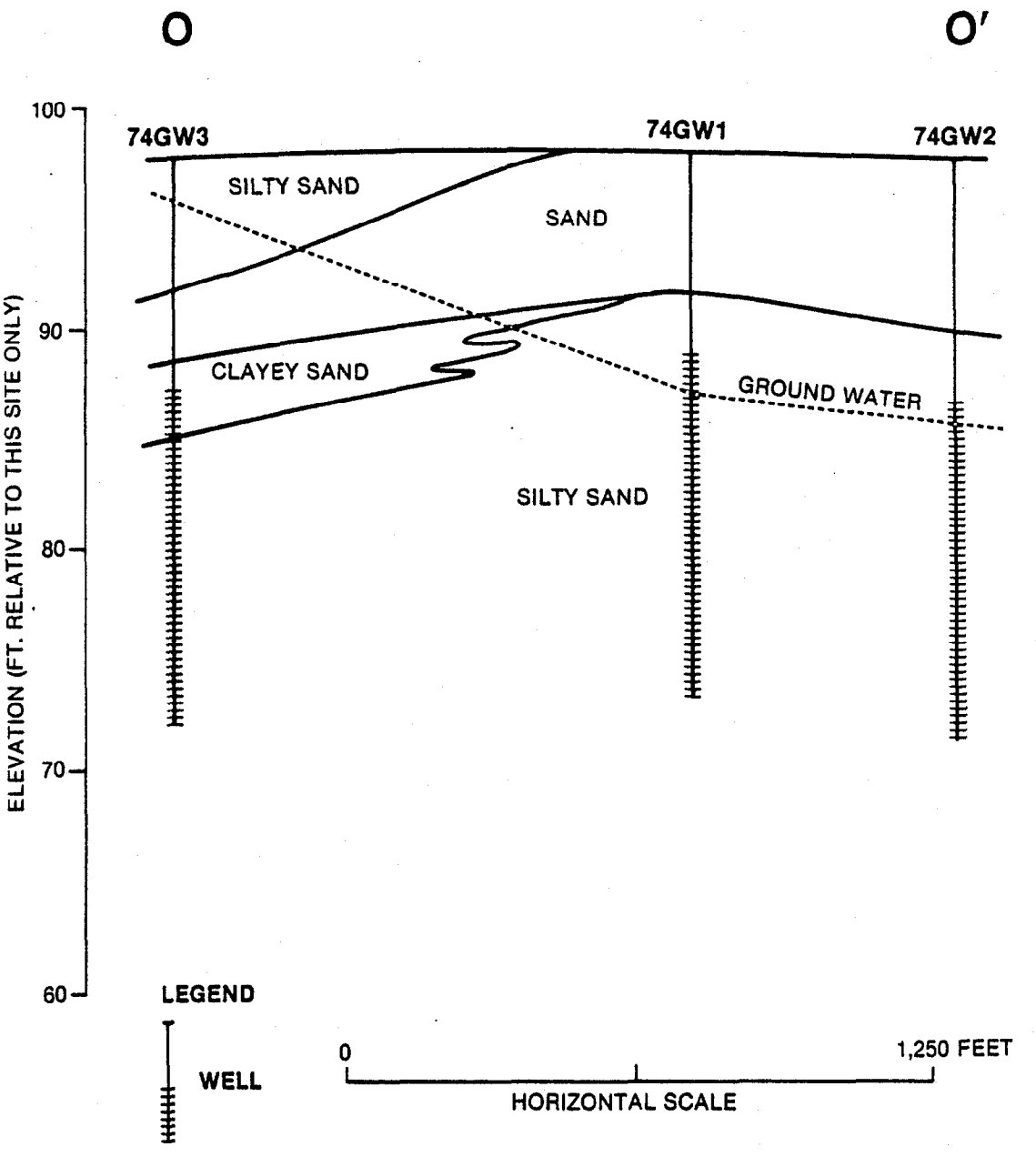


Figure 74-2
GEOLOGIC CROSS SECTION, SITE 74—
GREASE PIT AND PEST CONTROL AREA

MARINE CORPS BASE
CAMP LEJEUNE

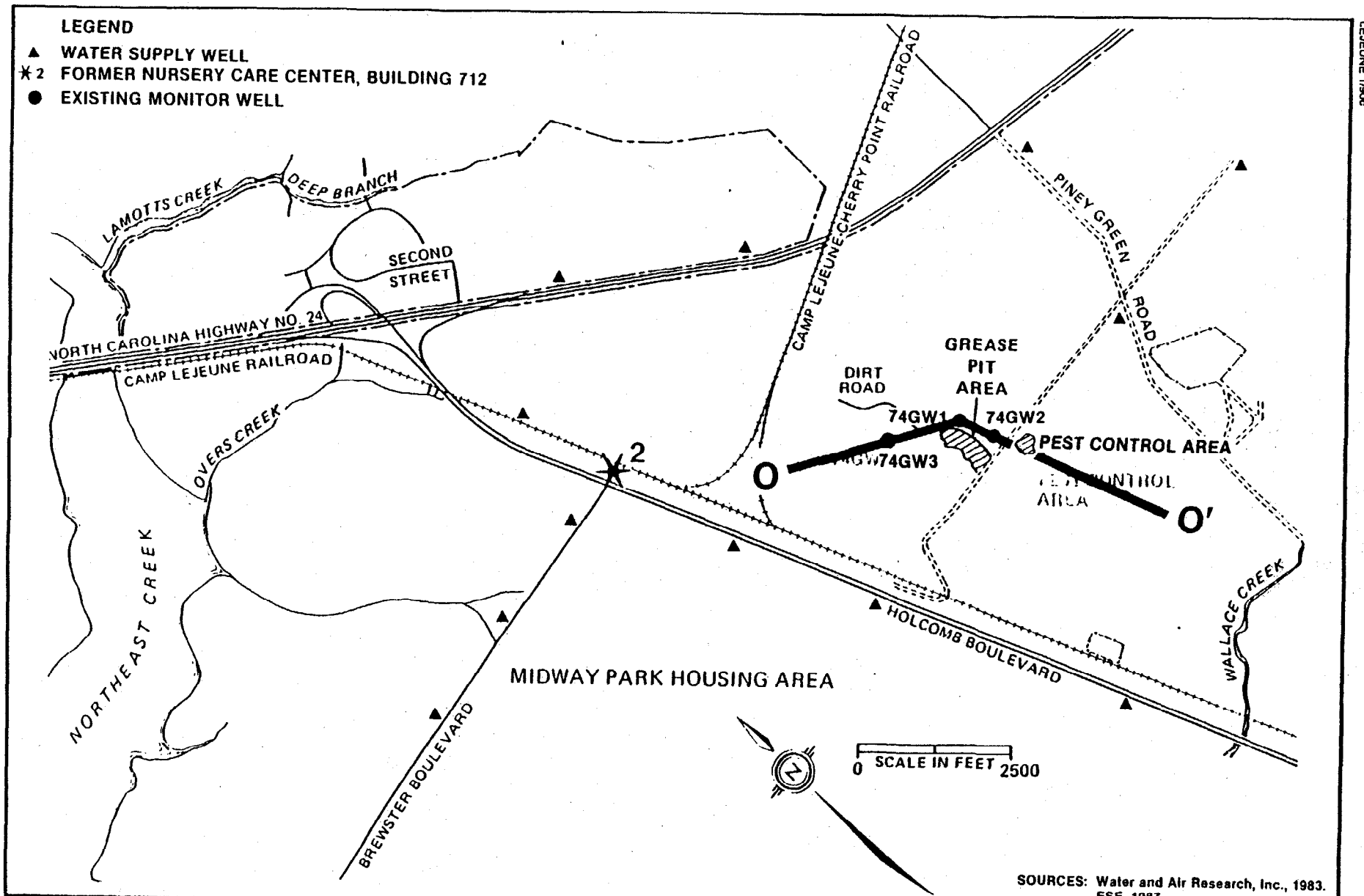


Figure 74-3
GEOLOGIC CROSS SECTION LOCATION, SITE 74—
GREASE PIT AND PEST CONTROL AREA

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c

drawn. The surface of the shallow groundwater lies within the silty sand. The depth to groundwater was measured to be between 2.01 to 12.12 feet below the ground surface. The groundwater contour map (Figure 74-4) shows the shallow groundwater to be flowing east at an approximate gradient of 0.014 ft/ft.

3.19.2 SITE INVESTIGATION

GROUNDWATER

Three shallow monitoring wells (Figure 74-1) were installed as part of the investigations conducted at this AOC. Two of the wells 74GW1 and 74GW2 were installed in 1984. The third well 74GW3 was installed in 1986. Well 74GW1 is located within the disposal area. Well 74GW2 is located southeast of the disposal area, downgradient and between the disposal area and Supply Well 654. Well 74GW3 is located northwest and upgradient of the disposal area. This well was installed as part of the second round investigation in 1986/87.

During the investigation conducted in 1984 Supply Well 654 was designated 74GW3. The sampling efforts conducted in December 1986 and March 1987 redesignate 74GW3 as a shallow monitoring well.

The three monitoring wells were sampled during two separate efforts. The first sampling effort was conducted in July 1984. The second effort was conducted in December 1986 and March 1987. Table 74-1 presents the analytical data from both the 1984 and 1986/87 sampling events. Only those target analytes that were detected above the detection limits are reported in the table.

The groundwater samples were analyzed for the following target compounds:

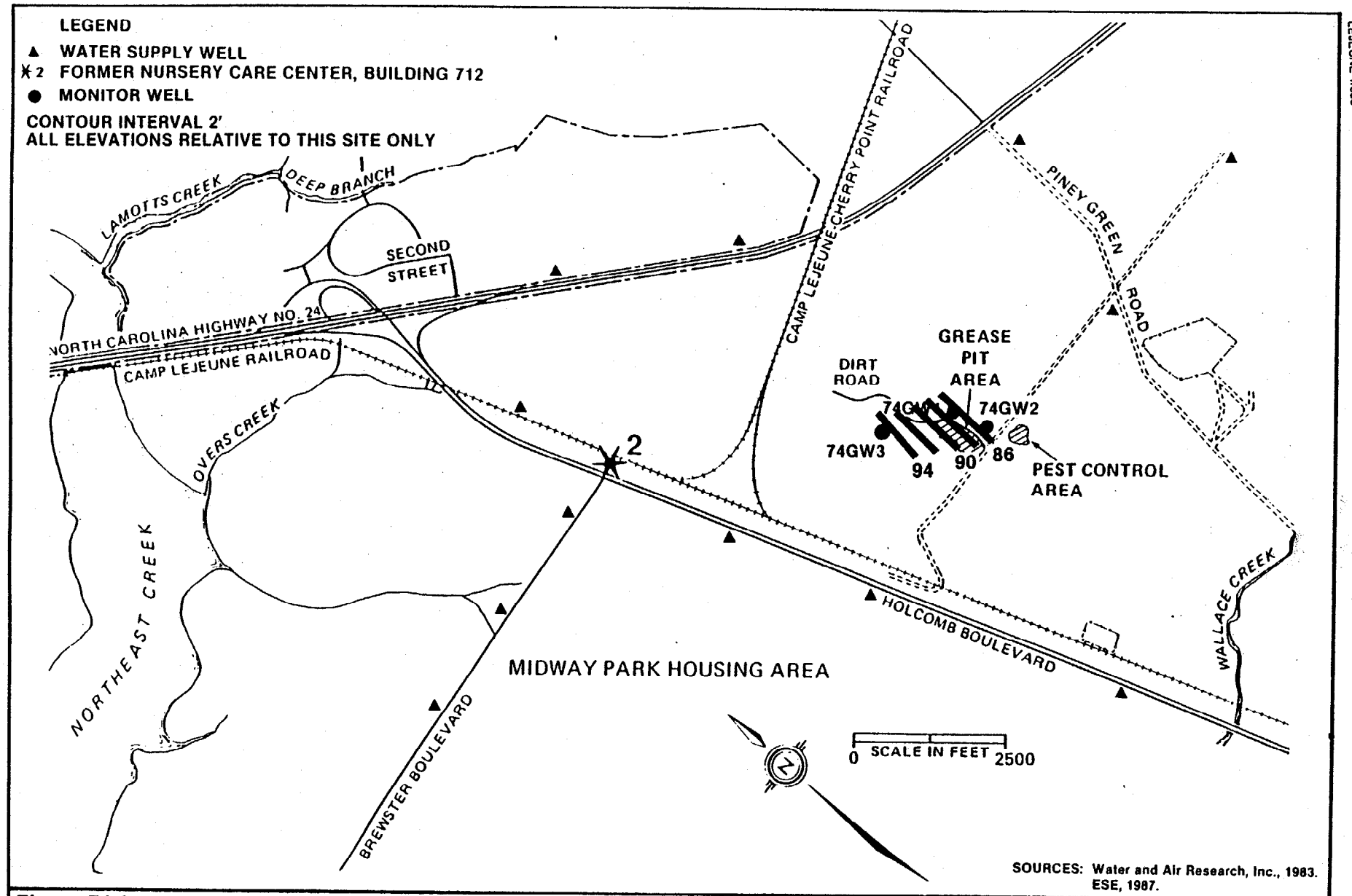


Figure 74-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 74—
GREASE PIT AND PEST CONTROL AREA

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c

TABLE 74-1. SITE 74 - MESS HALL GREASE DISPOSAL AREA
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

BETTER

DATE	74GW1 7/4/84	74GW1 12/4/86	74GW2 7/4/84	74GW2 12/4/86	74GW3 12/4/86	74GW3 3/4/87	74GW3(654) 7/4/84
PARAMETER							
ALDRIN	<0.0008	<0.006	<0.0008	0.029	<0.006	<0.006	<0
DDE,PP'	<0.0008	<0.006	0.001	<0.006	<0.006	<0.006	<0.0008
DDT,PP'	<0.005	<0.006	0.007	<0.006	<0.006	<0.006	<0.005
METHYLENE CHLORIDE	NA	<2.8	NA	<2.8	3.8	<2.8	NA

ARAR

NA - not analyzed

All units in micrograms per liter (ug/L).

Source: Hunter/ESE, 1990.

- o Organachlorine pesticides (OCP)
- o Organochlorine herbicides (OCH)
- o Polychlorinated Biphenols (PCB)
- o Tetrachlorodioxin (1986/87 only)
- o Volatile organic analysis (1986/87 only)

Appendix A presents a detailed listing of all target analytes and their abbreviations.

Trace levels of DDE and DDT were detected in 1984 in Well 74GW2 located approximately 200 feet west of the Pest Control Area. The most recent groundwater data indicate that this well is cross gradient of the Pest Control Area. In 1986, only trace levels of aldrin were detected in this well. The toxicity of aldrin is high, and the detected level (0.029 ug/L) is well in excess of the 10^{-6} health risk level of 7.4 x 10^{-8} ug/L. Trace levels of methylene chloride were detected in Well 74GW3 in 1986. This well was sampled twice as part of the 1986/87 investigation. Methylene chloride was not detected in the 1987 data set collected from the well. This may be the result of a general reduction in contaminant levels due to natural conditions experienced throughout Camp Lejeune, or may suggest that the level detected in December 1986 was a laboratory artifact.

detection limit doesn't reach this!

SOILS

Two soil borings were hand augered in the Pest Control Area and three samples were taken from each boring during an August sampling effort. Results of these samples are listed in Table 74-2. The analysis indicate that one or all of the following components were detected in each sample taken from the Pest Control Area: DDD, DDE, and DDT.

3.19.3 SUMMARY AND CONCLUSIONS

The laboratory data indicate that the soils in the Pest Control Area are contaminated with pesticides. Pesticides have also been identified in

TABLE 74-2. SITE 74 - MESS HALL GREASE DISPOSAL AREA
DETECTED TARGET ANALYTES
SOIL BORING SAMPLES

	74S1A	74S1B	74S1C	74S2A	74S2B	74S2C
DATE	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
PARAMETER						
DDD,PP'	8.4	<0.6	0.6	2.9	0.6	0.6
DDE,PP'	44	6	7.2	5.1	1	0.4
DDT,PP'	260	8.6	11	<1.2	<1.2	<1.3

All units in micrograms per kilogram (ug/kg).

Source: Hunter/ESE, 1990.

shallow groundwater in Well 74GW2 which is cross gradient from this area. No monitoring wells are currently downgradient from this area, therefore the extent of migration cannot be assessed. Contamination within the grease pit has not been identified.

3.19.4 RECOMMENDATIONS

The grease pit at this AOC does not appear to contain measurable levels of contamination. However, the Pest Control Area has been shown to contain problematic levels of pesticide contamination. Additional groundwater monitoring wells to detect the extent of the pesticide contamination should be installed. In addition, a soil sampling grid should be established to determine the volume of contaminated soil which may require remediation, as determined by a Risk Assessment.

3.20 SITE 75 - MCAS BASKETBALL COURT SITE

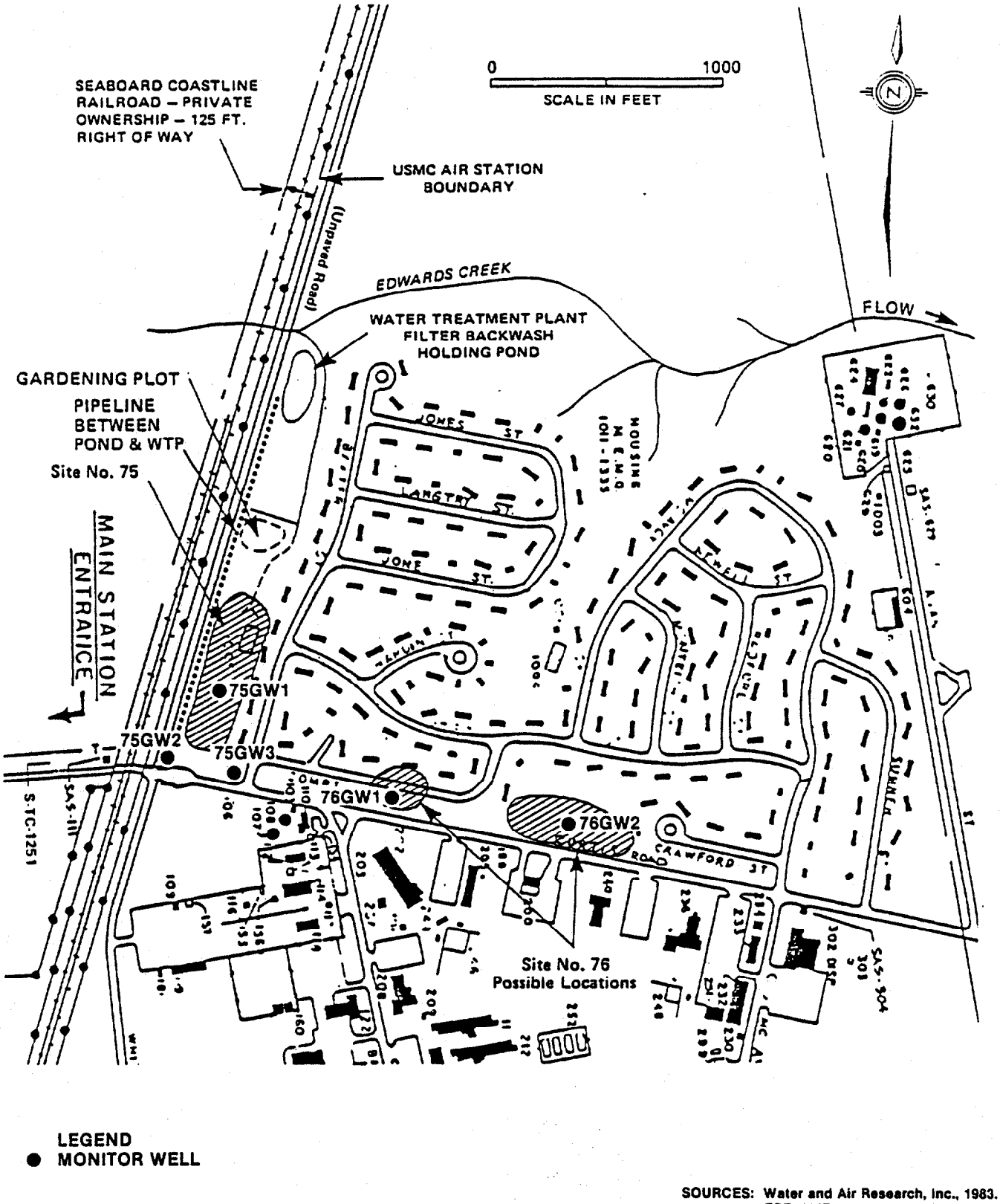
3.20.1 SITE BACKGROUND

The MCAS Basketball Court Site (Figure 75-1) is located at PWDM coordinates 23, 08-8/P8-9, along the north side of Curtis Road. This AOC was reportedly a drum burial area that was used on at least one occasion in the early 1950's. The excavation as seen in an aerial photograph, was an oval shaped pit approximately 90 feet long by 70 feet wide and was sufficiently deep to have cut into the groundwater table. An estimated 75 to 100 55-gallon drums were placed in this pit. The drums reportedly contained a chloroacetophenone tear gas solution used for training. Additional organic chemicals, such as: chloroform, carbon tetrachloride, benzene, and chloropicrin, may have been present in the solution. Degradation of the drums could have resulted in the release of the suspected materials into the groundwater. This was of particular concern due to the proximity of several water supply wells in the area, two of them being within 500 feet of the alleged disposal site.

This AOC is underlain by dipping layers of silty sand, silty-clayey sand, and clay (Figure 75-2). The geologic cross section for this site is drawn on a line from west to east (Figure 75-3). Shallow groundwater lies between 2.37 and 5.87 feet below the land surface. Groundwater measurements taken from the five monitoring wells installed at this AOC indicate that groundwater flows radially northward from Well 75GW3 and then east towards Site 76 (Figure 75-4). The gradient of the shallow groundwater is approximately 0.009 ft/ft to the east paralleling Curtis Road.

3.20.2 SITE INVESTIGATION

Prior to installation of shallow monitoring wells, a geophysical survey consisting of electromagnetic (EM) conductivity and metal detection techniques, was conducted on a grid system throughout this AOC. Areas specifically identified in aerial photography as containing drums were surveyed in detail. No signals representative of buried metallic objects were identified.



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 75-1
SAMPLING LOCATIONS, SITES 75 AND 76—MCAS BASKETBALL COURT AND CURTIS ROAD SITES

MARINE CORPS BASE
CAMP LEJEUNE

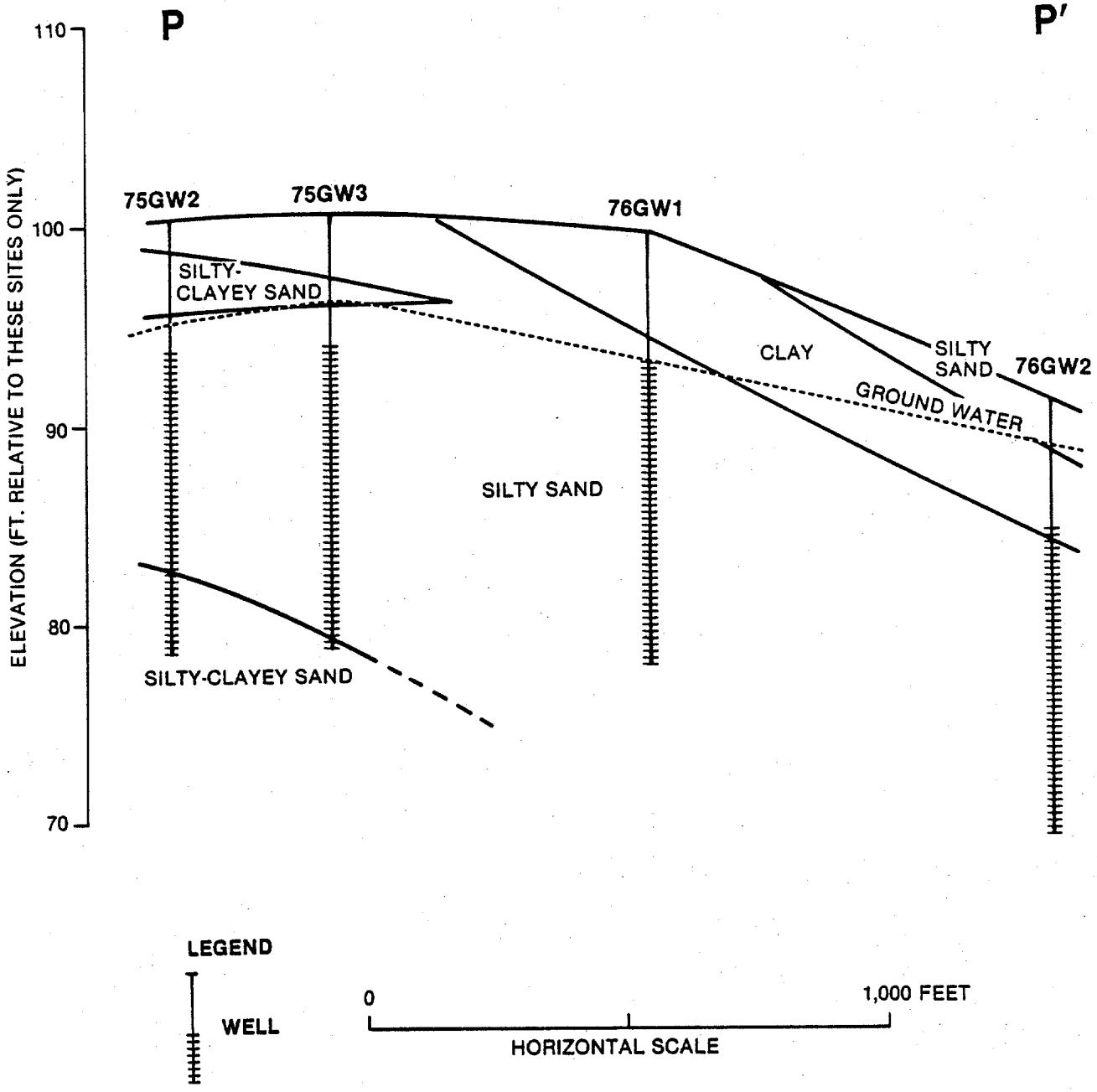
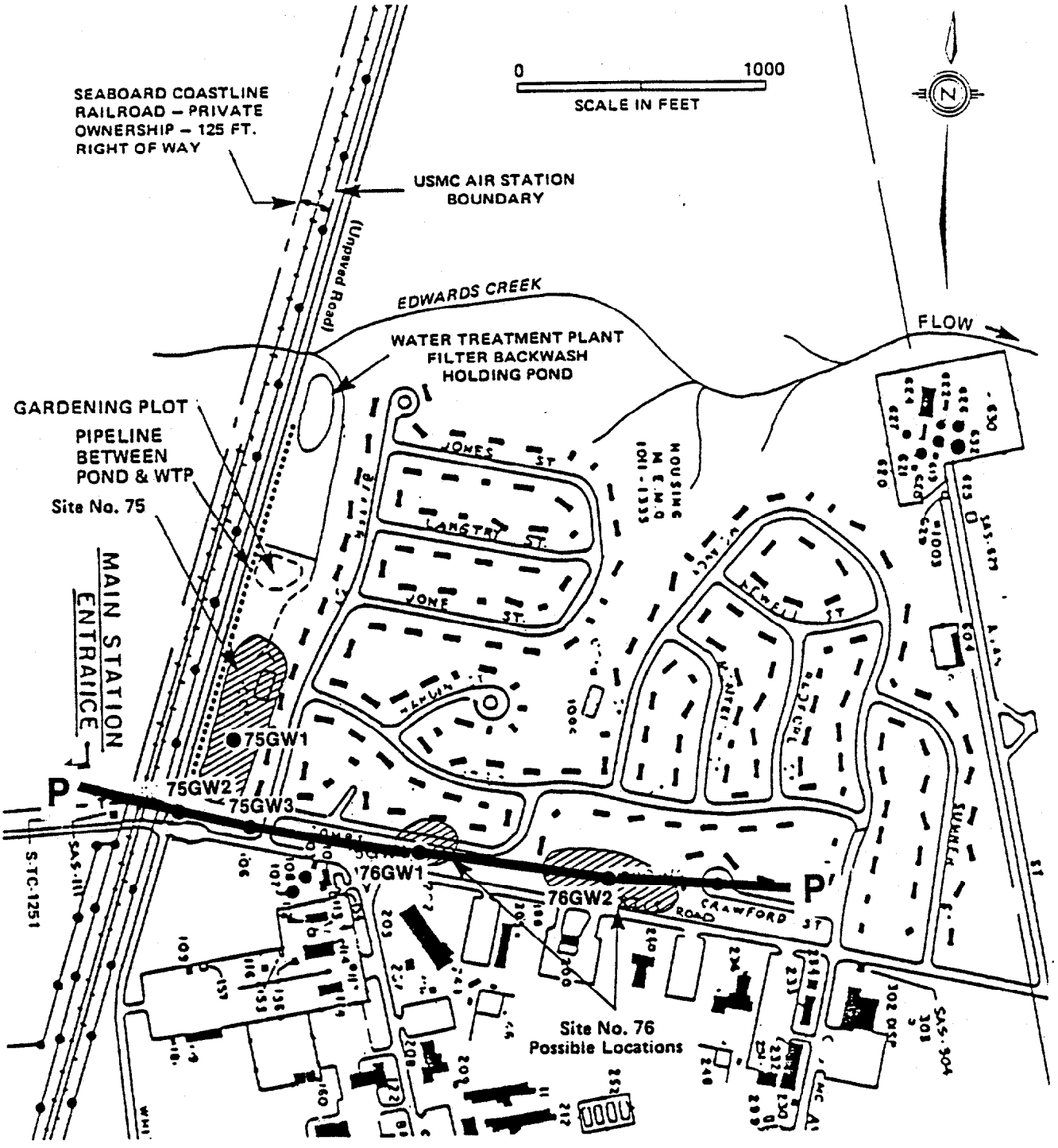


Figure 75-2
GEOLOGIC CROSS SECTION, SITES 75 AND 76—MCAS BASKETBALL COURT AND CURTIS ROAD SITES

MARINE CORPS BASE
CAMP LEJEUNE



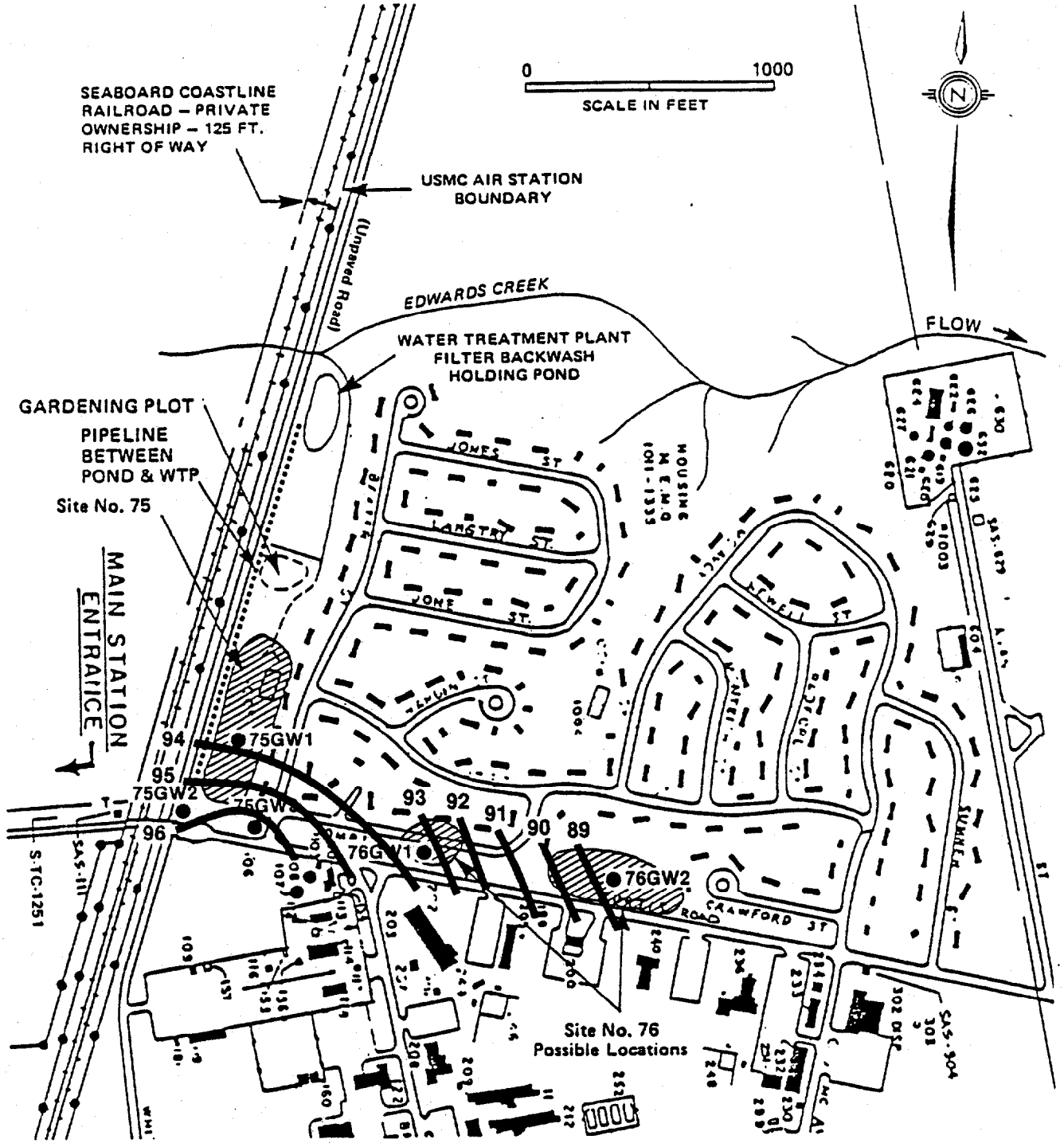
LEGEND

● EXISTING MONITOR WELL

SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 75-3
GEOLOGIC CROSS SECTION LOCATION, SITES 75 AND 76—MCAS BASKETBALL COURT AND CURTIS ROAD SITES

MARINE CORPS BASE
CAMP LEJEUNE



LEGEND

● MONITOR WELL

CONTOUR INTERVAL 1'

ALL ELEVATIONS RELATIVE TO THIS SITE ONLY

SOURCES: Water and Air Research, Inc., 1983. ESE, 1987.

Figure 75-4
GROUND WATER CONTOUR MAP—SHALLOW AQUIFER, SITES 75 AND 76—MCAS BASKET-BALL COURT AND CURTIS ROAD SITES

MARINE CORPS BASE
CAMP LEJEUNE

GROUNDWATER

Three shallow groundwater monitoring wells were installed for the first round of sampling in 1984. These wells (75GW1, 75GW2, and 75GW3) in addition to three Water Supply Wells (75GW4, 75GW5, and 75GW6) in the site vicinity were sampled in July 1984. The locations of these wells are shown in Figure 75-2. All six well samples were analyzed for VOCs only. No target compounds were detected in these samples.

was this enough

A second round of sampling, performed in November 1986, consisted of resampling the three shallow groundwater monitoring wells. These samples were analyzed for VOCs, chloropicrin, and tetrachlorodioxin. None of the target analytes were detected in these samples.

was this enough?

3.20.3 SUMMARY AND CONCLUSIONS

Since none of the target analytes were detected in the samples, it is unlikely that the groundwater in this area has been affected. The area was also subjected to a geophysical survey which failed to detect any buried objects. These factors suggest that a threat to local groundwater does not exist.

3.20.4 RECOMMENDATIONS

No contamination in this area has been documented and a geophysical survey performed in the site area did not reveal the presence of any buried objects. In addition, the water supply wells, which are the primary environmental concern at this AOC, showed no sign of contamination. It is recommended that no further investigation be performed.

3.21 SITE 76 - MCAS CURTIS ROAD SITE

3.21.1 SITE BACKGROUND

The MCAS Curtis Road Site is located in the vicinity of PWDM coordinates 23, L10/M10/N10, along the north side of Curtis Road (Figure 75-1). The precise location of the site is unknown, and two possible locations have been identified based on interviews and aerial photography. This alleged dumpsite was reportedly used as a drum disposal area on two occasions in 1949. The estimated area of the disposal unit is 1/4 acre and approximately 25 to 75 55-gallon drums were allegedly involved. It is believed that the drums contained a chloroacetophenone tear gas agent similar to that allegedly buried in the MCAS Basketball Court Site (Site 75). Potential contaminants are chloroform, carbon tetrachloride, benzene, and chloropicrin.

The geohydrology for this area was described with Site 75 - MCAS Basketball Court Site (Section 3.19.1).

3.21.2 SITE INVESTIGATION

Prior to installation of the shallow monitoring wells, a geophysical survey consisting of electromagnetic (EM) conductivity and metal detection techniques, was conducted on a grid system throughout this AOC. Areas specifically identified in aerial photography as containing drums were surveyed in detail. No signals representative of buried metallic objects were identified.

GROUNDWATER

Two monitoring wells were installed for the first round of sampling in 1984, both were located at the center of the potential locations identified for the disposal area. These shallow groundwater monitoring wells were designated 76GW1 and 76GW2. The two wells were sampled in July 1984, and the samples were analyzed for VOCs. None of the target analytes were detected in these samples.

A second round of sampling was performed in November 1986. Both wells were sampled and analyzed for VOCs, tetrachlorodioxin, and chloropicrin. Again, none of the target analytes were detected in the samples.

3.21.3 SUMMARY AND CONCLUSIONS

No target analytes were detected in the first or second rounds of sampling. This indicates that the alleged disposal is not currently contributing contaminants to the area surveyed. A geophysical survey was performed in and around the site area, and no buried objects were detected. This information strongly suggests that there are no buried drums of waste in the area. It is possible that the pits were staging areas and the drums were subsequently moved.

3.21.4 RECOMMENDATIONS

No further investigations at this AOC is recommended.

3.22 SITE A - MCAS (H) OFFICERS' HOUSING AREA

3.22.1 SITE BACKGROUND

The MCAS (H) Officers' Housing Area site is located on the west bank of the New River (Figure A-1). This area was identified during the second round of sampling conducted in 1986. Waste was identified eroding out of a cut bank along the New River in the vicinity of an officers' housing area. The materials were tentatively identified as hospital wastes. Various hospital waste materials were noted, including hypodermic needles and vials of white powder which were believed to contain a chlorine based substance. No information was available regarding the volume of the waste or the mode of disposal.

The site is underlain by clay at the surface, followed by layers of silty sand, sand, and returning to silty sand. Figures A-2 and A-3 illustrate a geologic cross section of the area. The shallow ground water surface at this AOC lies within the upper silty sand and sand at depths ranging from 7.68 to 11.10 feet below land surface. Shallow groundwater flows east towards the New River at a gradient of approximately 0.019 ft/ft (Figure A-4).

4.22.2 SITE INVESTIGATION

GROUNDWATER

Two shallow monitoring wells (Figure A-1) were installed in this area, AGW1 and AGW2. They were sampled twice, once in December 1986 and once in March 1987. Both sets of samples were analyzed for free chlorine, O&G, and VOCs. Very low concentrations of O&G were detected in the March 1987 groundwater samples, but not in the December 1986 samples. None of the other target analytes were detected in the groundwater samples.

SURFACE WATER

One surface water sample (Figure A-1) was taken from the New River in December 1986. It was analyzed for free chlorine, O&G, and VOCs. None of the target analytes were detected in this sample.

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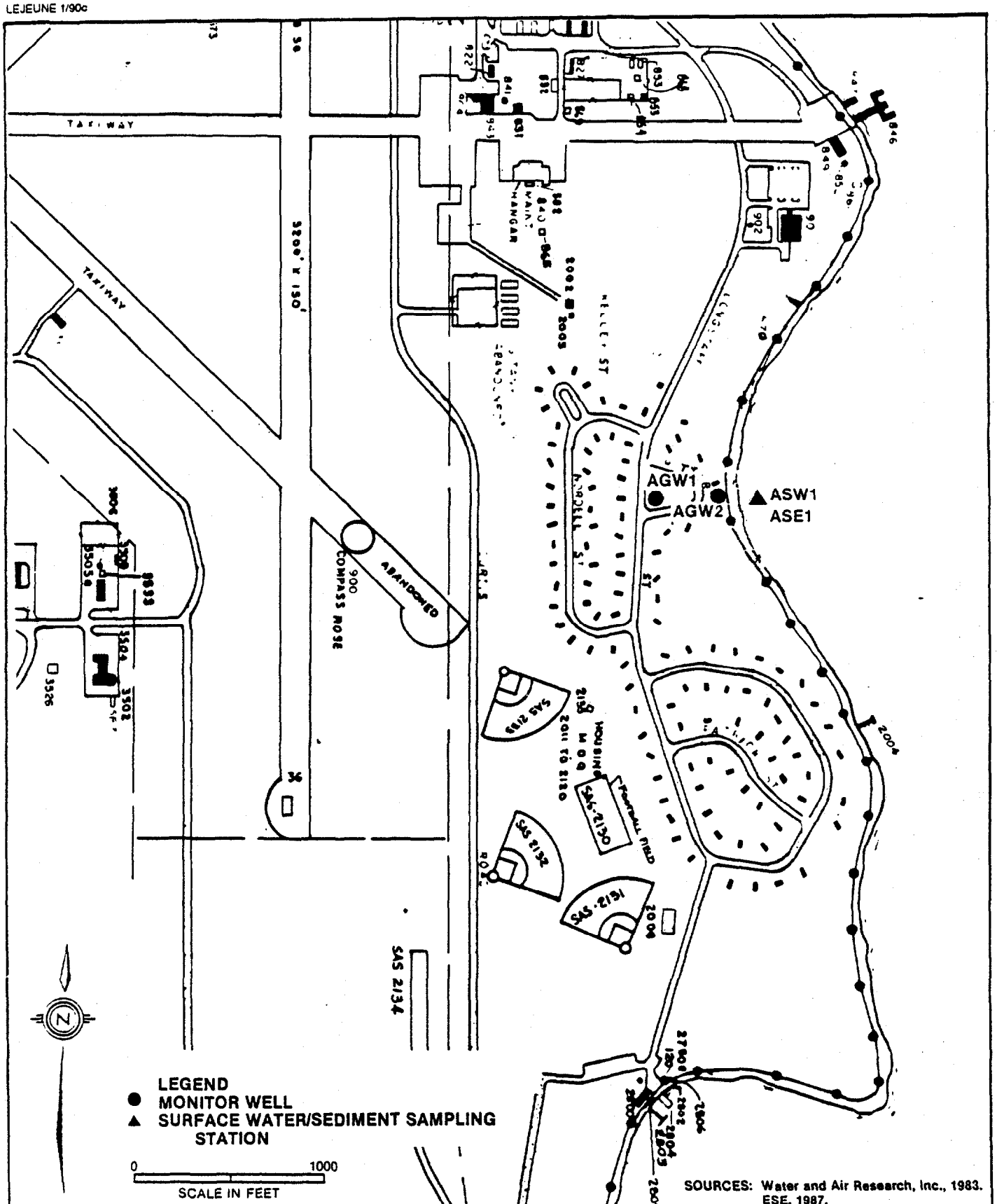

Figure A-1
SAMPLING LOCATIONS, SITE A—
MCAS (H) OFFICERS' HOUSING AREA

MARINE CORPS BASE
CAMP LEJEUNE

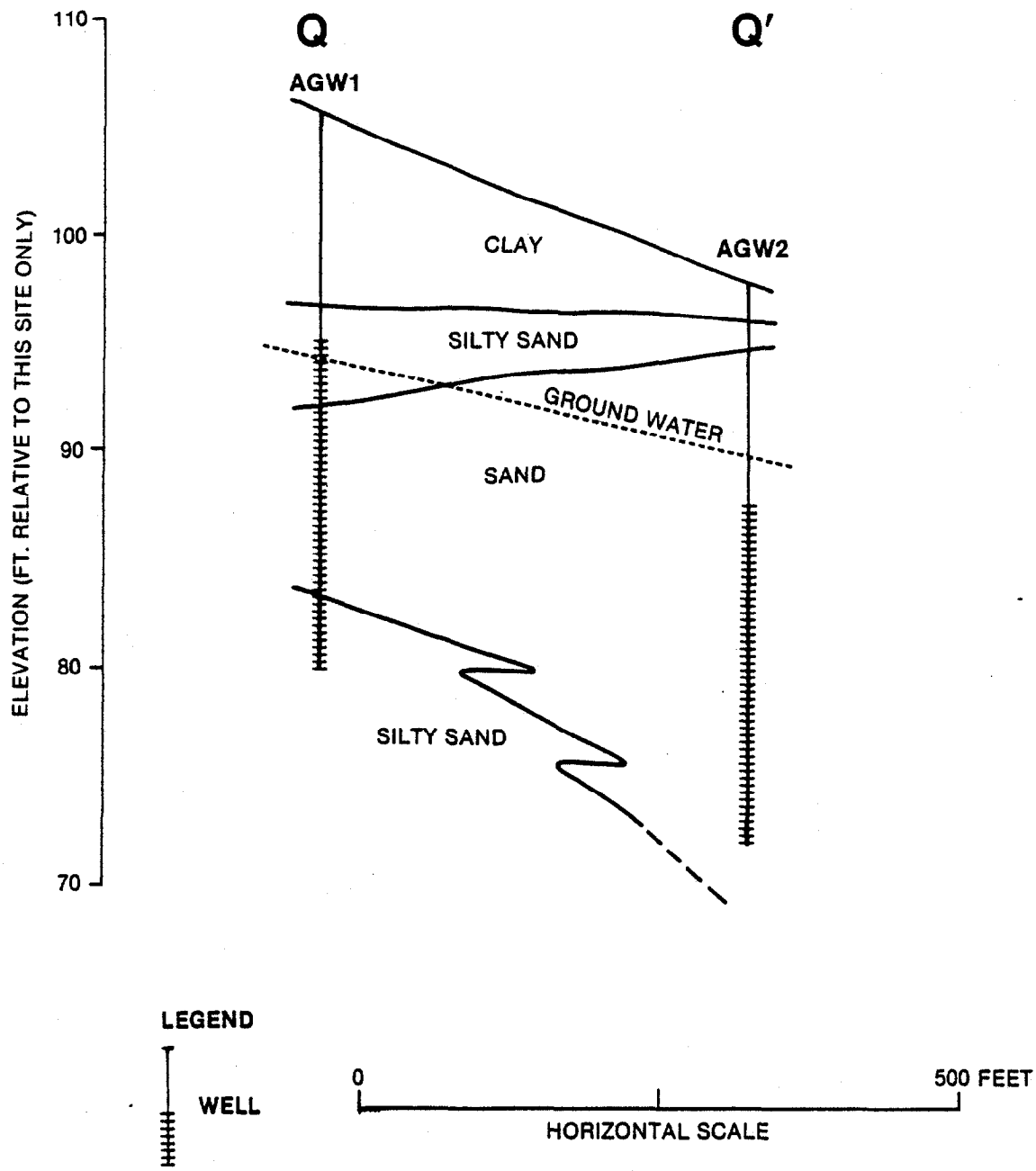

Figure A-2
GEOLOGIC CROSS SECTION, SITE A—
MCAS (H) OFFICERS' HOUSING AREA

MARINE CORPS BASE
CAMP LEJEUNE

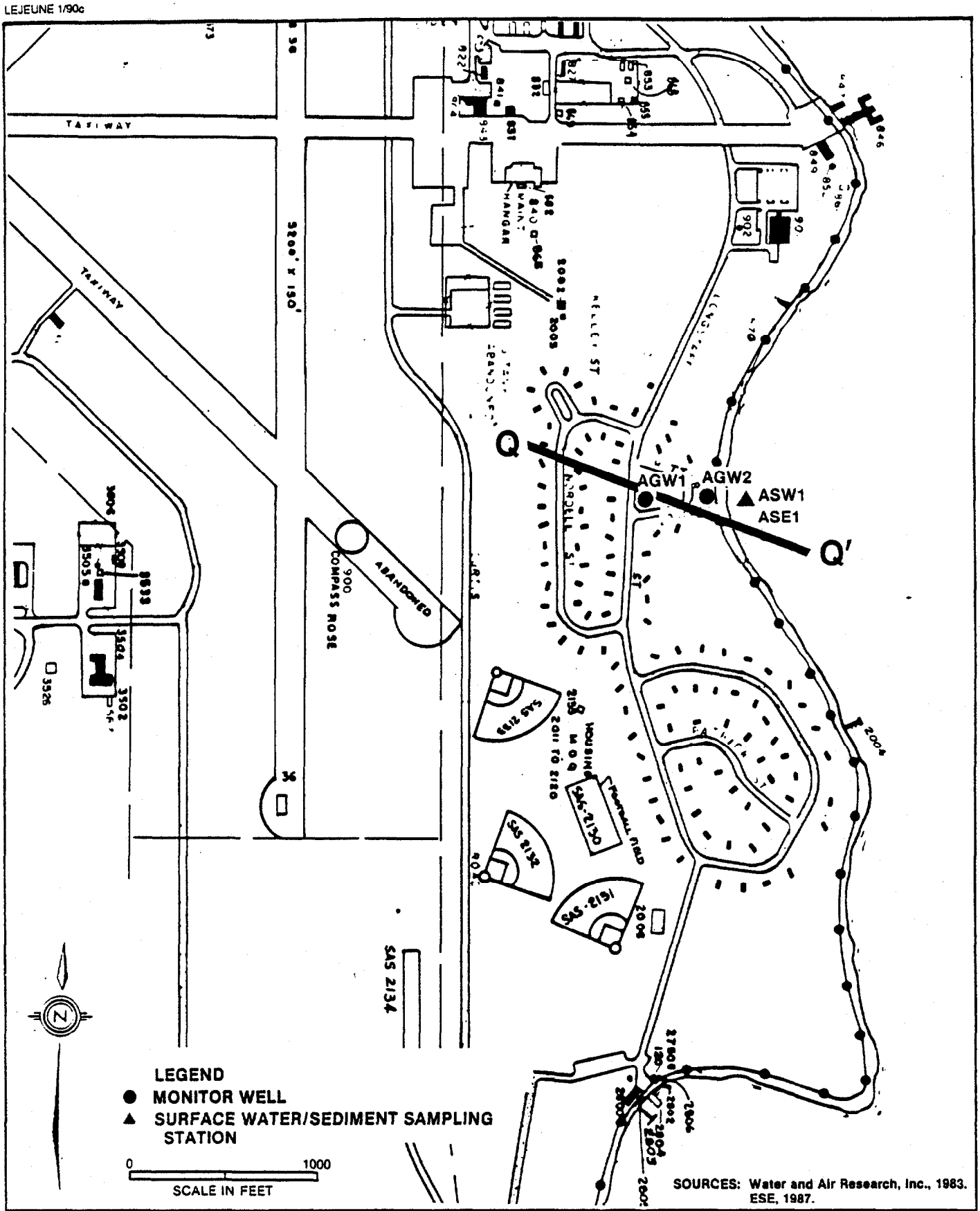

Figure A-3
GEOLOGIC CROSS SECTION LOCATION, SITE A—MCAS (H) OFFICERS' HOUSING AREA

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c

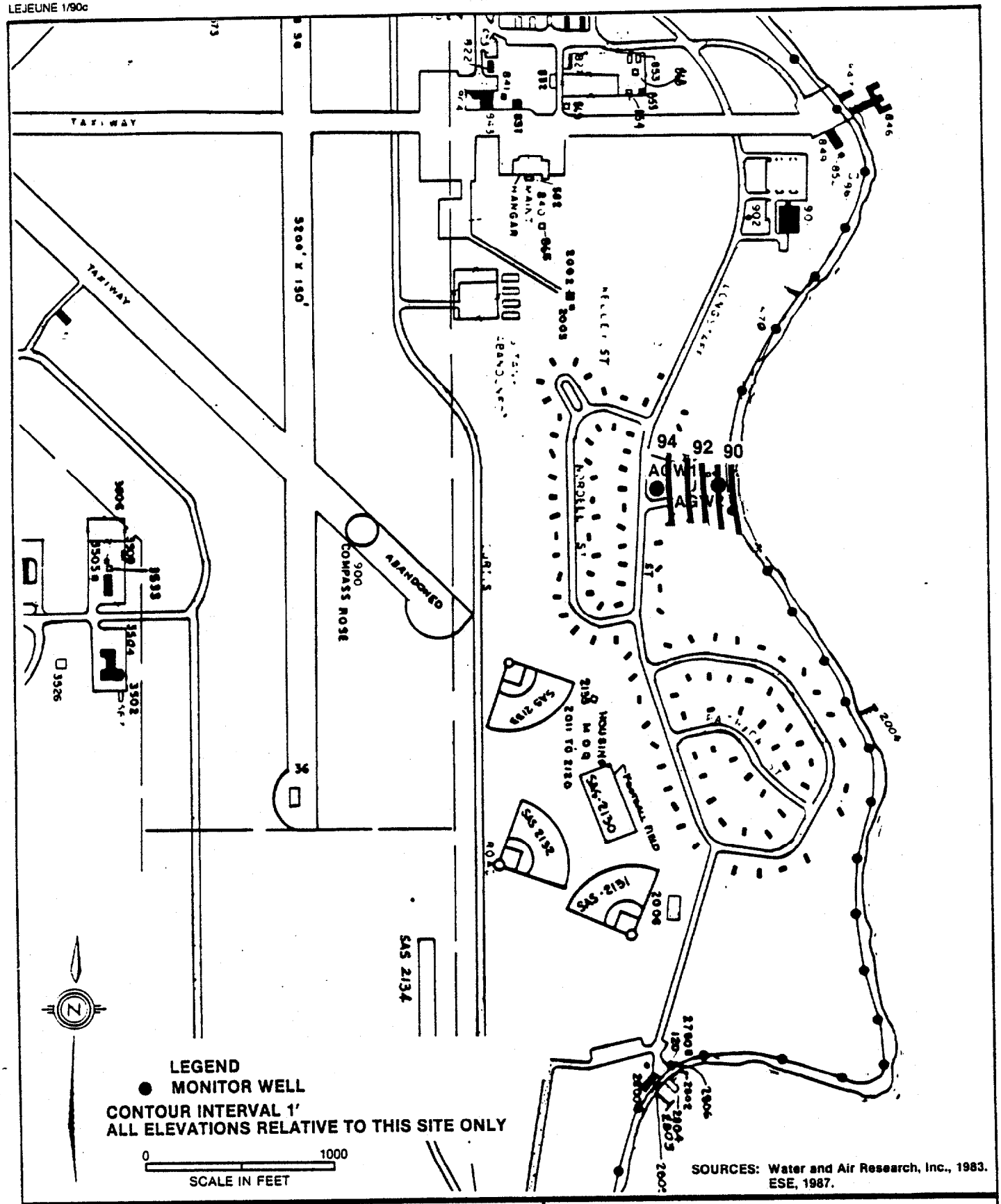

Figure A-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE A—
MCAS (H) OFFICERS' HOUSING AREA

MARINE CORPS BASE
CAMP LEJEUNE

SEDIMENT

One sediment sample was taken at the same time and at the same location as the surface water sample. It was analyzed for O&G content only. The O&G concentration (167 ug/g) is typical of the New River sediments in the vicinity of Camp Lejeune, and is not attributable to the hospital type wastes observed in this area.

3.22.3 SUMMARY AND CONCLUSIONS

The only target analytes detected at this AOC was O&G in the surface water and sediment of the New River. These materials are ubiquitous on base and are not related to the material observed at this AOC.

3.22.4 RECOMMENDATIONS

No further action is recommended for this area. No significant contamination was noted in the area and the waste materials that were identified in this site are not "hazardous wastes".

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APPENDIX A

Target Analytes and Abbreviations

TARGET ANALYTES AND ABBREVIATIONS

Cd	=	cadmium
Cr	=	chromium
Pb	=	lead
Sb	=	antimony
O&G	=	oil and grease
VOC	=	volatile organic compounds
T. Phenols	=	total phenols
OCP	=	organochlorine pesticides
OCH	=	organochlorine herbicides
DDT-R	=	o,p- and p,p″-isomers of DDD, DDE, and DDT
EDB	=	ethylene dibromide
TCDD	=	tetrachlorodioxin
PCB	=	polychlorinated biphenyls
Ordnance	=	TNT, DNT, RDX, and white phosphorus (WP)
PCP	=	pentachlorophenol
Hg	=	mercury
Cr+6	=	hexavalent chromium
Xylene	=	o, m, and p- isomers
MEK	=	methylethyl ketone
MIBK	=	methyl isobutyl ketone

METALS A

Arsenic
Cadmium
Chromium
Copper
Lead
Nickel
Selenium
Zinc

METALS B

Arsenic
Cadmium
Chromium
Lead
Mercury
Nickel
Zinc

VOLATILE ORGANIC COMPOUNDS (VOC)

Acrolein
Acrylonitrile
Benzene
Bromomethane
Bromodichloromethane
Bromoform
Carbon Tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloroemthane
Dibromochloromethane
Dichlorodifluoramethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
T-1,2-Dichloroethene
1,2-Dichloropropane
Cis-1,3-dichlorpropene
T-1,3-dichloropene
Eyhylbenzene
Methylene Chloride
1,1,2,2-Tetrachloroethane
Tetrachloroethene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Trichlorofluoromethane
Toluene
Vinyl Chloride
2-Chloroethylvinylether

ORGANOCHLORINE PESTICIDES (OCP)

Aldrin
a-BHC
b-BHC
d-BHC
g-BHC
Chlordane
4,4'-DDD
4,4'-DDE
4,4'-DDT
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan Sulfate
Endrin
Endrin Aldehyde
Heptachlor
Helptachlor Epoxide
Toxaphene

ORGANOCHLORINE HERBICIDES (OCH)

2,4-D
2,4,5-T
Silvex

DDT-R

o,p-DDD
o,p-DDE
o,p-DDT
p,p'-DDD
p,p'-DDE
p,p″-DDT