AD-A170 408

INSTALLATION RESTORATION PROGRAM
PHASE II--CONFIRMATION/QUANTIFICATION
STAGE 1

FINAL REPORT
FOR
MAXWELL AIR FORCE BASE
MONTGOMERY, ALABAMA 36112

HEADQUARTERS AIR UNIVERSITY
MAXWELL AIR FORCE BASE
MONTGOMERY, ALABAMA 36112

JUNE 1986

PREPARED BY
ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
P.O. BOX ESE
GAINESVILLE, FLORIDA 32602-3052

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USAFOEHL TECHNICAL PROGRAM MANAGERS
DENNIS D. BROWNLEY, MAJ., USAF
GARY L. WOODRUM, 2Lt, USAF

USAF OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY (USAFOEHL)
TECHNICAL SERVICES DIVISION (TS)
BROOKS AIR FORCE BASE, TEXAS 78235-5501

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A Phase II, Stage 1 survey was conducted at Maxwell Air Force Base (MAFB), Ala., to confirm the existence of potential contaminants at former disposal and storage sites identified by a Phase I record search. Ten sites were investigated including six landfill or disposal areas, two fire protection training areas, a drum storage area, and surface water drainage areas.

Geophysical surveys were conducted at four disposal areas, and 20 ground water monitor wells were installed. Surface waters, ground waters, and sediments were sampled and analyzed for various screening parameters including total organic carbon (TOC), total organic halogens (TOX), phenols, oil and grease, pH, specific conductance, and total dissolved solids (TDS). The samples were also analyzed for specific parameters including cyanide (CN), cadmium (Cd), chromium (Cr), copper (Cu), zinc (Zn), lead (Pb), selenium (Se), silver (Ag), barium (Ba), mercury (Hg), arsenic (As), sulfate (SO_4), nitrate (NO_3), iron (Fe), endrin, lindane,

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19. Abstract (Continued)

methoxychlor, toxaphene, 2,4-dichlorophenoxyacetic acid (2,4-D), and 2,4,5-trichlorophenoxyacetic acid (2,4,5-TP).

Results of the analysis indicate low-level contamination at several study sites. Additional testing is recommended to identify and quantify halogenated organic species and to further evaluate the extent of contamination of the shallow aquifer.

PREFACE

This report describes the Phase II, Stage 1 survey program conducted at Maxwell Air Force Base (MAFB), Ala., under Air Force Contract F33615-84-D-4401, Task Order 6. The work was performed during the period of October 1984 to June 1986 by personnel from Environmental Science and Engineering, Inc. (ESE), Gainesville, Fla. Law Engineering, Inc. provided the well drilling services for the contract. The contract was monitored by Major Dennis D. Brownley and 2Lt Gary L. Woodrum, Technical Services Division, United States Air Force Occupational Environmental Health Laboratory (OEHL), Brooks Air Force Base, San Antonio, Texas. Key contractor personnel included John D. Bonds, Ph.D. (Project Manager), A.P. Hubbard, B.S.E. (Project Engineer), M.T. Park, M.S. (Chemical Analysis Supervisor), John J. Mousa, Ph.D. (Quality Assurance Supervisor), G.K. Foster, B.S. (Site Geologist), M.J. Geden, B.S. (Sampling Team Leader), J.H. Chalkley, M.S. (Geophysics), and L.D. Tournade (Document Coordination).

The ESE project team wishes to express its gratitude for the assistance provided by Major Dennis D. Brownley (OEHL), 2Lt Gary L. Woodrum (OEHL), Captain Mark D. Knuth (MAFB Bioenvironmental Engineer), and various MAFB civil engineering and bioenvironmental engineering staff members in the preparation of this report.

Approved:

Jack D. Doolittle
Vice President
Installation Restoration Program Manager

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SUMMARY

The Phase II, Stage 1 Installation Restoration Program (IRP) Confirmation/Quantification Survey for Maxwell Air Force Base (MAFB) investigated 10 disposal, storage, and surface water drainage sites. These included five former and present landfills, two Fire Practice Training Areas (FPTA), one former drum storage area, the base surface water drainage system, and a former disposal site for electroplating wastes. The 10 sites were consolidated into 7 sites or study areas for the actual field survey and investigation (see Fig. S-1).

A geophysical survey was performed at four sites to locate buried items, delineate the boundaries of the burial areas, and determine if any leachate plumes were evident in the shallow ground water. Piezometers were installed at each site to determine ground water gradients in order to specify the locations of upgradient and downgradient wells. Twenty shallow monitoring wells were installed and developed at six study site locations on MAFB. Wells, surface waters, and sediments were sampled and analyzed as indicated in Table S-1.

Results from the screening tests [total organic halides (TOX), total organic carbon (TOC), pH, specific conductance, and dissolved solids], and the specific tests (metals, pesticides, phenols, cyanides, nitrate, sulfate, oil and grease, etc.) were used to determine if contamination existed in the shallow aquifer. Contaminants exceeding National Interim Primary Drinking Water Regulations (NIPDWR), National Secondary Drinking Water Regulations (NSDWR), and U.S. Environmental Protection Agency (EPA) criteria for the protection of freshwater aquatic life and human health were found at only a few locations.

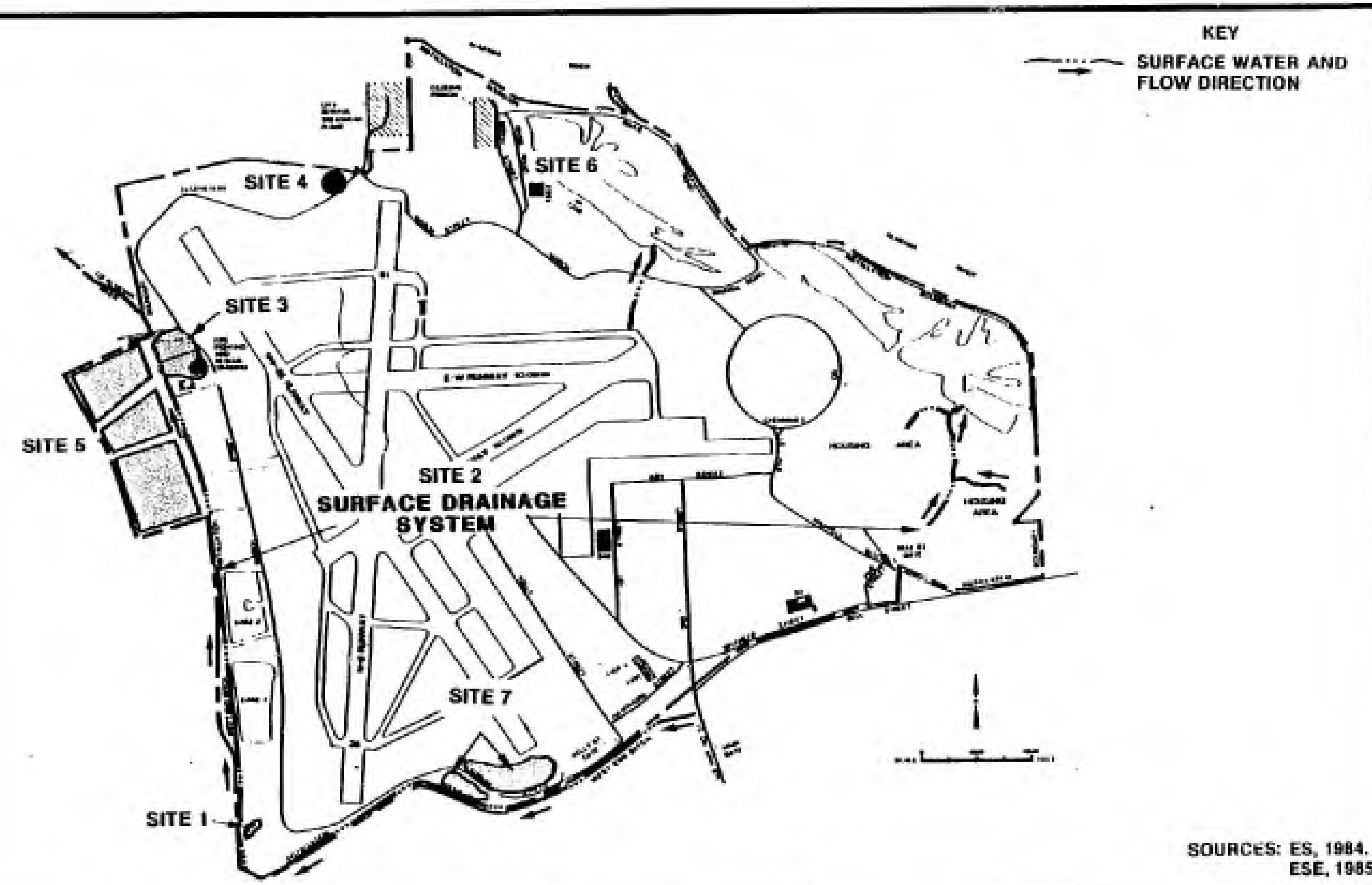

Figure S-1
LOCATION MAP OF SITES WHERE CONFIRMATION STUDIES WERE PERFORMED

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Table S-1. Summary of Sampling and Analyses for MAFB Phase II, Stage 1 Survey

Site No.	Site Description	Sample Locations	Sample Analyses
1	Electroplating Waste Disposal Areas (see Fig. S-2)	4 monitor wells	pH, specific conductance, total dissolved solids (TDS), phenols cyanides (CN), total organic carbon (TOC), zinc (Zn), nickel (Ni), copper (Cu), chromium (Cr), and cadmium (Cd)
2	Maxwell Surface Water Drainage System (see Fig. S-3)	4 surface water and 11 sediment samples from drainage ditches on MAFB	pH, specific conductance, arsenic (As), Cd, Cr, mercury (Hg), Ni, Cu (sediments only), lead (Pb), Zn, TDS, CN, phenols, oil and grease, total organic halides (TOX), TOC, specific conductivity, moisture, and extractable organics
3	Fire Protection Training Area No. 2 and Landfill No. 3 (see Fig. S-4)	3 monitor wells	pH, As, barium (Ba), Cd, Cu, Cr, iron (Fe), Hg, Ni, Pb, silver (Ag), Zn, nitrogen (NO_3), sulfate (SO_4), TDS, CN, phenols, oil and grease, TOX, TOC, endrin, lindane, methoxychlor, toxaphene, 2,4-D, 2,4,5-TP, fluoride (F), selenium (Se), and specific conductance
4	Fire Protection Training Area No. 1 (see Fig. S-5)	3 monitor wells	pH, As, Ba, Cd, Cu, Cr, Fe, Hg, Ni, Pb, Ag, Zn, NO_3, SO_4, TDS, CN, phenols, oil and grease, TOX, TOC, endrin, lindane, methoxychlor, toxaphene, 2,4-D, 2,4,5-TP, F, Se, and specific conductance
5	Landfills 4, 5, and 6 (see Fig. S-6)	4 monitor wells installed during Phase II; 1 existing monitor well	pH, As, Ba, Cd, Cu, Cr, Fe, Hg, Ni, Pb, Ag, Zn, NO_3, SO_4, TDS, CN, phenols, oil and grease, TOX, TOC, endrin, lindane, methoxychlor, toxaphene, 2,4-D, 2,4,5-TP, F, Se, and specific conductance

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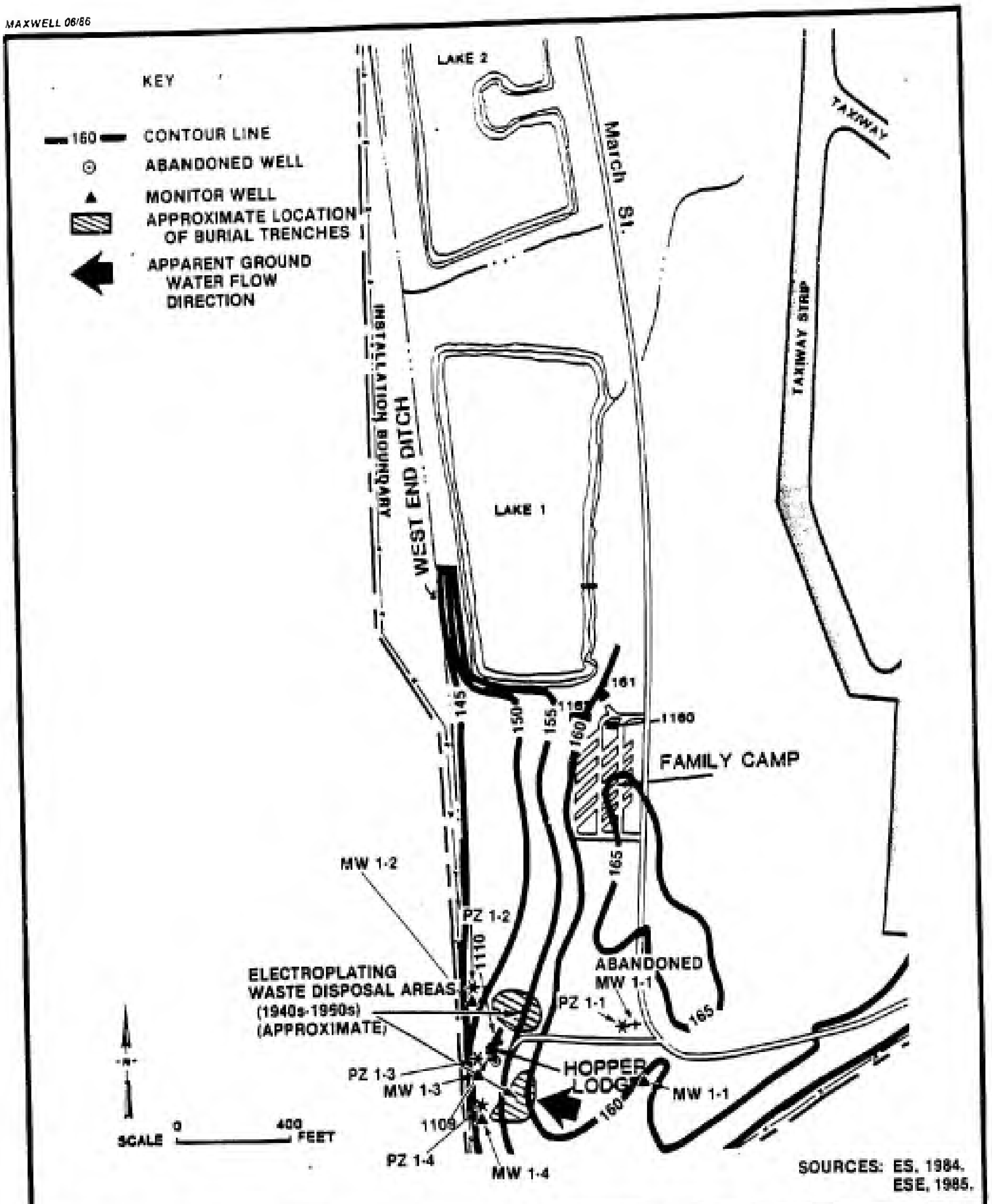

Figure S-2 LOCATIONS OF PIEZOMETERS AND MONITOR WELLS AT SITE 1, ELECTROPLATING WASTE DISPOSAL AREAS	INSTALLATION RESTORATION PROGRAM Maxwell Air Force Base

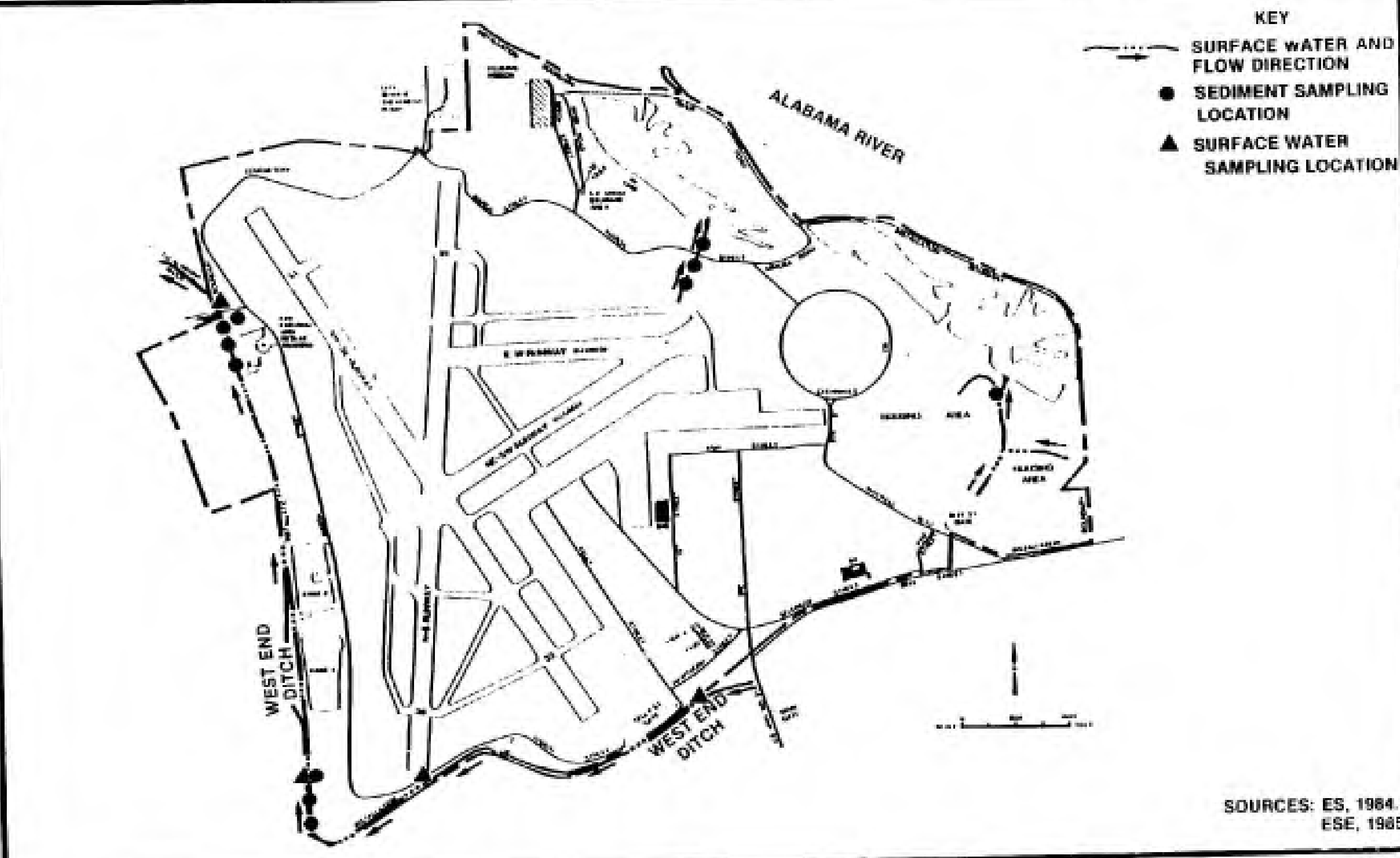

Figure S-3
SURFACE WATER AND SEDIMENT SAMPLE COLLECTION LOCATIONS FOR SITE 2

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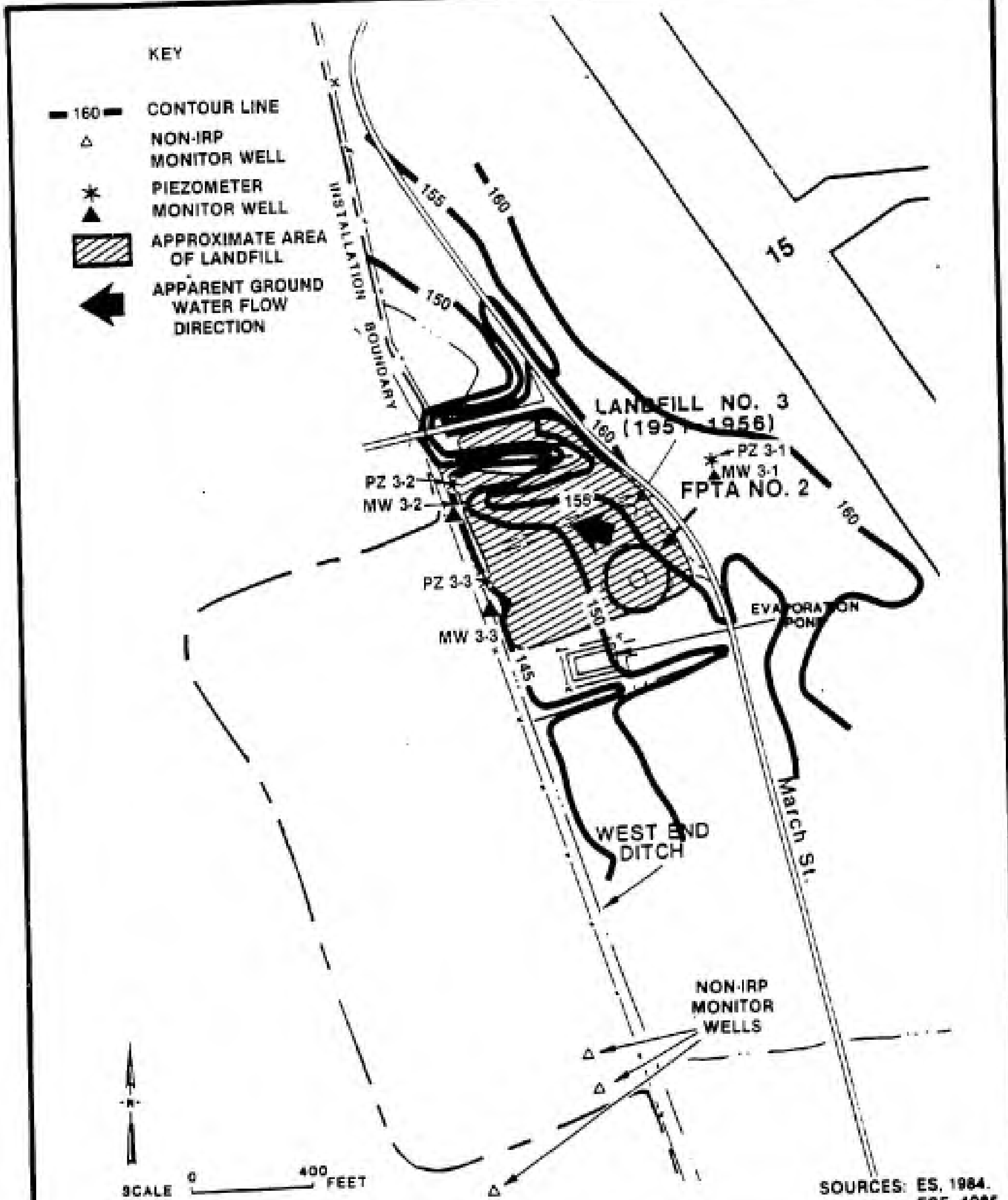

Figure S-4
LOCATIONS OF PIEZOMETERS AND MONITOR WELLS AT SITE 3, FPTA NO. 2, AND LANDFILL NO. 3

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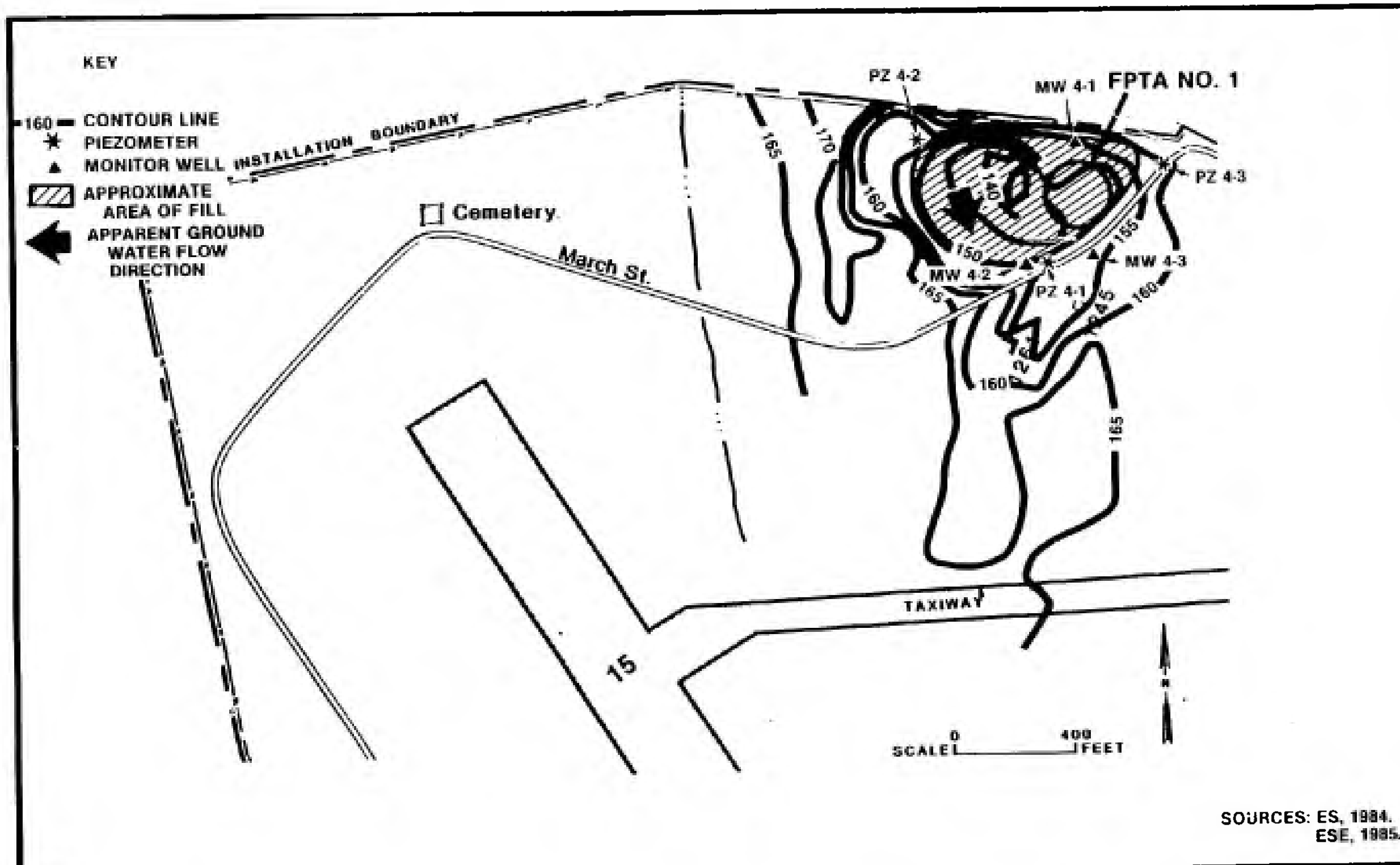

Figure S-5
LOCATIONS OF PIEZOMETERS AND MONITOR WELLS AT SITE 4, FPTA NO. 1

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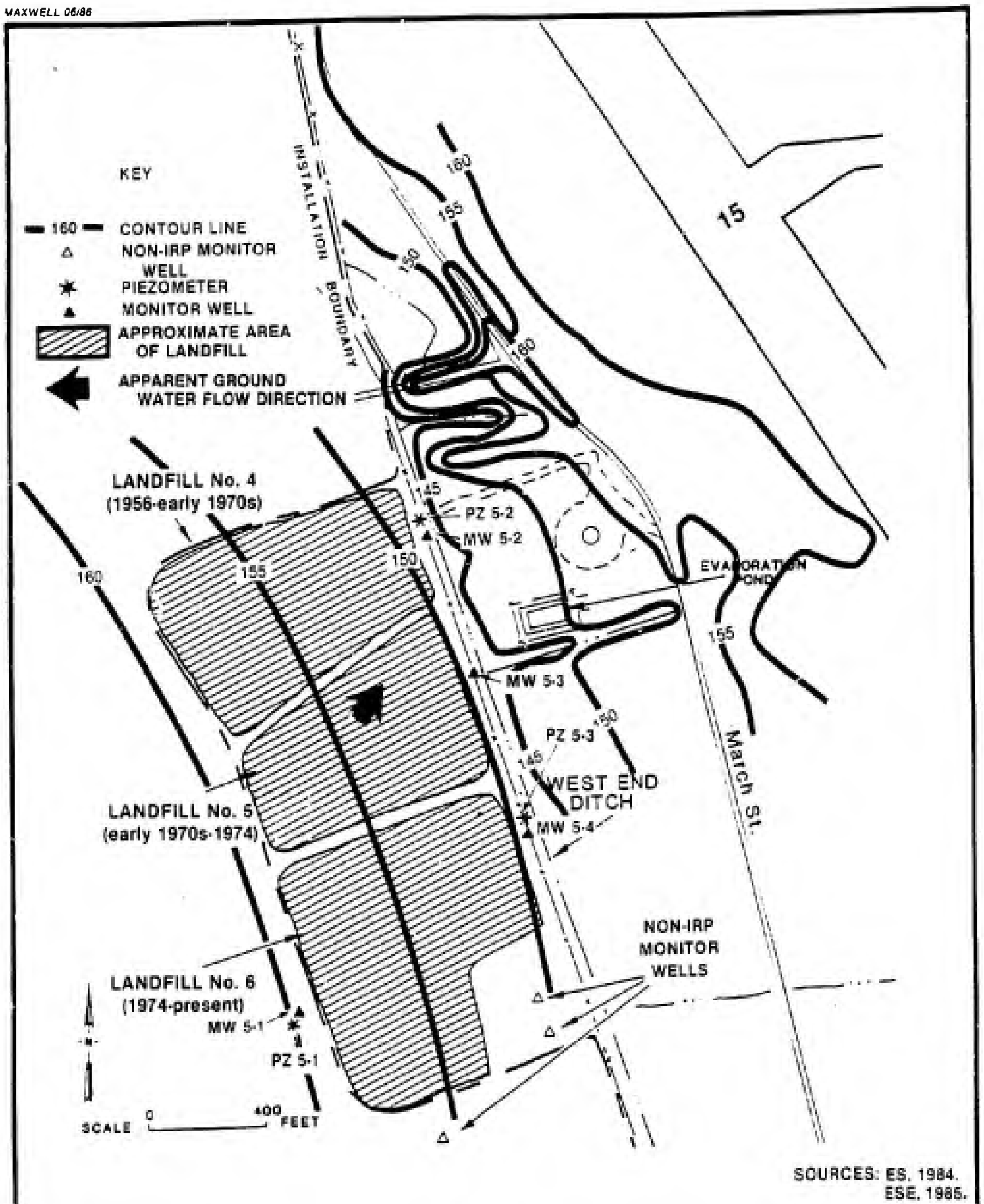

Figure S-6
LOCATIONS OF PIEZOMETERS AND MONITOR WELLS AT SITE 5, LANDFILLS 4, 5, AND 6

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Table S-1. Summary of Sampling and Analyses for MAFB Phase II, Stage 1 Survey (Continued, Page 2 of 2)

Site No.	Site Description	Sample Locations	Sample Analyses
6	Civil Engineer (C.E.) Drum Storage Area (see Fig. S-7)	3 monitor wells	pH, As, Ba, Cd, Cu, Cr, Fe, Hg, Ni, Pb, Ag, Zn, NO_3, SO_4, TDS, CN, phenols, oil and grease, TOX, TOC, endrin, lindane, methoxychlor, toxaphene, 2,4-D, 2,4,5-TP, F, Se, and specific conductance
7	Landfill No. 2 (see Fig. S-8)	3 monitor wells	pH, As, Ba, Cd, Cu, Cr, Fe, Hg, Ni, Pb, Ag, Zn, NO_3, SO_4, TDS, CN, phenols, oil and grease, TOX, TOC, endrin, lindane, methoxychlor, toxaphene, 2,4-D, 2,4,5-TP, F, Se, and specific conductance

Source: ESE, 1985.

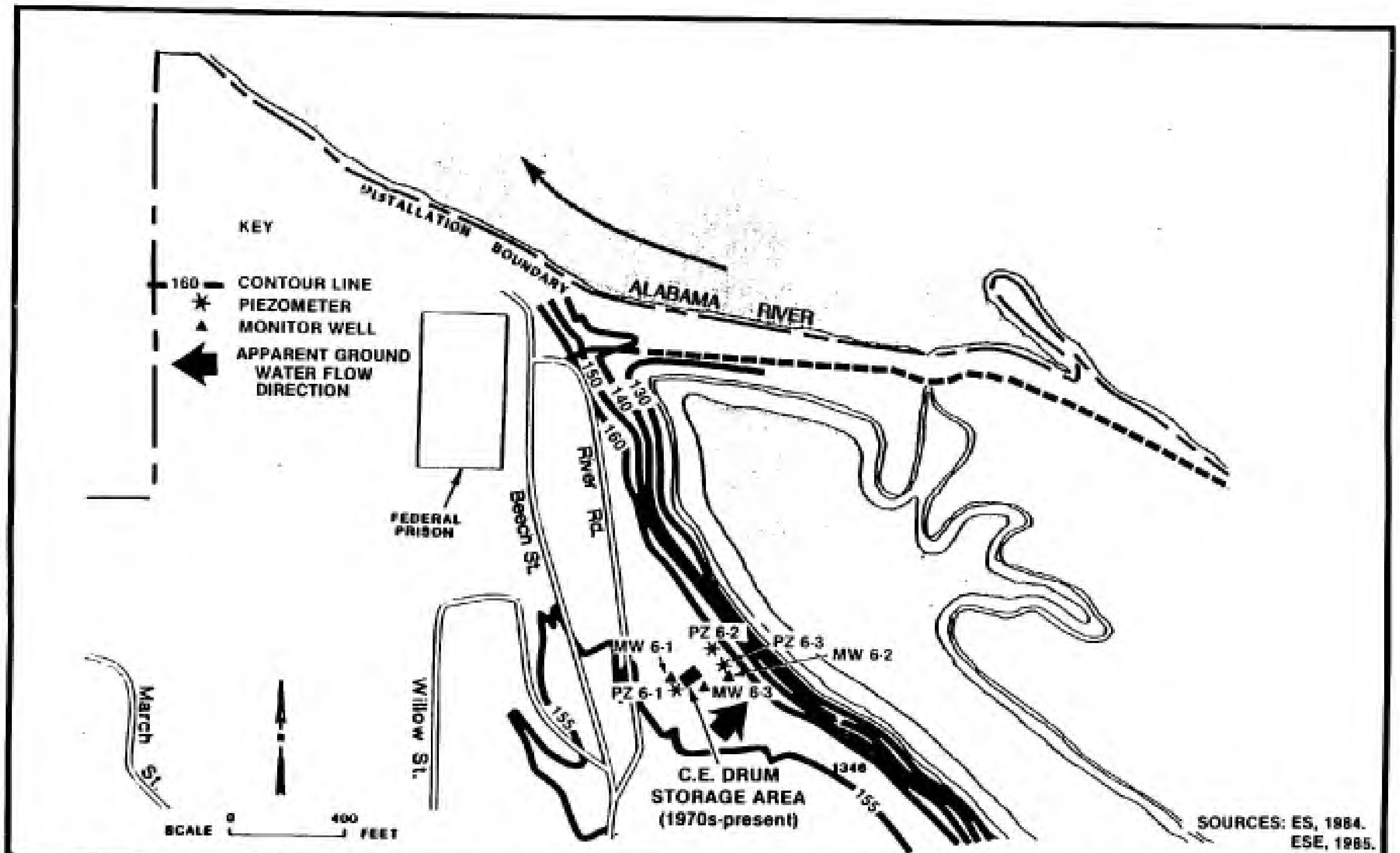

Figure S-7
LOCATIONS OF PIEZOMETERS AND MONITOR WELLS AT SITE 6, C.E. DRUM STORAGE AREA

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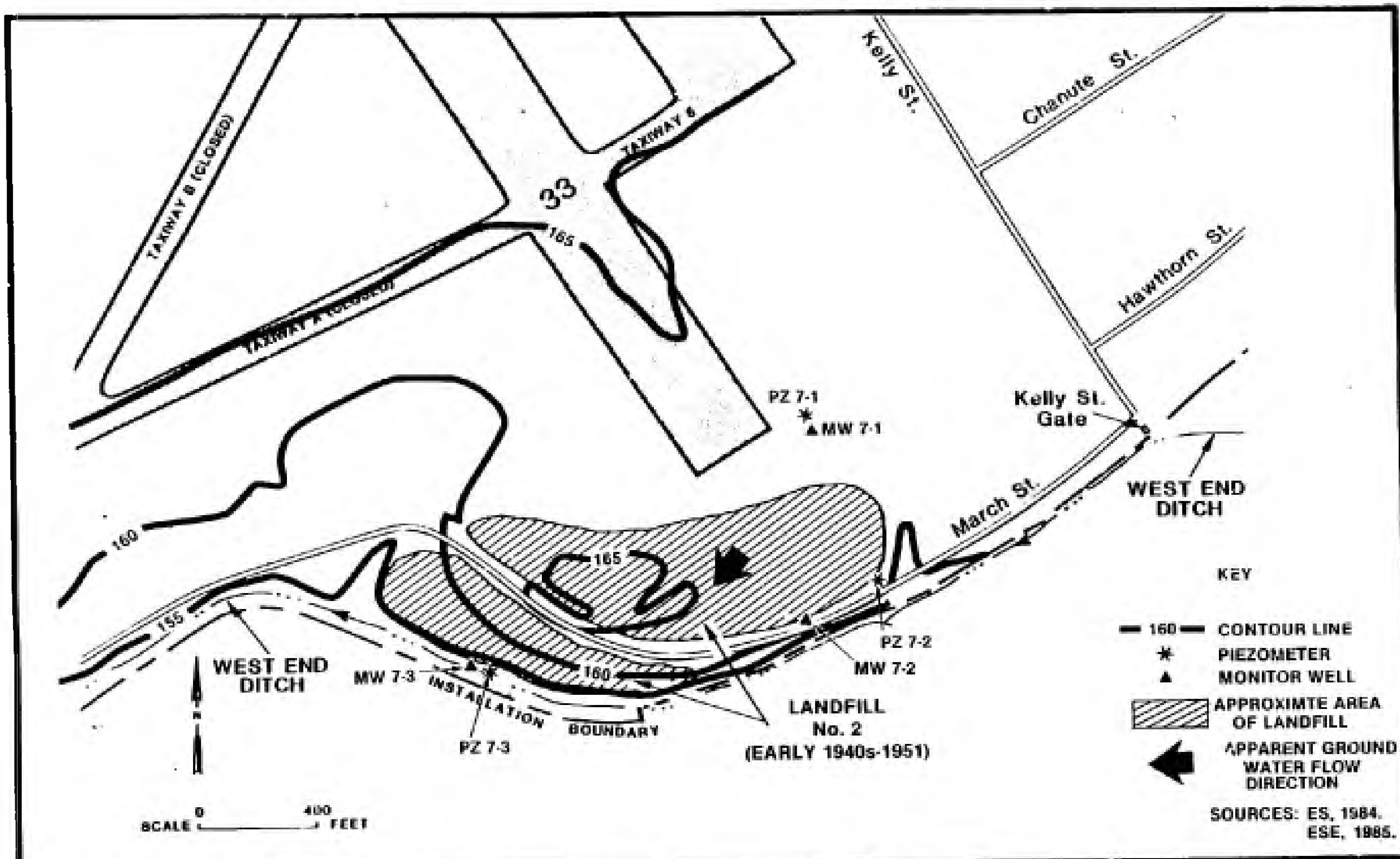

Figure S-8
LOCATIONS OF PIEZOMETERS AND MONITOR WELLS AT SITE 7, LANDFILL NO. 2

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Based on the results of this study, recommendations were made to:

1. Discontinue monitoring at Sites 1, 4, 6, and 7;
2. Continue the sediment sampling program;
3. Expand the surface water monitoring program at Site 2 by three monitor stations; and
4. Perform additional analyses at Sites 2, 3, and 5.

A summary of recommendations, including sampling locations and parameters to be analyzed, is presented in Table S-2.

Table S-2. Summary of Sampling and Analyses Recommended for MAFB, Phase II, Stage 2 Survey

		Analyses														
				Gas Chromatography/Mass Spectrometry												
Site	Sampling Locations	pH	Specific Conductance	Purgeables	Acid Extractables	Base/Neutral Extractables	Pesticides	CN	Cu	Cr	Cd	Ni	Pb	Hg	As	Rationale for Recommendation
2	Surface water sampling locations S 2-1, S 2-2, S 2-3, and S 2-4; new sites S 2-5, S 2-6, and S 2-7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	TOC found at low levels. Need gas chromatography/mass spectroscopy (GC/MS) to determine identities and concentrations of organic and chlorinated organics. Need to confirm Hg and As and determine source, if possible. Analyze for metals and cyanide since electroplating was performed in past.
	Sediment sampling locations S 2-1 through S 2-11; new sites upstream of S 2-1 (1 site), downstream of S 2-8 (1 site), and downstream of S 2-11 (1 site)			X	X	X	X	X	X	X	X	X	X	X	X	TOC found at low levels. Need GC/MS to determine identities and concentrations of organics. Need to confirm Hg and Pb and determine source, if possible. Analyze for metals and cyanide since electroplating was performed in past.
3	MW 3-1, 3-2, and 3-3	X	X	X	X	X	X									Pesticides, TOC, TOX, and low-level metals present. Need to confirm concentrations and identify the organics.
5	MW 5-1, 5-2, 5-3, 5-4, and the other existing well, MWS-5, if accessible	X	X	X	X	X	X									Pesticides, TOC, TOX, and low-level metals present. Need to confirm concentrations and identify the organics.

Source: ESE, 1985.

1.0 INTRODUCTION

1.1 PROGRAM BACKGROUND

This report describes Phase II of the Installation Restoration Program (IRP) for Maxwell Air Force Base (MAFB), Alabama. Phase II pertains to the confirmation and quantification of suspected contamination at former hazardous materials/waste storage or disposal sites.

Due to its primary mission, the U.S. Air Force (USAF) has long been engaged in operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of disposal sites and take action to eliminate the hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Sec. 6003 of the Act, Federal agencies are directed to assist the U.S. Environmental Protection Agency (EPA), and, under Sec. 3012, state agencies are required to inventory past disposal sites and make the information available to the requesting agencies. To assure compliance with these hazardous waste regulations, the Department of Defense (DOD) developed the IRP. The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated Dec. 11, 1981, and implemented by USAF message dated Jan. 21, 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the IRP. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination and to control hazards to health and welfare that resulted from these past operations. The IRP is the basis for response actions on USAF installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as clarified by Executive Order 12316.

The IRP has been developed as a 4-phase program:

Phase I--Initial Assessment/Records Search
Phase II--Confirmation and Quantification
Phase III--Technology Base Development
Phase IV--Operations/Remedial Actions

Phase I, Initial Assessment/Records Search, is designed to identify possible hazardous-waste-contaminated sites and potential problems that may result in contaminant migration from the installation. Engineering-Science (ES) was retained by the Air Force Engineering and Services Center (AFESC) to conduct the Phase I investigation at MAFB (see Fig. 1.1-1 for location). This records search was completed in January 1984.

Phase II of the IRP addresses the confirmation and quantification of the extent and magnitude of contaminant migration from sites identified in Phase I. Phase II, Stage 1 consists of a preliminary survey to confirm or rule out the presence and/or migration of contaminants. If the Phase II, Stage 1 work confirms the presence and/or migration of contaminants, then Phase II, Stage 2 field work would be conducted to determine the extent and magnitude of the contaminant migration.

Environmental Science and Engineering, Inc. (ESE) conducted a contamination assessment under Phase II of the DOD IRP of former waste disposal and/or storage sites at MAFB. The study was performed in response to the findings of the IRP Phase I Records Search, which indicated the potential for contaminant migration from the sites. The contamination assessment consisted of a Phase II, Stage 1 preliminary survey to confirm or refute the presence of contaminants in environmental media at the site.

1.2 INSTALLATION DESCRIPTION AND HISTORY

MAFB is situated in Montgomery County, Ala. (Fig. 1.1-1). The installation is bordered by the city of Montgomery, Ala., on the east

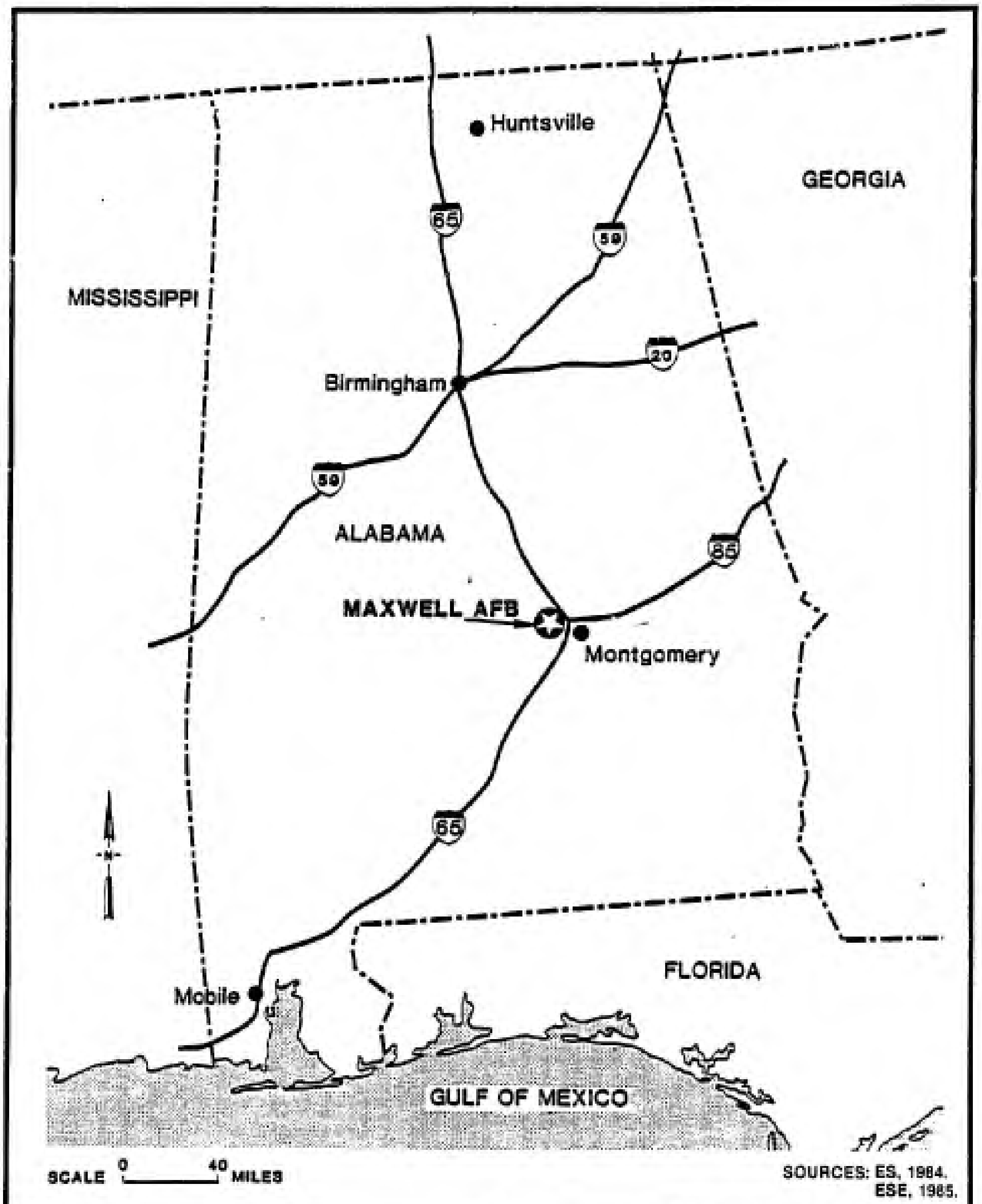

Figure 1.1-1
LOCATION MAP

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and south and by the Alabama River on the north. Mixed residential and industrial land uses predominate south and west of MAFB. A public housing project and the central business district of Montgomery are east of the base. An extensive undeveloped floodplain lies north of the base along the Alabama River.

MAFB's primary mission is to support the Air University (AU). The 3800 Air Base Wing operates and maintains MAFB and provides logistic support and base services for AU organizations.

The installation was originally a flight school begun in 1910 by Orville Wright with five student fliers and one mechanic. Wright's venture lasted less than a year, and the area which is now MAFB had little use until the outbreak of World War I. In 1918, the U.S. Army leased 300 acres and established the Montgomery Air Intermediate Depot primarily to provide engine and aircraft repair and maintenance support for six other airfields in the southeast. The leased acreage for the base was purchased in 1920. In November 1922, the Montgomery Air Intermediate Depot was renamed "Maxwell Field." Construction of the first permanent buildings on the base was completed in May 1928.

In June 1931, the first troops from the Air Corps Tactical School arrived at Maxwell Field as part of the transfer of that facility from Langley Field, Va. In 1940, the facilities were used by the Southeast Air Corps Training Center to train officers and pilots. Both the Air Corps Tactical School and the Southeast Air Corps Training Center served as flight-training operations rather than maintenance and repair organizations.

In 1946, AU was established and MAFB became the home of the Air Force's center for professional military education. AU provides instruction for more than 500,000 students annually. Active flying on MAFB is limited to a tenant reserve unit.

1.3 DISPOSAL/STORAGE SITES INVESTIGATED

In Phase I, 10 former and active disposal and storage sites were evaluated using the USAF Hazard Assessment Rating Methodology (HARM) system. The sites selected for HARM evaluation were found to have received contaminants and/or to have the potential for contaminant migration. Information regarding the sites is summarized in Table 1.3-1, and approximate locations of these sites are shown in Fig. 1.3-1. Each site was evaluated according to the HARM system with respect to waste characteristics, contamination pathways, receptors, and waste management practices. The 10 sites were consolidated into 7 sites based on location. A numerical score was assigned to each site, and all the sites were ranked as shown in Table 1.3-2. This ranking served as the basis for the development of a Phase II contamination survey work plan.

1.4 PROJECT STAFF

Key personnel participating in the MAFB survey are listed below. Resumes of the project staff are included as App. B.

J.D. Bonds, Ph.D., Chemist:	Project Manager
J.J. Mousa, Ph.D., Chemist:	Quality Assurance (QA) Supervisor
G.K. Foster, B.S., Geologist:	Site Geologist
M.J. Geden, B.S., Geologist:	Sampling Team Leader
J.H. Chalkley, M.S., Environmental Management:	Sampling Team, Geophysics
M.T. Park, M.S., Chemist:	Chemical Analysis Supervisor
A.P. Hubbard, B.S.E.	Project Engineer
L.D. Tournade, B.A., Document Coordinator:	Document Production Supervisor

Table 1.3-1. Summary of Ten Sites of Potential Environmental Contamination Identified at MAFB, Ala.

Site No.	Site Name	Period of Operation	Activity
1	Electroplating Waste Disposal Areas	Late 1940s to Mid 1960s	20 to 40 drums of spent electroplating solutions, containing copper, chromium, nickel, cadmium, and cyanide were reportedly disposed of at this site in trenches 8 to 10 ft deep at two locations
2	Surface Drainage System	1940s to Early 1970s	Received considerable quantities of industrial waste solutions, including paint booth water, paint strippers, electroplating rinse water, penetrant oil, dilute acid and caustic, and steam rack corrosion removal component
3	FPTA No. 2	1962 to Present	Prior to 1978, leakage of waste oils, fuels, and solvents from drums and the unlined pit went into soils; after 1978, leakage and spillage from 25 to 35 drums normally stored on the site went into soil and the water-table aquifer
4	FPTA No. 1	1940s to 1962	Waste oils, fuels, and solvents were stored at the site for use in training; these items were spilled on the soils or leached through the bottom of an unlined pit into the soils
5	Landfill No. 4	1956 to Early 1970s	Received household garbage, base trash, and industrial nonliquid wastes (paints, paint sludges, pesticide containers, and solvent sludges)
6	C.E. Drum Storage Area	Mid-1970s to Present	Used as drum storage area for 80 to 90 drums of paints, solvents, and oil/water mixtures
7	Landfill No. 5	Early 1970s to 1974	Received household garbage, base trash, and nonliquid industrial wastes (paints, paint sludges, pesticide containers) during period of operation
8	Landfill No. 6	1974 to Present	Same as Landfill No. 5

Table 1.3-1. Summary of Ten Sites of Potential Environmental Contamination Identified at MAFB, Ala. (Continued, Page 2 of 2)

Site No.	Site Name	Period of Operation	Activity
9	Landfill No. 2	Early 1940s to 1951	Same as Landfill No. 5
10	Landfill No. 3	1951 to 1956	Same as Landfill No. 5

Notes: FPTA = Fire Protection Training Area.
C.E. = Civil Engineer.

Sources: ES, 1984.
ESE, 1985.

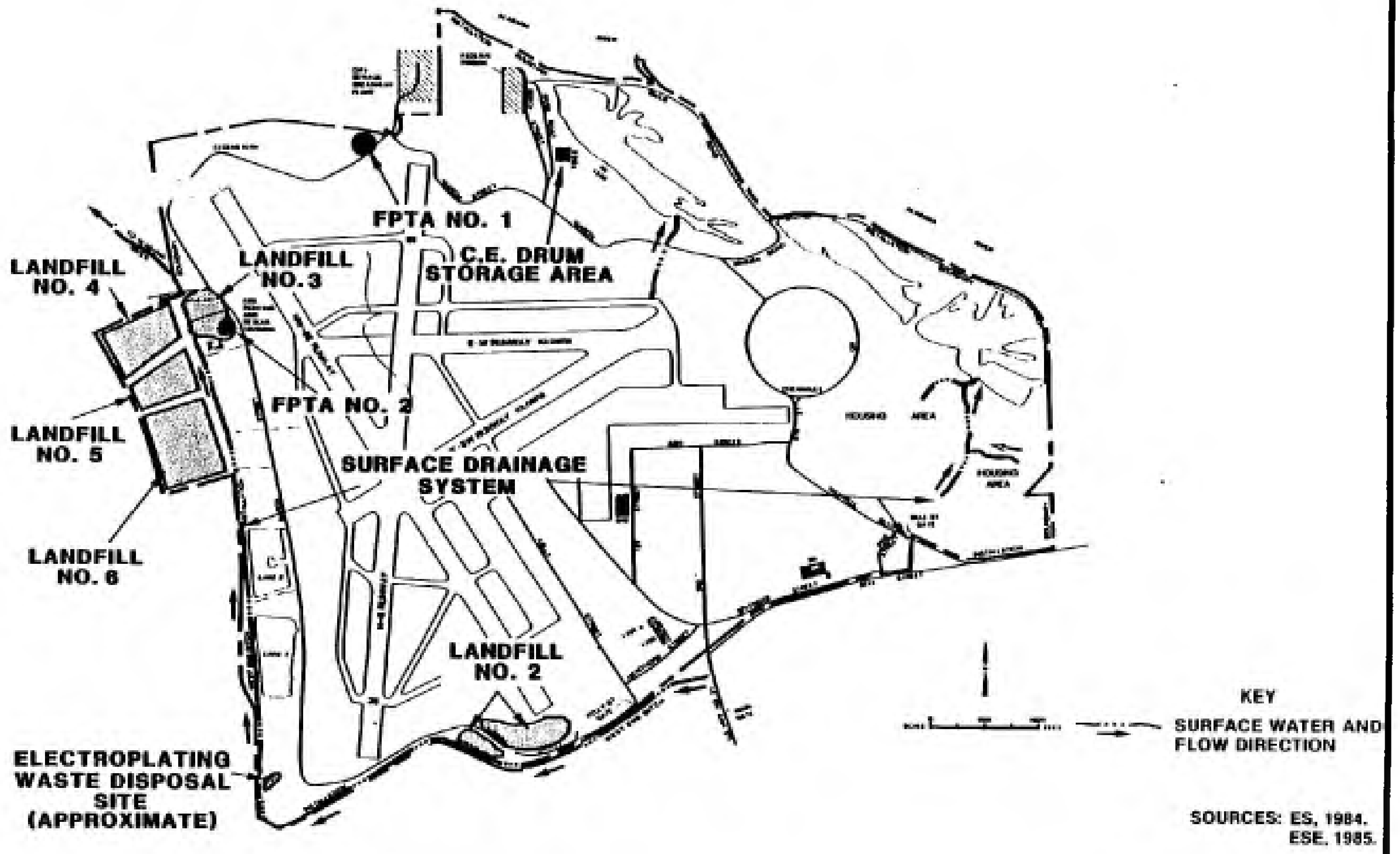

Figure 1.3-1
POTENTIAL SOURCES OF ENVIRONMENTAL CONTAMINATION

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Table 1.3-2. Prioritized Site Listing

Priority	Site(s)
1	Electroplating Waste Disposal Areas
2	Surface Drainage System
3	FPTA No. 2 and Landfill No. 3
4	FPTA No. 1
5	Landfills 4, 5, and 6
6	C.E. Drum Storage Area
7	Landfill No. 2

Source: ESE, 1985.

2.0 ENVIRONMENTAL SETTING

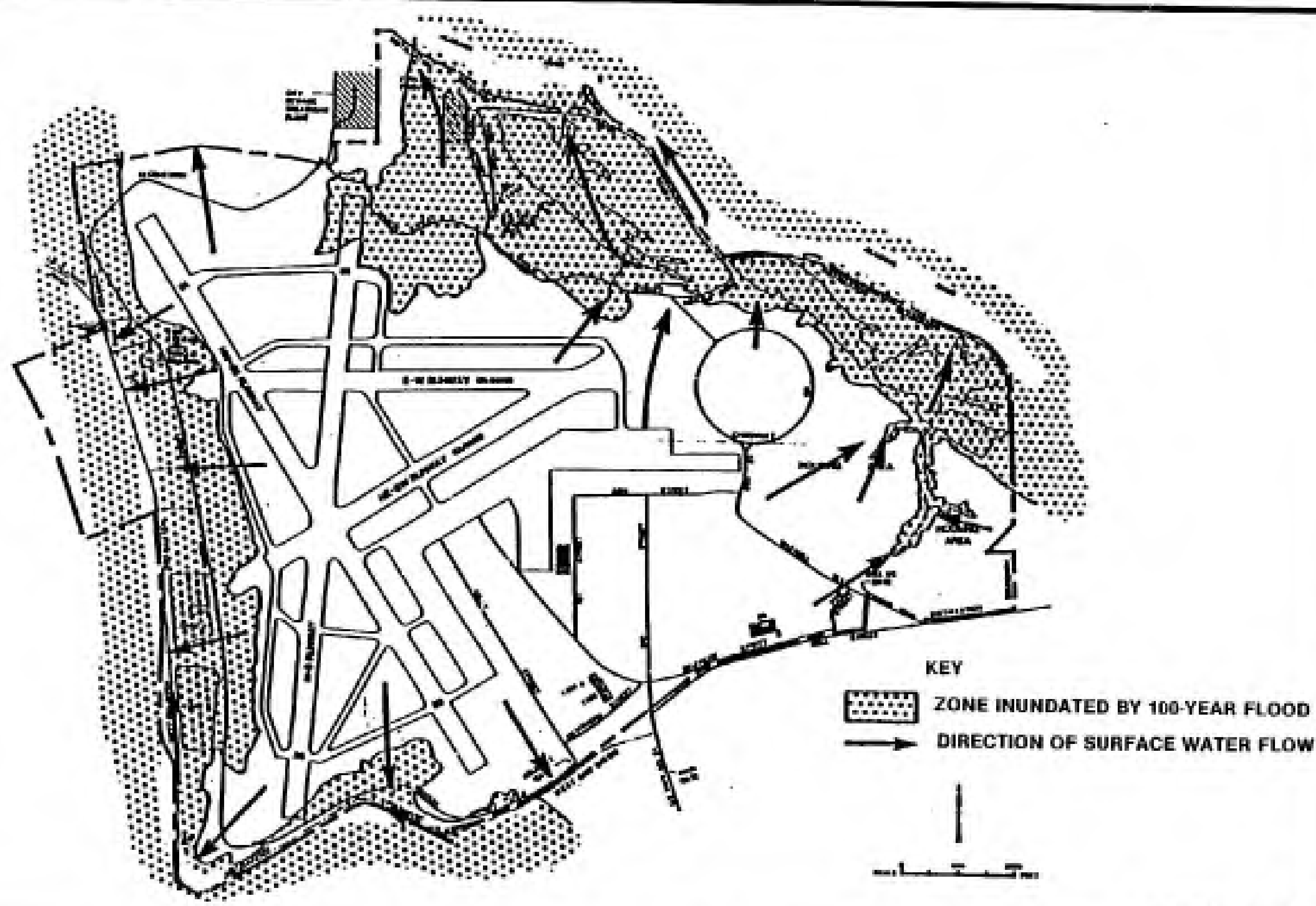
2.1 TOPOGRAPHY

MAFB is situated within the Fall Line Hills subdivision of the Gulf Coastal Plain physiographic province. This physiographic division is a narrow band of hilly uplands along the inner margin of the coastal plain, just south of the Fall Line. The Fall Line is the arbitrary boundary separating the Piedmont from the Coastal Plain. The Fall Line Hills subdivision is characterized by frequent rolling hills, extensive surficial dissection, nearly level plains, and mature streams.

The topography of the main sections of MAFB is generally level, with an average elevation of 168 feet (ft) [National Geodetic Vertical Datum (NGVD), 1929]. The only major variation is created by the alluvial terraces of the Alabama River which form the northwestern boundary of MAFB. Maximum local relief at MAFB is approximately 35 ft along the banks of the Alabama River.

MAFB is drained by overland flow to diversion structures and then to area streams, all of which terminate in the Alabama River. The western section of MAFB drains to West End Ditch, which flows around the southwestern installation boundary and joins the Alabama River about 2 miles northwest of the base. The northern, eastern, and southern sections of MAFB drain to local streams and ponds which have outlets to the Alabama River.

Flooding occurs on the northern, western, and southern portions of MAFB (ES, 1984). The 100-year flood limits portrayed in Fig. 2.1-1 are based on the City of Montgomery Flood Insurance Rate Map, published by the Federal Emergency Management Agency (1974), and roughly correspond to the record flood limits (1962) depicted in installation documents.



SOURCE: ES, 1984.

Figure 2.1-1
MAXWELL AIR FORCE BASE INSTALLATION DRAINAGE

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2.2 METEOROLOGY

Temperature, precipitation, and snowfall data furnished by Det. 9, 24th Weather Squadron are summarized in Table 2.2-1. The mean annual precipitation (all forms) at MAFB is 52.1 inches, and the maximum 24-hour rainfall event is 6.3 inches.

2.3 REGIONAL GEOLOGY AND HYDROGEOLOGY

(Note: Much of this information is excerpted from the Phase I records search conducted by ES in 1984.) Geologic units ranging in age from Upper Cretaceous to Recent have been identified in the Coastal Plain deposits of Montgomery County. These units are typically unconsolidated materials consisting of gravel, sand, silt, clay, chalk, glauconite, and lignite, reposing on a Precambrian crystalline basement complex.

The Coastal Plain sediments form a southerly dipping wedge, with a point of origin at the Fall Line, which extends along most of the Atlantic coast. In Alabama, it extends through Elmore County, north of Montgomery. At the Fall Line, sediment thickness is no more than a few feet; however, at the Gulf of Mexico, these same strata attain thicknesses measured in thousands of feet. The thickness of all unconsolidated deposits at MAFB is 1,008 ft, as measured in U.S. Geological Survey (USGS) Test Well G-33, located approximately 1,000 ft west of the installation near U.S. Route 31. Individual geologic units within the Coastal Plain sediments tend to dip seaward at a shallow rate and thicken substantially. They are not known to be faulted or otherwise disrupted in the Montgomery area; however, past cycles of erosion/deposition may have created significant local variations in unit characters or lithology.

The surficial geology of MAFB is dominated by Quaternary Terrace deposits which occur at ground surface and are approximately 40 ft thick at the USGS Test Well. The terrace materials consist principally of sands, silts, and clays in their upper extent and coarsen with depth (i.e., coarse sands and gravel are prevalent). The lithology of the terrace deposits at MAFB is reported as medium-grained to coarse, poorly sorted sand, sandy clay, and clay (upper extent of the formation).

Table 2.2-1. Climatological Data

Month	Temperature (°F) Mean Monthly Max.	Temperature (°F) Mean Monthly Min.	Temperature (°F) Mean Daily	Temperature (°F) Extreme Max.	Temperature (°F) Extreme Min.	Precipitation (inches) Monthly Mean	Precipitation (inches) Monthly Max.	Precipitation (inches) Monthly Min.	Precipitation (inches) Max. 24 Hours	Snowfall (inches) Monthly Mean	Snowfall (inches) Monthly Max.	Snowfall (inches) Max. 24 Hours
January	57	39	48	82	5	4.2	10.6	0.9	3.3	T	6	3
February	61	41	51	84	12	4.5	8.5	1.6	5.1	T	2	2
March	69	48	58	88	20	6.3	14.0	2.3	3.8	T	T	T
April	77	56	67	93	30	4.5	11.2	1.1	4.3	T	T	T
May	84	63	74	98	43	4.0	12.9	0.5	4.0	0	0	0
June	90	70	80	104	52	4.3	11.8	0.5	6.3	0	0	0
July	91	73	82	105	61	5.6	10.7	2.5	4.7	0	0	0
August	91	72	82	103	60	4.1	15.4	1.0	5.6	0	0	0
September	86	67	77	101	42	3.8	8.4	0.1	5.4	0	0	0
October	78	55	67	96	32	1.8	8.3	T	3.3	T	T	T
November	66	45	56	87	14	3.5	19.3	0.1	5.9	T	T	T
December	59	40	49	84	15	5.5	10.1	T	3.6	T	T	T
Annual	76	56	66	105	5	52.1	19.3	T	6.3	T	6	3

Notes: Period of Record: 1937-1981.
T = Trace.
°F = degrees Fahrenheit.

Sources: Det. 9, 24th Weather Squadron, 1983.
ESE, 1985.
ES, 1984.

Terrace Deposits are highly variable across the upper extent of MAFB. Alluvial materials (chiefly poorly graded, fine sands and silts) characterize the surficial geology of lowland areas, floodplains, and stream channels. These are recently deposited materials, associated with the development of area streams. The alluvium in the Alabama River Valley is reported to be as much as 90 ft thick.

The major hydrogeologic units identified in the Phase I study as relevant to the assessment of MAFB are Recent Alluvium, Pleistocene Terrace Deposits, Eutaw Formation, Gordo Formation, and Coker Formation. These units are described in the following paragraphs and grouped according to the typical depths (shallow or deep) at which they may be encountered.

The two shallow hydrogeologic units present in the study area are Recent Alluvium and Pleistocene Terrace Deposits. The alluvium consists principally of sand, silt, and clay deposited by the meandering streams (especially the Alabama River) of the area. The alluvial deposits reach a maximum thickness of 40 ft in the study area, adjacent to the Alabama River. Ground water occurs in the alluvium under water-table (unconfined) conditions. Recharge occurs by precipitation falling on any exposed portions of the unit and from the terrace deposits at higher elevations. Flow proceeds downslope with discharge directed to the Alabama River and the underlying Eutaw Formation, with which the alluvium is hydraulically connected. Much of the unit is at or below the level of the Alabama River because of recent increases in the normal pool elevation of the river. The alluvial aquifer is present along the northeastern boundary of MAFB, usually at elevations below 140 ft (NGVD, 1929) within the river channel. Water levels within the unit are usually close to ground surface.

The ubiquitous Terrace Deposits form a significant shallow aquifer which is present beneath MAFB. The unit consists of gravel, sand, silt, and clay deposited by meandering streams (ancestral Alabama River) during

Pleistocene time. The unit occurs at ground surface and is approximately 40 to 50 ft thick across the study area. Ground water usually occurs in the unit under water-table (unconfined) conditions. Recharge enters the unit primarily as infiltrating precipitation. MAFB is situated in the recharge area of this aquifer. Terrace Deposit ground water levels at MAFB range from 2 ft below ground surface to 10 ft below ground surface. Ground water flow within the terrace materials is probably a subdued replica of the topographic surface. Water flow proceeds from higher elevations to lower elevations. Discharge is directed to area surface streams and the underlying Eutaw Formation.

The deep hydrogeologic units present in the study area are, in order of occurrence, the Eutaw, Gordo, and Coker Formations of Upper Cretaceous age. The Eutaw Formation is a regional aquifer which has been extensively developed in the study area. The Eutaw crops out as an arcuate belt 2 miles wide and 11 miles long in northern Montgomery County, just east of MAFB. It extends beneath the installations, where it is uncomformably overlain by approximately 40 ft of Pleistocene Terrace Deposits. It is estimated to be 150 ft thick at MAFB (Knowles et al., 1963). Ground water occurs in the Eutaw under water-table conditions in the outcrop area and under artesian conditions elsewhere. The Eutaw is recharged by infiltration of precipitation in its outcrop zones and by downward leakage from Alluvial and Pleistocene Terrace Deposits. The magnitude of leakage from overlying strata is not known. Natural (prepumping) ground water flow in the Eutaw was most likely downdip to the south from the principal recharge zones. Extensive water resource development has altered this scenario locally; large-scale drawdowns in the potentiometric surface of the unit probably direct flow toward major pumping centers such as municipal wells. Eutaw Formation artesian water levels were reported to be approximately 150 ft mean sea level (MSL) at MAFB. The depth to water in the Eutaw is 10 ft below land surface in the well at MAFB Bldg. 1109. At MAFB, ground water flow in the Eutaw was postulated to be east toward municipal wells located north of Montgomery. The Eutaw is capable of producing large supplies [1,500 gallons per minute (gpm)] of water to wells.

The Gordo Formation is also considered to be a regional source of water but is not as prolific as the Eutaw or underlying Coker. It is exposed in Autauga and Elmore Counties, north of Montgomery. In the study area, it is unconformably overlain by the Eutaw Formation. It generally occurs at a depth of 200 to 400 ft below land surface at the Montgomery west well field, located 2 miles southwest of MAFB. In Montgomery, the Gordo ranges in thickness from 250 to 300 ft and contains water under artesian conditions. Recharge occurs by infiltration of precipitation in the outcrop area (Autauga and Elmore Counties) and by leakage from overlying units. In 1885, some Gordo wells installed just north of Montgomery flowed naturally under artesian pressures. By 1953, such flow had ceased, and water levels declined to about 100 ft below land surface due to the extensive use of the Gordo as a water supply. No reliable, current data are available to describe ground water flow in the Gordo with respect to MAFB; however, the Gordo is capable of furnishing water at 200 gpm.

The Coker Formation is a prolific aquifer of regional importance. The unit crops out north of Montgomery in Autauga and Elmore Counties and dips gently south. It unconformably overlies crystalline basement rocks and is, in turn, unconformably overlain by the Gordo Formation. At MAFB, the Coker occurs at an approximate depth of 500 ft below land surface and is estimated (interpolated from plate 3, Powell et al., 1957) to be 600 ft thick at a test well just west of the installation. The unit is recharged primarily by infiltrating precipitation in its outcrop area. Reliable, current data describing ground water levels and flow directions are not available. It is known that past extensive development of the aquifer and recent use of surface water to offset ground water overdevelopment at first created large-scale lowering of Coker water levels and then permitted some recovery. The Coker is known to be an excellent water source, capable of producing 1,000 gpm of water (Engineering Science, 1984). The period over which this yield could be sustained was not provided in the Records Search report.

2.4 LOCATIONS OF ONSITE AND OFFSITE WELLS

Formerly, MAFB obtained water resources from wells located on the installation. Three inactive wells are located on MAFB. At present, the installation obtains water from the municipal system of Montgomery. The City of Montgomery obtains its water supplies from ground and surface water sources. The surface water intake is located on the Tallapoosa River, near the confluence of the Coosa and Alabama Rivers. The municipal well system consists of 45 wells located west and north of the urban area. Six of the wells are located near the southeast corner of MAFB. Typically, city wells located west of the urban area are screened into both the Gordo and Coker Formations. Some wells located north of the city were reported to be screened into the Eutaw. It is unlikely that the terrace and alluvial deposits are used as water sources in the study area.

2.5 HISTORIC GROUND WATER AND SURFACE WATER MONITORING

Prior to the Phase II study, a ground water monitoring system consisting of three shallow wells was used to observe terrace-deposit water quality near the active landfill. Available information indicated water levels adjacent to the landfill ranged from 7 ft below land surface to 35 ft below ground, respectively. Moreover, the Phase I report mentioned that seepage into the open landfill trench was occurring at the time of the onsite Records Search survey.

Discharge to the West End Ditch is expected based on the assumption that terrace-deposit ground water flow follows topographic influences.

The Phase I report indicated that water resources obtained from the Eutaw, Gordo, and Coker Formations are generally very good. Wells screened into the upper extent of the Eutaw may encounter excessive amounts of iron locally. The Phase I study also indicated that the quality of water obtained from city wells is good; however, specific water quality analysis results for these wells were not available.

Base personnel routinely collect and analyze water samples from various surface drainage locations on MAFB in accordance with National Pollutant Discharge Elimination System (NPDES) Permit No. AL0003727 and AL0003719, respectively. The parameters for each sampling point have included flow, pH, oil and grease, suspended solids, temperature, and fecal coliform. Sampling point 0128NA001 monitors the influent of the surface drainage from a portion of the City of Montgomery to the east side of MAFB. Sampling point 0128NA003 on MAFB monitors surface drainage effluents exiting the installation. Sampling point 0128NA002 on MAFB monitors a drainage stream prior to discharge into an onbase lake. Sampling points 0128NA004 and 0128NA005 monitor surface drainage streams prior to discharge into the West End Ditch. None of the sampling points monitor West End Ditch directly. A review of the NPDES monitoring data for the period May 16, 1979, through March 31, 1983, indicated no water quality problems at the required sampling points.

Beginning in May 1982, the number of parameters analyzed at sampling point 0128NA001 (influent to the base) was expanded to include cyanide, phenols, arsenic, cadmium, lead, and mercury. Monitoring data indicate that levels of arsenic [1.5 milligrams per liter (mg/l) maximum] and lead (1.3 mg/l maximum) are present in the surface drainage entering the base. Levels of phenols and oil and grease are also indicated. Levels of cyanide, cadmium, and mercury were negligible or lower than detectable limits. The surface drainage flows through sampling point 0128NA002 on the east side of the base and enters a series of onbase lakes which drain to the Alabama River. The source(s) of the offbase contaminants has not been identified.

2.6 DESCRIPTIONS OF DISPOSAL AND STORAGE AREAS

The 10 disposal and storage areas described in the Phase I report were prioritized into seven sites (listed in Table 1.3-2). Some of the areas were grouped as sites because they are located close to one another and, therefore, are expected to share ground water flow patterns. Site 3 incorporates Fire Protection Training Area (FPTA) No. 2 and Landfill No. 3. Site 5 incorporates Landfills 4, 5, and 6.

2.6.1 SITE 1--ELECTROPLATING WASTE DISPOSAL AREAS

Electroplating operations were conducted at MAFB from the late 1940s through the early 1970s. From at least the late 1940s through the mid-1960s, spent electroplating solutions were drummed and disposed of in areas (Site 1) near Hopper Lodge (Bldg. 1110) (Fig. 2.6-1). These solutions included copper, chromium, nickel, cadmium, and cyanide compounds. Approximately four to five drums of solutions were disposed of each year during peak plating operation years from the mid-1950s to the early 1960s. It is estimated that approximately 20 to 40 drums of solutions have been disposed of in the area of Site 1.

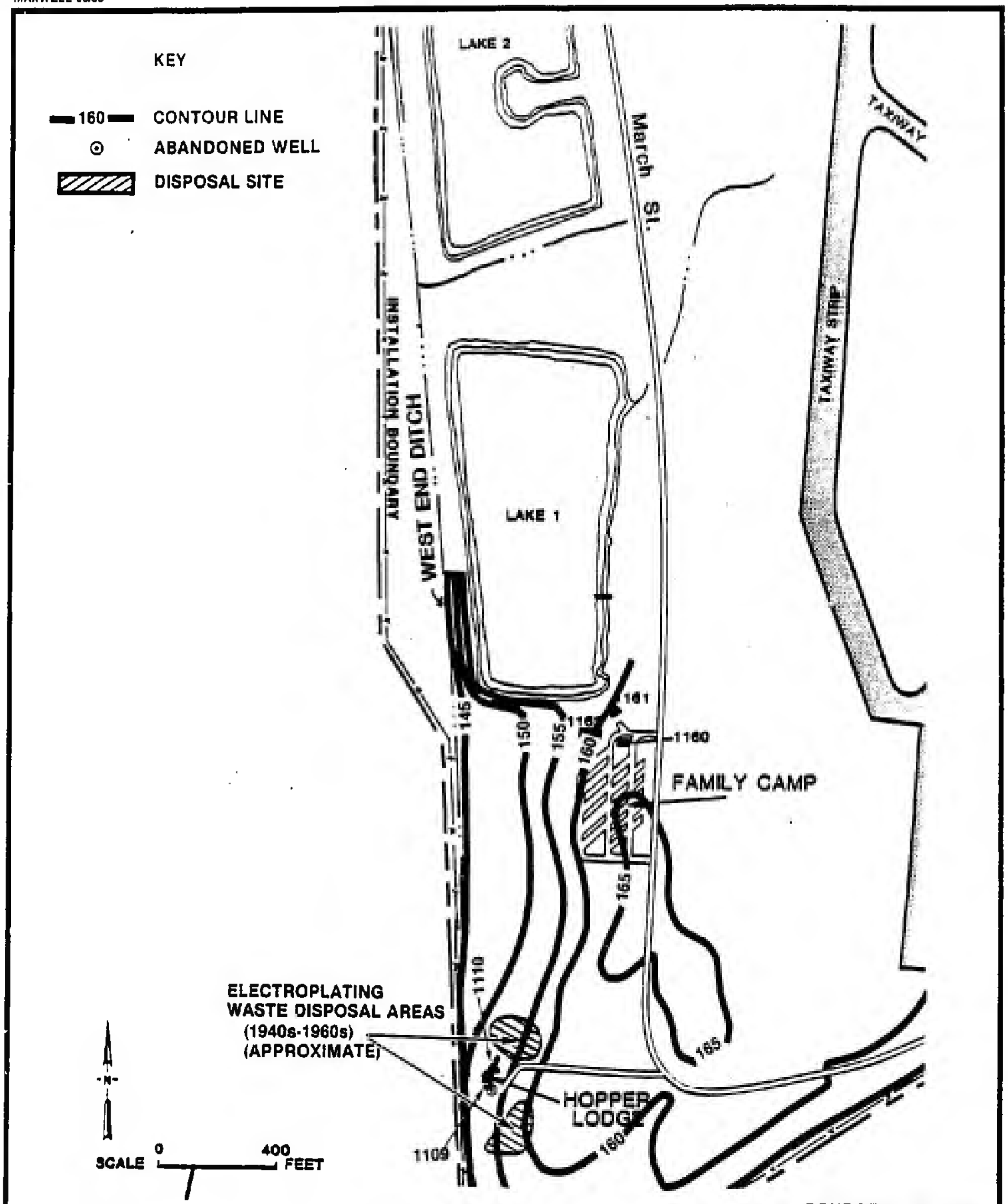
The electroplating operations ceased in the early 1970s, and the spent solutions were transported to Kelly AFB for disposal in the mid-1970s.

Trench landfilling was the disposal method used at Site 1. In the Phase I report, the typical trench was estimated to be 8 to 10 ft deep and 14 ft wide. The disposal areas reportedly have clay soil, and the areas are covered and closed. A parking lot covers a portion of one of the disposal areas.

2.6.2 SITE 2--SURFACE DRAINAGE SYSTEM

The surface drainage system at MAFB, designated as Site 2, includes open drainage ditches which discharge to the Alabama River. The general drainage patterns on the base are shown in Fig. 2.6-2.

The surface drainage system on the northern and western portions of MAFB received untreated industrial waste solutions from the 1940s through the early 1970s. These wastes included effluent from several washracks, rinse water from electroplating operations, unneutralized acids, and quantities of paint stripper. An internal USAF waste disposal survey was conducted by the Occupational Environmental Health Laboratory (OEHL) in March 1969 to assess industrial waste disposal practices at MAFB. Oil/water separators were installed in the early 1970s for the separation of oily wastes. Also, the practice of neutralizing acid wastes prior to discharge to the surface drainage system began in the early 1970s.



SOURCES: ES, 1984.
ESE, 1985.

Figure 2.6-1
SITE 1 — ELECTROPLATING
WASTE DISPOSAL AREAS

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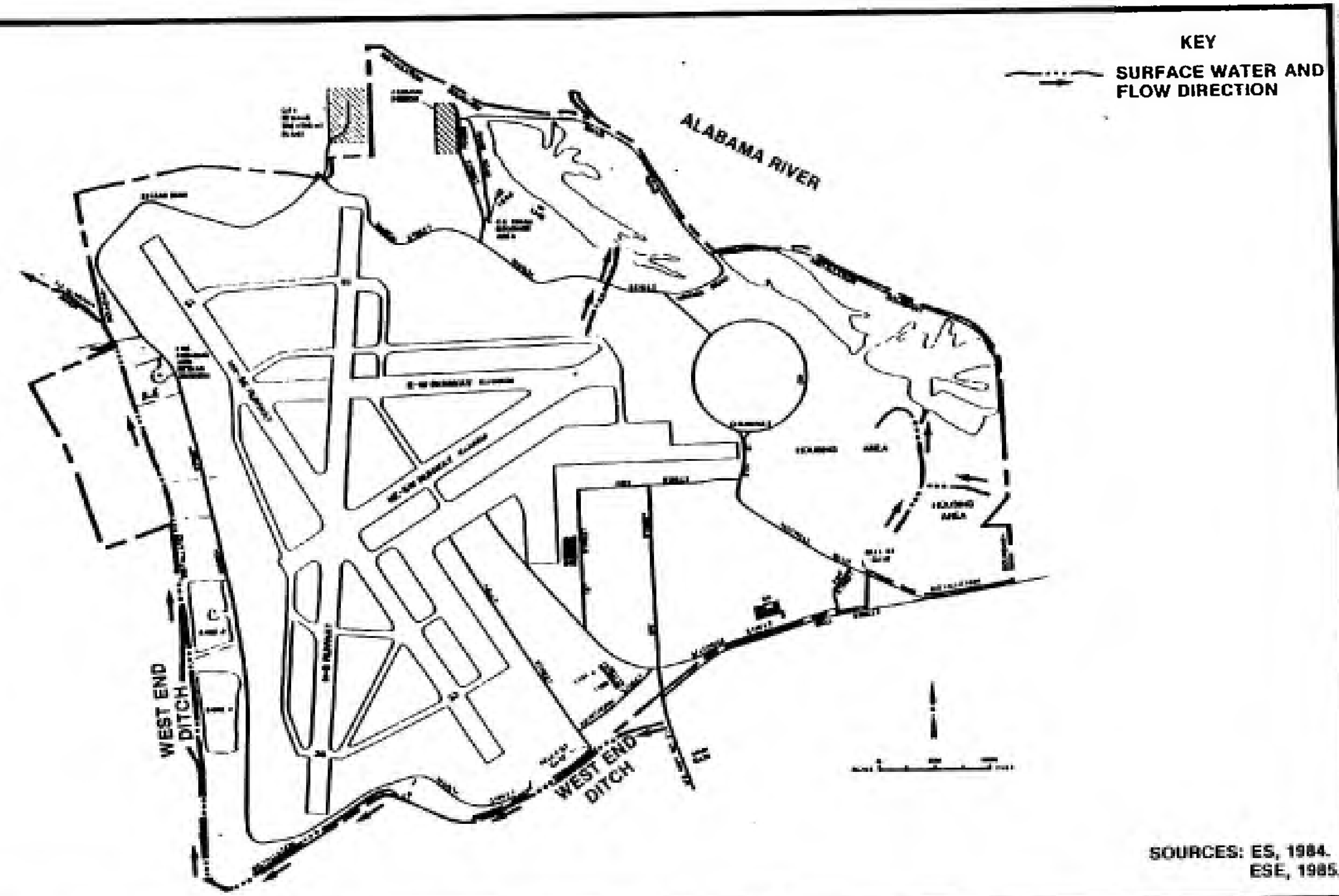

Figure 2.6-2
SITE 2 — SURFACE DRAINAGE SYSTEMS

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One of the major drainage ditches, West End Ditch, forms the western part of the southern boundary of MAFB. This ditch is owned and maintained by the City of Montgomery. The channel flows west and then north, eventually discharging into the Alabama River. At the time of the Phase II study, the city was lining the ditch with concrete along a portion of its length.

2.6.3 SITE 3—FPTA NO. 2 AND LANDFILL NO. 3

Landfill No. 3 is situated in the vicinity of FPTA No. 2 (Fig. 2.6-3). Household garbage, base trash (paper, wood, and scrap metal), and industrial nonliquid wastes such as waste paints, empty paint cans, paint booth sludges, and unrinsed pesticide containers were disposed of in this landfill from 1951 to 1956. Trench landfills were used over approximately 10 acres, with trenches averaging 10 ft deep by 14 ft wide. Daily cover was normally applied. The landfill area is closed and has been covered. Landfill No. 3 is located in a floodplain near West End Ditch, and the water table in the area is near the surface.

In 1962, fire protection training activities were moved from FPTA No. 1 to FPTA No. 2, the area of the closed landfill (Fig. 2.6-3). Initially, the training area was constructed as a shallow, unlined pit about 12 inches deep in the center and 35 ft in diameter. Protein foam, AFFF, and Halon® were used as extinguishing agents at this site.

From 1962 through 1973, waste oils, waste fuels, waste solvents, and other ignitable wastes were used for training exercises. Drums of these waste materials were delivered to a holding area just north of the fire pit. Between 25 and 35 drums frequently were stored at this location. Some leakage from these drums is believed to have occurred. Prior to each exercise, the pit area was soaked with water, then the ignitable materials were poured in the pit to conduct the training exercise. At the conclusion of the exercise, residue materials and water soaked into the pit area. Occasionally from 1962 to 1978, water and residual waste ignitable materials would overflow from the pit area to West End Ditch.

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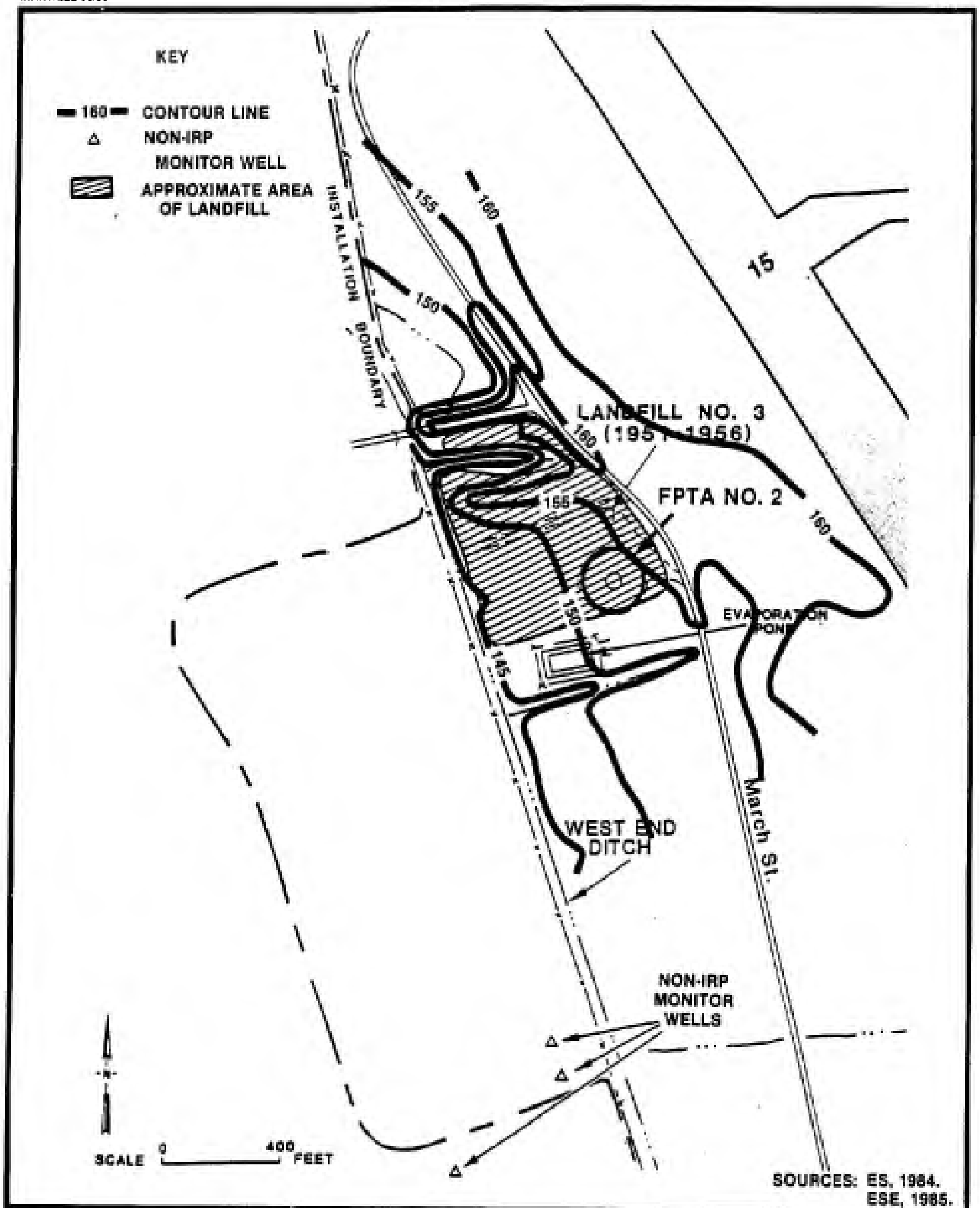

Figure 2.6-3 SITE 3 — FPTA NO. 2 AND LANDFILL NO. 3	**INSTALLATION RESTORATION PROGRAM** **Maxwell Air Force Base**

In 1978, a concrete liner, sump, oil/water separator, and evaporation pond system were constructed over the unlined fire pit area. This system is currently in operation. Residual fuel is separated and collected. Water is discharged to the evaporation pond and allowed to evaporate. The evaporation pond is unlined and has no discharge to surface waters.

2.6.4 SITE 4--FPTA NO. 1

Fire protection training exercises were conducted in the area currently used for disposal of landscape debris and construction rubble (Fig. 2.6-4). This site was used from the early 1940s to 1962. The training area consisted of a shallow, unlined depressed area no more than 12 inches deep in the center. Training exercises were typically conducted on weekends, and usually two to three exercises were conducted each day. High-pressure water was used to extinguish fires.

Before each exercise, the pit area was soaked with water. Waste oils, waste fuels, waste shop solvents, and other ignitable wastes were stored on an embankment near the area of the fire pit. Between 10 and 20 full or partially full drums were stored at the site. Occasionally, the waste fuels and solvent would be washed out of the pit area during an exercise into a small pond located nearby.

2.6.5 SITE 5--LANDFILLS 4, 5, AND 6

Landfills No. 4, 5, and 6 have been grouped as Site 5. These landfills and the wastes they contain are described in the following paragraphs.

Landfill No. 4 is situated on leased land adjacent to the installation boundary (Fig. 2.6-5). This landfill was operated from 1956 to the early 1970s as a trench landfill. Household garbage, base trash (paper, wood, and scrap metal), and industrial nonliquid wastes such as waste paints, empty paint cans, paint booth sludges, small quantities of solvent sludge, and pesticide containers were landfilled. Refuse was typically burned in the trenches before the daily soil cover was

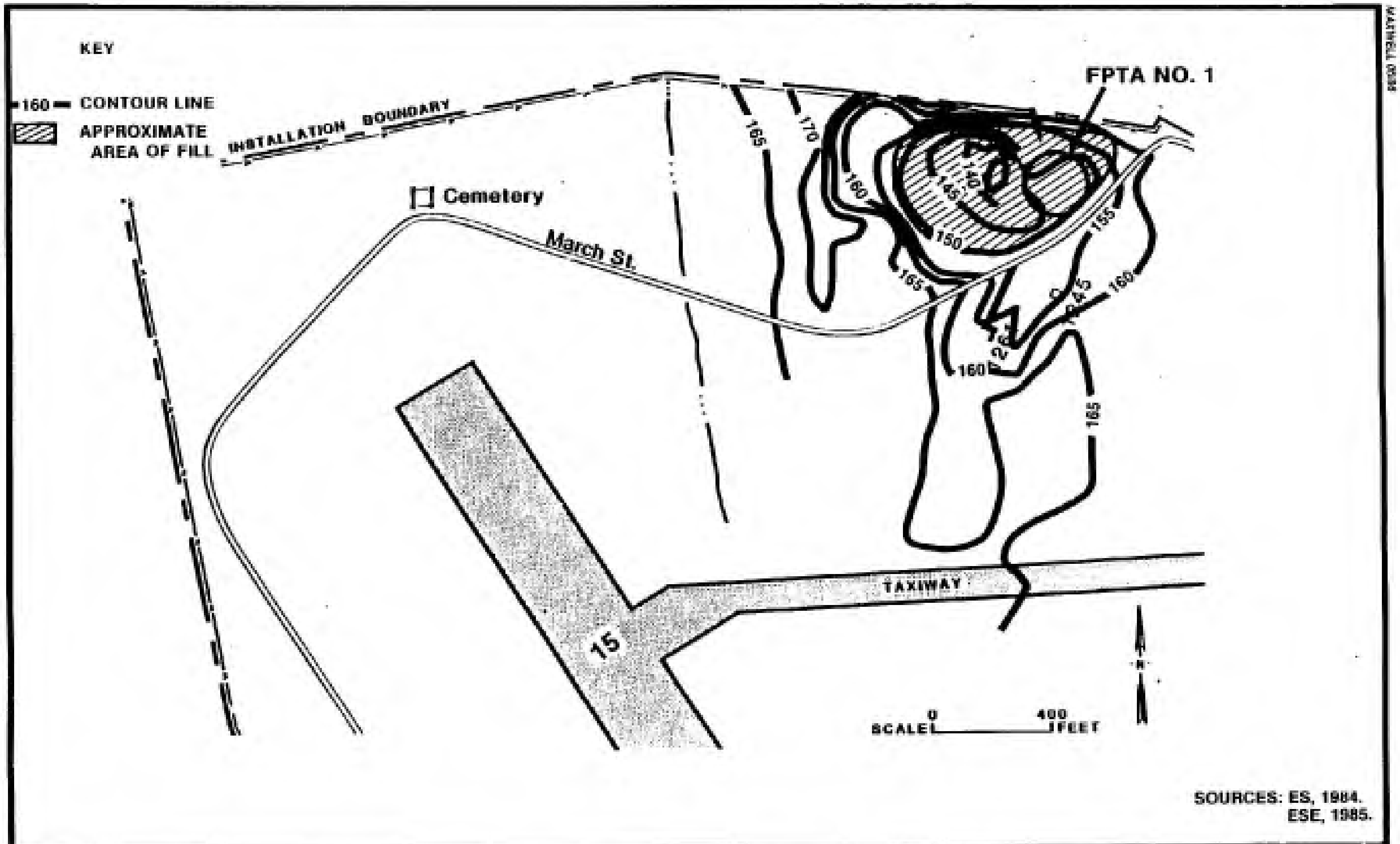

Figure 2.6-4
SITE 4 — FPTA NO. 1

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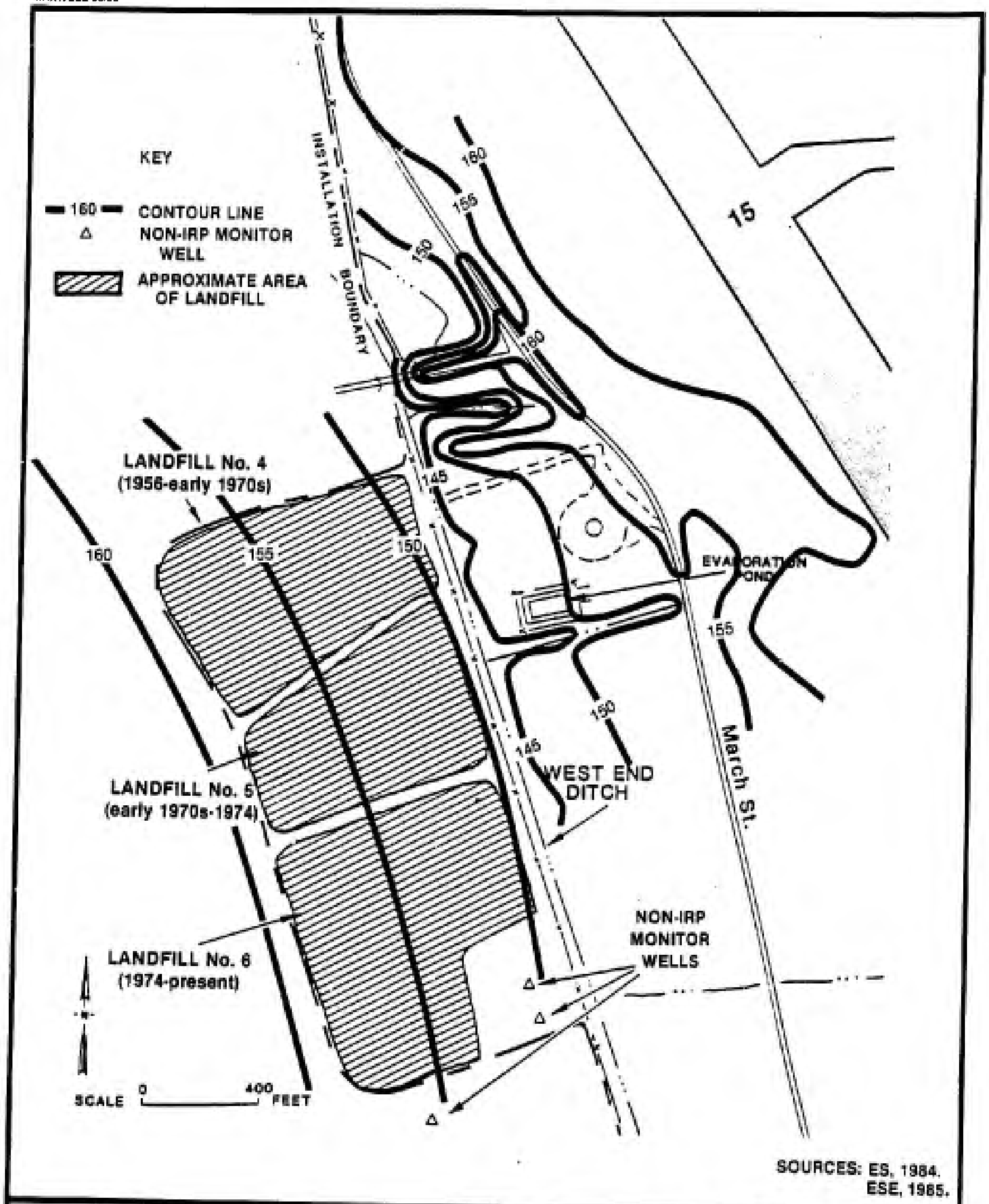

Figure 2.6-5
SITE 5 — LANDFILLS 4, 5, AND 6

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applied. The landfill covered approximately 12 acres, with trenches averaging 10 ft deep by 20 ft wide. Landfill No. 4 is closed, covered, and revegetated. This landfill is situated in a floodplain near West End Ditch, and the water table in the area is near the surface.

Landfill No. 5 is a 10-acre area situated on leased land south of Landfill No. 4 (Fig. 2.6-5). This landfill was operated from the early 1970s to 1974 for the disposal of household garbage, base trash (paper, wood, and scrap metal), and industrial nonliquid wastes such as waste paints, empty paint cans, paint booth sludges, and pesticide containers. Landfill No. 5 was operated as a trench landfill, with trenches averaging 8 ft deep by 20 ft wide. Burning of refuse was not a practice at this location, and the site is currently closed and covered. This landfill is situated in a floodplain near West End Ditch, and the water table in the area is near the surface.

Landfill No. 6 is a 15-acre leased site where disposal operations have been conducted since 1974 (Fig. 2.6-5). Trench landfilling is used for the disposal of household garbage, base trash, and industrial nonliquid wastes such as waste paints, empty paint cans, paint booth sludges, and pesticide containers. The average trench is approximately 5 ft deep by 20 ft wide. Daily soil cover is applied to the active disposal cell, except during periods of wet weather. Approximately 10 acres of Landfill No. 6 are closed and covered; approximately 5 acres are active. This landfill is situated in a floodplain near West End Ditch, and the water table in the area is near the surface.

In 1981, three monitor wells were installed at Landfill No. 6 and located as shown in Fig. 2.6-5. The monitor wells are 21 to 23 ft deep, and the depth to water in each well is 6 to 7 ft below land surface. Each monitor well is monitored by MAFB on an annual basis for pH, specific conductance, chloride, and iron.

The locations of the ground water monitor wells were specified by State of Alabama personnel. No observation wells were installed to determine ground water flow directions and to assure the wells were downgradient of the landfill area. Therefore, the ground water monitoring data available from the prior study may not be representative of the impact of Landfill No. 6 on the surrounding ground water.

2.6.6 SITE 6--C.E. DRUM STORAGE AREA

The Civil Engineering (C.E.) drum storage area (Fig. 2.6-6) has been used for the storage of waste paints and nonignitable mixtures of oil and water since the mid-1970s. As many as 80 to 90 drums of these wastes have been stored at this site at one time. Since the late 1970s, drums at the C.E. drum storage area have been placed on a concrete pad which drains to an oil/water separator. Before then, drums were stored on the ground. In Phase I, it was reported there were indications that some leakage had occurred, although no details were given.

2.6.7 SITE 7--LANDFILL NO. 2

During the early 1940s through approximately 1951, the base operated Landfill No. 2 (Fig. 2.6-7) for the disposal of household garbage, base trash (paper, wood, and scrap metal), and industrial nonliquid wastes such as waste paints, empty paint cans, paint booth sludges, and unrinsed pesticide containers. Trench landfilling was practiced, and wastes were covered daily. The trenches were approximately 10 ft deep by 15 ft wide. The landfill encompasses about 20 acres and is currently closed and covered. The landfill is situated in a floodplain near West End Ditch, and the water table in the area is near the surface.

2.7 SUMMARY OF ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation indicated that the following items are relevant to the assessment of past hazardous waste management practices at MAFB.

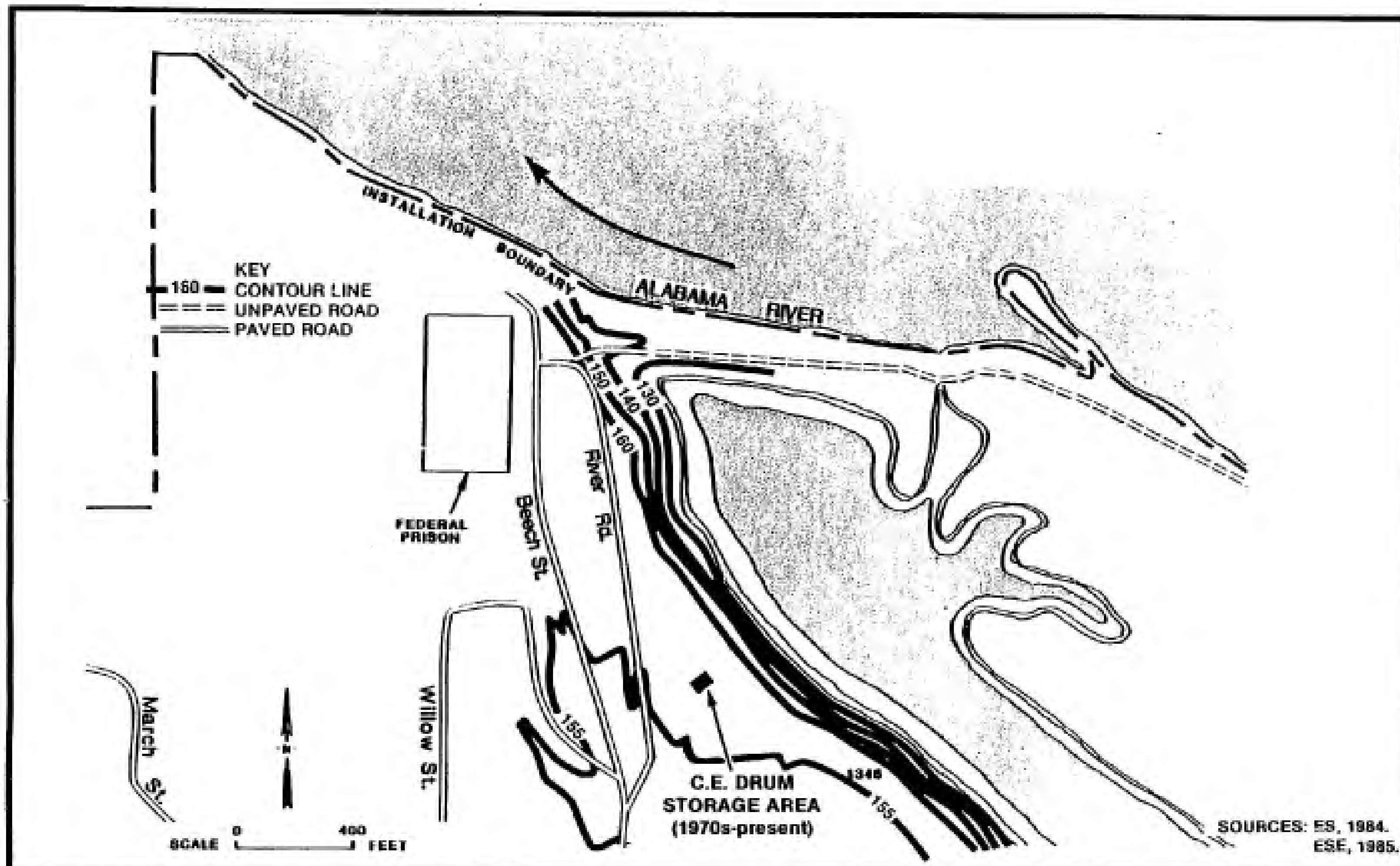

Figure 2.6-6
SITE 6 — C.E. DRUM STORAGE AREA

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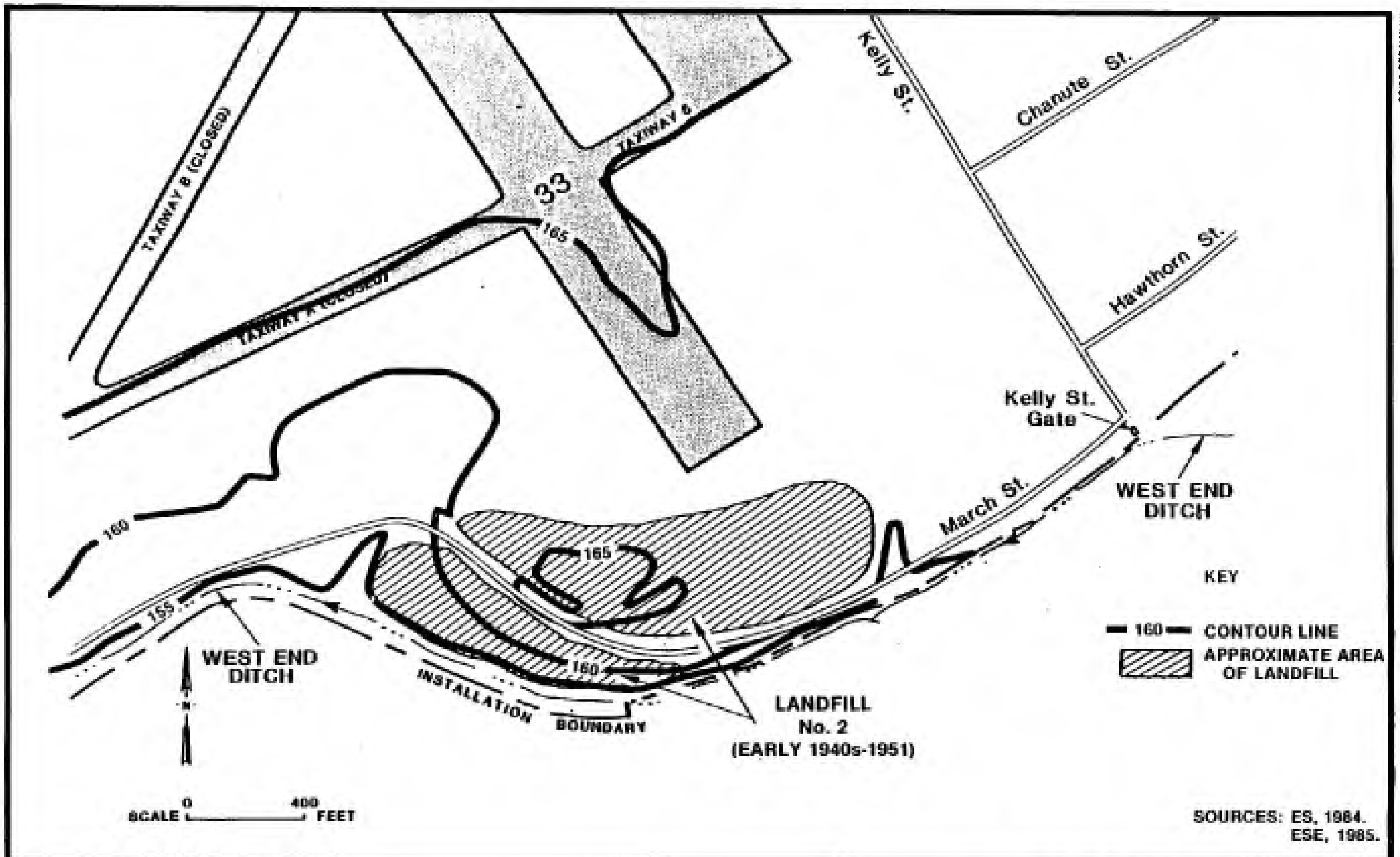

Figure 2.6-7
SITE 7 — LANDFILL NO. 2

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- Study area mean annual precipitation is reported to be 52.1 inches, and net precipitation was calculated to be approximately 8 inches, which represents the meteoric water available for infiltration. The 24-hour maximum rainfall event is 6.3 inches.
- Many of the Phase II, Stage 1 study areas on MAFB are situated in zones flooded by a 100-year rainfall event.
- Surface soils at MAFB tend to be moderately to poorly permeable but are underlain by highly permeable soils at shallow depths.
- The Terrace-Deposit aquifer is present at ground surface at MAFB. Water levels in this unit are shallow (3.5 to 7 ft below ground surface).
- The Terrace Deposits form the shallow aquifer in the study area and directly overlie and provide recharge to the Eutaw Formation, which is present at shallow depth (40 ft) below ground surface. The Eutaw Formation is a major regional aquifer. No separation exists between the terrace materials and the Eutaw. The water level in the Eutaw was measured at 10 ft below ground surface in a well at MAFB during studies not associated with the current project or other IRP projects.
- Two major regional aquifers, the Gordo and Coker Formations, exist below and are in contact with the Eutaw Formation. The City of Montgomery obtains most of its ground water supply from these two aquifers.
- Contaminants, including arsenic and lead, have been detected by previous studies entering MAFB through the surface drainage influent from a portion of the City of Montgomery on the east side of MAFB.

Potential pathways for the migration of hazardous-waste-related contamination exist. Hazardous materials present at ground surface could be mobilized to the area's shallow aquifer (Terrace Deposits) and subsequently discharged to local surface streams or transferred to the underlying Eutaw or Gordo Formations as recharge.

3.0 FIELD PROGRAM

3.1 DEVELOPMENT OF FIELD PROGRAM

The MAFB Phase II, Stage 1 field program was developed based on findings and recommendations of the Phase I Records Search conducted by ES in 1984, additional information obtained subsequent to the Records Search, and discussions with USAFOEHL personnel. A summary of the Phase II, Stage 1 monitoring and analysis work plan is given in Table 3.1-1. The complete scope of work outlined by OEHL appears in App. C. The quality assurance (QA) and safety plans applicable to Phase II, Stage 1 studies are found in Apps. D and E, respectively. In many instances the work scope reflects modifications of Phase I recommendations enacted due to changes in contamination assessment.

The MAFB Phase II, Stage 1 survey was designed primarily as a screening survey to determine whether contamination exists at the sites and is sufficient to warrant further monitoring. In addition to analyses for specific parameters, the survey utilizes general screening parameters such as pH, specific conductance, total phenolics, total organic carbon (TOC), and total organic halides (TOX) to detect the presence of nonspecific classes of pollutants. The parameters pH, specific conductance, TOC, and TOX are often collectively referred to as ground water contamination indicators. For sites where values of screening parameters are high enough to indicate that a problem may exist, additional sampling and analyses are recommended to determine the extent of contamination.

The Phase II, Stage 1 investigations at MAFB involved geophysical surveys, piezometer installation and monitoring, monitor well installation and ground water quality monitoring, surface water quality monitoring, and sediment sampling. This section details the field investigation methodology and program implementation at each disposal and storage site.

Table 3.1-1. MAFB Phase II, Stage 1 Monitoring and Analysis

Site Description	Monitoring/Analysis Description	Rationale
1. Electroplating Waste Disposal Areas	Perform geophysical survey with electromagnetic (EM) techniques and magnetometer	Attempt to locate the actual burial sites for the electroplating drums
	Install four piezometer wells	Determine flow direction in the shallow aquifer
	Install one upgradient and three downgradient wells (total of four monitor wells)	Sample shallow ground water migrating through the reported disposal site
	Collect four ground water samples and analyze for pH, specific conductance, total dissolved solids (TDS), TOC, and phenols	Indicators of nonspecific ground water contamination
	Cyanide (CN)	Buried wastes reportedly were metal cyanides
	Copper (Cu), nickel (Ni), cadmium (Cd), chromium (Cr), and zinc (Zn)	Contaminants from the metal plating solutions
2. Surface Drainage System	Collect four surface water samples and analyze for: pH, specific conductance, dissolved solids, TOC, and TOX	Indicators of nonspecific contaminants
	Phenols, oil and grease	Drainage system received effluent from washracks and paint strippers
	Cu, Ni, Cd, Cr, Zn, lead (Pb), arsenic (As), and mercury (Hg)	Drainage system received waters from electroplating rinsing operations. In addition, some metals were detected in surface streams during nonrelated prior studies on MAFB.

Table 3.1-1. MAFB Phase II, Stage 1 Monitoring and Analysis (Continued, Page 2 of 5)

Site Description	Monitoring/Analysis Description	Rationale
2. Surface Drainage System (continued)	CN	Electroplating contaminants were metal cyanides
	Collect 11 sediment samples and analyze for the parameters listed above (except TDS, pH, and specific conductance) in the surface waters	Same rationale as for surface water
3. FPTA No. 2 and Landfill No. 3	Perform geophysical survey with EM and magnetometer techniques	Attempt to locate boundaries of disposal areas to assure the monitor wells are located outside burial trenches
	Install three piezometer wells	Determine shallow ground water flow direction
	Install three monitor wells (one upgradient and two downgradient)	Sample shallow ground water to determine if contaminants are present and migrating
	Collect three ground water samples and analyze for: pH, specific conductance, TOC, TOX, and TDS	Indicators of nonspecific contaminants
	Phenols, oil and grease	Landfill and FPTA received phenolics, and oil and grease
	CN, Ni, Zn, and Cu	Contaminants from electroplating operations
	As, barium (Ba), Cd, Fe, Cr, Pb, Hg, fluoride (F), nitrate (NO_3), selenium (Se), silver (Ag), endrin, lindane, methoxychlor, toxaphene, 2,4,5-TP 2,4-Dichlorophenoxyacetic acid (2,4-D), and sulfate (SO_4)	Potential contaminants from the landfill

Table 3.1-1. MAFB Phase II, Stage 1 Monitoring and Analysis (Continued, Page 3 of 5)

Site Description	Monitoring/Analysis Description	Rationale
4. FPTA No. 1	Install three piezometer wells	Determine flow direction of the ground water
	Install three ground water monitor wells (one upgradient and two downgradient)	Sample ground water to determine if shallow aquifer is contaminated
	Collect three ground water samples and analyze for: pH, specific conductance, TDS, TOC, and TOX	Indicators of nonspecific contaminants
	Phenols, oil and grease	Landfill reportedly received phenols, and oil and grease
	CN, Ni, Zn, and Cu	Contaminants from electroplating
	As, Ba, Fe, Pb, Hg, Cd, Cu, Cr, F, NO_3, SO_4, Se, Ag, endrin, lindane, methoxychlor, toxaphene, 2,4,5-TP, and 2,4-D	Potential contaminants from the landfill
5. Landfills 5, 6, and 7	Perform geophysical survey	Determine the size and location of the disposal site and locate monitor wells outside burial trenches
	Install three piezometer wells	Determine the ground water flow direction
	Install four ground water monitor wells (one upgradient and three downgradient)	Sample ground water to determine if the shallow aquifer is contaminated
	Collect five* ground water samples and analyze for: pH, specific conductance, TDS, TOC, and TOX	Indicators of nonspecific contaminants

*Samples collected from four newly installed wells and one existing well.

Table 3.1-1. MAFB Phase II, Stage 1 Monitoring and Analysis (Continued, Page 4 of 5)

Site Description	Monitoring/Analysis Description	Rationale
5. Landfills 5, 6, and 7 (continued)	Phenols, oil and grease	Landfills reportedly received oil and grease and other items (e.g., paint strippers) containing phenolics
	CN, Ni, Zn, and Cu	Contaminants from electroplating activities
	As, Ba, Fe, Cd, Cr, Pb, Hg, F, NO_3, Se, Ag, endrin, lindane, methoxychlor, toxaphene, 2,4,5-TP, 2,4-D, and SO_4	Potential contaminants from activities conducted on MAFB
6. C.E. Drum Storage Site	Install three piezometer wells	Determine the direction of ground water flow
	Install three monitor wells (one upgradient and two downgradient)	Sample shallow ground water to determine if aquifer is contaminated
	Collect three ground water samples and analyze for: pH, specific conductance, TDS, TOC, and TOX	Indicators for nonspecific contaminants
	CN, Ni, Zn, and Cu	Potential contaminants from electroplating operations conducted on MAFB
	Phenols, oil and grease	Oils, greases, solvents, and possibly phenolics were reportedly spilled at this site

Table 3.1-1. MAFB Phase II, Stage 1 Monitoring and Analysis (Continued, Page 5 of 5)

Site Description	Monitoring/Analysis Description	Rationale
	As, Ba, Fe, Cd, Cr, Pb, Hg, F, NO_3, Se, Ag, endrin, lindane, methoxychlor, toxaphene, 2,4,5-TP, 2,4-D, and SO_4	Potential contaminants generated by activities on MAFB
7. Landfill No. 2	Perform geophysical survey using EM and magnetometer methods	Determine the areal extent of the disposal area in order to install the wells outside the burial area
	Install three piezometric wells	Determine the ground water flow direction
	Install three monitor wells (one upgradient and two downgradient)	Sample shallow ground water to determine if contaminants are present
	Collect three ground water samples and analyze for: pH, specific conductance, TDS, TOC, and TOX	Indicators for nonspecific contaminants
	CN, Ni, Zn, and Cu	Potential contaminants from electroplating operations
	Phenols, oils and grease	Phenolics, oils and greases reportedly went to the landfills
	As, Ba, Fe, Cd, Cu, Cr, F, NO_3, SO_4, Se, Ag, endrin, lindane, methoxychlor, toxaphene, 2,4,5-TP, and 2,4-D	Potential contaminants generated by activities on MAFB

Source: ESE, 1985.

The boundaries at some of the disposal and storage sites were poorly defined at the surface, overgrown with vegetation, or covered with pavement. Geophysical surveys incorporating electromagnetic (EM) and magnetometer techniques were conducted at several sites to assist in the determination of site boundaries, to locate landfilled wastes, and to attempt the preliminary identification of leachate plumes originating from specific sites.

Piezometers were installed around each disposal and storage site as observation wells in which ground water levels in the unconfined aquifer could be measured. Water-level data were used to determine ground water gradients and identify ground water flow directions. This information was used in determining appropriate upgradient and downgradient locations for monitor wells. Monitor wells were installed in upgradient and downgradient locations at each site for ground water quality monitoring to evaluate potential contaminant migration. In the shallow, unconfined aquifer, three or four monitor wells were installed at each site, and both organic and inorganic contaminants were monitored.

Soil samples were collected during the installation of each piezometer and monitor well, and boring logs were developed describing the subsurface geology at each site. Soil samples were stored at ESE's Gainesville, Fla. laboratory for potential analysis, if subsequently collected ground water samples were found to be significantly contaminated.

Surface water samples were collected at various points along the West End Ditch to evaluate water quality in the ditch and to assess the impact of runoff and ground water discharge from disposal and storage sites. Samples were collected and analyzed from locations within the West End Ditch near the point where the ditch enters MAFB and near its exit from the installation.

Sediment samples were collected from small streams and ditches in the MAFB surface drainage system to evaluate the accumulation of contaminants in the sediment from surface runoff and ground water discharge.

3.2 METHODOLOGY

3.2.1 GEOPHYSICAL SURVEY TECHNIQUES

A geophysical survey was conducted at Sites 1, 3, 5, and 7 on MAFB using EM and magnetometer techniques. These instruments are commonly used to determine the areal extent of disturbed soils, the existence of buried metallic objects, and the existence of leachate emanating from landfill areas into the shallow ground water.

EM instruments measure the resistance of the earth to the passage of an electrical current. EM data are usually read in conductivity rather than resistivity units. These two parameters are inversely related. EM techniques work on the principle of induction. A transmitter coil in the instrument induces small currents in the earth. The receiver coil senses the magnetic fields associated with both the transmitter and the induced current. The ratio of the strengths of these fields is proportional to the conductivity of the earth.

The magnetometer is a fluxgate gradiometer. An audible signal is emitted when its two sensors detect a difference in magnetic field strengths. This indicates a strong local perturbation in the total magnetic field due to the presence of ferromagnetic objects.

The magnetometer survey was performed using two different gain settings on the instrument which provide two different sensitivities, comparable to two different depths of penetration.

The geophysical surveys were conducted as follows:

1. The study areas were gridded and marked, and the location of the grid was noted on a map.

2. EM conduction and magnetometry surveys were conducted over the site referencing all data to the grid location.
3. The data were analyzed in the field to determine the presence of gross anomalies and to interpret their cause.

The EM conductivity survey was conducted to determine the location of contaminant plumes and buried metallic objects. The magnetometer was used to refine the location of ferrous metal objects. The implementation of these techniques is described in Sec. 3.3.

3.2.2 PIEZOMETER INSTALLATION AND MONITORING

Nineteen piezometers were installed at six sites on MAFB. The total footage installed was 449.7 ft, which consisted of 239.7 ft of solid casing and 210 ft of slotted screen. Three piezometers each were placed at Sites 3, 4, 5, 6, and 7, and four piezometers were placed at Site 1, as described in Sec. 3.2. The sample numbering system used for the piezometers is described in App. F.

The borings for all piezometers were completed using a Central Mine Equipment (CME) Model 45 drilling unit equipped with a hollow-stem auger with a 3.25-inch inside diameter and a 6-inch outside diameter. The unit was operated without water, except when necessary, to eliminate cave-in from the boring. The 2-inch polyvinyl chloride (PVC) well pipe and screen were installed through the center of the hollow drill stem and positioned at the appropriate depths. As the auger was withdrawn from the hole, the formation was allowed to collapse around the well screen and casing. This technique prevented collapse of the borehole that could have occurred had the auger been removed from the hole first and the well pipe introduced from the top of the empty hole.

The subsurface material in the 0- to 25-ft-depth interval consisted of unconsolidated gravels, sands, silts, and clays. As a result, the boreholes tended to collapse from a condition known as "running sand" when the water table was reached. In this condition, hydrostatic pressure caused saturated soil to rise in the dry hollow-stem auger and impede drilling. The sand was typically flushed out by using a rotary bit and circulating drilling water. The total depths and the locations of screened intervals in each piezometer are discussed for each site in Sec. 3.2. Cased depths vary from 15 to 39 ft, with all screens placed below the water table. The ESE Site Geologist maintained regular telephone contact with the Project Manager during the drilling program to make recommendations for well placement when unique hydrogeologic conditions required that well placement or configuration differed from the Work Plan.

The piezometers penetrated the shallow water table to depths of 25 ft or less. The piezometers were installed in a 6-inch borehole and consisted of Schedule 40 PVC pipe (2-inch inside diameter), with 0.010-inch slots (screen) in the bottom 10- or 15-ft interval. Pipe sections were joined by solvent welding. The bottom of the screen was capped before installation, and a vented cap was installed at the top of each piezometer. Filter packs, bentonite seals, and grout seals were not used in piezometer construction. Drill cuttings were backfilled around the screen and casing when placed in the borehole. This prevented contaminants from entering the ground water. A sketch of the well installation was included on the boring log depicting the depths of the bottom of the boring, screen location, coupling locations, cave-ins, cutting backfill, and the height of riser above ground surface.

Boreholes were drilled using procedures that ensured plumbness and cleanliness. Plumbness was obtained by careful leveling of the drill rig before drilling. Drilling was controlled to avoid wobble and chatter in the drill stem.

At each piezometer site, installation began within 48 hours of the time the borings were completed and continued uninterrupted until completion. The screen and casing were carefully cleaned with unchlorinated water prior to installation in the hole. Solid casing extended from the screen to approximately 2.5 ft above land surface.

It was assumed that the hydraulic gradient at each site was controlled by topography. Piezometers were located and installed in areas to verify this assumption. After the water-level elevations at each site were measured and surveyed (against other piezometers at the same site and not referenced against MSL), the piezometer casings and screens were removed. Each boring was grouted from the top of the collapsed portion to ground level using a grout mixture of 20 parts Portland cement to 1 part bentonite mixed with unchlorinated water. At many sites the monitor wells were installed near the former piezometer locations because the calculations for optimum ground water flow direction indicated these locations were appropriate.

Water-level measurements at the piezometers were obtained using the USGS wetted-tape method, which is accurate to 0.01 ft. The tape was rinsed with water from the approved source, wiped with a fresh cloth, and allowed to air dry between consecutive water-level measurements. At each site, static water-level measurements were obtained in all piezometers within a 1-hour period to ensure consistency among the measurements.

The relative elevation of the ground surface at each piezometer was determined by land surveying. However, piezometer elevations at individual sites were not related to those at other sites.

3.2.3 MONITOR WELL INSTALLATION AND SAMPLING

Twenty, 4-inch-diameter, ground water monitor wells were installed at six sites on MAFB. Total footage installed was 535.3 ft, consisting of 240.3 ft of casing and 295 ft of slotted screen. Three monitor wells each were installed at Sites 3, 4, 6, and 7, and four monitor wells each were installed at Sites 1 and 5. The sample numbering system used for the monitor wells is described in App. F.

Borings for all ground water monitor wells were completed using a Mobile B-53 drilling unit equipped with a hollow-stem auger with a 6-inch inside diameter and a 12-inch outside diameter. The unit was operated without water, except when required by soil conditions ["Running Sand" encountered when augering below the water table in sand and gravel units (consisting of coarse, unconsolidated, unlithified materials) required that approved drilling water be maintained in the auger to inhibit the entry of materials when the bottom plug was removed to collect split-spoon samples]. The 4-inch PVC well pipe and screen were installed through the center of the hollow drill stem and positioned at the appropriate depths. As the auger was withdrawn from the hole, the annular space was backfilled with clean silica sand. This technique prevented collapse of the borehole that could have occurred had the auger been removed from the hole first and the well pipe introduced from the top of the hole.

The augers were occasionally flushed out using a rotary bit and nonchlorinated water before the well casing and screen could be installed. The volume of drilling water lost to the formation during this procedure was recorded in the log.

Subsurface materials encountered during drilling consisted of unconsolidated gravels, sands, silts, and clays. As a result, the boreholes tended to collapse when the boring reached the water table, as described previously.

Split-spoon soil sampling was performed through the total depth of each borehole. Samples were collected every 2.5 ft for the first 10 ft and every 5 ft thereafter. Intact split-spoon soil samples were sectioned and stored in labeled glass jars that were kept in cooled, insulated containers in the field and en route to ESE's laboratory. Each container was marked with the sample depth interval, top and bottom of the sample, date, and time. The split-spoon sampler was cleaned with nonchlorinated water between each sample (i.e., each time a sample was removed from the tube).

The soil samples were retained for potential analysis in case ground water at the site was found to be contaminated. If no contamination was found, soil samples were to be discarded following completion of Phase II.

The total depths of monitor wells and the locations of screened intervals are discussed for each site in Sec. 3.3. Well depths vary from 14 to 40 ft; screened intervals vary from 10 to 20 ft. The ESE Site Geologist maintained regular telephone contact with the Project Manager during the drilling program to make recommendations for well placement when unique hydrogeologic conditions required that well placement or configuration differed from the Work Plan.

Typical monitor well construction in unconsolidated overburden material is shown in Fig. 3.2-1. The placement of the well in the boring was deemed appropriate if the ESE Site Geologist found the soil in the proposed screened interval to be saturated.

The monitor wells were finished in the shallow, unconfined aquifer and were typically 30 ft deep. The wells were constructed of threaded Schedule 40 PVC pipe, with 0.010-inch slotted screen in the bottom 10- to 20-ft interval. A filter pack was placed in the annular space between the screen and the borehole, a bentonite clay seal on the top of the filter pack, and grout in the upper annular space to the surface. The bottoms of the wells were capped before the screens were installed, and vented caps were installed at the tops of monitor wells. Protective steel casings and locking caps were installed over the risers for security.

If the screened interval consisted of clean sand or gravel, the formation was allowed to collapse around the well screen and filter material was added above the cave-in to the appropriate depth. If not, filter material was installed around the entire length and to the top of the well screen. Nonchlorinated water was added, as necessary, to assure that the bentonite pellets expanded to form a tight seal.

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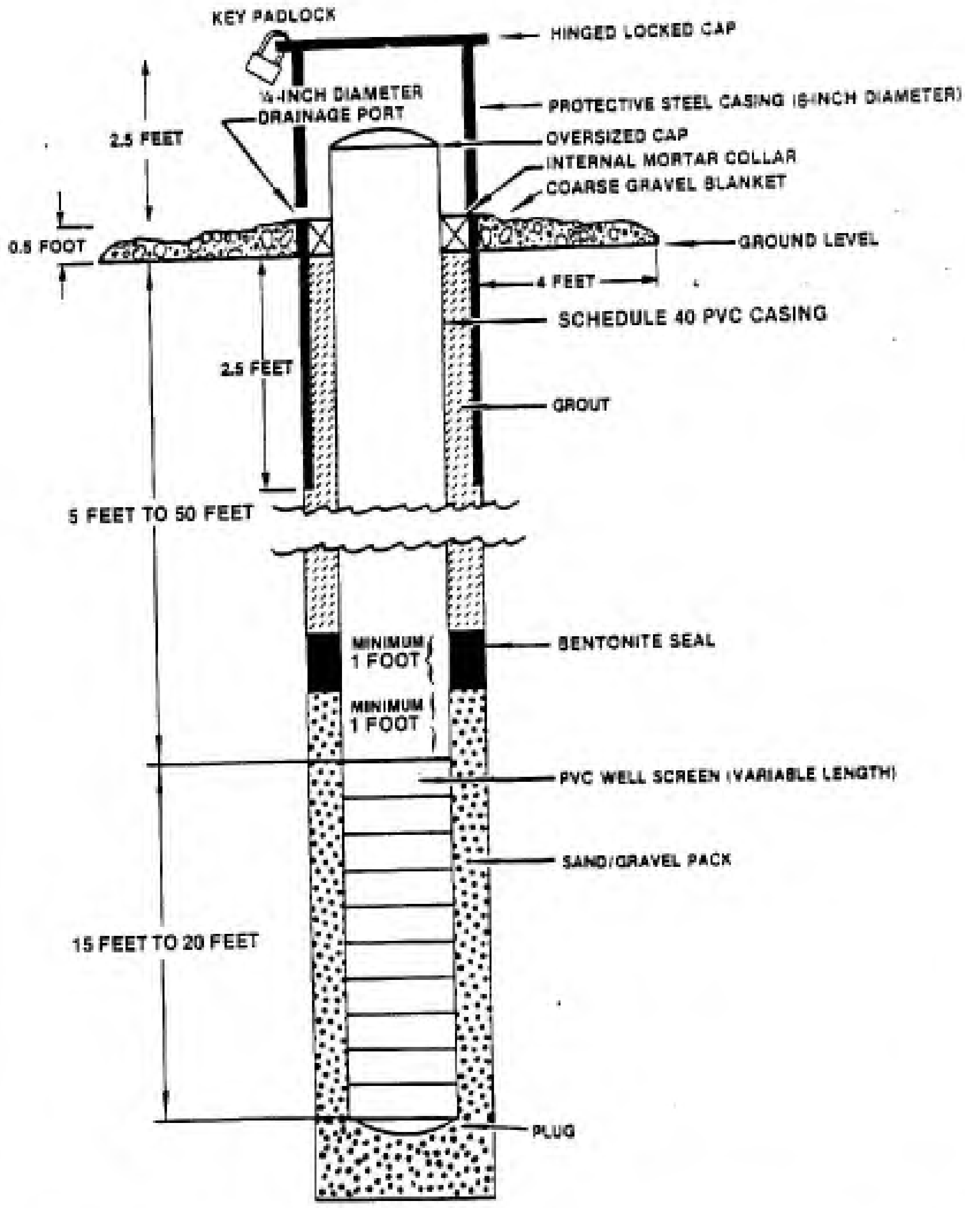

NOT TO SCALE

SOURCE: ESE, 1985.

Figure 3.2-1 TYPICAL MONITOR WELL CONSTRUCTION	INSTALLATION RESTORATION PROGRAM Maxwell Air Force Base

The bentonite-cement grout seal extended from the top of the bentonite seal to land surface. Grouting was performed in the presence of the ESE Site Geologist. The grout was pumped into the annular space under pressure using a tremie pipe placed at the top of the bentonite seal to ensure a continuous grout seal. The aboveground protective casing was also sealed in the grout, identifying marks were inscribed on the casing, and protective posts were installed around the well.

Coarse gravel, 0.5 ft thick and extending 4 ft radially from the protective casing, was placed on the ground surface at each monitor well.

The following materials were used in well construction.

1. Casing used in the well was threaded PVC Schedule 40, 4-inch nominal inside diameter. The well screen was factory slotted, with a slot width of 0.010 inch. An oversized slip-on cap was installed on each well.
2. The grout mixture was 10 parts Portland cement to one-half part bentonite (by weight), with a maximum of 10 gallons (gal) of nonchlorinated water per 94-pound (lb) bag of cement. Bentonite was added after mixing the cement and water.
3. Commercially available bentonite pellets manufactured specifically for well-sealing purposes were used in the seal.
4. Sand used in the filter envelope around the well screen was selected for compatibility with the screen slot size and aquifer materials.
5. A 6-inch aboveground protective steel casing was installed at each well, extending approximately 2.5 ft above land surface and seated 2.5 ft into the well seal grout. This casing was vented to the atmosphere via a lockable, hinged cap, which will prevent entry of water but is not airtight. This, and the oversized cap on the well, allows the well to remain at atmospheric pressure. A 0.25-inch-diameter drainage port was installed, centered 0.125 inch above the level of the internal monitor collar. Padlocks which open with the same key were used on all wells.

All well development data were recorded. Well development was performed as soon as possible after well installation.

Wells were developed by pumping with an electric, submersible pump (or a gasoline-powered, centrifugal pump) or by bailing with a PVC bailer until the water was as clear and the well as free of sediment as practical. Bailers were used for wells with yields that could not sustain the flow rate of the submersible or centrifugal pumps. No water was added to the wells during development. The pump or bailer was rinsed with the nonchlorinated drilling water and allowed to air dry prior to use in the next well. Well development data were recorded in the field in a tabular format and included the following:

1. Well identification;
2. Date of well installation;
3. Date of development;
4. Static water level before and 24 consecutive hours after development;
5. Quantity of water lost during drilling and fluid purging, if water was used;
6. Quantity of standing water in well and annulus (30-percent porosity assumed for calculation) prior to development;
7. Specific conductivity, temperature, and pH measurements were taken and recorded at the start, twice during, and at the conclusion of development. Calibration standards were run prior to, during, and after each day's operation in the field;
8. Depth from top of well casing to bottom of well;
9. Screen length;
10. Depth from top of well casing to top of sediment inside well, before and after development;
11. Physical character of removed water, including changes during development in clarity, color, particulates, and odor;
12. Type and size/capacity of pump and/or bailer used;
13. Height of well casing above ground surface; and
14. Quantity of water removed and time for removal.

Wells were allowed to equilibrate for at least 48 hours after installation of the protective casing and were developed until the following conditions were met.

1. The well water was clear to the unaided eye.
2. The sediment thickness remaining in the well was less than 5 percent of the screen length.
3. A volume of water was removed from the well equal to at least five well volumes (including the saturated filter material in the annulus) and a volume equal to that lost during drilling.

A 1-pint sample of the last water obtained during development at each well was obtained and stored in an insulated container chilled to approximately 4 degrees Celsius (°C). This water was examined by the onsite geologist to determine if the well had been sufficiently developed to be used as a monitoring well. The cap and all internal components of the well casing above the water table were rinsed with well water to remove all traces of soil, sediment, and cuttings. This washing was conducted before and/or during development.

All water-level measurements at monitor wells were obtained using the USGS wetted-tape method, which is accurate to 0.01 ft. The tape was rinsed with water from the approved source, wiped with a fresh cloth, and allowed to air dry between consecutive water-level measurements. At least one complete set of static water-level measurements for all wells was made over a single, consecutive 10-hour period.

Each monitor well was surveyed by a registered land surveyor to establish its map coordinates using the Alabama Plane Coordinate System, Western Zone, to an accuracy of at least one in 10 thousand (1:10,000). Additionally, elevations for the natural ground surface at each sampling well and the top of the PVC casing were determined to within 0.01 ft using the vertical datum established by USGS. The surveyor plotted the elevation of each monitor well (top of the PVC pipes) and its map coordinates on the MAFB base map (see App. G).

Ground water sampling began at MAFB after the new monitor wells had been allowed to reach equilibrium. The following procedures were performed during sampling.

1. The depth to water, total well depth, and length of the riser aboveground were measured.
2. During the initial sampling of each monitor well, the depth to the water/sediment interface in the well was measured and recorded.
3. Typically, five volumes of the water in the screen, well casing, and saturated annulus were purged by pumping or bailing before sampling. Fine soils at some of the well locations caused slow recharge rates. In such cases, reduction of well purging to less than five volumes was considered if excessive time would have elapsed attempting to collect one or two samples from low-yielding wells. The amount of fluid purged was measured and recorded.
4. a. All wells were sampled using bailers constructed of inert materials (PVC). No glue was used in the construction of these bailers.
   b. A dedicated bailer was supplied for each well and remained in the well after sampling. Each bailer was etched with the number of the sampling well.
   c. The pump and the hoses used for purging were thoroughly cleaned between sampling at each well using the nonchlorinated drilling water.
   d. After purging, each monitor well was sampled as soon as sufficient water returned to minimize the contact time between the water sample and the well casing.
   e. During sampling, all equipment was placed on polyethylene sheeting to avoid contact with the soil.
5. Conductivity, pH, and temperature were measured before sampling.

The following data were recorded in a logbook for each well:

1. Well number;
2. Date;

3. Time;
4. Static water level;
5. Depth of well;
6. Number of bailer volumes removed, if applicable;
7. Pumping rate, if applicable;
8. Time of pumping, if applicable;
9. Drawdown water level;
10. _In situ_ water quality measurements such as pH, specific conductance, and temperature;
11. Fractions sampled and preservatives;
12. Weather conditions and/or miscellaneous observations; and
13. Signature of sampler and date signed.

Each sample was labeled for identification by laboratory personnel. The sample label included the project number, a unique sample number, time and date sampled, and sampler's initials. All samples were identified with non-water-soluble ink on ESE's standard preprinted and prenumbered labels immediately after collection. Information concerning preservation methods, sample matrix, and sample location number was included on the labels. Samples were shipped in coolers and were chilled to approximately 4°C from time of sample collection until analysis.

3.2.4 DRILLING LOGS AND BORING PROCEDURES

Before borings were drilled for installation of the piezometers and monitor wells, the ESE Site Geologist reviewed the proposed drilling locations with MAFB Civil Engineering to avoid drilling into buried utilities such as cables or pipes. Based on this review, MAFB Civil Engineering approved all locations and issued appropriate drilling permits. The ESE Site Geologist supervised the drilling and installation of all piezometers and monitor wells, maintained drilling logs, obtained soil samples, and observed the grouting of abandoned borings.

Drilling was performed by Law Engineering Testing Company (LAW) as subcontractor to ESE. In addition to drilling, LAW was responsible for the following requirements:

1. Arrangement of access to all sites where drilling was proposed;
2. Steam cleaning of all drilling equipment before entrance to MAFB;
3. Arrangement with MAFB personnel for the storage of all well-drilling equipment and well-installation supplies in a clean and secure area; clean, unused equipment and supplies were temporarily stored on sheets of disposable polyethylene at each drilling location to eliminate contamination from the native soils;
4. Obtaining unchlorinated water for drilling and well installation; portable tubs were used to hold drilling water during circulation;
5. Recovery of all drill cuttings and disposal in the onbase hardfill area; and
6. Cleaning of drilling tools between borings with unchlorinated water to remove all traces of soil, rock, or other potential contaminants.

The ESE Site Geologist maintained drilling logs in a field notebook for all boreholes. The logs comprised a record of soil characteristics, lithology, piezometer and well construction, and personnel. Each boring was logged in the field notebook as it was being drilled. The following data were recorded in the boring logs:

1. Depths, recorded in feet;
2. Soil descriptions prepared in the field by the ESE Site Geologist in accordance with the Unified Soil Classification System;
3. Descriptions of split-spoon samples, including:
   a. Classification,
   b. Unified Soil Classification System symbol,
   c. Secondary components and estimated percentage,
   d. Color,
   e. Plasticity,

f. Consistency (cohesive soil) or density (noncohesive soil),
g. Moisture content, and
h. Texture, fabric, and bedding;

4. Descriptions of cuttings, including basic classification, secondary components, and other apparent parameters;
5. Percent of secondary soil constituents, based on visual estimates;
6. Length of sample recovered in each sampled interval for split-spoon samples;
7. Blow counts, hammer weight, and length of fall for split-spoon samples;
8. Estimated interval for each sample;
9. Depth to water as first encountered during drilling and method of determination; distinct water-bearing zones (if any) below the first zone;
10. When drilling fluid was used, fluid losses, quantities lost, and the intervals over which they occurred;
11. Type of drilling equipment used, including rod size, bit type, pump type, rig manufacturer, and model number;
12. Drilling sequence;
13. Special problems;
14. Start and completion dates of all borings; and
15. Lithologic boundaries.

3.2.5 SURFACE WATER SAMPLING

Before surface water samples were collected, the following site-specific data were recorded in the field notebook:

1. Site number or location;
2. Date;
3. Time (24-hour system);
4. Antecedent weather conditions, if known;
5. *In situ* parameter measurements (temperature, conductivity, and pH);
6. Fractions and preservatives;
7. Any other pertinent observations (e.g., odor or fish); and
8. Signature of sampler and date signed.

At the conclusion of each workday onsite, the Sampling Team Leader or designee reviewed each page of the notebook for errors and omissions before dating and signing each reviewed page. All field instrument calibrations were recorded in a designated portion of the notebook at the time of the calibration. Instruments were recalibrated as necessary.

Each surface water sample was collected in a manner that minimized aeration and prevented oxidation of reduced compounds in the sample. The container was filled until it overflowed, and caution was taken to avoid air bubbles. Sample containers were tightly capped. Surface water sampling procedures and precautions for the volatile fraction collection were identical to the ground water procedures.

Each sample was labeled for identification by laboratory personnel. The sample label included the project number, a unique sample number, time and date sampled, and sampler's initials. All samples were identified with non-water-soluble ink on ESE's standard preprinted and prenumbered labels immediately after collection. Information concerning preservation methods, sample matrix, and sample location number was included on the labels. Samples were shipped in coolers and chilled to approximately 4°C from time of sample collection until analysis.

3.2.6 STREAM SEDIMENT SAMPLING

Before sediment samples were collected, the following site-specific data were recorded in the field notebook:

1. Site number or location;
2. Date;
3. Time (24-hour system);
4. Antecedent weather conditions, if known;
5. *In situ* parameter measurements (temperature, conductivity, and pH);
6. Fractions and preservatives;
7. Any other pertinent observations (e.g., odor or fish); and
8. Signature of sampler and date signed.

At the conclusion of each workday onsite, the Sampling Team Leader or designee reviewed each page of the notebook for errors and omissions before dating and signing each reviewed page. All field instrument calibrations were recorded in a designated portion of the notebook at the time of the calibration. Instruments were recalibrated as necessary.

Samples were collected in a manner that minimized aeration and prevented oxidation of reduced compounds in the sample. Each sample was labeled for identification by laboratory personnel. The sample label included the project number, a unique sample number, time and date sampled, and sampler's initials. All samples were identified with non-water-soluble ink on ESE's standard preprinted and prenumbered labels immediately after collection. Information concerning preservation methods, sample matrix, and sample location number was included on the labels. Samples were shipped in coolers and chilled to approximately 4°C from the time of sample collection until analysis.

3.3 IMPLEMENTATION OF FIELD PROGRAM

The actual work completed at each of the seven sites on MAFB is described. Site 2 is actually a collection of points onbase where the surface water and stream sediment samples were collected, and Site 1 and Sites 3 through 7 were those locations where the ground water quality was investigated through the installation and sampling of monitor wells. A description of the subsurface geology is included for those sites where well borings were made.

3.3.1 SITE 1--ELECTROPLATING WASTE DISPOSAL AREAS

The objectives of the investigations at Site 1 were to:

1. Determine the physical extent of the disposal area and, if possible, the locations of the drums;
2. Determine if the hydrogeologic conditions in the area adjacent to the site are conducive to contaminant migration; and
3. Determine if contaminants are migrating from the area.

A detailed geophysical survey incorporating magnetometer and EM techniques was completed at Site 1 to delineate the horizontal extent of the burial area, to confirm the presence of the buried drums, and to locate any leachate plumes emanating from the site. The geophysical tracings for Site 1 are located in App. H.

The results of the survey did not conclusively indicate that the drums of electroplating waste were buried in the area. The results did indicate the locations of many ferrometallic objects in the vicinity of the reported burial area. The monitoring well sites were selected based on the results of this survey and the information obtained from the piezometers.

Four piezometers were installed at Site 1 to determine the configuration of the water table and predict the direction of shallow ground water flow at the site. The locations of the four piezometers are depicted in Fig. 3.3-1. The piezometer depths, screened intervals, relative casing elevations, absolute water levels, and relative water levels are given in Table 3.3-1. Borehole lithologies are described in the piezometer drilling logs located in App. I. Piezometer water levels suggested that ground water flow at Site 1 was from east to west and monitor well locations were selected accordingly.

Four monitor wells were installed at Site 1 to evaluate the quality of the shallow ground water in the vicinity and to determine whether contaminants were migrating from the site. The locations of the four wells are depicted in Fig. 3.3-1. The monitor well depths, screened intervals, lithology of the screened intervals, depth to water, and number of split-spoon soil samples collected are given in Table 3.3-2. The depth to water for all monitor wells installed for this study is presented in App. J. Individual borehole lithologies are described in detail on the monitor well drilling logs in App. K.

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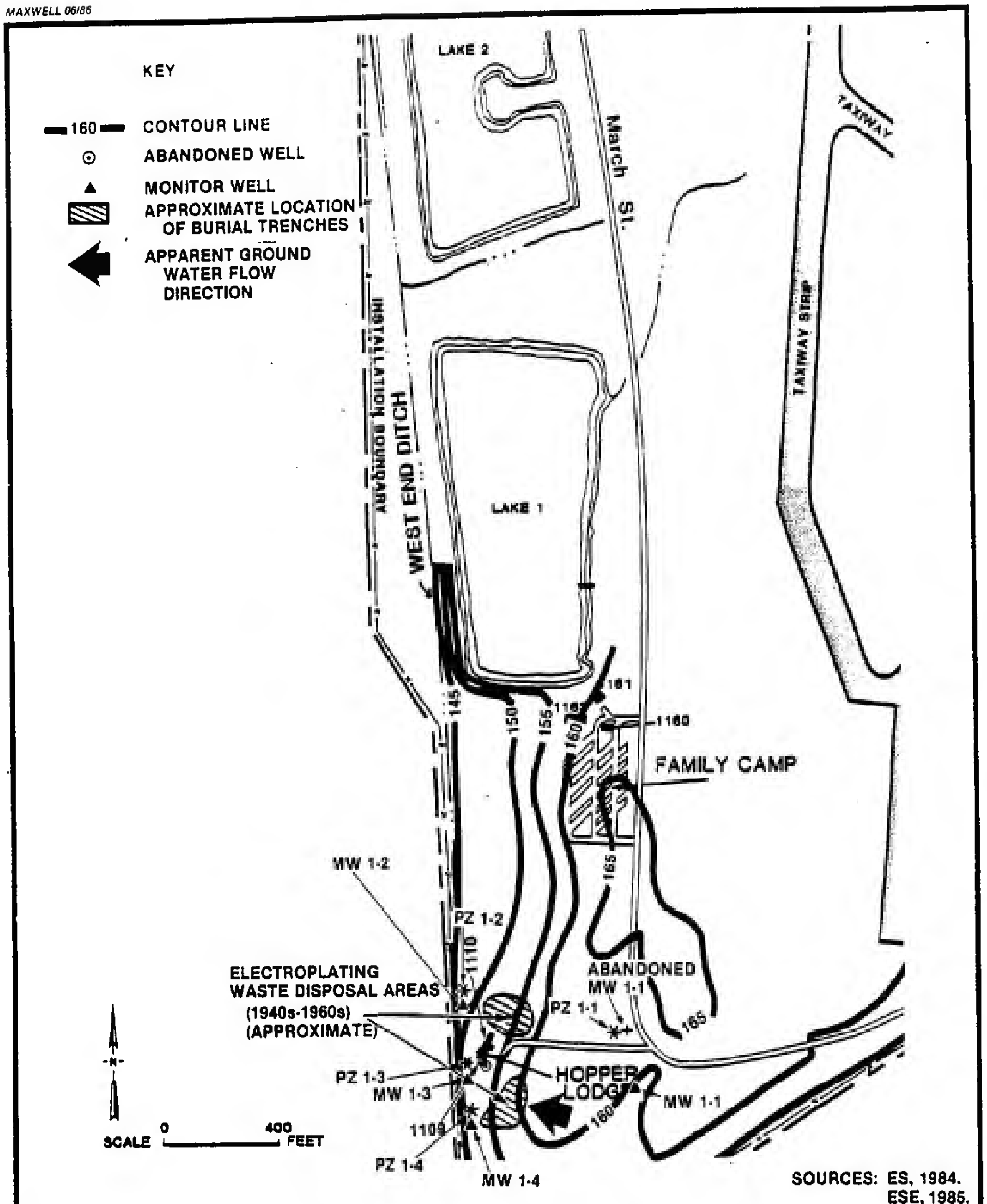

Figure 3.3-1
LOCATIONS OF PIEZOMETERS AND MONITOR WELLS AT SITE 1, ELECTRO-PLATING WASTE DISPOSAL AREAS

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Maxwell Air Force Base

Table 3.3-1. Site 1 Piezometers

Piezometer Number	Depth (ft)	Screened Interval (ft)	Relative Casing Elevation (ft)	Water Depth (ft)	Relative Water Elevation (ft)
PZ1-1	24	14 to 24	0	19.15	0
PZ1-2	24	14 to 24	-13.82	6.00	-0.67
PZ1-3	15	5 to 15	-13.16	7.06	-1.07
PZ1-4	16	6 to 16	-14.09	6.02	-0.96

Source: ESE, 1985.

Table 3.3-2. Site 1 Monitor Wells

Well Number	Depth (ft)	Screened Interval (ft)	Depth to Water* (ft)	Soil Samples Collected	Screened Interval Lithology
MW1-1	25	15 to 25	16.2	6	Gravelly quartz sand
MW1-2	14	4 to 14	5.5	6	Silty, clayey quartz sand
MW1-3	22.3	7.3 to 22.3	8.1	6	Gravelly quartz sand
MW1-4	21.5	6.5 to 21.5	7.4	7	Gravelly quartz sand

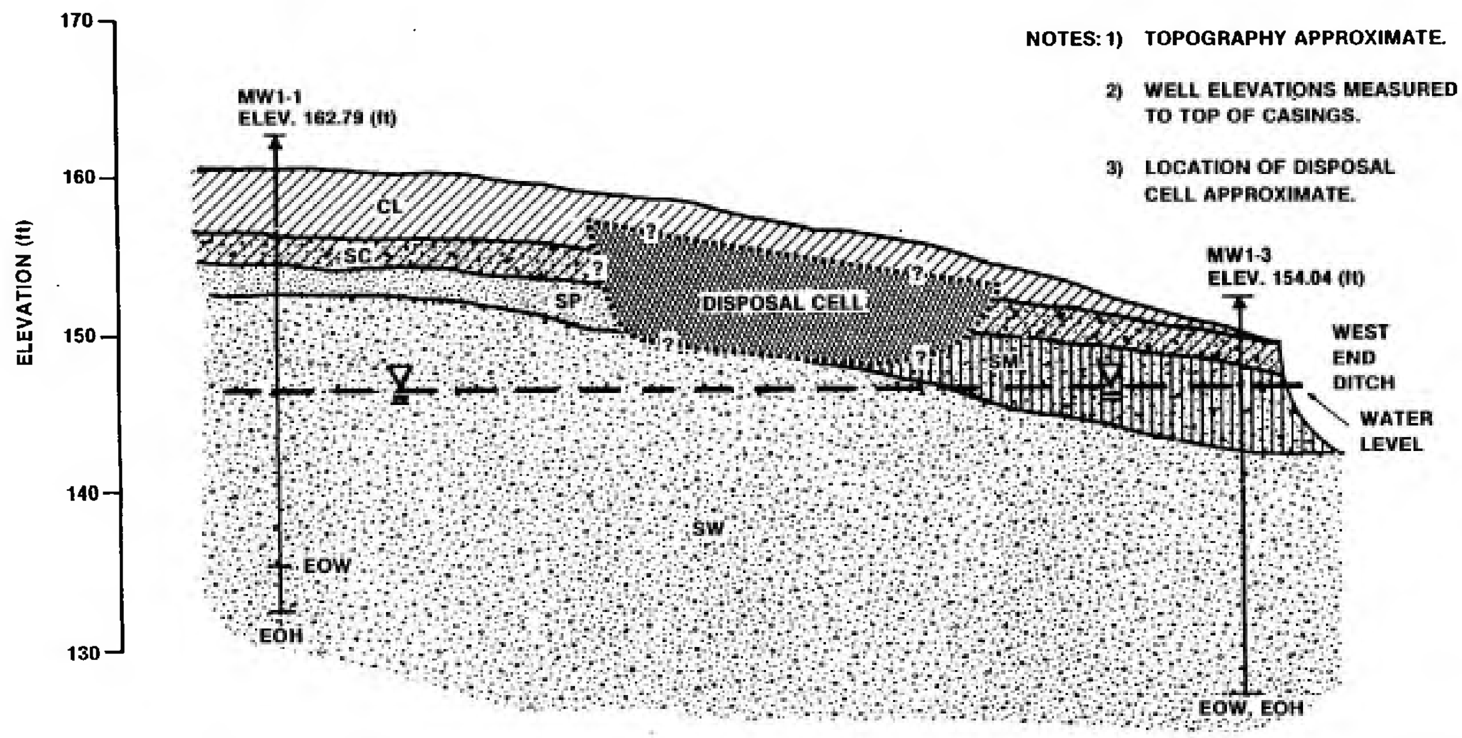
*Measured from top of PVC casing.

Source: ESE, 1985.

The soils at Site 1 generally consisted of unconsolidated clays, silts, sands, and gravels through the depths sampled. In most places, the upper 5 to 7 ft were comprised of sandy and silty clays, clayey and silty sands, and clayey silts of varying plasticity and consistency/density. In MW1-2, these soils were underlain by a very plastic, stiff gray clay from 7 to 11 ft deep that maintained a locally perched water body in the overlying silt. Silty and clayey gray to brown sands existed below the clay unit to 15 ft and were underlain by another clay unit of similar character that persisted to a depth of 18 to 19 ft. More shallow water was perched above this second clay in the overlying sands. Beneath the second clay unit was a very dense, poorly graded, slightly clayey, micaceous fine to medium-grained sand, olive in color, that extended to a depth of at least 26.5 ft. The sand held very little recoverable water and seemed almost cemented. The soil below 5 to 7 ft at MW1-1, MW1-3, and MW1-4 was significantly different. The surficial material was underlain by dense, well graded, fine to coarse gravelly sands and sandy gravels that graded from gray in color near the top to yellow and brown at depth. Cobbles exceeded 2 centimeters (cm) in diameter. These sands and gravels were present to at least 25 ft at MW1-1, but at 18 to 24 ft in MW1-3 and MW1-4 graded into the dense, micaceous, olive-colored sand found at the bottom of MW1-2. Depths to ground water at Site 1 varied from approximately 3 ft at MW1-2 to 13.7 ft at MW1-1. A geologic cross section of Site 1 is depicted by Fig. 3.3-2.

Each of the four monitor wells was developed as described in Sec. 3.2.3 of this report. Details of the development effort are available in App. L.

The elevations and horizontal coordinates of each of the wells were determined by a licensed surveyor as described in Sec. 3.2 of this report. The elevation and coordinate values for each well are listed on the map in App. G.



KEY

▽	WATER TABLE
EOW	END OF WELL
EOH	END OF HOLE

SOIL CLASSIFICATION

CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SM	SILTY SANDS, SAND-SILT MIXTURES
SC	CLAYEY SANDS, SAND-CLAY MIXTURES

SOURCE: ESE, 1986.

Figure 3.3-2
GEOLOGIC CROSS-SECTION OF SITE 1, ELECTROPLATING WASTE DISPOSAL SITES.

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MW1-1 through MW1-4 were sampled according to the procedure described in Sec. 3.2.3 of this report. The samples were analyzed for the parameters in List A, Table 3.3-3. Details of the sampling effort are available in App. M.

3.3.2 SITE 3--FPTA NO. 2 AND LANDFILL NO. 3

Site 3 consists of two areas: FPTA No. 2 and Landfill No. 3 (located within the landfill area).

The objectives of the investigations at Site 3 were to:

1. Determine the horizontal extent of Landfill No. 3,
2. Determine if the hydrogeologic conditions in the area adjacent to the site are conducive to contaminant migration, and
3. Determine if contaminants are present in ground waters from the area.

A detailed geophysical survey incorporating magnetometer and electromagnetic techniques was used to delineate the horizontal extent of the disposal area and to determine whether any leachate plumes were emanating from the disposal area or the fire protection training area. The geophysical tracings for Site 3 are located in App. H.

The results of the survey indicated the presence of metallic objects buried in the disposal area. No leachate plumes were detected by the study. The results of the study were used to decide the locations for the monitoring wells.

Three piezometers were installed at Site 3 to determine the configuration of the water table and predict the direction of shallow ground water flow at the site. The locations of the three piezometers are depicted in Fig. 3.3-3. The piezometer depths, screened intervals, relative casing elevations, absolute water levels, and relative water levels are given in Table 3.3-4. Borehole lithologies are described in the piezometer drilling logs located in App. I. Piezometer water levels

Table 3.3-3. List of Analytical Parameters for MAFB Sampling

List A

Copper	Cyanide
Nickel	pH
Cadmium	Total dissolved solids
Chromium	Zinc
Total organic carbon	Phenols

List B

Copper	Cyanide
Nickel	pH
Cadmium	Total dissolved solids
Chromium	Zinc
Total organic carbon	Phenols
Lead	Oil and grease
	Arsenic
	Total organic halogens
	Mercury

List C

Total organic halogens	Oil and grease
Total organic carbon	Nickel
Phenols	Cyanide
pH	Sulfate
Copper	Total dissolved solids
Iron	Zinc

National Interim Primary Drinking Water Standards (selected list)

Arsenic	Lead	Endrin	2,4,5-TP
Barium	Mercury	Lindane	
Cadmium	Nitrate	Methoxychlor	
Chromium	Selenium	Toxaphene	
Fluoride	Silver	2,4-D	

Source: ESE, 1985.

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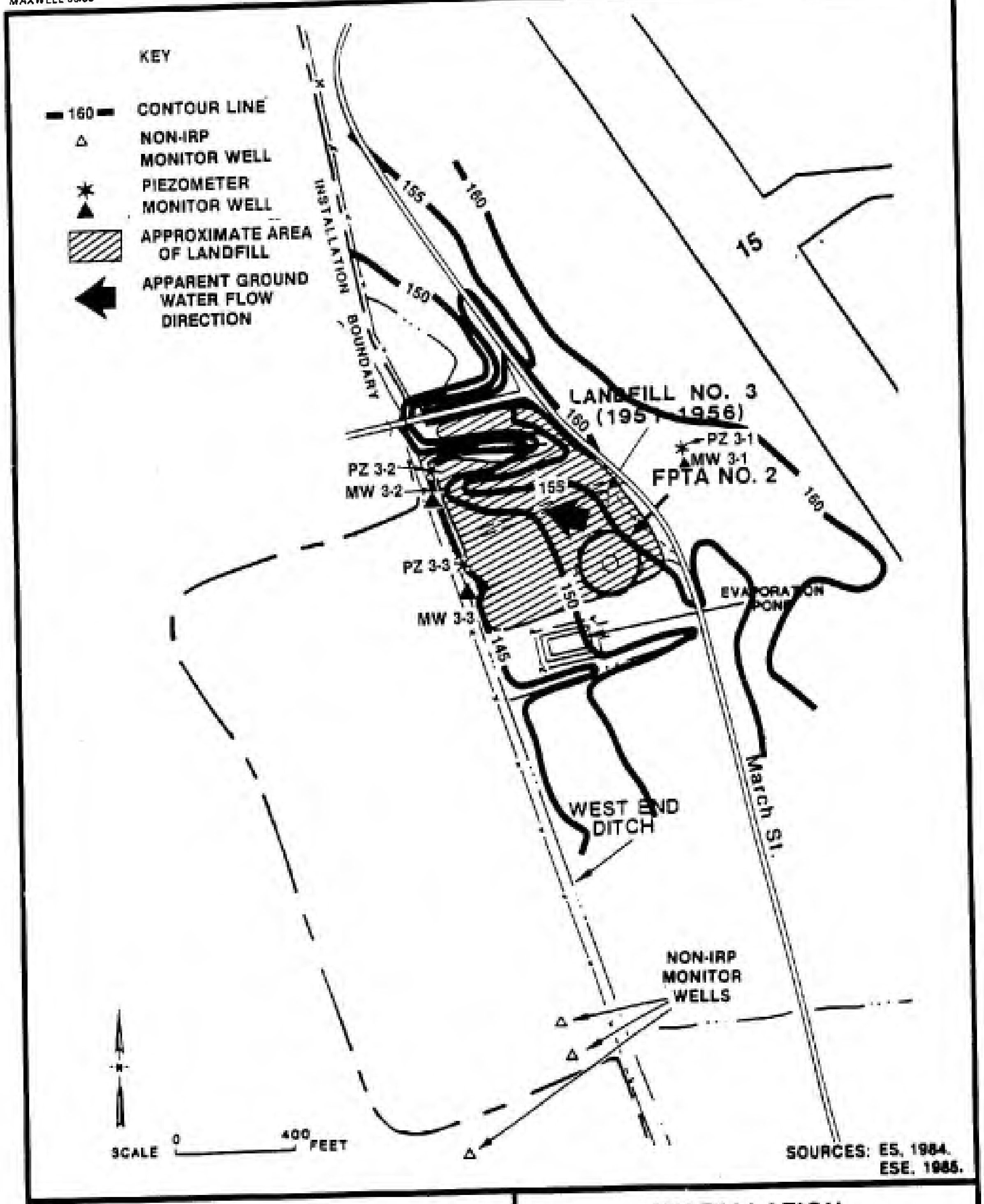

Figure 3.3-3
LOCATIONS OF PIEZOMETERS AND MONITOR WELLS AT SITE 3, FPTA NO. 2, AND LANDFILL NO. 3

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Maxwell Air Force Base

Table 3.3-4. Site 3 Piezometers

Piezometer Number	Depth (ft)	Screened Interval (ft)	Relative Casing Elevation (ft)	Water Depth (ft)	Relative Water Elevation (ft)
PZ3-1	27.7	17.7 to 27.7	0	10.06	0
PZ3-2	21.0	11.0 to 21.0	-8.77	7.79	-6.50
PZ3-3	16.0	6.0 to 16.0	-11.95	4.02	-5.91

Source: ESE, 1985.

suggested that ground water flow at Site 3 was from east to west, and monitor well locations were selected accordingly.

Three monitor wells were installed at Site 3 to evaluate the quality of the shallow ground water in the vicinity and to determine whether contaminants were migrating from the site. The locations of the three wells are depicted in Fig. 3.3-3. The monitor well depths, screened intervals, lithology of the screened intervals, and number of split-spoon soil samples collected are given in Table 3.3-5. Individual borehole lithologies are described in detail on the monitor well drilling logs in App. K.

The soils on the western side of Site 3 were typified by silty clays, clayey silts, and plastic clays to a depth of about 9 ft. Beneath the clays and silts were 4 to 5 ft of silty, fine gray quartz sand and fine to coarse gray quartz sand in varying proportions. The gray sands were underlain by 0 to 3 ft of loose, poorly graded, fine to medium-grained, micaceous, yellow quartz sands, which in turn were underlain by at least 11 ft of very dense, well-graded, fine to coarse, gravelly yellow sands and sandy gravels. Individual cobbles exceeded 5 cm in diameter. Beneath the yellow sands were moderately plastic, stiff, silty, micaceous, dark-olive clay that extended to an unknown depth. The soils on the eastern side of the site differed from those described above in that the surficial clays and silts were significantly thicker. Up to 28 ft of this material, slightly sandy and silty in places, was found above the yellow sands and gravels encountered at about 13 ft to the west. Additionally, a small perched water zone was detected above a very plastic clay at 18 ft. A geologic cross section of Site 3 is depicted in Fig. 3.3-4.

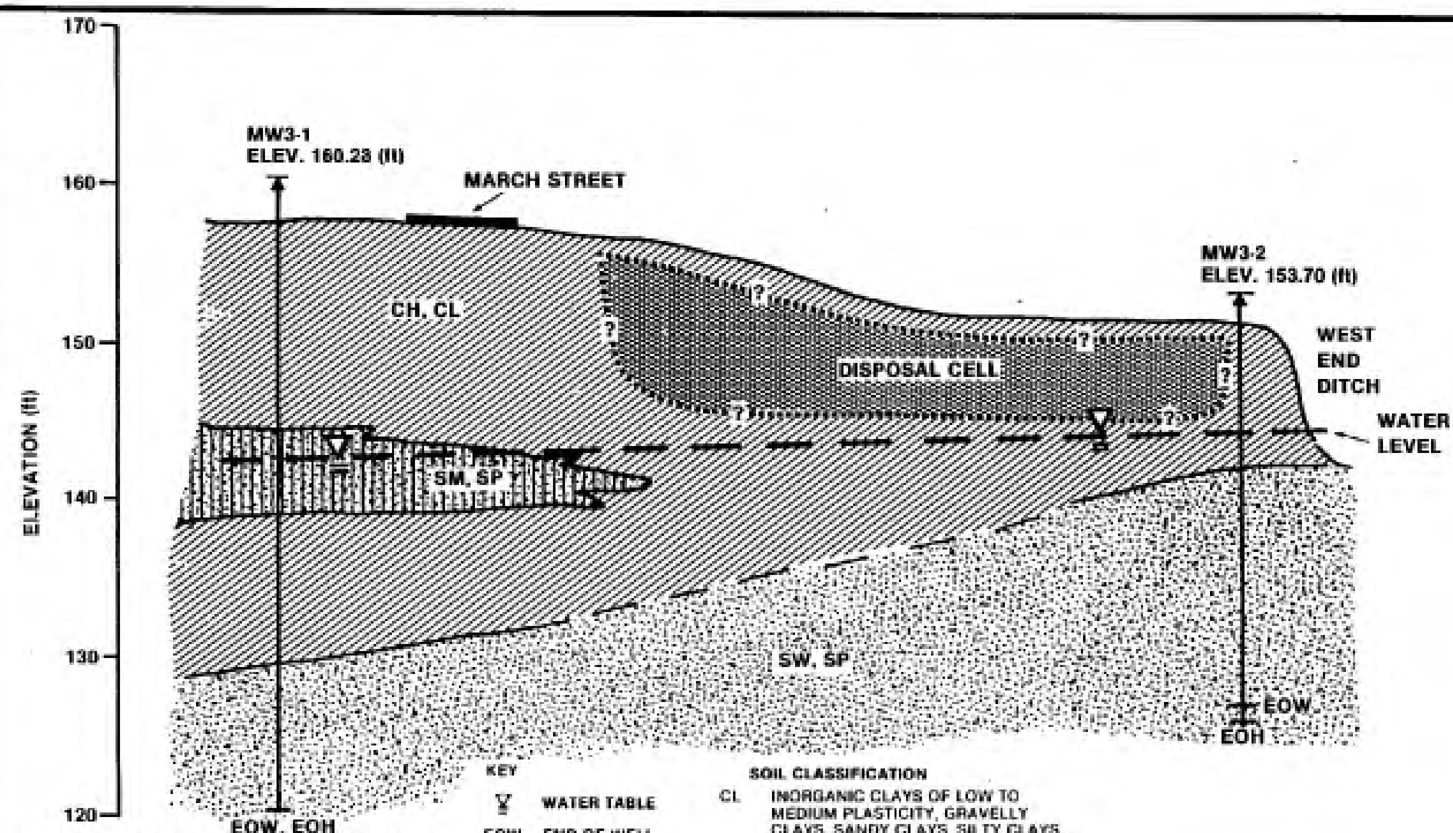
Water depths at Site 3 varied from about 15 ft below ground level at MW3-1 to as shallow as 2.4 ft at MW3-3.

Table 3.3-5. Site 3 Monitor Wells

Well Number	Depth (ft)	Screened Interval (ft)	Depth to Water* (ft)	Soil Samples Collected	Screened Interval Lithology
MW3-1	37.3	27.3 to 37.3	17.7	8	Gravelly quartz sand
MW3-2	24.2	4.2 to 24.2	9.3	6	Fine to medium, micaceous, quartz sand and gravelly quartz sand
MW3-3	25.2	5.2 to 25.2	4.7	6	Silt, fine sand, sandy gravel and gravelly quartz sand

*Measured from top of PVC casing.

Source: ESE, 1985.



NOTES: 1) TOPOGRAPHY APPROXIMATE.

2) WELL ELEVATIONS MEASURED TO TOP OF CASINGS.

3) LOCATION OF DISPOSAL CELL APPROXIMATE.

KEY

▽	WATER TABLE
EOW	END OF WELL
EOH	END OF HOLE

SOIL CLASSIFICATION

CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SM	SILTY SANDS, SAND-SILT MIXTURES

SOURCE: ESE, 1986.

Figure 3.3-4
GEOLOGIC CROSS-SECTION OF SITE 3, FPTA NO. 2, AND LANDFILL NO. 3

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Each of the four monitor wells was developed as described in Sec. 3.2.3 of this report. Details of the development effort are available in App. L.

The elevations and horizontal coordinates of each of the wells were determined by a licensed surveyor, as described in Sec. 3.2.3 of this report. The elevation and coordinate values for each well are listed on the map in App. G.

MW3-1 through MW3-3 were sampled according to the procedure described in Sec. 3.2.3 of this report. The samples were analyzed for the parameters in List C, Table 3.3-3.

3.3.3 SITE 4--FPTA NO. 1

Fire protection training exercises were conducted in the area currently used for disposal of landscape debris and construction rubble (Hardfill Area No. 2), as shown in Fig. 3.3-5.

The objectives of the studies at Site 4 were to:

1. Determine if the hydrogeologic conditions at the site are conducive for contaminant migration, and
2. Determine if contaminants are present in the ground water adjacent to the site.

Three piezometers were installed at Site 4 to determine the configuration of the water table and predict the direction of shallow ground water flow at the site. The locations of the three piezometers are depicted in Fig. 3.3-5. The piezometer depths, screened intervals, relative casing elevations, absolute water levels, and relative water levels are given in Table 3.3-6. Borehole lithologies are described in the piezometer drilling logs located in App. I. Piezometer water levels suggested that ground water flow at Site 4 was from north to south, and monitor well locations were selected accordingly.

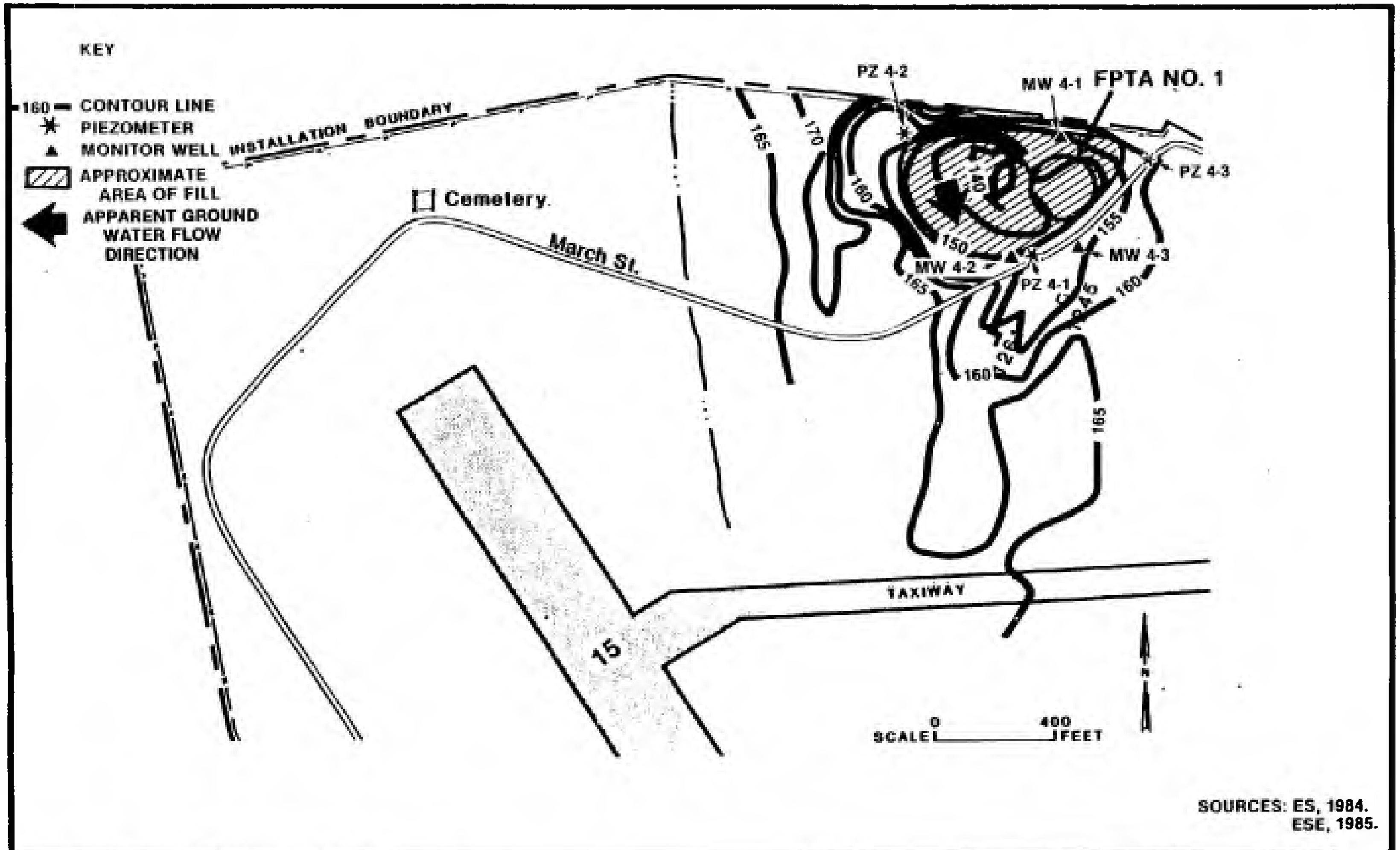

Figure 3.3-5
LOCATIONS OF PIEZOMETERS AND MONITOR WELLS AT SITE 4, FPTA NO. 1

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Maxwell Air Force Base

Table 3.3-6. Site 4 Piezometers

Piezometer Number	Depth (ft)	Screened Interval (ft)	Relative Casing Elevation (ft)	Water Depth (ft)	Relative Water Elevation (ft)
PZ4-1	25	15 to 25	0	22.60	-1.02
PZ4-2	18.8	8.8 to 18.8	-8.23	13.35	0
PZ4-3	26	16 to 26	-3.20	19.24	-0.86

Source: ESE, 1985.

Three monitor wells were installed at Site 4 to evaluate the quality of the shallow ground water in the vicinity and to determine whether contaminants were migrating from the site. The locations of the three wells are depicted in Fig. 3.3-5. The monitor well depths, screened intervals, lithology of the screened intervals, and number of split-spoon soil samples collected are given in Table 3.3-7. Individual borehole lithologies are described in detail on the monitor well drilling logs in App. K.

The surficial soils at Site 4 had been removed at all drilling locations, but a cut in the side of an adjacent hill suggested that the missing soils were 1 to 5 ft of silt and clay underlain by sand and gravel mixtures. The soils actually sampled consisted of dense, well graded, fine to coarse, gravelly quartz sands and sandy gravels, varying from yellow to brown in color, and extending to an undetermined depth. Cobbles exceeded 7 cm in diameter. A geologic cross section of Site 4 is depicted in Fig. 3.3-6.

Ground water levels at Site 4 varied from about 10.9 ft at MW4-3 to 15.8 ft at MW4-1.

Each of the four monitor wells was developed as described in Sec. 3.2.3 of this report. Details of the development effort are presented in App. L.

The elevations and horizontal coordinates of each of the wells were determined by a licensed surveyor, as described in Sec. 3.2.3 of this report. The elevation and coordinate values for each well are listed on the map in App. G.

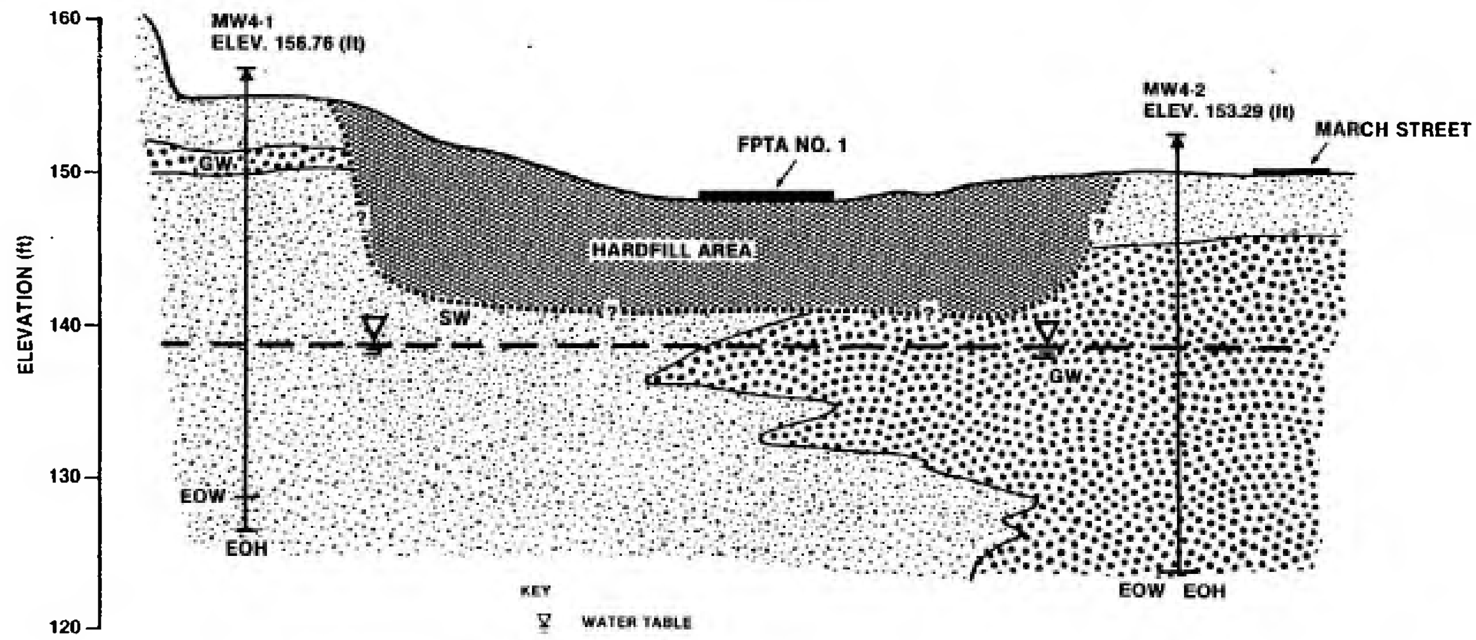
MW4-1 through MW4-3 were sampled according to the procedure described in Sec. 3.2.3 of this report. The samples were analyzed for the parameters in List C, Table 3.3-3.

Table 3.3-7. Site 4 Monitor Wells

Well Number	Depth (ft)	Screened Interval (ft)	Depth to Water* (ft)	Soil Samples Collected	Screened Interval Lithology
MW4-1	26	16 to 26	18.3	6	Gravelly, medium to coarse sand; and gravelly, fine to coarse quartz sand
MW4-2	26	6 to 26	14.2	6	Medium to coarse gravelly sand and gravel and fine to coarse sand
MR4-3	24.5	4.5 to 24.5	13.6	6	Gravelly, fine to coarse sand; medium to coarse sand; gravel

*Measured from top of PVC casing.

Source: ESE, 1985.



KEY

∇	WATER TABLE
EOW	END OF WELL
EOH	END OF HOLE

SOIL CLASSIFICATION

GW	WELL-GRADED GRAVELS, GRAVEL SAND MIXTURES, LITTLE OR NO FINES
SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES

NCTES: 1) TOPOGRAPHY APPROXIMATE.

2) WELL ELEVATIONS MEASURED TO TOP OF CASINGS.

3) LOCATION OF HARDFILL AREA AND FPTA NO. 1 APPROXIMATE.

SOURCE: ESE, 1986.

Figure 3.3-6
GEOLOGC CROSS-SECTION OF SITE 4, FPTA NO. 1

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3.3.4 SITE 5—LANDFILLS 4, 5, AND 6

Landfills 4, 5, and 6 were combined to form Site 5 (see Fig. 3.3-7).

The objectives of the investigations at Site 5 were to:

1. Determine the physical extent of Landfills 4, 5, and 6;
2. Determine if the hydrogeologic conditions in the area are conducive to contaminant migration; and
3. Determine if the contaminants are present in the ground water downgradient of the landfill areas.

A detailed geophysical survey incorporating magnetometer and EM techniques was completed at Site 5 to delineate the aereal extent of the disposal area and to locate any leachate plumes emanating from the site. The geophysical tracings are located in App. H.

The results of the survey indicated the boundaries of the landfill area and the location of metallic objects. No leachate plumes were detected migrating from the landfill area. These data were used to select the locations of the monitor wells.

Three piezometers were installed at Site 5 to determine the configuration of the water table and predict the direction of shallow ground water flow at the site. The locations of the three piezometers are depicted in Fig. 3.3-7. The piezometer depths, screened intervals, relative casing elevations, absolute water levels, and relative water levels are given in Table 3.3-8. Borehole lithologies are described in the piezometer drilling logs located in App. I. Piezometer water levels suggested that ground water flow at Site 5 was from southwest to northeast, and monitor well locations were selected accordingly.

Four monitor wells were installed at Site 5 to evaluate the quality of the shallow ground water in the vicinity and to determine whether contaminants were migrating from the site. The locations of the four wells are depicted in Fig. 3.3-7. The monitor well depths, screened

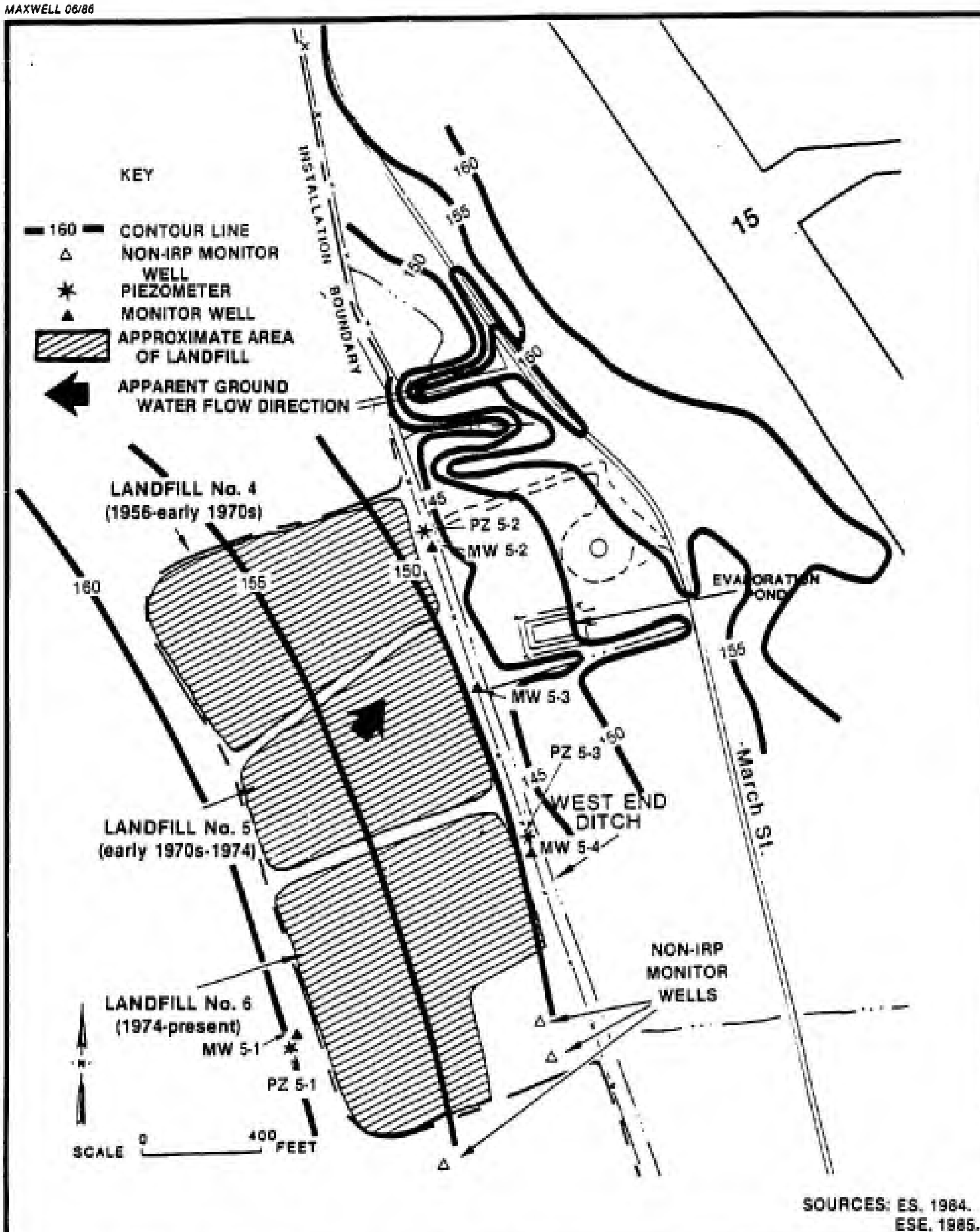

Figure 3.3-7
LOCATIONS OF PIEZOMETERS AND MONITOR WELLS AT SITE 5, LANDFILLS 4, 5, AND 6

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Table 3.3-8. Site 5 Piezometers

Piezometer Number	Depth (ft)	Screened Interval (ft)	Relative Casing Elevation (ft)	Water Depth (ft)	Relative Water Elevation (ft)
PZ5-1	23.5	13.5 to 23.5	0	18.69	0
PZ5-2	19	9 to 19	-12.80	7.44	-1.55
PZ5-3	18.6	8.6 to 18.6	-14.97	4.73	-1.01

Source: ESE, 1985.

intervals, lithology of the screened intervals, and number of split-spoon soil samples collected are given in Table 3.3-9. Individual borehole lithologies are described in detail on the monitor well drilling logs in App. J.

The soils at Site 5 generally consisted of unconsolidated clays, silts, sands, and gravels through the depths sampled. The upper 4 to 12.5 ft of soil were comprised of clayey sands, sandy and silty clays, and inorganic clays of varying plasticity and density/consistency. Beneath these surficial deposits were from 6 to 11 ft of poorly graded, silty, fine sands, slightly clayey and micaceous in places, very coarse in places, usually white to gray, and occasionally brown. This material was underlain by loose, well-graded, fine to coarse, yellow quartz sands, often very gravelly and dense, that extended to undetermined depths. A geologic cross section of Site 5 is depicted in Fig. 3.3-8.

Water depths at Site 5 varied from approximately 1.6 ft below ground level at MW5-4 to about 12.5 ft at MW5-1.

Each of the four monitor wells was developed as described in Sec. 3.2.3 of this report. Details of the development effort are available in App. L.

The elevations and horizontal coordinates of each of the wells were determined by a licensed surveyor, as described in Sec. 3.2.3 of this report. The elevation and coordinate values for each well are listed on the map in App. G.

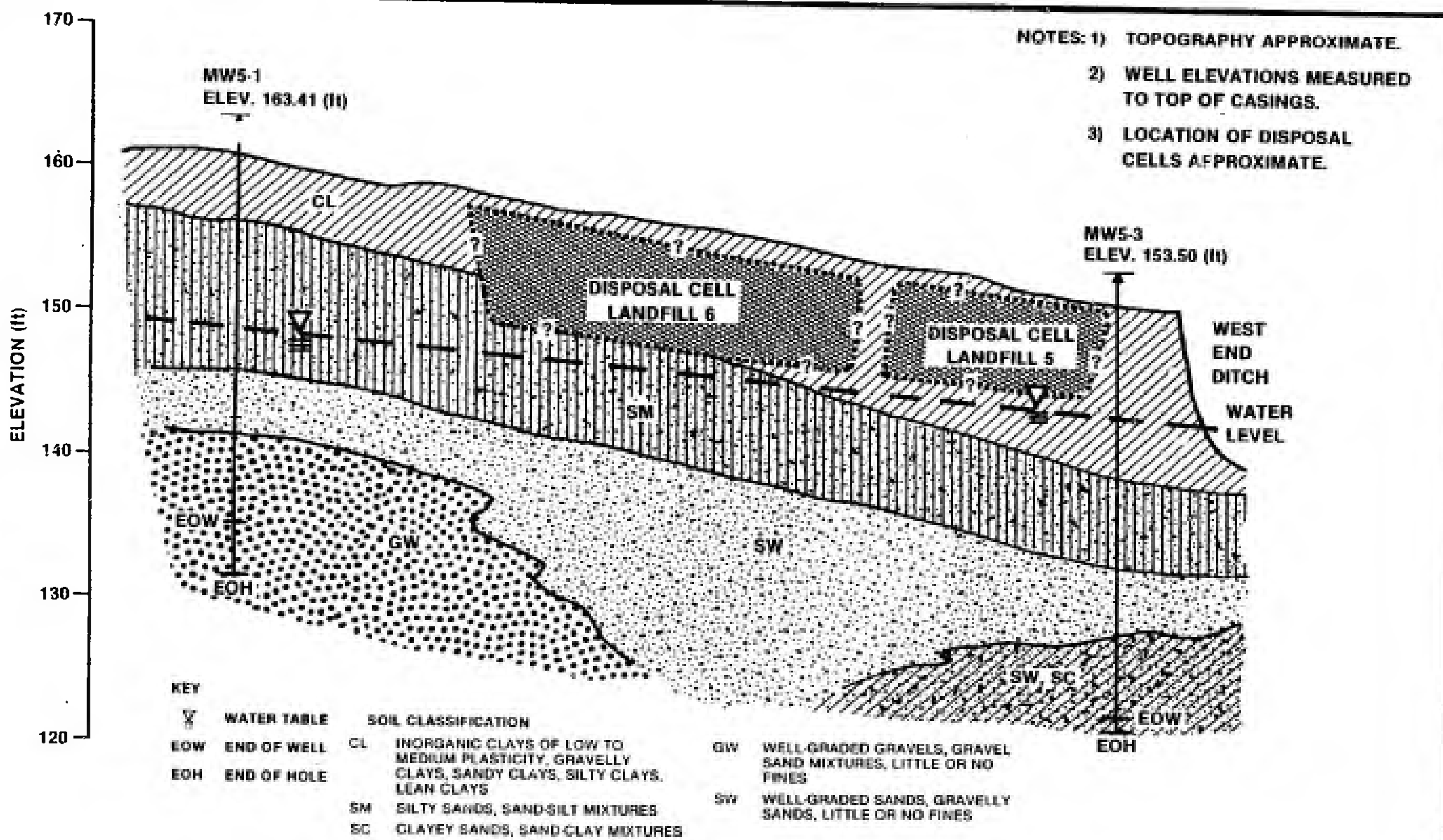
MW5-1 through MW5-4 were sampled according to the procedure described in Sec. 3.2.4 of this report. The samples were analyzed for the parameters in List A, Table 3.3-3. Additionally, one of the former monitor wells at the southeast corner of the present landfill (Landfill 6) was also sampled and analyzed for the same parameters. The other two former monitor wells were broken and could not be sampled.

Table 3.3-9. Site 5 Monitor Wells

Well Number	Depth (ft)	Screened Interval (ft)	Depth to Water* (ft)	Soil Samples Collected	Screened Interval Lithology
MW5-1	25.4	15.4 to 25.4	15.0	6	Gravelly quartz sand
MW5-2	22.5	7.5 to 22.5	8.3	6	Fine to coarse quartz sand and clayey quartz sand
MW5-3	28	8 to 28	9.9	7	Fine to coarse quartz sand; silty, fine to medium quartz sand; and silty, sandy clay
MW5-4	25.5	10.5 to 25.5	4.0	6	Fine to coarse quartz sand and clayey, silty, fine quartz sand

*Measured from top of PVC casing.

Source: ESE, 1985.



SOURCE: ESE, 1986.

Figure 3.3-8
GEOLOGIC CROSS-SECTION OF SITE 5, LANDFILLS 4, 5, AND 6

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3.3.5 SITE 6--C.E. DRUM STORAGE AREA

The C.E. drum storage area has been used for the storage of waste paints and nonignitable mixtures of oil and water.

The objectives of the investigations at Site 6 were to:

1. Determine if the hydrogeologic conditions in the area are conducive to contaminant migration, and
2. Determine if the ground water contains contaminants which could have originated from the storage area.

Three piezometers were installed at Site 6 to determine the configuration of the water table and predict the direction of shallow ground water flow at the site. The locations of the three piezometers are depicted in Fig. 3.3-9. The piezometer depths, screened intervals, relative casing elevations, absolute water levels, and relative water levels are given in Table 3.3-10. Borehole lithologies are described in the piezometer drilling logs located in App. I. Piezometer water levels suggested that shallow ground water flow at Site 6 was from west to east, and monitor well locations were selected accordingly. The very subdued hydraulic gradient measured at the site was a reflection of the almost level topography typical of the immediate area.

Three monitor wells were installed at Site 6 to evaluate the quality of the shallow ground water in the vicinity and to determine whether contaminants were migrating from the site. The locations of the three wells are depicted in Fig. 3.3-9. The monitor well depths, screened intervals, lithology of the screened intervals, and number of split-spoon soil samples collected are given in Table 3.3-11. Individual borehole lithologies are described in detail on the monitor well drilling logs in App. J.

The soils at Site 6 generally consisted of unconsolidated clays, silts, sands, and gravels through the depths sampled. The upper 23 to 25 ft were comprised almost entirely of stiff, moderately plastic, silty,

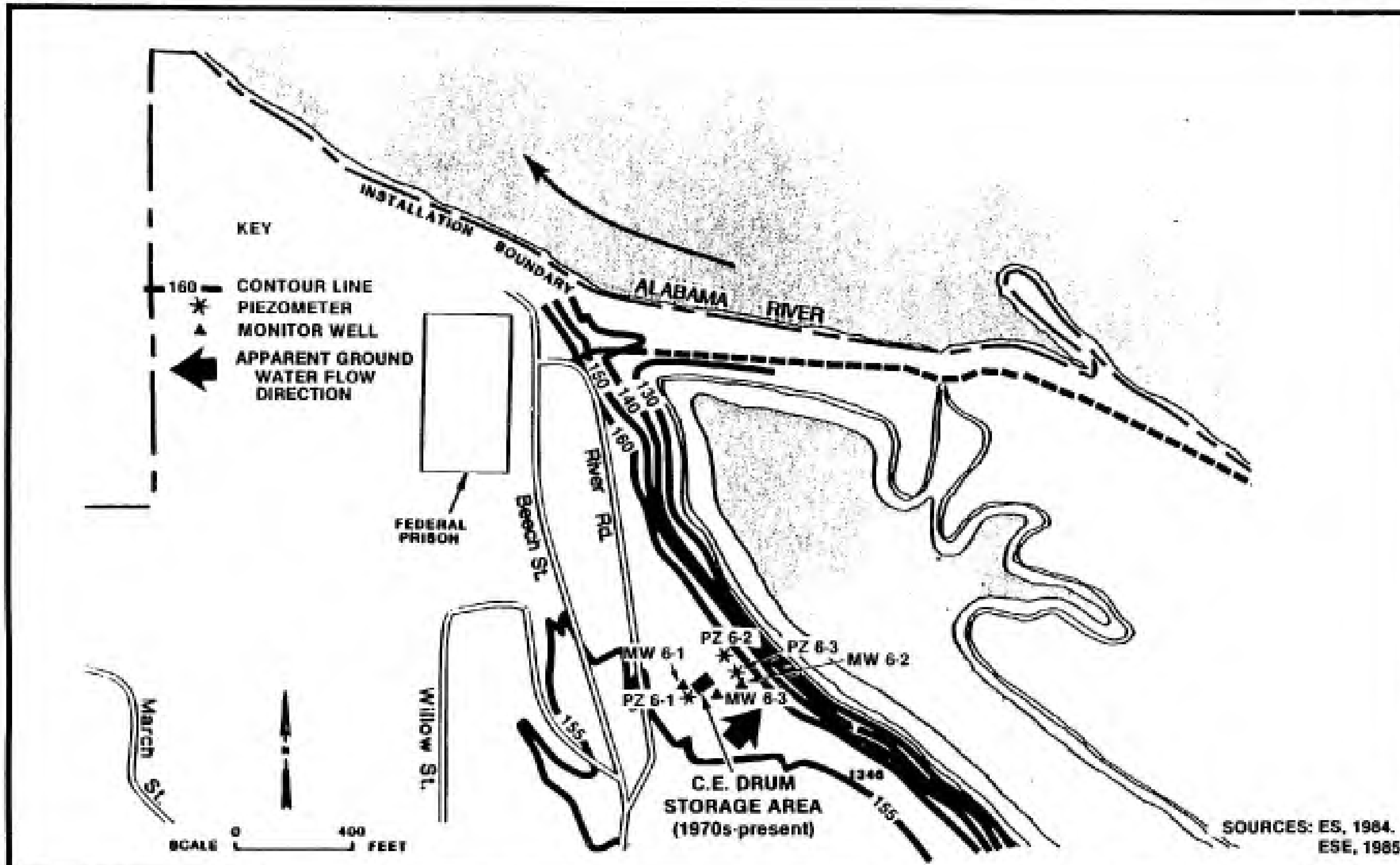

Figure 3.3-9
LOCATIONS OF PIEZOMETERS AND
MONITOR WELLS AT SITE 6, C.E. DRUM STORAGE AREA

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Table 3.3-10. Site 6 Piezometers

Piezometer Number	Depth (ft)	Screened Interval (ft)	Relative Casing Elevation (ft)	Water Depth (ft)	Relative Water Elevation (ft)
PZ6-1	31.5	16.5 to 31.5	0	29.54	0
PZ6-2	38.3	23.3 to 38.3	-0.29	29.30	-0.05
PZ6-3	39	24 to 39	-1.51	28.16	-0.13

Source: ESE, 1985.

Table 3.3-11. Site 6 Monitor Wells

Well Number	Depth (ft)	Screened Interval (ft)	Depth to Water* (ft)	Soil Samples Collected	Screened Interval Lithology
MW6-1	39.6	24.6 to 39.6	29.0	9	Gravelly, fine to coarse quartz sand; silty sand; sandy silt
MW6-2	39.7	24.7 to 39.7	30.0	9	Gravelly, fine to coarse quartz sand; silty sand
MW6-3	40	25 to 40	29.5	9	Gravelly, fine to coarse quartz sand; clayey silt

*Measured from top of PVC casing.

Source: ESE, 1985.

slightly sandy, mottled, gray to brown clays. The clays contained up to 5-percent organic matter in places that existed as small nodules and fracture infillings. Below the clays were 4 to 5.5 ft of silty, micaceous, fine, gray quartz sands and clayey, micaceous gray silts that contained up to 5-percent organic matter. Beneath the fine sands and silts were dense, well-graded, fine to coarse, gravelly, yellow quartz sands that persisted to undetermined depths. Individual cobbles exceeded 2 cm in diameter. A geologic cross section of Site 6 is depicted in Fig. 3.3-10.

The water depth at Site 6 varied from approximately 26.5 ft relative to ground level at MW6-1 to 27.5 ft at MW6-2..

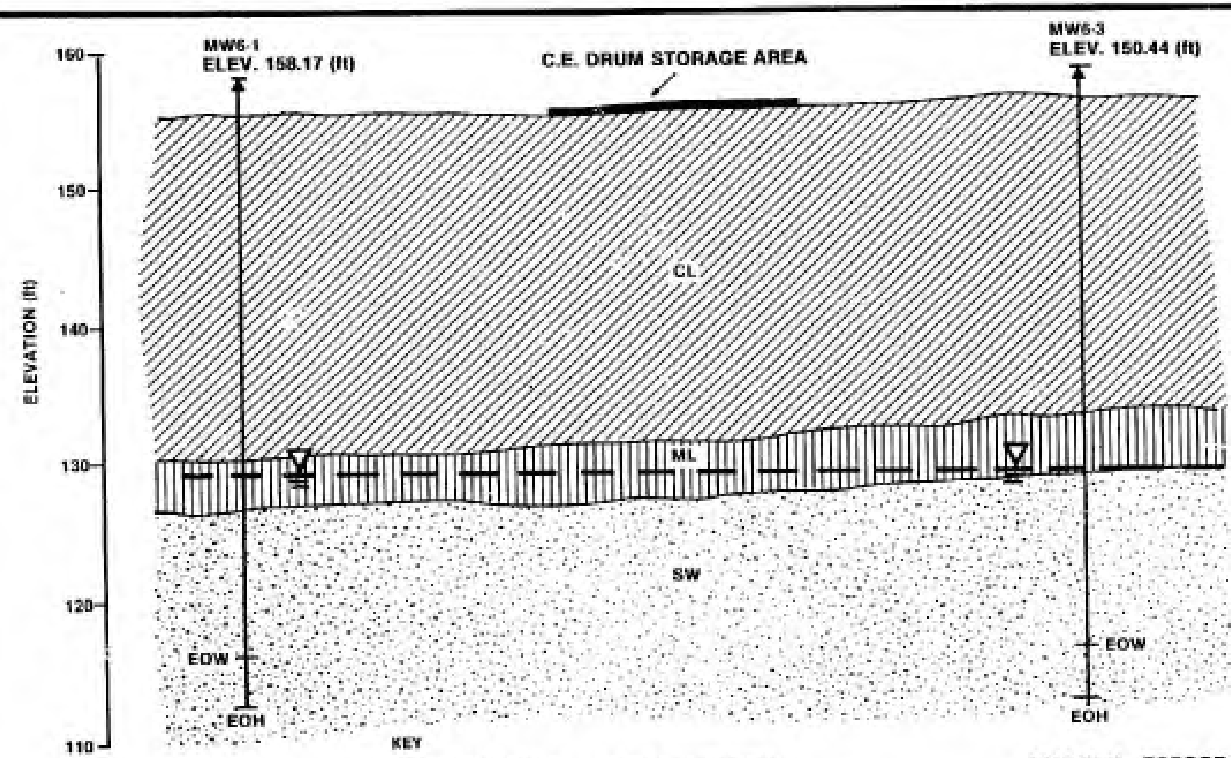
Each of the four monitor wells was developed as described in Sec. 3.2.3 of this report. Details of the development effort are available in App. L.

The elevations and horizontal coordinates of each of the wells were determined by a licensed surveyor, as described in Sec. 3.2.3 of this report. The elevation and coordinate values for each well are listed on the map in App. G.

MW6-1 through MW6-3 were sampled according to the procedure described in Sec. 3.2.4 of this report. The samples were analyzed for the parameters in List C, Table 3.3-3.

3.3.6 SITE 7--LANDFILL NO. 2

During the early 1940s through approximately 1951, the base operated Landfill No. 2 for the disposal of household garbage, base trash (paper, wood, scrap metal), and some industrial nonliquid wastes such as waste paints, paint cans, paint booth sludges, and unrinsed pesticide containers (Fig. 3.3-11).



KEY

∇	WATER TABLE
EOW	END OF WELL
EOH	END OF HOLE

SOIL CLASSIFICATION

SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY SILTS WITH SLIGHT PLASTICITY
CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS

NOTES:
1) TOPOGRAPHY APPROXIMATE.
2) WELL ELEVATIONS MEASURED TO TOP OF CASINGS.
3) LOCATION OF DRUM STORAGE AREA APPROXIMATE.

SOURCE: ESE, 1986.

Figure 3.3-10
GEOLOGIC CROSS-SECTION OF SITE 6,
C.E. DRUM STORAGE AREA

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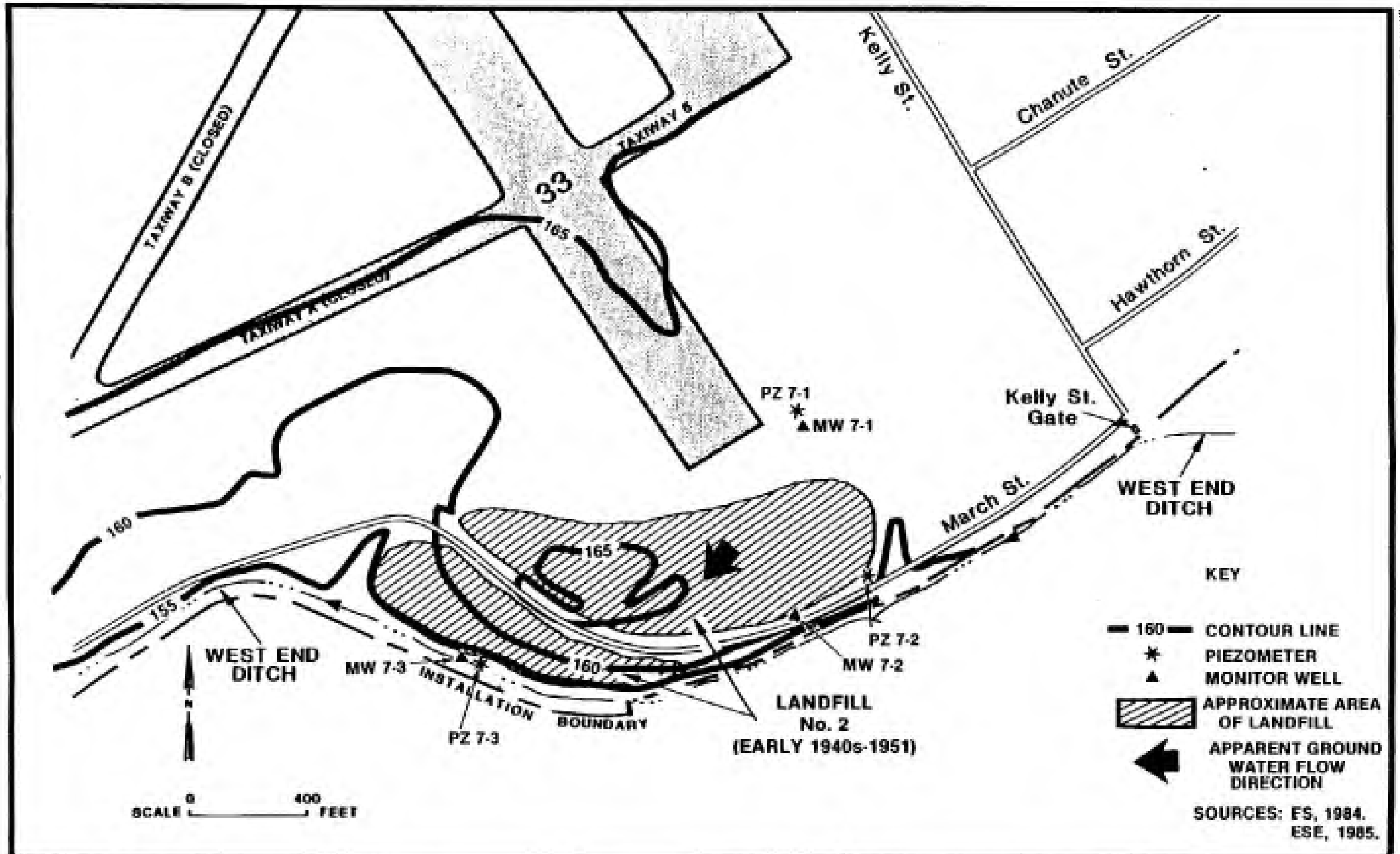

Figure 3.3-11
LOCATIONS OF PIEZOMETERS AND MONITOR WELLS AT SITE 7, LANDFILL NO. 2

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The objectives of the investigations at Site 7 were to:

1. Determine the areal extent of the landfill,
2. Determine if hydrogeologic conditions favor contaminant migration, and
3. Determine if contaminants are present in the ground water.

A detailed geophysical survey incorporating magnetometer and EM techniques was completed to delineate the horizontal extent of the landfill and to locate any leachate plumes emanating from the site. The geophysical tracings are located in App. H.

The results of the survey indicated the boundaries of previous landfilling activities and the locations of buried metallic objects. No leachate plumes were detected migrating from the disposal area. These data were used to select the locations for the monitor wells.

Three piezometers were installed at Site 7 to determine the configuration of the water table and predict the direction of shallow ground water flow at the site. The locations of the three piezometers are depicted in Fig. 3.3-11. The piezometer depths, screened intervals, relative casing elevations, absolute water levels, and relative water levels are given in Table 3.3-12. Borehole lithologies are described in the piezometer drilling logs located in App. I. Piezometer water levels suggested that shallow ground water flow at Site 7 was from east-northeast to west-southwest, and monitor well locations were selected accordingly.

Three monitor wells were installed at Site 7 to evaluate the quality of the shallow ground water in the vicinity and to determine whether contaminants were migrating from the site. The locations of the three wells are depicted in Fig. 3.3-11. The monitor well depths, screened intervals, lithology of the screened intervals, and number of split-spoon soil samples collected are given in Table 3.3-13. Individual borehole lithologies are described in detail on the monitor well drilling logs in App. K.

Table 3.3-12. Site 7 Piezometers

Piezometer Number	Depth (ft)	Screened Interval (ft)	Relative Casing Elevation (ft)	Water Depth (ft)	Relative Water Elevation (ft)
PZ7-1	23.5	8.5 to 23.5	0	15.75	0
PZ7-2	22	12 to 22	-4.27	11.55	-0.07
PZ7-3	20.8	10.8 to 20.8	-5.75	10.60	-0.60

Source: ESE, 1985.

Table 3.3-13. Site 7 Monitor Wells

Well Number	Depth (ft)	Screened Interval (ft)	Depth to Water* (ft)	Soil Samples Collected	Screened Interval Lithology
MW7-1	24.3	14.3 to 24.3	15.8	6	Fine to coarse quartz sand
MW7-2	22.3	7.3 to 22.3	13.8	6	Fine to coarse, gravelly quartz sand and fine, silty sand
MW7-3	22	7 to 22	12.7	6	Fine to coarse quartz sand and gravelly quartz sand

*Measured from top of PVC casing.

Source: ESE, 1985.

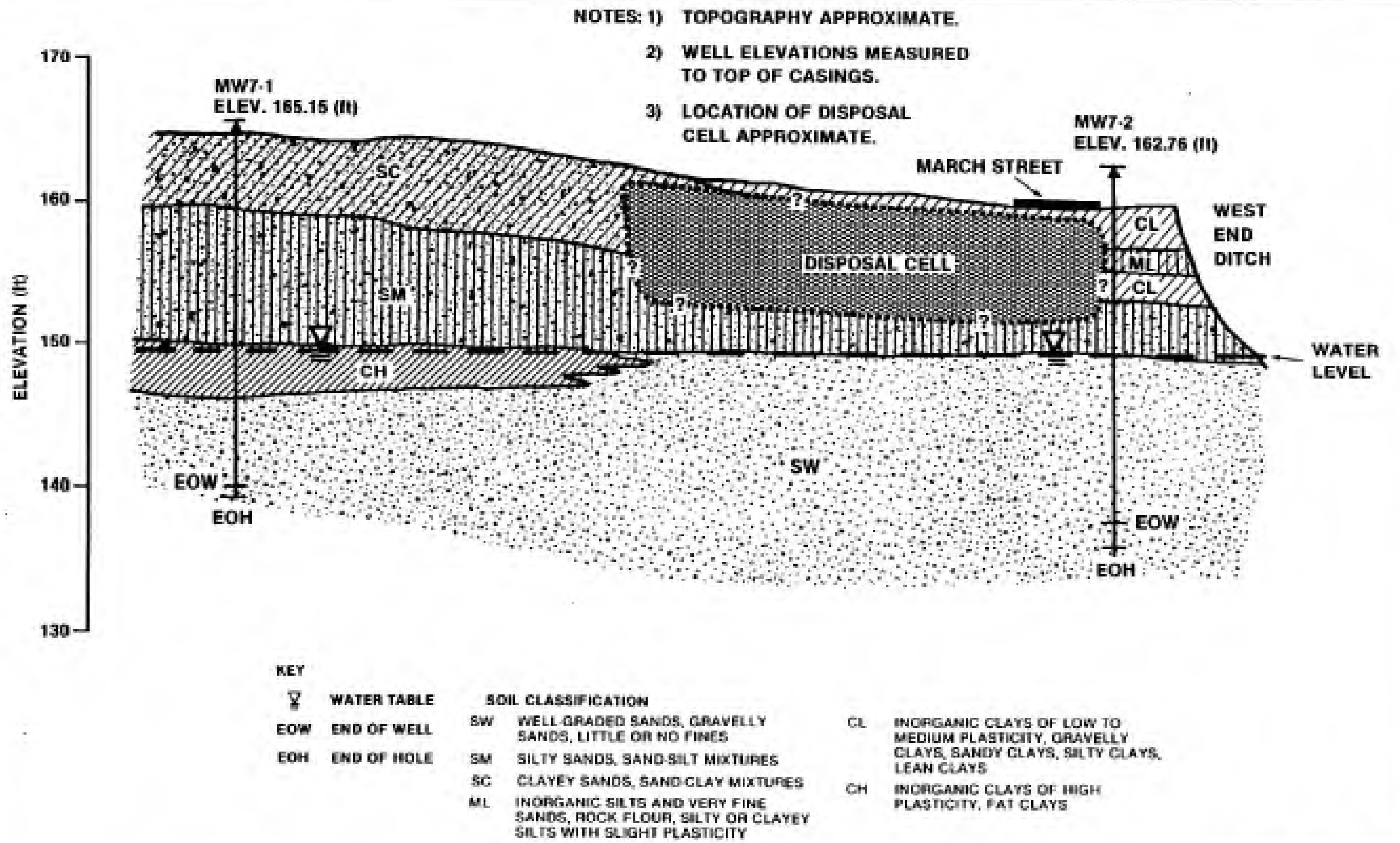
The soils at Site 7 generally consisted of unconsolidated clays, silts, sands, and gravels through the depths sampled. The surficial soils consisted primarily of 4.5 to 9.5 ft of clayey, silty sands; silty, sandy clays; and clayey, gravelly sands of varying plasticity and density/consistency. Colors ranged from yellow and brown to gray. These soils were underlain by 4 to 9 ft of dense, silty, fine, gray quartz sands and dense, poorly sorted, fine to medium, gray quartz sands. These sands were occasionally yellow in color. Three to 7 ft of loose to dense, well graded, fine to coarse, gray quartz sands were found at subsequent depths, and below these were an unknown thickness of dense, well graded, fine to coarse, gravelly yellow quartz sands. A geologic cross section of Site 7 is depicted in Fig. 3.3-12.

The depth to ground water at Site 7 varied from approximately 10.2 ft relative to ground level at MW7-3 to 14.8 ft at MW7-1.

Each of the four monitor wells was developed as described in Sec. 3.2.3 of this report. Details of the development effort are available in App. L.

The elevations and horizontal coordinates of each of the wells were determined by a licensed surveyor, as described in Sec. 3.2.3 of this report. The elevation and coordinate values for each well are listed on the map in App. G.

MW7-1 through MW7-3 were sampled according to the procedure described in Sec. 3.2.4 of this report. The samples were analyzed for the parameters in List C, Table 3.3-3.



SOURCE: ESE, 1988.

Figure 3.3-12
GEOLOGIC CROSS-SECTION OF SITE 7, LANDFILL NO. 2

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4.0 RESULTS AND SIGNIFICANCE OF FINDINGS

4.1 RELEVANT WATER QUALITY CRITERIA AND STANDARDS

Pursuant to Sec. 1412 of the Public Health Service Act, as amended by the Safe Drinking Water Act (Public Law 93-523), the U.S. Environmental Protection Agency (EPA) has promulgated National Interim Primary Drinking Water Regulations (NIPDWR) (EPA, 1984a) and National Secondary Drinking Water Regulations (NSDWR) (EPA, 1984b). These regulations establish primary and secondary maximum contaminant levels (MCLs) for certain inorganic and organic substances in drinking water. The NIPDWR address contaminants which adversely affect health, while the NSDWR address contaminants that affect aesthetic qualities relating to the acceptance of drinking water. At considerably higher concentrations of the secondary contaminants, health implications may also exist, as well as aesthetic degradation (EPA, 1984a; 1984b).

The State of Alabama has adopted the Federal primary and secondary MCLs as Domestic Water Supply Criteria (at the point of withdrawal) for surface waters of the state (State of Alabama, 1982).

Standards established by these regulations are not directly applicable to the surface waters or ground waters sampled during the MAFB Phase II, Stage 1 survey, as the regulations pertain to public drinking water systems. However, MCLs established by EPA regulations can be used to indicate the quality of the surface waters and ground waters relative to drinking water. The relevant MCLs established by EPA are shown in Table 4.1-1.

EPA (1976) has also developed water quality criteria for the protection of human health and aquatic life, pursuant to Sec. 304 of the Clean Water Act. In 1980, EPA criteria (EPA, 1980) were updated for the 64 toxic pollutants or pollutant categories named in Sec. 307A of the

Table 4.1-1. Relevant Maximum Contaminant Levels (MCLs) for Drinking Water*

Parameter	EPA Drinking Water Standards
	Primary Standards† (ug/l)
Arsenic	50
Barium	1,000
Cadmium	10
Chromium	50
Lead	50
Mercury	2
Nitrate	10,000
Selenium	10
Silver	50
Endrin	0.2
Lindane	4
Methoxychlor	100
Toxaphene	5
2,4-D	100
2,4,5-TP	10
	Secondary Standards** (ug/l except for pH)
Copper	1,000
Iron	300
pH	6.5 - 8.5
Total dissolved solids	500,000
Zinc	5,000

*MCLs are given only for parameters for which analytical results are reported in the MAFB Phase II, Stage 1 study.
†EPA National Interim Primary Drinking Water Regulations.
**EPA National Secondary Drinking Water Regulations.

Source: ESE, 1985.

Clean Water Act, based on evaluation of new toxicological and environmental data and changes in the methodology of hazard/risk assessment. The 1980 criterion for mercury was additionally revised in 1981 (EPA, 1981). The 1980 and 1981 EPA criteria supersede the 1976 criteria for the 64 toxic compounds, since the former were evaluated by more advanced methodology. The new EPA criteria considered the acute and chronic adverse effects of water pollutants on aquatic organisms, nonhuman mammals, and humans and have been designed to protect aquatic life and humans from effects of exposure to the pollutants.

The level of protection afforded aquatic organisms by the 1980 and 1981 EPA criteria is that most aquatic life would be protected and aquatic ecosystem functions would be preserved but that a few untested species might be adversely affected if the highest allowable concentrations persisted for long periods of time. The 1980 and 1981 EPA criteria specify concentrations both in terms of 24-hour averages and maximum concentrations not to be exceeded at any time. Since the sampling program in the MAFB Phase II, Stage 1 survey did not quantify 24-hour averages, assessment of potential effects on aquatic life has been made by comparison to EPA criteria, which are the maximum allowable concentrations at any time.

The State of Alabama has promulgated water quality standards for the protection of aquatic life. The latest revisions of these standards in 1982 are based on the 1976 EPA criteria (EPA, 1976) and the revised EPA criteria (EPA, 1980; EPA, 1981c), which relaxed some of the limits (notably mercury). Assessment of the significance of the effects on aquatic life due to contaminants at MAFB takes into account the new Federal criteria. The Alabama standards do not identify specific MCLs for toxic substances, only that such substances shall not be present in amounts that would be deleterious or interfere with designated beneficial uses. Federal criteria provide these guidelines.

Human-health criteria have been incorporated by EPA into the 1980 and 1981 criteria, based on the carcinogenic, toxic, or organoleptic (taste and odor) properties of the 64 toxic pollutants. For noncarcinogens, the criteria have been based on the prevention of adverse health effects in humans due to toxicity. In the case of suspected or known carcinogens, the criteria represent incremental increases in the cancer risk to exposed populations. In assessing the human-health significance of contaminants at MAFB, the incremental risk level chosen was 10^{-6}. This level is the concentration of a specific contaminant, which is projected by the EPA risk analysis to potentially increase the incidence of cancer by no more than one case per 1,000,000 individuals. The applicable human-health criteria (for human consumption of water and organisms taken from water containing the contaminant), along with the criteria for the protection of freshwater aquatic life for the principal contaminants analyzed for at MAFB, are shown in Table 4.1-2. The methodology for development of the criteria for protection of both human health and aquatic life are summarized in EPA (1980). No sediment criteria have been developed.

Ground water samples collected at MAFB were taken from the unconsolidated deposits underlying the study sites. Ground water in this formation could discharge to downgradient surface drainages and thus form a component of the surface water base flow. The surface waters of MAFB, natural drainages, and channelized natural drainages all discharge directly or indirectly into the Alabama River. The Alabama River, the reach adjacent and immediately downstream from MAFB, is classified for beneficial usage, including wildlife and aquatic life usage and propagation, and recreation (State of Alabama, 1982).

The Alabama River in the reach adjacent and downstream of MAFB is commonly used for recreation, including sport fishing, and for limited commercial fishing. For these reasons, the following criteria have generally been considered the critical concentrations upon which assessment of significant contamination is based: (1) the maximum

Table 4.1-2. Relevant EPA Water Quality Criteria

Parameter	Criteria for Freshwater Aquatic Life (ug/l)				Human-Health Criteria (ug/l)		
						Ingestion of Water and Aquatic Organisms	
	Acute Toxicity Level	Chronic Toxicity Level	Maximum 24-hour Average	Maximum Concentration	Potable Water Taste/Odor Control†	Ambient Criterion	10^{-6} Incremental Cancer Risk
Cadmium			0.012**	1.5		10	
Chromium, trivalent		44		2,200**		170,000	
Chromium, hexavalent			0.29	21		50	
Lead			0.75**	74**		50	
Nickel			56**	1,100**		13.4	
Zinc			47	180	5,000		
Arsenic, trivalent				440		0††	0.0022
Copper			5.6**	12**	1,000		
Mercury			0.20	4.1		0.144	
Silver		0.12		1.2		50	
Endrin			0.0023	0.18		1	
Toxaphene			0.013	1.6		0††	0.00071
Cyanide			3.5	52		200	
BHC, G (Lindane)	100		0.080	2		0††	0.186
Selenium	760		35	260		10	
Phenol	10,200	2,560			300	3,500	

*Toxicity may occur at lower concentrations among species more sensitive than those tested. Zero level may not be attainable.

†Organoleptic data used as basis for taste and odor control have no demonstrated relationship to adverse human-health effects.

**Based on calculation with assumed water hardness of 50 mg/l.

††Zero level may not be attainable.

Source: ESE, 1985.

drinking water contaminant level, (2) the criterion for protection of freshwater aquatic life, or (3) the criterion for protecting human health when both aquatic organisms and water are ingested.

4.2 ANALYTICAL RESULTS

Sample collections and *in situ* measurements were performed between Jan. 14 and Jan. 19, 1985. Samples were split and sent to the ESE laboratory in Gainesville, Fla., and the OEHL laboratory at Brooks AFB in San Antonio, Tex. Chain-of-custody data are presented in App. N. All proposed analyses were performed by the ESE laboratory. Analytical methods used and the detection limits are presented in Table 4.2-1.

The detectable concentrations of various analytes in ground waters, surface waters, and sediments are found in Sec. 4.3. Representative quality assurance/quality control (QA/QC) data for the various analytes are presented in Tables 4.2-1 and 4.2-2. A summary of additional QA/QC control data generated during the various chemical analyses performed for this project are found in App. O.

4.3 GENERAL DISCUSSION

Results of analyses on environmental samples collected during the MAFB Phase IIa survey are discussed in terms of relevant water quality standards and criteria whenever possible. Ground waters sampled during the survey are not classified by any State of Alabama or Federal regulations. They will be compared to the NIPDWR and NSDWR MCLs. Of the parameters analyzed in this survey, MCLs are established for all the parameters listed in Table 4.1-1.

Where MCLs are not available for direct comparison, EPA criteria for surface water nearest the site can be used to compare with ground water quality. This is an indirect comparison, and in order to estimate the

Table 4.2-1. Analytical Methods, Detection Limits, and Representative Quality Assurance/Quality Control Data (Continued, Page 2 of 2)

Parameter	Method	Units	Detection Limit	Spiked Sample	Target Value	Found Value	Percent Recovery	Replicate Sample	First Value	Second Value	Method Blank
Mercury	EPA 245.1	µg/l µg/g-soil	0.2 µg/l 0.07 µg/g-soil	469508	5.0	4.6	92	469501	*	*	*
Iron	EPA 200.7	µg/l	4 µg/l	469400	100	105	105	469509	*	*	*
Sulfate	EPA 375.4	mg/l	1 mg/l	469509	3.8	4.1	107	469500	20.5	18.4	*
Barium	EPA 200.7	µg/l	5 µg/l	469400	100	104	104	469500	30.2	30.1	*
Fluoride	EPA 340.2	mg/l	0.1 mg/l	469509	0.99	0.89	90	469501	0.066	0.060	*
Nitrate	EPA 353.2	mg/l	0.01 mg/l	469500	0.125	0.123	98	469500	0.085	0.085	*
Selenium	EPA 270.3	µg/l	1 µg/l	469516	5.0	5.4	108	469503	*	*	*
Silver	EPA 200.7	µg/l	5 µg/l	409509	100	109	109	469500	*	*	*
Endrin	EPA 608	µg/l	0.005 µg/l	Laboratory pure water	0.043	0.040	93	469500	*	*	*
Lindane	EPA 608	µg/l	0.001 µg/l	Laboratory pure water	0.023	0.018	78	469500	*	*	*
Methoxychlor	EPA 608	µg/l	0.027 µg/l	Laboratory pure water	0.23	0.21	91	469500	*	*	*
Toxaphene	EPA 608	µg/l	0.120 µg/l	NA	NA	NA	NA	469500	*	*	*
2,4-D	EPA 615	µg/l	0.030 µg/l	Laboratory pure water	0.41	0.30	73	469500	*	*	*
2,4,5-TP	EPA 615	µg/l	0.007 µg/l	Laboratory pure water	0.094	0.070	74	469500	*	*	*
pH	EPA 150.1	Standard units	NA	NA	NA	NA	NA	469508	5.3	5.3	NA

NA = Not applicable.

*Below detection.
†See Table 4.2-2 for quality control data for the eight EP toxicity metals.

Source: ESE, 1985.

Table 4.2-1. Analytical Methods, Detection Limits, and Representative Quality Assurance/Quality Control Data

Parameter	Method	Units	Detection Limit	Spiked Sample	Target Value	Found Value	Percent Recovery	Replicate Sample	First Value	Second Value	Method Blank
Total Organic Carbon (TOC)	EPA 415.1	mg/l µg/g-soil	1 mg/l 1,000 µg/g-soil	469517	50	53	106	469516	1.6	1.8	*
EP Toxicity	40 CFR 261.24	µg/l	†	†	†	†	†	†	†	†	†
Ignitability	40 CFR 261.21	deg-C	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Halogens (TOX)	EPA 9020	µg/l µg/g-soil	5 µg/l 5ug/g-soil	469517	250	283	113	469508	32.4	31.3	*
Oil and Grease	EPA 413.2	mg/l µg/g-soil	0.1 mg/l 100 µg/g-soil	Laboratory pure water	18.3	17.1	94	469300	354	334	*
Total Dissolved Solids	EPA 160.1	mg/l	1 mg/l	NA	NA	NA	NA	469400	65	69	NA
Copper	EPA 200.7	µg/l µg/g-soil	3 µg/l 2 µg/g-soil	469408	100	99.9	99.9	469403	17.3	16.3	*
Nickel	EPA 200.7	µg/l µg/g-soil	9 µg/l 0.5 µg/g-soil	469500	100	102	102	469500	*	*	*
Cadmium	EPA 200.7	µg/l µg/g-soil	3 µg/l 0.1 µg/g-soil	469509	100	109	109	469500	*	*	*
Chromium	EPA 200.7	µg/l µg/g-soil	6 µg/l 3 µg/g-soil	469500	100	96.7	96.7	469500	*	*	*
Cyanide	EPA 335.2	µg/l µg/g-soil	10 µg/l 0.7 µg/g-soil	469510	19.9	18.5	92.7	469510	*	*	*
Zinc	EPA 200.7	µg/l µg/g-soil	3 µg/l 0.5 µg/g-soil	469400	100	111	111	469500	49	47	*
Phenols	EPA 420.1	µg/l µg/g-soil	1 µg/l 1 µg/g-soil	469515	59.6	57.0	95.7	469510	1.6	1.7	*
Lead	EPA 239.2 (waters) EPA 200.7 (soils)	µg/l µg/g-soil	20 µg/l 2 µg/g-soil	469511	25.0	26.4	106	469502	*	*	*
Arsenic	EPA 206.3	µg/l µg/g-soil	1 µg/l 1 µg/g-soil	469517	5.0	4.9	98	469505	*	*	*

Table 4.2-2. Representative Quality Control Data--RCRA EP Toxicity Metals

Parameter	Detection Limit (µg/l)	Spiked Sample	Target Value	Found Value	Percent Recovery	Replicate Sample	First Value	Second Value	Method Blank
Arsenic	1.0	484900	5.0	3.8	76	484900	*	*	*
Barium	1.0	484900	538	473	88	484900	871	876	*
Cadmium	3.0	484900	100	109	109	484900	*	*	*
Chromium	6.0	484900	100	86	86	484900	*	*	*
Lead	20	484900	100	106	106	484900	*	*	*
Mercury	1.0	484900	5.0	5.1	102	484900	*	*	*
Selenium	1.0	484900	100	98	98	484900	*	*	*
Silver	5.0	484900	100	109	109	484900	*	*	*

*Below detection.

Source: ESE, 1985.

potential impact of ground water quality on the receiving surface water, the following factors must be taken into account:

1. Rate of migration of any contaminant from shallow ground water to the adjacent surface water, and
2. Fate of the contaminant once it reaches the surface water (e.g., degree of dispersion or mixing, degree of dissolution, adsorption on sediments or vegetation).

With the limited data available for the MAFB Phase II, Stage 1 sites, these factors cannot be quantified. Thus, if ground water concentrations of pollutants exceed adjacent surface water criteria, it cannot be said with certainty that the surface water will be adversely impacted. However, if ground water parameters are within adjacent surface water criteria, it can be stated with certainty that the surface water criteria will not be exceeded due to local ground water discharge.

EPA water quality criteria are listed in Table 4.1-2 for metals, pesticides, cyanide, and phenolic compounds. EPA water quality criteria are not established for all compounds analyzed in the MAFB Phase II, Stage 1 survey.

There are no criteria or standards for direct evaluation of TOX data. If used in a rigorous manner [e.g., Resource Conservation and Recovery Act (RCRA) ground water compliance monitoring], extensive background data are required to determine statistically whether monitoring well levels are significantly higher than background well levels. When used as a screening indicator, as is the case with the MAFB Phase II, Stage 1 survey, such data are not available.

Because TOX concentrations were found in all monitor wells, including the background monitor wells, the MAFB Phase II, Stage 1 TOX results may be indicative of background levels or may indicate a positive interference in the analysis. If an interference is responsible for the concentration indicated, this positive interference may be due to the presence of inorganic halides (e.g., chlorides) in the samples. Inorganic chlorides were not determined but are commonly found in ground water leaching from landfill areas. The TOX analysis was developed as a screening analysis for drinking water and was adopted by EPA for landfill monitoring. It has since been found that the TOX analysis is subject to positive matrix interferences, particularly inorganic halides (Dressman, 1984). Documentation on the magnitude of these interferences is not currently available in the literature.

The analytical method for TOX consists of:

1. Passing the sample through a carbon column to adsorb all organics, including halogenated organics;
2. Washing the carbon column with a potassium nitrate solution to reduce the concentrations of inorganics, especially chlorides;
3. Heating of the carbon column, including the adsorbed organics, to convert any chlorinated organics into inorganic chlorides; and
4. Coulometrically measuring the concentrations of chlorides (compared to chlorinated phenol used as a standard).

Theoretically this method should detect all organic halogens including organochlorine pesticides, chlorinated phenols, and volatile organohalogens. Although this method is designed to reduce the interference by inorganic halides, the possibility exists that some interferences can remain (i.e., if the water sample contains 10 mg/l as chloride and the potassium nitrate rinse is 99.9-percent efficient, a positive TOX value of 10 ug/l would be obtained). There are no data available to establish background levels of TOX in the MAFB area. Because the TOX method is used for screening and the identification of potential problems from high-level concentrations of organic solvents (e.g., tetrachloroethylene, trichloroethylene, etc.) leaching into the ground waters or surface waters from landfills, the detection of low levels of TOX may not be indicative of contamination. Because there are no standards promulgated for the direct evaluation of TOX, an arbitrary concentration must be established to use as a guideline in determining if a potential contamination problem exists. The MCL for drinking water may be used to establish this arbitrary concentration. A drinking water standard of 100 ug/l for trihalomethanes (e.g., chloroform) has been established by EPA. This concentration would represent a TOX value of 29.7 ug/l (as converted from chloroform). If the assumption is made that the chloride concentrations in the samples are at least 10 mg/l and a positive interference of 10 ug/l can occur, a reasonable arbitrary TOX value of 40 ug/l can be established as the guideline. The TOX value of 40 ug/l will be used in this report as an indicator of the potential presence of contaminants and the possibility that additional analyses may be required.

Inspection of the MAFB data indicates that TOX analyses fall in the range of 10 to 88 micrograms per liter (ug/l), with only five water samples exceeding 40 ug/l. Some or all of the TOX could be a result of positive interference. Because the data are insufficient to verify the presence of interferences or to quantify their magnitude, additional analyses (purgeable aromatics and organic halogens, EPA Methods 601 and 602) will be required.

TOC is a measure of both biodegradable and nonbiodegradable organic carbon in water. TOC can be used as an indicator for organic contaminants leaching from landfills, oil spills, etc. and contaminating surface water or ground water. There are no criteria or standards for direct evaluation of TOC data since the source of background organic carbon levels varies from site to site. Background TOC concentrations in natural water samples can vary widely, depending primarily on the rate of decomposition of organic matter in the soil. Background TOC concentrations at MAFB are probably in the range of 10 to 12 mg/l. TOC data for this survey are evaluated subjectively as an indication of general organic contamination.

4.3.1 SITE 1--ELECTROPLATING WASTE DISPOSAL AREAS

Detectable concentrations of various analytes in the ground water from MW1-1, MW1-2, MW1-3, and MW1-4 are presented in Fig. 4.3-1. In addition, all analytical data from the analysis of ground water at Site 1 is presented as Table 4.3-1. The entire data set for all ground water samples analyzed during this study is presented in App. O.

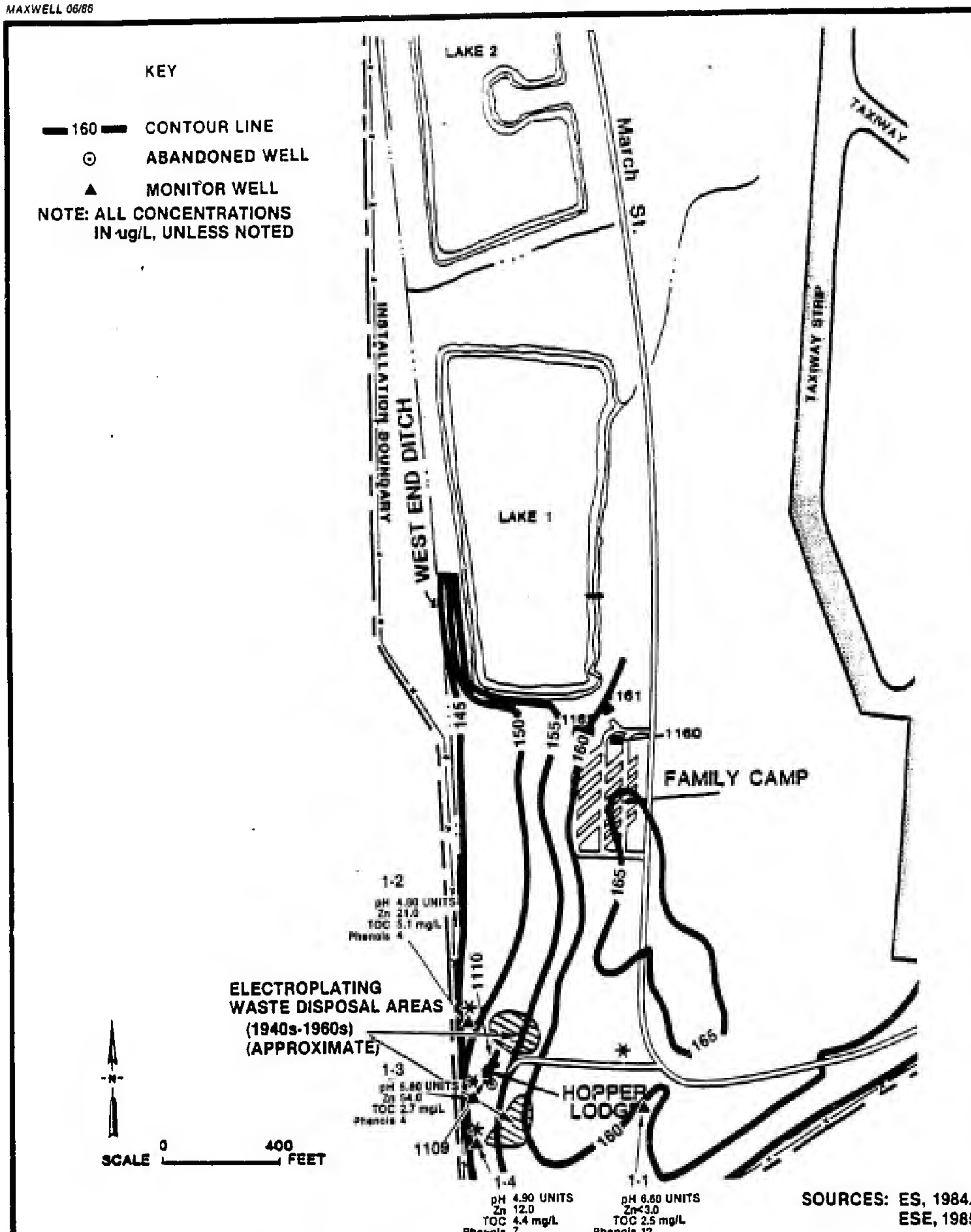
The pH values determined at this site vary from 4.8 to 6.6. NSDWR regulations specify that acceptable pH values should range between 6.5 and 8.5, unless affected by natural conditions. A comparison of the pH values at Site 1 with values from other locations on the base indicates that the shallow ground water on MAFB tends to be acidic. Therefore, the pH values less than 6.5 are not indicative of contamination problems.

Analyses for metals used in the plating process (e.g., Cd, Cr, Cu, Ni) and cyanides did not yield any concentrations above the detection limit. This does not assure that the metals are not present in the disposal area but only indicates they are not present in the ground water at this time.

Concentrations of Zn varying from <3.0 ug/l to 54.0 ug/l were detected in the ground water. These concentrations are very low and are well below the 5,000-ug/l NSDWR MCL and the 180-ug/l maximum criterion for the protection of aquatic life.

TOC values for the four wells vary from 2.5 to 5.1 mg/l. These data do not indicate the availability of any large sources of organic carbon in the disposal area at the time of sampling. Because the background TOC for MAFB probably ranges to a high of 12 mg/l, these samples at Site 1 are indicative of background levels.

Phenols ranged from 4 ug/l in ground waters from MW1-2 and MW1-3 to 7 ug/l at MW1-4 and 12 ug/l at MW1-1. These values are well below the



SOURCES: ES, 1984.
ESE, 1985.

Figure 4.3-1
DETECTABLE CONCENTRATIONS OF VARIOUS ANALYTES IN GROUND WATERS AT SITE 1, ELECTROPLATING WASTE DISPOSAL AREAS

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Table 4.3-1. Analytical Results for Ground Water Samples from Site 1

Parameters	GW1-1*	GW1-2	GW1-3	GW1-4
pH, field (std units)	6.60	4.80	5.80	4.90
Cadmium, diss. (ug/l)	ND†	ND	ND	ND
Chromium, diss. (ug/l)	ND	ND	ND	ND
Copper, diss. (ug/l)	ND	ND	ND	ND
Nickel, diss. (ug/l)	ND	ND	ND	ND
Zinc, diss. (ug/l)	ND	21.0	54.0	12.0
Carbon, TOC (mg/l)	2.5	5.1	2.7	4.4
Phenols (ug/l)	12	4	4	7
Residue, diss. (mg/l)	54	153	26	80
Sp. Cond., field (umhos/cm)	75.0	203	95.0	77.0
Water Temp. (°C)	19.2	17.0	18.1	17.5
Cyanide (ug/l)	ND	ND	ND	ND

*GW1-1 indicates a ground water sample from Monitor Well 1 at Site 1.
†ND = Not detected.

Source: ESE, 1985.

acute toxicity level, chronic toxicity level, and the human-health criteria established by EPA.

The specific conductance values indicate a specific conductance in MW1-2 which is slightly higher than the other wells. MW1-2 is downgradient of the disposal site and could be expected to have an elevated conductivity if any contaminants are migrating from the disposal site. The entire data set for the chemical analyses performed is presented in App. O.

4.3.2 SITE 2--SURFACE DRAINAGE SYSTEM FOR MAFB

Surface Waters

Surface water samples were collected at four locations on MAFB. These locations along with detectable concentrations of various pollutants are shown in Fig. 4.3-2. The data for all surface water analyses are presented as Table 4.3-2. The results of all surface water analyses completed at MAFB during this study are presented in App. O.

Arsenic (As) values varying from 6 to 30 ug/l were detected in surface waters from the point where the West End Ditch enters MAFB to a point downstream of Sites 1, 3, and 5. The As concentrations have been reported in previous surface water samples collected in other surface water drainage ditches (ES, 1984). The concentrations determined in this present study are below the 50-ug/l MCL established by NIPDWR. The As was determined as total As, and no attempt was made to detect concentrations based on valence state. If all the As were in the trivalent state, it would not exceed the criteria for the protection of freshwater aquatic life, but would exceed the human health standards. The source of As is unknown, but could originate either off or on MAFB since it is found in both offbase and onbase samples.

Chromium (Cr) concentrations of <6 ug/l to 8.1 ug/l were determined. No attempt was made to determine the Cr concentrations with respect to valence state. Regardless of the valence state, Cr concentrations are

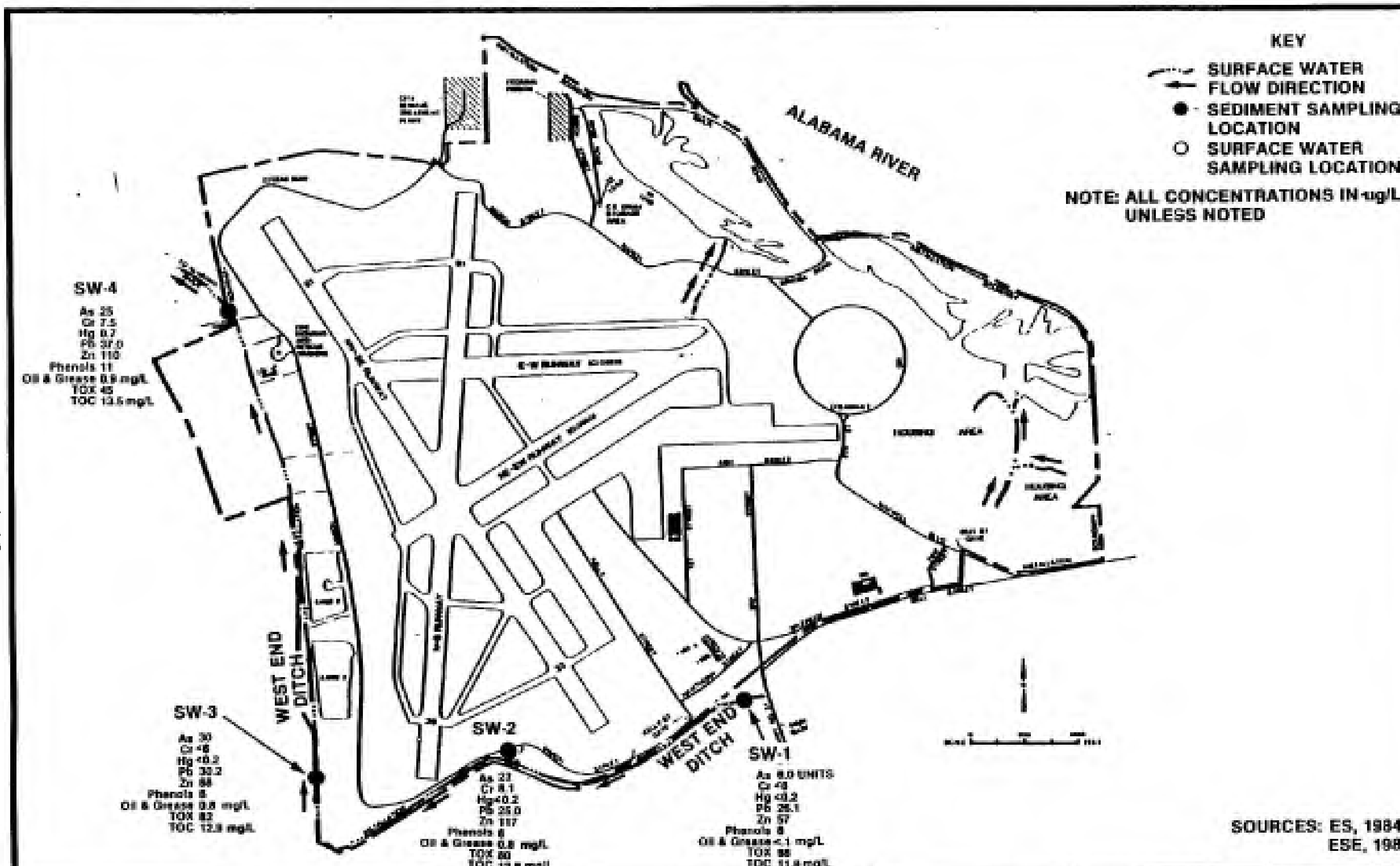

Figure 4.3-2
DETECTABLE CONCENTRATIONS OF VARIOUS ANALYTES IN SURFACE WATERS ON MAFB, SITE 2

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Table 4.3-2. Analytical Results for Surface Waters from Site 2

Parameters/Sample Location	SW2-1*	SW2-2	SW2-3	SW2-4
Arsenic, total (ug/l)	6.0	23	30	25
Cadmium, total (ug/l)	ND†	ND	ND	ND
Chromium, total (ug/L)	ND	8.1	ND	7.5
Mercury, total (ug/l)	ND	ND	ND	0.7
Nickel, total (ug/l)	ND	ND	ND	ND
Lead, total (ug/l)	26.1	25.0	30.2	37.0
Zinc, total (ug/l)	57	117	66	110
Residue, diss. (mg/l)	67	87	82	68
Phenols (ug/l)	8	8	6	11
Oil & Grease, IR (mg/l)	ND	0.8	0.8	0.9
TOX (ug/l-CL)	88	80	82	45
Carbon, TOC (mg/l)	11.9	12.8	12.9	13.5
Sp. Cond., lab (umho/cm)	63.0	96.8	82.8	63.0
Cyanide (ug/l)	ND	ND	ND	ND

*SW2-1 indicates a surface water sample from Location 1 at Site 2.
†ND = Not detected.

Source: ESE, 1985.

below the maximum concentration allowable under NIPDWR (50 ug/l) and the criteria for the protection of freshwater aquatic life (21 ug/l for hexavalent and 2,200 ug/l for trivalent). The low levels of Cr may be from natural sources (clays at MAFB).

Mercury (Hg) was detected (0.7 ug/l) in sample SW-4 downstream from Sites 1, 3, and 5. This concentration is less than allowable under NIPDWR but exceeds concentration criteria for the protection of human health (0.14 ug/l) and freshwater aquatic life (maximum 24-hour average of 0.2 ug/l). Hg has not been reported in previous samples of surface water at MAFB.

Lead (Pb) values vary from 25 to 37 ug/l. These values are less than the NIPDWR standard of 50 ug/l and the 74-ug/l maximum concentration allowable for the protection of freshwater aquatic life. The Pb concentrations may represent background values. However, the surface runoff from an adjacent highway may contribute to the Pb concentrations. Pb concentrations have been reported in previous surface water samples from MAFB.

Zinc (Zn) concentrations ranging from 57 ug/l to 117 ug/l were detected. These values are within the standards allowed and probably represent background concentrations of Zn.

Phenol concentrations ranged from 6 ug/l to 11 ug/l. These values are within the standards allowed and probably represent background concentrations.

Oil and grease concentrations were determined to range from <0.1 mg/l to 0.9 mg/l. No standards are available for this parameter; however, concentrations less than 1 mg/l are ususally considered to be background levels.

TOX concentrations were determined to range from 45 ug/l to 88 ug/l, with the highest concentration found at the point where West End Ditch enters MAFB. The TOX concentrations determined are above the arbitrary value of 40 ug/l, which was selected to designate a positive response. Therefore, these samples may contain chlorinated organic compounds as contaminants. Since these data are insufficient to verify the presence of interferences or to quantify their magnitude, additional analyses [purgeable aromatics and organic halogens (EPA Methods 601 and 602)] will be required.

TOC concentrations ranged from 11.9 mg/l to 13.5 mg/l. These concentrations approximate the background levels of 10 to 12 mg/l present at MAFB. These concentrations at or slightly above the background may reflect the influence of organics being washed from an adjacent highway.

Sediments

The concentrations of the various analytes found in the sediment samples are presented in Table 4.3-3. Many of these analytes are generally representative of background levels of the various constituents. It should be noted, however, that Hg concentrations of 0.47 microgram per gram (ug/g) and 0.21 ug/g were determined at sampling locations S2-4 and S2-11 (see Fig. 4.3-3).

In addition, Pb concentrations at locations S2-3, S2-4, S2-6, S2-7, S2-8, and S2-11 were determined to range from 77 to 380 ug/g. The source of the lead may be runoff from areas where MOGAS or AVGAS was used for fire training activities and disposed of in landfills. In addition, this stream flows adjacent to a highway, and surface runoff containing particulate lead from gasoline engines would enter the stream and be deposited in the sediments. The results of all sediment analyses completed as part of this study at MAFB are also presented in App. O. In addition, the analytical results for all samples are presented in Table 4.3-4.

Table 4.3-3. Analytical Results for MAFB Sediment Samples

Parameters	Sample Numbers										
	S2-1	S2-2	S2-3	S2-4	S2-5	S2-6	S2-7	S2-8	S2-9	S2-10	S2-11
Moisture (% wet wt)	26.0	23.0	19.0	39.0	29.0	28.0	40.0	34.0	26.0	22.0	26.0
Cadmium, sed (ug/g-dry*)	0.3	0.2	0.4	0.9	0.3	1.0	0.8	0.9	0.3	0.3	0.4
Chromium, sed (ug/g-dry)	9.8	3.3	11.2	20.8	16.0	16.0	27.6	26.1	13.0	15.1	14.8
Copper, sed (ug/g-dry)	11	3	14	28	24	27	33	26	8	8	17
Mercury, sed (ug/g-dry)	ND†	ND	ND	0.47	ND	ND	ND	ND	ND	ND	0.21
Nickel, sed (ug/g-dry)	2	0.6	3	8	5	6	11	7	4	5	5
Lead, sed (ug/g-dry)	51	12	100	99	39	120	380	280	41	43	77
Zinc, sed (ug/g-dry)	22	6	46	116	63	149	334	118	39	36	72
Cyanide, sed (ug/g-dry)	ND	ND	ND	1	ND	ND	0.8	0.8	0.8	ND	ND
Arsenic, sed (ug/g-dry)	7.4	3.6	4.0	7.1	2.0	7.3	3.6	3.4	1.1	1.4	1.5
Phenols, sed (ug/g-dry)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOX**, sed (ug/g-dry)	ND	ND	ND	ND	ND	ND	5.70	ND	ND	ND	ND
TOC††, sed (ug/g-dry)	1760	3120	4320	17400	5490	19600	7500	22300	6490	5380	5810

*ug/g = micrograms per gram.
†ND = Not detected.
**TOX = Total organic halogen.
††TOC = Total organic carbon.

Source: ESE, 1985.

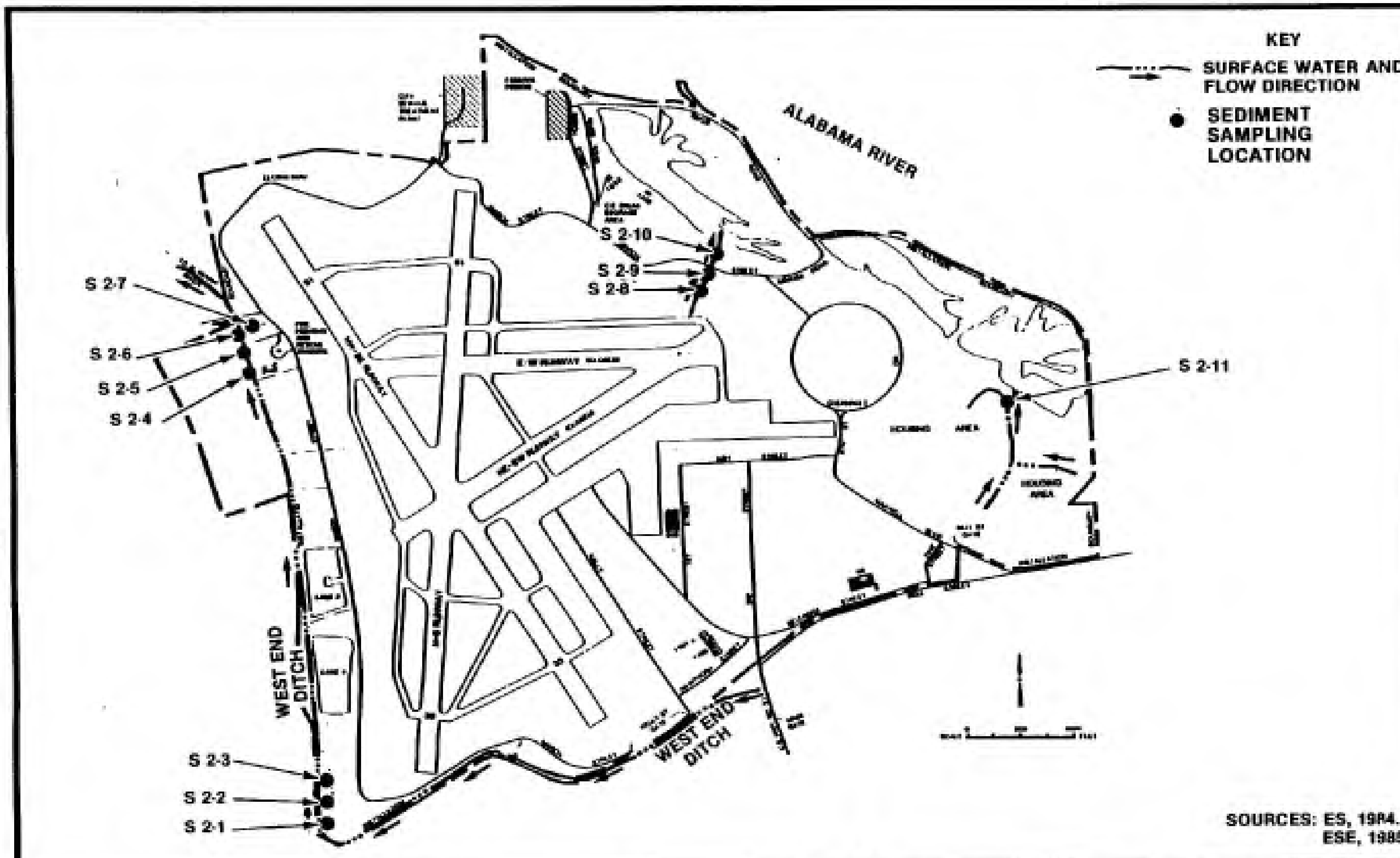

Figure 4.3-3
STREAM SEDIMENT SAMPLING
LOCATIONS, SITE 2

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4.3.3 SITE 3--FPTA NO. 2 AND LANDFILL NO. 3

The locations of the sampling points and detectable concentrations of various analytes at Site 3 are presented in Fig. 4.3-4. The pH values determined for these samples (5.2 through 5.9) are outside the range recommended (6.5 to 8.5) by NSDWR. The values seem typical for the MAFB ground water and probably represent background levels.

Concentrations of barium (Ba), Zn, iron (Fe), nitrate (NO_3), and sulfate (SO_4) were detected in samples from Site 3. None of these parameters, except Fe in MW3-1, exceeded NIPDWR or NSDWR standards or the criteria for the protection of freshwater aquatic life or human health. Fe, detected at a concentration of 568 ug/l, exceeded the NSDWR standard of 300 ug/l. The concentrations determined are probably representative of background levels.

Phenol values were determined to vary from <1 ug/l to 6 ug/l. These values are probably representative of background levels.

TOX values of 21 to 32 ug/l were detected in ground waters at Site 3. These values do not necessarily indicate the presence of significant chlorinated organic compounds, as positive interferences may be represented.

TOC concentrations range from 1.4 mg/l to 3.5 mg/l. These concentrations are considered background levels for the site.

Lindane was detected at concentrations of 0.17 and 1.3 ug/l in downgradient wells 3-3 and 3-2, respectively. Analyses were performed using a second GC column to confirm the existence of lindane in the samples. The second column was used to confirm the presence of the lindane in the sample. Lindane concentrations were not calculated from the second column chromatogram because the second column is normally used only to confirm the presence of a compound.

Table 4.3-4. Analytical Results for Ground Water Samples from Site 3

Parameters	Sample Location		
	GW 3-1	GW 3-2	GW 3-3
pH, field (std units)	5.60	5.20	5.90
Arsenic, diss. (ug/l)	ND†	ND	ND
Barium, diss. (ug/l)	30	19	33
Cadmium, diss. (ug/l)	ND	ND	ND
Copper, diss. (ug/l)	ND	ND	ND
Chromium, diss. (ug/l)	ND	ND	ND
Iron, diss. (ug/l)	568	70	91
Mercury, diss. (ug/l)	ND	ND	ND
Nickel, diss. (ug/l)	ND	ND	ND
Lead, diss. (ug/l)	ND	ND	ND
Silver, diss. (ug/l)	ND	ND	ND
Zinc, diss. (ug/l)	48.7	ND	17.8
Nitrogen, NO_2 + NO_3 (mg/l-as N)	0.085	0.712	0.655
Sulfate (mg/l)	41	14	43
Residue, diss. (mg/l)	101	55	145
Phenols (ug/l)	6	ND	6
Oil & Grease, IR (mg/l)	ND	ND	ND
TOX (ug/l-CL)	32	25	21
Carbon, TOC (mg/l)	3.5	1.4	3.2
Endrin (ug/l)	ND	ND	ND
BHC,G (Lindane)(ug/l)	ND	1.3	0.17
Methoxychlor (ug/l)	ND	ND	ND
Toxaphene (ug/l)	ND	ND	ND
2,4-D, total (ug/l)	ND	ND	ND
2,4,5-TP/silvex (ug/l)	ND	ND	ND
Fluoride (mg/l)	0.15	ND	0.11
Sp. Cond., field (umhos/cm)	91.0	67.0	264
Water Temp. (°C)	17.0	17.6	16.4
Selenium, diss. (ug/l)	ND	ND	ND
Cyanide (ug/l)	ND	ND	ND

*GW3-1 indicates a ground water sample from Monitor Well 1 at Site 3.
†ND = Not detected.

Source: ESE, 1985.

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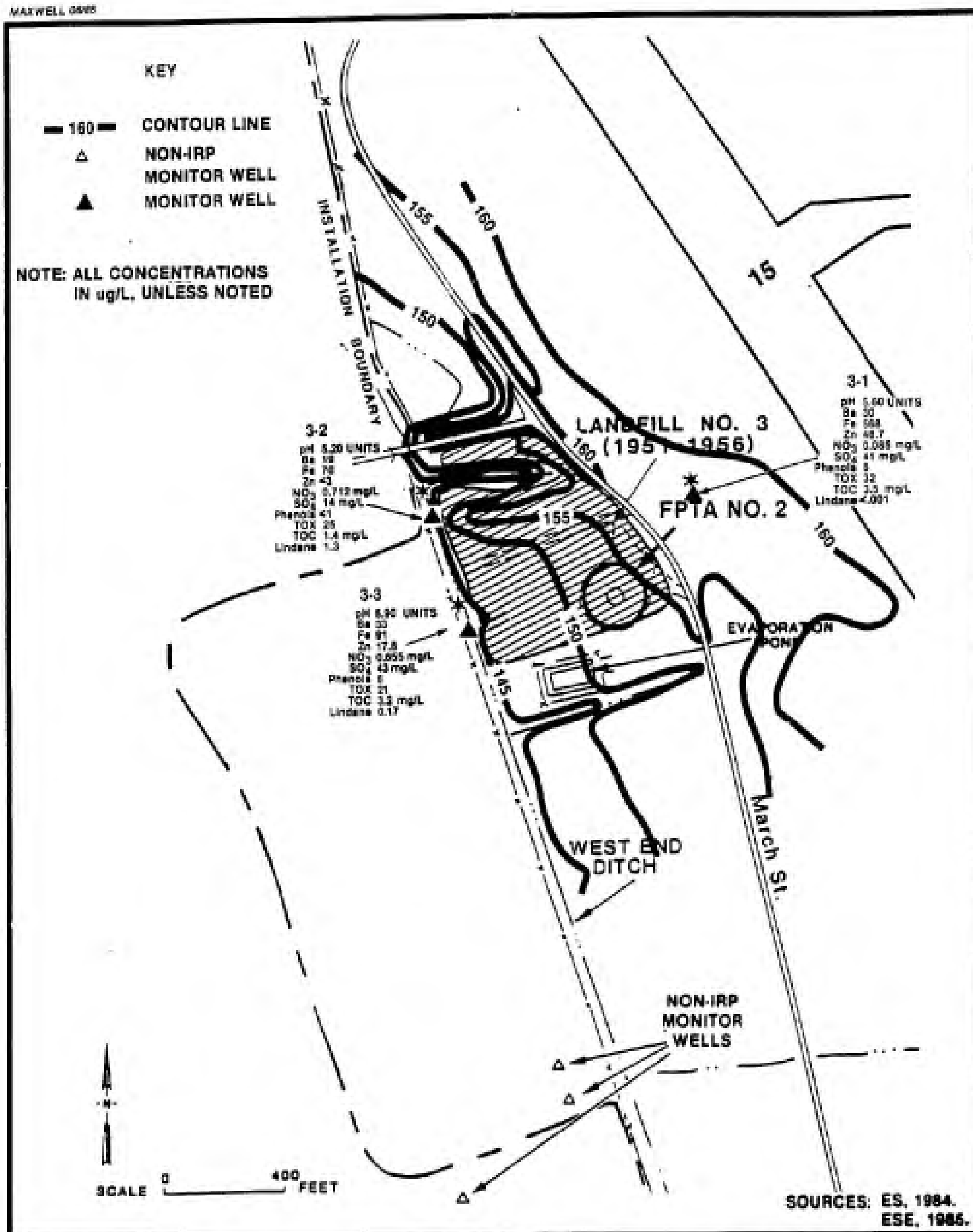

Figure 4.3-4 DETECTABLE CONCENTRATIONS OF VARIOUS ANALYTES IN GROUND WATERS AT SITE 3, FPTA NO. 2, AND LANDFILL NO. 3	INSTALLATION RESTORATION PROGRAM Maxwell Air Force Base

The lindane values obtained are less than the 4-ug/l criterion promulgated under NIPDWR but exceed the concentrations recommended for the protection of human health. The detection of lindane is indicative of low-level ground water contamination, probably from items formerly buried in Landfill No. 3.

4.3.4 SITE 4--FPTA NO. 1

The locations of MW4-1, 4-2, and 4-3, along with detectable concentrations of various analytes, are presented in Fig. 4.3-5. In addition, the analytical results for all ground water samples from Site 4 are presented in Table 4.3-5.

As with prior sites discussed, the pH values at Site 4 are less than the recommended range under NSDWR. This is indicative of the acidic-trending ground water found under the installation.

Low-level concentrations of Ba, Fe, Zn, NO_3, SO_4, and phenols were detected at Site No. 4. The concentrations detected were all less than applicable standards or criteria and probably represent background levels.

TOX concentrations ranging from 16 to 26 ug/l were determined. These concentrations do not necessarily represent high concentrations of chlorinated organic compounds, since positive interferences may be occurring.

TOC values ranged from 1.9 to 4.9 mg/l and are not indicative of large sources of available organic carbon in the ground water. These concentrations are probably representative of background levels.

4.3.5 SITE 5--LANDFILLS 4, 5, AND 6

The locations of MW5-1 through MW5-5, along with detectable concentrations of various analytes, are presented in Fig. 4.3-6. The analytical results for all ground water samples collected at Site 5 are presented in Table 4.3-6.

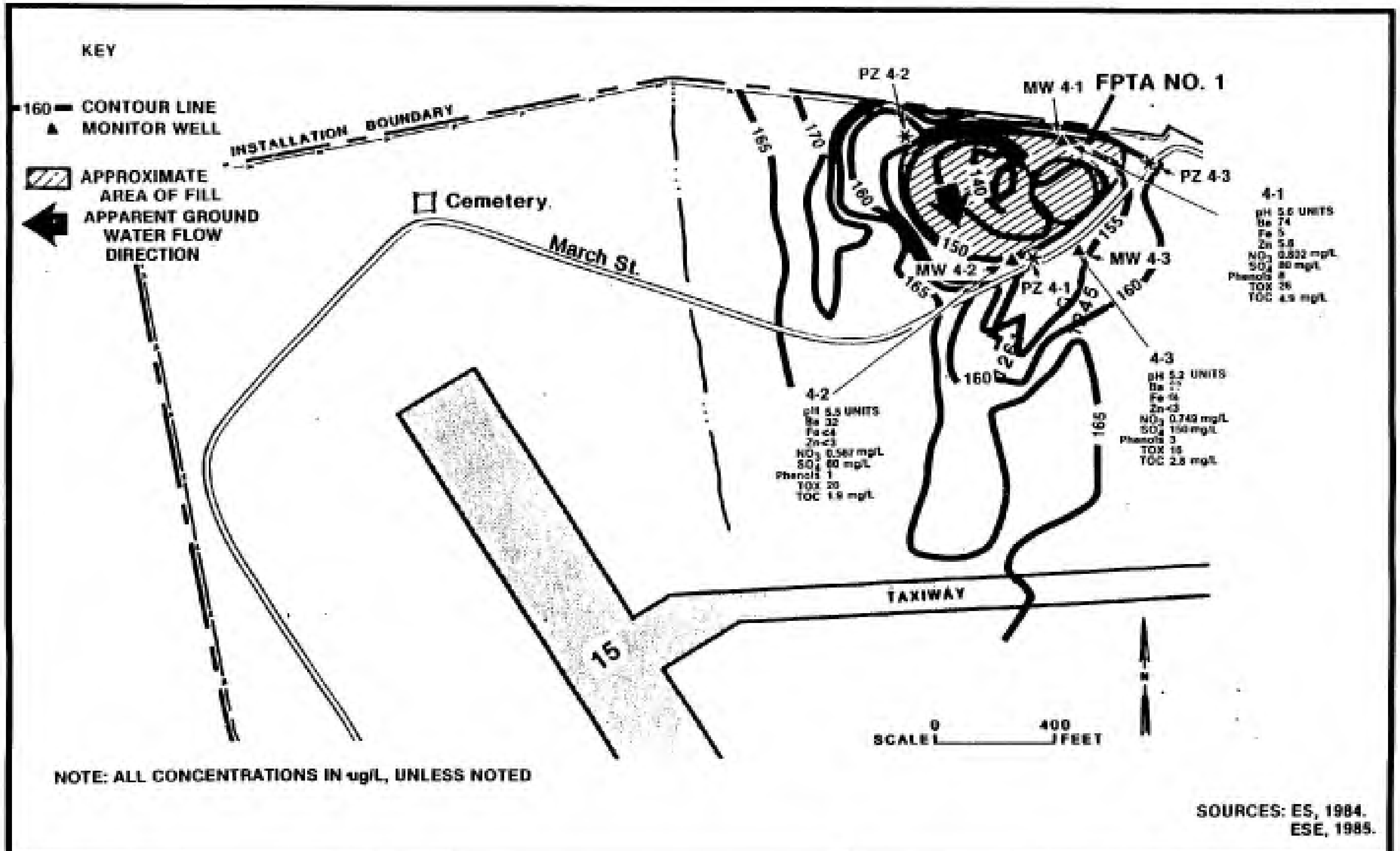

Figure 4.3-5
DETECTABLE CONCENTRATIONS OF VARIOUS ANALYTES IN GROUND WATERS AT SITE 4, FPTA NO. 1

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Table 4.3-5. Analytical Results for Ground Water Samples from Site 4

Parameters	Sample Location GW4-1*	GW4-2	GW4-3
pH, field (std units)	5.60	5.50	5.20
Arsenic, diss. (ug/l)	ND†	ND	ND
Barium, diss. (ug/l)	74	32	22
Cadmium, diss. (ug/l)	ND	ND	ND
Copper, diss. (ug/l)	ND	ND	ND
Chromium, diss. (ug/l)	ND	ND	ND
Iron, diss. (ug/l)	5	ND	ND
Mercury, diss. (ug/l)	ND	ND	ND
Nickel, diss. (ug/l)	ND	ND	ND
Lead, diss. (ug/l)	ND	ND	ND
Silver, diss. (ug/l)	ND	ND	ND
Zinc, diss. (ug/l)	5.6	ND	ND
Nitrogen, NO_2 + NO_3 (mg/l-as N)	0.802	0.567	0.749
Sulfate (mg/l)	80	60	150
Residue, diss. (mg/l)	121	69	76
Phenols (ug/l)	8	1	3
Oil & Grease, IR (mg/l)	ND	ND	ND
TOX (ug/l-CL)	26	20	16
Carbon, TOC (mg/l)	4.9	1.9	2.8
Endrin (ug/l)	ND	ND	ND
BHC,G (Lindane)(ug/l)	ND	ND	ND
Methoxychlor (ug/l)	ND	ND	ND
Toxaphene (ug/l)	ND	ND	ND
2,4-D, total (ug/l)	ND	ND	ND
2,4,5-TP/silvex (ug/l)	ND	ND	ND
Fluoride (mg/l)	ND	ND	0.12
Sp. Cond., field (umhos/cm)	149	88.0	92.0
Water Temp. (°C)	19.0	19.9	17.1
Selenium, diss. (ug/l)	ND	ND	ND
Cyanide (ug/l)	ND	ND	ND

*GW4-1 indicates a ground water sample from Monitor Well 1 at Site 4.
†ND = Not detected.

Source: ESE, 1985.

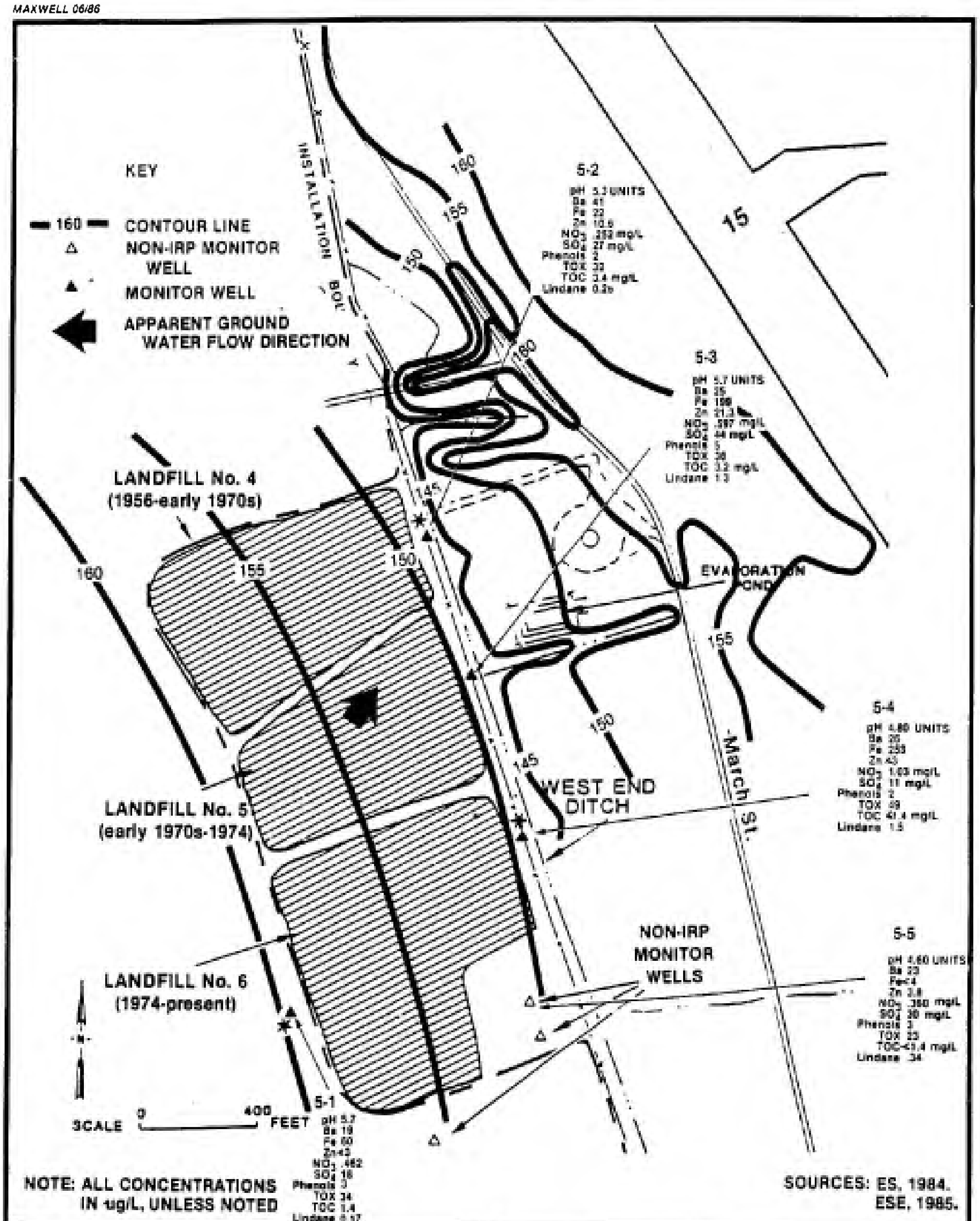

Figure 4.3-6
DETECTABLE CONCENTRATIONS OF VARIOUS ANALYTES IN GROUND WATERS AT SITE 5, LANDFILLS 4, 5, AND 6

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Table 4.3-6. Analytical Results for Ground Water Samples from Site 5

Parameters	Sample Location				
	GW5-1*	GW5-2	GW5-3	GW5-4	GW5-5
pH, field (std units)	5.70	5.30	5.70	4.80	4.60
Arsenic, diss. (ug/l)	ND†	ND	ND	ND	ND
Barium, diss. (ug/l)	19	41	25	26	23
Cadmium, diss. (ug/l)	ND	ND	ND	ND	ND
Copper, diss. (ug/l)	ND	ND	ND	ND	ND
Chromium, diss. (ug/l)	ND	ND	ND	ND	ND
Iron, diss. (ug/l)	60	22	199	253	<4
Mercury, diss. (ug/l)	ND	ND	ND	ND	ND
Nickel, diss. (ug/l)	ND	ND	ND	ND	ND
Lead, diss. (ug/l)	ND	ND	ND	ND	ND
Silver, diss. (ug/l)	ND	ND	ND	ND	ND
Zinc, diss. (ug/l)	ND	10.6	21.3	ND	3.8
Nitrogen, NO_2 ▪ NO_3 (mg/l-as N)	0.462	0.252	0.597	1.03	0.360
Sulfate (mg/l)	18	27	44	11	30
Residue, diss. (mg/l)	92	122	150	63	74
Phenols (ug/l)	3	2	5	2	3
Oil & Grease, IR (mg/l)	ND	ND	ND	ND	ND
TOX (ug/l-CL)	34	32	36	49	23
Carbon, TOC (mg/l)	1.4	3.4	3.2	<1.4	ND
Endrin (ug/l)	ND	ND	ND	ND	ND
BHC,G (Lindane)(ug/l)	0.17	0.26	1.3	1.5	0.34
Methoxychlor (ug/l)	ND	ND	ND	ND	ND
Toxaphene (ug/L)	ND	ND	ND	ND	ND
2,4,5-TP/silvex (ug/l)	ND	ND	ND	ND	ND
2,4-D, Total (ug/L)	ND	ND	ND	ND	ND
Fluoride (mg/l)	0.14	ND	ND	ND	ND
Sp. Cond., field (umhos/cm)	146	186	170	79.0	36.0
Water Temp. (°C)	16.7	17.5	18.1	16.6	16.1
Selenium, diss. (ug/l)	ND	ND	ND	ND	ND
Cyanide (ug/l)	ND	ND	ND	ND	ND

*GW5-1 indicates a ground water sample from Monitor Well 1 at Site 5.
†ND = Not detected.

Source: ESE, 1985.

The pH values for ground waters at Site 5 vary from 4.6 to 5.7. These values are considered to be representative of the background pH.

Concentrations of Ba, Fe, Zn, NO_3, SO_4, and phenols are detectable in many of the wells at Site 5. The concentrations detected are less than the standards for NIPDWR and NSDWR or the criteria for protection of freshwater aquatic life or human health. The concentrations detected are representative of background levels.

TOX values range from 23 to 49 ug/l. The 49-ug/l concentration was detected in the well (MW5-4) immediately adjacent to and downgradient of the current landfill. This value may be indicative of the presence of chlorinated organic compounds as contaminants. Additional analyses (EPA Methods 601 and 602) will be required to confirm these results.

TOC values at Site 5 vary from <1.4 mg/l to 3.4 mg/l. These values are considered background and do not indicate a large availability of organic carbon in the ground waters downgradient from the site. The pesticide lindane was detected in the ground water samples from all five monitor wells at concentrations ranging from 0.17 ug/l to 1.5 ug/l. This indicates low-level contamination of the ground waters at Site 5. The concentrations detected are less than allowable under NIPDWR standards; however, they do exceed the maxima recommended for the protection of human health. These waters are not used on MAFB as a source of drinking water, and no private potable wells are located downgradient of this site.

4.3.6 SITE 6--C.E. DRUM STORAGE AREA

The locations of MW6-1, MW6-2, and MW6-3 and detectable concentrations of various analytes in the ground water at Site 6 are presented in Fig. 4.3-7. The analytical results for all ground water samples from Site 6 are presented in Table 4.3-7.

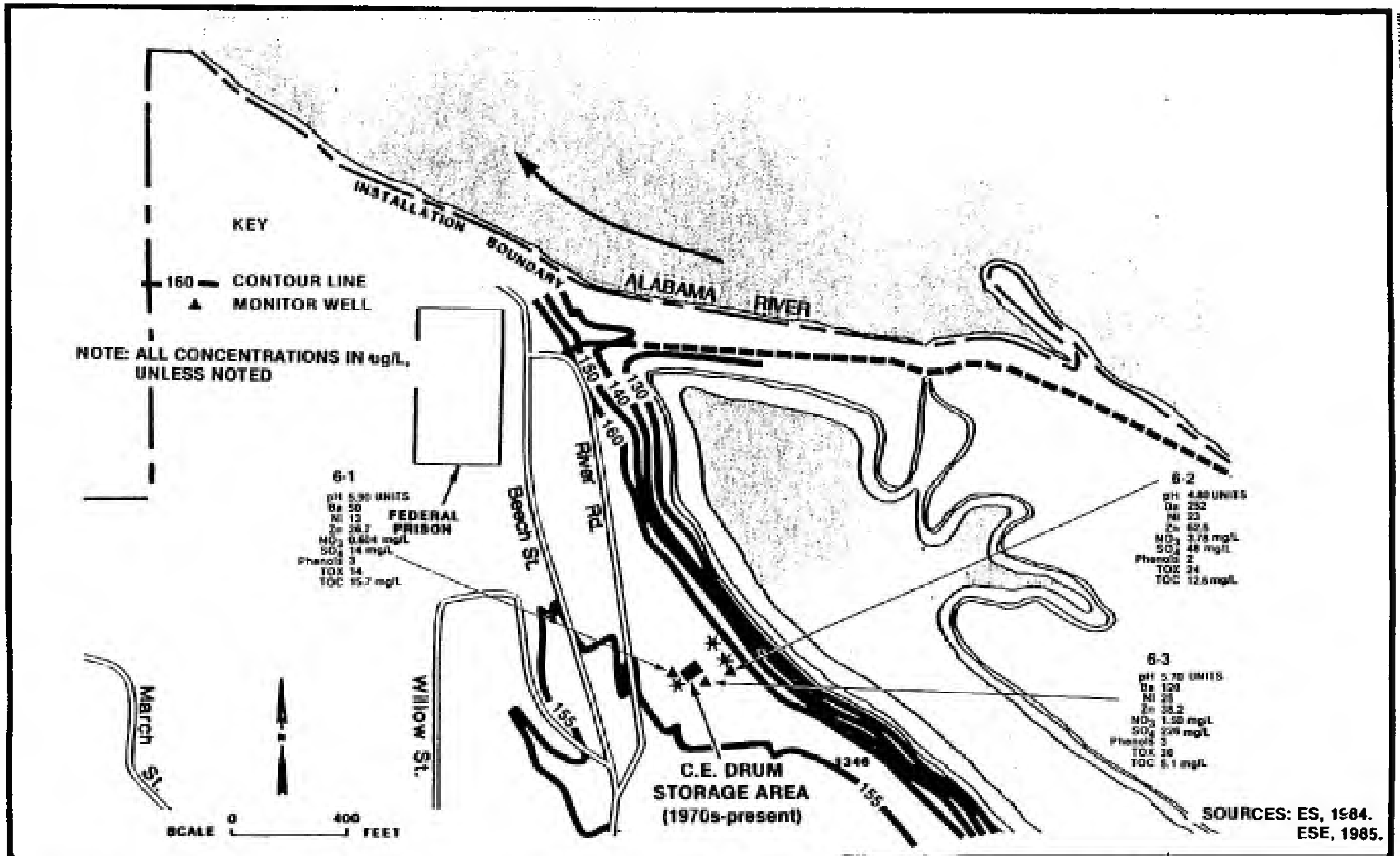

Figure 4.3-7
DETECTABLE CONCENTRATIONS OF VARIOUS ANALYTES IN GROUND WATERS AT SITE 6, C.E. DRUM STORAGE AREA

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Table 4.3-7. Analytical Results for Ground Water Samples from Site 6

Parameters	Sample Location		
	GW6-1*	GW6-2	GW6-3
pH, field (std units)	5.90	4.80	5.70
Arsenic, diss. (ug/l)	ND†	ND	ND
Barium, diss. (ug/l)	50	252	120
Cadmium, diss. (ug/l)	ND	ND	ND
Copper, diss. (ug/l)	ND	ND	ND
Chromium, diss. (ug/l)	ND	ND	ND
Iron, diss. (ug/l)	ND	ND	ND
Mercury, diss. (ug/l)	ND	ND	ND
Nickel, diss. (ug/l)	13	23	25
Lead, diss. (ug/l)	ND	ND	ND
Silver, diss. (ug/l)	ND	ND	ND
Zinc, diss. (ug/l)	26.7	62.6	38.2
Nitrogen, NO_2 + NO_3 (mg/l-as N)	0.604	3.78	1.50
Sulfate (mg/l)	14	48	226
Residue, diss. (mg/l)	304	262	224
Phenols (ug/l)	3	2	3
Oil & Grease, IR (mg/l)	ND	ND	ND
TOX (ug/l-CL)	14	24	36
Carbon, TOC (mg/l)	15.7	12.6	5.1
Endrin (ug/l)	ND	ND	ND
BHC,G (Lindane)(ug/l)	ND	ND	ND
Methoxychlor (ug/l)	ND	ND	ND
Toxaphene (ug/L)	ND	ND	ND
2,4-D Total (ug/L)	ND	ND	ND
2,4,5-TP/silvex (ug/l)	ND	ND	ND
Fluoride (mg/l)	0.14	ND	ND
Sp. Cond., field (umhos/cm)	430	241	336
Water Temp. (°C)	17.2	18.2	18.3
Selenium, diss. (ug/l)	ND	ND	ND
Cyanide (ug/l)	ND	ND	ND

*GW6-1 indicates a ground water sample from Monitor Well 1 at Site 6.
†ND = Not detected.

Source: ESE, 1985.

The pH values at Site 6 range from 4.8 to 5.9. These values are considered background for the site and are acceptable even though they are outside the 6.5-to-8.5-range specified under NSDWR.

Ba, Zn, NO_3, SO_4, and phenols were determined at various concentrations in the samples. The concentrations were all less than the levels allowable under NIPDWR, NSDWR, and the criteria for the protection of freshwater aquatic life and human health. Nickel (Ni) concentrations of 13, 23, and 25 ug/l were detected in the samples. Although these concentrations are less than the criteria for the protection of freshwater life, the two higher values exceed the human-health criterion of 13.4 ug/l. No potable water wells are located downgradient of this area, and any ground water entering the Alabama River would probably be diluted to values conforming to the acceptable criteria range. These Ni concentrations may be representative of background concentrations, since no prior sources are known at this site.

TOX concentrations at Site 6 vary from 14 to 36 ug/l and may be indicative of positive method interferences rather than ground water contamination by chlorinated organic compounds.

TOC concentrations range from 5.1 to 15.7 mg/l. These concentrations are relatively elevated when compared to other TOC values in ground waters at MAFB. Although Site 6 formerly received spillage from petroleum products directly on the soils, the elevated values possibly represent only limited migration of these petroleum products into the ground water because oil and grease values are less than 0.1 mg/l. These values would be indicative of other organic compounds in the ground water at this site.

4.3.7 SITE 7--LANDFILL NO. 2

The locations of MW7-1, MW7-2, and MW7-3, along with detectable concentrations of various analytes, are presented in Fig. 4.3-8. The analytical results for all ground water samples from Site 7 are presented in Table 4.3-8.

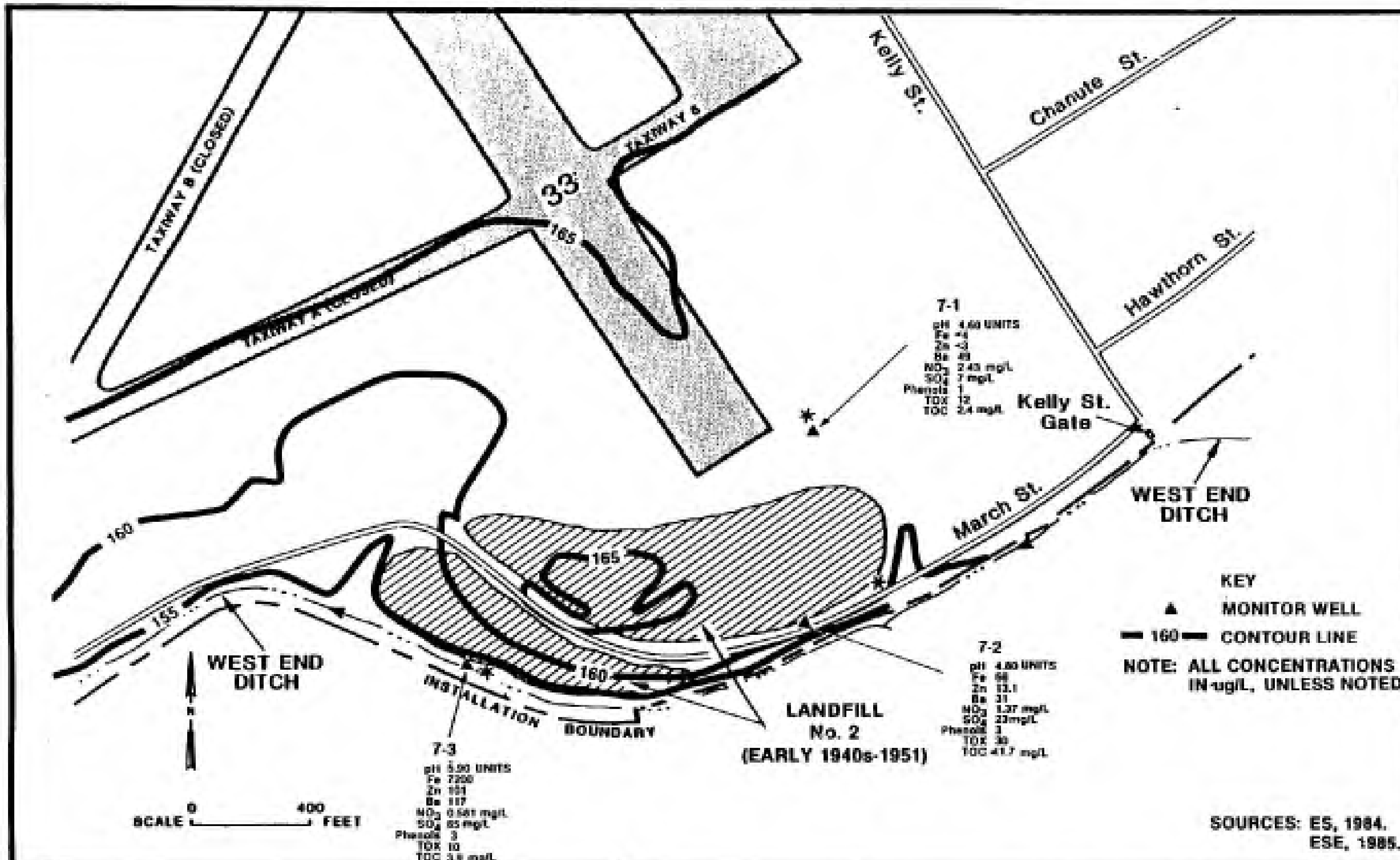

Figure 4.3-8
DETECTABLE CONCENTRATIONS OF VARIOUS ANALYTES IN GROUND WATERS AT SITE 7, LANDFILL NO. 2

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Table 4.3-8. Analytical Results for Ground Water Samples from Site 7

Parameters	Sample Location		
	GW7-1*	GW7-2	GW7-3
pH, field (std units)	4.60	4.80	5.90
Arsenic, diss. (ug/l)	ND†	ND	ND
Barium, diss. (ug/l)	49	31	117
Cadmium, diss. (ug/l)	ND	ND	ND
Copper, diss. (ug/l)	ND	3.1	ND
Chromium, diss. (ug/l)	ND	ND	ND
Iron, diss. (ug/l)	ND	66	7,200
Mercury, diss. (ug/l)	ND	ND	ND
Nickel, diss. (ug/l)	ND	ND	ND
Lead, diss. (ug/l)	ND	ND	ND
Silver, diss. (ug/l)	ND	ND	ND
Zinc, diss. (ug/l)	ND	13.1	101
Nitrogen, NO_2 + NO_3 (mg/l-as N)	2.43	1.37	0.581
Sulfate (mg/l)	7	23	65
Residue, diss. (mg/l)	51	71	136
Phenols (ug/l)	1	3	3
Oil & Grease, IR (mg/l)	ND	ND	ND
TOX (ug/l-CL)	12	30	10
Carbon, TOC (mg/l)	2.4	ND	3.9
Endrin (ug/l)	ND	ND	ND
BHC,G (Lindane)(ug/l)	ND	ND	ND
Methoxychlor (ug/l)	ND	ND	ND
Toxaphene (ug/L)	ND	ND	ND
2,4-D Total (ug/L)	ND	ND	ND
2,4,5-TP/silvex (ug/l)	ND	ND	ND
Fluoride (mg/l)	ND	0.11	1.09
Sp. Cond., field (umhos/cm)	56.0	102	260
Water Temp. (°C)	18.5	18.4	19.9
Selenium, diss. (ug/l)	ND	ND	ND
Cyanide (ug/l)	ND	ND	ND

*GW7-1 indicates a ground water sample from Monitor Well 1 at Site 7.
†ND = Not detected.

Source: ESE, 1985.

As with the other sites previously discussed, the pH of ground waters at Site 7 is acidic and ranges from 4.6 to 5.9. Other detectable parameters including Ba, SO_4, Zn, NO_3, and phenols were found at concentrations within the acceptable limits under NIPDWR, NSDWR, and the criteria for the protection of freshwater life and human health.

Concentrations of Fe at Site 7 varied from <4 ug/l at MW7-1 to 7,200 ug/l at MW7-3. The higher value exceeds the concentration under NSDWR. NSDWR is primarily for aesthetic or organoleptic qualities and does not necessarily represent values which will cause potential human-health problems. The high Fe value is indicative of limited ground water contamination at the site.

TOX concentrations range from 10 to 30 ug/l. These concentrations may represent positive interference or background and do not necessarily indicate the presence of significant chlorinated organic compounds in the shallow aquifer.

The TOC values range from <1.7 to 3.9 mg/l. These values are representative of background TOC levels in the ground water at Site 2.

5.0 ALTERNATIVE MEASURES

Three categories of alternatives are possible for the sites investigated:

I. Take no further action;

II. Conduct further monitoring to determine the need, if any, of cleanup; or

III. Undertake corrective actions to mitigate any contamination.

Category I (No Further Action) is appropriate for sites where there is little, if any, evidence to indicate that the site is or will ever be a source of significant contamination. This is a difficult decision in that one can never be absolutely sure no problem will ever exist at a site. However, reasonable judgments must be made so that resources can be allocated to sites that have the highest potential for environmental or human-health problems.

Category II (Additional Monitoring) is appropriate where insufficient evidence exists to place a site in either Category I or III. This category should be utilized with care since there is some risk that delay could allow contamination to spread and worsen the problem. That goal should be to gather enough evidence in a timely manner to resolve the question of whether or not the site should be cleaned up.

Category III (Mitigation) is appropriate where there is clear indication that current or future human or environmental problems will exist. The priority for actions would depend on the magnitude of the threat and whether that threat was current or future. Mitigative actions may include (but are not limited to) removal, containment, treatment, or stabilization of the contamination.

Category II (Additional Monitoring) is judged to be the only appropriate alternative for three of the seven Phase II, Stage 1 sites at MAFB. These sites are:

1. Site 2, Surface Drainage System (surface water and sediments);
2. Site 3, FPTA No. 2 and Landfill No. 3; and
3. Site 5, Landfills 4, 5, and 6.

Criteria for recommending additional analyses for these zones are listed below.

1. Results reported for one or more screening or specific parameters at one or more sampling locations within the zone are positive and indicate that contamination may exist within the zone;
2. Existing information, particularly the records search, indicates that the contaminants of concern may have been disposed of or spilled within the zone; and
3. Available data for the site are insufficient to proceed to Category I (No Further Action) or Category III (Mitigative Action).

Recommendations for additional monitoring at the sites listed above are given in Sec. 6.0.

Two alternatives were considered for the remaining four sites--Category II (Additional Monitoring) and Category I (No Further Action). These sites include:

1. Site 1, Electroplating Waste Disposal Areas;
2. Site 4, FPTA No. 1;
3. Site 6, C.E. Drum Storage Area; and
4. Site 7, Landfill No. 2.

The three criteria listed previously were used to decide whether these sites would be recommended for additional analyses or for no further action.

These sites were dropped from further consideration based on the fact that the first set of screening samples did not indicate the presence of contaminants in the ground water at the sites.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

Most evidence of ground water and surface water contamination at MAFB is based on general screening analyses. These analyses have the advantage of relatively low cost, but they do not identify specific compounds. Analyses for phenolics and TOC measure classes of compounds, portions of which are synthetic organic compounds and portions of which are the result of the natural decay of organic matter. TOX is a measure of total organic halogens which are mostly synthetic. As discussed in Sec. 4.3.1, the TOX data suggest a positive interference most likely caused by inorganic halides.

A conservative attitude requires that positive results be investigated via expanded sets of analyses. Since the suspected positive TOX interference can be neither verified nor quantified, this assumption also holds for TOX data. An exception to this approach to TOX can be made in cases where the Phase I records search and all other available information indicate that there were no significant quantities of halogenated organic compounds used, spilled, or disposed of at the study site.

Indications of organic contamination in ground water require analyses for purgeable organics, base/neutral extractable organic compounds, and acid extractable organic compounds which are three groups of the EPA Priority Pollutant List. Approximately one-third of the base-neutral extractable organics are halogenated and, in theory, should be detected by the TOX analysis. Acid extractable organics are all phenolic compounds or creosols. The expanded set of analyses would again include metals, cyanides, and pesticides, based on the Phase I record search information and the screening analysis conducted in Phase II, Stage 1.

Field measurement of pH and specific conductance for all water samples are included with recommended analyses since these are generally performed at no additional cost and can provide useful information.

6.2 RECOMMENDATIONS

This section presents recommendations for Phase II, Stage 2 work at MAFB on a site-by-site basis. One or both of the following criteria were used in selection of Phase II, Stage 2 sampling locations for specific zones:

1. Phase II, Stage 1 sampling locations which indicated the greatest potential for contamination were recommended for further analyses; and
2. Locations where samples were not collected during Phase II, Stage 1 and, based on the results obtained in the study, might provide additional useful information.

6.2.1 SITE 2--SURFACE WATER DRAINAGE SYSTEM

The surface water monitoring program should be expanded to include three additional sites. The new surface water monitoring sites are included in Fig. 6.2-1. Samples should be collected and analyzed for purgeable organics, base/neutral extractables, organics, acid extractables, pesticides, and metals to determine specific contaminants in the surface waters. A summary of the analyses recommend for Site 2 during the MAFB Phase II, Stage 2 study is presented in Table 6.2-1. New data should be examined and compared with previous data to determine if As concentrations are consistently higher at onbase locations. Field pH and specific conductivity should be determined during sampling. Additional data searching should be performed to determine the source of As and Hg in the surface water samples. Based on the results of these analyses, additional actions may be necessary.

The sediment monitoring program should also be continued. Additional sediment sampling sites should be added to determine if the Hg and Pb concentrations are indicative of contamination or natural background.

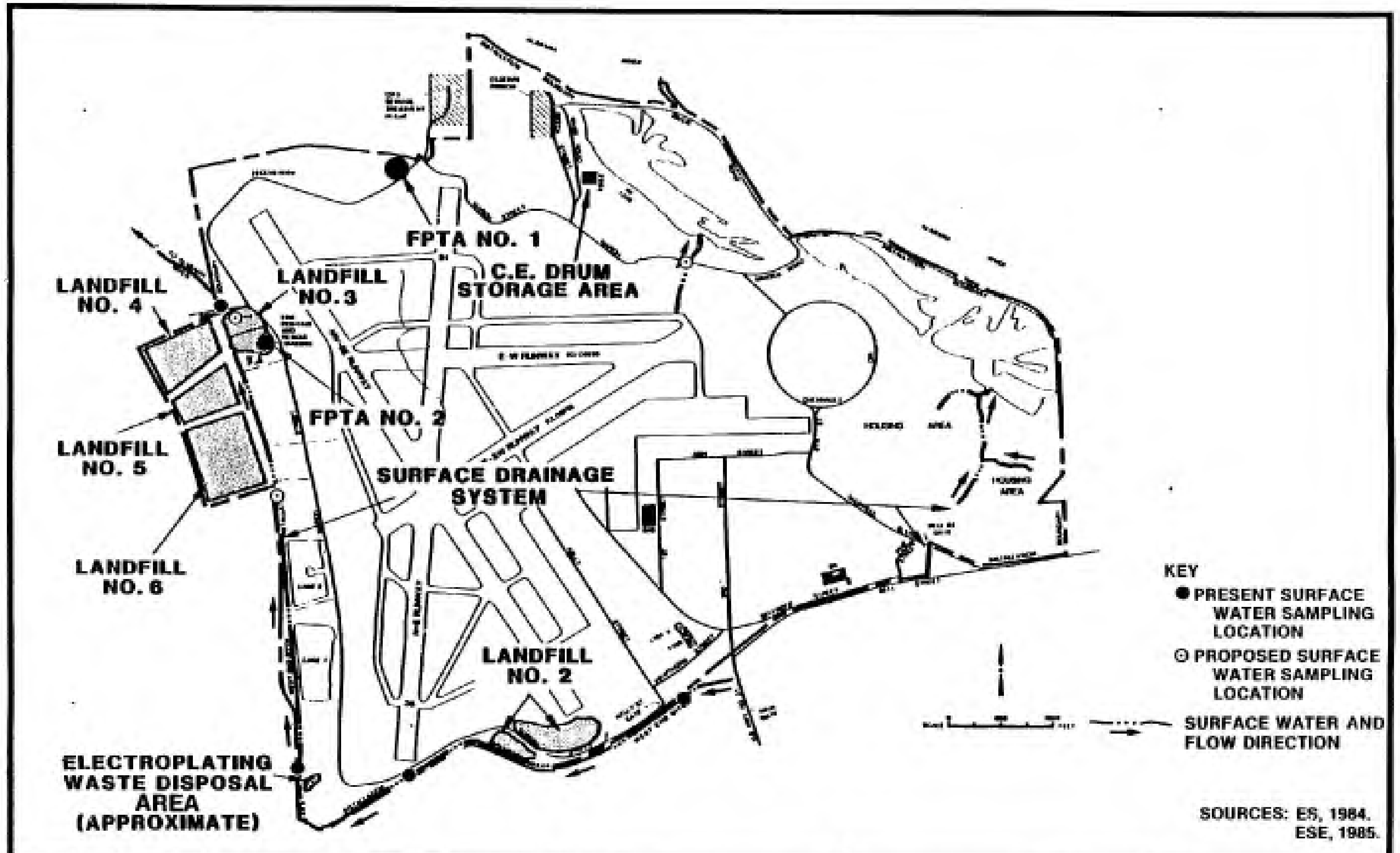


Figure 6.2-1
LOCATIONS OF PRESENT AND PROPOSED SURFACE WATER SAMPLING SITES ON MAFB

INSTALLATION RESTORATION PROGRAM
Maxwell Air Force Base

Table 6.2-1. Summary of Sampling and Analyses Recommended for MAFB, Phase II, Stage 2 Survey

		Analyses															
				Gas Chromatography/Mass Spectrometry													
Site	Sampling Locations	pH	Specific Conductance	Purgeables	Acid Extractables	Base/Neutral Extractables	Pesticides	CN	Cu	Cr	Cd	Ni	Pe	Hg	As	Rationale for Recommendation
2	Surface water sampling locations S 2-1, S 2-2, S 2-3, and S 2-4; new sites S 2-5, S 2-6, and S 2-7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	TOC found at low levels. Need GC/MS to determine identities and concentrations of organic and chlorinated organics. Need to confirm Hg and As and determine source, if possible. Analyze for metals and cyanide since electroplating was performed in past.
	Sediment sampling locations S 2-1 through S 2-11; new sites upstream of S 2-1 (1 site), downstream of S 2-8 (1 site), and downstream of S 2-11 (1 site)			X	X	X	X	X	X	X	X	X	X	X	X	TOC found at low levels. Need GC/MS to determine identities and concentrations of organics. Need to confirm Hg and Pb and determine source, if possible. Analyze for metals and cyanide since electroplating was performed in past.
3	MW 3-1, 3-2, and 3-3	X	X	X	X	X	X									Pesticides, TOC, TOX, and low-level metals present. Need to confirm concentrations and identify the organics.
5	MW 5-1, 5-2, 5-3, 5-4, and other existing wells, if accessible (5-5, etc.)	X	X	X	X	X	X									Pesticides, TOC, TOX, and low-level metals present. Need to confirm concentrations and identify the organics.

Source: ESE, 1985.

The new sediment sampling sites should be located upstream of S2-1 (1 new site), upstream of S2-4 (2 new sites), downstream of S2-6 (1 new site), downstream of S2-8 (1 new site), and downstream of S2-11 (see Figure 6.2-2). Based on the results of these analyses, additional actions may be necessary.

6.2.2 SITE 3--FPTA NO. 2 AND LANDFILL NO. 3

Ground water samples should be collected at MW3-1, MW3-2, and MW3-3. These samples should be analyzed for purgeable organics, base/neutral extractable organics, acid extractable organics, pesticides, Fe, Cd, Cu, Ni, Cr, and field pH and specific conductance. A summary of the analyses recommended for Site 3 during the MAFB Phase II, Stage 2 study are presented in Table 6.2-1. Based on the results of these analyses, additional actions may be necessary.

6.2.3 SITE 5--LANDFILLS 4, 5, AND 6

Ground water samples should be collected at MW5-1, MW5-2, and MW5-3. These samples should be analyzed for purgeable organics, base/neutral extractable organics, acid extractable organics, pesticides, Fe, Cd, Cu, Ni, Cr, field pH, and specific conductance. Based on the results of these analyses, additional actions may be necessary.

A summary of the analyses recommend for Site 5 during the MAFB Phase II, Stage 2 study is presented in Table 6.2-1.

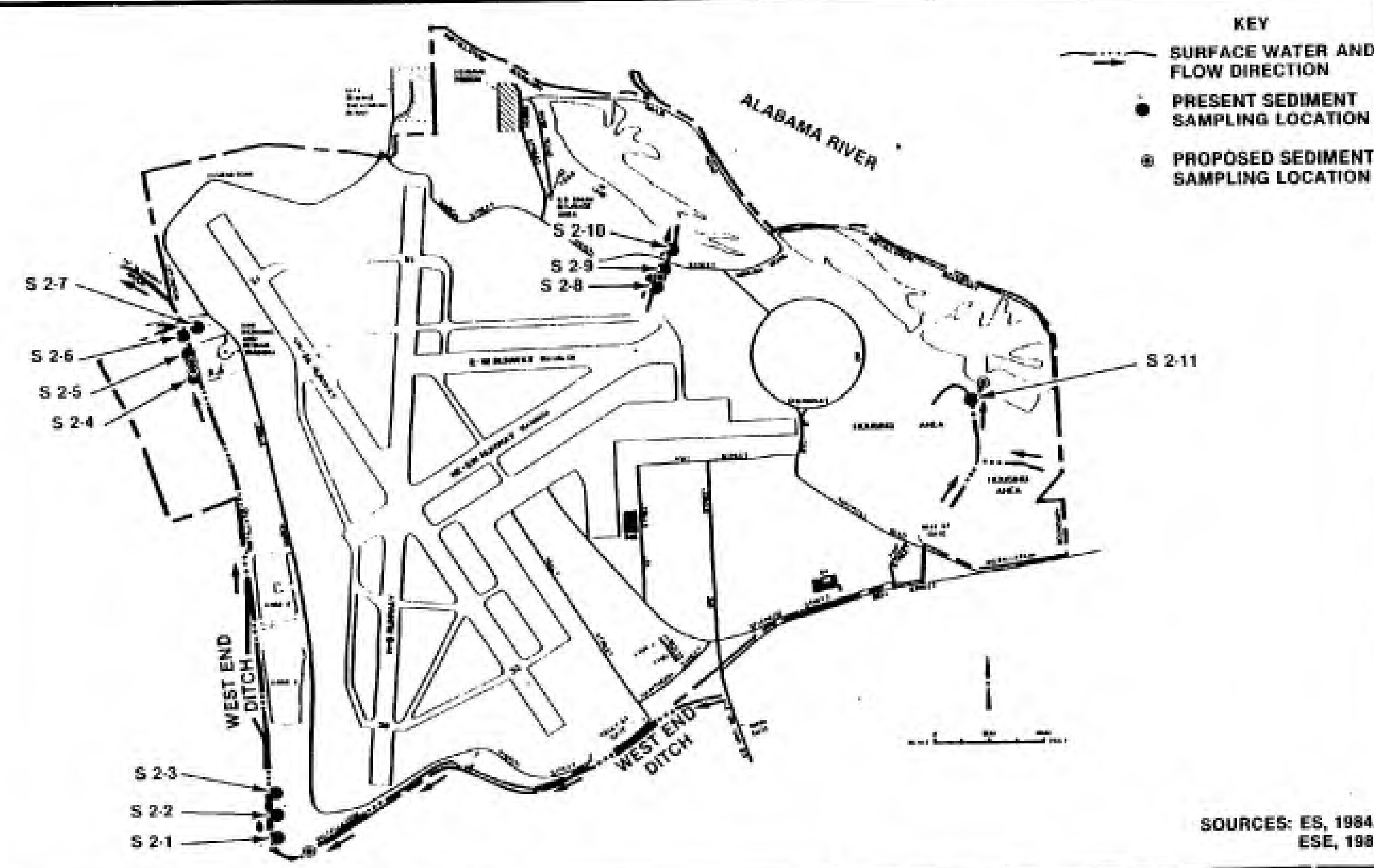


Figure 6.2-2
LOCATIONS OF PRESENT AND PROPOSED SEDIMENT SAMPLING SITES ON MAFB

INSTALLATION RESTORATION PROGRAM
Maxwell Air Force Base

APPENDIX A--GLOSSARY OF TERMINOLOGY, ABBREVIATIONS, AND ACRONYMS

APPENDIX A

GLOSSARY OF TERMINOLOGY, ABBREVIATIONS, AND ACRONYMS

AFB	Air Force Base
AFESC	Air Force Engineering and Service Center
Ag	Chemical symbol for silver, a metal used in photographic emulsions and other industrial operations; toxic to humans and aquatic life at low concentrations
As	Chemical symbol for arsenic
AU	Air University
Ba	Chemical symbol for barium
Cd	Chemical symbol for cadmium, a metal used in batteries and other industrial applications; highly toxic to humans and aquatic life
C.E.	Civil Engineering
°C	degrees Celsius
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	Centimeter(s)
CME	Central Mine Equipment
CN	Chemicl symbol for cyanide
Contamination	Degradation of natural water quality to the extent that its usefulness is impaired; degree of permissible contamination depends on intended use of water
Cr	Chemical symbol for chromium, a metal used in plating, cleaning, and other industrial applications; highly toxic to aquatic life at low concentrations, toxic to humans at higher levels
Cu	Chemical symbol for copper

DEQPPM	Defense Environmental Quality Program Policy Memorandum
Det.	Detachment
Disposal of hazardous waste	Discharge, deposit, injection, dumping, spilling, or placing of any hazardous waste into or on land or water so that such waste, or any constituent thereof, may enter the environment, be emitted into the air, or be discharged into any waters, including ground water
DOD	Department of Defense
Downgradient	In the direction of decreasing hydraulic static head; the direction in which ground water flows
EM	Electromagnetic
EPA	U.S. Environmental Protection Agency
ES	Engineering-Science
ESE	Environmental Science and Engineering, Inc.
°F	degrees Fahrenheit
F	Chemical symbol for fluoride
Fe	Chemical symbol for iron, a metal commonly found in water as a consequence of dissolution of geologic materials; relatively nontoxic
FPTA	Fire Protection Training Area
ft	Foot (feet)
gpm	Gallon(s) per minute
HARM	Hazard Assessment Rating Methodology
Hazardous waste	As defined in RCRA, a solid waste or combination of solid wastes which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed

Hg	Chemical symbol for mercury
IIA	Initial Installation Assessment
IRP	Installation Restoration Program
LAW	Law Engineering Testing Company
lb	Pound(s)
MAFB	Maxwell Air Force Base
MAJCOM	Major Command
MCL	Maximum contaminant level
mg/l	Milligram(s) per liter
MSL	Mean sea level
MW	Monitor well
NGVD	National Geodetic Vertical Datum
Ni	Chemical symbol for nickel, a metal used in batteries, plating, and other industrial applications; highly toxic to humans and aquatic life
NIPDWR	National Interim Primary Drinking Water Regulations
NO_3	Chemical formula for nitrate, a common anion in natural water
NPDES	National Pollutant Discharge Elimination System
NSDWR	National Secondary Drinking Water Regulations
OEHL	Occupational and Environmental Health Laboratory
Pb	Chemical symbol for lead, a metal additive to gasoline and used in other industrial applications; toxic to humans and aquatic life; bioaccumulates
pH	Negative logarithm of hydrogen ion concentration; an expression of acidity or alkalinity
QA/QC	Quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
Se	Chemical symbol for selenium, a metal with numerous applications as a catalyst; toxic to humans and aquatic life

SO_4	Chemical formula for sulfate, a common anion in sea water
TDS	Total dissolved solids
TOC	Total organic carbon
TOE	Total organic extractables
TOX	Total organic halogens
2,4-D	2,4-Dichlorophenoxyacetic acid
2,4,5-TP	2,4,5-Trichlorophenoxyacetic acid
ug/g	Microgram(s) per gram
ug/l	Microgram(s) per liter
USAF	U.S. Air Force
USGS	U.S. Geological Survey
Zn	Chemical symbol of zinc, a metal with a wide variety of industrial applications, particularly corrosion-resistant; highly toxic to aquatic life, slightly toxic to humans at high dose levels

APPENDIX B--RESUMES OF KEY PROJECT PERSONNEL

ESE

PROFESSIONAL RESUME

JOHN D. BONDS, Ph.D.
Senior Scientist/Project Manager

SPECIALIZATION

Project Management, Atmospheric Chemistry, Water Chemistry, Industrial Hygiene, Quality Assurance, Hazardous Waste

RECENT EXPERIENCE

Initial Assessment for Hazardous Wastes at Army Installations, Team Leader--Comprehensive study at 48 Army installations to determine both past and present history with respect to the use of hazardous substances, quantities used, disposal methods and disposal sites. Also includes a current assessment of safety practices and compliance with regulations.

Initial Assessment Studies for the United States Air Force, Team Leader--Comprehensive studies at 2 Air Force bases to determine both past and present history with regard to the use and disposal of toxic and hazardous materials. Conducted in accordance with the Department of Defense Installation Restoration Program policies.

Initial Assessment Studies for the Naval Energy and Environmental Support Activity, Team Leader--Evaluating 2 Naval installations with regard to past hazardous waste generation, storage, treatment, and disposal practices. Investigations include records review, aerial and ground site surveys, employee interviews, and limited sampling and analysis including geophysical techniques. Determine extent of contamination at former disposal/spill sites, potential for contaminant migration, and potential effects on human health and the environment.

Phase II Confirmation Studies to Determine the Presence and Migration of Hazardous Wastes from Military Installations, Team Leader--Five comprehensive field studies to determine the actual sites where hazardous substances were used, their current concentrations in soils, surface waters and groundwater, and an assessment of the quantities which may migrate from the installation. The study also included recommendations for decontamination operations.

Determination of Hazardous Chemicals in Landfills, Project Manager--Several studies in which field sampling techniques and laboratory methods were developed to determine the existence and concentrations of explosive gases generated by landfill operations, priority pollutants escaping to the atmosphere and contaminating the groundwater.

Preparation of Quality Assurance Guidelines for EPA Project Officers, Project Manager--Preparation of QA guidelines for use by EPA project officers in selecting contractors for projects requiring sampling and analysis. Also included guidelines for quality assurance audits of the field sampling and analysis portion of any awarded contract. EPA publication 600/9-79-046 entitled Quality Assurance Guidelines for IERL-Ci Project Officers was produced under this project.

Air Compliance Testing of Industrial Sources, Project Manager--Various projects involving compliance testing at petroleum refineries, Kraft pulp mills, power plants, iron and aluminum smelting operations, and various other industries.

Ambient Air Monitoring, Project Manager--Various projects to determine ambient air concentrations of sulfur oxides, particulates, nitrogen oxides, carbon monoxide, photochemical oxidants, priority pollutant organics, and hydrocarbons.

EDUCATION

Ph.D.	1969	Analytical Chemistry	University of Alabama
B.S.	1963	Chemistry	University of Alabama

U.S. EPA Air Pollution Training Institute: Quality Assurance for Air Pollution Measurement Systems--workshop graduate (1977)

ASSOCIATIONS

American Chemical Society
American Industrial Hygiene Association
Air Pollution Control Association

REPORTS AND PUBLICATIONS

More than 50 reports and publications on Installation Assessments, source air emissions, hazardous materials and quality assurance.

GEORGE K. FOSTER
Geologist

ESE PROFESSIONAL RESUME

SPECIALIZATION

Geology, Clay Mineralogy, and Portland Cement Chemistry

RECENT EXPERIENCE

United States Air Force, Maxwell AFB, Team Hydrogeologist--
Served as hydrogeologist for the pre-performance survey and prepared detailed plans for the emplacement of monitor wells around hazardous waste disposal areas on the installation.

University of Florida, Graduate Teaching Assistant--Responsible for X-ray analysis, clay mineralogy, and engineering geology. Also acted as Lab Instructor for clay mineralogy.

Analex, Aurora, Colorado, Well-Site Geologist--Responsible for collecting and logging drill cuttings, monitoring downhole gases and drill rates, and observing DSTs and corings.

Florida Mining and Materials Corp., Brooksville, Florida, Lab Technician--Responsibilities included testing and quality control of Portland cement raw materials and microscopic analysis of cement clinker.

EDUCATION

M.S.	1984	Geology/Clay Mineralogy	University of Florida
B.A.	1980	Geology	University of South Florida

MICHAEL J. GEDEN, B.S.
Water Resources

ESE PROFESSIONAL RESUME

SPECIALIZATION

Geophysical Investigation, Geologic Structure and Process, Geomorphology, Field Sampling and Techniques

RECENT EXPERIENCE

Ohio Superfund Site, Task Manager--Conducted a multitechnique geophysical survey at an abandoned hazardous waste site in northeastern Ohio. Also supervised installation of monitoring wells.

Solite Corporation, Project Geologist--Conducted a geophysical survey at a hazardous waste site in northeast Florida. Sampled surface and ground water and installed monitoring wells.

Pinellas County, Subproject Manager--Geophysical survey of refuse-to-energy plant and active landfills. Design and installation of ground water monitoring wells. Aquifer testing and analysis through use of single well slug tests.

Geophysical Investigations for Uncontrolled Disposal Site, Scientist--Conducted investigations to locate buried drums using remote sensing techniques. More than 1,000 drums were located and excavated.

Midwest Manufacturer, Project Scientist--Installation and sampling of ground water monitor wells to determine extent of ground water contamination. Aquifer testing and analysis through use of single well slug tests.

Florida Manufacturer, Associate Scientist--Conducted multitechnique geophysical survey. Design, construction, aquifer analysis, and sampling of ground water monitoring system to determine extent of subsurface contamination.

Aero Corportion, Associate Scientist--Construction, aquifer analysis, and sampling of ground water monitor wells to determine effectiveness of wastewater treatment process.

Ida-Con Corporation, Associate Scientist--Design, siting, construction, and sampling of ground water monitor wells to test effectiveness of surface water retention ponds.

Seminole Electric Cooperative, Project Scientist--Installation and aquifer testing of ground water monitor wells as part of siting study for new electric-generating station.

Alabama Army Ammunitions Plant Ground Water Monitoring, Associate Scientist--Installation, development, and sampling of ground water monitor wells and piezometric clusters.

Georgia Pacific, Associate Scientist--Installation and development of ground water monitor wells and piezometric transects in Santa Fe Swamp.

USATHAMA-Ft. Navajo, Ft. Wingate, Bluegrass, Phoenix, AAAP, Lima, and Savannah Army Depots, Associate Scientist--Compilation and preparation of field drilling data for entry into U.S. Army computer system.

General Electric Company, Project Scientist--Monthly sampling of ground water monitor wells to monitor integrity of surface chemical retention ponds.

EDUCATION

B.S. 1979	Earth Science	Northeastern Illinois University

ALLEN P. HUBBARD, B.S.E.,P.E.
Department Manager, Hazardous Materials Engineering

ESE PROFESSIONAL RESUME

SPECIALIZATION

Hazardous Waste Management, Remedial Actions, Industrial Waste Operations Design and Permitting

RECENT EXPERIENCE

Environmental Audits and Records Search of U.S. Army Facilities, Project Team Engineer--Served for two years on this project to assist the U.S. Army in its Installation Assessment Program. Project teams conduct onsite environmental surveys which assess current and past waste management activities at military installations. Hazardous and toxic waste management is emphasized. The team engineer inspects industrial operations, POL storage and transfer facilities, wastewater treatment facilities, RCRA permitting and compliance, status, central records, and compliance of transportation, property sales and disposal. Interviews are conducted with current and former employees. In a following report, recommendations are presented for upgrading to comply with state, federal, and army regulations. Sites included: Fort Buchanan, PR; Fort Benjamin Harrison, IN; Fort Leavenworth, KS; Fort McPherson, GA; Fort Knox, KY; and Fort Bragg, NC.

Hazardous Waste Delisting Projects, Project Manager/Engineer--Four separate projects for three plants in the steel finishing industry. Projects included negotiation with state and federal agencies (in different states), sampling and analysis, and formal petition documents to exclude listed hazardous wastes from RCRA regulations according to 40 CFR Part 260.22.

Evaluation and Conceptual Design of Solid Waste Management Facilities for Coal-Fired Power Plants, Project Engineer--Part of the siting and licensing of three coal-fired generating stations for Florida Power Corporation, Atlantic City Electric, and Soyland Electric Cooperative. Involved in estimating ash characteristics and quantities, evaluating FGD processes, and conceptual design of flyash landfills.

RCRA Closure Plans for Hazardous Waste Treatment and Storage Facilities, Project Manager/Engineer--Developed plans for five separate clients for closure of hazardous waste treatment, storage, disposal facilities (TSDFs). Types of operations included hazardous waste incinerator, burning ground, and storage tank farm, chemical/physical treatment system, land treatment facility, surface impoundments. Final plans complied with 40 CFR Part 265.

Regional Hazardous Waste Inventory, Tampa Bay Area Regional Planning Council (TBARPC), Task Leader of abandoned dumps and landfill practices of multicounty study mandated by state law. Project encompasses a year-long survey of all hazardous waste generators and TSDFs in the TBARPC area. Includes evaluation of hazardous wastes at sanitary landfills and site surveys of abandoned dumps. Objectives are interference of total waste generation rate from a partial sample and location of suitable areas for siting of offsite storage or treatment facilities.

Hazardous Waste Remedial Action/Decontamination Study, Alabama Army Ammunition Plant, Project Engineer--Project to develop and implement corrective measures for decontamination of buildings, process equipment, sewers and soil to control surface water and ground water contamination at U.S. Army ammunition plant. Developed decontamination alternatives with consideration of risk, cost and technical feasibility.

EDUCATION

B.S.E. 1979 Environmental Engineering University of Florida

REGISTRATION

EIT 1979 Florida

ASSOCIATION

American Society of Civil Engineers

PUBLICATIONS

"Operating and Monitoring Requirements for Hazardous Waste Land Treatment Facilities." Hearne, S.R., P.E., Hubbard, A.P., Hart, Robin, Ph.D. Proceedings from National Conference on Risk and Decision Analysis for Hazardous Waste Disposal. 1981. Sponsored by Hazardous Materials Control Research Institute.

"Delisting Hazardous Wastes at Industrial Plants--Procedures and Case Study." Hubbard, A.P., Frey, E.E., Ruen, M.J. Proceedings of the Industrial Wastes Symposia, 55th Annual Conference of the Water Pollution Control Federation. 1982.

JOHN J. MOUSA, Ph.D.
Quality Assurance Manager

ESE PROFESSIONAL RESUME

SPECIALIZATION

Quality Assurance, Environmental Sampling and Analysis, Analytical Chemistry, Water Quality Assessment, Environmental Fate and Assessment Studies, Trace Organic Residue Analysis, Gas Chromatography and High-Pressure Liquid Chromatography

RECENT EXPERIENCE

ESE Corporate Quality Assurance Manager--Responsible for auditing quality control, implementation of department and division level QC programs, providing independent peer review of project deliverables.

Research and Development--Responsible for staffing, direction, review and technical quailty of projects involving environmental/fate studies, trace organic residue analysis, environmental sampling and analysis, special instrumental techniques and analytical methods development.

Remedial Investigation and Feasibility Study for the French Limited and Sikes Pit Abandoned Waste Disposal Sites, Quality Assurance Manager--Prepared QA plans and performed quality assurance/quality control duties for field sampling, analysis, and report preparation.

Environmental Contamination Assessment of Army Munitions Manufacturing and Storage Facilities, Laboratory Manager/Subproject Manager--Managed laboratory analyses for four environmental assessment studies conducted for U.S. Army Toxic and Hazardous Materials Agency. Work involved methods development certification and trace organics analysis in water, soil, and sediment samples.

Sampling and Analysis of Boundary Monitoring Wells, Project Manager--Sampling and analysis of ground water for trace organics and inorganics at industrial explosives manufacturing facility. Supervised methods documentation and analysis.

Analytical Methods Development for Hazardous Compounds in Water and Soil, Project Manager--Development of analytical method for seven organic compounds at part-per-billion and part-per-million level in water and soil. Includes development of HPLC screening method for organics in water. Compounds include hazardous munitions and related degradation products.

Effluent Guidelines BAT Review-Printing and Publishing and Gum and Wood Industries, Project Manager--Supervised and coordinated laboratory analyses for priority pollutants in industrial wastewaters.

EDUCATION

Ph.D.	1973	Analytical Chemistry	University of Florida
B.S.	1970	Chemistry (Summa Cum Laude)	University of Houston

ASSOCIATIONS

American Chemical Society
Society of Environmental Toxicology and Chemistry (SETAC)
American Society for Testing and Materials (ASTM)
Phi Kappa Phi Honor Society

MEREDITH T. PARK, M.S.

Professional Resume

Areas of Specialization

Hazardous Waste; Analysis, Field Investigation, and Contamination Assessment; Inorganic Chemistry; Marine Chemistry

Experience

Staff Scientist, Chemsitry Division, ESE, Gainesville, Florida, 1984-Present. Atomic Spectroscopy Department Manager, ESE, 1979-1984.

Department of Defense (DOD) Installation Restoration Program (IRP), Project Manager--Responsible for project/task management as well as task technical support within the program structure. IRP is the DOD identification and control program for past hazardous materials released at military facilities under CERCLA.

Rocky Mountain Arsenal, Environmental Program, Task Manager--Managing ongoing task involving analtyical methods development and subsequent analysis of environmental soil and sediment samples.

West Virginia Ordnance Works Environmental Survey, Task Manager--Managing ongoing 10,000-manhour comprehensive environmental contamination survey for the above CERCLA (Superfund) site, ranked 86th on the National Priorities List (NPL).

Sharpe Army Depot, Task Manager--Managing ongoing chemical analysis task for ground water contamination assessment.

Maxwell Air Force Base, Environmental Survey, Task Manager--Managing ongoing 1,000 manhour environmental survey involving analysis of surface water, sediments, and hazardous wastes.

Aberdeen Proving Ground Environmental Survey, Project Manager--Managed 1,500-manhour exploratory ground water and surface water contamination survey at Edgewood Arsenal, Maryland.

Volunteer Army Ammunition Plant, Task Manager--Managed chemical analysis task involving testing of ground waters and soil samples.

Atomic Spectroscopy Department Manager--Responsible for trace metals analysis for a wide range of samples. Also responsible for analtyical methods development by atomic absorption and inductively coupled plasma emission spectroscopy.

<u>Environmental Assessment Studies for Oil Recovery Steamflood Project in Sumatra, Indonesia, Project Chemist</u>--Conducted water quality analysis of an oil field steamflood project for Caltex Pacific Indonesia. Instructed local technicians in chemical analyses and laboratory techniques.

<u>Florida Acid Deposition Study</u>--Responsible for trace metals portion of a multiyear study investigating acid rain. Analyses performed using inductively coupled plasma emission spectroscopy and atomic emission spectroscopy.

<u>Florida Institute of Phosphate Research</u>--Responsible for providing analytical support for a research study of the limnology of reclaimed lakes in central Florida. Supervised analysis of water and sediment samples by atomic absorption (AA) and by inductively coupled argon plasma (ICAP) spectroscopy.

<u>Hazardous Waste Characterization for RCRA Compliance, Project Manager</u>--Ongoing project providing analytical services for clients filing applications or fulfilling monitoring program requirements for RCRA compliance. Involves elutriation of samples and subsequent analysis for trace metals and pesticides.

Laboratory Manager, Connell Metcalf and Eddy, Inc., Coral Gables, Florida, 1979 to 1980.

Staff supervisor of biological and chemical techniques performing a wide variety of environmental analyses. Involved in multi-disciplined environmental community, benthic and planktonic community structure study for a nuclear power plant, and master planning and related environmental studies for Metropolitan Dade County marinas. Responsible for analysis of industrial effluents and process streams.

Chemical Oceanographer, Everglades National Park, National Park Service, 1979.

Responsible for development of an automated monitoring system to assess long-term changes in the estuarine and marine waters of the Everglades National Park and for developing computerized data management procedures.

Marine Chemist, College of Marine Studies, University of Delaware, 1978 to 1979.

Supervisor of Marine Chemistry Laboratory with managerial and technical duties. Work included investigation of pathways of cadmium transport in terrestrial vegetation, research concerning nitrogen fluxes in estuarine systems, and the monitoring of drinking water for excessive nitrate levels. Responsible for report preparation and the drafting of proposals.

Analytical Chemist, Virginia Associated Research Campus, William and Mary College, 1976 to 1978.

Involved in an environmental benchmark study designed to assess the potential environmental impact of oil exploration on the mid-Atlantic outer continental shelf. Developed analytical procedures for analyzing marine sediments and organisms by flame and flameless atomic absorption spectrometry. Responsible for data reduction and interpretation, and the preparation of progress reports to the funding agency (Bureau of Land Management, Department of the Interior).

Research Assistant, U.S. Army Corps of Engineers, Port Hampton Roads, Virginia, 1975 to 1976.

Conducted contract work involving water quality monitoring of the Craney Island Dredge Material Disposal Area. Work concerned with fate of trace metals in an estuarine environment. Responsible for project design, analytical quality control, and data interpretation. Acted as liaison between the University and Corps of Engineers.

Laboratory Technician, Sanitation District Commission, Lamberts Point Treatment Plant Laboratory, Hampton Roads, Virginia, 1972 to 1975.

Performed wide range of chemical analyses, including determination for nutrients, fecal coliform, dissolved oxygen, carbon, and heavy metals. Gained experience with various means of instrumental analysis including spectrophotometry, organic carbon techniques, and atomic absorption spectrophotometry.

Education

M.S.	1976	Chemical Oceanography	Old Dominion University
B.A.	1968	Chemistry	Duke University

Affiliations

American Chemical Society
American Society of Limnology and Oceanography

Publications

Adams, D.D. and Park, M.T.. 1976. Water Quality Monitoring of the Craney Island Dredge Material Disposal Area. Port of Hampton Roads, Virginia. April 1975 to March 1976. Technical Report, No. 29, Institute of Oceanography, Old Dominion University, Norfolk, Virginia. 189 p.

Gaby, R., Langley, S.P., Park, M.T., and Curry, R.W. 1980. Key Largo Coral Reef Marine Sanctuary--Literature Survey and Water Quality Monitoring Program. National Oceanic and Atmospheric Administration, Office of Coastal Zone Management. 196 p.

Newman, J.R., Novakova, E., Bergdoll, M.K., and Park, M.T. 1984. Ducks as Site Specific Bioindicators of Trace Metal Pollution. Presented at the Society of Environmental Toxicology and Chemistry, Fifth Annual Meeting, November 1984.

Julia H. Chalkley, M.S.
Senior Associate Scientist/Geologist

ESE PROFESSIONAL RESUME

SPECIALIZATION

Geology and Hydrogeology, Environmental Permitting, Environmental and Hazardous Waste Management

RECENT EXPERIENCE

Ground Water Monitoring Plan, Project Manager--Investigated existing ground water monitoring program for industrial facility including field sampling, recommended plan to correct deficiencies, and trained industrial personnel in field sampling techniques.

Initial Installation Assessment, Naval Facilities, Team Geologist--Evaluation of two Naval installations with regard to potential for environmental contamination from past hazardous waste generation, storage, treatment, and disposal practices. Responsibilities included assessment of geohydrology of potential contamination sites, identification of pollutant migration pathways, and recommendation for further study.

Phase II Confirmation Study, U.S. Air Force, Project Geologist--Field team leader for sampling of ground water monitor wells to determine extent of ground water contamination at abandoned and current disposal sites.

Environmental Permit Appication, Staff Editor and Reviewer--Prepare EPA Parts A and B applications for commercial hazardous waste disposl facilities, including facility designed for subsurface disposal of hazardous wastes in solution-mined salt caverns, large industrial above- and below-ground landfill and incineration complex, and several facilities with treatment ponds and lagoons.

Evaluation of Surface and Subsurface Hazardous Waste Disposal Sites, Staff Geologist--Performed investigations of subsurface geology and geohydrology at potential deep well disposal sites, salt domes for use as mined repositories, and landfill sites.

EDUCATION

M.S.	1985	Environmental Management	University of Houston
B.S.	1980	Geology	Florida State University

LINDA D. TOURNADE
Senior Technical Writer and Editor

ESE
PROFESSIONAL RESUME

SPECIALIZATION

Technical Writing and Editing, Publications Management, Document Coordination, and Historical Research

RECENT EXPERIENCE

Technical Editor/Document Coordinator for U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) Waste Treatment Technology Contracts--Responsible for coordination and management of report production, including liaison with project manager and client in regard to client requirements, report organization, writing assignments, report format, quality control, word processing, graphics, printing/binding, and distribution.

Subproject Manager for Environmental Contamination Survey of Sharpe Army Depot for USATHAMA--Responsibilities include monitoring and controlling document production budget, preparing cost and performance reports, editing, and document coordination of draft and final technical plans, management plans, and community relations plans, as well as presentation materials for regulating liaison meetings and public workshops.

Technical Editor/Document Coordinator for Assessment of Contamination at Phoenix Military Reservation for USATHAMA-- Edited and coordinated production of presentation materials, draft and final assessment reports, and draft technical and management plans for remedial action alternatives assessments.

Technical Editor/Document Coordinator for Installation Assessment of U.S. Military Academy, West Point--Responsible for editing and managing production of draft and final assessment reports detailing past and current use of toxic and hazardous materials at West Point and subinstallations.

Subproject Manager for Installation Restoration Program Records Search for U.S. Air Force Installations--Researching history, mission, and organization of U.S. Air Force installations and writing sections for records search documents. Installations include Cape Canaveral Air Force Station, Patrick Air Force Base (AFB), Vandenberg AFB, Columbus AFB, and Andersen AFB. Additional responsibilites include editing sections authored by other team members, monitoring and controlling document production budget, and coordinating and managing report production.

EDUCATION

B.S. (Candidate)	1985	Journalism/Technical Communication	University of Florida

ASSOCIATIONS

- Society for Technical Communication, Secretary-Treasurer for North-Central Florida Chapter

APPENDIX C--SCOPE OF WORK AS OUTLINED BY OEHL

16 JUL 1984

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION (STAGE 1)
MAXWELL AFB ALABAMA

I. DESCRIPTION OF WORK

The purpose of this task is to undertake a field investigation at Maxwell AFB Alabama (1) to determine the presence or absence of contamination within the specified areas of investigation; (2) if contamination exists, determine the potential for migration of those contaminants in the various environmental media; (3) identify additional investigations necessary to determine the magnitude, extent, direction and rate of migration of discovered contaminants; and (4) identify potential environmental consequences and health risks of migrating pollutants.

The Phase I IRP Report (mailed under separate cover) incorporates the background and description of the sites for this task. To accomplish this survey effort, the contractor shall take the following actions:

A. General

1. All exploratory well drilling and borehole operations shall be monitored with a photoionization meter or equivalent organic vapor detection device to identify potential generation of hazardous and/or toxic materials. In addition, drill cuttings shall be monitored for discoloration and odor. During drilling operations, if soil cuttings are suspected to be hazardous, the contractor will place them in proper containers and test them for EP Toxicity and Ignitibility. Results of monitoring shall be included in boring logs. A maximum of six samples shall be collected for EP Toxicity and Ignitibility testing.

2. All water samples collected shall be analyzed on site by the contractor for pH, temperature and specific conductance. Sampling, maximum holding time, and preservation of samples shall strictly comply with the following references: Standard Methods for The Examination of Water and Wastewater, 15th Ed. (1980), pp. 35-42; ASTM, Part 31, pp. 76-86, (1980), Method D-3370: and Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pp. xiii to xix (1979). All chemical analyses (water and soil) shall meet the required limits of detection for the applicable EPA method identified in Attachment 1.

3. Locations where sediment samples are taken or where soil exploratory borings are drilled shall be marked with a permanent marker, and the location marked on a project map of the site.

4. Field data collected for each site shall be plotted and mapped. The nature, magnitude, and potential for contaminant flow within each zone to receiving streams and ground waters shall be estimated. Upon completion of the sampling and analysis, the data shall be tabulated in the next R&D Status report as specified in Item VI below.

5. Determine the areal extent of the sites by reviewing available aerial photos of the base, both historical and the most recent panchromatic and infrared.

6. Split all water and soil samples as part of the contractor's specific Quality Assurance/Quality Control (QA/QC) protocols and procedures. One set of samples shall be analyzed by the contractor and the other set of samples shall be forwarded for analysis through overnight delivery to:

USAF OEHL/SA
Bldg 140
Brooks AFB TX 78235

The samples sent to the USAF OEHL/SA shall be accompanied by the following information:

a. Purpose of sample (analyte)

b. Installation name (base)

c. Sample number (on containers)

d. Source/location of sample

e. Contract Task Numbers and Title of Project

f. Method of collection (bailer, suction pump, air-lift pump, etc.)

g. Volumes removed before sample taken

h. Special conditions (use of surrogate standard, special nonstandard preservations, etc.)

i. Preservatives used

This information shall be forwarded with each sample by properly completing an AF Form 2752 (copy of form and instructions on proper completion mailed under separate cover). In addition, copies of field logs documenting sample collection should accompany the samples.

Chain-of-custody records for all samples, field blanks, and quality control duplicates shall be maintained.

7. An additional 10% of all samples, for each parameter, shall be analyzed for quality control purposes, as indicated in Attachment 1.

8. For ground water monitoring wells, comply with U.S. EPA Publication 330/9-S1-002, NEIC Manual for Ground Water/Subsurface Investigations at Hazardous Waste Sites for monitoring well installation. Only screw type joints shall be used.

9. Wells shall be of sufficient depth to collect samples representative of aquifer quality and to intercept contaminants if they are present. Well development shall proceed until the discharge water is clear and free of sediment to the fullest extent possible.

10. Elevations of all newly installed monitoring wells shall be surveyed with respect to bench mark on base to an accuracy of ±0.05 feet. Horizontally locate the new wells to an accuracy to ±10 feet and record on site map.

11. Water levels shall be measured at all contractor installed wells to the nearest 0.01 foot, and locations recorded on a project map and specific site maps.

12. All monitor wells shall be drilled using the following specifications:

a. Each well shall be drilled with a 8-inch outside diameter drill bit using hollow-stem auger equipment. Soil samples shall be taken every 2.5 feet to a depth of 10 feet, and then every 5 feet to a maximum depth of 25 feet, except at the C.E. Drum Storage Area where samples shall be taken every 2.5 feet to a depth of 10 feet, and then every 5 feet to a maximum depth of 70 feet. Samples shall not be analyzed in Stage 1, but will be retained in the event that contamination is detected in the ground water. These samples shall be collected using split spoon samplers. Total number of soil samples to be archived shall not exceed 167. Each pilot boring log and well completion summaries shall be included in the Final Report (as specified in Item VI below).

b. The average depth of each of these wells shall be 25 feet; except for the C.E. Drum Storage Area, where the average depth shall be 70 feet. Total footage of wells installed shall not exceed 635 linear feet. Each well shall be constructed of 4-inch diameter Schedule 40 PVC casing using threaded, non-glued fittings. Each well shall be screened to 8 feet below the water-table surface, as it is encountered during drilling. Total screened casing shall not exceed 345 feet. The screen shall consist of 4-inch diameter, 40 PVC with 0.010-inch slots. The screen shall be capped at the bottom. All connections shall be flush-joint threaded. Each well shall be gravel-packed with a grain size distribution compatible with the screen and the formation. The pack will be emplaced from the bottom of the borehole to the top of the screen. Granulated or pelletized bentonite shall be tremied above the sand/gravel pack to a minimum thickness of five feet. Grout shall be emplaced from above the top of the bentonite seal to the land surface. Each well shall be completed with installation of a cap and locking hasp and shall be clearly numbered with an exterior paint.

13. Each well shall be developed with a PVC or stainless steel bailer or electric powered submersible pump until clean of suspended solids.

14. Wells shall be purged prior to sampling. Purging will be complete when five well volumes of water have been displaced or until the pH, temperature, specific conductance, color, and odor of the discharge is noted to stabilize. Purging operations shall be conducted using a PVC or stainless steel bottom-discharge bailer or bladder pump. All sampling shall be conducted using a 2-inch stainless steel Kemmerer sampler, bailer, or bladder pump. As the first step of ground water sampling operations at each well, water level measurements shall be taken to the nearest 0.01 foot with respect to an established surveyed mark-point on top of the well casing.

15. Second-column confirmation shall be required when detection limits exceed values identified in Attachment 1, for EPA Methods 509A and 509B. Second-column confirmation shall be conducted on a maximum of 50% of the samples collected for these analyses. Total number of samples for Methods 601 and 602 in Attachment 1 include these confirmation analyses.

16. Sediment samples will be collected using a hand piston sampler. Total number of sediment samples shall not exceed 11.

17. Piezometers shall be installed for determination of ground water flow. Total piezometer footage for this project shall not exceed 635 linear feet.

B. In addition to items delineated in A above, conduct the following specific actions at the following sites on Maxwell AFB:

1. Electroplating Waste Disposal Site

a. Conduct a geophysical survey incorporating magnetometer and electromagnetic (EM) techniques to delineate the horizontal extent of the burial site, confirm the location of buried drums, and locate any leachate plumes.

b. Install a total of 4 piezometers to determine the depth and configuration of the water table for predicting shallow ground water flow. The average depth for each piezometer shall be 25 feet; therefore, total piezometer footage shall be 100 feet.

c. Install one well upgradient and three wells downgradient to evaluate ground water quality. Total footage of wells shall not exceed 100 feet. Screened casing shall not exceed 15 feet per well, for a maximum of 60 feet, for this site. Each well shall be sampled once, for a total of 4 samples. Analyze the samples for the parameters listed in Attachment 2, list A.

2. Surface Drainage System

a. A total of 6 sediment samples shall be taken from the West End Ditch, 3 adjacent to the electroplating waste site and 3 adjacent to landfills 4, 5 and 6.

b. One sediment sample shall be taken from the ditch flowing across landfill 5 into the West End Ditch.

c. A total of 3 sediment samples shall be taken from the drainage ditch located southeast of the C.E. Drum Storage Area.

d. One sediment sample shall be taken from the drainage ditch that empties into the lake in the northeast corner of the base, where the concrete lining discontinues.

e. Analyze all 11 sediment samples for the parameters listed in Attachment 2, list B , excluding total dissolved solids.

f. Analyze 4 surface water samples from various locations along West End Ditch for the parameters in Attachment 2, List B.

3. Landfill No. 3 and FPTA No. 2

a. Conduct a geophysical survey incorporating magnetometer and electromagnetic techniques to delineate the horizontal extent of the landfill and locate any leachate plumes.

b. Install a total of 3 piezometers to determine the depth and configuration of the water table for predicting shallow ground water flow. The average depth for each piezometer shall be 25 feet; therefore, total piezometer footage shall be 75 feet.

c. Install one well upgradient and two wells downgradient to evaluate ground water quality. Total footage of wells shall not exceed 75 feet. Screened casing shall not exceed 20 feet per well, for a maximum of 60 feet for this site. Each well shall be sampled once, for a total of 3 samples. Analyze the samples for the parameters listed in Attachment 2, list C.

4. Fire Protection Training Area No. 1

a. Install a total of 3 piezometers to determine the depth and configuration of the water table for predicting shallow ground water flow. The average depth for each piezometer shall be 25 feet; therefore, total piezometer footage shall be 75 feet.

b. Install one well upgradient and two wells downgradient to evaluate ground water quality. Total footage of wells shall not exceed 75 feet. Screened casing shall not exceed 20 feet per well, for a maximum of 60 feet for this site. Each well shall be sampled once, for a total of 3 samples. Analyze the samples for the parameters listed in Attachment 2, list C.

5. Landfill Nos. 4, 5, and 6

a. Conduct a geophysical survey incorporating magnetometer and electromagnetic techniques to delineate the horizontal extent of the landfill areas and locate any leachate plumes.

b. Install a total of 4 piezometers to determine the depth and configuration of the water table for predicting shallow ground water flow. The average depth for each piezometer shall be 25 feet; therefore, total piezometer footage shall be 100 feet.

c. Install one well upgradient and three wells downgradient to evaluate ground water quality. Total footage of wells shall not exceed 100 feet. Screened casing shall not exceed 15 feet per well, for a maximum of 60 feet for this site. Each well shall be sampled once, for a total of 4 samples. Analyze the samples for the parameters listed in Attachment 2, List C.

d. Sample each of the three existing wells to the south and east of Landfill No. 6 one time for a total of three samples (if the wells are accessible). Analyze the samples for the parameters listed in Attachment 2, List C.

6. C.E. Drum Storage Area

a. Install a total of 3 piezometers to determine the depth and configuration of the water table for predicting shallow ground water flow. The average depth for each piezometer shall be 70 feet; therefore, total piezometer footage shall be 210 feet.

b. Install one well upgradient and two wells downgradient to evaluate ground water quality. Total footage of wells shall not exceed 210 feet. Screened casing shall not exceed 20 feet per well, for a maximum of 60 feet for this site. Each well shall be sampled once, for a total of 3 samples. Analyze the samples for the parameters listed in Attachment 2, list C.

7. Landfill No. 2

a. Conduct a geophysical survey incorporating magnetometer and electromagnetic techniques to delineate the horizontal extent of the landfill area and locate any leachate plumes.

b. Install a total of 3 piezometers to determine the depth and configuration of the water table for predicting shallow ground water flow. The average depth for each piezometer shall be 25 feet; therefore, total piezometer footage shall be 75 feet.

c. Install one well upgradient and two wells downgradient to evaluate ground water quality. Total footage of wells shall not exceed 75 feet. Screened casing shall not exceed 15 feet per well, for a maximum of 45 feet for this site. Each well shall be sampled once, for a total of 3 samples. Analyze the samples for the parameters listed in Attachment 2, list C.

C. Well Cleanup

All well drill cuttings shall be removed and the general area cleaned following the completion of each well. Only those drill cuttings suspected as being a hazardous waste (based on discoloration, odor, or organic vapor detection instrument) shall be properly containerized (according to local civil engineering office requirements) by the contractor for eventual government disposal. The suspected hazardous waste shall be tested by the contractor for EP toxicity and ignitibility. The contractor is not responsible for ultimate disposal of the drill cuttings. Disposal will be conducted by base personnel.

D. Data Review

Results of sampling and analysis shall be tabulated and incorporated in the Informal Technical Information Report (as specified in Item VI below) and forwarded to the USAF OEHL for review. Results shall also be forwarded as available in the next monthly R&D status report.

E. Reporting

1. A draft report delineating all findings of this field investigation shall be prepared and forwarded to the USAF OEHL (as specified in Item VI below) for Air Force review and comment. This report shall include a discussion of the regional/site specific hydrogeology, well and boring logs, data from water level surveys, groundwater surface and gradient maps, water quality and soil analysis results, available geohydrologic cross sections, and laboratory quality assurance information. The report shall follow the USAF OEHL supplied format (mailed under separate cover).

2. The recommendation section will address each site and list them by categories. Category I will consist of sites where no further action (including remedial action) is required. Data for these sites are considered sufficient to rule out unacceptable health or environmental risks. Category II sites are those requiring additional monitoring or work to quantify or further assess the extent of current or future contamination. Category III sites are sites that will require remedial actions (ready for IRP Phase IV actions). In each case, the contractor will summarize or present the results of field data, environmental or regulatory criteria, or other pertinent information supporting these conclusions.

F. Meetings

The contractor's project leader shall attend one meeting with Air Force headquarters and regulatory agency personnel to take place at a time to be specified by the USAF OEHL. The meeting shall take place at Maxwell AFB for a duration of one day (eight hours).

II. SITE LOCATION AND DATES:

Maxwell AFB AL
Date to be established

III. BASE SUPPORT: Maxwell AFB will provide the following base support:

A. Secure permission from legal landowner of the area surrounding landfills 4, 5, and 6 for soil boring and monitor well installations.

B. Determine structural soundness of the bridge across the West End Ditch between landfills 3 and 4.

C. Conduct site preparation between landfills 4, 5, and 6 so that drill rigs can maneuver into position.

IV. GOVERNMENT FURNISHED PROPERTY: None

V. GOVERNMENT POINTS OF CONTACT:

1. Maj Dennis D. Brownley
USAF OEHL/TSS
Brooks AFB TX 78235
(512) 536-2158
AV 240-2158

2. Capt Mark D. Knuth
USAF Rgn Hospital Maxwell/SGPB
Maxwell AFB AL 36112
(205) 293-5848
AV 875-5848

VI. In addition to sequence numbers 1*, 5, and 11 in Attachment 1 to the contract, which are applicable to all orders, the sequence numbers listed below are applicable to this order. Also shown are data applicable to this order.

* Forward a copy of the R D Status Report to all government POC's identified in Section V.

Sequence No.	Block 10	Block 11	Block 12	Block 13	Block 14
3	O/Time	*	*		
4	One/R	4 Mar 85	19 Mar 85	12 Aug 85	**

* Upon completion of analytical effort before submission of first draft report.

** Two draft reports will be required. After incorporating Air Force comments concerning the first draft report, the contractor shall supply the USAF OEHL with one copy of the second draft report. Upon acceptance of the second draft, the USAF OEHL will furnish a distribution list for the remaining 24 copies of the second draft. The contractor shall supply 50 copies plus the original camera ready copy of the final report.

Attachment 1
Analytical Methods and Required Detection Limits
(For Water Unless Otherwise Shown)

PARAMETER	METHOD	DETECTION LIMIT	SAMPLES	QA	TOTAL SAMPLES
*Total Organic Carbon (TOC)	EPA 415.1	1000 µg/L (1000 µg/g soil)	31	4	35
EP Toxicity	40 CFR 261.24	**	5	1	6
Ignitibility	40 CRF 261.21	***	5	1	6
Total Organic Halogens (TOX)	EPA 9020	5 µg/L (5 µg/g, soil)	27	3	30
OIL and Grease (using IR)	EPA 413.2	100 µg/L (100 µg/g, soil)	27	3	30
Total Dissolved Solids (TDS)	EPA 160.1	1000 µg/L	31	3	34
Copper	EPA 220.1	20 µg/L (2 µg/g, soil)	31	3	34
Nickel	EPA 249.1	100 µg/L (10 µg/g, soil)	31	3	34
Cadmium	EPA 213.2	10 µg/L (1 µg/g, soil)	31	3	34
Chromium	EPA 218.1	50 µg/L (5 µg/g, soil)	31	3	34
Cyanide	Standard 412	10 µg/L (1 µg/g, soil)	31	3	34
Zinc	EPA 289.1	50 µg/L (5 µg/g, soil)	31	3	34
Phenols	EPA 420.1	1 µg/L (1 µg/g, soil)	31	3	34
Lead	EPA 239.2	20 µg/L (2 µg/g, soil)	27	3	30

PARAMETER	METHOD	DETECTION LIMIT	SAMPLES	QA	SAMPLES
Arsenic	EPA 206.2 or 206.3	10 µg/L (1 µg/g, soil)	27	3	30
Mercury	EPA 245.1	1 µg/L (.1 µg/g, soil)	27	3	30
Iron	EPA 236.1	100 µg/L	16	2	18
Sulfate	EPA 375.4	1000 µg/L	16	2	18
Barium	EPA 208.2	200 µg/L	16	2	18
Fluoride	EPA 340.2	100 µg/L	16	2	18
Nitrate	EPA 353.2	100 µg/L	16	2	18
Selenium	EPA 270.3	10 µg/L	16	2	18
Silver	EPA 272.2	10 µg/L	16	2	18
Endrin	Standard 509A	.02 µg/l	24	3	41****
Lindane	Standard 509A	.01 µg/L	24	3	41****
Methoxychlor	Standard 509A	.20 µg/L	24	3	41****
Toxaphene	Standard 509A	1.0 µg/L	24	3	41****
2,4-D	Standard 509B	.06 µg/L	24	3	41****
2,4,5-TP	Standard 509B	.06 µg/L	24	3	41****
pH	——— ——	——	31	—	31

* Detection limit for TOC must be 3 times the noise level of the instrument. Laboratory distilled water must sho no response; if it shows a response, corrections of positive results must be made.

** Metal	ug/L of solution
As	10
Ba	200
Cd	10
Cr	50
Pb	20
Hg	1
Se	10
Ag	10

*** Find if sample is ignitable at 140 degrees F. or below. If so, it is a hazardous waste.

**** Total of 41 includes second column confirmation for 50% of the samples (14).

Attachment 2

LIST OF ANALYTICAL PARAMETERS AT MAXWELL AFB

List A

Copper	Chromium	pH	Total Dissolved Solids
Nickel	Total Organic Carbon	Zinc	
Cadmium	Cyanide	Phenols	

List B

Copper	Total Organic Carbon	Lead	Phenols
Nickel	Total Dissolved Solids	Cyanide	Arsenic
Cadmium	Oil and Grease	pH	Mercury
Chromium	Total Organic Halogens	Zinc	

List C

Total Organic Halogens	Total Dissolved Solids	Copper	Cyanide
Total Organic Carbon	Phenols	Iron	Sulfate
Oil and Grease	pH	Nickel	Zinc

Interim Primary Drinking Water Standards (selected list)

Arsenic	Fluoride	Selenium	Methoxychlor
Barium	Lead	Silver	Toxaphene
Cadmium	Mercury	Endrin	2,4-D
Chromium	Nitrate	Lindane	2,4,5-TP

APPENDIX D--QUALITY ASSURANCE PLAN

APPENDIX D

QUALITY ASSURANCE PLAN

The purpose of the QA Plan is to provide processes for controlling the validity of the data generated in all phases of the sampling and analysis efforts proposed under the scope of work. The procedures detailed as follows describe the general methodologies during the study and when implemented will provide documentation of the individual work elements and mechanism by which "data gaps" can be controlled. It should be noted that procedures outlined below may not apply to all circumstances which may arise during the course and scope of the study. Deviation from these procedures will be noted in the field logbooks and discussed with OEHL personnel to determine corrective actions.

Two types of audit procedures will be used by QA to assess and document performance of project staff--system audits and performance audits. These are performed at frequent intervals under the direction of the Project QA Supervisor. These audits form one of the bases for corrective action requirements and constitute a permanent record of the conformance of measurement systems to QA requirements.

System audits are inspections of training status, records, QC data, calibrations, and conformance to Standard Operating Procedures (SOPs) without the analysis of check samples. System audits will be performed periodically on laboratory and office operations or on field operations. The development and approval of the project Work Plan constitutes the initial system audit for this study.

The systems audit protocol is summarized as follows:

1. Field Operations--The Project QA Supervisor will periodically check:

a. Field notebooks, logsheets, bench sheets, tracking forms, and report any inconsistencies and/or omissions;
b. Field sampling plans; and
c. Sample site briefing package.

2. Laboratory Operations--The Project QA Supervisor will periodically check:
a. Parameter and/or laboratory notebooks;
b. Instrument logbooks;
c. Sample log-in, dispensing, and labeling for analysis;
d. Updating of QC criteria for spike recoveries; and
e. Final approval of data from each sample lot.

In addition, the Project QA Supervisor will monitor all analyses to assure complete adherence to approved analytical methods.

3. Final Reports--The Project QA Supervisor will review all final reports and deliverables to OEHL.

Performance audits will include evaluation and analysis of check samples. A performance evaluation sample from EPA will be analyzed periodically along with the regular samples.

ESE's laboratory is certified for drinking water analysis by the Florida Department of Health and Rehabilitative Services according to the regulations set forth under the Florida Safe Drinking Water Act (Chapter 403.863, F.S.). ESE is also certified by the National Institute for Occupational Safety and Health (NIOSH) through their NIOSH Proficiency Analytical Testing (PAT) Program.

ESE routinely participates in performance test sample programs administered by:

1. EPA, Environmental Monitoring and Support Laboratory-Cincinnati (EMSL-CI);
2. EPA, Environmental Monitoring and Support Laboratory-Research Triangle Park (EMSL-RTP);
3. EPA, Region IV;
4. Florida Department of Environmental Regulation;

5. Florida Department of Health and Rehabilitative Services;
6. Alabama Department of Health;
7. U.S. Army Corps of Engineers, South Atlantic Division; and
8. American Industrial Hygiene Association (AIHA) (ESE is an AIHA-accredited laboratory).

The results of these interlaboratory studies will be periodically evaluated by the Project QA Supervisor during the project as part of the performance audits.

D.1 <u>WELL DRILLING</u>

Prior to drilling any test borings and installing any monitoring wells, each proposed drilling location will be cleared with the Base Civil Engineering Department to avoid drilling into buried cables, pipes, etc. The Civil Engineering Department will approve all locations. If required, appropriate drilling permits will be acquired.

Prior to commencement of any portion of the proposed drilling plan the drilling subcontractor will complete the following requirements:

1. Arrange access to all sites where drilling of wells is proposed.
2. Steam clean all drilling equipment prior to movement to Maxwell AFB.
3. Arrange with Maxwell AFB personnel for the storage of all well-drilling equipment and well-installation supplies in a clean and secure area. At each drill location, clean unused equipment/supplies will be temporarily stored on sheets of disposable polyethylene to eliminate contamination from the native soils at the well location.

The ESE Site Geologist will be present during drilling of all wells and will maintain drilling logs. Any abandoned borings will be grouted in the presence of the ESE Site Geologist. All grout will be mixed and installed according to standard specifications.

The drilling will be performed under subcontract and will proceed as follows:

1. Unchlorinated water for drilling and well installations will be obtained by the driller. Portable tubs will be used to hold drilling water during circulation, if required.
2. All drill cuttings will be recovered and stored in 55-gallon (gal) drums. Disposal of the cuttings will be the responsibility of Maxwell AFB.
3. Drilling will be conducted by the drilling subcontractor under the direct supervision of the assigned ESE Geologist.
4. Between borings, the drilling tools will be cleaned with unchlorinated water to remove all traces of soil, rock, or other contaminants.

D.2 BORING PROCEDURES AND SOIL SAMPLING

The borings for all ground water monitoring wells will be completed using a truck-mounted portable drilling unit equipped with a hollow-stem auger device with a 6-inch (minimum) inside diameter and 8-inch (minimum) outside diameter. The unit is operated without water, unless necessary, and produces an 8-inch diameter borehole. The 4-inch PVC well pipe and screen are installed through the center of the hollow drill stem and positioned at the appropriate depths. As the auger is withdrawn from the hole, the annular space is backfilled with suitable packing material. This technique prevents collapse of the borehole that may occur of the auger is removed from the hole and the well pipe introduced from the top of the empty hole.

Eight-inch boreholes extending to a minimum depth of 25 ft below ground surface will be excavated. The material at Maxwell AFB consists of unconsolidated gravels, sands, silts, and clays to this depth, and the boreholes may have a tendency to collapse. Continuous split-spoon soil sampling will be concomitant with boring, and most boreholes will be sampled through their expected depth of 25 ft.

The split-spoon soil samples will be retained by the driller and subsequently stored by ESE. If ground water proves to be contaminated, the soil samples will be analyzed for the same pollutants; if not, they will be disposed of following completion of the Phase II program. The split-spoon samples must be of undisturbed soil and, therefore, the samples must be pushed ahead of the auger in all instances, and sampling must be continuous.

Split-spoon soil samples will be sectioned and stored in labeled glass containers and kept in cooled, insulated compartments in the field and enroute to the laboratory at ESE. Each container will be marked with the sample depth interval, top and bottom of the sample, date, and time. The split-spoon sampler must be cleaned with approved, dechlorinated water between each sampling event (i.e., each time a sample is removed from the tube).

Monitor well depths and screening lengths are discussed for each of the sites individually in Sec. 3. Well depths vary from 20 to 30 ft and are screened into and below the water table from 5 or 10 to 20 or 30 ft. The ESE Site Geologist will maintain regular contact with the major command (MAJCOM) during the drilling program and will make recommendations for well placement to MAJCOM in the event that unique geohydrologic conditions dictate variation of the plans presented in this document.

D.3 WELL-DRILLING LOGS AND DOCUMENTATION

The driller and the ESE Site Geologist will both maintain accurate drilling logs for all boreholes excavated. The names of all persons present and involved in the drilling operation will be recorded in the logs. Each well will be fully described on a well log as it is being drilled. Transcription of the log from a field notebook to log form will not be permitted. Upon completion of each well, information from the well logs will be transferred to OEHL. Data included in the logs are:

1. Depths will be recorded in feet and fractions thereof.
2. Soil descriptions, in accordance with the Unified Soil Classification System, will be prepared in the field by the Site Geologist.
3. Soil samples will be fully described on the log. For split-spoon samples, the description will include:
   a. Classification,
   b. Unified Soil Classification System symbol,
   c. Secondary components and estimated percentage,
   d. Color,
   e. Plasticity,
   f. Consistency (cohesive soil) or density (noncohesive soil),
   g. Moisture content, and
   h. Texture/fabric/bedding.

   Cutting descriptions will include basic classification, secondary components, and other parameters that are apparent.
4. Numerical, visual estimates will be made of secondary soil constituents. If terms such as "trace," "some," or "several" are used, their quantitative meanings will be defined in a general legend.
5. The length of sample recovered for each sampled interval for drive (split-spoon) samples will be recorded.
6. Blow counts, hammer weight, and length of fall for split-spoon samples will be recorded.
7. Rock core, if obtained, will be fully described on the log. Core description will include:
   a. Classification by rock type,
   b. Lithologic characteristics,
   c. Bedding characteristics,
   d. Color,
   e. Hardness,
   f. Degree of cementation,
   g. Texture,
   h. Structure,

i. Degree of weathering,

j. Solution or void conditions,

k. Primary and secondary permeability estimates and rationale, and

l. Length of core recovered and rock quality designation (RQD).

8. The estimated interval for each sample will be specified.

9. Depth to water will be indicated along with the method of determination, as first encountered during drilling. Any distinct water-bearing zones below the first zone also will be noted.

10. When drilling fluid is used, fluid losses, quantities lost, and the intervals over which they occur will be recorded.

11. The drilling equipment used will be described generally on each log, including such information as rod size, bit type, pump type, rig manufacturer, and model.

12. The drilling sequence will be recorded on each log.

13. All special problems will be recorded.

14. The dates for the start and completion of all borings will be recorded on the log.

15. Lithologic boundaries will be noted on the boring log.

16. The boring logs will be submitted to the OEHL within 10 working days after each individual boring is completed. In cases where a monitoring well is inserted into the boring hole, both the log for that boring and the installation sketch will be submitted within 10 working days.

Evaluation of the existing geologic and hydrogeologic data at Maxwell AFB indicates that the ground water sampling wells to be installed at Maxwell AFB may be screened totally within a saturated soil column. Although screening intervals may be proposed in other sections of the plan, the actual screened interval will be determined by evaluation of the geologic data obtained during the drilling operations.

D.4 DESCRIPTION OF GROUND WATER SAMPLING WELLS

Fig. D-1 shows a typical well configuration for a monitor well in unconsolidated, overburden material. The placement of the well screen in the saturated soil will be deemed appropriate if standing water is found in the boring at the well site after waiting overnight.

The monitor wells will penetrate the shallow water table and, in general, will extend to depths up to 30 ft. The well will be installed in a 6- to 8-inch borehole and will consist of threaded Schedule 40 PVC pipe (which is resistant to low pH and cyanide-rich ground water), with 0.010-inch slots (screen) in the bottom 5- or 10-ft interval, a gravel pack in the annular space between the screen and the borehole, a bentonite clay seal on top of the gravel pack, and grout in the upper annular space to the surface. The bottom of the well will be capped before installation, and a vented cap will be installed at the top of each monitor well. A protective steel casing and a locking cap will be installed for security reasons.

D.5 GROUND WATER SAMPLING WELL INSTALLATION PROCEDURES

When a boring is completed, the ESE Site Geologist will visually inspect the hole to ensure plumbness and cleanliness. Plumbness will be obtained by careful leveling of the drill rig prior to commencement of the drilling. Additionally, the drilling will proceed in an efficient and controlled manner to eliminate wobble/chatter in the drill stem. No problems are expected from artesian systems.

All well installations will begin within 48 hours of boring completion and, once begun, will continue, uninterrupted, until completion. Any temporary casing used to maintain the borehole will remain in the hole up to and including the time of grouting. The well screen and casing will be carefully cleaned with unchlorinated water prior to installation in the hole. All well screens will have a solid bottom. Solid casing will extend from the screen to approximately 2.5 ft above land surface.

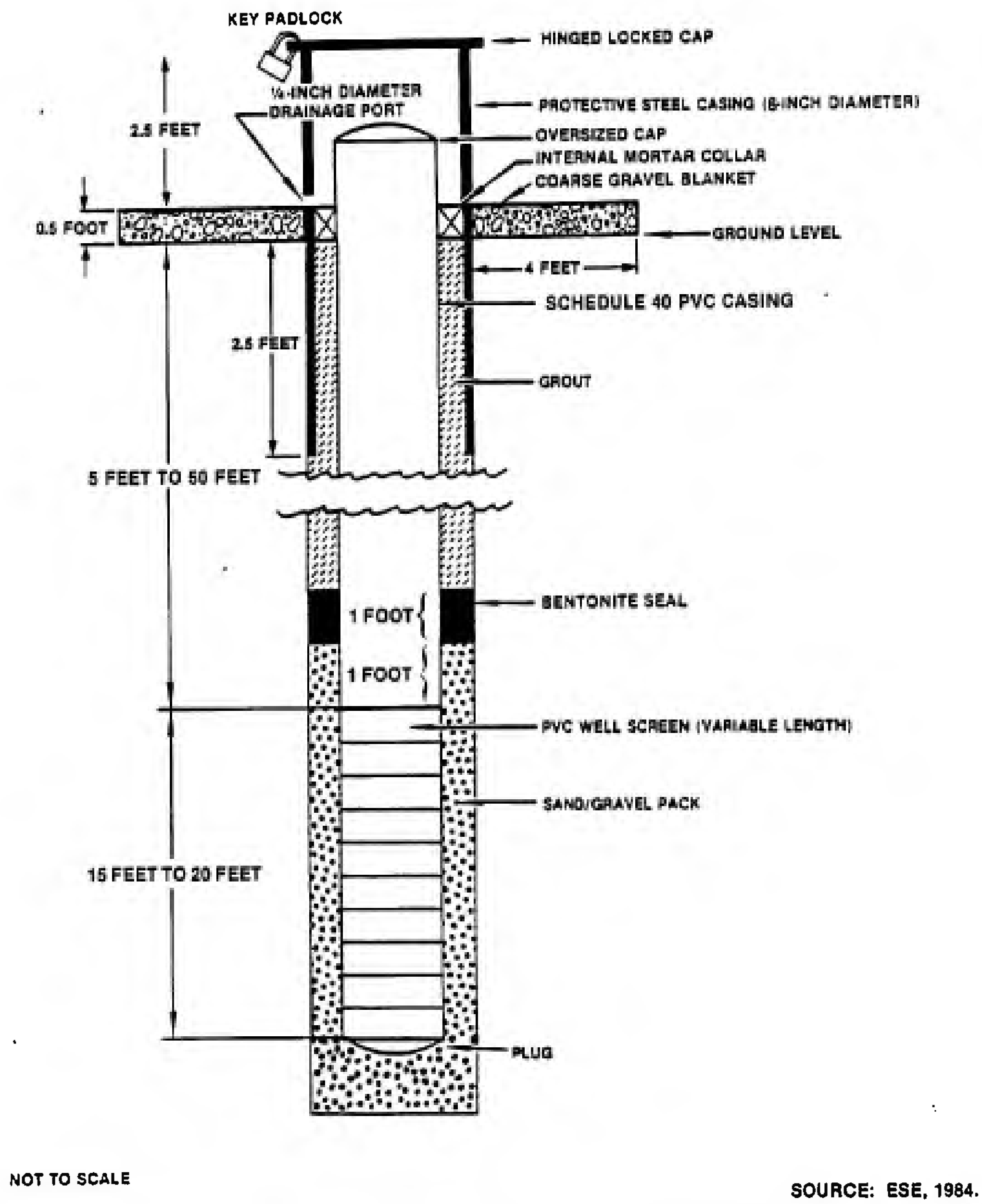


Figure D-1 TYPICAL MONITOR WELL CONSTRUCTION	INSTALLATION RESTORATION PROGRAM Maxwell Air Force Base

Filter material will be installed around and to the top of the well screen. As the 5-ft bentonite seal is placed on top of the filter material, unchlorinated water from the approved source will be added, when necessary, to assure that the pellets expand to form a tight seal. Properly wetted bentonite pellets are the most time-effective form of bentonite for this application.

The bentonite-cement grout seal will extend from the top of the bentonite seal to the land surface. Grouting will be completed as a continuous operation in the presence of the ESE Site Geologist. The grout will be pumped into the annular space under pressure using a tremie pipe placed at the top of the bentonite seal to ensure a continuous grout seal. The protective casing will be sealed in the grout. Identification and protective posts will be installed around the well to prevent damage to the wells by vehicular operation. A coarse gravel pad, 0.5-inch thick, extending 4 inches radially from the protective casing, will be placed at each water sampling well.

The following materials will be used in well construction:

1. Casing used in the well will be threaded PVC Schedule 40, 4-inch nominal inside diameter. The well screen will be factory slotted, with a slot width of 0.010 inch. A screw-on cap will be installed on each of the wells. The four monitor wells at the electroplating waste disposal site (Site 1) will be constructed of corrosion-resistant stainless steel able to withstand low pH and cyanide waste waters.
2. Grout will be composed by weight of 10 parts Portland cement to one-half part bentonite, with a maximum of 10 gal of approved water per 94-pound (lb) bag of cement. Bentonite will be added after mixing of the cement and water.
3. Bentonite pellets used in the seal will be a commercially available product designed for well-sealing purposes.
4. Sand material used in the filter envelope around the well screen will be selected to be compatible with both the screen

slot size and aquifer materials. A coarse sand is recommended, but, if the well is screened in a gravel horizon, coarser material should be used.

5. A 6-inch protective iron casing will be installed around all wells. This casing will extend approximately 2.5 ft above land surface and will be seated 2.5 ft into the well seal grout. This casing will be vented to the atmosphere via a lockable, hinged cap. This cap will prevent entry of water but will not be airtight. In this manner, the well will be in open connection to the atmosphere to allow for water level stabilization. A 0.25-inch diameter drainage port will be installed, centered 0.125-inch above the level of the internal monitor collar. The same key will be used for all padlocks at the site.
6. A sketch of the well installation will be included on the boring log and show, by depth, the bottom of the boring, screen location, coupling location, granular backfill, seals, grout, cave-in, and height of riser above ground surface. The actual composition of the grout, seals, and granular backfill will be recorded on each sketch.
7. Well sketches will include the protective casing detail.
8. After the grout seal has set (approximately 24 hours), it will be checked for settlement, and additional grout (of approved composition) will be added to fill any depressions.

D.6 WELL DEVELOPMENT

The initial development or the purging of the drilling fluid from monitor wells will be recorded and submitted to MAJCOM within 3 working days after development. The development will be performed, as soon as practical, after well installation. The following data will be recorded for development:

1. Well designation.
2. Date of well installation.
3. Date of development.

4. Static water level before and 24 consecutive hours after development.
5. Quantity of water loss during drilling and fluid purging, if water is used.
6. Quantity of standing water in well and annulus (30-percent porosity assumed for calculation) prior to development.
7. Specific conductivity, temperature, and pH measurements taken and recorded at the start, twice during, and at the conclusion of development. Calibration standards will be run prior to, during, and after each day's operation in the field.
8. Depth from top of well casing to bottom of well.
9. Screen length.
10. Depth from top of well casing to top of sediment inside well, before and after development.
11. Physical character of removed water, including changes during development in clarity, color, particulates, and odor.
12. Type and size/capacity of pump and/or bailer used.
13. Description of surge technique, if used.
14. Height of well casing above ground surface.
15. Quantity of water removed and time for removal.

Development of wells will be accomplished with an electric-powered submersible pump until the water is clear and the well sediment-free to the fullest extent practical. Four-inch Schedule 40 PVC wells will not permit the use of a 4-inch submersible pump. A 3-inch pump will be available for use at Maxwell AFB. If well yields cannot sustain the flow rate of the submersible pump, a bottom discharge bailer will be used. Water will not be added to the well to aid in development. The pump or bailer will be rinsed with the approved drilling water and allowed to air dry prior to use in the next well. Well development data will be recorded in the field in a tabular format.

Well development will begin no sooner than 48 hours after completion of the mortar collar placement. Development will proceed until the following conditions are met:

1. The well water is clear to the unaided eye.
2. The sediment thickness remaining in the well is less than 5 percent of the screen length.
3. At least five well volumes (including the saturated filter material in the annulus) have been removed from the well.
4. A 1-pint (pt) sample of the last water obtain from the development process for each well is retained and stored in an insulated compartment maintained at 4 degrees Celsius (°C). This water was examined by the onsite geologist to determine if the well had been suitably developed to be used as a monitor well.
5. The cap and all internal components of the well casing above the water table are rinsed with well water to remove all traces of soil/sediment/cuttings. This washing will be conducted before and/or during development.

D.7 WATER LEVEL MEASUREMENTS

All water level measurements at the various wells will be obtained using the U.S. Geological Survey (USGS) wetted-tape method. This procedure is accurate to 0.01 ft. The tape will be rinsed with water from the approved source, wiped with a fresh cloth, and allowed to air dry between consecutive water level measurements.

At least one complete set of static water level measurements for all wells will be made over a single, consecutive 10-hour period. Relative water levels in the wells will also be determined.

D.8 SURVEYING

Each water sampling well installed at Maxwell AFB during this study will be surveyed by a professional land surveyor registered in the state of Alabama.

Each water sampling well will be surveyed to establish its map coordinates using the Alabama Plane Coordinate System, Western Zone, with an accuracy no less than 1:10,000 (one in ten thousand). Additionally, elevations for the natural ground surface at each sampling well and the top of the PVC casing will be determined to within 1/100 ft using the vertical datum established by USGS.

The surveyor will plot each well site on the Maxwell AFB base map (supplied by ESE). The elevations of both the top of the monitor well (top of the PVC pipe) and of the ground surface at the well at each site will be noted on the map adjacent to the point representing that location. Additionally, the map coordinates for each point will be included on each map or appended to the map in tabulated form.

D.9 GROUND WATER SAMPLING

Ground water sampling at Maxwell AFB will begin after the new monitor wells have been allowed to reach equilibrium (no less than 14 days after well development). The following procedures will be followed on the day of sampling:

1. The depth to water will be measured from the top of casing.
2. The well depth will be sounded and recorded. The depth of the water in the well will be calculated.
3. During the initial sampling of a new monitor well, the depth to the water/sediment interface in the well will be measured and recorded.
4. Samples will be taken after the fluid in the screen, well casing, and saturated annulus has been exchanged five times. In the event of low well yields (e.g., in the presence of fine-grained sediments and/or limited bedrock fracturing), some wells may have slow recovery rates. A decision to reduce the well purging to less than five volumes will be recommended by ESE only if excessive time would elapse attempting to collect one or two samples from low-yielding wells. This decision will be subject to approval by the USAF. The amount of fluid purged will be measured and recorded. Sampling will be accomplished by a bailer constructed of inert materials (PVC). No glue will be used in the construction of these bailers.

5. To protect the wells from contamination during sampling procedures, the following guidelines will be followed:
   a. A separate bailer will be supplied for each well. After each bailer is used to sample each well for the first time, it will be allowed to remain in the well. Each bailer will be etched with the number of the sampling well.
   b. If a pump is used to purge the standing water from the well, the pump and the hoses will be thoroughly cleaned between the samples, using the approved drilling water source. All sampling, however, will be performed with the dedicated bailer.
   c. All sampling equipment will be protected from ground water contact by polyethylene plastic sheeting to prevent soil contamination from tainting the ground water samples.
6. Conductivity, pH, and temperature will be measured prior to sampling.
7. If the wells are flowing, a flow rate will be determined, and five volumes of water will be allowed to flow out of the well prior to sampling.

Inert threaded PVC well casings will be used in this program. Adsorption of certain compounds on the plastic surface may affect the apparent ground water concentration. However, the following precaution will be taken to minimize adsorption of analytes by PVC. Each well will be purged and then sampled as soon as sufficient water returns. In this manner, the contact time between the water sample and the PVC will be kept to the shortest possible period.

During the sampling of each monitor well, information regarding the sampling will be kept in a notebook. The following data will be collected:

1. Well number;
2. Date;
3. Time;

4. Static water level;
5. Depth of well;
6. Number of bailer volumes removed, if applicable;
7. Pumping rate, if applicable;
8. Time of pumping, if applicable;
9. Draw down water level;
10. *In situ* water quality measurements such as pH, specific conductance, and temperature;
11. Fractions sampled and preservatives;
12. Weather conditions and/or miscellaneous observations; and
13. Signature of sampler and date.

Each sample will be carefully labeled so it can be identified by laboratory personnel. The sample label will include the project number, sample number, time and date, and sampler's initials. All samples will be identified with non-water-soluble ink on a standard preprinted and prenumbered label immediately after collection. Information concerning preservation methods, matrix, and sample location will be included on the label. Samples will be shipped in styrofoam ice chests and will be kept below 4°C from time of sample collection until analysis.

D.10 SURFACE WATER SAMPLING

Prior to surface water sampling, the following data will be noted and recorded in the field notebook:

1. Site number or location;
2. Date;
3. Time (24-hour system);
4. Antecedent weather conditions, if known;
5. *In situ* parameter measurements (temperature, conductivity, and pH);
6. Fractions and preservatives;
7. Any other pertinent observations (odor, fish, etc.); and
8. Signature of sampler and date.

At the conclusion of each day in the field, the Sampling Team Leader will review each page of the notebook for errors and omissions. He/she will then date and sign each reviewed page.

All field instrument calibrations will be recorded in a designated portion of the notebook at the time of the calibration. Adverse trends in instrument calibration behavior will be corrected.

The sample will be collected in a manner which will minimize its aeration and prevent oxidation of reduced compounds in the sample. The container will be filled until it overflows without air bubbles and then tightly capped. Special attention will be given to minimize air contact with the water sample. Sampling procedures and precautions for the volatile fraction collection are identical to the ground water procedures.

Each sample will be carefully labeled so it can be identified by laboratory personnel. The sample label will include the project number, sample number, time and date, and sampler's initials. All samples will be identified with non-water-soluble ink on a standard preprinted and prenumbered label immediately after collection. Information concerning preservation methods, matrix, and sample location will be included on the label. Samples will be shipped in styrofoam ice chests and will be kept below 4°C from time of sample collection until analysis.

D.11 SOIL AND SEDIMENT SAMPLING

Prior to soil and/or sediment sampling, the following data will be noted and recorded in the field notebook:

1. Site number, location, or designation;
2. Date;
3. Time (24-hours system);
4. Antecedent weather conditions, if known;

5. Any other pertinent observations (e.g., vegetation, substrate characteristics, etc.); and
6. Signature of sampler and date.

At the conclusion of each day in the field, the Sampling Team Leader will review each page of the notebook for errors and omissions. He/she will then date and sign each reviewed page.

D.12 SOIL SAMPLING

The soils collected during this study will consist of the split-spoon samples collected during the drilling of wells. These samples will be collected and placed in glass wide-mouth jars with Teflon®-lined lids. Sample containers will be labeled with a preprinted label, chilled to 4°C, and shipped to the laboratory for storage. These samples were analyzed in the Phase IIa study. If contaminants are found, these samples are available for analysis in the Phase IIb study.

D.13 SEDIMENT SAMPLING

1. All sediment samples will be collected with a hand piston sampler or other appropriate device.
2. After sampling, depth of water at each sampling point will be measured and recorded.
3. Sampling equipment will be thoroughly cleaned with water from an approved source and solvent rinsed with acetone and hexane and allowed to air dry.
4. Sediment samples will be placed in glass containers with Teflon®-lined lids, shipped under ice, and stored at 4°C.

D.14 LABORATORY

The Laboratory Task Manager is responsible for implementing the laboratory QC procedures. The QA Supervisor will monitor the performance of the analysts and the Chemical Analysis Supervisor for implementation of proper QC checks and to final approve all data.

For analyses conducted in this project, the following QC checks will apply:

1. At least five standards for standard curve (three standards for organic analyses) [for gas chromatograph/mass spectrometer (GC/MS) analyses and metals analyses by inductively coupled argon plasma (ICAP) one calibration standard is run and a daily response factor is established after initial calibration],
2. Correlation coefficient for curve is greater than 0.995,
3. Percent recovery for spikes is within acceptance criteria as described below,
4. Samples are within range of standards,
5. At least 10 percent of the samples are replicates (except GC/MS), and
6. At least 5 percent of the samples are spiked.

D.15 DATA ANALYSES AND REPORT REVIEW

Peer review of all deliverable reports and data supporting this project will be performed by technically qualified individuals from each major discipline represented in the particular deliverable. Fig. D-2 is a sample Deliverable Review Form to be used in this project.

ESE ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.

DELIVERABLE REVIEW SHEET

SHORT TITLE: ____________________

PROPOSAL/PROJECT NUMBER: ____________________

PROPOSAL/PROJECT MANAGER: ____________________

AUTHOR(S): ____________________

____

CLIENT: ____________________

DATE/TIME TO LEAVE ESE: ____________________

CLIENT DUE DATE: ____________________

DOCUMENT COORDINATOR: ____________________

REVIEW CHECKLIST REVIEWER SHOULD PLACE CHECK UNDER APPROPRIATE REVIEW CATEGORY D—DRAFT F—FINAL		REQUIRED REVIEW								*OPTIONAL REVIEW* BY AUTHOR OR OTHER QUALIFIED INDIVIDUAL							
REVIEWER'S INITIALS	DOCUMENT/SECTION	① Organization/ Presentation Reviewed		① Technical Approach and Conclusions Reviewed		② Proposal Costs Reviewed (If Applicable)		③ Laboratory Data Checked (If Applicable)		Tables, Figures, Test Data Checked		Critical Calculations Checked		Computer Models/ Programs Verified		Field Measurements Checked	
		D	F	D	F	D	F	D	F	D	F	D	F	D	F	D	F
	Document																
	SECTION(S)																

APPROVALS: ____________ ____________ ____________ *(as appropriate)*

AUDITED BY: ____________________ *(QA Manager or designate)*

REMARKS: ____________________

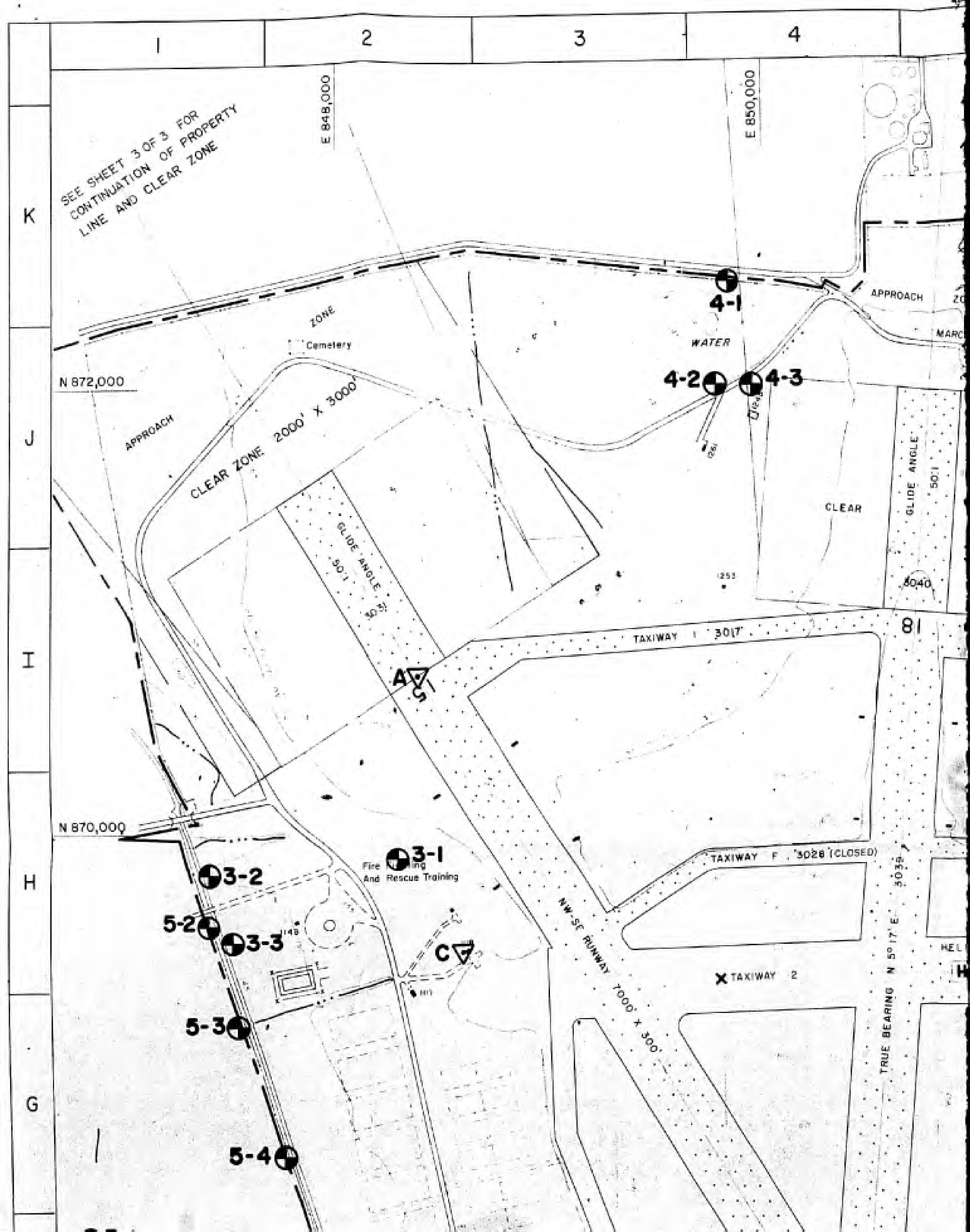
① Required review by at least one reviewer other than author in these categories.
② Required F & A review for proposals.
③ Required check by laboratory coordinator or other individual for laboratory data reports.

ORIGINAL TO PROJECT MANAGER—COPY TO QA

SOURCE: ESE, 1984.

Figure D-2
DELIVERABLE REVIEW SHEET

INSTALLATION RESTORATION PROGRAM
Maxwell Air Force Base



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N 872,000
N 870,000
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Cemetery
CLEAR ZONE 2000' X 3000'
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WATER
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4-2
4-3
APPROACH
CLEAR
GLIDE ANGLE 50:1
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TAXIWAY I 3017
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Fire Fighting And Rescue Training
3-2
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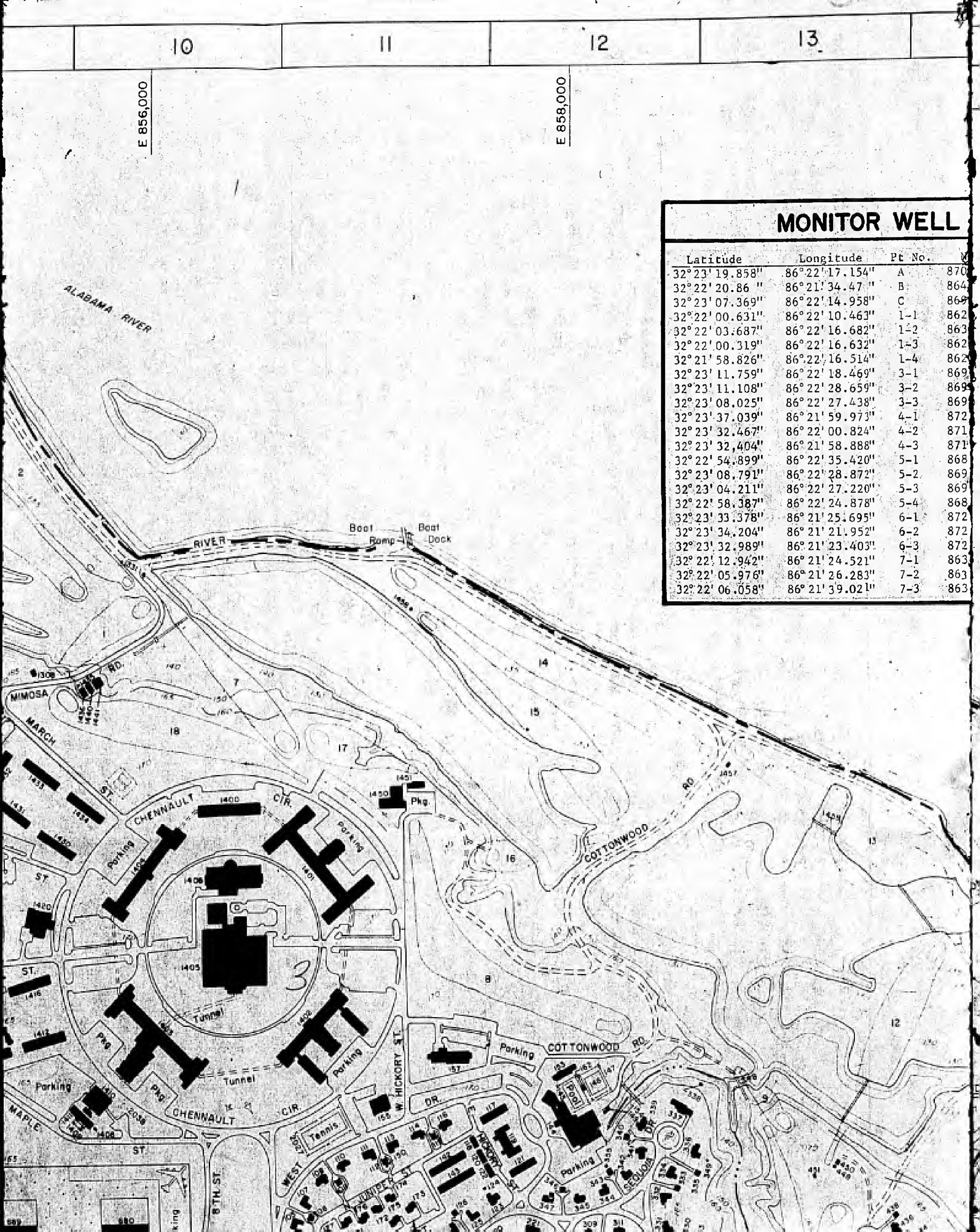
WILLOW ST.
BEECH ST.
RIVER RD
6-1
6-2
6-3
ZONE
POND
HEMLOCK RD
Range
LAKE 3
TAXIWAY F (CLOSED) 3016
APRON 3036
E-W RUNWAY 5650' X 300' (CLOSED)
TAXIWAY 3038
APRON 3037
TAXIWAY I 3018
TAXIWAY I 3022
SW RUNWAY 5700' X 300' (CLOSED)
APRON 3034
APRON 3033
TAXIWAY 3035
TAXIWAY
3003
2004
440 Track
TAXIWAY G (CLOSED)
Driving Range
MAPLE ST.
Parking
PALM
SYCAMORE



MONITOR WELL

Latitude	Longitude	Pt No.	N
32° 23' 19.858"	86° 22' 17.154"	A	870
32° 22' 20.86 "	86° 21' 34.47 "	B	864
32° 23' 07.369"	86° 22' 14.958"	C	869
32° 22' 00.631"	86° 22' 10.463"	1-1	862
32° 22' 03.687"	86° 22' 16.682"	1-2	863
32° 22' 00.319"	86° 22' 16.632"	1-3	862
32° 21' 58.826"	86° 22' 16.514"	1-4	862
32° 23' 11.759"	86° 22' 18.469"	3-1	869
32° 23' 11.108"	86° 22' 28.659"	3-2	869
32° 23' 08.025"	86° 22' 27.438"	3-3	869
32° 23' 37.039"	86° 21' 59.973"	4-1	872
32° 23' 32.467"	86° 22' 00.824"	4-2	871
32° 23' 32,404"	86° 21' 58.888"	4-3	871
32° 22' 54.899"	86° 22' 35.420"	5-1	868
32° 23' 08.791"	86° 22' 28.872"	5-2	869
32° 23' 04.211"	86° 22' 27.220"	5-3	869
32° 22' 58.387"	86° 22' 24.878"	5-4	868
32° 23' 33.378"	86° 21' 25.695"	6-1	872
32° 23' 34.204"	86° 21' 21.952"	6-2	872
32° 23' 32.989"	86° 21' 23.403"	6-3	872
32° 22' 12.942"	86° 21' 24.521"	7-1	863
32° 22' 05.976"	86° 21' 26.283"	7-2	863
32° 22' 06.058"	86° 21' 39.021"	7-3	863

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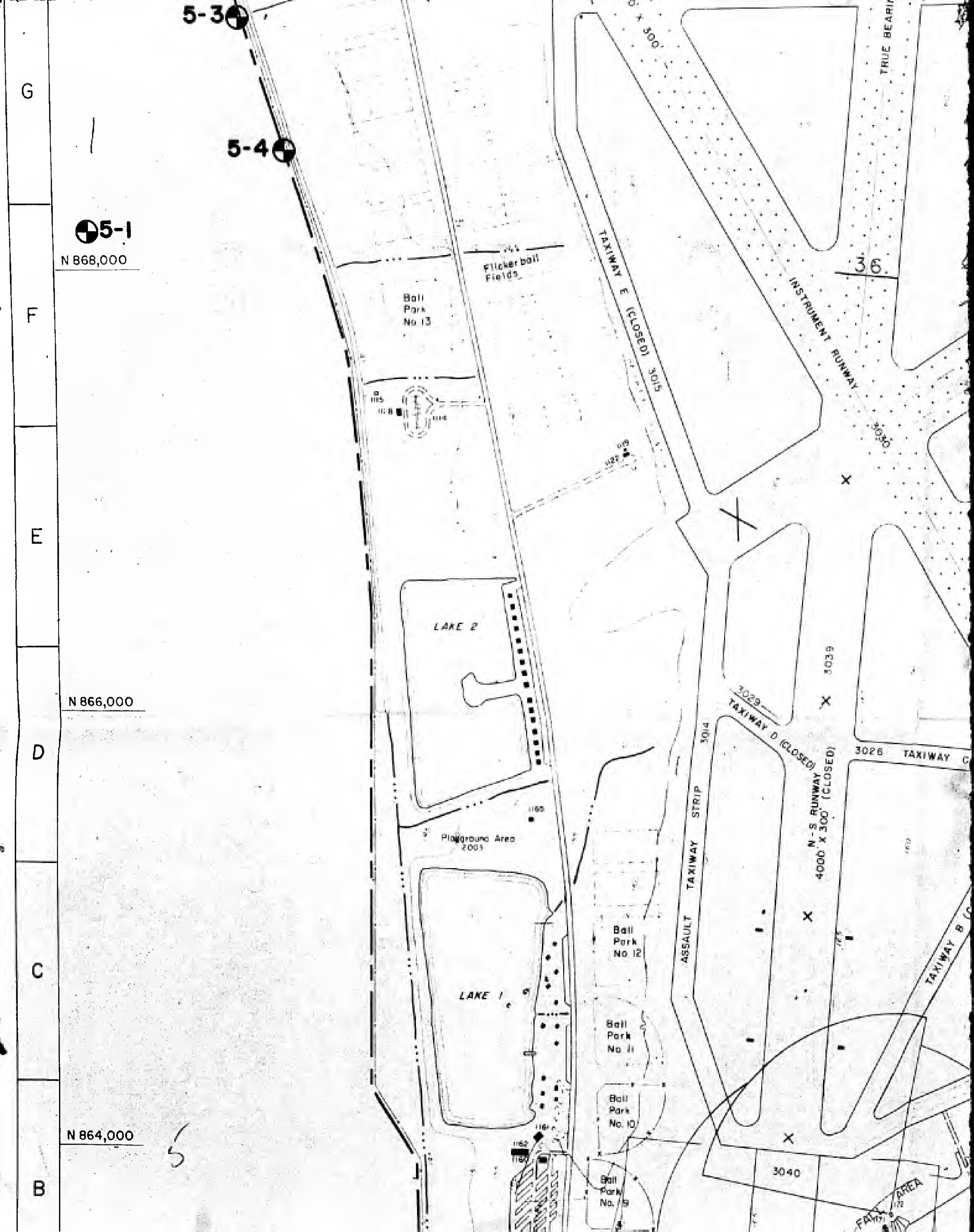
MONITOR WELL LOCATIONS

Latitude	Longitude	Pt No.	Northing	Easting	Elevation
32° 23' 19.858"	86° 22' 17.154"	A	870,707.7240	848,383.8400	168.08
32° 22' 20.86 "	86° 21' 34.47 "	B	864,784.2920	852,107.5590	
32° 23' 07.369"	86° 22' 14.958"	C	869,447.5870	848,585.4250	159.33
32° 22' 00.631"	86° 22' 10.463"	1-1	862,707.1132	849,042.2059	162.79
32° 22' 03.687"	86° 22' 16.682"	1-2	863,010.2693	848,505.5396	152.00
32° 22' 00.319"	86° 22' 16.632"	1-3	862,669.9996	848,513.3909	154.04
32° 21' 58.826"	86° 22' 16.514"	1-4	862,519.2560	848,525.0737	153.26
32° 23' 11.759"	86° 22' 18.469"	3-1	869,888.0336	848,279.6937	160.28
32° 23' 11.108"	86° 22' 28.659"	3-2	869,813.1057	847,406.5249	153.70
32° 23' 08.025"	86° 22' 27.438"	3-3	869,502.6444	847,514.4790	149.67
32° 23' 37.039"	86° 21' 59.973"	4-1	872,459.6674	849,838.7418	156.76
32° 23' 32.467"	86° 22' 00.824"	4-2	871,996.8199	849,770.7059	152.56
32° 23' 32,404"	86° 21' 58.888"	4-3	871,992.1922	849,936.7780	153.29
32° 22' 54.899"	86° 22' 35.420"	5-1	868,168.9200	846,843.9653	163.41
32° 23' 08.791"	86° 22' 28.872"	5-2	869,578.7316	847,390.7370	153.16
32° 23' 04.211"	86° 22' 27.220"	5-3	869,117.3890	847,537.3000	153.50
32° 22' 58.387"	86° 22' 24.878"	5-4	868,530.8987	847,744.3478	148.95
32° 23' 33.378"	86° 21' 25.695"	6-1	872,120.9177	852,781.9734	158.17
32° 23' 34.204"	86° 21' 21.952"	6-2	872,207.8439	853,102.0953	158.70
32° 23' 32.989"	86° 21' 23.403"	6-3	872,083.7056	852,978.9644	158.44
32° 22' 12.942"	86° 21' 24.521"	7-1	863,993.0914	852,969.5769	165.15
32° 22' 05.976"	86° 21' 26.283"	7-2	863,287.5294	852,825.9739	162.76
32° 22' 06.058"	86° 21' 39.021"	7-3	863,284.1161	851,733.2756	160.05

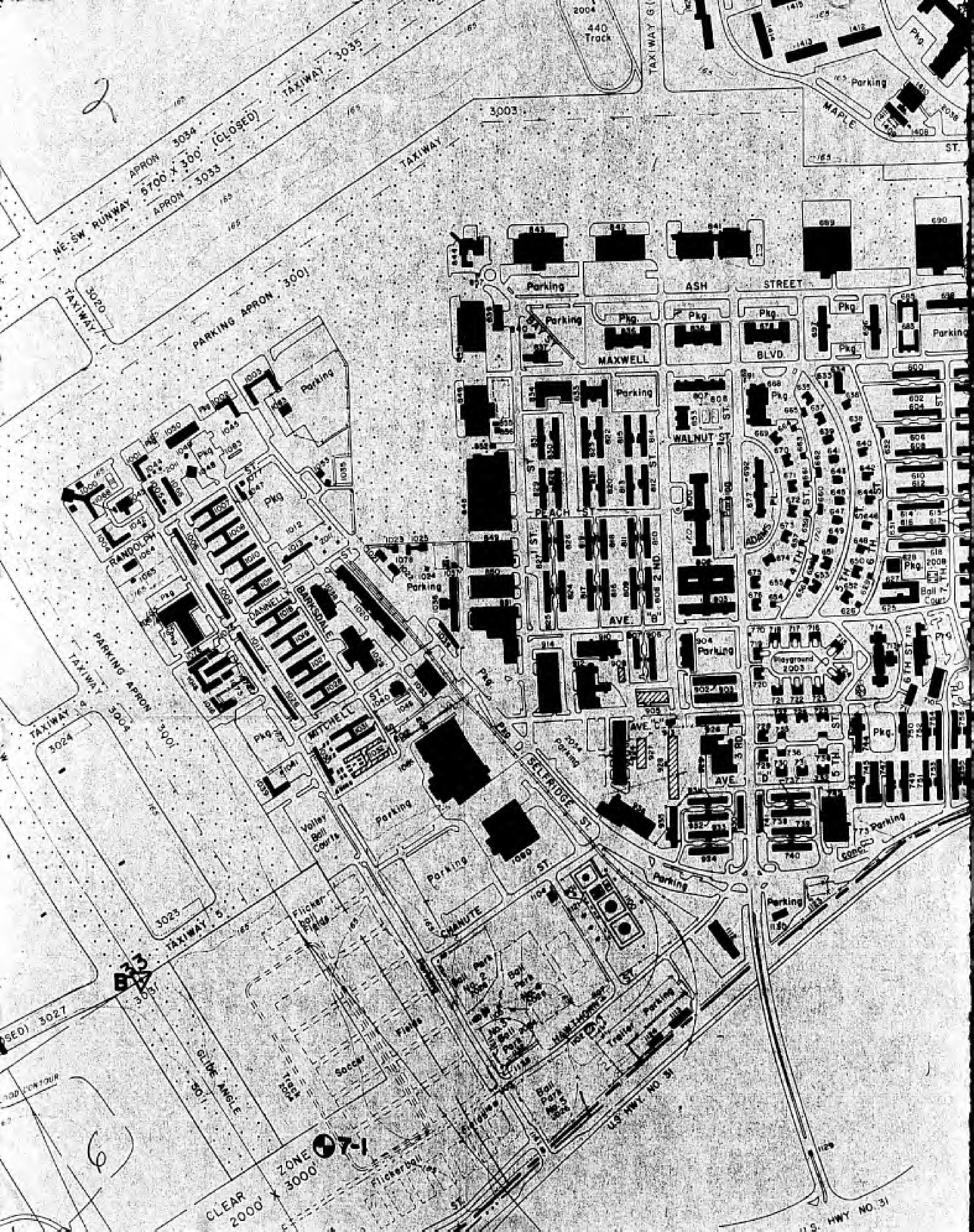
J

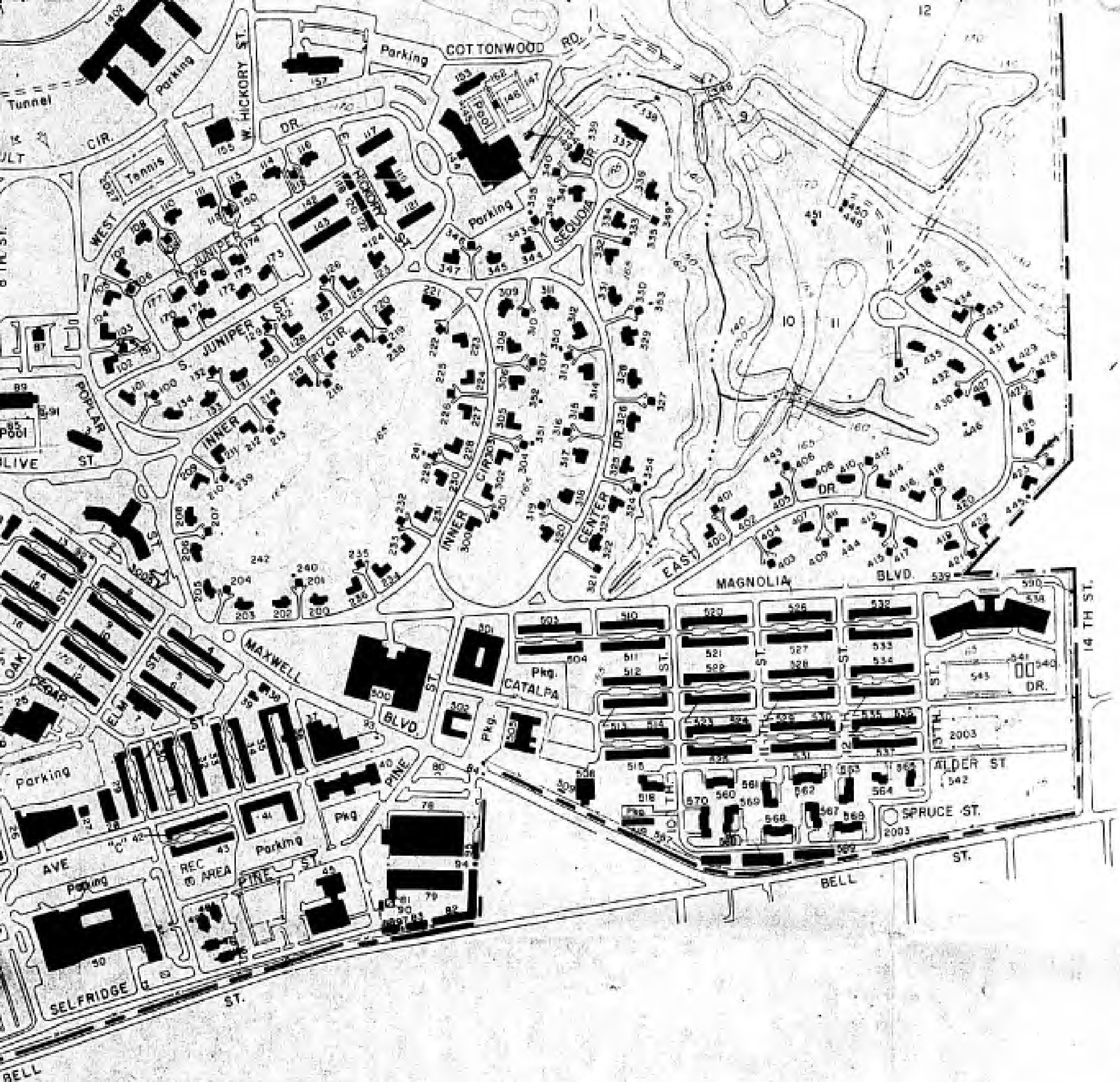
I

4



G
F
E
D
C
B
5-3
5-4
5-1
N 868,000
N 866,000
N 864,000
Flickerball Fields
Ball Park No 13
LAKE 2
Playground Area 2003
LAKE 1
Ball Park No 12
Ball Park No 11
Ball Park No. 10
Ball Park No. 9
TAXIWAY E (CLOSED) 3015
INSTRUMENT RUNWAY 3030
TRUE BEARING
36
3039
3029
TAXIWAY D (CLOSED)
3014
ASSAULT TAXIWAY STRIP
N-S RUNWAY 4000' X 300' (CLOSED)
3026 TAXIWAY
TAXIWAY B
3040


2
440 Track
TAXIWAY 3035
APRON 3034
NE-SW RUNWAY 5700' X 300' (CLOSED)
APRON 3033
TAXIWAY
3003
Parking
MAPLE
ST.
TAXIWAY 3020
PARKING APRON 3001
Parking
ASH STREET
MAXWELL BLVD.
WALNUT ST.
PEACH ST.
ADAMS
4 TH
5 TH
2 ND.
AVE. "B"
RANDOLPH
CANNELL
BARKSDALE
MITCHELL
Pkg.
Playground 2003
AVE. "C"
AVE. "D"
3 RD
6 TH ST.
SELFRIDGE ST.
CHANUTE ST.
Volley Ball Courts
PARKING APRON
TAXIWAY 4
3004
3024
3023
TAXIWAY 5
Flicker-ball Fields
Ball Park No. 2
Ball Park No. 1
HAWTHORNE ST.
Trailer Parking
Soccer
Fields
Track
GLIDE ANGLE
U.S. HWY. NO. 31
3027
3051
CLEAR ZONE 2000' X 3000'
7-1
Flickerball
6



L E G E N D

EXISTING

BUILDING, PERMANENT

BUILDING, SEMI-PERMANENT

BUILDING, TEMPORARY

ROADS AND PARKING

TRAIL OR EARTH ROAD

FENCE

NORTH

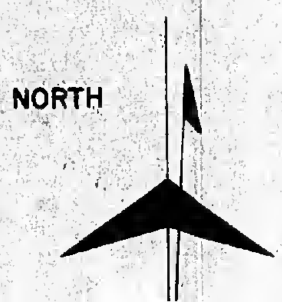
PROJEC

M

HORIZONT

ENVIRONMENT

1	1-29-85
REV	DATE



CONSULTING ENGINEERING SERVICES, INC.
MONTGOMERY, ALABAMA

PROJECT NO. ESE 84-607-0200

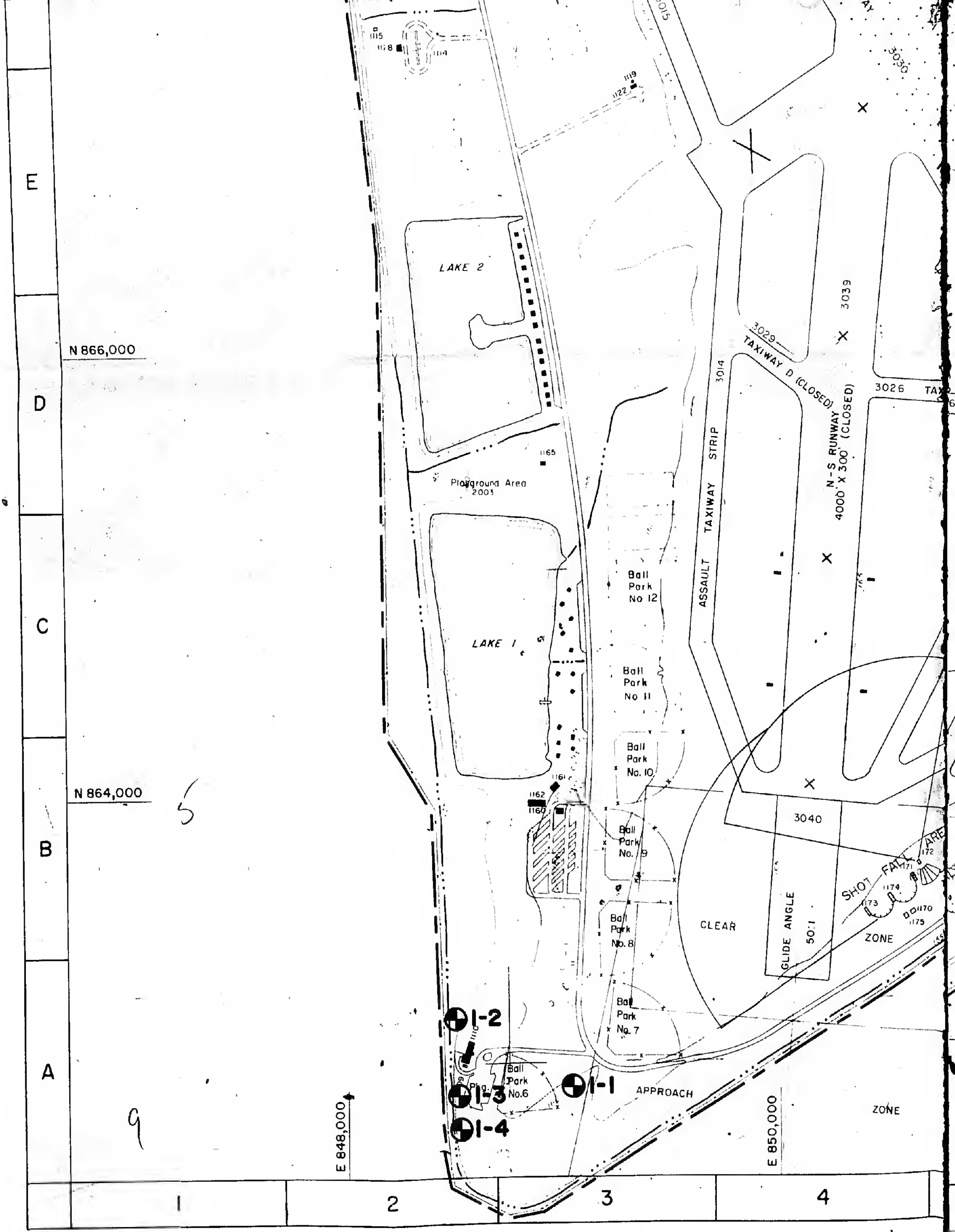
MONITOR WELLS
HORIZONTAL & VERTICAL CONTROL
FOR
ENVIRONMENTAL SCIENCE AND ENGINERING INC.
GAINESVILLE, FLORIDA

8

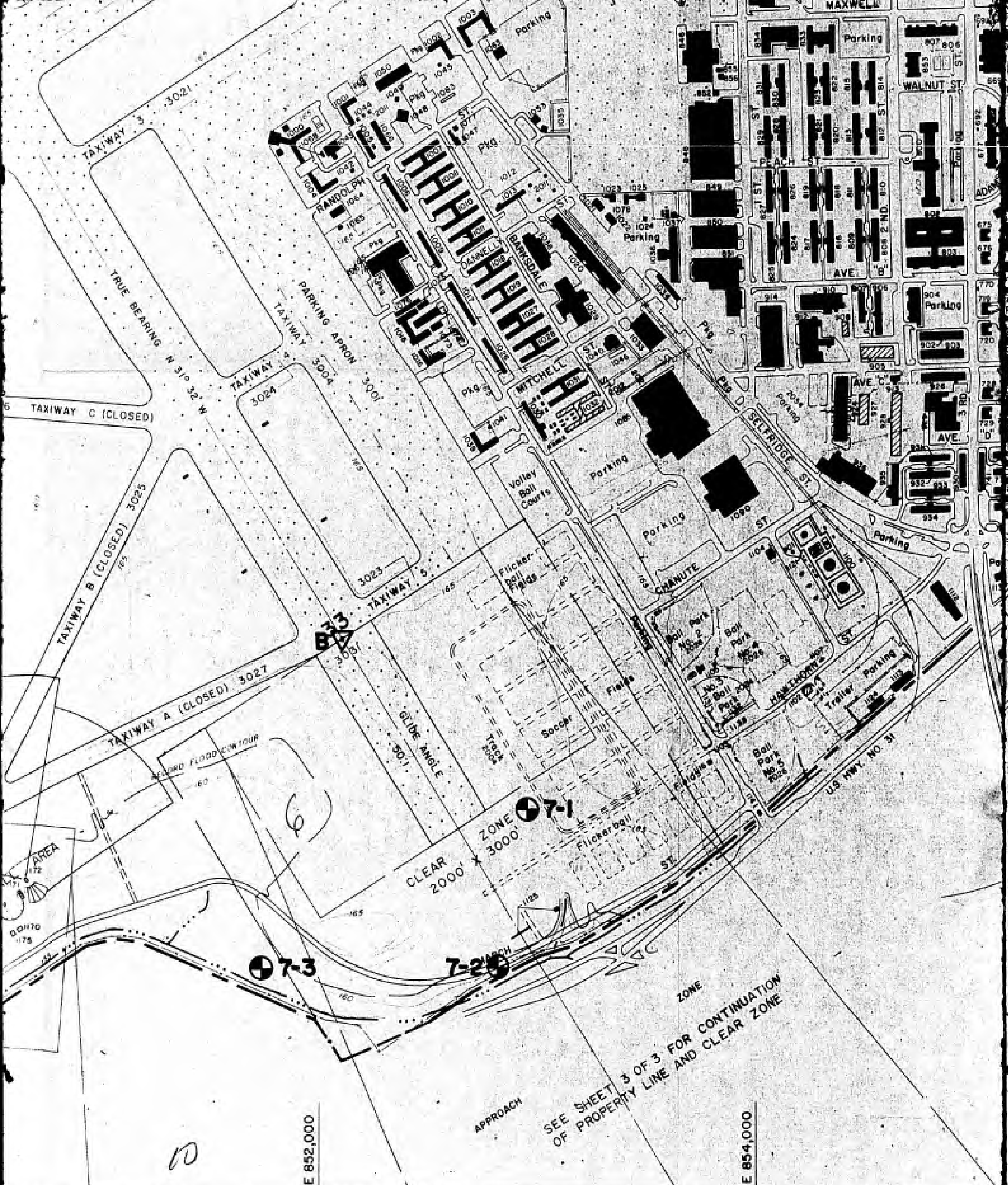
REV	DATE	DESCRIPTION	INITIAL
1	1-29-85	WELLS 7-1, 7-2 & 7-3	B.H.

PLAN REVISIONS

GRID BASED ON ALABAMA STATE PLANE COORDINATE SYSTEM, WEST ZONE

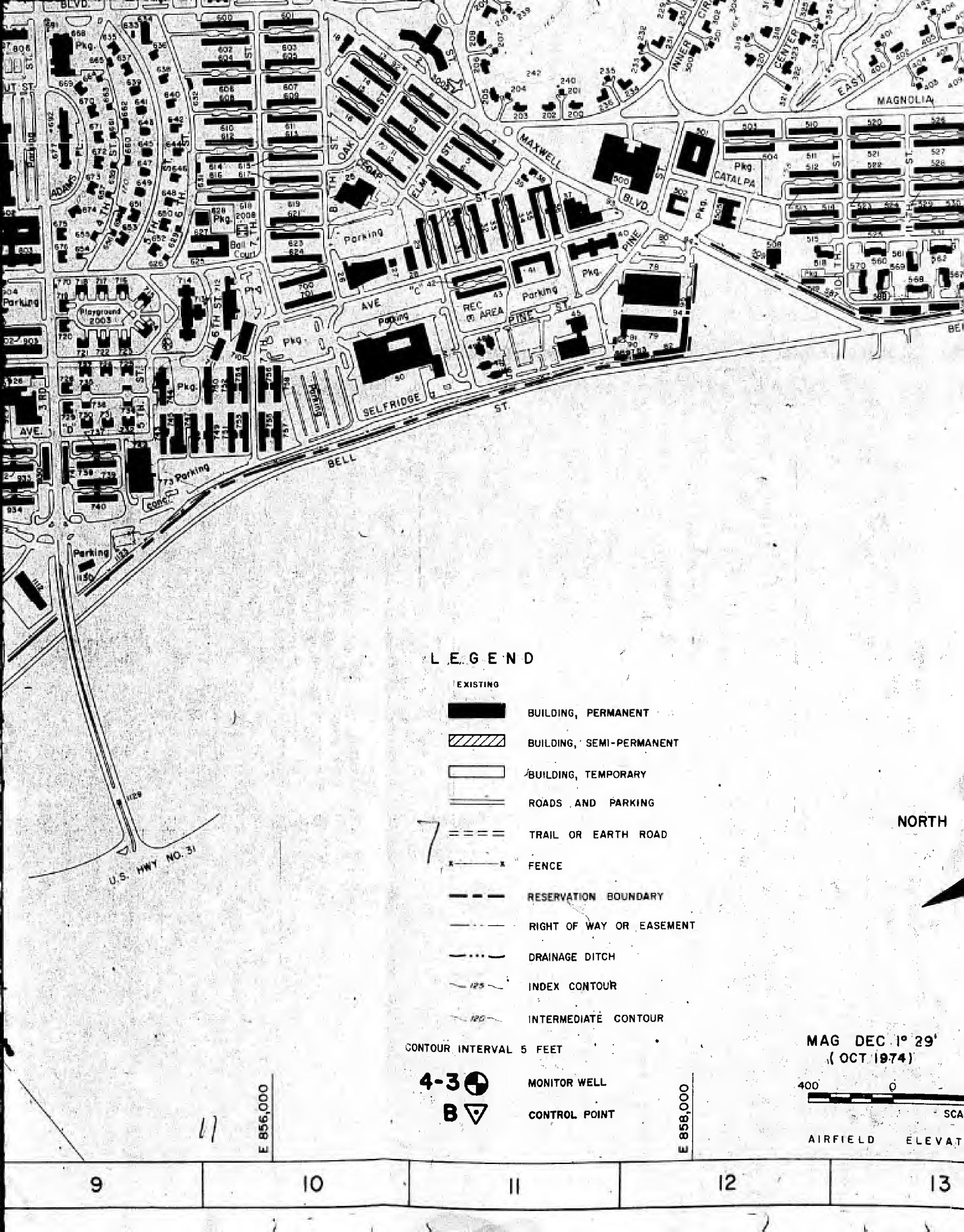


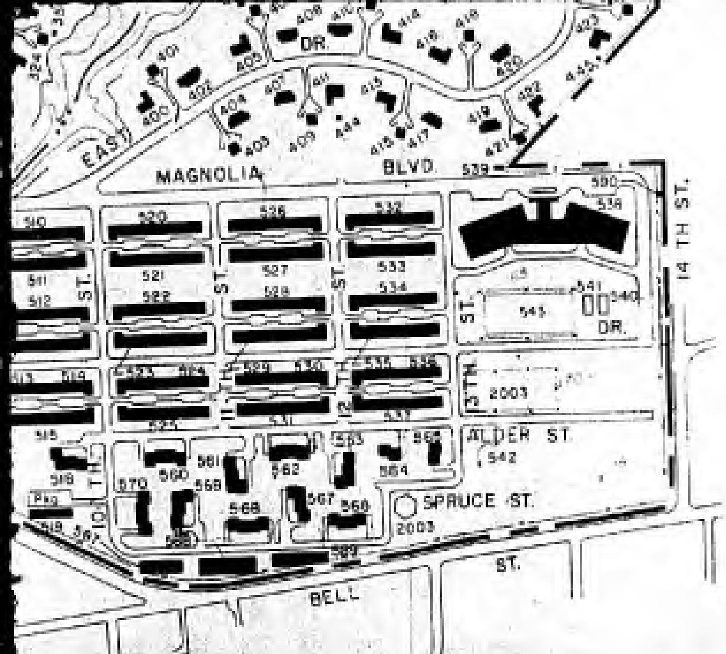
E
D
C
B
A
1
2
3
4
N 866,000
N 864,000
E 848,000
E 850,000
LAKE 2
LAKE 1
Playground Area 2003
1165
Ball Park No 12
Ball Park No 11
Ball Park No. 10
Ball Park No. 9
Ball Park No. 8
Ball Park No. 7
Ball Park No.6
1162
1160
1161
I-1
I-2
I-3
I-4
APPROACH
ZONE
CLEAR
GLIDE ANGLE 50:1
3040
SHOT FALL ZONE
ASSAULT TAXIWAY STRIP
3014
3029
TAXIWAY D (CLOSED)
N-S RUNWAY 4000' X 300' (CLOSED)
3039
3026
3030
1115
1118
1119
1122
1173
1174
1175
1170
1171
1172
5
9



TAXIWAY 3
3021
TAXIWAY 4
TAXIWAY 5
TAXIWAY C (CLOSED)
TAXIWAY B (CLOSED) 3025
TAXIWAY A (CLOSED) 3027
TRUE BEARING N 31° 32' W
PARKING APRON
3024
3004
3001
3023
3031
GLIDE ANGLE 50:1
CLEAR ZONE 2000' X 3000'
APPROACH ZONE
SEE SHEET 3 OF 3 FOR CONTINUATION OF PROPERTY LINE AND CLEAR ZONE
7-1
7-2
7-3
RANDOLPH
DONNELLY
BARKSDALE
MITCHELL
SELFRIDGE ST.
CHANUTE
HAWTHORNE
MAXWELL
WALNUT ST.
PEACH ST.
AVE. "B"
AVE. C
AVE. "D"
2 ND
3 RD
Parking
Volley Ball Courts
Flicker-ball Fields
Flickerball
Soccer
Track
Fields
Ball Park No. 2
Ball Park No. 4
Ball Park No. 3
Ball Park No. 5
Trailer Parking
U.S. HWY. NO. 31
E 852,000
E 854,000

5	6	7	8


LEGEND
EXISTING
BUILDING, PERMANENT
BUILDING, SEMI-PERMANENT
BUILDING, TEMPORARY
ROADS AND PARKING
TRAIL OR EARTH ROAD
FENCE
RESERVATION BOUNDARY
RIGHT OF WAY OR EASEMENT
DRAINAGE DITCH
INDEX CONTOUR
INTERMEDIATE CONTOUR
CONTOUR INTERVAL 5 FEET
4-3 MONITOR WELL
B CONTROL POINT
NORTH
MAG DEC 1° 29'
(OCT 1974)
AIRFIELD ELEVAT
E 856,000
E 858,000
MAXWELL BLVD
SELFRIDGE ST
BELL ST
AVE "C"
MAGNOLIA
PINE ST
U.S. HWY NO. 31
REC AREA
Playground 2003
Ball Court
9
10
11
12
13



E

N 866,000

D

CONSULTING ENGINEERING SERVICES, INC.
MONTGOMERY, ALABAMA

PROJECT NO. ESE 84-607-0200

MONITOR WELLS
HORIZONTAL & VERTICAL CONTROL

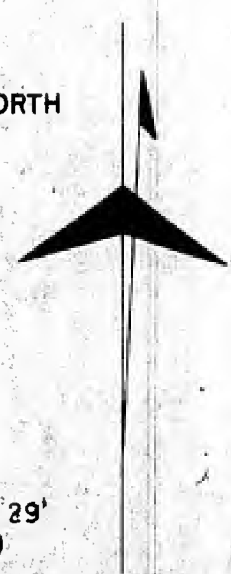
FOR

ENVIRONMENTAL SCIENCE AND ENGINERING INC.
GAINESVILLE, FLORIDA

8

REV	DATE	DESCRIPTION	INITIAL
1	1-29-85	WELLS 7-1, 7-2 & 7-3	B.H.

PLAN REVISIONS
GRID BASED ON ALABAMA STATE PLANE COORDINATE SYSTEM, WEST ZONE



MAG DEC 1° 29'
(OCT 1974)

400 0 400 800 1200
SCALE IN FEET

AIRFIELD ELEVATION 169 FEET

12

DEPARTMENT OF THE AIR FORCE
DIRECTORATE OF CIVIL ENGINEERING DCS/P&R – WASHINGTON, D.C.

AIR UNIVERSITY COMMAND

MONITOR WELL LOCATION MAP

MAXWELL AIR FORCE BASE
MONTGOMERY, ALABAMA

SCALE: 1" = 400'
DATE JANUARY 28, 1985
TAB NO. MO2061-8501
U.S. ARMY ENGINEER DISTRICT, MOBILE
MOBILE, ALABAMA
SHEET 1 OF 1

13	14

324

APPENDIX E--SAFETY PLAN

APPENDIX E
SAFETY PLAN

This element consists of the activities necessary to ensure the safety of all ESE and subcontractor personnel and the general public during onsite and laboratory activities. This will be done by indoctrination of all personnel in the requirements of the Maxwell AFB safety plan prior to site activities and by ensuring that all personnel are adequately trained; provision of adequate safety equipment; medical surveillance for personnel exposed to potentially toxic chemicals; provision for safe, legal sample transport and handling; provision for the safe conduct of field inspections, construction, and well drilling operations; and provision, as necessary, of exclusion areas and decontamination activities to prevent contamination migration impact to onsite personnel, the general public, or the environment.

Principal physical hazards at Maxwell AFB during sampling and analysis involve the operation of the drilling rigs, operation of soil boring equipment, and operation of field testing equipment.

Chemical hazards at the site involve the potential inhalation of or skin contact by solvents, plating wastes, and cyanides during the drilling operations and the sampling of ground water. Also, the potential for skin contact with sediments potentially contaminated with plating wastes and other nonspecific toxic materials is a concern at Maxwell AFB.

It is anticipated that all sampling will be conducted using Level D protection. Level C protection (full-face canister masks equipped with organic vapor cartridges worn by samplers and drilling crew) will be required in these areas if organic vapors are detected in the atmosphere at breathing level during operations.

The decontamination assumptions for equipment such as drilling rigs which are costed into the proposed scope include the decontamination between borings or well installations using approved drilling water in an area provided by the Base Civil Engineer. It must be recognized, however, that although the above decontamination activities are considered to be sufficient to prevent hazard to the public health or onsite personnel, regulatory review of the work plan may result in additional requirements. These would impact the time requirement for decontamination of equipment, as well as introducing construction costs for building a separate decontamination wash rack, storage of drill cuttings, and providing for storage, treatment, and testing of the decontamination water. Additional costs would be required for such an upgraded decontamination program.

APPENDIX F--PIEZOMETERS, MONITOR WELLS, SURFACE WATER, AND SEDIMENT SAMPLING LOCATION DESIGNATIONS

APPENDIX F

PIEZOMETERS, MONITOR WELLS, SURFACE WATER,
AND SEDIMENT SAMPLING LOCATION DESIGNATIONS

SAMPLE NUMBERING SYSTEM

The sample numbering system for piezometers and ground water monitor wells consists of the site number followed by the number indicating the order in which the wells were drilled at the study site (e.g., Well 3-3 indicates the well was the third well drilled at study site number 3). The actual sample numbers assigned to the ground water samples collected from the monitor wells were selected by the ESE Laboratory data computer system and are unique numbers for the samples. The piezometer/monitor well numbers and the ground water sampling site designations and sample numbers are presented in Table F-1.

The sampling location designations for the sediment sampling sites were arbitrarily selected and sequentially numbered from one to eleven. These sites and the numbers issued to the samples collected from these sites are listed in Table F-2. The site designation 2 is indicative of the fact that the entire drainage system of MAFB was declared Site 2 in the work plan.

The sampling location designations for the surface water sites were also arbitrarily selected and numbered one through four. These sites and the numbers issued to the samples collected at these sites are listed in Table F-3. The surface water samples were collected in the surface drainage system on MAFB, which had been designated as Site 2 in the work plan.

Table F-1. Piezometer/Monitor Well Numbers and Ground Water Sampling Site Designations and Sample Numbers

Site	Piezometer/ Monitor Well Number	Ground Water Sampling Site Designation	Ground Water Sample Number
1	1	GW1-1	469200
1	2	GW1-2	469201
1	3	GW1-3	469202
1	4	GW1-4	469203
3	1	GW3-1	469500
3	2	GW3-2	469501
3	3	GW3-3	469502
4	1	GW4-1	469503
4	2	GW4-2	469504
4	3	GW4-3	469505
5	1	GW5-1	469507
5	2	GW5-2	469508
5	3	GW5-3	469509
5	3	GW5-4	469510
5	5*	GW5-5	469511
6	1	GW6-1	469512
6	2	GW6-2	469513
6	3	GW6-3	469514
7	1	GW7-1	469515
7	2	GW7-2	469516
7	3	GW7-3	469517

*This was an existing well which was arbitrarily assigned the 5-5 designation.

Source: ESE, 1985.

Table F-2. Sediment Sampling Site Designation and Sediment Sample Number

Sediment Sampling Site Designation	Sediment Sample Number
S2-1	469300
S2-2	469301
S2-3	469302
S2-4	469303
S2-5	469304
S2-6	469305
S2-7	469306
S2-8	469307
S2-9	469308
S2-10	469309
S2-11	469310

Source: ESE, 1985.

Table F-3. Surface Water Sampling Site Designation and Sample Numbers

Surface Water Sampling Site Designation	Surface Water Sample Numbers
SW2-1	469400
SW2-2	469401
SW2-3	469402
SW2-4	469403

Source: ESE, 1985.

APPENDIX G--HORIZONTAL LOCATIONS AND ELEVATIONS OF MONITOR WELLS

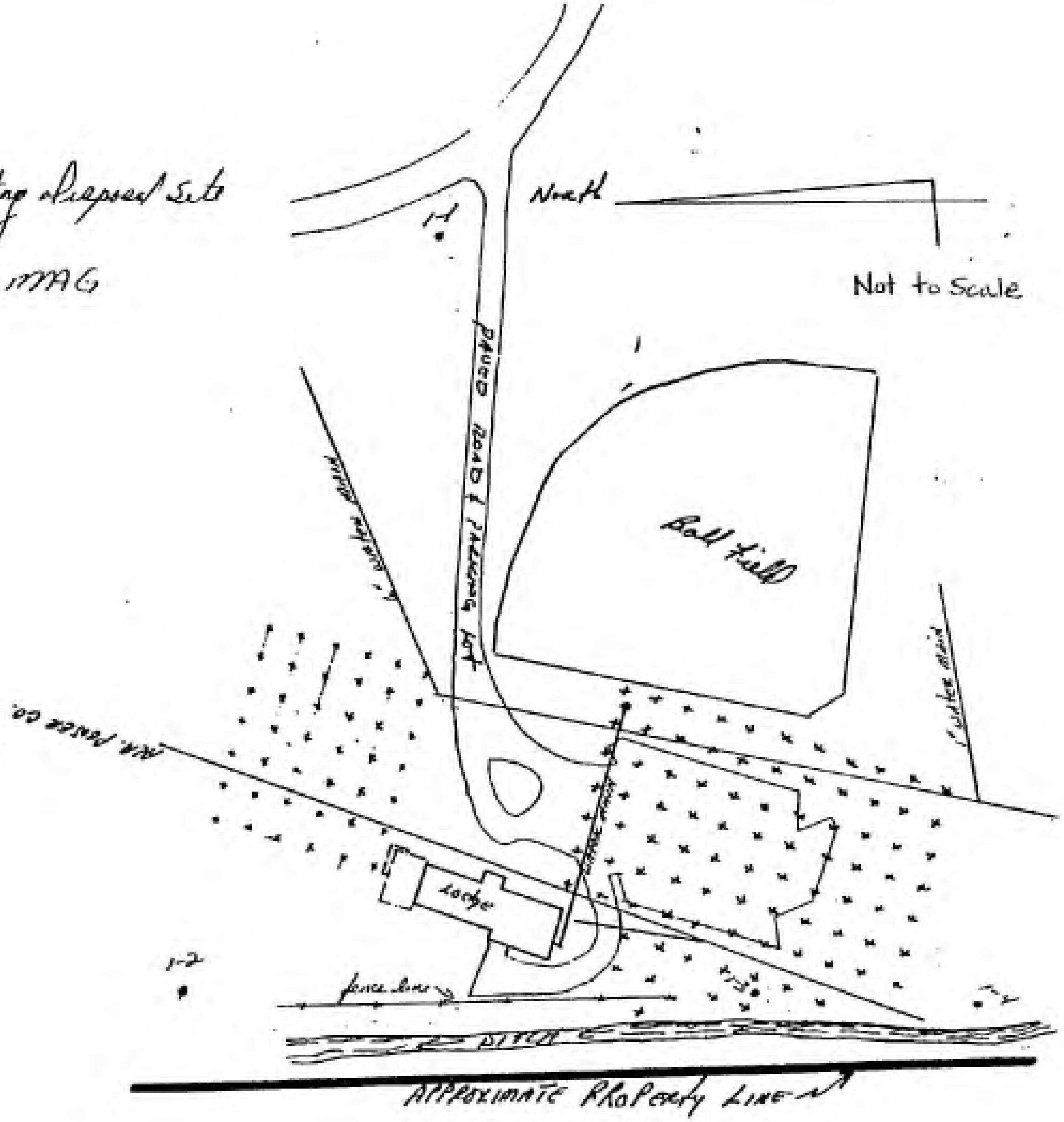
APPENDIX H--GEOPHYSICAL TRACING FOR SITES 1, 3, 5, AND 7

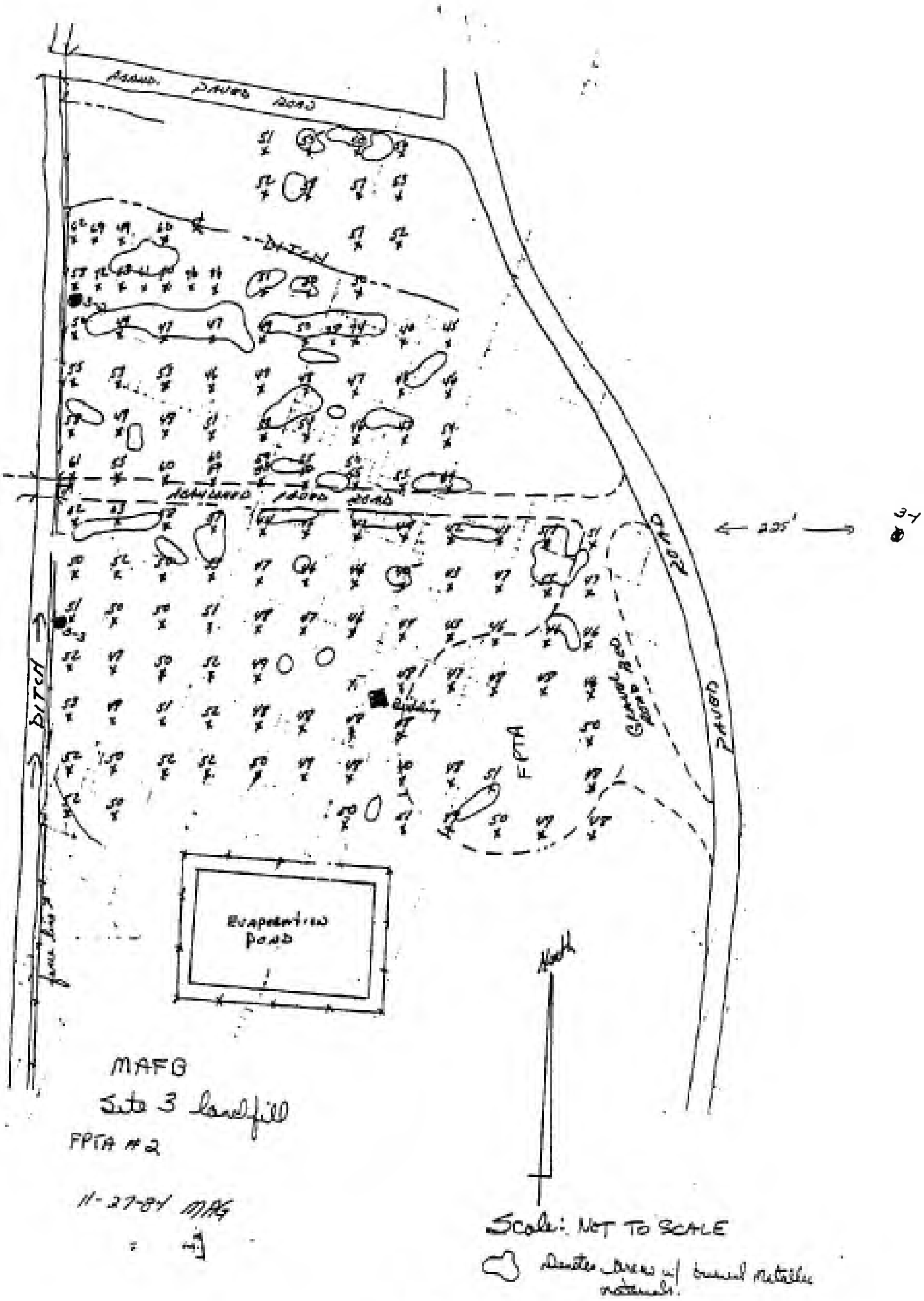
MAFB

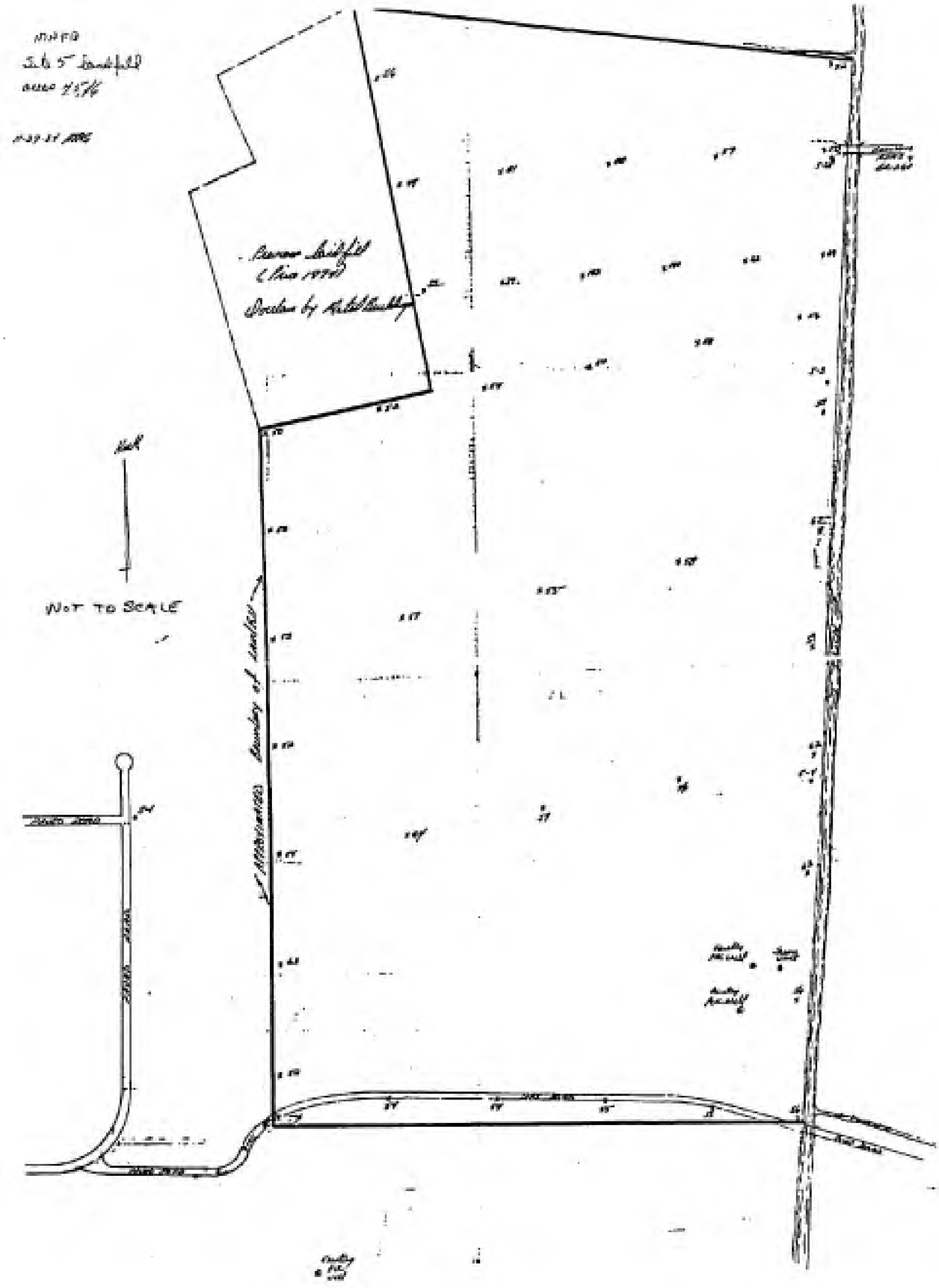
Site # 1

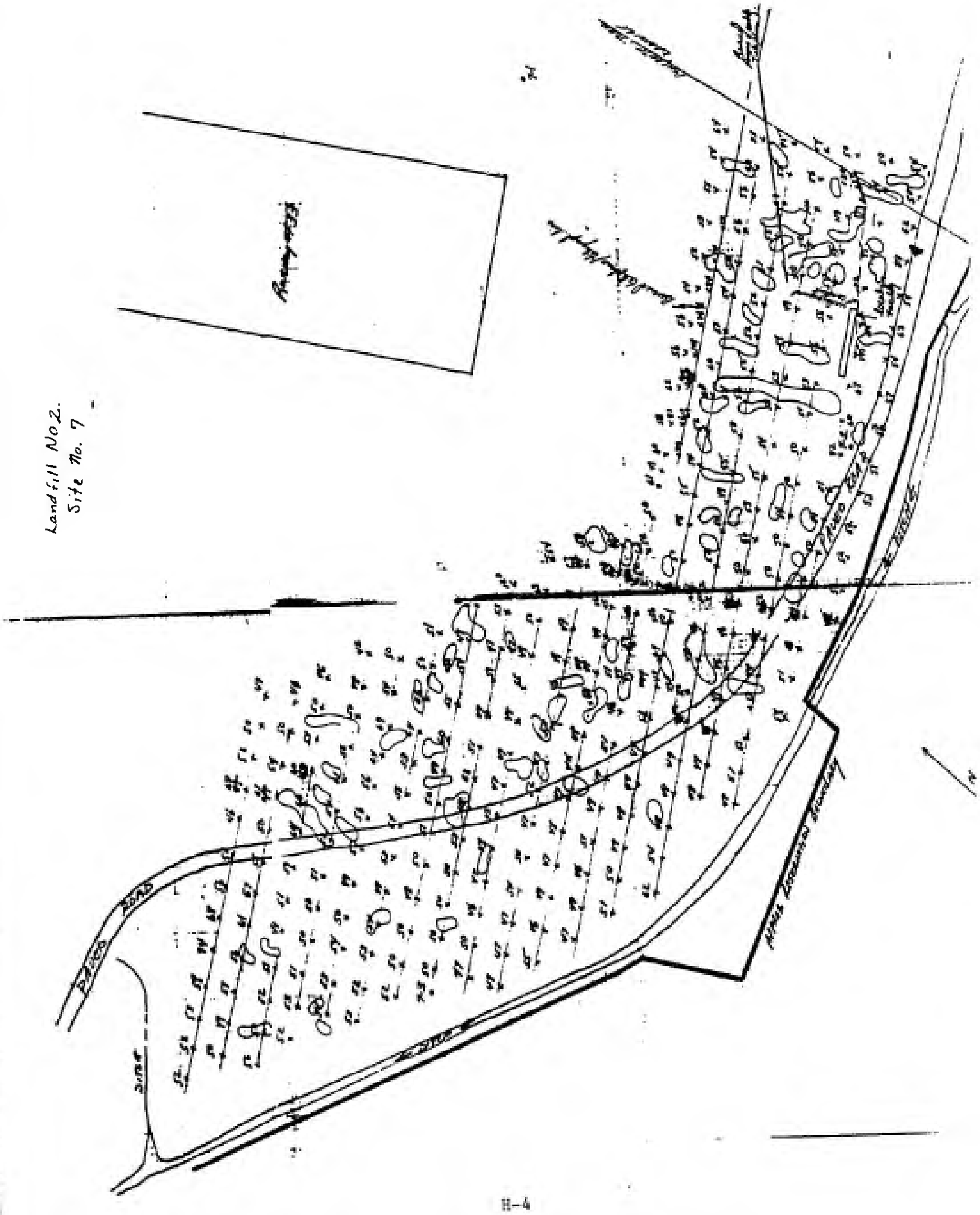
Electroplating Disposal Site

11-28-84 MAG




ABAND. PAVED ROAD
DITCH
ABANDONED PAVED ROAD
PAVED ROAD
FPTA
DITCH
← 235' →
Evaporation Pond
North
MAFB
Site 3 landfill
FPTA #2
11-27-84 MAG
Scale: NOT TO SCALE
Denotes areas w/ buried metallic materials.


NOT TO SCALE


Landfill No.2.
Site No. 7

APPENDIX I--PIEZOMETER BORING LOGS

Site Maxwell AFB

Boring No. PZ 1-1 upgradient

Hole Size 6 in Slot 0.010 in

Screen Length 10 ft Mat'l Sch 40 PVC

Diameter 2 in

Casing Length 14 ft + 3 ft S.U. Mat'l Sch 40 PVC

Diameter 2 in

Date Start 12/4/84 Finish 12/4/84

Contractor ESE Driller Law Eng.

Location Coordinates N ______ E ______

Filter Materials none

Grout Type none

Development n.a.

Static Water Level ______

Top of Well Elevation ______

Drill Type hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
				PVC slip cap; vent				Log based on cutting returns only
	0	CL	Silty clay, 25% silt, 5YR 5/8 (yellowish red), mod. plastic, stiff, dry, floodplain	G.L.				Contact @ 2.5 ft sharp but approximate
		ML	Clayey silt, 30% clay, 10YR 4/3 (brown), sl. plastic, med. consist., moist, floodplain	joint				Contact @ 4.0 ft gradational and approximate
	5	CL	Silty, sandy clay, 15% silt, 20% sand, 5% muscovite, 7.5YR 5/8 (strong brown), sl. plastic, med consist., damp, floodplain					6 in borehole
	10			2 in PVC casing				Contact @ 11.0 ft sharp
		SP	Med gr. quartz sand, 3% muscovite, mod round, poorly graded, 7.5YR 5/8 (strong brown), nonplastic, loose, dry, fluvial	joint				Cuttings; Contact @ 15.0 ft approximate and gradational
	15	SW	Fine to m quartz sand, mod. round, well graded, 10YR 6/8 (brown-yellow), non plastic, loose, moist, fluvial	2 in PVC screen				1st H_2O @ about 18 ft based on wet cutting to surface
	∇							

Signed George Kxxx   Approved ______

Site Maxwell AFB

Boring No. PZ 1-1, upgradient | Location Coordinates N ______

Hole Size ______ Slot ______ | E ______

Screen Length ______ Mat'l ______ | Filter Materials ______

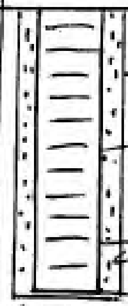
Diameter ______ | Grout Type ______

Casing Length ______ Mat'l ______ | Development ______

Diameter ______ | Static Water Level ______

Date Start 12/4 Finish 12/4 | Top of Well Elevation ______

Contractor ______ Driller ______ Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
		SW						6 in borehole
	20	SW	Fine to coarse sand, 20% gravel (pebbles to 0.5 in diam), 10YR6/8 (yellow brown), non plastic loose, wet, fluvial					2 in PVC screen
		SW						Sand cavings
	25	EOH	Med to coarse quartz sand, 50% gravel (to 3.0 cm diam), non plastic, loose, wet, fluvial				EOW, EOH 24 Ft	PVC end cap

Signed ______ Approved ______

Site Wardwell AFB

Boring No. PZ 1-1 upgradient, Site I

SHEET 3 OF 3

0700 - Driller, ESE on-site
- Rig: CME 45
3¼' hollow stem auger (O.D = 6 in)
- Crew: Mike , Randy

0710 - Set up rig
Begin augering
0740 - Down to 24 ft - 1st H_2O near 18 ft
0745 - Drop spoon down auger to clean out the bottom - sand
& gravel inside
0755 - Utilities people arriving (gas, electric, sewer, etc.)
- will go to different site with them to get clearance to
drill shortly
0800 - Spoon out of hole (14.2 to 24.2)
0815 - ~~Pull auger~~ Install well to 24.0 ft (screen ~~12 to 22 ft~~)
0820 - ~~Install~~ Pull auger - managed to push
well to 24.2 ft - ~~pad in setting~~
0830 - Left w. utility people to inspect sites
0920 - Inspection complete (well installation complete ~ 0900)
Return to Site I
Drill rig buried in mud trying to move over to
Connecticut piezometer at Site I
1000 - Air Force can't assist in freeing truck from mud
(Called ESE (J. Bond))
1020 - Return to rig + attempt again to free truck (rig)

Materials used: 11 ft screen, 17 ft casing

12/4/94 DATE

[signature] SIGNED

APPROVED

SHEET 1 OF 3

Site Wurtsmith AFB

Boring No. PZ 1-2, Compressor, Site I Location Coordinates N ______

Hole Size 6 in Slot 0.010 in E ______

Screen Length 10 ft Mat'l Sch 40 PVC Filter Materials none

Diameter 2 in Grout Type none

Casing Length 14 ft + 3.0 ft S.U. Mat'l Sch 40 PVC Development N.A.

Diameter 2 in Static Water Level ______

Date Start 12/4/84 Finish 12/4/84 Top of Well Elevation ______

Contractor ESE Driller Law Eng. Drill Type Hollow Stem Auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
							PVC slip caps vent	Log based on cuttings only
	0	SC	Med sand, 50% clay, 5YR 4/6 (yellow-red), mod graded, mod round, mod plastic, med. consist, damp, flood plain				G.L.	Contact @ 2.0, 7.5, and 11.0 ft approximate and gradational
	5	ML	clayey silt, 40% clay, 5Y 6/2 (light olive gray), sl. plastic, soft, wet, flood plain				joint	Perched water in silt above ~ 7.5 ft
	10	CL	silty clay, 30% silt, 5Y 6/1 (gray), mod. plastic, stiff, moist, flood plain				6 in borehole 2 in PVC casing	cuttings Contact @ 15.0 ft approx and gradational
		CH	Inorganic clay, 5Y 6/1 (gray) to 10YR 5/8 (yellow brown), mottled colors, v plastic, stiff, moist, flood plain					joint
	15 ▽	SC	Fine to coarse sand, 25% clay, well graded, subangular to round, sl. plastic, loose, v wet, fluvial, 10YR 7/6 (yellow)				2 in PVC screen	1st significant water near 15 ft @ top of sand - wet sand to surface

Signed [signature]

Approved ______

SHEET 2 OF 3

Site Maxwell AFB

Boring No. PZ1-2, downgradient, Site I

Location Coordinates N ____

E ____

Hole Size ____ Slot ____

Screen Length ____ Mat'l ____

Filter Materials ____

Diameter ____

Grout Type ____

Casing Length ____ Mat'l ____

Development ____

Diameter ____

Static Water Level ____

Date Start 12/4 Finish 12/4.

Top of Well Elevation ____

Contractor ____ Driller ____ Drill Type ____

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW to SC	Fine to coarse quartz sand, 0 to 30% clay, non to sl. plastic, 5% black fine grains, 3% muscovite, well graded, mod. round, dense, wet, fluvial 5Y 6/3 (pale olive)	6 in borehole; 2 in PVC screen				Drill rate fell @ about 18.5 ft suggesting a substantial increase in clay content; Collapsed sand
	25			PVC end cap			EOW, EOB 24 ft	

Signed George I. Bost

Approved ____

Site Maxwell A.F.B.

Boring No. PZ 1-2 , downgradient, Site I   SHEET ______ OF ______

0900 - Rig stuck in mud moving onto hole - see preceding narrative

1110 - Rig freed & ready to move onto new hole chosen on drier ground 30 ft to the south inside the playground area (NW corner)

1115 - Water run: Hose on outlet was too large to fit into water tank; Took 10 or 15 minutes to rig up a system

1140 - Fill-up complete

1145 - Lunch

1230 - Clean augers w ~~[illegible]~~ with dewater (unchlorinated) using rig pump

1255 - Back rig onto new hole location & set up
A few raindrops fell, but doesn't look too bad!

1300 - Begin augering

1320 - Down to 24 ft

- Take spoon sample @ 24.0 ft (Driller's choice!)
A few more raindrops!

1335 - Pull spoon (no blow counts taken)

1345 - Install well to 24 ft (screen 14 to 24 ft)

1355 - Pull augers

1410 - ~~[illegible]~~
Water in hole @ 7.5 ft
Water in pipe @ 17.5 ft

1410 - Waiting for radiator to be installed before moving off of hole - DOWNTIME
Rain light but steady

1430 - Repairs complete
Move off hole to clean augers

1500 - Move to new hole

Materials: 10 ft screen, 17 ft casing

12/4/84 DATE

[illegible] SIGNED

APPROVED

SHEET ______ OF ______

Site Maxwell AFB

Boring No. PZ 1-3, Dounce-Dixie Site T

Location Coordinates N ______ E ______

Hole Size 6 in Slot 0.010 in

Screen Length 10 ft Mat'l Sch 40 PVC Filter Materials none

Diameter 2 in Grout Type none

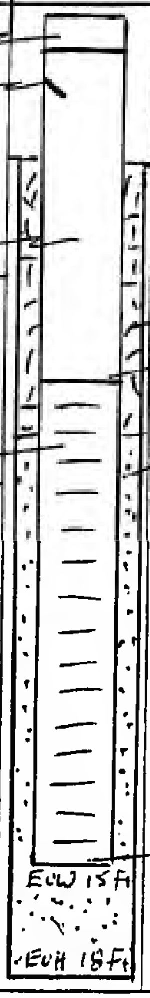
Casing Length 5 ft + 3 ft S.U. Mat'l Sch 40 PVC Development N.A.

Diameter 2 in Static Water Level ______

Date Start 12/4/84 Finish 12/4/84 Top of Well Elevation ______

Contractor ESE Driller Law Eng Drill Type Hollow Stem Auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			Slip cap; vent					Log based on cuttings only
	0	SP	Fine to med sand, 5% clay, mod graded, mod round, nonplastic, loose, 10YR 5/4 (yellow brown), moist, fluvial				G.L.; 2 in PVC casing	All contacts approximate & gradational; ← Cuttings; ← joint
	5	CL	Sandy clay, 30% med sand, 10YR 5/4 (yellow brown), mod plastic, med consist., moist, floodplain					
		∇ SW	Fine to coarse quartz sand, 5% gravel (to 2 cm diam.) 3% muscovite, well graded, mod round, nonplastic, loose, 5Y 6/2 (lt olive gray) wet, fluvial				2 in PVC screen	← sand collapse; 1st H_2O near 6.0 ft based on wet cuttings and water to surface
	10	SW	Fine to co. quartz sand, 30% gravel (to 2 cm diam) well graded, round, non plastic, loose, 5Y 6/2 (lt. olive gray), wet, fluvial					
	15						EOW 15 Ft; EOH 18 Ft	← PVC end cap



Signed George Ross Approved ______

Site Maxwell AFB

Boring No. PZ 1-3, downgradient, Site I

SHEET ______ OF ______

1510 - Set up on-site

1515 - Begin augering

1530 - Down to 18 ft

Install well to 15.3 ft (screen 5.3 to 15.3 ft)

1540 - Pull augers.

1550 - Move off hole

Run for water to clean augers

1620 - Water truck back - clean augers

1645 - Augers cleaned

Note: ~~Plan to install PZ 1-4 Wed afternoon (12/5) or Thursday (12/6) because we have to install PZ 7-1 Wed morning (12/5) at OBCO~~

1650 - Set up on PZ 1-4

1700 - Depart site

12/4/84 DATE

George [illegible] SIGNED

______ APPROVED

Site Maxwell AFB

SHEET ____ OF ____

Boring No. PZ 1-4, downgrad. Site I

Location Coordinates N ____ E ____

Hole Size 6 in   Slot 0.010 in

Screen Length 10 ft   Mat'l Sch 40 PVC

Filter Materials none

Diameter 2 in

Grout Type none

Casing Length 6 ft + 2 ft S.U.   Mat'l Sch 40 PVC

Development N.A.

Diameter 2 in

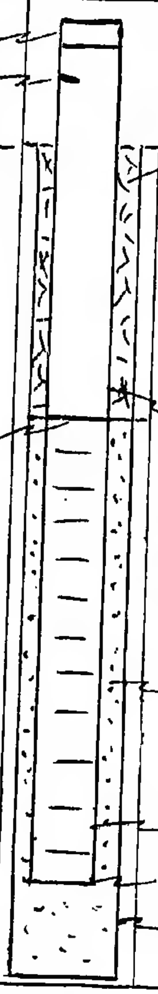
Static Water Level ____

Date Start 12/5/84   Finish 12/5/84

Top of Well Elevation ____

Contractor ESE   Driller Law Eng   Drill Type Hollow Stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap; vent					Log based on cuttings only
	0	CL	Sandy, silty clay, 15% sand, 15% silt, 10YR 4/4 (lt. yellow brown), sl plastic, med consist., moist, floodplain				G.L	Cuttings
		SW	Med to cs. grained sand, 15% gravel (to 1 cm), mod sorted, round, 10YR 5/2 (grayish brown), non plastic, loose, moist, fluvial					All contacts approximate, + contacts @ 6 ft and 10 ft are gradational
	5							2 in PVC casing
		GW	Gravel (to 3 cm), 20% fine to cs sand, 2% clay, non plastic, loose, v. wet, fluvial, 10YR 5/3 (brown)				joint	1st H_2O near 6 ft, based on wet cuttings, water to surface
	10	SW	Fine to coarse sand, 40% gravel (to 1 cm), well graded, mod round, 10YR 6/6 (brown, yellow), non plastic, loose, v. wet, fluvial					Sand cavings
	15							2 in PVC screen; PVC end cap; 6 in borehole



Signed George Roster   Approved ____

Site Maxwell AFB
Boring No. PZ1-4, Pumppad., Site I

SHEET ______ OF ______

0630 - ESE arrive on-site
0725 - Drillers arrive on-site
0735 - Begin augering
0745 - Down to 18 ft (overdrilled 3 ft)
Install well to 16 ft (screen 6 to 16 ft)
0800 - Installation complete
0805 - Cleaning augers while I go after the Support manager who will accompany us to Site VII near the S end of the N-S runway
0830 - Augers clean, Depart site.

12/5/84 DATE

SIGNED

APPROVED

Site Maxwell A.F.B. SHEET ____ OF ____

Boring No. PZ3-1 Location Coordinates N ____

Hole Size 6 in Slot 0.010 in E ____

Screen Length 10 ft Mat'l Sch 40 PVC Filter Materials none

Diameter 2 in Grout Type none

Casing Length 17.7 ft + 2 ft SU Mat'l Sch 40 PVC Development N.A.

Diameter 2 in Static Water Level ____

Date Start 12/6/84 Finish 12/6 Top of Well Elevation ____

Contractor ESE Driller Law Eng. Drill Type Hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap					Log based on cuttings only
			vent					
	0		G.L.					
	0		Inorganic clay, 5YR 5/8 (yellow red), v. plastic, med. consist., damp, flood plain					
	5		Silty clay, 10% silt, 7.5YR 6/8 (red yellow), mod. plastic, med. consist., damp, flood plain					All contacts approximate & gradational
	10		Silty clay, 15% silt, 5% fine sand, 7.5YR 5/6 (strong brown) to 5Y 7/2 (light gray), mottled, mod. plastic, stiff, damp, flood plain					cuttings; joint; 6 in borehole
			Sandy clay, 25% fine sand, 10% silt, 10YR 6/8 (brown. yellow), mod. plastic, med. consist., moist, floodplain					PVC casing
	15		Gravelly, sandy clay, 30% gravel (to 5 cm), 25% f-med. sand, 10YR 7/8 (yellow), med. consist., moist, floodplain					caved sand; joint; PVC screen

Signed George [illegible]

I-11

Approved ____

Site *Maxwell AFB* SHEET ______ OF ______

Boring No. *PZ 3-1* Location Coordinates N ______

Hole Size ______ Slot ______ E ______

Screen Length ______ Mat'l ______ Filter Materials ______

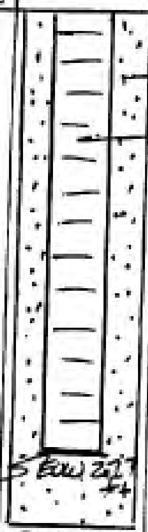
Diameter ______ Grout Type ______

Casing Length ______ Mat'l ______ Development ______

Diameter ______ Static Water Level ______

Date Start *12/6/84* Finish *12/6* Top of Well Elevation ______

Contractor ______ Driller ______ Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20		*Sandy gravelly clay, 35% fine to med sand, 5% gravel (to 1 cm) 10YR6/6 (brown. yellow), sl. plastic, med. consist., moist, flood plain*					*Split spoon sample @ 29 ft (29 to 31) was gravelly sand, very clean + wet; water level's @ 19.9 ft, indicating we missed the top of the sand or the water is confined*
	25							
	30		*Inorganic clay, 5Y5/1 (gray), very plastic, soft, v. wet, flood-plain.*					
			Fine to coarse sand, 20% gravel					

Signed *George Rose* I-12 Approved ______

Site Maxwell AFB
Boring No. PZ 3-1, upgrad. Site III

SHEET ______ OF ______

1415 – Arrive, set up on-site
1420 – Begin augering – monitor w. H-NU
1450 – Down to 29 ft
Knock plug out of augers w. spoon sampler
we still haven't hit sand (probably!), but there's
about 2 or 3 inches of H_2O in bottom of augers
Spoon brought up coarse sand & gravel, wet, clean (but
only a handful)
1505 – Water measured in augers @ 19.9 ft (G.L)
Attempt to install well to 29 ft – sand has heaved
about 3 ft inside augers
Tough time pushing well through the plug
1520 – Pulling augers & pushing well down simultaneously
Well down to 27.7 ft w. 2 ft S.U (screen 17.7 to 27.7)
water measured @ 19 ft (G.L) inside well
1550 – Augers finally out – bottom 20 ft or so enveloped
in the gray, slick clay – explains why the sand
wasn't reaching the surface; all flights were clogged.
Will take a long time to decon!
1625 – Water run – augers still not clean
Measure water in well @ 17.5 ft (GL)
" " in hole @ 9.2 ft (was 8 ft – dropping)
1700 – water @ 17.2 ft (GL)
Water truck returns – resume decon.
1730 – Decon complete.
Depart Site

12/6/84 DATE
[signature] SIGNED

APPROVED

Site Mather AFB

Boring No. PZ 3-2, Doumpad, Site III

Hole Size 6 in — Slot 0.010 in

Screen Length 10 ft — Mat'l Sch 40 PVC

Diameter 2 in

Casing Length 11 ft + 2.5 ft Stick-up — Mat'l Sch 40 PVC

Diameter 2 in

Date Start 12/7/84 — Finish 12/7

Contractor ESE — Driller Law Eng.

Location Coordinates N ______ E ______

Filter Materials none

Grout Type none

Development N.A.

Static Water Level ______

Top of Well Elevation ______

Drill Type Hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap, vent, GL					Log based on cuttings only
	0	CL	Silty clay, 25% silt, 10YR4/3 (dk brown), mod. plastic, soft, moist, flood plain					joint; PVC casing; cuttings
	5	CL	Silty clay, 30% silt, 10YR6/6 (yellow), mod. plastic, stiff, v. moist, flood plain					1st H_2O near 9 ft based on wet cuttings to the surface
		CL	Silty clay, 15% silt, 7.5YR5/8 (strong brown) to 5Y6/2 (lt olive gray), mottled, stiff, damp, flood plain					6 in borehole
	10	SC	Clayey fine sand, 40% clay, well graded, 5Y6/2 (lt olive gray), med density, moist, flood plain					joint; PVC screen; caved sand
	15	SW	F-cr sand, 5% gravel, well graded, mod round, 5Y7/1 (lt. gray), loose, wet, fluvial					All contacts approximate & gradational
		SW						

Signed George Bost

Approved ______

SHEET 2 OF 3

Site Maxwell

Boring No. PZ 3-2

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 12/7/84 Finish 12/7

Contractor ______ Driller ______

Location Coordinates N ______

E ______

Filter Materials ______

Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW EOH	F-co. sand, 15% gravel, well graded, mod round, 10YR 6/6 (brown. yellow, nonplastic, loose, wet, fluvial Near bottom of hole alot of gravel (50%) to 5 in diameter				EOW 21 ft EOH 22 ft	caved sand PVC screen PVC end cap

Signed George Rock

Approved ______

Site Maxwell AFB
Boring No. PZ 3-2, Downgrad, Site III

SHEET 3 OF 3

1115 - Set up on-site
1120 - Begin augering
Encountered debris (glass, metal, brick) @ about 2-3 ft - abandon hole, move 20 ft north and several ft west, start again
1130 - Start augering
Encountered debris again - move hole
1135 - Encountered concrete - move hole
1140 - Start augering
Debris again - stop, move hole
1145 - Start augering - no debris!
1155 - Down to 22 ft
1200 - Install well to 21.1 ft (screen 11.1 to 21.1, 2.5 S.U.)
Pull augers
1215 - Bump out
1220 - Clean augers
Water measured @ 8.2 ft (TOC), 5.7 ft GL
1300 - LUNCH
1400 - Return for rig
- Depart site.

12/7/84 DATE

George [signature] SIGNED

APPROVED

SHEET ______ OF ______

Site Maxwell AFB

Boring No. PZ3-3, Drumyard Site IV   Location Coordinates N ______

Hole Size 6 in   Slot 0.010 in   E ______

Screen Length 10 ft   Mat'l Sch 40 PVC   Filter Materials none

Diameter 2 in   Grout Type none

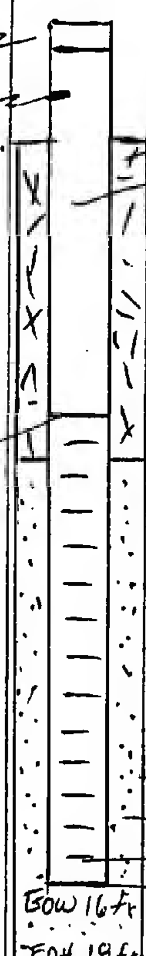
Casing Length 6 ft + 2 ft SU   Mat'l Sch 40 PVC   Development N.A.

Diameter 2 in   Static Water Level ______

Date Start 12/7/84   Finish 12/7   Top of Well Elevation ______

Contractor ESE   Driller Law Eng.   Drill Type Hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap					Log based on cuttings only
				vent				
	0	CL	Sandy, silty clay, 20% f-med. sand, 10% silt, 3% muscovite, 10YR 4/3 (brown), sl. plastic, soft, moist, flood plain	G.L.				cuttings; PVC casing
	5	CL	Silty clay, 20% silt, 10YR 6/2 (lt brown. gray), mod. plastic, soft, moist, flood plain					Contacts @ 3 ft + 6 ft approximate + gradational.
		ML	Silt, 10YR 7/1 (gray), sl. plastic, soft, moist, flood plain	joint				Contact @ 13 ft very approximate
	10	SW	Fine to m. sand, 10% gravel (to 1 in), 5% clay, 10YR 7/1 (gray), non plastic, loose, wet, fluvial					Split spoon sample 14.0 to 15.5 ft
	15	SW	Fine to coarse sand, well graded, med. round, 10YR 7/8 (yellow) & 7.5YR 5/8 (strong brown), loose, wet, fluvial					6 in borehole; caved sand; PVC screen; PVC endcap



Signed George Kook   Approved ______

Site

Boring No. PZ 3-3, Boneyard, Site III SHEET ______ OF ______

0730 - ESE, driller on-site
0745 - Set up rig
0750 - Begin augering, monitor w HNU
0815 - Down to 14 ft
Split spoon sample (my choice) 14 to 15.5 ft
0830 - Spoon out
Sand heaved 4 ft inside augers
0840 - Place well + try + pull augers, dislodge plug
0855 - Still having problems
well got stuck inside augers + could not remove plug
0910 - Pull augers + well
0920 - wash plug out of augers ~~[illegible]~~
Water in hole to 5.0 ft - must be confined!
Hole stayed open to 7.0 ft (top of sand?)
0922 - Back into hole w. augers
0930 - Back down to 18 ft
Install well to
0945 - Pull augers - same problem! Having rough time!
Allowing cathead to cool off!
1000 - Still can't pull augers w/o the pipe
Flush water down pipe to free (50 gallons)
1040 - No go! Pull augers + well again!
~~[illegible]~~
Sand had no trouble free + did not have to pull well for 3rd time!
1050 - Well set @ 16 ft (screen 6 to 16, 2 ft SU)
1100 - Augers cleaned
- Cuttings to surface (caved to 7 ft)
1105 - Repair site!

12/7/84 George Bar[illegible]
DATE SIGNED

APPROVED

SHEET 1 OF 3

Site Maxwell AFB

Boring No. PZ-4-1

Hole Size 6 in

Slot 0.010 in

Screen Length 10 ft

Mat'l Sch 40 PVC

Diameter 2 in

Casing Length 15 ft + 3 ft SU

Mat'l Sch 40 PVC

Diameter 2 in

Date Start 12/8/84

Finish 12/8/84

Contractor ESE

Driller Law Eng.

Location Coordinates N

E

Filter Materials caved sand

Grout Type none

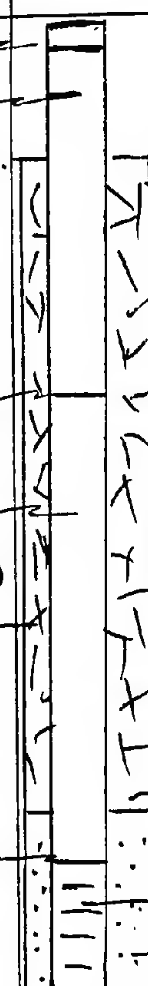
Development N.A.

Static Water Level

Top of Well Elevation

Drill Type Hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap					Log based on cuttings only
				vent				
	0	CL	Sandy, gravelly clay, 20% med sand, 15% gravel (to 5 cm), 5YR4/6 (yellow. red), sl plastic, med consist., damp, fluvial		G.L.			6 in borehole
								Well is up against a 10 ft deep cut in the hillside
	5	SW	Med to coarse gravelly sand, 30% gravel (to 5 cm), well graded, mod. round, 7.5YR5/8 (strong brown), non plastic, loose, wet, fluvial	joint				
				PVC casing				Cuttings below 3 ft seem wet enough to be saturated, but no water inside augers @ 14 ft; don't want to knock plug out of augers, so we pulled them to check for water
	10	SW	Med to coarse sand, 40% gravel (to 8 cm), well graded, mod round, 7.5YR 5/8 (strong brown), non plastic, loose, wet, fluvial	sand cuttings				
	15			joint				PVC screen
								Caved sand



Signed [signature]

Approved

SHEET 2 OF 3

Site MAFB

Boring No. PZ 4-1

Location Coordinates N ____ E ____

Hole Size ____ Slot ____

Screen Length ____ Mat'l ____

Filter Materials ____

Diameter ____

Grout Type ____

Casing Length ____ Mat'l ____

Development ____

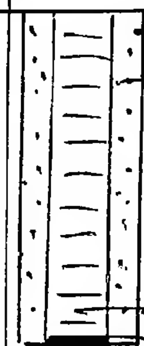
Diameter ____

Static Water Level ____

Date Start 12/8/84 Finish 12/8

Top of Well Elevation ____

Contractor ____ Driller ____ Drill Type ____

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
		SW						6 in borehole coarse sand
	20	▽ SW	Med to cr. sand, 15% gravel (to 0.5 cm), well graded round, 10YR 7/6 (yellow), nonplastic, loose, v. wet, fluvial					1st H_2O near 21.5 ft based on water level in augers PVC screen
	25	EOH					EOW, EOH 25 ft	PVC endcaps

Signed George [illegible] I-20 Approved ____

Site Maxwell AFB
Boring No. PZ 4-1

SHEET 3 OF 3

0730 ESE on-site
Drill crew picking up pipe & water before coming out here this AM.
selected locations for boreholes, Site IV
0855 Drillers on-site
Cleaning yesterday's augers!
0920 Set up on hole
0925 Begin augering

* Note: Well is along the edge of landfill area next to a 10 ft deep cut in the hillside — natural elevation here is 10 ft higher than present
0935 Pull augers & check for water in hole @ 14 ft
Hole caved to 9 ft; no water in hole!
Maybe water below 9 ft?
0950 Down to 25 ft — water measured in augers @ 21.5 ft (F.L.)
0955 Install well to 25 ft (screen 15 to 25, 3 ft S.U.)
1000 Pull augers
Rig running poorly (missing, sputtering); may need work after this hole!
1010 Augers out
Hole caved to 14 ft — no water in hole
water in well @ ± 23 ft TOC, 20 ft BGL
1020 Cuttings to surface
1025 Pull off hole
Clean augers
1030 Move to next hole

12/18/84 DATE — George [signature] SIGNED

APPROVED

SHEET 1 OF 3

Site Maxwell AFB
Boring No. PZ 4-2
Hole Size 6 in — Slot 0.010 in
Screen Length 10 ft — Mat'l Sch 40 PVC
Diameter 2 in
Casing Length 8.8 ft + 39 ft SU — Mat'l Sch 40 PVC
Diameter 2 in
Date Start 12/8/84 — Finish 12/8/84
Contractor ESE — Driller Law Eng

Location Coordinates N
E
Filter Materials none
Grout Type none
Development N.A.
Static Water Level
Top of Well Elevation
Drill Type Hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap / Casing joint					Log based on cuttings only
	0	SW	Med to coarse sand, 30% gravel (to 2.5 in) well graded, sub round, 10YR 6/8 (brown, yellow), non plastic, loose, wet, fluvial		G.L. / sand cuttings			All contacts approximate & gradational
	5	SW			PVC casing joint			1st H_2O based on water level measured inside augers 9 ft
	10	SW	Med to coarse sand, 20% gravel (to 1.5 in) well graded, sub round 10YR 6/8 (brown, yellow), non plastic, loose, wet, fluvial					PVC screen / caved sand / 6 in borehole
	15	GW						

Signed George Foster — Approved

SHEET 2 OF 3

Site MAFB

Boring No. PZ 4-2 | Location Coordinates N

E

Hole Size | Slot

Screen Length | Mat'l | Filter Materials

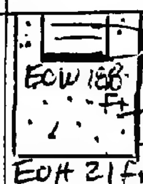
Diameter | Grout Type

Casing Length | Mat'l | Development

Diameter | Static Water Level

Date Start 12/8/84 | Finish 12/8 | Top of Well Elevation

Contractor | Driller | Drill Type

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	GW	Gravel, 40% med to coarse sand, well graded, round (to 3 cm diameter), 10YR6/8 (brown-yellow), non plastic, loose, wet, fluvial					PVC screen PVC endcaps caved sand 6 in borehole

Signed George Post   Approved

Site MAFB
Boring No. PZ4-2

SHEET 3 OF 3

1035 — Set up on-site
Begin augering ~ monitor w H-NU
1045 - Down to 14 ft
water measured in augers @ 9.8 ft, G.L.
(no clay plug - sand total depth of hole)
1050 — Down to 21 ft
Runs for screen section
Water inside augers @ 15.8 ft, G.L. ?!
1105 - Helper leaves w. person (10 min DOWN TIMES)
Install well to 18.8 ft (screen 8.8 to 18.8, 3.9 ft S.U.)
1110 - Begin pulling auger
* Hole is not straight - gravel kept it from being so, + augers hard to pull
1125 - Can't get the well to break through the bottom of the augers + it comes up with them
1140 — Well set! (to 18.8 ft)

Water in well @ 13.6 ft TOC, 9.8 ft GL
Caved to 4 ft
cuttings to surface

1145 - Clean augers
1150 — Augers clean
~~Depart site~~
~~to UMC~~
Move to next hole — FOOD LATER!

12/8/84
DATE

SIGNED

APPROVED

SHEET 1 OF 3

Site Maxwell AFB

Boring No. PZ 4-3 Location Coordinates N

Hole Size 6 in Slot 0.010 in E

Screen Length 10 ft Mat'l Sch 40 PVC Filter Materials none

~~Diameter~~ Casing length 9.5 ft + 2 ft S.U. Grout Type none

~~Casing Length~~ diameter 2 in Mat'l Sch 40 PVC Development N.A.

Diameter 2 in Static Water Level

Date Start 12/8/84 Finish 12/8/84 Top of Well Elevation

Contractor ESE Driller Law Eng Drill Type Hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap					Log based on cuttings only
			vent					
	0	CL	Silty, sandy clay, 20% silt, 5% fine sand, 7.5YR4/4 (brown), mod plastic, med. consist., damp, flood plain		G.L.			All contacts approximate + gradational
	5	GC	Sandy, clayey gravel, 20% med-co. sand, 15% clay, well graded, round, (pebbles to 5 cm) 7.5YR 4/4 (brown), sl. plastic, loose, very wet below ~7 ft,	joint				PVC casing; cuttings
	10	GW	Sand/gravel mixture, well graded, round, 7.5YR 5/8 (strong brown), non plastic, loose, wet, fluvial (pebbles to 5 cm)	joint				caved sand; 6 in borehole; 1st H_2O near 17 ft based on water in augers; PVC screen
	15	▽						

Signed George Post   Approved

SHEET 2 OF 3

Site MAFB

Boring No. PZ 4-3

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 10/8/94 Finish 10/8

Contractor ______ Driller ______

Location Coordinates N ______

E ______

Filter Materials ______

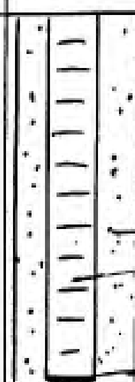
Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
		GW						6 in borehole
	20		Coarse sand / gravel mix, well graded, round, 7.5YR5/8 (strong brown), non plastic, loose, wet, fluvial; (pebbles to 2 cm)					water @ 20 ft approximate & gradational
		SW						caved sand
								PVC screen
	25							PVC end cap
		EOH					EOW, EOH 26 ft	

Signed George Foster

Approved ______

Site M.A.F.B.
Boring No. PZ 4-3

SHEET 3 OF 3

1200 Set up on hole
Begin ~~augering~~ - Monitor w. H-NU
1215 Down to ~~19 ft~~ 18.5 ft
Water inside augers @ ~ 17.5 ft (1 ft H_2O inside)
Resume augering
1222 Down to 23 ft
Water in augers @ ~ 17.90 ft
Let set for 5 minutes & remeasure!
1227 Water @ 17.1 ft
Resume augering
1230 Down to 28 ft
Install well to 26 ft (screen 16-26 ft, 2 ft S.U.)
1240 Pull augers
Hole caved to 10 ft
Water in well @ 19.4 ft, TOC, 17.3 ft G.L.
Cuttings to surface
1250 Wash augers after LUNCH!
1300 Lunch Break

12/8/84
DATE

George [illegible]
SIGNED

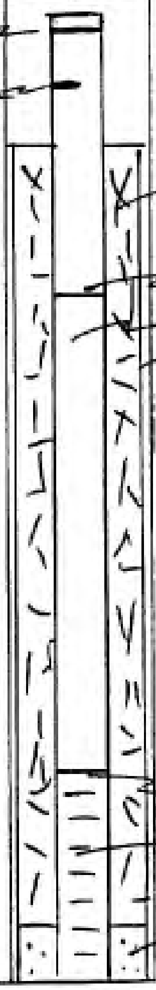
APPROVED

SHEET 1 OF 3

Site Maxwell AFB
Boring No. PZ 5-1
Hole Size 6 in Slot 0.010 in
Screen Length 10 ft Mat'l Sch 40 PVC
Diameter 2 in
Casing Length 2.5 + 2 ft S.U. Mat'l Sch 40 PVC
Diameter 2 in
Date Start 12/7/84 Finish 12/7
Contractor ESE Driller Law Eng

Location Coordinates N
E
Filter Materials none
Grout Type none
Development N.A.
Static Water Level
Top of Well Elevation
Drill Type Hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
							PVC slip cap; vent; G.L.	Log based on cuttings only
	0	CL	Sandy clay, 50% med sand, 7.5YR 5/6 (strong brown), sl plastic, soft, damp, floodplain					cuttings; joint; PVC casing; 6 in borehole
	5	SW	Fine to med sand, 5% clay, well graded, mod. round, 10YR 5/8 (yellow. brown), nonplastic, loose, damp, fluvial. Increase in muscovite content from 1 to 5% between 5 ft and 13 ft.					1st H_2O near 17 ft based on wet cuttings to surface
	10							All contacts approximate + gradational
	15	SC	Fine sand, 15% clay, well graded, mod. round, 10YR 4/6 (dk yellow. brown), sl plastic, loose, damp, fluvial. (variable muscovite: 1 to 5%)					joint; PVC screen
		SW						caved sand

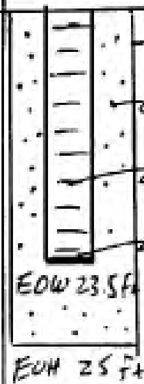


Signed

Approved

Site MAFB
Boring No. PZ 5-1
Hole Size ______ Slot ______
Screen Length ______ Mat'l ______
Diameter ______
Casing Length ______ Mat'l ______
Diameter ______
Date Start 12/7/84 Finish 12/7
Contractor ______ Driller ______

Location Coordinates N ______
E ______
Filter Materials ______
Grout Type ______
Development ______
Static Water Level ______
Top of Well Elevation ______
Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	Fine to coarse sand, 30% gravel (to 5 cm diam), well graded, round, 10YR 5/8 (yellow brown), non-plastic, loose, wet fluvial					6 in borehole caved sand PVC screen PVC end cap
		EOH						

Signed George Post

Approved ______

Site

Boring No. PZ-1 | SHEET 3 OF 3

1430 - Set up on-site

1435 - Begin augering - HNU monitoring

1500 - Down to 25 ft

1504 - Set well inside augers

1507 - Pull augers - coming up easily w/o the well!
Upper 13 ft of the 25 ft of augers in hole came
up dry - water is at least 13 ft deep.
Lower 5 ft or so of augers (flights) filled w.
coarse sand & gravel!

1515 - Clean augers

Well set @ 23.5 ft (screen 13.5 - 23.5, 2 ft S.U.)
Water level @ 19.2 ft TOC, 17.2 ft GL
Caved to 17 ft
Cuttings to surface

* Mr. M augers (property owner) stopped in for
a friendly visit while drilling

1530 - Depart site

12/7/84 DATE

SIGNED

APPROVED

Site Maxwell AFB

SHEET 1 OF 4

Boring No. PZ5-2

Location Coordinates N ____ E ____

Hole Size 6 in Slot 0.010 in

Screen Length 10 ft Mat'l Sch 40 PVC Filter Materials None

Diameter 2 in Grout Type None

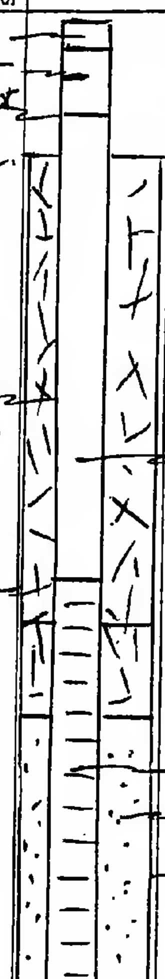
Casing Length 9 ft + 2 ft SU. Mat'l Sch 40 PVC Development N. A.

Diameter 2 in Static Water Level ____

Date Start 10/8/84 Finish 10/9/84 Top of Well Elevation ____

Contractor ESE Driller Law Eng. Drill Type Hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap / vents / joint					Log based on cuttings only
	0	SC	Clayey sand, 30% clay, f.-co. grained, well graded, mod round, 10YR5/4 (yellowish brown), sl. plastic, loose, moist, fluvial		G.L.			Contact @ 5 ft approximate & gradational
	5	CL	Silty clay, 20% silt, 10YR5/3 (brown), mod. plastic, med. consist., moist, flood-plain	cuttings				Contact @ 10 ft sharp PVC casing 1st H_2O @ 10 ft, based on wet cuttings & water to surface
	10	SW	Fine to coarse quartz sand, well graded, round, 5Y 7/1 (light gray), nonplastic, loose, wet, fluvial	joint				PVC screen caved sand
	15	SW						6 in borehole



Signed George [illegible] Approved ____

SHEET 2 OF 4

Site M.A.F.B.

Boring No. PZ S-2

Location Coordinates N

E

Hole Size

Slot

Screen Length

Mat'l

Filter Materials

Diameter

Grout Type

Casing Length

Mat'l

Development

Diameter

Static Water Level

Date Start 12/8/84

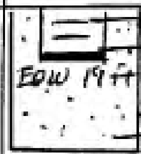
Finish 12/9/84

Top of Well Elevation

Contractor

Driller

Drill Type

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	Fine to cr. sand, well graded, round, 10YR6/6 (brownish yellow), non plastic, med density, wet, fluvial				 EOW 19 ft	PVC screen PVC endcap 6 in borehole caved sand
		EOH					EOH 21 ft	
	25							

Signed

Approved

Site MAFB
Boring No. PZ 5-2

12/8 1335 - ESE return from lunch
Spent 45 minutes looking for a way onto the site - possibly found one!
1425 - Drillers return
1435 - Move onto site - we made it!
Set up rig
1445 - Begin augering - H-110 monitoring
1455 - Encountered something hard - abandon hole
Clear a space in the brush 10 ft closer to West End Ditch
1505 - Begin augering again
1525 - Down to 21 ft (overdrilled 1 ft intentionally)
Install well
1530 - Pulled about 10 ft of augers & well became lodged inside augers & couldn't be freed
1600 - Well & auger out; well stuck inside last auger
1610 - Removing a stiff clay plug inside last auger
1615 - Going back into hole w/ augers, clay plug
1620 - Back to 20 ft
1640 - Sand heaved through clay plug 6 or 7 ft into augers - well wouldn't go through
1650 - Tried again with large clay plug
Same thing happened!
Will drill new hole several ft over
1715 - Depart site

12/9 0715 - ESE on-site
0730 - Drillers on-site
0745 - Begin augering
0955 - Down to 19 ft
0800 - Install well

→ See next page

12/8/84 DATE
George [illegible] SIGNED

APPROVED

Site MAFB
Boring No. 7E5-2

SHEET 4 OF 4

12/9 0800 Pull augers – came up w/o well!
0805 Augers out
Caved to 12 ft, water in hole @ 8 ft
Water in well @ 7.7 ft TOC, 5.7 ft GL

Well set @ 19 ft (screen 9 to 19, 2 ft S.U.)
0815 Clean augers

12/9/84 DATE

George Kost SIGNED

APPROVED

Site Maxwell AFB

Boring No. PZ 5-4

Hole Size 6 in Slot 0.010 in

Screen Length 10 ft Mat'l Sch 40 PVC

Diameter 2 in

Casing Length 8.6 ft + 2.3 ft SU Mat'l Sch 40 PVC

Diameter 2 in

Date Start 12/7/84 Finish 12/7

Contractor ESE Driller Law Eng.

Location Coordinates N

E

Filter Materials none

Grout Type none

Development N.A.

Static Water Level

Top of Well Elevation

Drill Type Hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			2 in PVC slip cap; vent; G.L.					Log based on cuttings only
	0	ML	Clayey silt, 30% clay, 10YR 7/3 (very pale brown), sl. plastic, soft, dry, flood plain					cuttings; 6 in borehole; PVC casing
	5	CL	Silty clay, 20% silt, 7.5YR 5/8 (strong brown) to 5Y 6/2 (lt olive gray), mod. plastic, med consist., dry, flood plain					All contacts approximate + gradational
		ML	Clayey silt, 30% clay, 2.5Y 7/4 (pale yellow), mod. plastic, soft, wet, flood plain				joint	1st H_2O near 7 ft based on wet cuttings to surface
	10	SC	Clayey, silty, fine sand, 20% clay, 10% silt, well graded, 2.5Y 6/2 (light brown gray), sl. plastic, loose, wet, floodplain					PVC screen
	15	SW	Fine to co. sand, 10% gravel (to 0.5 in), well graded, round, 2.5Y 7/4 (pale yellow), non plastic, loose, wet, fluvial					caved sand

Signed George Foster

Approved

Site Maxwell AFB
Boring No. PZ 5-4
Location Coordinates N ______ E ______
Hole Size ______ Slot ______
Screen Length ______ Mat'l ______
Filter Materials ______
Diameter ______
Grout Type ______
Casing Length ______ Mat'l ______
Development ______
Diameter ______
Static Water Level ______
Date Start 12/7/84 Finish 12/7
Top of Well Elevation ______
Contractor ______ Driller ______ Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW EOH	Fine to c. sand, 20% gravel, well graded, round, 2.5Y 7/4 (pale yellow), nonplastic, loose, wet, fluvial				EOW 18.6 ft EOH 21 ft	PVC screen PVC end cap Cave in borehole At about 21 ft had ~~a~~ alot of resistance & chatter - probably gravel

Signed George [illegible] I-36 Approved ______

Site Maxwell AFB

Boring No. PZ 5-4

SHEET 3 OF 3

1550 Set up on-site (Dozer cleared us a path)
1555 Begin augering - monitor w H-NU
1610 Down to 12 ft
1615 Install well to 18.6 ft (screen 8.6 to 18.6, 2.3 ft S.U)
1650 Augers out - tough time!
~~1655~~ Pull off site
1705 Water measured @ 9.4 ft TUC, 7.1 ft G.L.
Will clean augers tomorrow

Sand caved to 15 ft

12/7/84 DATE

SIGNED

APPROVED

SHEET ____ OF ____

Site Maxwell AFB

Boring No. PZ6-1, upgrad, Site VI — Location Coordinates N ____

Hole Size 6 in — Slot 0.010 in — E ____

Screen Length 15 ft — Mat'l Sch 40 PVC — Filter Materials none

Diameter 2 in — Grout Type none

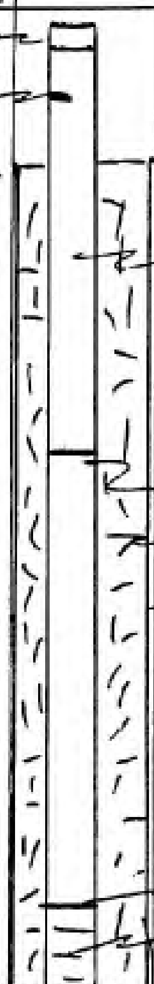
Casing Length 16.5 + 2.5 ft — Mat'l Sch 40 PVC — Development N.A.

Diameter 2 in — Static Water Level ____

Date Start 12/5/84 — Finish 12/5 — Top of Well Elevation ____

Contractor ESF — Driller Law Eng. — Drill Type Hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap					Log based on cuttings only
			vent					
	0	CL	Silty clay, 30% silt, 10YR 5/6 (yellow brown), mod. plastic, med. consist., damp, floodplain		G.L.			PVC casing; All contacts approximate & gradational
	5	CH	Inorganic clay, 10YR5/6 (yellow brown) to 5Y7/1 (light gray), mottled colors, v. plastic, stiff, damp, floodplain					joint; cuttings; 6 in borehole
	10	CH						
	15	CL	Silty clay, 25% silt, 10YR 6/8 (brownish yellow), mod. plastic, stiff, damp, floodplain					joint; PVC screen



Signed ____ Approved ____

SHEET ____ OF ____

Site Maxwell AFB

Boring No. PZ6-1

Hole Size ____ Slot ____

Screen Length ____ Mat'l ____

Diameter ____

Casing Length ____ Mat'l ____

Diameter ____

Date Start 12/5/84 Finish 12/5

Contractor ____ Driller ____

Location Coordinates N ____

E ____

Filter Materials ____

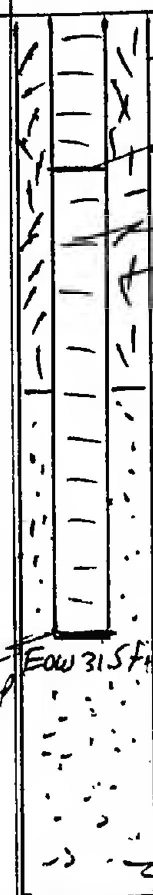
Grout Type ____

Development ____

Static Water Level ____

Top of Well Elevation ____

Drill Type ____

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	CL	Silty clay, 30% silt, 1% muscovite, 10YR 6/6 (brown. yellow), mod. plastic, stiff, moist., flood plain					6 in borehole; joint; PVC screen; cuttings
	25	SM	Fine to med quartz sand, 20% silt, 5% muscovite, mod. well graded, mod round, 2.5Y 7/4 (pale yellow), non plastic, loose, v. wet, fluvial					1st H_2O near 26 ft based on wet cuttings to surface
	30		No cutting returns below about 30 ft, but probably sand: Coarse Sand	PVC	end cap		EOW 31.5 ft	when pulling augers fine to coarse gravelly sand filled the lower 8 to 10 ft of the flights
	35						EOH 37 ft	sand cavings

Signed George [illegible]

Approved ____

Site Maxwell AFB
Boring No. PZ 6-1, upgrad., Site VI

SHEET ______ OF ______

1305 - Arrive on-site
- Rig stuck in mud moving onto hole
1345 - Rig freed + set up
1350 - Begin augering
1430 - Down to 37 ft. (overdrilled 2 ft intentionally)
1435 - Install well to 33.8 ft (screen 18.8 to 33.8, 2.8 ft S.U.)
1445 - Installation complete
Pull augers
1455 - Well caught on augers + pulled up about 3 or 4 ft -
couldn't push it back down
Will measure water level tomorrow + if there isn't @
least 5 ft of water in well will pull it + redo!
Continue pulling augers - having a very rough time!
1525 * Well ended up being 31.5 ft deep w. 2.8 ft S.U.
- Water measured in well @ 26.2 ft (G.L) -
there's 5.3 ft water in well
1530 - Pull off hole
Clean augers
1555 - Cleaning complete
1600 - Move onto PZ 6-2

12/5/84 DATE
George [illegible] SIGNED

APPROVED

Site Maxwell AFB

Boring No. PZ 6-2, Lounsgrad Site VI — Location Coordinates N ______

Hole Size 6 in — Slot 0.010 in — E ______

Screen Length 15 ft — Mat'l Sch 40 PVC — Filter Materials none

Diameter 2 in — Grout Type none

Casing Length 23.3 + 2.5 ft SU — Mat'l Sch 40 PVC — Development NA.

Diameter 2 in — Static Water Level ______

Date Start 12/5/84 — Finish 12/6/84 — Top of Well Elevation ______

Contractor ESE — Driller Law Eng — Drill Type Hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap					Log based on cuttings only
			vent					
	0					G.L.		
		CH	Inorganic clay, 10YR5/6 (yellow brown), very plastic, stiff, moist, flood plain					cuttings
								joint
	5	CH	Inorganic clay, 10YR5/6 (yellow brown) to 5Y 7/1 (light gray), mottled colors, v. plastic, stiff, damp, flood plain					All contacts approximate or gradational
								6 in borehole
	10							PVC casing
								joint
	15	CL	Silty clay, 20% silt, 10YR 6/6 (brownish yellow), mod. plastic, med. consist., damp, flood plain					

Signed [signature] — Approved ______

Site MAFB

Boring No. MZ 6-2

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 12/5/84 Finish 12/6.

Contractor ______ Driller ______

Location Coordinates N ______

E ______

Filter Materials ______

Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	CL						PVC casing cuttings joint
	25	CL	Silty clay, 30% silt 2.5Y6/4 (light yellow. brown), mod. plastic, med. consistency, moist flood plain					All contacts approximate + gradational 6 in borehole caved sand
		∇	Fine to med sand, 25% silt, well graded, mod. round, 10YR5/4 (yellow. brown), sl. plastic, wet, fluvial					joint PVC screen
	30–35	SW	Fine to coarse sand, 20% gravel (to 1.0 in diam.), well graded, mod. round, nonplastic, v. wet, fluvial (see REMARKS)					Cuttings from below about 30 ft were mixed with clay from above coming up the hole, + color is impossible to determine
		SW					Elev 38.3 ft	

Signed [signature] I-42 Approved ______

SHEET 3 OF 4

Site MAFB

Boring No. PZ-6-2

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 12/5/84 Finish 12/6

Contractor ______ Driller ______

Location Coordinates N ______

E ______

Filter Materials ______

Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	40		med to coarse sand, 30% gravel (≤ 1.0 cm), well graded, mod. round, non plastic, loose, wet, 2.5Y 6/4 (lt yellow brown) fluvial		formation sand (caving)		EOH 43 ft	6 in borehole; When pulling augers coarse sand + gravel (clean) were found on lower section
	45							

Signed ______ I-43 Approved ______

Site M.A.F.B.

Boring No. PZ 6-2

12/5 1600 – Begin augering
Rain falling gently!
1645 – Down to 43 ft (overdrilled 3 ft intentionally)
1650 – Install well to 38.3 ft (screen 23.3 to 38.3, 2.5 F+S.U.)
1700 – Pull 1st auger – complete 12/6/84
1720 – Depart site
It is pouring rain!

12/6 0700 – Water run
0730 – Drillers, ESE arrive on-site
Bill Roe, John Maxwell (ESE) arrived last
site (2300); showed them where to begin
well leveling.
0740 – Continue pulling augers
0820 – Augers out
– Clean augers
– Water measured in well @ 29 ft TOC, 26.5 ft G.L.
0850 – Decon complete
Depart site (hole!)

12/6/84 DATE

George Post SIGNED

APPROVED

Site Maxwell AFB

Boring No. PZ 6-3, Loungeal, Site VI

Hole Size 6 in

Slot 0.010 in

Screen Length 15 ft

Mat'l Sch 40 PVC

Diameter 2 in

Casing Length 24 ft + 2 ft S.U.

Mat'l Sch 40 PVC

Diameter 2 in

Date Start 12/6/84

Finish 12/6

Contractor ESE

Driller Law Eng.

Location Coordinates N

E

Filter Materials none

Grout Type none

Development N.A.

Static Water Level

Top of Well Elevation

Drill Type Hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap					Log based on cuttings only
			vent					
	0	ML	Clayey silt, 30% clay, 10YR 3/4 (dk yellow. brown), sl. plastic, soft, damp, floodplain			G.L.		Contacts @ 2.5, 6, 12 ft approximate + gradational.
	5	CH	Inorganic clay, 7.5YR 5/8 (strong brown), v. plastic, stiff, damp, flood plain		joint			Contacts @ 16 and 17.5
		CH	Inorganic clay, 10YR 5/6 (yellow brown), to 5Y7/1 (gray), mottled colors, very plastic, stiff, damp, flood plain					6 in borehole; cuttings; PVC casing
	10							
	15	CL	Sandy, silty clay, 25% fine sand, 10% silt, 10YR 6/8 (brown, yellow), sl. to mod. plastic, soft, moist, flood plain;					joint; 1st H_2O near 16 ft; then perched zone
		SM	1.5 Ft thick fine sand/silt lense with perched water					
		CL						

Signed George Yost

Approved

Site Maxwell AFB

Boring No. PZ6-3

Location Coordinates N

E

Hole Size Slot

Screen Length Mat'l

Filter Materials

Diameter

Grout Type

Casing Length Mat'l

Development

Diameter

Static Water Level

Date Start 12/6/84 Finish 12/6

Top of Well Elevation

Contractor Driller Drill Type

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
								cuttings caved sand PVC casing 6 in borehole joint
	20	CL	Silty, sandy clay, 20% silt, 15% fine sand, 10YR6/8 (brown. yellow), sl. plastic, soft, moist, floodplain					Increase in drill rate @ 25 ft; Lots of water to surface below 25 ft - probably top of sand @ 25 ft
	25	SM	Fine sand, mod. graded, 10% clay, 10% silt, 10YR6/8 (brown. yellow), loose, v. wet, fluvial		PVC screen			
	30	SW	Fine to med sand, 10% silt, 10YR6/8 (brown. yellow), loose, v. wet fluvial		joint			Sand colors off because of contamination by uphole clays. Contacts @ 25, 29, 35 ft very approximate & gradational
	35	SW	Fine to coarse sand, 15% gravel, well graded, mod. round, non plastic, loose, v. wet, fluvial					EOW 39 ft

Signed

Approved

SHEET 3 OF 4

Site Maxwell AFB

Boring No. PZ 6-3

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 12/6/84 Finish 12/6

Contractor ______ Driller ______ Drill Type ______

Location Coordinates N ______

E ______

Filter Materials ______

Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	40	SW						6 in Borehole
		EOH					EOH 41 ft	
	45							

Signed George [illegible] I-47 Approved ______

Site Maxwell AFB.
Boring No. PZ6-3

0900 - Set up on hole
0910 - Begin augering - Monitor w. H-NU
- Hit piece of concrete (LARGE!)
- Move hole about 1 ft + start again
0945 - Down to ~~44.5 ft~~ (overdrilled 3 ft intentionally) [41 ft]
0950 - Install well to 38 ft (screen 23 to 38 ft)
1005 - Pull augers
1020 - Having a hard time w. augers - well keeps pulling up as well
1055 - Augers out
Well slipped to 39 ft (screen 24 to 39 ft, 2 ft S.U.)
Clean augers
1130 - Decon complete

Cuttings shovelled into well - caved to 19 ft
cuttings 19 ft to G.L.
1135 - Depart site
LUNCH

12/6/84 DATE

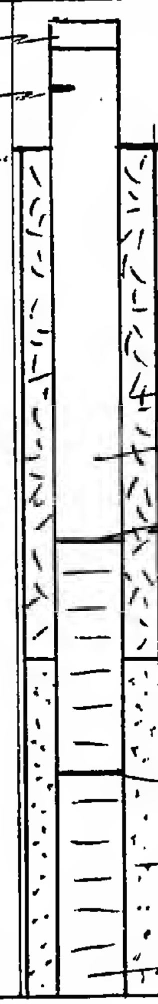
George [signature] SIGNED

APPROVED

SHEET ______ OF ______

Site Maxwell AFB	
Boring No. P27-1, upgrad., Site VII	Location Coordinates N ______
	E ______
Hole Size 6 in Slot 0.010 in	
Screen Length 15 ft Mat'l Sch 40 PVC	Filter Materials none
Diameter 2 in	Grout Type none
Casing Length 8.5 ft + 3.0 ft SU Mat'l Sch 40 PVC	Development N.A
Diameter 2 in	Static Water Level ______
Date Start 12/5/84 Finish 12/5/84	Top of Well Elevation ______
Contractor ESE Driller Lou Cox	Drill Type Hollow Stem Auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap; Vent; G.L.					Log based on cutting returns only
	0	CL	Sandy, silty clay, 20% fine sand, 20% silt, 5YR 5/8 (yellow red), sl. plastic, soft, moist, flood plain					All contacts approximate and gradational
	5	SC	Fine sand, 25% clay, 5% muscovite, poorly graded, round, nonplastic, loose, damp, flood plain, 5YR 5/8 (yellow. red)					Cuttings; PVC casing
	10	SC	Fine sand, 30% clay, 5% muscovite, poorly graded, round, non to sl plastic, damp, flood plain, 7.5YR 5/8 (strong brown)					Joint; First H_2O near 11 ft based on wet cuttings to surface
		SW	Fine to med sand, 5% clay, 5% muscovite, mod. well graded, mod. round-subangular, 10YR 7/6 (yellow), non plastic, loose, wet, fluvial					Joint
	15	CL	Sandy, silty clay, 25% f.-med. sand, 15% silt, 10YR 6/6 (brown. yellow), mod plastic, soft, wet, flood plain					Sand cavings; 6 in borehole; PVC screen



Signed George Foster I-49 Approved ______

SHEET ______ OF ______

Site MAFB

Boring No. PZ 7-1

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 12/5/84 Finish 12/5

Contractor ______ Driller ______

Location Coordinates N ______

E ______

Filter Materials ______

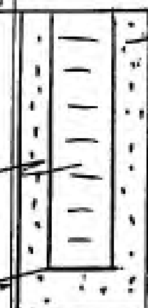
Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	CL						Caved sand 6 in borehole
		?	Sand No cutting returns below about 20 ft.	PVC screen				Below 20 ft drilled like sand, but no returns.
	25			PVC end cap			EOW @ 23.5 ft EOH @ 24.5 ft	When pulling augers, the lowest 10 or 15 ft of flight, were filled w. f. to coarse gravelly sand, very wet, orange, suggesting sand below ~20 ft.

Signed ______

Approved ______

Site Maxwell AFB
Boring No. PZ7-1, upgrad, Site VII

SHEET ______ OF ______

0835 - Set up on-site
0840 - Begin augering
0900 - Down to 24 ft
Install well
0915 - well set @ 23.5 ft (screen ~~to 24 ft~~ 8.5 to 23.5 ft)
0920 - Pull augers
Water inside well @ 15 ft
0935 - Clean augers
0950 - Depart site

12/5/84
DATE

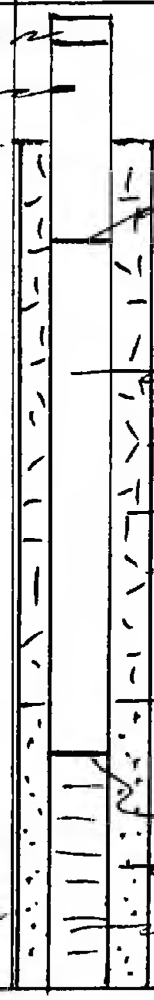
George [signature]
SIGNED

APPROVED

SHEET ______ OF ______

Site Maxwell AFB
Boring No. PZ7-2, downgrad, Site VII
Location Coordinates N ______
E ______
Hole Size 6 in
Slot 0.010 in
Screen Length 10 ft
Mat'l Sch 40 PVC
Filter Materials none
Diameter 2 in
Grout Type none
Casing Length 12 ft + 2 ft SU
Mat'l Sch 40 PVC
Development n.c
Diameter 2 in
Static Water Level ______
Date Start 12/6/84
Finish 12/6/84
Top of Well Elevation ______
Contractor ESE
Driller Law Eng
Drill Type Hollow Stem Auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap					Log based on cuttings only
			Vent					
					G.L			
	0	CL	Sandy silty clay, 25% fine-med sand, 15% silt, 10YR5/3 (brown), mod. plastic, med consist., moist, floodplain					joint; All contacts approximate + gradational
	5	CL	Sandy, silty clay, 30% v fine sand, 20% silt, 2.5Y5/4 (lt olive brown), sl plastic, med consist, wet, flood plain					PVC casing; 6 in borehole
		CL	Sandy, silty clay, 10% f-med sand, 10% silt, 2.5Y7/2 (light gray), sl plastic, med. consist., damp, flood plain					Cuttings
	10	SC	Fine-med sand, 25% clay, mod graded, 2.5Y6/2 (lt brown gray), sl plastic, loose, moist, fluvial					1st H_2O near 12 ft based on wet cuttings to surface
		SW	Fine to coarse sand, 5% clay, well graded, mod. rnd., 2.5Y7/2 (lt. gray), non plastic, loose, wet, fluvial					joint
	15	SW	Fine & cs sand, 20% gravel, well graded, 2.5Y7/2 (lt. gray), nonplastic, wet, fluvial					Sand cavings; PVC screen



Signed George [illegible]

Approved ______

SHEET ______ OF ______

Site MAFB

Boring No. PZ 7-2

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 12/6/84 Finish 12/6

Contractor ______ Driller ______ Drill Type ______

Location Coordinates N ______

E ______

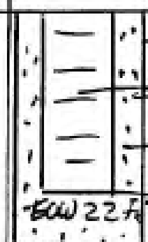
Filter Materials ______

Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	Fine to coarse sand, 20% gravel, well graded, 2.5Y 7/2 (light gray), non plastic, loose, wet, fluvial				 EOW 22 ft	6 in borehole pvc screen Sand caving pvc end cap
		EOH					EOH 23 ft	

Signed George Po[illegible] I-53 Approved ______

Site Maxwell AFB
Boring No. PZ 7-2, Downgrad, Site VII

SHEET ______ OF ______

12/5 1000 - Set up on-site -
1010 - Begin augering - Monitor w. H-NU
Encountered plastic debris, wood (likely landfill material) @ about 3 ft depth
1015 - Abandon hole & select a new location, another time
1020 - Depart site to await clearance for new site from utilities people

12/6 1250 - ESE on-site
- Received clearance for new hole location
- Drill crew returns (water run 1230 - 1250)
- Set up rig
1305 - Begin augering
1320 - Down to 23 ft
Install well to 22 ft (screen 12 to 22 + 1.9 ft SU)
1340 - Augers out - installation complete
1350 - Clean augers
+ ~~Depart site~~
* Water measured in well @ 11.7 ft TOC, 9.7 ft G.L.
Formation caved to 9.5 ft (Top of water!)
Cuttings to surface (cleared w. H-NU)

1410 Depart site

12/6/94 DATE   George R[illegible] SIGNED

APPROVED

SHEET ____ OF ____

Site Maxwell AFB
Boring No. PZ 7-3, Lowngal, Site VII
Hole Size 6 in
Slot 0.010 in
Screen Length 10 ft
Mat'l Sch 40 PVC
Diameter 2 in
Casing Length 10.8 ft + 3 ft S.U.
Mat'l Sch 40 PVC
Diameter 2 in
Date Start 12/5/84
Finish 12/5
Contractor ESE
Driller Law Eng.
Location Coordinates N ____ E ____
Filter Materials none
Grout Type none
Development N.A.
Static Water Level ____
Top of Well Elevation ____
Drill Type Hollow Stem Auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap; Vent					Log based on cutting returns only
	0		Inorganic clay, 20% silt, 10YR 4/3 (dk brown), v. plastic, med. consistency, moist, flood plain				GL	joint; All contacts approximate & gradational
	5		Silt, 20% fine sand, 20% clay, 2.5Y 6/2 (lt. brown. gray), sl. plastic, soft, moist, flood plain					cuttings; 6 in borehole
	10	∇	Fine to cr. sand, 10% clay, well graded, mod. round, 5Y 6/1 (gray), sl. plastic, loose, v. moist, fluvial					PVC casing; 1st H_2O near 10 ft based on wet cuttings to surface.
			Fine to med sand, 25% silt, mod well graded, mod round, 5Y 6/1 (gray), non plastic, loose, wet, fluvial				joint	
	15		Fine to cr. sand, 20% gravel (to 0.5 cm), well graded, mod round 5Y 5/2 (olive gray), non plastic, loose, wet, fluvial					sand caving; PVC screen

Signed [signature]

Approved ____

SHEET ______ OF ______

Site MAFB

Boring No. FZ 7-3

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 12/5/04 Finish 12/5

Contractor ______ Driller ______

Location Coordinates N ______

E ______

Filter Materials ______

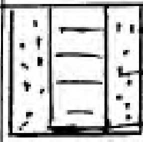
Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	EOH	Fine to coarse sand, 25% clay, well graded, mod. round, 5Y 5/2 (olive gray), sl. plastic, loose, very wet, fluvial				 EOW, EOH 20.8 ft.	6 in borehole caved sand PVC end cap

Signed George [illegible]

I-56

Approved ______

Site Maxwell AFB
Boring No. PZ 7-3, Downgrad Site VII SHEET ______ OF ______

1030 - Set up on-site
1040 - Begin augering

NOTE: Field recently seeded in grass (rye) + very soft because of rain - may be tough coming off hole.

1100 - Down to 20 ft
Install well to 20.8 ft (screen 10.8 to 20.8 ft), 2.4 ft S.U.
1100 - Pull augers
Water measured in pipe (well) @ 13 ft (G.L.)
1115 - Water run (will clean augers off-site)
1120 - Depart site
1130 - Lunch
1205 - Water Run
1235 - Water truck returns
Clean augers
1300 - Move to next hole

12/5/84 DATE
George Bo[illegible] SIGNED

APPROVED

APPENDIX J--MONITOR WELL WATER LEVELS

APPENDIX J

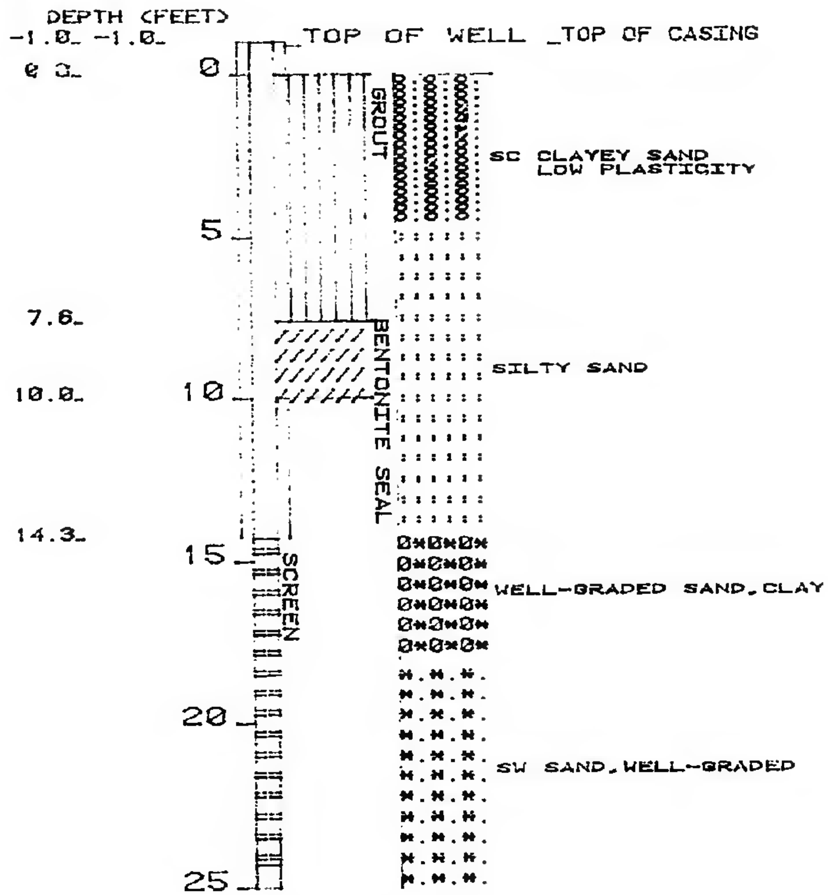
Monitor Well Water Levels
(1-15-85 through 1-19-85, initial sampling event)

Well Designation	Depth to Water (ft)*	Stick Up (ft)	Depth to Water (ft)†
MW1-1	16.2	2.5	13.7
MW1-2	5.5	2.5	3.0
MW1-3	8.1	2.7	5.4
MW1-4	7.4	2.5	4.9
MW3-1	17.7	2.7	15.0
MW3-2	9.3	2.5	6.8
MW3-3	4.7	2.3	2.4
MW4-1	18.3	2.5	15.8
MW4-2	14.2	2.5	11.7
MW4-3	13.6	2.7	10.9
MW5-1	15.0	2.5	12.5
MW5-2	8.3	2.5	5.8
MW5-3	9.9	2.5	7.4
MW5-4	4.0	2.4	1.6
MW6-1	29.0	2.5	26.5
MW6-2	30.0	2.5	27.5
MW6-3	29.5	2.5	27.0
MW7-1	15.8	1.0	14.8
MW7-2	13.8	2.7	11.1
MW7-3	12.7	2.5	10.2

*Measured from the top of PVC casing.
†Measured from ground level.

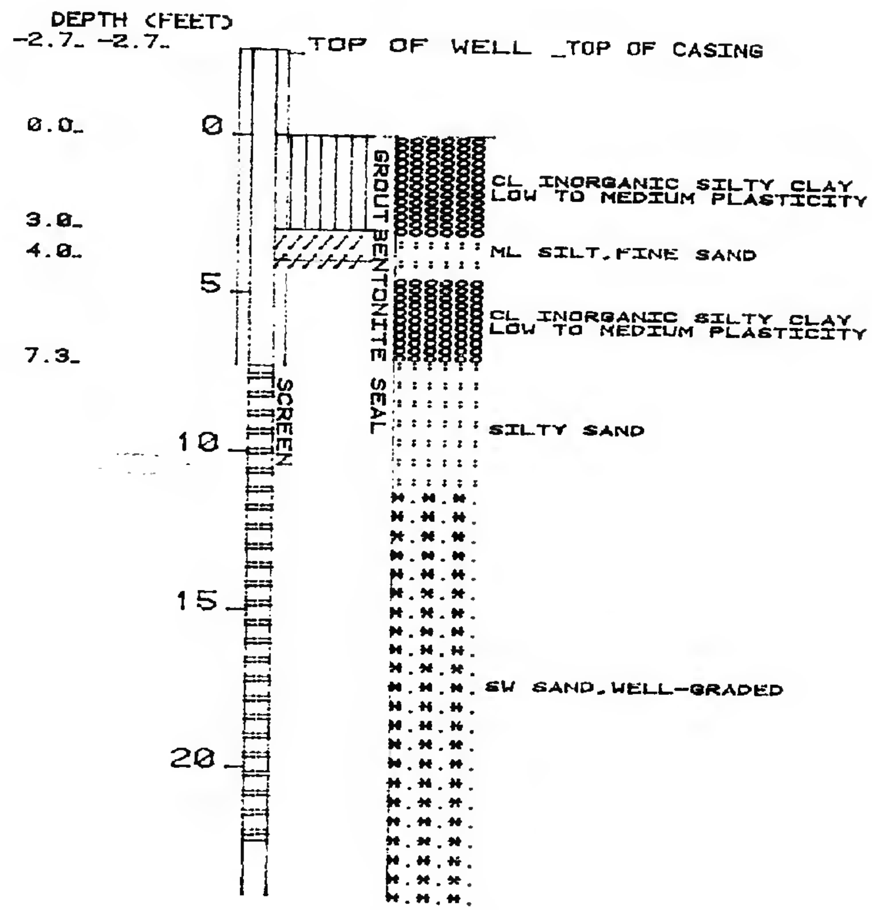
Source: ESE, 1985.

APPENDIX K--MONITORING WELL BORING LOGS



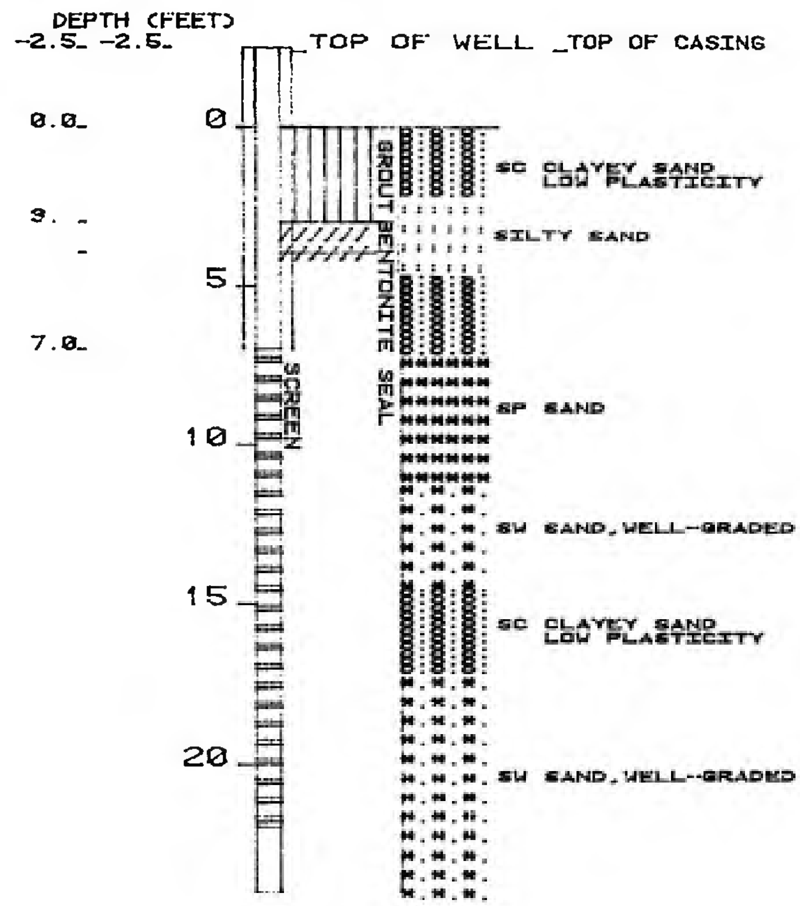
FIELD BORING PROFILE FOR STATION: MXMW7-1

DATE COMPLETED: 1/4/85
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



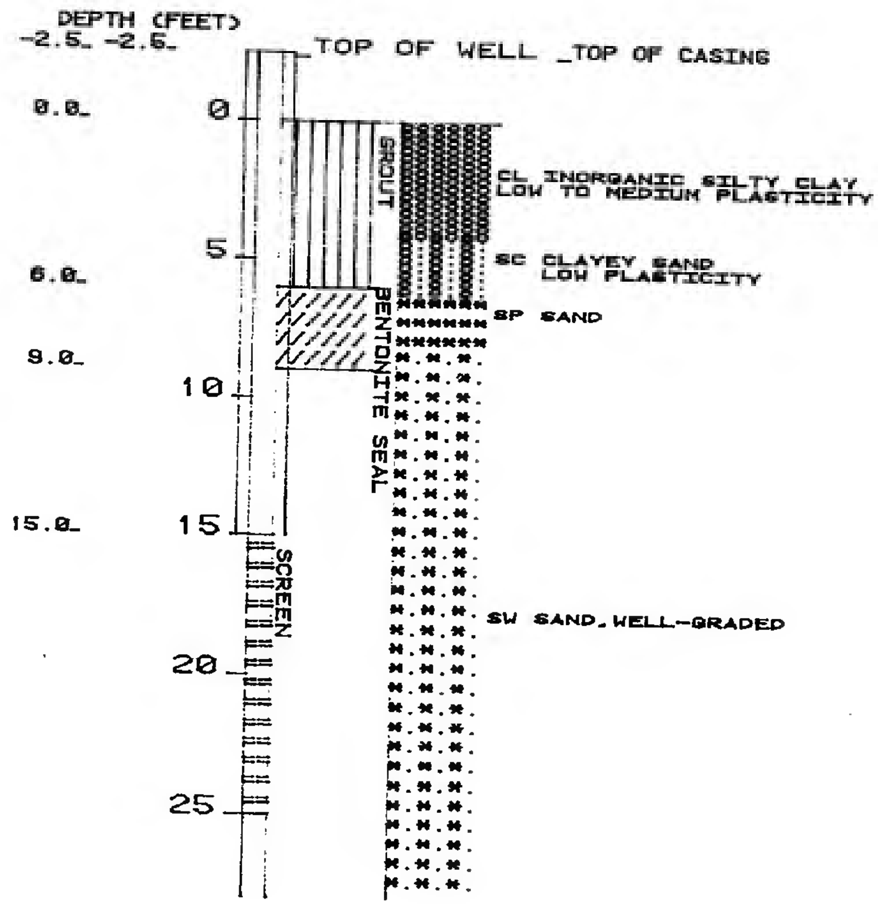
FIELD BORING PROFILE FOR STATION: MXMW7--2

DATE COMPLETED: 12/20/84
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



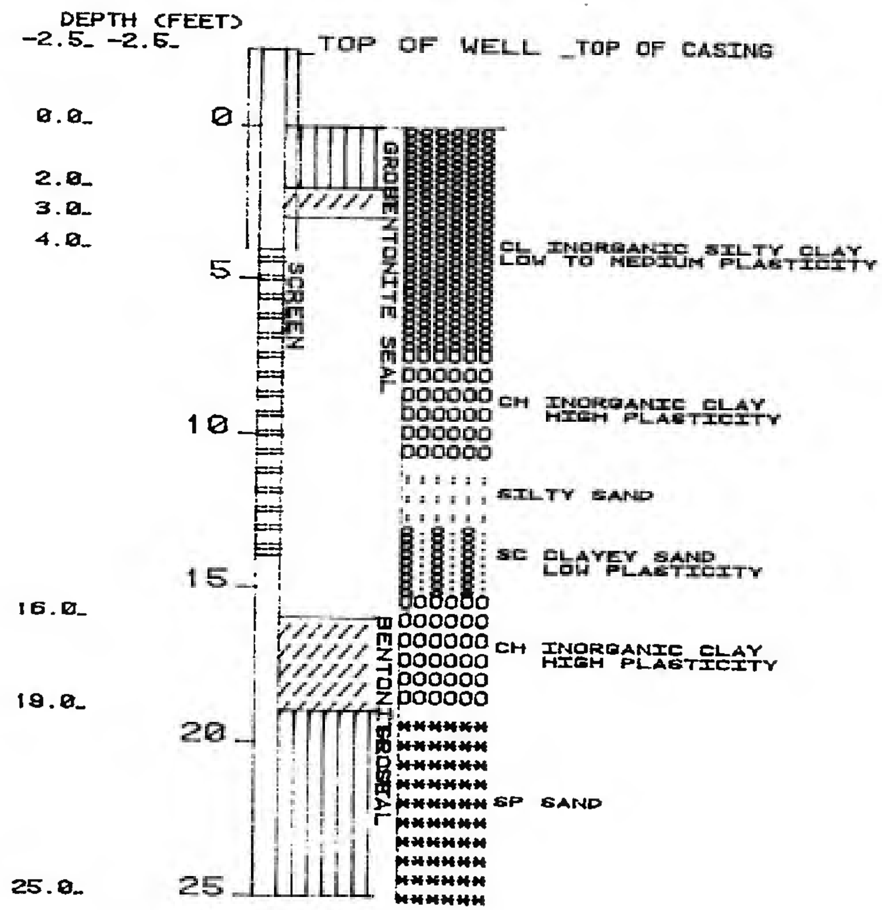
FIELD BORING PROFILE FOR STATION: MXMW7--3

DATE COMPLETED: 12/20/84
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



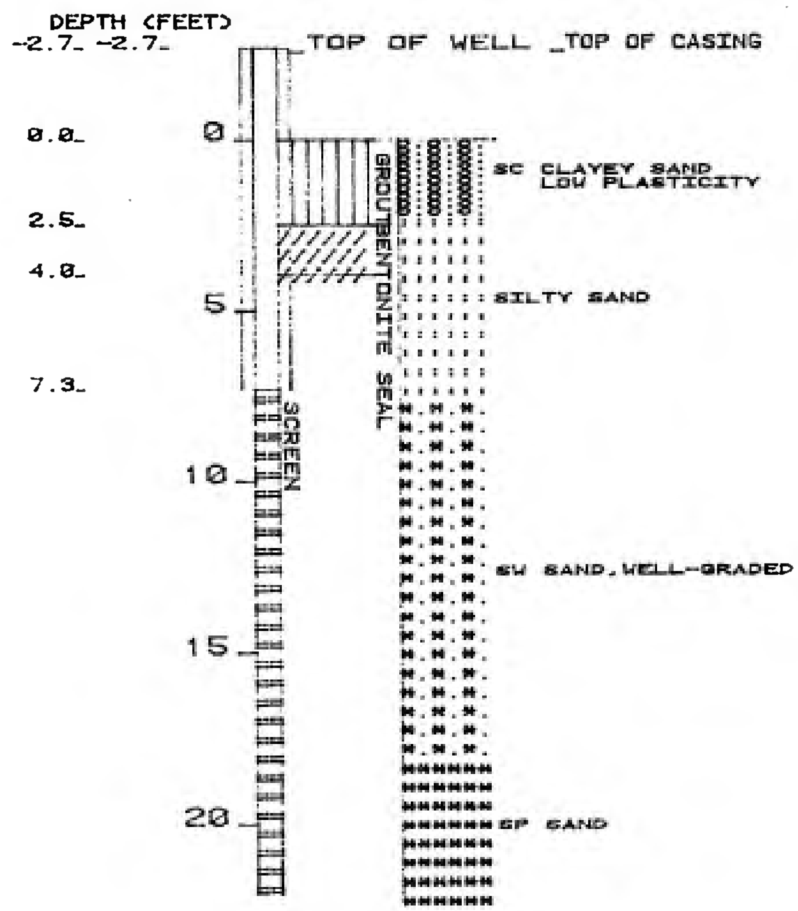
FIELD BORING PROFILE FOR STATION: MXMW1-1

DATE COMPLETED: 12.20.84
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



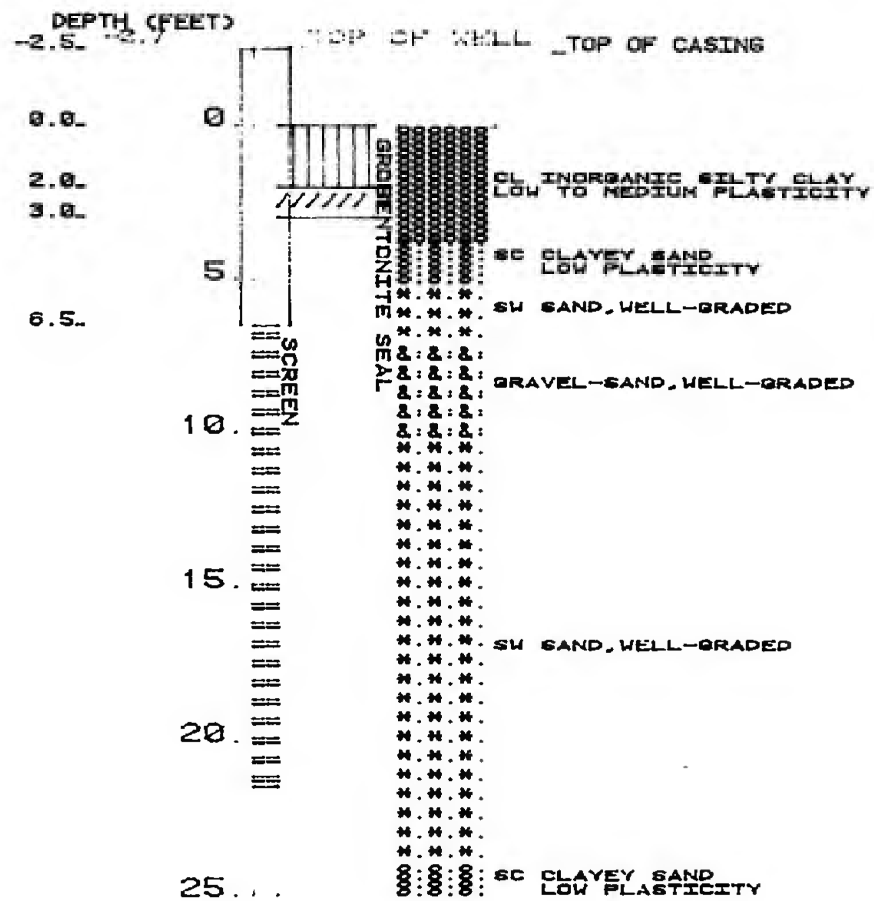
FIELD BORING PROFILE FOR STATION: MXMW1-2

DATE COMPLETED: 12/17/84
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



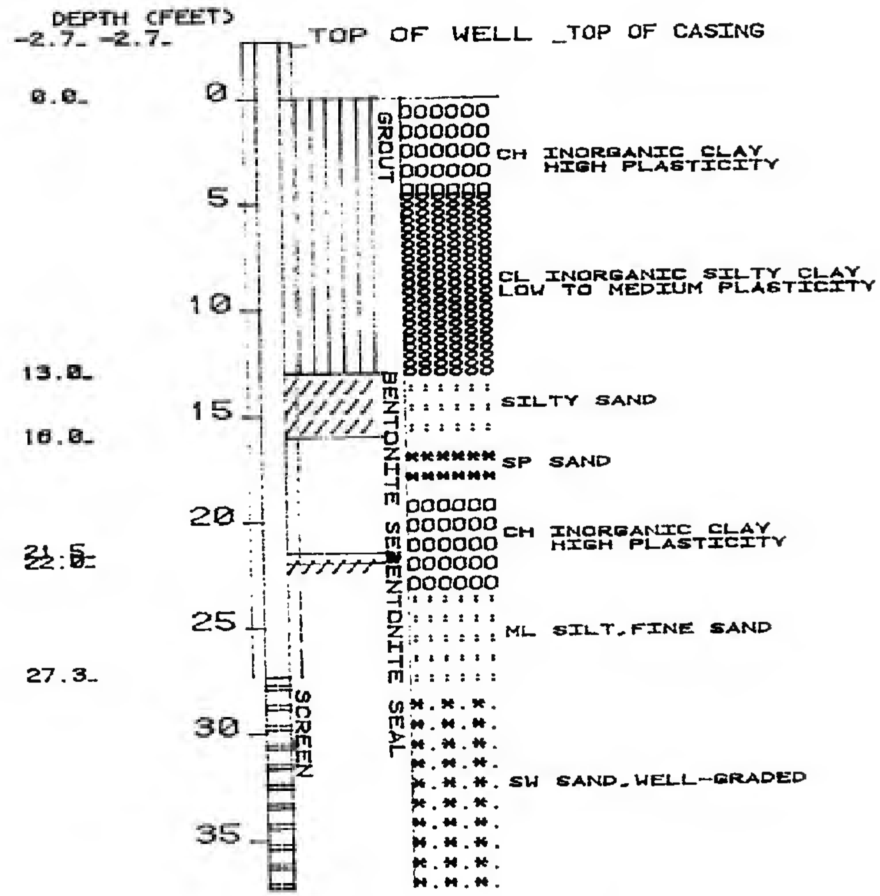
FIELD BORING PROFILE FOR STATION: MXMW1-3

DATE COMPLETED: 12/18/84
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



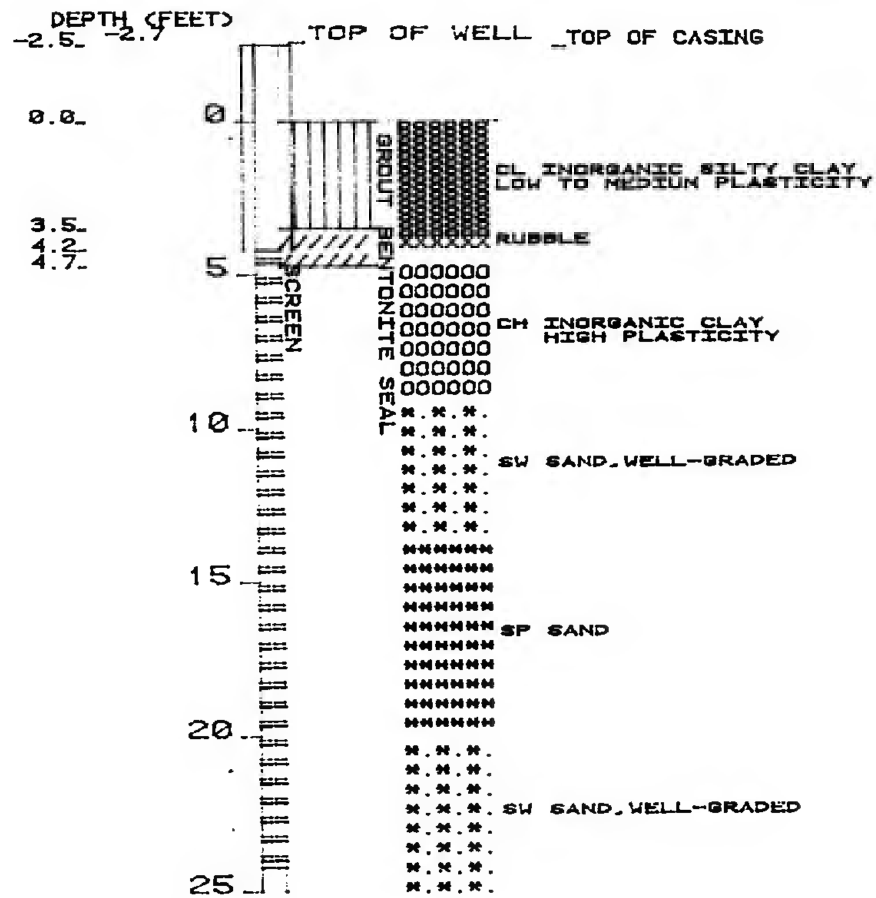
FIELD BORING PROFILE FOR STATION: MXMW1-4

DATE COMPLETED: 12/18/84
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



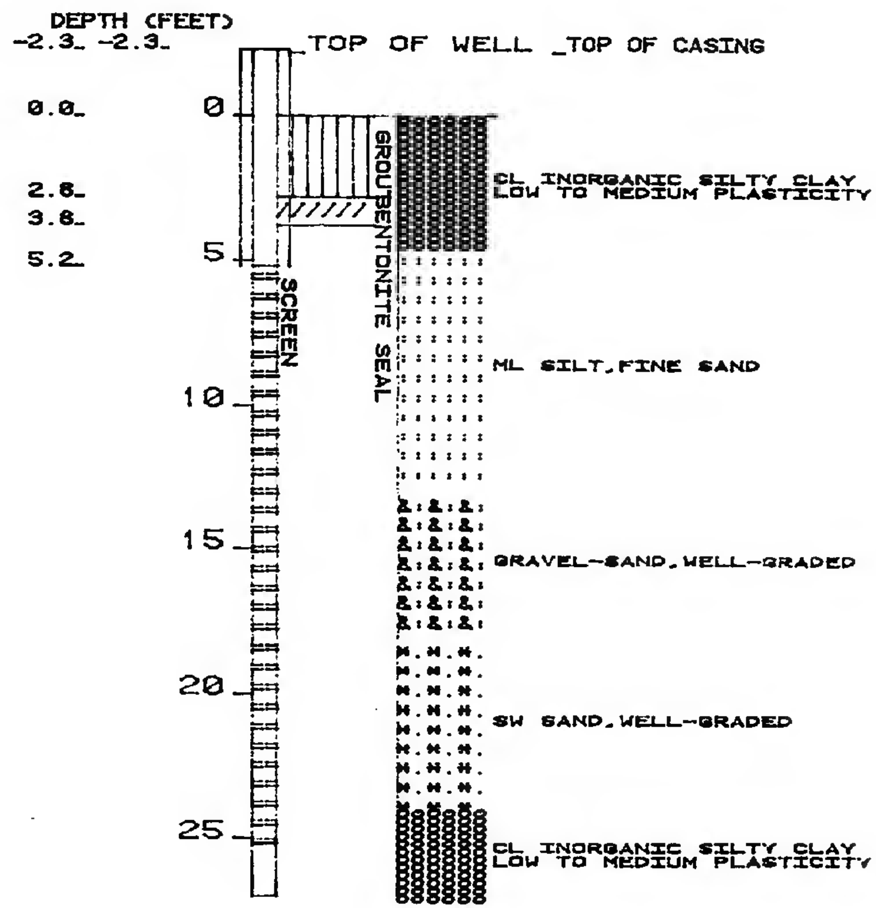
FIELD BORING PROFILE FOR STATION: MXMW3-1

DATE COMPLETED: 12/21/84
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



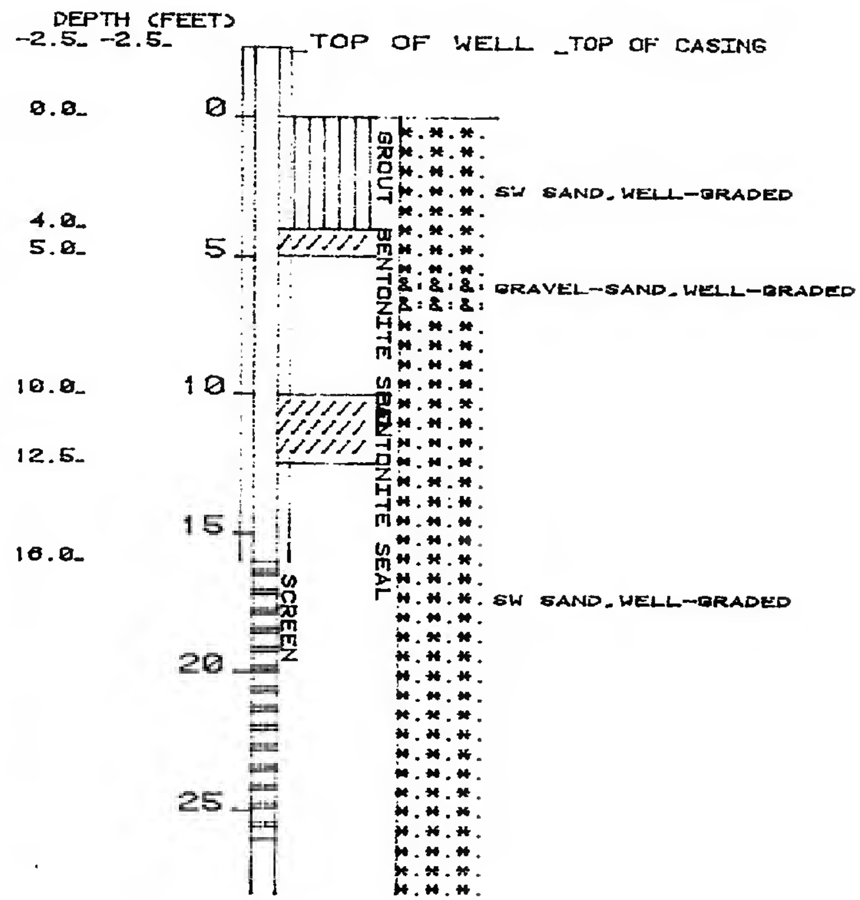
FIELD BORING PROFILE FOR STATION: MXMW3-2

DATE COMPLETED: 1/5/85
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



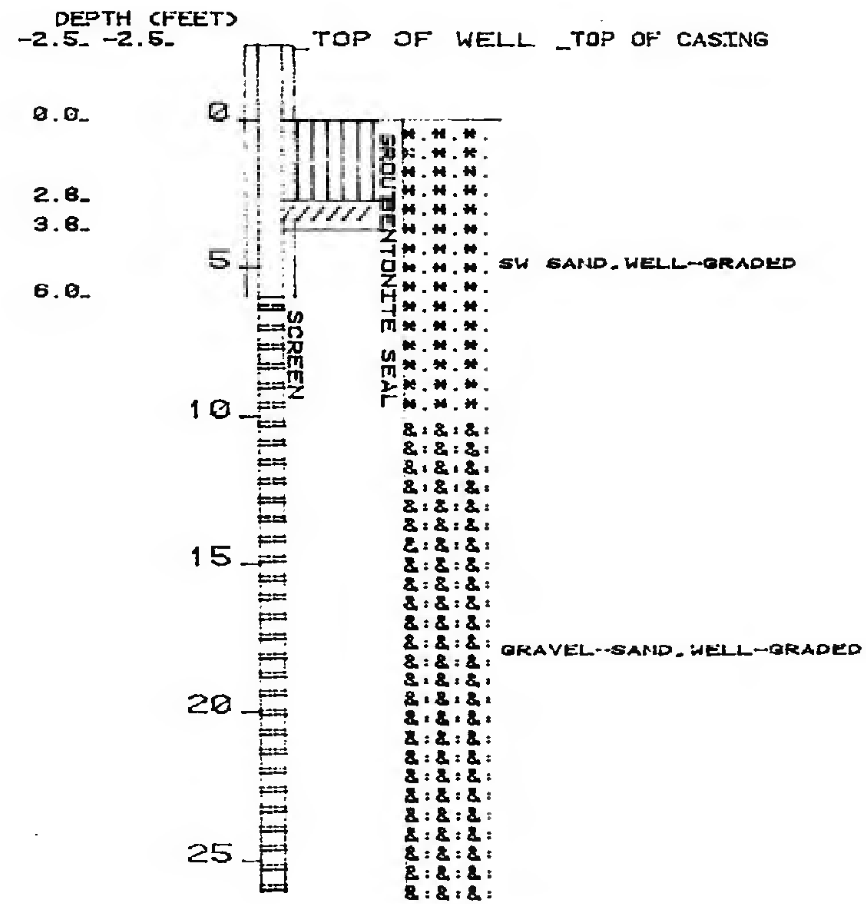
FIELD BORING PROFILE FOR STATION: MXMW3--3

DATE COMPLETED: 1/3/85
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



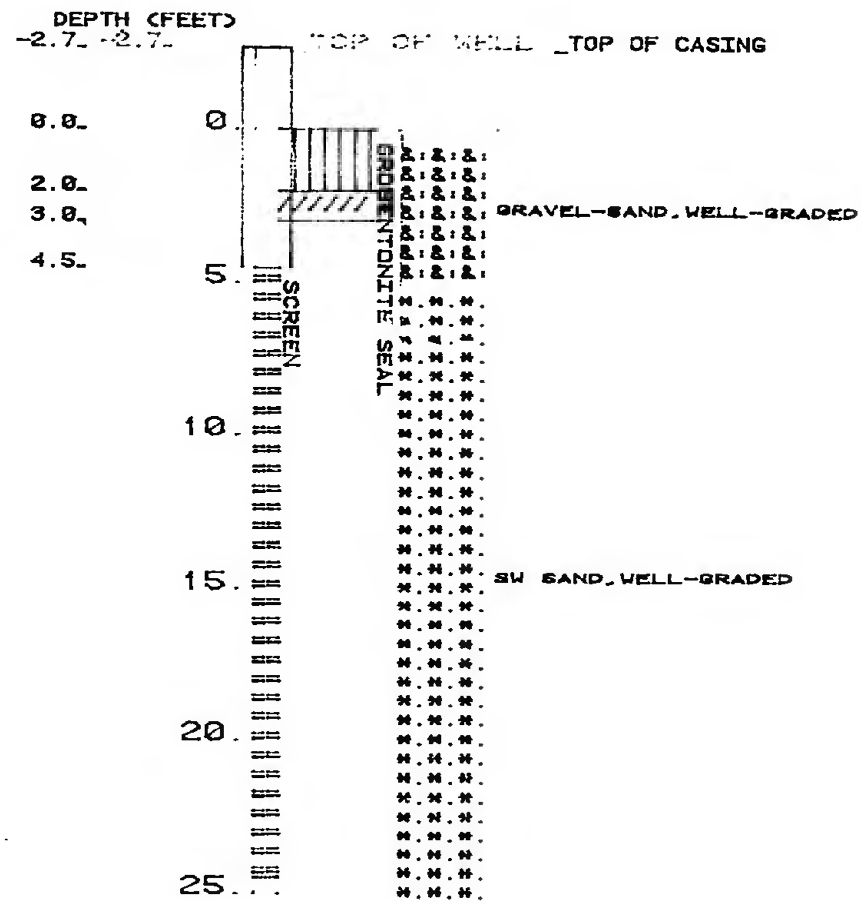
FIELD BORING PROFILE FOR STATION: MXMW4-1

DATE COMPLETED: 1/7/85
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



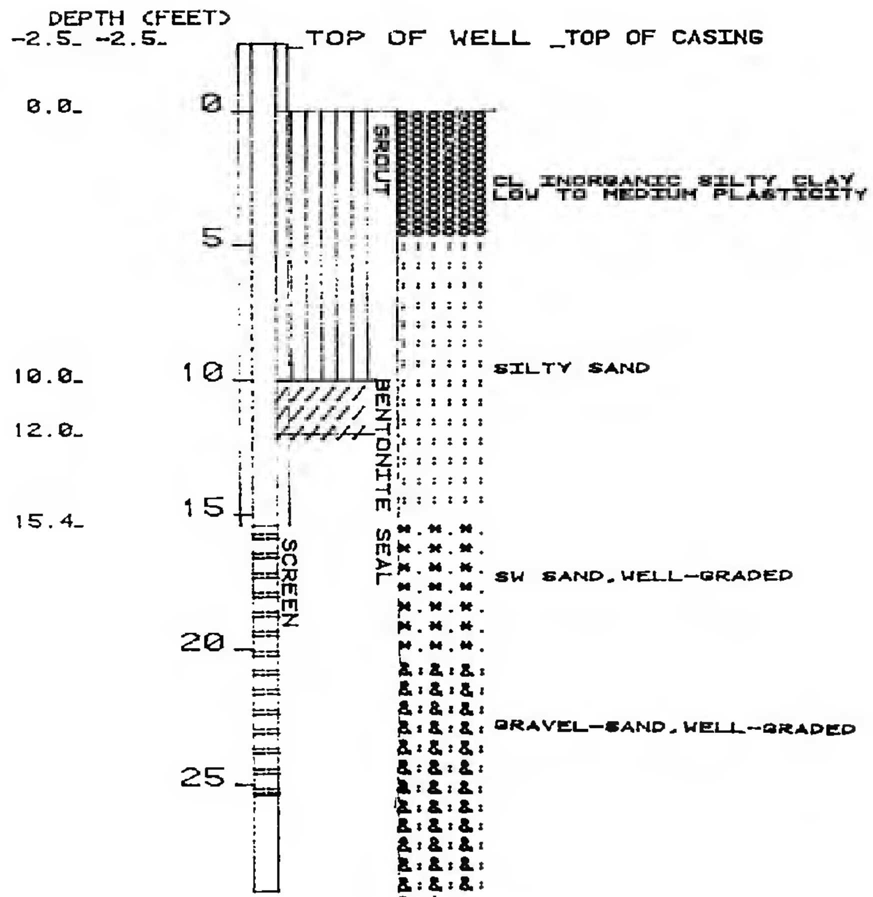
FIELD BORING PROFILE FOR STATION: MXMW4-2

DATE COMPLETED: 1/6/85
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEMRAUGER
DEVELOPEMENT:



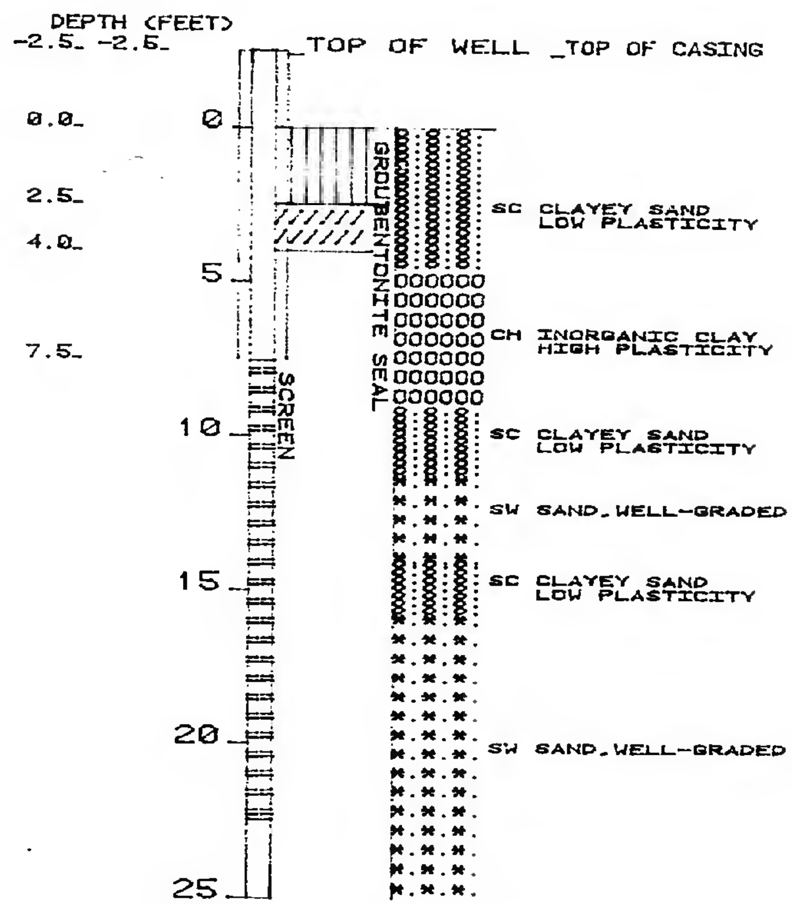
FIELD BORING PROFILE FOR STATION: MXMW4-3

DATE COMPLETED: 1/6/85
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



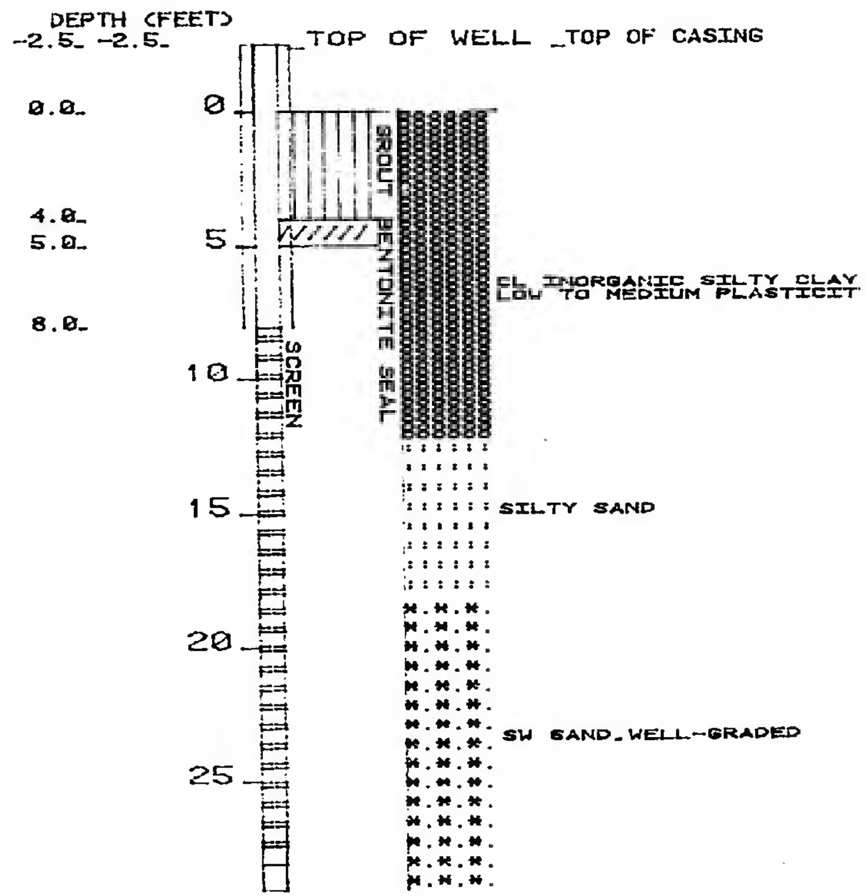
FIELD BORING PROFILE FOR STATION: MXMW5-1

DATE COMPLETED: 12/14/84
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



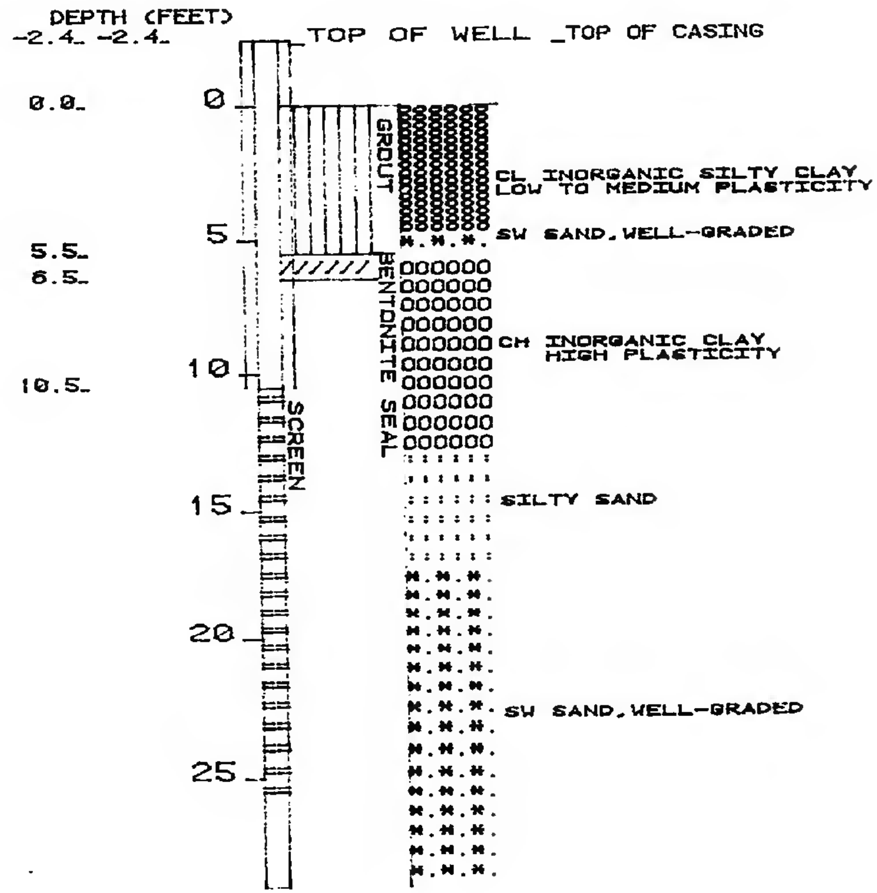
FIELD BORING PROFILE FOR STATION: MXMW5-2

DATE COMPLETED: 12/15/84
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



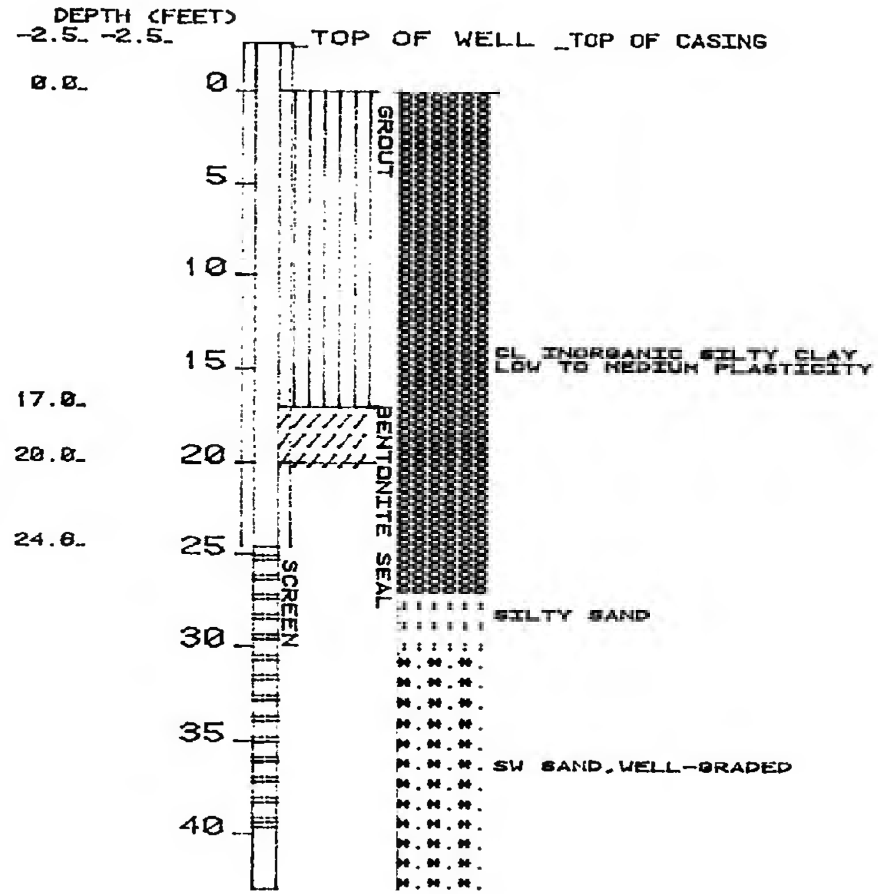
FIELD BORING PROFILE FOR STATION: MXMW5-3

DATE COMPLETED: 1/11/85
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



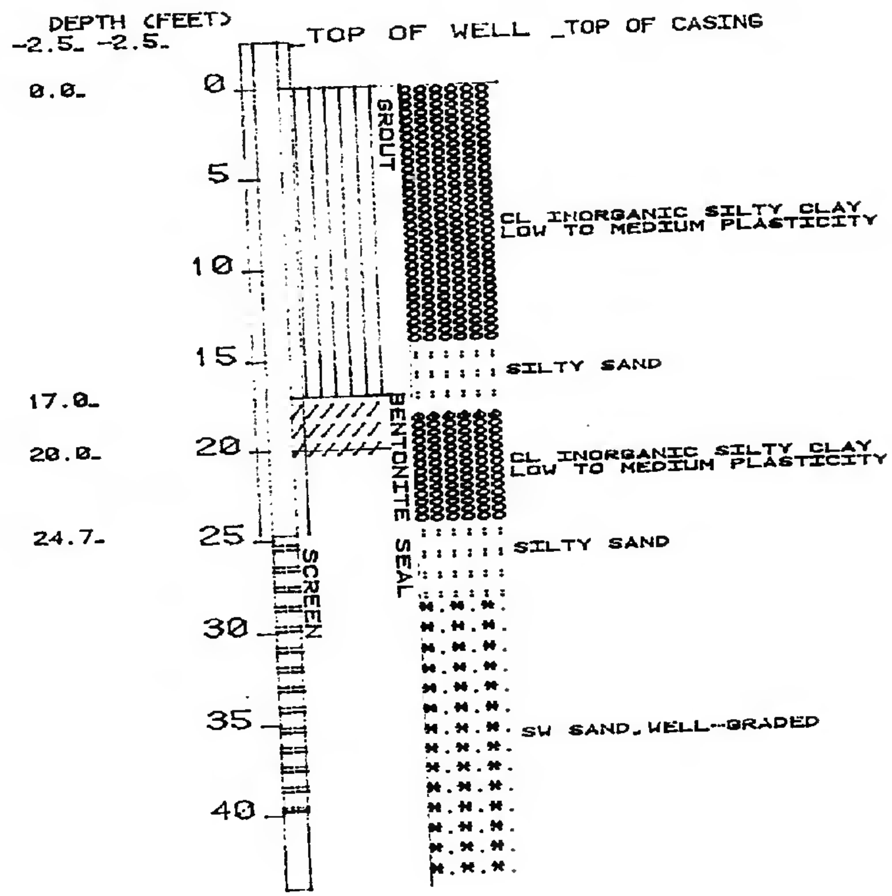
FIELD BORING PROFILE FOR STATION: MXMW5-4

DATE COMPLETED: 12/16/84
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



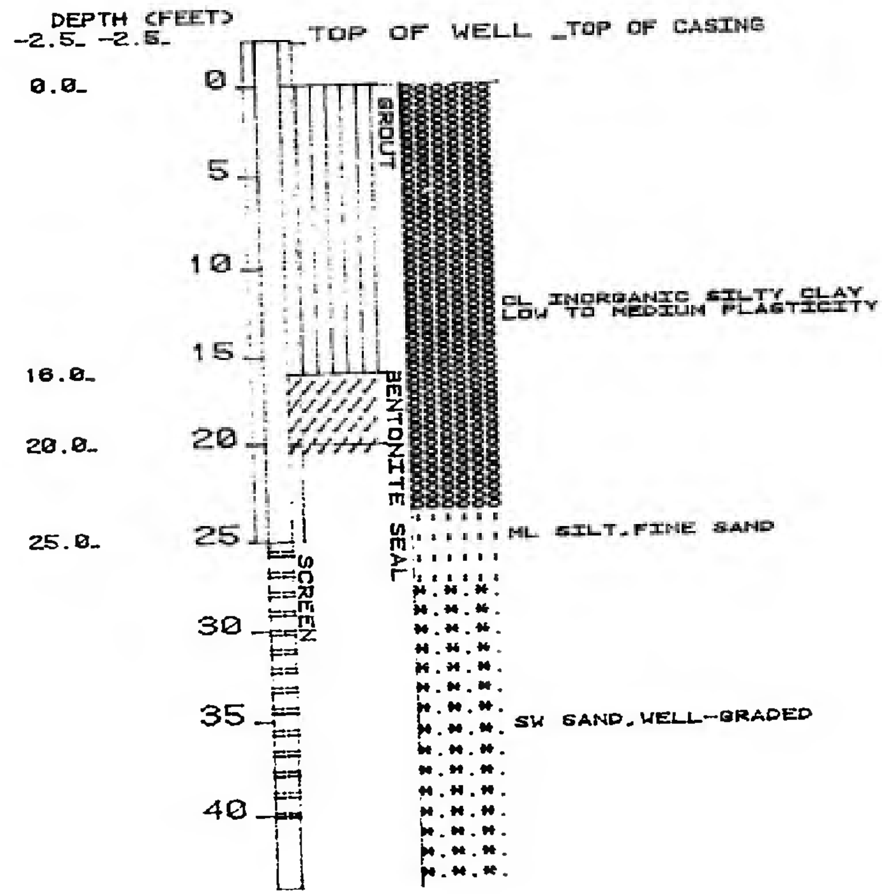
FIELD BORING PROFILE FOR STATION: MXMW6-1

DATE COMPLETED: 1/9/85
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



FIELD BORING PROFILE FOR STATION: MXMW6-2

DATE COMPLETED: 1/9/85
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:



FIELD BORING PROFILE FOR STATION: MXMW6-3

DATE COMPLETED: 1/8/85
WELL DIAMETER: 4"
DRILLING METHOD: HOLLOW STEM AUGER
DEVELOPEMENT:

SHEET 1 OF 5

Site Maxwell AFB

Boring No. MW 1-1 Second attempt

Hole Size 12 in — Slot 0.010 in

Screen Length 10 ft — Mat'l Sch 40 PVC

Diameter 4 in

Casing Length 15 ft + 2.5 ft S.U. — Mat'l Sch 40 PVC

Diameter 4 in

Date Start 12/20/84 — Finish 12/20/84

Contractor ESE — Driller Lane Eng

Location Coordinates N ______ E ______

Filter Materials ______

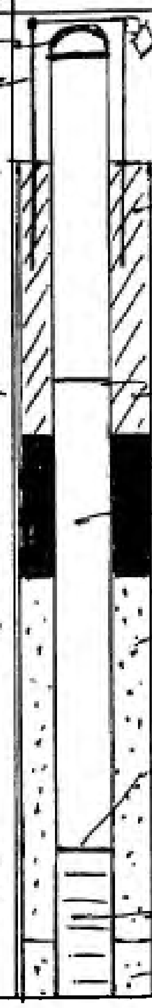
Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Drill Type Hollow stem auger

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap; 6 in locked, steel casing					Log based on split spoon samples, cuttings, drill rate
	0	CL	Sandy, silty clay, 20% very fine sand, 20% silt, sl. plastic, soft, 7.5YR5/8 (strong brown), damp, N.A.B., flood plain; less sandy & more silty below 3 ft	2, 6, 9	10	1	G.L.	grout; All contacts approximate & gradational
	5	SC	Clayey, silty, v. fine sand, 20% clay, 15% silt, 10YR5/8 (yel. brown), sl. plastic, dense, damp, N.A.B., flood plain	7, 17, 20	15	2		joint; bentonite seal
		SP	Fine to med sand, 3% clay, poorly graded, round, 5YR 5/8 (yellow red), non plastic, dense, damp, N.A.B., fluvial	7, 12, 12	14	3, 4		PVC casing
	10	SW	Very fine to med sand, 2% clay, 2% gravel (to 2 in), well graded, round, 5YR5/8 (yell. red), non plastic, dense, moist, N.A.B., fluvial	7, 12, 14	16	5, 6		12 in borehole; bagged sand; joint
	15	SW	Fine to coarse sand, 1% clay, well graded, round, 10YR 6/8 (brown, yellow), non plastic, dense, moist, N.A.B., fluvial					1st H_2O near 14 ft based on wet spoon sample
		SW	Fine to coarse sand, 40% gravel, 4% clay, well graded, round, 10YR6/8 (brown. yellow), non plastic, v. dense, wet, N.A.B., fluvial	14, 26, 33	16	7, 8		PVC screen; caved sand

Signed [signature] — Approved ______

Site M.A.F.B.

Boring No. MW 1-1

Location Coordinates N

E

Hole Size Slot

Screen Length Mat'l

Filter Materials

Diameter

Grout Type

Casing Length Mat'l

Development

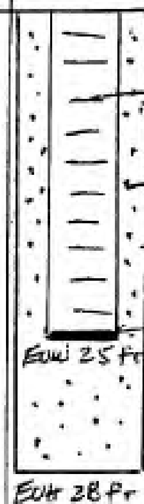
Diameter

Static Water Level

Date Start 12/20/84 Finish 12/20/84

Top of Well Elevation

Contractor Driller Drill Type

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	Fine to coarse sand, 20% gravel, 5% clay, well graded, round, 10YR 7/8 (yellow), non plastic, dense, wet, N.A.B., fluvial	12 9 13	8	9		PVC screen caved sand 12 in borehole 4 in PVC end cap
	25							
	30							

Signed [signature]

Approved

SHEET 3 OF 5

Site Maxwell AFB

Boring No. MW 1-1 (1st attempt)

Hole Size 12 in

Slot 0.010 in

Screen Length

Mat'l Sch 40 PVC

Diameter 4 in

Casing Length

Mat'l Sch 40 PVC

Diameter 4 in

Date Start 12/19/88

Finish

Contractor ESE

Driller

Location Coordinates N

E

Filter Materials

Grout Type

Development

Static Water Level

Top of Well Elevation

Drill Type Hollow Stem auger, 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	0		Silty clay, 25% silt, 7.5YR 5/6 (strong brown), mod. plastic soft, damp, N.A.E., flood plain	2 4 5	1	1		H-NU read 10 ppm above Background - smoke coming up augers below ~4 ft
	5							
			Hole abandoned & grouted					
	10							
	15							

Signed George [illegible]

Approved

Site Maxwell AFB

Boring No. MW 1-1 SHEET 4 OF 5

12/19 0730 ESE, driller on-site
Calibrate H-NU
Span @ 9.8 = 65 ppm
Utilities man is supposed to be here now to clear site.
0745 No utilities man! Make phone call!
0850 Drillers leave for coffee
0851 Man shows up – clears site
0930 Driller return, set up rig
0945 Begin augering
Auger to 2.5 ft
Spoon 2.5 to 4 ft
Auger to 5 ft
H-NU detected 10 ppm above B.G. @ ground level
1000 Discontinue augering – clear site
1015 Called Charlie ~~[illegible]~~ Harry (safety man) + described condition to him: white to gray smoke, vapor, fume coming up inside augers from about 4 ft below ground level – registered at least 10 ppm on H-NU; after several minutes the ~~[illegible]~~ reading was down to almost 5 ppm (no reading in breathing zone)
1030 Driller + helper with respirators pull augers + load rig – move across road; they were fit tested for snugness beforehand
Augers + plug cleaned thoroughly + taken off-site
1045 Cuttings shoveled into 5 gal plastic buckets w. lids + sealed for air force disposal
Hole grouted to G.L.
Area roped off, containerized cuttings inside roped area
1115 Decon complete – depart site
Will choose a new hole location + have it cleared this afternoon or tomorrow
Move to MW 7-3

12/19/84 DATE [signature] SIGNED

APPROVED

Site MAFB

Boring No. MW 1-1

12/20 1600 Arrive on site for second attempt
1605 Auger to 2.5 ft - monitor w/ H-NU
Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
Auger to 7.5 ft
Spoon 7.5 to 9 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
1640 Setting up lights + generator
Auger to 15 ft
Spoon 15 to 16.5 ft
1700 Auger to 20 ft
Spoon 20 to 21.5 ft
Auger to ~~25 ft~~ 24 ft
2 ft of sand inside augers
1720 while waiting for water truck check out other sites
Auger to 28 ft - only 1 ft of sand inside augers
1750 Set well to ~25 ft
Pull augers - had a very tough time
1845 Caved to 17 ft
Add sand to 9 ft (3 bags - (6 small ones))
1910 Bent pellets to 6 ft (2 buckets)
1940 Grout to surface (1 bag cement, 5# bent)
Augers cleaned
2000 Depart site - will load augers in A.M.

* well set @ 7.5 ft, (10 ft screen, 2.5 ft S.U.)
* used 250 gal. H_2O to mud well (75% return)
* Materials - 17.5 ft riser, 10 ft screen, 3 bags sand, 2 buckets pellets, 1 bag cement, 5# bent. powder, 1 steel casing w/ lock

12/20/84
DATE

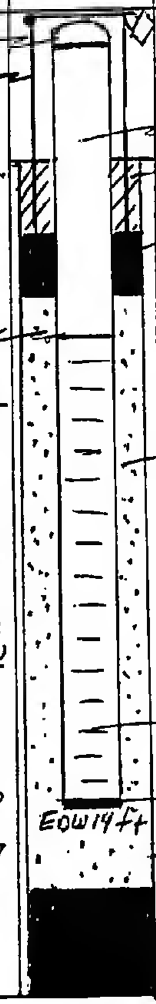
[signature]
SIGNED

APPROVED

SHEET 1 OF 4

Site Maxwell AFB
Boring No. MW 1-2
Hole Size 12 in
Slot 0.010 in
Screen Length 10
Mat'l Sch 40 PVC
Diameter 2 in
Casing Length 4 ft + 2.5 ft
Mat'l Sch 40 PVC
Diameter 2 in
Date Start 12/16/84
Finish 12/17/84
Contractor ESE
Driller Law Eng.

Location Coordinates N
E
Filter Materials Bagged sand
Grout Type 20/1 cement / bent.
Development
Static Water Level
Top of Well Elevation
Drill Type Hollow Stem Auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap; 6 in locked steel casing					Log based on split spoon samples, cuttings, drill rate; PVC casing
	0	CL	Sandy clay, 35% med to co. sand, 5Y 4/6 (yellow red), mod. plastic, med. consist, damp, N.A.B., floodplain			G.L.		grout; bentonite seal
		CL to ML	Interbedded clay + clayey silt, 5Y 6/1 (gray), sl. to v. plastic, med. consist, damp, N.A.B., floodplain	4 5 5	11	1; joint		Probably some perched H_2O above 4.5 ft in the silt lenses.
	5	CL	Silty clay, 10% silt, 5Y 6/1 (gray), v. plastic, stiff, damp, N.A.B., floodplain	4 8 13	14	2		bagged sand
		CH	Inorganic clay, 5Y 6/1 (gray) to 10YR 5/6 (yellow brown), mottled, v. plastic, stiff, damp, N.A.B, floodplain	4 8 13	12	3		The water above 15 ft is perched above a thick clay layer
	10	SM	Silty fine sand, 25% silt, 5% clay, 5% muscovite, 5Y 5/2 (olive gray), non plastic, dense, moist, N.A.B., floodplain	6 10 10	13	4, 5		PVC screen
		SC	Sand / clay mixture, 5Y 7/4 (yellow), very wet	—	—	6	EOW 14 ft	PVC end cap
	15	CH	Inorganic clay, 5Y 6/1 (gray) to 10YR 5/6 (yellow brown), v. plastic, stiff, moist, N.A.B floodplain	2 8 10	12	7		12 in borehole; bentonite pellets

Signed
K-26
Approved

Site M.A.F.B. SHEET 2 OF 4

Boring No. MW 1-2 Location Coordinates N ______

Hole Size ______ Slot ______ E ______

Screen Length ______ Mat'l ______ Filter Materials ______

Diameter ______ Grout Type ______

Casing Length ______ Mat'l ______ Development ______

Diameter ______ Static Water Level ______

Date Start 12/16/84 Finish 12/17 Top of Well Elevation ______

Contractor ______ Driller ______ Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
		CH						12 in borehole bentonite pellets Grout
	20	SP	Med. sand, 10% black grains, 5% clay, 5% muscovite, poorly graded, round, 5Y6/4 (lt. olive) to 10YR 6/8 (brown. yellow), non plastic, v. dense, moist, fluvial, N.A.B.	14 24 47	14	8, 9		
		SP						The sand below ~19 ft (beneath the clay) is moist but not saturated.
	25	EOH	Fine to med sand, 10% black grains, 5% clay, 5% muscovite, poorly graded, round, 5Y6/4 (lt olive) to 10YR 6/8 (brown yellow), non plastic, very dense, moist, fluvial N.A.B.	21 38 53	14	10, 11	EOH 25 Ft	

Signed George [illegible] K-27 Approved ______

Site Maxwell AFB
Boring No. MW 1-2

SHEET 3 OF 4

12/16 1115 Arrive on-site
Set up rig
1145 Lunch, phone calls
1245 Begin augering - monitor w. H-NU
Auger to 2.5 ft
Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
Auger to 7.5 ft
Spoon 7.5 to 9 ft
Auger to 10 ft
1400 Spoon 10 to 11.5 ft
Auger to 15 ft
Spoon 15 to 16.5 ft
Auger to 20 ft
Spoon 20 to 21.5 ft
Auger to 25 ft
1500 Spoon 25 to 26.5 ft
Sand below 19 ft (beneath a thick clay) is not saturated to at least 26.5 ft; grout the hole up to 20 ft + allow to set overnight
Plan to set the well @ 15 ft tomorrow
Used 3 bags cement, 15# bent. powder
1630 Depart site
12/17 0630 ESE, driller on-site
Cement top at 19 ft (total of 6 ft)
Add bent. pellets to 16 ft (1½ buckets)
0730 Pellets bridged in augers - use auger plug to remove; didn't work
Use rotary bit to remove bridge
0815 Add sand from 16 to ~~15 ft~~ 14 ft (2 bags)
Install well to 14 ft (10 ft screen)
0915 Add sand to 3 ft (8 bags)(include 2 bags above)

12/16/84 DATE
George Book SIGNED

APPROVED

Site Maxwell AFB
Boring No. MW 1-2

12/17 cont 1000 Bent pellets to 2 ft (1 bucket)
Grout to surface (2 bags cement, 10# bent powder)

1010 Cleaning augers - flights clogged with clay + insides all coated w. bentonite

1100 Still cleaning augers, cleaning site

* NOTE : Spent 30 min 10/16, mixing grout + pumping down hole (used 3 bags cement, 15# bent, but only about 2/3 was used in this hole - the rest was used to fill in PZ 5-2 hole)
On 10/17 spent about 30 min adding bent pellets to the bottom of the hole; pellets bridged + we spent an hour or so removing the plug

1140 Will clean up site after the clay has had time to dry out
Depart site, move to MW 1-3

* Well set @ 14 ft (10 ft screen + 2.5 ft S.U.)
* Used 200 gal H_2O to make well (75% return)
* Materials - 6.5 ft riser, 10 ft screen, 8 bags sand, 5 bags cement, 25# bent. powder, 2 1/2 buckets pellets, 1 steel casing w/lock.

12/17/84
DATE

George [illegible]
SIGNED

APPROVED

Site Maxwell AFB

Boring No. MW 1-3

Hole Size 12 in Slot 0.016 in

Screen Length 15 ft Mat'l Sch 40 PVC

Diameter 2 in

Casing Length 7.3 ft + 2.7 ft S.U. Mat'l Sch 40 PVC

Diameter 2 in

Date Start 12/17/84 Finish 12/18/84

Contractor ESE Driller Law Eng.

Location Coordinates N

E

Filter Materials formation + bagged sand

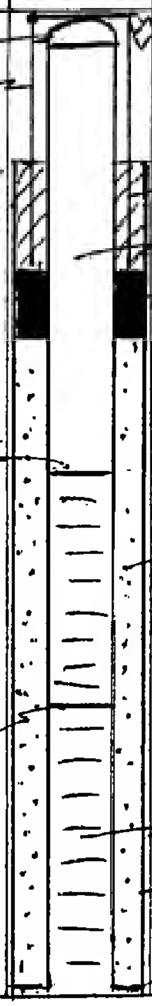
Grout Type 30/1 cement/bentonite

Development

Static Water Level

Top of Well Elevation

Drill Type Hollow stem auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap; 6 in locked steel casing					Log based on split spoon samples, cuttings, drill rate
	0	SC	Clayey fine sand, 15% clay, 10YR 6/6 (brownish yellow), sl. plastic, loose, dry, N.A.B., flood plain		G.L.			grout; PVC casing
		SM	Silt/fine sand mixture, 5Y 6/1 (gray), sl. plastic, dense, dry, N.A.B., flood plain	4 19 17	10	1		bentonite seal
	5	SM	Silty fine sand, 25% silt, 5% clay, 5Y 6/1 (gray), sl. plastic, loose, wet N.A.B., flood plain	5 7 8	8	2		1st H_2O near 6 ft based on water contact in spoon sample
					joint			
		SW	Very fine to very coarse sand, 40% gravel (to 2 cm) 5Y 6/1 (gray), non plastic, v. dense, wet, N.A.B., fluvial	8 18 36	10	3		bagged sand
	10			3 6 8	11	4		Doesn't seem to be any perched water as in MW 1-2
		SW	Fine to coarse sand, well graded, sl. round, 5Y 6/3 (pale olive), non plastic, med. density, wet, N.A.B., fluvial		joint			PVC screen
	15	SW	Fine to very coarse sand, 25% gravel (to 2 cm), well graded, round, 2.5Y 7/4 (pale yellow), non plastic, dense, wet, N.A.B., fluvial	6 8 31	10	5		12 in borehole; formation sand (caved)

Signed [signature] Approved

Site MAFB | SHEET ____ OF ____

Boring No. MW 1-3 | Location Coordinates N ____ E ____

Hole Size ____ Slot ____

Screen Length ____ Mat'l ____ | Filter Materials ____

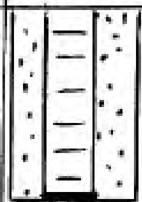
Diameter ____ | Grout Type ____

Casing Length ____ Mat'l ____ | Development ____

Diameter ____ | Static Water Level ____

Date Start 12/17/84 Finish 12/18/84 | Top of Well Elevation ____

Contractor ____ Driller ____ Drill Type ____

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SP EOH	Fine to med sand, 10% clay, 10% black grains, 5% muscovite, poorly graded, 5Y 5/3 (olive), sl. to non plastic, very dense, moist, NAB. fluvial				 EOW, EOH 22.3 ft	The confining clay layer above the green sand in MW 1-2 was not present in this hole

Signed ____ Approved ____

Site Maxwell AFB
Boring No. MW 1-3

SHEET 3 OF 4

12/17 1140 Set up on-site – Calibrate H-NU
1150 Begin augering
Auger to 2.5 ft
Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
Auger to 7.5 ft
Spoon 7.5 to 9 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
1230 LUNCH
1305 Auger to 15 ft
Spoon 15 to 16.5 ft
1310 Belt on rig motor slipped off
Fan bearing shot!
Discontinue activities for the day to repair rig
1700 Depart site
12/18 0630 Arrive on-site – Calibrate H-NU meter
Allowing rig to warm up in order to introduce "STOP LEAK" to radiator to fill a hole
0710 Begin augering
Auger to 20 ft
Spoon 20 to 21.5 ft
0830 Auger to 22 ft – no heaving sands!
0900 Install well
Add gravel sand from 22 to 18 ft (1 bag)
Sand caved from 18 to 12 ft
0930 Add sand from 12 to 4 ft (6 bags)
* Representative of the "grounds" department came by & he & I went to FPTA #2 to discuss removing a fence along the west end ditch to allow the rig to move in closer to the ditch
1000 Bentonite pellets to 3.5 ft (1 bucket)

12/17/84 DATE

George [illegible] SIGNED

APPROVED

Site Maxwell AFB
Boring No. MW1-3

SHEET 4 OF 4

12/18 1005 Mixing grout
cont 1030 Grout to surface (2 bags cement, 10# bent. powder)

* Well set @ 22.3 ft (15 ft screen, 2.7 ft S.U.)
* Used 0 gal H_2O to make well!
* Materials - 10 ft riser, 15 ft screen, 7 bags sand, 1 bucket pellets, 2 bags cement, 10# bent. powder, 1 steel casing w/lock

1040 Grout up PZ 1-3 after pulling
Prepare site after cleaning augers
1050 Calibrate H-NU
Span @ 9.8 - 65 ppm
Zero, OK

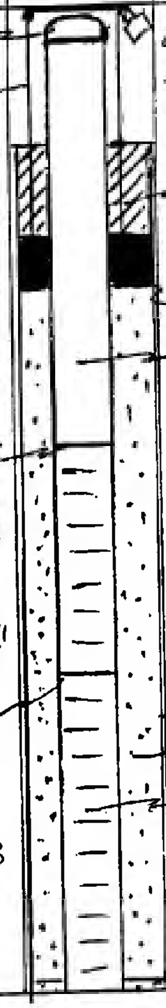
12/18/84
DATE

[signature]
SIGNED

APPROVED

Site M.A.F. Base
Boring No. MW 1-4
Hole Size 12 in Slot 0.010 in
Screen Length 15 ft Mat'l Sch 40 PVC
Diameter 4 in
Casing Length 6.5 ft + 2.5 ft S.U. Mat'l Sch 40 PVC
Diameter 4 in
Date Start 12/18/84 Finish 12/18/84
Contractor ESE Driller Law Eng.

Location Coordinates N ______
E ______
Filter Materials formation + bagged sand
Grout Type 20/1 cement / bentonite
Development ______
Static Water Level ______
Top of Well Elevation ______
Drill Type Hollow stem auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap 6 in locked steel casing		G.L.			Log based on split spoon samples, cuttings, drill rates grout
	0	CL	Sandy, silty clay, 30% sand, 10% silt, 5Y 3/2 (dk olive) to 7.5YR 4/6 (strong brown), soft, sl.-mod plastic, damp, N.A.B., flood plain	3, 5	13	1, 2		Contact @ 3.6 ft sharp bentonite seal PVC casing
		SC	Fine to coarse clayey sand, 30% clay, well graded, 5Y 6/1 (gray), sl. plastic, loose, moist, N.A.B., fluvial	3, 2, 8	1	3		1st H_2O near 5 ft based on wet spoon sample
	5	SW	Fine to med sand, 10% clay, well graded, 5Y 6/2 (lt olive gray), non-sl. plastic, loose, wet, N.A.B., fluvial	10, 7, 10	joint 11	4, 5		All contacts below 5 ft approximate or gradational
		GW	Sandy gravel, 40% f.-c. sand, well graded, round, 5Y 7/3 (pale yellow), nonplastic, dense, wet, N.A.B., fluvial	3, 7, 8	14	6, 7		
	10	SW	Fine to coarse sand, 15% gravel (to 1 cm), well graded, round, 5Y 7/4 (pale yellow), non plastic, dense, wet, N.A.B., fluvial, +10% black grains		joint			12 in borehole bagged sand PVC screen
	15	SW	Very fine to v. coarse sand, 5% gravel (to 1 cm), well graded, mod. round, 10YR 6/8 (brown yellow), non plastic, loose, wet, N.A.B., fluvial	4, 4, 4	8	8		caved sand

Signed ______ K-34 Approved ______

Site MAFB

Boring No. MW 1-4

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 12/18/84 Finish 12/18/84

Contractor ______ Driller ______

Location Coordinates N ______

E ______

Filter Materials ______

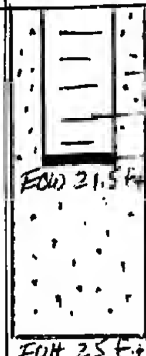
Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	Fine to v. coarse sand, 5% clay, well graded, 10YR 6/8 (brownish yellow), non plastic, loose, wet, N.A.B., fluvial	4 5 4	0	X		12 in borehole caved sand PVC screen PVC end cap
				X	5	9		
						10		
	25	SC EOH	Hole overdrilled to 25 ft — when pulling augers the bottom flights (3 or 4 ft) were found to be clogged w. the dense, olive clayey sand					No blow counts taken on last spoon sample because we had to drive it through sand heaved up in the augers to reach virgin soil

Signed George ... K-35 Approved ______

Site Maxwell AFB
Boring No. MW 1-4

SHEET 3 OF 3

1100 Set up on site
1115 LUNCH
1200 Auger to 2.5 ft
Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft – only recovered 1 in of material
Auger to 7.5 ft
Spoon 7.5 to 9 ft
Auger to 10 ft
1315 Spoon 10 to 11.5 ft – made 2 attempts as first yielded no sample
Auger to 15 ft
Spoon 15 to 16.5 ft
Auger to 20 ft
Spoon 20 to 21.5 ft – only recovered an inch of sample, of dubious quality
Auger to 22 ft
Spoon 22 to 23.5 ft
Overdrill to 25 ft (sand heaved several ft into auger)
1350 Water run
1430 Water truck returns
Wash out hole w. rotary bit
1455 Pull rotary bit
1500 Install well to ~22 ft
Hole caved to 18 ft
1530 Add sand from 18 to 3 ft (4 bags) (partially caved)
1550 Bent pellets to 2 ft (1 bucket)
1620 Grout to surface (3 bags cement, 15 # bent.)
1700 Depart site (also grout P=1-4)
* Used 250 gal H_2O to make well (75% return)
* Well set @ ~~22~~ 21.5 ft, 15 ft screen, 2.5 ft S.U.
* Materials – 9 ft riser, 15 ft screen, 4 bags sand, 1 bucket pellets, 3 bags cement, 15 # bent., [illegible], 1 steel casing w/ lock

12/18/84
DATE

[signature]
SIGNED

APPROVED

SHEET 1 OF 4

Site Maxwell AFB

Boring No. MW 3-1 | Location Coordinates N ______ E ______

Hole Size 12 in | Slot 0.010 in

Screen Length 10 ft | Mat'l Sch 40 PVC | Filter Materials formation sand, bagged sand

Diameter 4 in | Grout Type 20/1 cement/bentonite

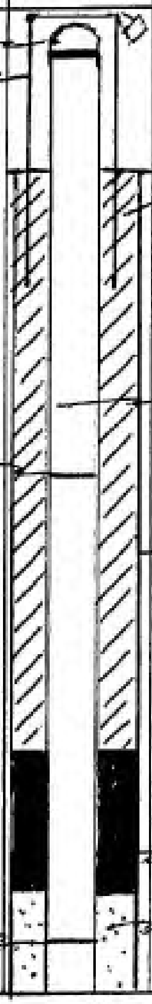
Casing Length 27.3 ft + 2.7 ft s.u. | Mat'l Sch 40 PVC | Development ______

Diameter 4 in | Static Water Level ______

Date Start 12/21/84 | Finish 12/21/84 | Top of Well Elevation ______

Contractor ESE | Driller Law Eng | Drill Type Hollow Stem Auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	Recovery	Box or Sample #	Remarks
			4 in PVC slip cap; 6 in locked steel casing				Log based on split spoon samples, cuttings, drill rate
	0				G.L.		grout
		CH	Inorganic clay, 10% silt, 5YR5/6 (yellow red) to 10YR5/8 (yellow brown), mod plastic, hard, dry, mottled, flood plain	12 26 37	15	1, 2	Contacts at 4.5, 7, 9.5, 13 ft approximate + gradational
	5	CL	Silty clay, 25% silt, 10YR 5/8 (yellow brown) to 5Y7/2 (lt gray), mod. plastic, stiff, dry, mottled, flood plain	9 17 21	18	3, 4	PVC casing; Contact @ 16.3 ft sharp
					joint		
		CL	Silty, sandy clay, 15% silt, 15% fine sand, 10YR5/8 (yellow brown) to 5Y7/2 (gray), mod. plastic, stiff, dry, mottled, flood plain	9 16 20	15	5	12 in borehole
	10	CL	Sandy, silty clay, 30% fine sand, 10% silt, 7.5YR5/8 (strong brown) to 5Y7/2 (lt. gray), sl. plastic, stiff, damp, mottled, flood plain	6 9 12	18	6	1st H_2O near 13 ft based on wet spoon sample @ 15 ft
	15	SM	Silty fine sand, 25% silt, 5Y7/2 (lt gray), non plastic, dense, wet, N.A.B., flood plain	13 17 28	16	7	bentonite seal
		SP			joint		caved sand



Signed [signature] | K-37 | Approved ______

Site MAFB

Boring No. MW3-1

Hole Size ____ Slot ____

Screen Length ____ Mat'l ____

Diameter ____

Casing Length ____ Mat'l ____

Diameter ____

Date Start 12/21/84 Finish 12/21/84

Contractor ____ Driller ____

Location Coordinates N ____

E ____

Filter Materials ____

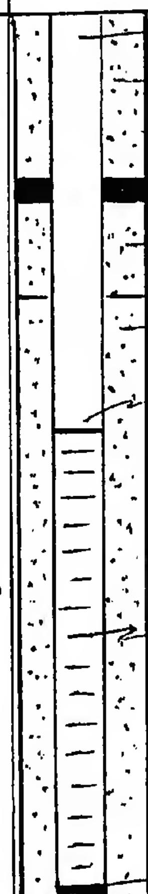
Grout Type ____

Development ____

Static Water Level ____

Top of Well Elevation ____

Drill Type ____

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SP	Fine to med sand, 2% clay, poorly graded, round, 7.5YR 5/8 (strong brown), non plastic, dense, wet, N.A.B., fluvial	2 3 4	18	8		PVC casing caved sand 12 in borehole bentonite seal bagged sand
		CH	Inorganic clay, 5Y 5/1 (gray), very plastic, soft, moist, N.A.B., floodplain					
	25	ML	Clayey sandy silt, 20% clay, 20% fine sand, 5% muscovite, 5Y 4/1 (dk gray), sl. plastic, soft, moist, N.A.B., flood plain	1 2 3	18	9		caved sand joint
	30	SW	Fine to med sand, 40% gravel (to 2cm), well graded, round, 10YR 7/6 (yellow), non plastic, very loose, wet, N.A.B., fluvial	1 2 4	5	10		Auger plug coated with sand & gravel when pulled to take 30 ft sample PVC screen
	35						EOW, EOH 37.3 Ft	PVC end cap

Signed ____ Approved ____

Site Maxwell AFB
Boring No. MW 3-1

SHEET 3 OF 4

0600 - Driller called to say they'd be later this AM because someone stole their tools & they had to talk to police (stolen from the hotel!)
0700 - Arrive on-site (MW 1-1) & load augers; move to MW 3-1
0800 - Begin augering, calibrate H-NU, monitor hole
Auger to 2.5 ft
Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
Auger to 7.5 ft
Spoon 7.5 to 9 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
Auger to 15 ft
0910 - Spoon 15 to 16.5 ft
Auger to 20 ft
Spoon 20 to 21.5 ft
Auger to 25 ft
1015 - Spoon 25 to 26.5 ft
1045 = Auger to 30 ft
Spoon 30 to 31.5 ft
Auger to 40 ft (overdrilled 5 ft)
1130 - Lunch
1230 - Water run - 250 gal
1300 - Take soil from MW 1-1 (1st attempt) to Drum Storage area
1400 - While driller reams out the augers & paint second of the well casings fluorescent orange (MW 1-1, 7-2, 7-3)
1410 - Water run - 500 gal
1450 - Water run - 750 gal
1630 ~~1530~~ - Water run - 1000 gal

12/21/84 DATE
George [signature] SIGNED

APPROVED

Site M.A.F.B.
Boring No. MW 3-1

SHEET 4 OF 4

1700 - Supplies run
- Only 3 ft of sand/gravel inside augers
1750 - Set well & attempt to pull augers
well fell to ~ 37 ft, but acceptable (wanted 35 ft)
- Caved to 24 ft
- Add sand to 22 ft (1 lg. bag = 2 sm bags)
Pellets to ~~####~~ 21.5 ft
Bridged about 5 ft from bottom of augers,
Attempt to push them out the bottom with pipe
1900 - Couldn't remove bridge
Pulled augers all the way out — hole caved to 16 ft
1930 - Add pellets to 13 ft = 3 buckets
2000 - Grout to surface (5 bag cement, 25# powder)

* Used 1000 gal. H_2O with 75% recovery (~250 gal still in hole)
* Well set @ 37.3 ft, 10 ft screen, 2.7 ft S.U.)
* Materials — 30 ft riser, 10 ft screen, 5 bags cement, 25# bent. powder, 3 buckets pellets, 1 bag sand, 1 steel casing w/ lock

Note - Also grouted PZ 3-1.

Note - Well was supposed to be placed to 35 ft; driller placed it to 37 ft (unavoidably!); who pays for the extra 2 ft?!

Note - Because of the pellet bridge in the augers the clay seal couldn't be properly placed; the suitability of the well will be determined during development, & if not acceptable the driller says he'll redo it.

2045 Depart site - return 1/3/84

12/21/84 DATE

[signature] SIGNED

APPROVED

SHEET 1 OF 4

Site Maxwell AFB

Boring No. MW3-2

Hole Size 12 in

Slot 0.010 in

Screen Length 20 ft

Mat'l Sch 40 PVC

Diameter 4 in

Casing Length 4.2 ft + 2.5 ft s.u.

Mat'l Sch 40 PVC

Diameter 4 in

Date Start 1/5/85

Finish 1/5/85

Contractor ESE

Driller [illegible]

Location Coordinates N

E

Filter Materials formation & gravel sand

Grout Type 20/1 cement/[illegible]

Development

Static Water Level

Top of Well Elevation

Drill Type Hollow stem auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap; 6 in locked steel casing					Log based on split spoon samples, cuttings, drill rate
	0	CL	Silty clay, 25% silt, 10YR 5/4 (yellow brown), mod plastic, med consist, damp, N.A.B., flood plain	4 5 5	G.L. 10	1	grout; PVC casing; 12 in borehole	
			Landfill debris (glass, plastic)			cont		Below 3.5 ft encountered landfill debris
	5	CH	Inorganic clay, 10YR 6/8 (brown yellow) to 5Y 6/1 (gray), v. plastic, soft, damp, mottled, flood plain	2 3 5	11	2	bentonite seal	
		CH	Inorganic clay, 5Y 5/1 (gray) v. plastic, soft, moist, N.A.B., flood plain	3 2 4	18	3		1st H_2O near 9 ft, based on wet sand in spoon foot
	10	SW	Fine to v. coarse quartz sand, well graded, round, 5Y 6/1 (gray), non plastic, dense, N.A.B., wet, fluvial	5 9 14	10	4, 5	bagged sand; PVC screen	
						cont		Contacts @ 4.5 ft and 13.5 ft approximate; other contacts sharp
	15	SP	Fine to med micaceous sand, 15% muscovite, 5% black grains, poorly graded, round, 2.5Y 6/4 (lt. brown yellow), non plastic, loose, N.A.B., wet, fluvial	5 2 4	12	6	caved sand	

Signed [signature]

Approved

SHEET 2 OF 4

Site MAFB

Boring No. MW3-2

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 1/5/85 Finish 1/5/85

Contractor ______ Driller ______

Location Coordinates N ______

E ______

Filter Materials ______

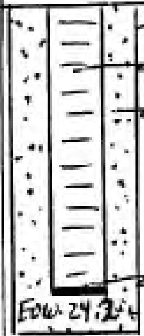
Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	Fine to co. sand, 3% black grains, well graded, round, 2.5Y6/6 (olive yellow), non plastic, very loose, wet, N.A.B., fluvial	2 1 2	18	7	 EOW 24.2 ft EOH 25 ft	12 in borehole PVC screen Cased sand
		SW	Fine to co. sand, 15% gravel (to 1 cm), well graded, round, 2.5Y6/6 (olive yellow), non plastic, very loose, wet, N.A.B., fluvial			8		PVC endcaps
	25	EOH						

Signed George [illegible] K-42 Approved ______

Site Maxwell AFB
Boring No. MW 3-2

SHEET 3 OF 4

0630 Arrive on-site
Calibrate H-NU — 65 ppm @ Span 9.8
Water run
0710 Water truck returns
Rig hard to start (very cold)
0730 Move onto hole, set up rig
0805 Begin augering
I had the fence taken down & we are as close to the edge of the West End Ditch as possible (within 5 ft)
Auger to 2.5 ft
Spoon 2.5 to 4 ft
Lower part of spoon (3.5 to 4 ft) landfill debris — glass, plastic, concrete, etc. — we're as close to the edge of the fill area as possible
Auger to 5 ft — out of the fill material now!
0825 Spoon 5 to 6.5 ft
Auger to 7.5 ft
Spoon 7.5 to 9 ft
Auger to 10 ft
0845 Spoon 10 to 11.5 ft
Auger to 15 ft
Spoon 15 to 16.5 ft
0920 Auger to 20 ft (had problem w/ a connection)
Spoon 20 to 21.5 ft
0940 Auger to 25 ft
0945 Sound hole [illegible] 7 ft of sand inside augers
Prepare to rotary out the hole
1005 Bit out — ready for well — add 1½ sand from 27 to 25 ft
Install well to ~25 ft
Can't pull augers, chain broken
1030 Stop to go to store for new chain
1105 Chain is here & ready to resume operation
1120 Augers are coming up!

1/5/85
DATE

[signature]
SIGNED

APPROVED

Site M.AFB
Boring No. MW 3-2

1140 Sand caved to 12 ft
Add sand to 4.7 ft (7 bags = 14 little bags)
Well is set @ 24.2 ft (shifted up 0.8 ft); Top 0.5 ft of screened section is not slotted, so top of the ~20 ft screen is @ 4.7 ft rather than 4.2 ft; did not extend the sand filter pack above the top of the screen in order to seal off the landfill debris, encountered from 3.5 to 4.5 ft, from the well.
1235 Pellets to 3.5 ft (1 bucket)
LUNCH
1315 Mixing cement - (1 bag cement, 5# bent. powder)
1330 Grout to surface
Cleaning augers.
1415 Depart site.

* Used 200 gal H_2O to make well (75% return)
~~* Well set @ 26 ft (20 ft screen, 2.5 ft S.U.);~~
~~* [illegible] 8.5 ft [illegible], 20 ft screen, 11 bag sand, 2 bucket pellets,~~

* Well set @ 24.2 ft (20 ft screen, 2.5 ft S.U.)
* Materials - 6.7 ft riser, 20 ft screen, 7 bags sand, 1 bucket pellets, 1 bag cement, 5# bent. powder, 1 steel casing w/ lock

1/5/85
DATE

[signature]
SIGNED

APPROVED

Site Maxwell AFB

Boring No. MW 3-3

Hole Size 12 in Slot 0.010 in

Screen Length 20 ft Mat'l Sch 40 PVC

Diameter 4 in

Casing Length 5.2 ft + 2.3 ft SU Mat'l Sch 40 PVC

Diameter 4 in

Date Start 1/3/85 Finish 1/3/85

Contractor ESE Driller Law Eng.

Location Coordinates N ____ E ____

Filter Materials formation + bagged sand

Grout Type 50/N cement/bentonite

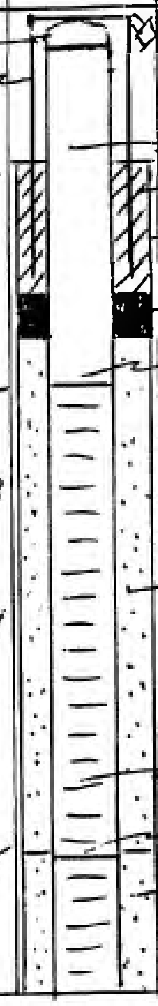
Development

Static Water Level

Top of Well Elevation

Drill Type Hollow Stem Auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap; 6 in steel locked casing					Log based on split spoon samples, cuttings, drill rate
	0				G.L.			PVC casing; grout; 12 in borehole
		CL	Silty clay, 20% silt 3% muscovite, 5Y7/1 (lt gray) to 10YR5/8 (yellow brown), mottled, mod. plastic, med. consist., damp, floodplain	2 4 10	16	1		bentonite seal
	5	ML	Clayey silt, 20% clay, 5% muscovite, 5Y7/1 (lt gray) to 2.5Y6/4 (lt. yellow brown), mottled, sl. plastic, very stiff, dry, floodplain	12 18 23	15	2		joint
		ML to SM	Interbedded clayey silt and silty fine sand, 5Y7/1 (lt gray), non to sl. plastic, soft, wet, floodplain	4 4 4	17	3		1st H_2O near 7 ft based on wet spoon sample @ 7.5 ft; bagged sand
	10	ML to SP	Interbedded clayey silt and fine to med sand, 5Y7/1 (lt gray) to 10YR7/8 (yellow), to 7.5YR5/8 (strong brown), mottled, non to sl. plastic, med density, wet, flood plain, (10% muscovite)	2 2 10	10	4		All contacts approximate or gradational; PVC screen; joint
	15	GW	Gravel (to 5 in), 40% fine to coarse sand, well graded, round, 2.5Y7/6 (yellow), nonplastic, v. dense, wet, N.A.B., fluvial	12 16 17	8	5		caved sand



Signed George [illegible] K-45 Approved

Site MAFB
Boring No. MW 3-3
Hole Size ______ Slot ______
Screen Length ______ Mat'l ______
Diameter ______
Casing Length ______ Mat'l ______
Diameter ______
Date Start 1/3/85 Finish 1/3/85
Contractor ______ Driller ______

Location Coordinates N ______
E ______
Filter Materials ______
Grout Type ______
Development ______
Static Water Level ______
Top of Well Elevation ______
Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	Fine to coarse quartz sand, 10% gravel, well graded, round, 2.5Y 7/6 (yellow), non plastic, very dense, wet, N.A.B., fluvial	3 15 50/4	8	6		R in borehole; Gravel sand; PVC screen
	25	CL	Silty micaceous clay, 20% silt, 15% muscovite, 5Y 3/6 (dark olive), mod. plastic, stiff, moist, N.A.B., flood-plain		PVC end cap		EOW 25.2 Ft	Green clay cuttings to surface when cleaning hole w. rotary bit (from bottom)
		EOH					EOH 27 Ft	Green clay on bit (augers) when pulled from hole

Signed [signature] K-46 Approved ______

Site Maxwell AFB
Boring No. MW 3-3

SHEET 3 OF 4

1/3 0700 ESE on-site
0730 Driller w/ full water truck on-site
0740 Attempted to start rig, but had problems
0745 Rig finally started but now stuck in the mud (rained last night)
0830 Rig freed - move back to MW 3-1 & load augers
0845 Set up on MW 3-3
Greasing rig, cleaning drill pipe.
0935 Begin augering
Auger to 2.5 ft
~~Auger 2.5 to 4 ft~~
~~Auger to 5 ft~~
~~Spoon 5 to 6.5 ft~~
~~Auger to 7.5 ft~~
~~Spoon 7.5 to 9 ft~~
~~Calibrate HNU - 65 ppm @ Span 9.8~~
0945 Supply run to hardware store (35 min DOWNTIME)
Calibrate HNU - 65 ppm @ Span 9.8
1025 Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
Auger to 7.5 ft
1050 Spoon 7.5 to 9 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
Auger to 15 ft
1110 Spoon 15 to 16.5 ft
Auger to 20 ft
1130 Auger plug stuck inside augers (heaving sand & gravel)
1140 Plug freed
Spoon 20 to 21.5 ft
Auger to 25 ft
1215 LUNCH
1300 Return to site

1/3/85 DATE

George K[illegible] SIGNED

APPROVED

Site M.A.F.B.
Boring No. MW 3-3

1/3 1305 10 ft of sand/gravel heaved inside augers
1310 Hook up rotary bit + clean out augers
1335 Still rigging up bit — having problems — line plugged w. cement
1400 Water line cleared (50 min downtime)
Begin w. rotary bit — overdrill to ~ 27 ft
1430 Pull rotary bit
~~Hole~~ Hole stayed open to 27 ft — add 2 small bags sand (=1 lg. bag) to 25 ft
1440 Install well to ~ 25 ft
1445 Pull augers
Well set @ 25.2 ft, 20 ft screen, 2.3 ft S.U.
Hole caved to 15 ft
Add sand from 15 to 3.8 ft (18 small bags)
1600 Bent pellets to 2.8 ft (1½ buckets)
1640 Grout to surface (1½ bags cement, 7.5 # bent powder)
Spent 35 min attempting to free water truck buried in the mud — soil is soft + wet everywhere. Will have to call tow truck or get some back-heavy equipment to pull out the truck (+ possibly the rig) tomorrow A.M.
1700 Depart site.

1/4 0700 Attempt again to free water truck + rig, to no avail.
0800 Bulldozer pulls out both.
0830 Depart site, restore run

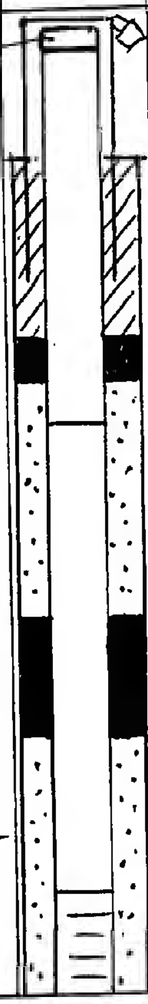
* Used 400 gal H_2O to make well (75% return)
* Well set @ 25.2 ft (20 ft screen, 2.3 ft S.U.)
* Materials — 20 ft screen, 7.5 ft casing, 20 small bags sand (=10 lg. bags), 1½ buckets pellets, 1½ bags cement, 7.5 # bent. powder, 1 steel casing w/lock

1/3/85 DATE
SIGNED

APPROVED

SHEET 1 OF 4

Site Wurtsmith AFB	Location Coordinates N
Boring No. MW 4-1	E
Hole Size 12 in Slot 0.010 in	
Screen Length 10 ft Mat'l Sch 40 PVC	Filter Materials formation sand
Diameter 4 in	Grout Type 70/ cement/bentonite
Casing Length 16 ft + 2.5 ft SU Mat'l Sch 40 PVC	Development
Diameter 4 in	Static Water Level
Date Start 1/7/85 Finish 1/7/85	Top of Well Elevation
Contractor ESE Driller Law Eng.	Drill Type Hollow stem auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap					Log based on split spoon samples, cuttings, drill rate
	0				G.L.			
		SW	Gravelly fine to cs quartz sand, 45% gravel, well graded, round, 7.5YR 5/8 (strong brown), nonplastic, dense, dry, N.A.B., fluvial	12 21 22	8	1		Boring is along a 14 ft bank cut, so upper 14 ft of soil is absent here
	5	GW	Sandy gravel (to 8 cm), 40% fine to cs. sand, well graded, round, 7.5YR 5/8 (strong brown), nonplastic, dense, dry, N.A.B., fluvial	13 27 31	12	2		
		SW	Gravelly f. to cs. sand (40% gravel (to 5 cm), well graded, round, 10YR 7/8 (yellow), nonplastic, dense, sl. damp, N.A.B., fluvial	19 27 29	12	3		
	10	SW	Gravelly med to cs. sand, 35% gravel (to 3 cm), well graded, round, 10YR 7/8 (yellow), nonplastic, dense, sl. damp, N.A.B., fluvial	15 16 19	9	4		1st H_2O near 16 ft based on water contact in spoon
	15	SW	Gravelly med to cs. sand, 25% gravel (to 2 cm), 10YR 6/8 (brown. yellow), nonplastic, dense, wet, N.A.B., fluvial	9 13 13	8	5		All contacts approximate & gradational
		SW						

Signed [signature]

K-49

Approved

SHEET 2 OF 4

Site MAFB
Boring No. MW 4-1
Hole Size ______ Slot ______
Screen Length ______ Mat'l ______
Diameter ______
Casing Length ______ Mat'l ______
Diameter ______
Date Start 1/7/85 Finish 1/7/85
Contractor ______ Driller ______

Location Coordinates N ______
E ______
Filter Materials ______
Grout Type ______
Development ______
Static Water Level ______
Top of Well Elevation ______
Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
		SW	Gravelly fine to v.c. quartz sand, 30% gravel (≤ 3 cm), well graded, round, 10YR 7/4 (v. pale brown), non plastic, dense, wet, N.A.B., fluvial	6 6 23	3	6		
	20	SW						
		SW						
	25							
		EOH						

Signed George Porter(?) K-50 Approved ______

Site Maxwell AFB
Boring No. MW 4-1

SHEET 3 OF 4

0700 Arrive on-site, set up rig
0715 Water truck arrives w. full tank
Calibrate H-NU; 65 ppm @ Span = 9.5
Rig hard to start
0745 Auger to 2.5 Ft – begin H-NU monitoring
Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
0820 Driller left to use phone
0845 Driller return (25 min DOWNTIME)
Resume operations
Auger to 7.5 ft
0900 Spoon 7.5 to 9 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
Auger to 15 ft
0910 Spoon 15 to 16.5 ft – 1st H_2O
Auger to 20 ft
Spoon 20 to 21.5 ft
Auger to 25 ft
0945 Sound hole – water ~ 19 ft G.L., sand 3 ft up augers
Water swivel for rotary setup broke off – Down for repairs (75 min downtime)
1100 Repairs complete – water @ ~ 18 ft GL in augers
Run rotary into Down hole
1140 Didn't remove much of the washed in sand (want well ~ 25 ft)
Add another auger + auger to 28 ft – there's only about 6 in of material in augers!
1150 Install well to ~ 26 ft
Pull augers using chain + hydraulics
Sand caved to 12.5 ft
1220 Add bent. pellets to 10 ft (2 buckets) + then some more from 5 to 4 ft (1 bucket); caved sand between
1240 LUNCH

1/7/85 DATE

George Porter SIGNED

APPROVED

Site MAFB
Boring No. MW 4-1

SHEET 4 OF 4

1320 Grout to surface (3 bags cement, 15# bent. powder)
Clean augers
1415 Depart site

* Well set @ 26 ft (10 ft screen, 2.5 ft S.U.)
* Used 750 gal H_2O (50% return) to make well
* Material: 18.5 ft riser, 10 ft screen, 3 bucket pellets, 3 bags cement, 15# bent. powder, 1 steel casing w/ lock

7/7/85 DATE

George Post SIGNED

APPROVED

Site Maxwell AFB

Boring No. MW 4-2

Hole Size 12 in

Slot 0.010 in

Screen Length 20 ft

Mat'l Sch 40 PVC

Diameter 4 in

Casing Length 6 ft + 2.5 ft + SU

Mat'l Sch 40 PVC

Diameter 4 in

Date Start 1/5/85

Finish 1/6/85

Contractor ESE

Driller Law Eng.

Location Coordinates N

E

Filter Materials formation & bagged sand

Grout Type 20/1 cement / bentonite

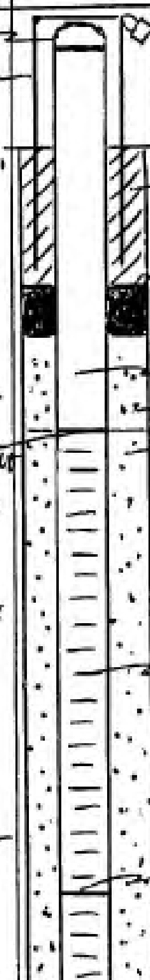
Development

Static Water Level

Top of Well Elevation

Drill Type hollow stem auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap; 6 in locked steel casing					Log based on split spoon samples, cuttings, drill rate.
	0	SW	Gravelly fine to coarse quartz sand, 20% gravel (to 3 cm), well graded, round, 7.5YR 5/8 (strong brown), non plastic, dense, dry, N.A.B., fluvial	7 13 15	8	1	G.L.	grout; bentonite seal; All contacts are approximate and gradational
	5	SW	Med to coarse gravelly sand, 25% gravel, well graded, round, 10YR 7/8 (yellow), non plastic, dense, dry, N.A.B., fluvial	9 16 19	10	2	joint	PVC casing; bagged sand; caved sand
				14 16 19	8	3		1st H_2O near 9.5 ft based on wet spoon sample
	10	GW	Gravel (to 7 cm), 45% fine to coarse sand, well graded, round, 10YR 7/8 (yellow), non plastic, very dense, wet, N.A.B., fluvial	19 24 29	10	4		12 in borehole; PVC screen
	15	GW		18 26 37	10	5		joint



Signed

Approved

SHEET 2 OF 4

Site MAFB

Boring No. MW 4-2 Location Coordinates N ______

Hole Size ______ Slot ______ E ______

Screen Length ______ Mat'l ______ Filter Materials ______

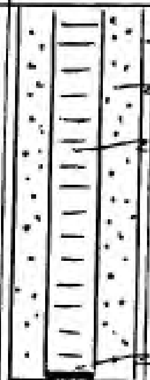
Diameter ______ Grout Type ______

Casing Length ______ Mat'l ______ Development ______

Diameter ______ Static Water Level ______

Date Start 1/5/85 Finish 1/6/85 Top of Well Elevation ______

Contractor ______ Driller ______ Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	GW	Gravel (to 5cm), 40% fine to coarse sand, well graded, round, 10YR 7/8 (yellow), non plastic, very dense, wet; N.A.B., fluvial	19 26 31	18	6		12 in borehole cased sand PVC screen PVC endcap
	25	ECH					EOW, EOH 26 ft	

Signed [signature] K-54 Approved ______

Site Maxwell AFB
Boring No. MW4-2

1/5 1430 Arrive on-site
1450 Begin augering - monitor w. H-NU
Auger to 2.5 ft
Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
Auger to 7.5 ft
1525 Auger plug caught on bottom of augers - pull augers + free
1530 Resume operations
Back to 7.5 ft w. augers
Spoon 7.5 to 9 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
Auger to 15 ft
Spoon 15 to 16.5 ft
Auger to 20 ft
Spoon 20 to 21.5 ft
Auger to 25 ft
1630 Sound hole - ~ 3 ft of sand/gravel inside augers
Secure site for nite, pull augers up from bottom
1700 Depart site

1/6 0630 ESE, driller on-site (helper after water)
0700 Begin starting rig
0715 Water truck on-site
Measured water inside augers - 9 ft G.L.
Calibrate H-NU; Span at 9.6 = 65 ppm
0730 Take augers back down to 25 ft + sound hole
Still ~ 2 ft of matl. in augers
0740 Prepare to rotary out the hole
0810 Out w. rotary bit
0815 Install well - fell to ~ 26 ft

1/5/85
DATE

[signature]
SIGNED

APPROVED

Site MAFB

Boring No. MW 4-2

SHEET 4 OF 4

0820 Pull augers
Sand caved to 6 ft
Add sand to 3.3 ft (2 small bags = 1 lg. bag)
0850 Bent. pellets to 2.3 ft (2 buckets)
0920 Grout to surface, clean augers
0930 Depart site

* Used 175 gal H_2O to make well (75% return)
* Well set to 26 ft (20 ft screen, 3.5 ft S.U.)
\# Materials - 8.5 ft riser, 20 ft screen, 1 bag sand,
2 bucket pellets, bags cement, 1 bent. powder,
1 steel casing w/ lock

1/6/85
DATE

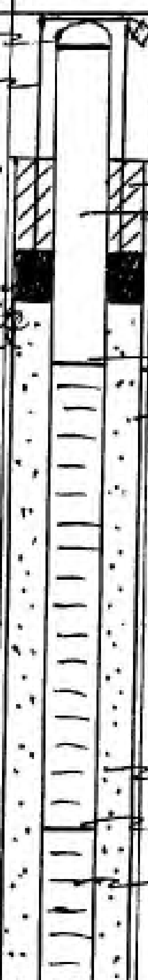
[illegible]
SIGNED

APPROVED

SHEET 1 OF 3

Site Maxwell AFB
Boring No. MW4-3
Hole Size 12 in
Slot 0.010 in
Screen Length 20
Mat'l Sch 40 PVC
Diameter 4 in
Casing Length 4.5 + 2.7 ft S.U.
Mat'l Sch 40 PVC
Diameter 4 in
Date Start 1/6/85
Finish 1/6/85
Contractor E&E
Driller L Gui Eng

Location Coordinates N
E
Filter Materials formation sand
Grout Type 20/1 Cement/bentonite
Development
Static Water Level
Top of Well Elevation
Drill Type Hollow stem auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap; 6 in locked steel casing					Log based on split spoon samples, cuttings, drill rate
	0	GW	Sandy gravel (to 5 cm), 40% fine to coarse sand, well graded, round, 10YR 7/8 (yellow), non plastic, dense, N.A.B., sl. damp, fluvial	8 20 19	11	1	G.L.	grout; PVC casing; Contacts approximate + gradational; bentonite seal
	5	SW	Gravelly fine to co. sand, 40% gravel (to 7 cm), well graded, round, 10YR 7/8 (yellow), non plastic, dense, N.A.B., sl. damp, fluvial	13 15 16	10	2		joint; 12 in borehole
		SW	Gravelly fine to co. sand, 20% gravel (to 2 cm), well graded, round, 10YR 7/8 (yellow), non plastic, dense, N.A.B., sl. damp, fluvial	5 12 14	13	3		1st H_2O near 10.5 ft based on water content in spoon sample
	10	SW	Med to co. gravelly sand, 30% gravel (to 1 cm), well graded, round, 10YR 6/8 (brown-yellow), non plastic, dense, wet, N.A.B., fluvial	10 12 9	10	4		Measured H_2O in auger @ 9.5 ft, G.L.
								caved sand; joint
	15	SW		12 18 16	8	5		PVC screen

Signed [signature]

K-57

Approved

SHEET 2 OF 3

Site MAFB

Boring No. MW 4-3 Location Coordinates N ____

Hole Size ____ Slot ____ E ____

Screen Length ____ Mat'l ____ Filter Materials ____

Diameter ____ Grout Type ____

Casing Length ____ Mat'l ____ Development ____

Diameter ____ Static Water Level ____

Date Start 1/6/85 Finish 1/6/85 Top of Well Elevation ____

Contractor ____ Driller ____ Drill Type ____

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	Med to coarse sand, 10% gravel (to 0.5 cm), well graded, round, 10YR6/8 (brown, yellow), nonplastic, dense, N.A.B., wet, fluvial	16 19 20	1	6		12 in borehole caved sand PVC screen PVC endcap
	25	EOH					EOW 24.5ft EOH 25ft	

Signed ____ K-58 Approved ____

Site Maxwell AFB
Boring No. MW 4-3

SHEET 3 OF 3

0940 Set up on-site
0945 Begin augering - monitor w. H-NU
Auger to 2.5 ft
Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
Auger to 7.5 ft
1010 Spoon 7.5 to 9 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
Auger to 15 ft
Spoon 15 to 16.5 ft
Auger to 20 ft
1040 Spoon 20 to 21.5 ft
Only recovered 3" or so an inch of material - driller out of sample catchers for the spoon - will see about getting more after this hole.
1055 Auger to 25 ft - sand 3 ft inside augers
Rig up rotary bit to clean hole, begin drilling
1100 Water in
1130 Resume drilling (water truck return)
1155 Pull rotary bit
Sand heaved back up 1 ft
Attempt to install well - fall to 23.7 ft, G.L.
Attempt to pull augers - won't come up
Wrap augers w/ chain + pull w. hydraulics
1210 Augers coming up - well fell to ~24.5 ft
Sand caved to 3 ft
1230 Bento. pellets to 2 ft (2 buckets)
1300 Grout to surface

* Used ~350 gal H_2O to make well (75% return)
* Well set @ 24.5 ft (20 ft screen, 2.7 ft S.U.)
* Materials - 7.2 ft riser, 20 ft screen, 3 bags cement, 15# powder, 2 buckets pellets, 1 steel casing w/ lock

1315 Depart site

1/6/85
DATE

SIGNED

APPROVED

Site M.A.F.B. (Maxwell) SHEET 1 OF 5

Boring No. MW 5-1 Location Coordinates N

Hole Size 12 in Slot 0.010 in E

Screen Length 10 ft Mat'l Sch 40 PVC Filter Materials Formation + bagged sand

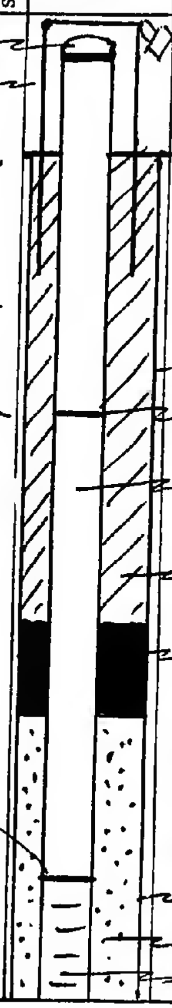
Diameter 4 in Grout Type 20/1 cement/bentonite

Casing Length 15.4 ft + 2.5 ft S.U. Mat'l Sch 40 PVC Development

Diameter 4 in Static Water Level

Date Start 12/13/84 Finish 12/14/84 Top of Well Elevation

Contractor ESE Driller Law Eng. Drill Type Hollow stem auger 12 in OD 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap					Log based on split spoon samples, cuttings, drill rates
			6 in locked steel casing					
	0	CL	Sandy clay, 35% fine to cs. sand, 7.5YR 4/6 (strong brown), sl. plastic, soft, damp, N.A.B. floodplain	7 10 14	G.L. 11"	1		Contacts 4.5, 7.5, 15 ft approximate + gradational
	5	SM	Fine sand, 10% silt, 5% clay, mod. graded, mod. round, 7.5YR 5/8 (strong brown), nonplastic, loose, damp, N.A.B., fluvial (3% muscovite)	4 5 4 / 4 3 7	12" / 18"	2 / 3		12 in borehole; joint; 4 in PVC casing; grout
	10	SM	Very fine sand/silt mixture (50/50), 7.5YR 5/8 (strong brown), non plastic, loose, damp, N.A.B., floodplain (5% muscovite)	4 4 4	18"	4		bentonite seal
					joint			1st H_2O near 15 ft based on wet spoon sample
	15 ▽	SW	Very fine to med sand, mod. graded, round, 5% clay, 10YR 5/6 (yellow. brown), nonplastic, v. loose, wet, N.A.B., fluvial	1 2 1	18"	5		12 in borehole; filter pack; 4 in PVC screen

Signed George Bost Approved

SHEET 2 OF 5

Site Maxwell AFB

Boring No. MW 5-1 | Location Coordinates N

Hole Size | Slot | E

Screen Length | Mat'l | Filter Materials

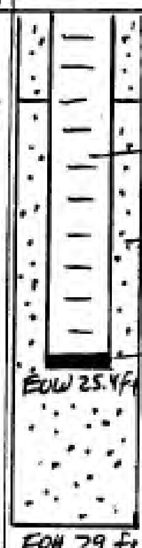
Diameter | Grout Type

Casing Length | Mat'l | Development

Diameter | Static Water Level

Date Start 12/13/84 | Finish | Top of Well Elevation

Contractor | Driller | Drill Type

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	GW	Gravel, 50% med. to coarse quartz sand, well graded, mod. round, 10YR 6/6 (brownish yellow), nonplastic, very dense, N.A.B., wet, fluvial	12 25 25	16"	6; 7		12 in borehole Caved to 20 ft 4 in PVC screen formation sand (caved) PVC end cap
	25							
	30	EOH						

Signed George Post | Approved

Site Maxwell A.F.B.
Boring No. MW 5-1

SHEET 3 OF 5

12/13 1220 Set up on-site
Calibrate H-NU
- 65 ppm @ 9.8 span setting
- Zero OK
Rig: Mobil B-53
Pump: L-6 monopump
Casing: 10 ft threaded 4 in Sch 40 PVC
Screen: threaded 4 in Sch 40 PVC, 0.010 in slots
Spoon: one, 18 in x 1.75 in, two 24 in x 1.75 in (I.D.)
Hammer: 140 lb
Fall: 30 in

1315 Begin augering
Down to 2.5 ft
Spoon 2.5 to 4.0 ft
Auger to 5.0 ft
Spoon 5.0 to 6.5 ft
1340 Auger to 7.5 ft
Spoon 7.5 to 9.0 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
1400 Auger to 15 ft
Spoon 15 to 16.5 ft
1st H_2O near 15 ft
Auger to 20 ft
Spoon 20 to 21.5 ft
1430 Auger to 25 ft
1440 Run for supplies (screen & pipe)
1450 Supplies here (10 min DOWNTIME)
Pulling out the auger plug
Sand heaved 8 ft inside augers
1500 Rigging up rotary bit to wash out augers
Run inside augers
1545 Water run

12/13/88
DATE

SIGNED

APPROVED

Site MAFB
Boring No. MW 5-1

SHEET 4 OF 5

1600 Water truck returns — someone took outlet hose from pump
Leave to call city water Dept.
Tap into fire hydrant on Foshee Rd.
1650 Fill water truck!
Resume rotary drilling to flush out augers

Cement: Type I Portland, Blue Circle, Inc., 94 # bags
Sand: Silica (sandblasting), Cosby-Carmichael Sand + Gravel, Selma, Ala., 50# bags

1830 Plan to overdrill (auger) to 30 ft tomorrow — there's still 2 ft of sand & gravel inside augers
Depart field

12/14 0630 ESE, driller on-site
Auger to 30 ft after lifting augers up
Just 0.5 ft of sand inside augers
0700 Install well
Water run
0740 Water truck returns
Pull well + lift augers w. hydraulics to about 26 ft
0815 Reinstall well + pull augers

Screen length is 10.1 ft with end cap (w/o the threads)
Riser length is 9.9 ft, each section

0845 Well set @ 25.4 ft w. 2.5 ft S.U. (screen 15.4 to 25.4 ft)
Caved to 20 ft (top of gravel/sand?)
0930 Sand to 12 ft (6 bags)
0945 Bentonite pellets, Peltonite by Rocotas, Inc., 5 gal. buckets, to 10 ft (2 buckets) (50# buckets)

12/14/84 DATE
[signature] SIGNED

APPROVED

Site MAFB
Boring No. MW 5-1

SHEET 5 OF 5

12/14 cont

1020		Grout to surface (4 bags cement, 20# bent. powder)
1045		Grouting complete
		Cleaning equipment / flushing pump lines
1200		Decon complete
		Depart site
		Will pull piezometer + grout later
	*	Used ~ 400 gal H_2O to make well (75% recovery)
	*	Well set @ 25.4 ft, 10 ft screen, 2.5 ft S.U.
	*	Materials - 17.9 ft riser, 10 ft screen, 6 bags sand, 2 buckets bent pellets, 4 bags cement, 20 lb bent. powder, 1 steel casing w/lock

12/14/84
DATE

George [illegible]
SIGNED

APPROVED

SHEET 1 OF 4

Site Maxwell AFB

Boring No. MW5-2

Hole Size 12 in   Slot 0.010 in

Screen Length 15 ft   Mat'l Sch 40 PVC

Diameter 4 in

Casing Length 7.5 ft + 2.5 ft SU   Mat'l Sch 40 PVC

Diameter 4 in

Date Start 12/14/84   Finish 12/15/84

Contractor ESE   Driller Law Eng.

Location Coordinates N

E

Filter Materials formation + bagged sand

Grout Type 2011 cement, bentonite

Development

Static Water Level

Top of Well Elevation

Drill Type Hollow Stem Auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap					Log based on split spoon samples, cuttings, drill rate
			6 in locked steel casing					
	0				G.L.			grout
		SC	Clayey sand, 30% clay, 7.5YR 4/4 (dk yellow brown) to 10YR 7/1 (light gray), sl. plastic, soft, damp, N.A.B., flood plain	2 3 4	8"	1		Contact @ 4.5 to 9.0 ft approximate; bentonite seal
	5	CH	Inorganic clay, 10YR 5/8 (yellow brown) to 5Y 7/1 (lt. gray), very plastic, med. consist., damp, mottled, flood plain	3 5 7	13	2		Contact @ 11 ft sharp; 12 in borehole; PVC casing joint
				4 6 7	10	3		PVC screen; bagged sand
	10	SC	Interbedded clayey sand + clay, 5Y 6/1 (gray), sl. to v. plastic, dense + stiff, damp, flood plain	10 10 20	18	4		1st H_2O @ 11 ft based on wet sand in sampler
		SW	Fine to coarse quartz sand, well graded, subang., 5Y 8/1 (white), non plastic, loose, wet, fluvial		JOINT			
	15	SC	Fine clayey sand lens, 7.5YR 5/8, sl. plastic, wet	6 8 7	14	5		Contact @ 15.5 ft sharp
		SW	V. fine to cs. sand, 5% muscovite, well graded, round, 2.5Y 7/4 (yellow), non plastic, loose, wet, fluvial					caved sand

Signed George Cole   K-65   Approved

Site MAFB

SHEET 2 OF 4

Boring No. MW5-2

Location Coordinates N

Hole Size Slot

E

Screen Length Mat'l

Filter Materials

Diameter

Grout Type

Casing Length Mat'l

Development

Diameter

Static Water Level

Date Start 12/14/84 Finish 12/15/84

Top of Well Elevation

Contractor Driller Drill Type

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	Fine to coarse quartz sand, 1% muscovite, well graded, mod. round, 10YR 7/6 (yellow), non plastic, very loose, wet, N.A.B. fluvial	1, 2, 1	18	6, 7	EOW 22.5 Ft	12 in borehole Caved sand PVC screen PVC end cap
	25	EOH					EOH 25 Ft	

Signed George Voth

K-66

Approved

Site Maxwell AFB
Boring No. MW 5-2

SHEET 3 OF 4

12/14 1200 Set up on-site
Pull PZ 5-2
Move 10 ft to the south for MW 5-2
1300 Lunch
1400 Prepare to start
1440 Auger to 2.5 ft
Spoon 2.5 to 4.0 ft
Auger to 5.0 ft
Spoon 5 to 6.5 ft
1500 H-NU calibrated
Span @ 9.8 = 65 ppm
Zero, OK
Auger to 7.5 ft
Spoon 7.5 to 9 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
1520 1st sand + water @ 11 ft — no (0) reading on H-NU
Auger to 15 ft
Spoon 15 to 16.5 ft
Auger to 20 ft
1540 Spoon 20 to 21.5 ft
Water level in augers @ 8.9 ft, G.L.
1600 Overdrill to 25 ft (plan to set well @ 22 ft) to attempt to remove 7 ft of sand in augers
Lift up & auger down several times — no luck
Fill augers w/ water & repeat — no luck
1650 Pull augers to 25 ft, fill w. water, & leave overnite

12/15 0600 Drillers arrive
0630 ESE arrive
Dozer gone for load of sand
Still 8 ft of sand in augers
0645 Rig up rotary bit to clean out augers

12/14/84 DATE

George Post SIGNED

APPROVED

Site Maxwell AFB
Boring No. MW 5-2

12/15 cont 0700 Out of water (truck is in town for sand)
DOWNTIME - 2 hours
0900 Truck w. water & sand returns
Recommence drilling - cleaning hole w rotary bit
0940 Hole cleaned out - yea!
Pipe run - 20 min DOWNTIME
1000 Pipe's here - clean w. water & brushes
1005 Install well to 22.5 ft (screen 7.5 to 22.5 ft)
1050 Augers pulled to 10 ft
Hole caved to 12 ft
Add sand (washing into hole w. water)
1050 Water run
1130 Water truck back
Resume sanding
1200 Sand to 4 ft (6 bags, from 12 to 4 ft)
Bentonite pellets to 2.5 ft (1 bucket)
Grout to surface

* Used 225 gal to make well (water!) (75% recovery)
* Well set @ 22.5 ft, 15 ft screen, 2.5 ft S.U.
* Materials - 25.0 ft riser, 15 ft screen,
6 bags sand, 1 bucket bent. pellets

1230 Cleaning augers
1245 Depart site - move to 5-4
Calibrate H-NU
Span @ 9.8 = 65 ppm
Zero, OK

12/15/84
DATE

George Post
SIGNED

APPROVED

Site Maxwell AFB
Boring No. MWS-3
Hole Size 12 in Slot 0.010 in
Screen Length 20 ft Mat'l Sch 40 PVC
Diameter 4 in
Casing Length 8 ft + 2.5 ft SU Mat'l Sch 40 PVC
Diameter 4 in
Date Start 1/10/85 Finish 1/11/85
Contractor ESE Driller Lambing
Location Coordinates N ______ E ______
Filter Materials formation + bagged sand
Grout Type 20/1 cement / bentonite
Development ______
Static Water Level ______
Top of Well Elevation ______
Drill Type Hollow Stem auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap					Log based on split spoon samples, cuttings, drill rate
			6 in locked steel casing					
	0				G.L.			
		CL	Silty clay, 20% silt, 7.5YR 5/8 (strong brown) to 5Y 7/1 (lt. gray), mod plastic, soft, mottled, moist, flood plain	grout 5 7 21	6	1		PVC casing. A piece of wood was wedged in the foot of the spoon (Sample 1)
	5	CL	Sandy, silty micaceous clay, 20% f. sand, 10% silt, 5% muscovite, 5Y 6/1 (gray) w. some 7.5YR 5/8 (strong brown), mod. plastic, soft, N.A.B., moist, flood plain	3 4 5	12	2		bentonite seal
				2 1 3	6	3		12 in borehole; bagged sand; joint
	10	CL	Silty, sandy micaceous clay, 20% silt, 10% fine sand, 5% muscovite, 2% dk green nodules, 5Y 6/1 (gray), mod. plastic, v. soft, N.A.B., wet, flood plain	1 2 1	10	4		1st H_2O based on water level in augers near 12 ft (probably shallower)
					PVC screen			Water later measured @ 10 ft in augers
	15	SM	Silty, sl clayey f. to med sand, well graded, 20% silt, 5% clay, 5% muscovite, 7.5YR 5/8 (strong brown) to 2.5Y 7/4 (pale yellow), non plastic, loose, colors alternate, wet, flood plain	4 5 6	18	5		All contacts approximate & gradational
					joint			

Signed George Book K-69 Approved ______

Site MAFB

Boring No. MW5-3

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 1/10/85 Finish 1/11/85

Contractor ______ Driller ______

Location Coordinates N ______

E ______

Filter Materials ______

Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	V. fine to coarse sand, 5% silt, 5% muscovite, 5% black grains, well graded, 10YR 7/8 (yellow), nonplastic, loose, wet, N.A.B. fluvial	2 3 2	18	6		logged sand caved sand 12 in borehole Contact at 23 ft approximate and gradational
	25	SW to SC	V. fine to coarse sand, 5% silt, 5% clay, 5% black grains, 5% muscovite, well graded, 10YR 5/8 (yellow brown), non plastic, loose, wet, N.A.B., fluvial	3 5 6	18	7	EOW 28 ft EOH 29 ft	PVC screen PVC end cap
	30	EOH						

Signed ______ K-70 Approved ______

Site Maxwell AFB
Boring No. MW 5-3 SHEET 3 OF 4

1/9 Rig stuck moving onto hole — wait for dozer in AM

1/10 0800 Dozer pulls onto rig
Rig moves onto hole along path cut by dozer.
0830 Water truck stuck + pulled out by dozer!
0845 Set up rig
Calibrate HNU; 65 ppm @ Span = 7.31
Starting to rain — may never get rig out!
0900 Auger to 2.5 ft
Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
Auger to 7.5 ft
Spoon 7.5 to 9 ft
Auger to 10 ft
0935 Spoon 10 to 11.5 ft
Auger to 15 ft
Spoon 15 to 16.5 ft
Auger to 20 ft
1010 Spoon 20 to 21.5 ft
Would like to put 15 ft of screen (from 8 to 23 ft) but driller is out of 5 ft sections; plan to set well @ 28 ft (w. 20 ft of screen)
1015 Sand heaved up augers — can't get auger plug back down
Auger to 25 ft
1035 Spoon 25 to 26.5 ft
Auger to 29 ft — ~10 ft inside augers
1100 Driller left to get [illegible] supplies — we're also out of PVC riser (casing)
1430 Can't get any more threaded PVC until tomorrow afternoon; will attempt to heat-weld a piece of 10 ft unthreaded riser to the 20 ft of threaded screen (with a slip coupling)
1445 Rig up to wash out hole w. rotary bit
Rain has stopped

1/10/85 DATE George [illegible] SIGNED

APPROVED

Site MAFB
Boring No. MWS-3

SHEET 4 OF 4

1/10 500 Heat welding did not work
Driller gone to Birmingham for pipe, will return in AM (~1100)

1/11 1100 Driller, ESE on-site (w. threaded casing!)
1115 Wash out hole again w. rotary bit
1125 Well set in augers
Begin pulling augers
Well fell to 29 ft, pull up to 28 ft
1150 Sand caved to 19 ft
Add sand to 5 ft (14 sm bags = 7 lg bags)
1215 Pellets to 4 ft (1 bucket)
1245 Grout to surface

* Used 500 gal. H_2O to make well (75% return)
* Well set @ 28 ft (screen 8 to 28, 2.5 ft S.U.)
* Materials - 10.5 ft riser, 20 ft screen, 14 small bags sand, 1 bucket pellets, bags cement, # bent. powder, 1 steel casing w/lock

We will probably have to be pulled off-site by the dozer

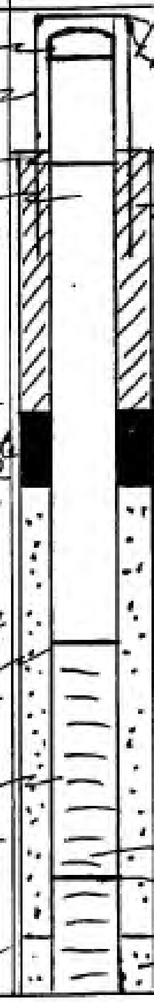
1/11/85
DATE

[signature]
SIGNED

APPROVED

Site Maxwell AFB
Boring No. MW 5-4
Hole Size 12 in — Slot 0.010 in
Screen Length 15 — Mat'l Sch 40 PVC
Diameter 4 in
Casing Length 10.5 ft + 2.4 ft SU — Mat'l Sch 40 PVC
Diameter 4 in
Date Start 12/15/84 — Finish 12/16/84
Contractor ESE — Driller Law Eng.

Location Coordinates N ______ E ______
Filter Materials formation + bagged sand
Grout Type 20/1 cement / bentonite
Development ______
Static Water Level ______
Top of Well Elevation ______
Drill Type Hollow Stem auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			PVC slip cap; 6 in steel locked casing; joint					Log based on split spoon samples, cuttings, drill rate
	0	CL	Silty clay, 25% silt, 10YR 7/1 (lt gray) to 10YR 5/8 (yel. brown), mod. plastic, stiff, dry, N.A.B, mottled colors, flood plain	3 8 8	9	1	PVC casing	grout
		∇ SW	Fine to coarse sand, well graded, non plastic, loose, wet, fluvial	7 9 14	14	2		Actual thickness of unit marked 5.5 to 6.5 ft is unknown but no more than 1 ft
	5	CH	Inorganic clay, 10% silt, 10YR 7/1 (lt gray) to 10YR 5/8 (yel. brown), v. plastic, stiff, sl. damp, N.A.B, mottled, flood plain (moist below 8.5 ft)	4 7 8	14	3	bentonite seal	Perched H_2O between 4.5 + 5.5 ft
	10	CH ∇	Inorganic clay, 10% silt, 5% muscovite, 5Y 5/1 (gray) to 10YR 6/6 (brown. yellow), v. plastic, stiff, moist, N.A.B, mottled, flood plain	3 6 7	16	4	joint; bagged sand	Increase in drill rate @ ~12.5 ft; True water table near 12 ft
	15	SM	Interbedded v. fine to fine micaceous sand and clayey micaceous silt, 5Y 5/1 (gray), non to sl. plastic, loose, wet, flood plain	1 1 1	14	5		PVC screen; joint
		SW						caved sand

Signed [signature] — K-73 — Approved ______

Site Maxwell AFB

Boring No. MW 5-4

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 12/15/84 Finish 12/16.

Contractor ______ Driller ______

Location Coordinates N ______

E ______

Filter Materials ______

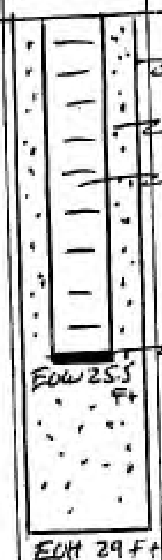
Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	Fine to coarse sand, well graded, round, 10YR 6/8 (brown-yellow), non plastic, loose, N.A.B., wet, fluvial	2 2 2	9	6		12 in borehole caved sand pvc screen pvc end cap
	25							
	30	EOH						

Signed George ______ K-74 Approved ______

Site Maxwell AFB
Boring No. MW 5-4

SHEET 3 OF 4

12/15 1300 Arrive + set up on-site
Pull + grout piezometer (PZ 5-4) (1 bag cement)
1330 LUNCH
1430 Begin augering - monitor w. H-NU
Auger to 2.5 ft
Spoon 2.5 to 4.0 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
Auger to 7.5 ft
Spoon 7.5 to 9 ft
Auger to 10 ft
1515 Spoon 10 to 11.5 ft
Auger to 15 ft
Spoon 15 to 16.5 ft
Auger to 20 ft
1600 Spoon 20 to 21.5 ft
Auger to 29 ft (overdrilled 4 ft to aid in setting well to 25 ft
Sand heaved 10 ft up inside augers!
1630 Depart site + drop off cement, etc. near Site I

12/16 0630 ESE, drillers arrive on-site
Clean augers w. rotary bit
0725 water run
0800 water truck returns
Resume wash drilling - 3 more ft of sand to remove!
0820 Calibrate H-NU
Span @ 9.5 = 65 ppm
Zero, OK
0900 Install well, pull augers
0915 Caved to 17 ft - begin adding sand
Sand to 7 ft (7 bags)
1000 Pellets to 5.5 ft (1.5 buckets)

12/15/84 DATE

George Foe[?] SIGNED

APPROVED

Site Maxwell AFB

Boring No. MW 5-4

SHEET 4 OF 4

12/16 1000 Mixing grout
cont 1035 Grout to surface

* Well placed @ 25.5 ft, 15 ft screen, 2.4 ft S.U.
* Used 300 gal H_2O to make well (75% return)
* Materials - 13 ft riser, 15 ft screen, 7 bag sand, 1½ bucket pellets, 4 bags cement, 20# bent. powder, 1 steel casing w/ lock

1035 Cleaning augers
Cleaning site

1100 Depart site - move to Site I

12-16-84 DATE

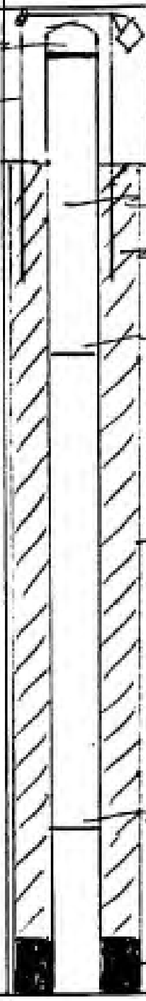
[signature] SIGNED

APPROVED

SHEET ________ OF ________

Site Maxwell AFB
Boring No. MW6-1
Hole Size 12 in Slot 0.010 in
Screen Length 15 ft Mat'l Sch 40 PVC
Diameter 4 in
Casing Length 24 ft+2.5 ft SU Mat'l Sch 40 PVC
Diameter 4 in
Date Start 1/9/85 Finish 1/9/85
Contractor ESE Driller Law Eng Drill Type Hollow Stem auger 12 in OD, 6 in ID

Location Coordinates N ________
E ________
Filter Materials formation + bagged sand
Grout Type 20/1 cement/bentonite
Development ________
Static Water Level ________
Top of Well Elevation ________

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap					Log based on split spoon samples, cuttings, drill rate
			6 in locked steel casing					
	0	CL	Silty clay, 15% silt, 5% "organic" nodules, 10YR 5/8 (yellow. brown) to 5Y 7/1 (lt. gray), mod. plastic, med. consist., damp, mottled, flood plain	5 7 9	13	1	G.L	PVC casing; grout; joint
	5			5 11 15	15	2		Contacts approximate and very gradational
		CL	Silty clay, 20% silt, 7.5YR 5/8 (strong brown) to 5Y 7/1 (lt. gray), mod. plastic, stiff, damp, mottled, flood plain	7 16 17	18	3, 4		12 in borehole
	10			8 13 20	18	5, 6		
		CL	Silty clay, 30% silt, 10% very fine sand, 7.5YR 5/8 (strong brown) to 5Y 7/1 (lt. gray), mod. plastic, stiff, damp, mottled, flood plain					joint
	15			8 10 16	14	7, 8		
		CL	Sl. silty clay, 10% silt, 5Y 7/1 (lt. gray), mod. plastic, stiff, damp, N.A.B., flood plain					bentonite seal

Signed [signature] K-77 Approved ________

SHEET ______ OF ______

Site MAFB

Boring No. MW 6-1

Location Coordinates N ______ E ______

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Filter Materials ______

Diameter ______

Grout Type ______

Casing Length ______ Mat'l ______

Development ______

Diameter ______

Static Water Level ______

Date Start 1/9/85 Finish 1/9/85

Top of Well Elevation ______

Contractor ______ Driller ______ Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	Recovery	Box or Sample #	Sketch of Construction	Remarks
		CL						bentonite seal
	20	CL	Silty, sandy clay, 20% silt, 15% very fine sand, 7.5YR 5/8 (strong brown) to 5Y 7/1 (lt. gray), mod plastic, stiff, damp, mottled, flood plain	4 10 15	16	9, 10		12 in borehole; bagged sand; PVC casing
	25	CL to ML	Interbedded silty clay and clayey, sandy silt, 10% muscovite, 5% "organic" matter, 5Y 7/1 to 7/2 (lt. gray), non to mod. plastic, stiff, very damp, flood-plain	8 13 14	18	11, 12		joint; 1st H_2O near 27 ft based on water measured inside augers
	30	SM	Silty, micaceous fine sand, 15% silt, 10% muscovite, 10YR 7/6 (yellow) with some lenses 7.5YR 5/8 (strong brown), non plastic, dense, wet, U.A.B., fluvial	14 18 37	18	13, 14		joint; Contact at 31 ft sharp; all others approximate & gradational
	35	SW	Gravelly fine to coarse sand, 20% gravel (to 2 cm), well graded, round, 10YR 7/6 (yellow), non plastic, dense, wet, U.A.B, fluvial	1 2 3	18	15, 16		PVC screen; caved sand

Signed [signature]

K-78

Approved ______

SHEET ______ OF ______

Site MAFB

Boring No. MW 6-1

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 1/9/85 Finish 1/1/85

Contractor ______ Driller ______

Location Coordinates N ______

E ______

Filter Materials ______

Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	40	SW	Gravelly fine to coarse sand, 30% gravel (to 1.5in), well graded, round, 10YR 7/8 (yellow), non plastic, loose, wet, N.A.B., fluvial				ECW 39.6 ft	PVC screen PVC endcap caved sand 12 in borehole
		EOH					EOH 43 ft	
	45							

Signed [signature] K-79 Approved ______

Site Maxwell AFB
Boring No. MW 6-1 SHEET ____ OF ____

1200 Set up on-site
1230 Begin augering - monitor w H-NU
Auger to 2.5 ft
Spoon 2.5 to 14 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
Auger to 7.5 ft
Spoon 7.5 to 9 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
Auger to 15 ft
1255 Spoon 15 to 16.5 ft
Auger to 20 ft
Spoon 20 to 21.5 ft
Auger to 25 ft
Spoon 25 to 26.5 ft
Auger to 30 ft
Spoon 30 to 31.5 ft
Auger to 35 ft
1350 Spoon 35 to 36.5 ft
Auger to 40 ft (sev. ft sand in augers)
1410 Auger to 43 ft + attempt to set well
Couldn't pull auger w/o well
Pull well out, lift augers, auger back down to 43 ft
Install well
Pull augers - coming up w/o well!
Well placed @ 40 ft (15 ft screen, 2.5 ft S.U.)
Sand caved to 27 ft
Add sand to 20 ft (10 sm bags = 5 lg bags)
1555 Bent. pellets to 17 ft (3 buckets)
1630 Grout to surface + clean augers (4 bags cement; 20# powder)
1645 Depart site

1/9/85 DATE [signature] SIGNED

APPROVED

Site MAFB

Boring No. MW6-1 SHEET ____ OF ____

* Well set @ 39.6 ft (15 ft screen, 2.5 ft S.U.)
* Used 25 gal H_2O to make well (0% recovery)
* Materials: 27.5 ft casing, 15 ft screen, 10 small bags sand (= 5 lb. bags), 3 bucket pellets, 4 bags cement, 20# bent. powder, 1 steel casing w/ lock

1/9/85 DATE

George [illegible] SIGNED

APPROVED

Site Maxwell AFB | SHEET ____ OF ____

Boring No. MW 6-2 | Location Coordinates N ____ E ____

Hole Size 12 in | Slot 0.010 in

Screen Length 15 ft | Mat'l Sch 40 PVC | Filter Materials formation + graded sand

Diameter 4 in | Grout Type 20/1 cement / bentonite

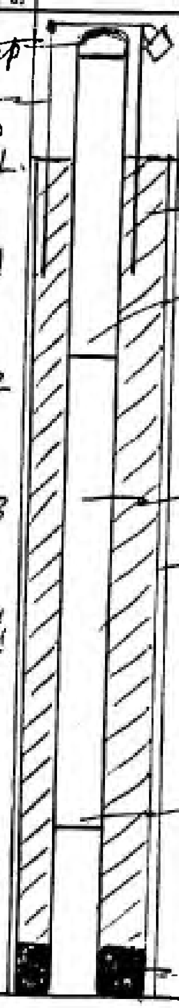
Casing Length 24.7 + 2.5 ft. SU | Mat'l Sch 40 PVC | Development ____

Diameter 4 in | Static Water Level ____

Date Start 1/9/85 | Finish 1/9/85 | Top of Well Elevation ____

Contractor ESE | Driller Law Guy | Drill Type Hollow stem auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap; 6 in locked steel casing					Log based on split spoon soil samples, drill rates, cuttings
	0	CL	Silty clay, 25% silt, 10YR 4/4 (dk yellow brown), mod plastic, med., damp, N.A.B., flood plain	5, 12, 13	15	1	G.L.	grout; joint
	5	CL	Silty clay, 15% silt, "organic" lense near 5.5 ft, 5% "organic" throughout, 7.5YR 4/6 (strong brown) to 10YR 7/6 (yellow), mod plastic, med. consist., damp, mottled, flood plain	3, 8, 11	16	2		All contacts approximate and gradational
		CL	Silty clay, 30% silt, 7.5YR 5/8 (strong brown) to 5Y 7/1 (lt gray), mod. plastic, stiff, damp, mottled, flood plain	7, 10, 15	13	3		PVC casing; 12 in borehole
	10	CL	Silty, sandy clay, 25% silt, 15% v. fine sand, 7.5YR 5/8 (strong brown) to 5Y 7/1 (lt. gray), mod. plastic, stiff, damp, mottled, flood plain	7, 11, 12	13	4, 5		joint
	15	SM	Silty, clay fine sand, 25% silt, 10% clay, 5Y 7/1 (lt. gray), sl. plastic, dense, moist, N.A.B., flood plain	7, 12, 13	15	6, 7		bentonite seal



Signed [signature]

Approved ____

Site *MAFB* SHEET ____ OF ____

Boring No. *MW6-2* Location Coordinates N ____

Hole Size ____ Slot ____ E ____

Screen Length ____ Mat'l ____ Filter Materials ____

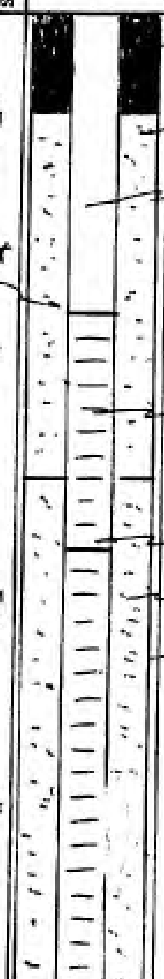
Diameter ____ Grout Type ____

Casing Length ____ Mat'l ____ Development ____

Diameter ____ Static Water Level ____

Date Start *1/9/85* Finish *1/9/85* Top of Well Elevation ____

Contractor ____ Driller ____ Drill Type ____

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	CL	Silty clay, 30% silt, 7.5YR 5/8 (strong brown), to 5Y7/1 (lt. gray), mod plastic, stiff, damp, mottled, flood-plain	10 12 14	18	8, 9		bentonite seal; bagged sand; PVC casing
					joint			
	25	SM	Silty, micaceous fine sand, 20% silt, 10% muscovite, 5% black grains, 5Y7/1 (lt. gray), non plastic, loose, occasional clay stringers, moist, floodplain	12 14 17	11	10, 11		All contacts approximate and gradational; PVC screen
	30	SW	Fine to coarse gravelly sand, 20% gravel (to 1.5 cm), 5% f. black grains, well graded, round, 10YR 7/8 (yellow), non plastic, loose, N.A.B., wet, fluvial	7 12 22	12	12, 13		joint; caved sand; 12 in borehole
	35	SW	Fine to coarse gravelly sand, 30% gravel (to 2 cm), 3% black grains, well graded, round, 10YR 7/8 (yellow), non plastic, loose, N.A.B., wet, fluvial	1 2 4	12	14		

Signed *[signature]* K-83 Approved ____

Site LLAFB

SHEET ______ OF ______

Boring No. MW6-2

Location Coordinates N ______

E ______

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Filter Materials ______

Diameter ______

Grout Type ______

Casing Length ______ Mat'l ______

Development ______

Diameter ______

Static Water Level ______

Date Start 1/9/85 Finish 1/9/85

Top of Well Elevation ______

Contractor ______ Driller ______ Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	40	SW	Fine to coarse gravelly sand, 30% gravel (to 2cm) 3% black grains, well graded, round, 10YR7/8 (yellow), non plastic, loose, N.A.B., wet, fluvial				EOW 39.7 ft	PVC screen PVC end cap Coarse sand 12 in borehole
	45	EOH					EOH 44 ft	

Signed [signature]

K-84

Approved ______

Site Maxwell AFB
Boring No. MW6-2

SHEET ______ OF ______

0730 Set up on-site
0740 Calibrate H-NU, 65 ppm @ Span = 7.32
Auger to 2.5 ft
Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
Auger to 7.5 ft
Spoon 7.5 to 9 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
Auger to 15 ft
Spoon 15 to 16.5 ft
Auger to 20 ft
Spoon 20 to 21.5 ft
0830 Auger to 25 ft
Spoon 25 to 26.5 ft
Auger to 30 ft
Spoon 30 to 31.5 ft
Auger to 35 ft
Spoon 35 to 36.5 ft
0905 Auger to 44 ft (overdrilled 4 ft intentionally)
0910 Install well (sev. ft. of sand in augers but we're going to try it !) (well set @ ~ 38 ft)
0915 Begin pulling augers (w- chain + hydraulics)
Well fell to ≈ 39.7 ft, 0.3 ft short of desired depth but quite acceptable!
Continue pulling augers
Sand caved to 28 ft
Add sand to 20 ft (12 sm. bags = 6 big ones)
0945 Bent. pellets to 17 ft (3 buckets)
1015 Grout to surface
Clean augers
1045 Depart site

1/9/85
DATE

George [illegible]
SIGNED

APPROVED

Site MAFB

Boring No. MW6-2

SHEET ______ OF ______

* Well set @ 39.7 ft (15 ft screen, 2.5 ft S.U.)

* Used 0 gal H_2O to make well

* Materials – 27.5 ft casing, 15 ft screen, 12 cu. bags sand (≈ 6 lg. bags), 3 buckets pellets, 2 bags cement, 15# bent. powder, 1 steel casing w/ lock

1/9/85 DATE

SIGNED

APPROVED

Site Maxwell AFB | SHEET 1 OF 5

Boring No. MW 6-3 | Location Coordinates N ______ E ______

Hole Size 12 in | Slot 0.010 in

Screen Length 15 ft | Mat'l Sch 40 PVC | Filter Materials formation + graded sand

Diameter 4 in | Grout Type 20/1 cement/bentonite

Casing Length 25 ft + 2.5 ft S.U. | Mat'l Sch 40 PVC | Development ______

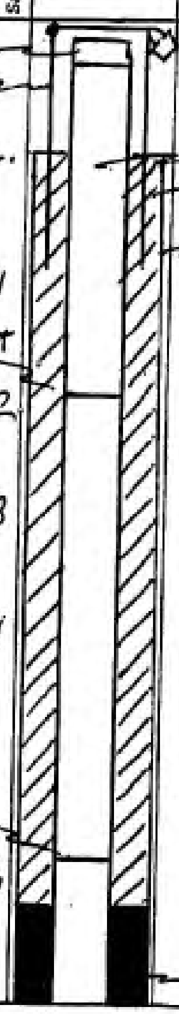
Diameter 4 in | Static Water Level ______

Date Start 1/7/85 | Finish 1/8/85 | Top of Well Elevation ______

Contractor ESE | Driller Lan Eng | Drill Type Hollow stem auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Remarks
			4 in PVC slip cap 6 in locked steel casing				Log based on split spoon samples, cuttings, drill rate
	0	CL	Sl. silty inorganic clay, 10% silt, 5% "organic" black nodules (2 cm), 5Y 7/2 (lt gray) to 7.5YR 5/6 (strong brown), mod. plastic, stiff, dry, mottled, flood plain	7 16 19	G.L. 11	1 joint	PVC casing Grout 12 in borehole
	5	CL	Silty inorganic clay, 20% silt, 5Y 7/2 (lt. gray) to 7.5YR 5/6 (strong brown), mod. plastic, stiff, dry, mottled, floodplain (some "organic" smears)	7 16 20	12	2	The "organic" matter may be oxidized Fe oxides (or ?) — appears almost crystalline in places; when present in the upper few ft. of boring existed as nodules, but at depth seems to fill fractures in the clay
		CL	Silty inorganic clay, 20% silt, 5Y 7/2 (lt. gray) to 7.5YR 5/6 (strong brown), mod. plastic, stiff, dry, mottled but less so than above, flood-plain	10 15 18	12	3	
	10			10 16 20	13	4	
		CL	Silty inorganic clay, 15% silt, 5Y 7/1 (lt gray) to 10YR 5/6 (yellow brown), mod. plastic, stiff, damp, sl. mottled, flood plain		joint		All contacts approximate + gradational
	15	CL	Silty clay, 35% silt, 5Y 7/1 (lt gray) to 10YR 5/6 (yellow brown), sl.-mod. plastic, stiff, damp, sl. mottled, flood plain	10 16 23	15	5, 6	Bentonite seal

Sketch of Construction:



Signed ______ | Approved ______

Site MAFB

Boring No. MW 6-3

Hole Size 12 in Slot 0.010 in

Screen Length ______ Mat'l Sch 40 PVC

Diameter 4 in

Casing Length ______ Mat'l Sch 40 PVC

Diameter 4 in

Date Start 1/7/85 Finish 1/8/85

Contractor ESE Driller Law Eng. Drill Type hollow stem auger

Location Coordinates N ______

E ______

Filter Materials ______

Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	CL	Silty inorganic clay, 25% silt, 5Y 7/1 (lt gray) to 10YR 5/6 (yellow brown), 5% "organic" matter, mod. plastic, stiff, damp, mottled, flood plain	bentonite seal; 13 18 26	18	7, 8		Log based on split spoon samples, cuttings, drill rate; PVC casing; bagged sand; 12 in borehole
	25	ML	Clayey silt, 25% clay, 10% muscovite, 5Y 7/1 (lt. gray), 2% "organic" matter, sl. plastic, stiff, moist, flood plain	7 10 14	18	9, 10		joint; PVC screen
		SW	Fine to coarse sand, 10% black grains, well graded, 2.5Y 7/4 (pale yellow), non plastic, dense, wet, fluvial	joint		10.5		1st H_2O near 27 ft based on water level in augers
	30	SW	Gravelly fine to coarse quartz sand, 30% gravel (to 2 cm), well graded, round, 10YR 7/8 (yellow), non plastic, v. dense, wet, N.A.B., fluvial	12 32 42	18	11, 12		Contact @ 30.4 ft sharp; caved sand
	35	SW	Gravelly fine to coarse sand, 25% gravel (to 2 cm) well graded, round, 2.5Y 7/6 (yellow), non plastic, v. dense, wet, N.A.B., fluvial	5 12 37	18	13		

Signed ______ Approved ______

SHEET 3 OF 5

Site MAFB

Boring No. MW 6-3

Hole Size ______ Slot ______

Screen Length ______ Mat'l ______

Diameter ______

Casing Length ______ Mat'l ______

Diameter ______

Date Start 1/7/85 Finish 1/8/85

Contractor ______ Driller ______

Location Coordinates N ______

E ______

Filter Materials ______

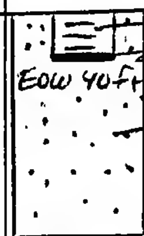
Grout Type ______

Development ______

Static Water Level ______

Top of Well Elevation ______

Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	40		Gravelly fine to coarse sand, 25% gravel (to 2 in), well graded, round, 2.5Y 7/6 (yellow), nonplastic, v. dense, wet, N.A.B., fluvial				 EOW 40ft	PVC screen PVC end caps 12 in borehole coarse sand
							EOH 44 Ft	
	45	EOH						

Signed George Foster K-89 Approved ______

Site Maxwell AFB
Boring No. MW 6-3

SHEET 4 OF 5

1/7 1430 Set up on-site
1445 Begin augering - monitor with HNU
Auger to 2.5 ft
Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
Auger to 7.5 ft
Spoon 7.5 to 9 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
Auger to 15 ft
Spoon 15 to 16.5 ft
Auger to 20 ft
1530 Spoon 20 to 21.5 ft
Auger to 25 ft
1545 Spoon 25 to 26.5 ft
1630 Auger to 30 ft
Spoon 30 to 31.5 ft
Auger to 35 ft
Spoon 35 to 36.5 ft
Water measured @ 27.5 ft - G.L.
1700 Overdrilled to ~44 & pulled up to 40 ft ~ 4 ft of sand leaved inside augers
Depart site - return and in AM
1/8 0730 Arrive on-site
Water in augers @ 27.2 ft, G.L.
0755 Auger to 44 ft - only 2 ft of sand in augers (2 ft fell out!)
0805 Set well to ~~~~ 42 ft; will pull up to 40 after pulling augers several ft
0810 Pulling augers w/ chain / hydraulics
Well pulled up to 40 ft
Pull rest of augers (Continue!)
0835 Hole caved to 29 ft
Add sand to 20 ft (13 small bags = 6.5 bags (reg))

1/7/95
DATE

[signature]
SIGNED

APPROVED

Site MAFB
Boring No. MW 6-3

SHEET 5 OF 5

0900 Bentonite pellets to 16 ft (3 buckets)
Pull augers all the way out
0935 Grout to surface (3 bags cement, 15# bent. powder)
1030 Clean augers
Calibrate HNU; 65 ppm @ Span 9.9
1040 Depart site

* Used 0 gal H_2O to make well
* Well set @ 40 ft (15 ft screen, 2.5 ft S.U.)
* Materials - 27.5 ft riser, 15 ft screen, 3 bags cement, 15# bent. powder, 3 buckets pellets, 13 small bags sand (= 6.5 lg. bags), 1 steel casing w/ lock

1/8/85
DATE

George Post
SIGNED

APPROVED

SHEET 1 OF 4

Site Maxwell AFB

Boring No. MW 7-1 | Location Coordinates N

Hole Size 12 in | Slot 0.010 in | E

Screen Length 10 ft | Mat'l Sch 40 PVC | Filter Materials formation + bagged sand

Diameter 4 in | Grout Type 20/1 cement / bentonite

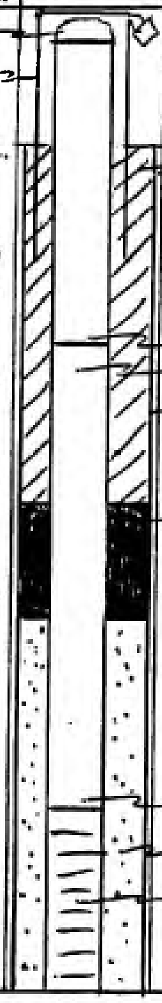
Casing Length 14.3 ft + 1 ft | Mat'l Sch 40 PVC | Development

Diameter 4 in | Static Water Level

Date Start 1/4/85 | Finish 1/4/84 | Top of Well Elevation

Contractor ESE | Driller Law Eng | Drill Type Hollow Stem Auger 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap; 6 in locked steel casing					Log based on split spoon samples, cuttings, drill rate
	0					G.L.		grout
		SC	Clayey, silty fine sand, 20% clay, 20% silt, 2.5YR 4/8 (red) to 10YR 6/8 (brown. yellow), sl. plastic, dense, dry, mottled colors, flood plain (5% muscovite)	9 16 20	18	1, 2		All contacts approximate and gradational
	5	SM	Silty, clayey fine sand, 20% silt, 15% clay, 2.5YR 4/8 (red) to 10YR 6/8 (brown. yellow), sl. plastic, dense, damp, mottled, flood plain (5% muscovite)	6 10 11	16	3		joint; PVC casing; 12 in borehole
		SM	Silty, clayey very fine sand, 35% silt, 10% clay, 10YR 6/8 (brown. yellow) to 5Y 7/2 (lt. gray), sl. plastic, dense, damp, mottled, flood plain (7% muscovite)	6 8 9	16	4		bentonite seal
	10	SM	Silty, clayey fine sand, 10% silt, 10% clay, 10YR 6/6 (brown. yellow), non to sl. plastic, med. consist., v. damp, N.A.B., flood plain (7% muscovite)	4 6 7	13	5		1st H_2O near 14 ft based on wet spoon sample @ 15 ft (PZ7-1, 10 ft to the north, has static water @ ~16 ft)
	15	SW / CH	Interbedded fine to coarse sand and inorganic clay, 5Y 7/2 (lt gray) to 7.5YR 6/8 (red yellow) non to very plastic, soft, wet, mottled slightly, flood plain	2 3 4	18	6		joint; bagged sand; PVC screen



Signed ________ K-92 Approved ________

Site MAFB | SHEET 2 OF 4

Boring No. MW7-1 | Location Coordinates N ______

Hole Size ______ Slot ______ | E ______

Screen Length ______ Mat'l ______ | Filter Materials ______

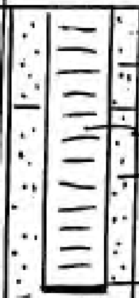
Diameter ______ | Grout Type ______

Casing Length ______ Mat'l ______ | Development ______

Diameter ______ | Static Water Level ______

Date Start 1/4/85 Finish 1/4/85 | Top of Well Elevation ______

Contractor ______ Driller ______ Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	Very fine to med micaceous quartz sand, 20% muscovite, well graded, sub round, 10YR 7/8 (yellow), non plastic, loose, wet, N.A.B., fluvial	2 3 6	18	7, 8	 EOW 24.3 Ft	12 in borehole bagged sand PVC screen caved sand PVC end cap
		SW						
	25	EOH					EOH 25 Ft	

Signed [signature] K-93 Approved ______

Site Maxwell AFB

Boring No. MW7-1

SHEET 3 OF 4

0900	Move onto hole. Cleared w. Mr. Carter, airport manager)
	Calibrate H-NU; 65ppm @ Span = 9.8
0915	Waiting for water truck so augers can be cleaned prior to use.
0935	Water truck return
	Cleaning augers
1000	Begin augering – monitor w. H-NU
	Auger to 2.5 ft
	Spoon 2.5 to 4 ft
	Auger to 5 ft
	Spoon 5 to 6.5 ft
	Auger to 7.5 ft
	Spoon 7.5 to 9 ft
	Auger to 10 ft
	Spoon 10 to 11.5 ft
	Auger to 15 ft
	Spoon 15 to 16.5 ft
	Auger to 20 ft
1105	Spoon 20 to 21.5 ft
1120	Auger to 25 ft
	Sound hole – only 1 ft of sand in augers
	Materials run
1205	Driller return w. pipe, sand, etc (45 min DOWNTIME)
	Water measured inside augers @ ~15.5 ft, G.L.
1215	Install well to ~ 25 ft (10 ft screen)
	Pull augers, well pulled up to ~ 24.5 ft
	Sand caved to 20 ft
	Add sand from 20 to 10 ft (8 small bags)
1255	Bent pellets to 7.6 ft (2 bucket)
	~~Grout to surface~~ LUNCH
1340	Mixing grout (3½ bags cement, 20# bent. powder)
1400	Grout to surface

1/4/85
DATE

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Site MAFB
Boring No. MW 7-1

SHEET 4 OF 4

1400 PZ 7-1 removed & grouted
Will clean augers after moving off hole
1420 Depart site.

* 0 gal H_2O used to make well
* Well set @ 24.3 ft (10 ft screen, 1.0 ft. S.O.)
(airport manager requested no more than 1 ft stick up)
* Materials - 15.3 ft casing, 10 ft screen, 3½ bags cement, 20# bent. powder, 2 buckets pellets, 8 small bags sand (4 lg. bags), 1 steel casing w/ lock

Will spend the rest of the afternoon setting up on MW 3-2, collecting supplies from storage for the weekend, conducting inventory, locating protective posts for wells, etc.

1/4/85 DATE

George [illegible] SIGNED

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Site Maxwell AFB

Boring No. MW 7-2 | Location Coordinates N ____

Hole Size 12 in | Slot 0.010 in | E ____

Screen Length 15 ft | Mat'l Sch 40 PVC | Filter Materials formation + bagged sand

Diameter 2 in | Grout Type 20:1 cement/bentonite

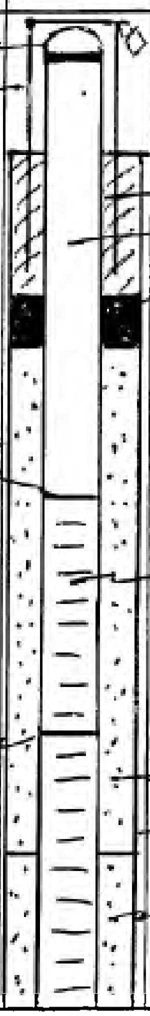
Casing Length 7.3 ft + 2.7 ft 6 in | Mat'l Sch 40 PVC | Development ____

Diameter 4 in | Static Water Level ____

Date Start 12/20/84 | Finish 12/20/84 | Top of Well Elevation ____

Contractor ESE | Driller Lau Eng. | Drill Type Hollow stem auger, 12 in OD, 6 in ID

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap 6 in locked steel casing					Log based on split spoon samples, cuttings, drill rates
	0	CL	Silty sandy clay, 15% silt, 15% fine sand, 10YR4/3 (brown), mod plastic, soft, moist, N.A.B., flood plain	2 3 3	15	1		grout PVC casing bentonite seal
		ML	Clayey silt, 25% clay, 10YR 5/4 (yellow brown), sl. plastic, soft, moist, N.A.B., flood plain					All contacts approximate & gradational except @ 11 ft
	5	CL	Sandy, silty clay, 20% fine sand, 15% silt, 5Y6/1 (gray) to 10YR5/8 (yellow brown), mottled, mod plastic, soft, moist, flood plain	4 4 4	14 joint	2, 3		contact @ 11 ft sharp
		SM	Silty clayey very fine to fine sand, 30% silt, 5% clay (up to 20% clay in places), 5Y 6/1 (gray) to 10YR5/8 (yellow brown), mottled, non to sl. plastic, med density, moist, flood plain	4 6 8	18	4, 5		PVC screen
	10			7 13 13	17	6		1st H_2O near 11 ft based on wet spoon sample
		SW	Fine to coarse sand, 2% muscovite, 2% clay, well graded, mod. round, 5Y7/1 (light gray), non plastic, dense, wet, N.A.B, fluvial		joint			bagged sand 12 in borehole
	15	SW	Fine to coarse sand, 25% gravel (to 0.5 in), well graded, round, 5Y8/2 (white), non plastic, v. dense, wet, N.A.B., ~~fluvial~~	10 20 25	18	7, 8		caved sand



Signed ____ | K-96 | Approved ____

Site MAFB SHEET 2 OF 3

Boring No. MW 7-2 Location Coordinates N

Hole Size Slot E

Screen Length Mat'l Filter Materials

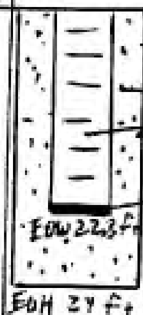
Diameter Grout Type

Casing Length Mat'l Development

Diameter Static Water Level

Date Start 12/20/84 Finish 12/20/84 Top of Well Elevation

Contractor Driller Drill Type

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	Med to coarse quartz sand, 20% gravel (to 2 cm), well graded, round, 10YR 7/8 (yellow), non plastic, dense, wet, N.A.B., fluvial	6 13 18	15	9	 	12 in borehole coarse sand PVC screen PVC end cap
	25	EOH						

Signed George [illegible] K-97 Approved

Site Maxwell AFB
Boring No. MW 7-3

SHEET 3 OF 3

1030 Move onto site w. rig
Helpers still cleaning augers @ 7-3
1040 Decon for MW 7-3 complete
Prepare to commence augering
1045 Auger to 2.5 ft — monitor w. H-NU
Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft
Auger to 7.5 ft
Spoon 7.5 to 9 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
Auger to 15 ft
1130 Spoon 15 to 16.5 ft
Auger to 20 ft
Spoon 20 to 21.5 ft
Auger to 25 ft (overdrilled 2 ft)
Sand heaved inside auger — will rotary out after lunch
1150 Lunch
1230 Water run
1320 Begin w. rotary bit
1345 Well set, pulling augers
Well set @ 22.3 ft (15 ft screen, 2.7 ft S.U.)
Caved to 15 ft
Add sand to 4 ft (8 bags; actually 16 small bags)
1450 Bent. pellets to 3 ft (1 bucket)
Grout to surface (3 bags cement, 15# bent. powder)
1455 Depart site after cleaning augers

* Used 200 gal H_2O to make well (95% return)
* Well set @ 22.3 ft (15 ft screen, 2.7 ft S.U.)
* Materials — 10 ft riser, 15 ft screen, 8 bags sand,
1 bucket pellets, 3 bags cement, 15# bent. powder,
1 steel casing w/ lock

12/20/84
DATE

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Site *Maxwell AFB* SHEET *1* OF *4*

Boring No. *MW 7-3* Location Coordinates N ______

Hole Size *12 in* Slot *0.010 in* E ______

Screen Length *15 ft* Mat'l *Sch 40 PVC* Filter Materials *formation + bagged sand*

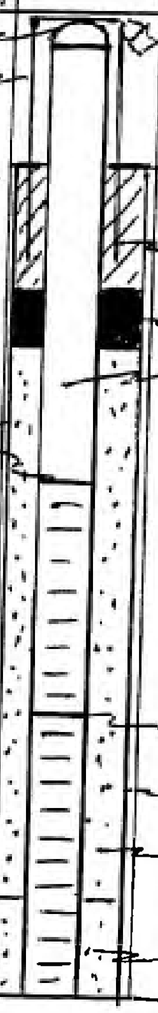
Diameter *4 in* Grout Type *20/4 cement / bentonite*

Casing Length *7 ft + 2.5 ft stickup* Mat'l *Sch 40 PVC* Development ______

Diameter *4 in* Static Water Level ______

Date Start *12/19/84* Finish *12/20/84* Top of Well Elevation ______

Contractor *ESE* Driller *Law Eng.* Drill Type *Hollow stem auger 12 in OD, 6 in ID*

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
			4 in PVC slip cap 6 in locked steel casing					Log based on split spoon samples, cuttings, drill rate
	0	SC	Clayey, gravelly fine to coarse sand, 20% clay, 10% gravel, well graded, 7.5YR 4/6 (strong brown), sl. plastic, loose, damp, N.A.B., flood plain		G.L.			grout
		SM	Silty clayey fine sand, 30% silt, 20% clay, 5Y 5/1 (gray), sl. plastic, med density, damp, N.A.B., flood plain	3 7 4	7	1		bentonite seal
	5	SC	Clayey, silty fine sand, 30% clay, 20% silt, 5Y 5/1 (gray), sl. plastic, soft, moist, N.A.B., flood plain	1 1 1	0	2		PVC casing 1st H_2O near 7 ft based on water measured inside augers
		SP	Fine to med sand, 3% clay, poorly graded, round, 5Y 6/1 (gray), nonplastic, med density, wet, N.A.B., fluvial.	4 5 6	14	3, 4		
	10			10 8 9	12	5		All contacts approximate and gradational
		SW	Med to coarse sand, 5% gravel, well graded, 5Y 6/1 (lt gray), non plastic, dense, wet, N.A.B., fluvial					joint 12 in borehole
	15	SC	Interbedded fine to coarse sand and inorganic clay, 7.5YR 5/8 (strong brown), non to v. plastic, loose to soft, wet, fluvial/flood plain	2 3 5	18	6		bagged sand
		SW						caved sand

Signed *George Koob* K-99 Approved ______

Site MAFB

Boring No. MW 7-3

Hole Size ______ Slot ______ Location Coordinates N ______

Screen Length ______ Mat'l ______ E ______

Diameter ______ Filter Materials ______

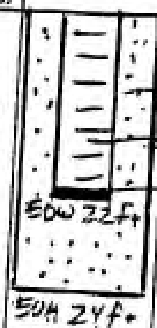
Casing Length ______ Mat'l ______ Grout Type ______

Diameter ______ Development ______

Date Start 12/19/84 Finish 12/20/84 Static Water Level ______

Contractor ______ Driller ______ Top of Well Elevation ______

Drill Type ______

Elevation (ft)	Depth (ft)	Legend	Classification of Materials	Blow Counts	% Recovery	Box or Sample #	Sketch of Construction	Remarks
	20	SW	Fine to very coarse sand, well graded, round, 10YR 6/8 (brownish yellow), non-plastic, dense, wet, N.A.B., fluvial	10 28 28	13	7/8		12 in borehole caved sand PVC screen PVC end cap
	25	SW	Gravelly sand, 35% gravel (to 3 cm), 5% clay, well graded, round to angular, 7.5YR 5/6 (strong brown), non plastic, very dense, wet, N.A.B., fluvial					

Signed [signature] K-100 Approved ______

Site Maxwell AFB
Boring No. MW 7-3

SHEET 3 OF 4

1120 Arrive on-site
1130 Lunch
12:15 Go to Wing's Locksmith & pick up locks for Law Eng.
1300 Return to Base & call John Bowles, Luther Bowles to discuss site cleanup, protective posts, etc.
1310 Return to site — Drillers attempting to free a bolt using torch ~~[illegible]~~ (had to cut it off)
1330 Drillers go for bolt (hardware store)
Helper & I replace 4 locks with new ones on previously installed wells
1405 ESE back to site
1515 Drillers return
~~[illegible]~~
1520 Begin augering
Auger to 2.5 ft
Spoon 2.5 to 4 ft
Auger to 5 ft
Spoon 5 to 6.5 ft — 0 recovery (sample 2 in cuttings)
Auger to 7 ft — plastic, metal, glass debris coming up the augers
1545 Discontinue augering while charging H-NU with portable generator
1555 Calibrate H-NU — 0 ppm above background
Auger to 7.5 ft — carefully monitoring w. H-NU
1600 Spoon 7.5 to 9 ft
Auger to 10 ft
Spoon 10 to 11.5 ft
Auger to 15 ft
Spoon 15 to 16.5 ft
Auger to 20 ft
1615 Spoon 20 to 21.5 ft

12/19/84
DATE

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Site Maxwell AFB
Boring No. MW 7-3

1630 Auger to 24 ft (overdrilled 2 ft)
1640 Set well
1645 Couldn't push the auger plug out with the well
Pull well
Will rotary out the augers 12/20/84
1700 Depart site

12/20 0630 ESE, drillers on-site
0645 Rotary out augers while I take broken auger fork to welding shop (20 min trip)
0730 Set well, pull augers
well set @ 22 ft
Sand caved to 16 ft
0830 Add sand from 16 to 4 ft (8 bags)
Bent. pellets to 3 ft (1 bucket)
~~Grout to surface~~
Supply run (45 min DOWNTIME)
0915 Water run (30 minutes)
1000 Grout to surface (3 bags cement, 15 # powder)
1010 Depart site

* well set @ 22 ft (15 ft screen, 2.5 ft S.U.)
* Used 200 gal H_2O to make well (75% return)
* Materials - 9.5 ft riser, 15 ft screen, 8 bags sand, 1 bucket pellets, 3 bags cement, 15 # powder, 1 steel casing w/ lock

Note: Removed & grouted PZ 7-3 using leftover grout!

12/19/84 DATE
George Noel SIGNED

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APPENDIX L--WELL DEVELOPMENT LOGS

PROJECT MAXWELL AFB Notebook No.

Continued From Page

AT Grams

WELL DEVELOPMENT

Partly cloudy, very cool

0740 (1) Well I-2 G. Foster has already pumped 90 gallons from this well

3" Submersible pump No drilling fluid lost

Well depth = 14.0'

Date of installation Date of development 1/9/85

Beginning static water level @ 0930 + 3.00 = 1.59' from TOC

PVC stickup = 1.83' above ground

Sediment = 15.88' below TOC

		(1220)	1315	1555	1/10/85 0920
1030 Initial ST Readings =	T°	14.5°	15.5	16.4	16.3
One well volume =	cond	140	173	193	189
22.9 gallons	pH	4.0	4.6	4.5	4.5
		turbid	v. sl. turbid	v. sl. turbid	

Pumping rate = 17 gpm

10 gallons removed before pump ran dry 1003

8 gallons removed before pump ran dry 1100

17 gallons removed before pump ran dry 1300

18 gallons removed before pump ran dry 1441

10 gallons " " " " " 1557

8 gallons " " " " " 1710

1/10/85 16 gallons before pump ran dry 0800

Water is slightly turbid, no odor at first - decreasing turbidity w/ pumping

71 + 90 = 161 gallons removed as of 1710 - water is very slightly turbid - will continue tomorrow

1/10/85 14 gallons removed

Total volume removed = 191 gallons - sample taken 2130 1/10/85

Water is still slightly turbid

Final water level 0930 1/10/85 3.00 - 1.36 below TOC

24hr Final water level 1030 1/11/85 3.00 - 1.56 below TOC

Continued on Page

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L-1 [signature] 1/21/85

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PROJECT MAXWELL AFB

Notebook No.

Continued From Page

AT G.mvs

Broke for lunch 11:30 - 12:00

(2) Well 1-3

Pump: Honda NB20X 2.5 hp centrifugal pump w/ PVC standpipe

Well depth = 22.3

Date of installation Date of development 1/9/85

Beginning static water level @ 1224 = 10.00 - 1.89 below TOC

PVC stickup = 2.20'

Depth to sediment = 24.65' below TOC initial 24.66' below TOC final

Rate of pumping = 30 liters/min

~~PVC stickup~~

~~Well volume~~

	Initial 1245	1308	1335	Final 1343	
~~1245~~ initial SC Readings t°	14.0	19.4	19.6	19.7	Sample taken
cond	99	100	100	100	
pH =	5.5	5.5	5.4	5.5	1347
	sl. turbid	v. sl. turbid		trace of turbidity	

One Volume to be removed = 31.5 gallons including annulus

Total volume of water removed = 425 gallons - pumped for 1 hr. 3 min

Final water level @ 1352 = 10.00 - 1.39 below TOC

1/10/85 24 hr final water level @ 1330 10.00 - 1.88 below TOC

Continued on Page

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Signed 1/2/85

Date

166.4 1.21

PROJECT MAXWELL AFB

Notebook No.

Continued From Page

AT Evans

63 gallons of drilling water remain in hole

③ Well I-4

Centrifugal Honda pump w/ PVC standpipe

well depth = 21.5'

Date of installation

Date of development 1/9/85

Beginning static water level @ 1335 = 13.00 - 5.37 below TOC

PVC stick up = 1.86'

Depth to sediment = 23.23' below TOC

Rate of pumping = 16.5 liters/min until well pumps out completely

Start pumping 1812 - water is extremely muddy to start

SCT readings	Initial	1330	1700	Final (0856 1/10/85)
T°	20.1	19.3	18.6	17.2
cond	109	63	53	54
pH	5.4	4.9	4.8	4.9

Volume tally One Volume to be removed = 34 gallons

1. 4 min = 9 gal

2.2 min = 5 gal — Turbidity decreased somewhat by beginning of SCT readings

2nd (1445) Pumping rate increased to 30 l/min

2.1 min 16 gallons

2.5 min 20 gallons — Water is still showing considerable turbidity even after 160 gallons pumped

1.8 min 14 gallons

2.4 min 19 gallons

2.3 min 15 gallons — 300 gallons pumped as of 1720 - will continue tomorrow morning

2.5 min 20 gallons

2.4 min 19 gallons — 304 gallons water removed - sample taken 0855 1/10/85

2.5 min 20 gallons — Water is still fairly turbid

2.5 min 20 gallons

2.6 min 21 gallons — Final water level @ 0905 1/10/85 - 9.00 - 1.03 below TOC

2.9 min 23 gallons — 24 hr. water level @ 1015 1/11/85 13.00 - 5.39

2.6 min 21 gallons } 1/10/85

2.6 min 21 gallons

2.6 min 21 gallons

2.6 min 21 gallons

Continued on Page

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L-3 [signature] 1/21/85

0.961

PROJECT MAXWELL AFB

Notebook No.

Continued From Page

.32.96

1/10/85 ATEvans

Cloudy, cool, occas. lt. rain

(4) Well MW 1-1

Centrifugal Honda pump w/ standpipe

Well depth = 25.0'

Screen length = 10.0'

Date of installation 12/20/84 Date of development 1/10/85

Initial GWL @ 1015 18.03 - 1.90 below TOC

Sediment depth = 27.48' below TOC

PVC stickup = 2.18' above ground

Start pumping 1026 at rate of 24 l/min = 6.3 gpm

Water is very turbid, yellowish-brown color

SCT Readings	Initial (1030)	1040	1102	Final (1124)
T°	19.6	20.4	20.6	20.7
cond.	100	49	40	38
pH	5.3	5.0	4.6	4.6

One well volume = 24.6 gallons 62 gallons of drilling water remain in hole

Water is clearing up considerably with continued pumping

Pumped for 60 minutes = 380 gallons removed

Water is almost clear, still some yellowish brown turbidity

Final water level @ 1130 = 18.00 - 1.85 below TOC

24hr water level @ 1140 = 17.00 - 0.89 below TOC

Continued on Page

L-4

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[signature] 1/21/85

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Notebook No.____

ROJECT MAXWELL AFB

Continued From Page____

1/10/85 ATEVANS

(5) Well 7-3

centrifugal Honda pump w/ standpipe

Well depth = 22.0'

Screen length = 15.0'

Date of installation 12/20/84 Date of development 1/10/85 - 1/11/85

Initial GWL @ 1148 1300 - 1.22' below TOC

Sediment depth = 22.9' below TOC

PVC stickup = 2.02'

Pumps at rate of ~~30~~ 7.9 g/min before wellbore runs dry

				Initial (1345)	0935	1/15/85 1140	1/16/85 1642
Eilly		SCT	T°	19.4	17.9	17.2	17.2
			cond	445	345	287	271
2 min	~~gallons~~ 16 g		temp	6.5	6.0	6.1	6.1

2 min 16 g

1.2 min 10 g

1.2 min 10 g Water is grayish-brown, very murky at first, starting to clear after 30 gallons

1.2 min 10 g

1.2 min 12 g

1.3 min 8 g One volume = 27.2 gallons 50 gallons drilling fluid remaining in hole

1.3 min 8 g

1.2 min 10 g Well takes up to 1 hr. to recover - will continue developing

1.2 min 10 g 1/11/85

1.2 min 12 g

1.2 min 12 g

Final water level ~~___ - 1.47~~

17.66 - 1.43

1/15/85 80 ~~100~~ gallons removed by intermittent pumping

1/16/85 ~~100~~ 100 gallons removed by intermittent pumping - sampled 1645

Final water level @ 1650 = 24.06 - 1.85' Water is still somewhat turbid - some sand

Final sediment = 23.95' below TOC

Continued on Page

24 hr. water level = 23.06 - 3.90

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1/21/85

Date

PROJECT Notebook No. Continued From Page

(6) Well 7-2
~~Centrifugal~~ Submersible pump
Depth of well = 22.3'
Screen length = 15.0'
Date of installation 12/20/84   Development date 1/10/85
Initial GWL @ 1311 17.00 - 4.06' below TOC
Sediment depth = 24.10' below TOC
PVC stickup = 2.42
Pumps at rate of 17 gpm

Time	Amt	SCT		Initial (1523)	1/11/85 0848	1/14/85 0918	Final 0741
			T°	18.4	17.5	13.0	13.7
0.7m	12 gal		cond	175	107	93	92
			pH	5.8	5.0	4.8	4.3

One well volume = 26.1 gal   50 gallons of drilling fluid remaining in hole

1500 - Had to stop pumping well because submersible pump froze up. Unable to free impeller after 30 minutes of backflushing. Initial water was very muddy and ~~sandy~~ contains much very fine sand. Pump had been located 1 ft above top of sediment to prevent clogging but enough was picked up by pump to jam impeller. Well closed and locked.

1615 - Took apart submersible to clear sand out, will wash out completely tonight before reassembly. Will resume purging of well with centrifugal pump that G. Fowler has

1730 55 gallons removed by ~~a~~ centrifugal pump

Continued on Page

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L-6

Signed   Date   1/21/85

Continued From Page________

PROJECT________

1/11/84 Resume pumping with centrifugal pump at rate of 30 l/min
start 0830 - should pump continuously

water is almost clear

0845 Total volume removed = 465 gallons - water is clear.
sample taken

0950 Final water level = 15.00 - 1.96 below TOC

1/11/85 24-hr. water level = 17.00' - 4.05' = 12.95' below TOC

Continued on Page

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L-7

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1/21/85

Date

PROJECT MAXWELL AFB

Notebook No.

Continued From Page

1/11/85 ATE(?)
Cloudy breezy cold

(7) Well Y-1
Centrifugal pump
Well depth = 26.0'
Date of installation 1/7/85
(1110) Initial SWL = 20.00 - 1.84'
Sediment depth = 28.24' below TOC
PVC stickup = 2.47'

250 gallons of fluid remain in hole

Screen length 10.0'

Date of Development 1/11/85

Start pumping at 1045 - rate 20 l/min = 5.3 gpm

SCT	initial	1112	1200	1230	1300 final
T°		17.7	18.5	18.5	18.5
cond.		155	145	143	140
pH		5.6	5.6	5.6	5.6

One well volume = 23.0 gallons

Water starts turbid - yellowish brown - clears up completely within 5 min.

Total volume pumped (145 min) = 770 gallons
Sample taken 1310 - water is clear
Final sediment depth = 28.44' below TOC
Final water level @ 1315 24.00 - 5.81 below TOC
@ 24 hr. water level 22.00 - 3.82 below TOC

Continued on Page

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1/21/85

PROJECT MAXWELL AFB

Notebook No.

Continued From Page

1/11/85 ATEVAN

(8) Well 4-2

44 gallons drilling fluid remaining in hole

Well depth = 26.0'
Date of installation 1/6/85 Date of development
initial GWL @ 1500 20.0 - 2.23' below TOC
Sediment depth 27.78' below TOC
PVC stickup = 2.55'
Dr. well volume = 35.0 g
Pump at rate of 20 l/min - start pumping 1530

		SCT	Initial (1548)	1604	1620	18.8°C	Final
20 min	11g	T°	17.5	18.8	[illegible]	[illegible]	18.7
20 min	11g	cond	180	137	138	[illegible]	94
24 min	13	pH	6.0	5.8	5.6	5.8	5.5
31 min	17g						
30 min	11g						
35 min	13g						
40 min	22g						
35 min	19g						
23 min	17g						
25 min	14g						
27 min	15g						
? min	14g						
35 min	11g						
3 min	11g						

Water is initially yellowish brown and very turbid
cleared up rapidly after 40 gallons pumped

Started pumping continuously after 100 gallons

Water is clear except for trace of sand

Sample taken 1723 - Total volume removed = 230 gallons
1716 Final water level = 16.0 - 2.43' below TOC
24 hr water level = 14.0 - 1.21' below TOC
Final sediment depth = 28.39' below TOC

Continued on Page

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1/21/85

PROJECT MAXWELL AFB

Notebook No.

Continued From Page

1/13/85 A T Greene
Mostly cloudy, windy, COLD!

(B) G-1

255 gallons drilling fluid in hole

well depth = 37.3'
Screen length = 10.0'
installation date 12/21/84
Dev. date = 1/13/85
PVC stickup = 2.38'
1.13 well volume = 49 gallons

0835 Static GWL = 30.0' - 6.55' below TOC
Sediment depth = 39.5'

		1/13/85		1/14/85	
	initial 0843	1725	1404	1147 final	
SC T°	17.2	17.9	16.6	17.4	
cond.	236	94	105	96	
pH	6.1	5.7	5.6	5.6	

Well depletes quickly, not fast recovery
Water is greyish brown, turbid - This well will be very slow to develop

As of 1725, 160 gallons removed by intermittent pumping
9 to 10 gallons removed after 30 minute wait
Will resume tomorrow morning - water is almost clear

Additional 200 gallons removed 1/13-14/85 by intermittent pumping, total volume removed = 360 gallons
Water is still slightly turbid - sample taken 1150 (1/14/85)

Final GWL @ 1155 (1/14/85) 30.00 - 4.15 = 25.85' below TOC
Final sediment = 39.5'
24-hr. GWL = 30.0' - 2.61' = below TOC

Continued on Page

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[signature] 1/21/85

Continued From Page ______

PROJECT MAXWELL AFB

1/12/85 ATEvans

UM.

(10) Well 43

Well depth = 24.5'
Screen length = 20.0'
Sediment depth = 22.08 below TOC
PVC stickup = 2.36'
One well volume = 340 gallons
Start Pumping at rate of 18 l/min 0945
Static GWL @ 0945 ~~22.00-8~~ 22.00 - 8.47 below TOC

99 gallons drilling fluid remain in hole
Installation date = 1/6/85
Development date = 1/12/85

280 gallons to be removed

SCT	T°	16.7	19.0	17.6	19.8
	Cond	75	71	59	55
	pH	5.3	5.3	5.2	5.0
		turbid (0950)	1006	1039	1050 final

Water initially is yellowish-brown, very turbid - clears up with pumping
Completely clear after 120 gallons removed
Well pumps continuously

Time pumped = 70 min Total vol removed = 335 gallons
Sample taken 1053 - water is clear

Final GWL @ 1057 = 24.05 - 10.46' below TOC
Final sediment depth = 27.23' below TOC

24-hr GWL = 24.00 - 10.44' below TOC

Continued on Page ______

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L-11 4-21 [signature] Signed

1/2/85 Date

Notebook No.____

PROJECT MAXWELL AFB

Continued From Page____

AT Evans 1/12/85

① Well 3-2
Centrifugal pump w/ standpipe
Well depth = 24.2'
Screen length = 20.0'
Installation date: 1/5/85 Development date = 1/12/85
Initial GWL @ 1120 = 11.00 - 1.85' = 9.15' below TOC
Sediment depth = 26.48'
PVC stickup = 2.29'
Start pumping 1124 at rate of 20 l/min = 3.3 g/m
One well volume = 38.5 gallons Volume to be removed = 245 gallons

50 gallons drilling fluid remain in hole

		Initial (1127)			
SCT	T°	18.8	19.5	19.5	20.1
	cond	73	89	74	71
	pH	5.0	5.2	5.1	5.0
		1127	1138	1200	1219

Water initially is greyish and moderately turbid
cleared up completely after 50 gallons

Final GWL @ 1227 11.00 - 1.81
Final sediment depth = 25.76

Sample taken 1220
Pumped for 65 minutes = 345 gallons removed
Water is clear

24-hr. GWL = 12.00 - 2.89' below TOC

Continued on Page

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L-12

1/21/85

Notebook No. W

PROJECT MAXWELL AFB

Continued From Page

ATEKAM 1/12/85

(12) Well 3-3
Centrifugal pump w/ standpipe
Well depth = 23.2'
Screen length = 20'
Installation date = 1/3/85 Development date = 1/12/85
Initial GWL @ 1355 = 6.00' - 1.51 = 4.49' below TOC
Sediment depth = 26.94
Start pumping 1400 at rate of 30 l/min
One well volume = 50.5 gallons
PVC stickup = 2.03'

106 gallons drilling fluid remain in hole - 353 gallons to be removed

SCT	T	18.5	19.7	19.2	18.1
	cond	654	104	92	92
	pH	6.0	5.1	5.0	5.0
		1402 (initial)	1432	1450	1520

Water initially turbid and yellowish-brown - clears up rapidly

Very slight turbidity by 1520 - sample taken 1530
Pumped for 90 min - 480 gallons removed

Final GWL @ 1532 = 6.00 - 1.73
Final sediment depth = 27.00

24-hr GWL @ 1320 6.00 - 1.53' = 4.47' below TOC

Continued on Page

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L-13

1/21/88

Notebook No.

PROJECT MAXWELL AFB

Continued From Page

ATEvans 1/12/85

(13) Well S-4
centrifugal pump w/ standpipe
Well Depth = 25.5'
screen length = 15.0'
PVC sticking = 1.48'
Installation Date 12/16/84
Initial GWL @ 1545 7.00' - 2.24' below TOC
Sediment depth = 25.80' (very soft bottom)
1548 Start pumping at rate of 20 l/min

75 gallons drilling water remain in hole

320 gallons to be removed

Development date 1/12/85

SCT	T°	19.6	19.6	18.5	19.6
	cond	120	82	90	85
	pH	5.3	5.0	5.3	~~1658~~ 5.1
		1550 (initial)	1606	1630	1658 (final)

One well volume = 49 gallons

Water initially yellowish-brown and very turbid, clears up after 40 gallons somewhat
Even after 200 gals water still has same turbidity - yellowish brown clay

Pumped for 75 min - 400 gallons pumped
Water still has some yellowish-brown turbidity - no sand
Sample taken 1703

Final GWL @ 1705 = 7.00' - 2.03'
Final sediment depth = ~~25~~ 26.73'

24-hr GWL = 7.00 - 2.23' below TOC'

Continued on Page

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[signature] 1/21/85

DATE 1/13/85
Fair, slight breeze, very cold

(14) Well 5-1
Centrifugal pump w/ standpipe
Well depth 25.4'
Screen length = 10.0'
PVC stickup = 3.13'
Installation date 12/14/84
Initial GWL @ 0823 20.00 - 1.19 = 18.81' below TOC
Sediment depth 22.90' below TOC
One well volume = 14.4 gallons

100 gallons drilling fluid remain in hole
200 gallons to be removed
Development date 1/13/85

		1/13/85		1/14/85	1/16/85
		1215	1700	0848	1046
SCT	T°	12.3	12.5	12.6	12.7
	cond	175	198	137	108
	pH	6.2	6.8	6.3	5.8

0840 Both centrifugal pumps are frozen solid and will not start. George is looking for a propane torch to heat the pumps.

0955 Pump thawed and working, but water is too deep to pump effectively through centrifugal pump, so we are using new submersible pump which arrived yesterday. Because of rapid depletion of water, well will have to be pumped intermittently. Rate = 14 gpm - well is slow to recover

25 sec. 6 gallons
25 sec. 6 gallons

1300 - Pumping only with difficulty - well does not seem to recover sufficiently to allow pumping of a full column of water.

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L-15
[signature]
Signed
1/21/85
Date

PROJECT MAXWELL AFB

Notebook No.

Continued From Page

ATG/ord 1/13/85

1/15/85

100 gallons removed by bailing well by hand using 1" PVC - stainless steel bailer. Water initially very muddy and yellowish - brown, clears with continued bailing somewhat

1/16/85

100 gallons pumped intermittently with centrifugal pump w/ standpipe

Final water level @ 1048 = 25.00 - 2.80
Final sediment depth = 28.20'

Water is almost completely clear - trace of sand - sample taken 1046

Continued on Page

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1/21/85

Notebook No.

Continued From Page

PROJECT MAXWELL AFB

1/13/85 DTEvans

(13) S-3

125 gallons drilling fluid remain in hole
375 gallons to be removed

Well depth = 28.0'
Screen length = 20.0
Date of installation 1/11/85 Date of development 1/13/85

One well volume = 50.3 gallons
Initial GWL @ 1027 9.00 - 1.18 below TOC
Sediment depth = 29.60' below TOC
PVC stickup = 2.95'
Start purging 1035 at rate of 28 l/min initial - reduced to 4.5 gpm

SCT	T°	17.8	20.3	21.7	21.9
	cond	444	90	82	83
	pH	5.4	5.8	5.8	5.2
		Initial (1027)	NS	1135	1208 (final)

Water initially shows yellowish-brown turbidity - clears rapidly

Sample taken 1210 - water is almost completely clear
Pumped for 95 minutes. 420 gallons removed

Final GWL @ 1215 = 10.00 - 1.99
Final sediment depth = 29.65'
24-hr water level = 9.00 - 1.19'

Continued on Page

Read and Understood By

L-17 Steve Vanche 1/21/85

PROJECT MAXWELL AFB

Notebook No.

Continued From Page

~~1/11/85~~

DATE 1/13/85

(1) Centrifugal pump w/ standpipe
Well S-2
Well depth = 22.5'
Screen length = 15.0'
Date of installation 12/15/84
One well volume = 36.3 gallons
Initial GWL @ 1438 10.00 - 1.84 = 8.16' below TOC
Sediment depth = 24.40'
Stickup PVC = 2.0'
Start pumping @ 1445 at rate of 24 l/min = 6.3 gpm

57 gallons drilling fluid remain in hole
240 gallons to be removed

Date of development 1/13/85

SCT	Initial (1448)	1500	1520	1533 (final)
T°	18.6	20.5	20.2	20.0
cond	153	114	110	109
pH	5.6	5.2	5.2	5.2

Water is turbid, yellowish-brown at start, clears up rapidly with pumping

Final GWL @ 1530 = 10.00 - 1.75 = 8.25' below TOC
Final sediment = 24.43'

Water is almost completely clear, sample taken 1536
Pumped for 50 min. - 315 gallons removed

1540 - 1640 - George's truck got stuck - spent 1 hr. freeing it

24-hr. water level = 10.00 - 1.81 = 8.19' below TOC

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1/21/95

Notebook No.______

ROJECT MAXWELL AFB

Continued From Page______

ATG 1/19/85

Cloudy, very cold, breezy

No drilling fluid remaining in hole
180 gallons to be pumped

17 G-3 Submersible pump
Well depth:
Screen length:
Date of installation

Date of development 1/19/85

One well volume = 35.5 gallons
Initial GWL @ 0850 33.00 - 3.75 = 29.25' below TOC
sediment depth = 42.72'
PVC Stickup = 2.50'
Start pumping 0900 - rate = 7.9 gpm

SCT:

T°	16.1	18.3	18.8	18.6
cond.	190	229	222	220
pH	5.1	5.1	5.1	5.1
	Initial (0904)	0918	0928	0935 (final)

Water very turbid, yellowish-brown at first, cleared up rapidly

Pumped for 40 minutes : 320 gallons removed
Water is clear - sample taken 0941

Final water level @ 0943 = 31.00 - 1.78 = 29.22' below TOC
Final sediment depth = 42.80'

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L-19 [signature]

Signed

1/24/85

Date

PROJECT MAXWELL AFB Notebook No.

Continued From Page

ATFvans 1/15/85

Centrifugal pump w/ hose

(18) Well 7-1

Well depth = 24.3

Screen length = 10.0'

Installation date = 1/14/85

Development date = 1/14/85

One well volume = 21.0 gallons

PVC stickup = 1.01'

Initial GWL @ 1025 17.00 - 1.21 = 15.79' below TOC

Sediment depth = 24.80'

Start pumping 1028 at rate of 3 gpm

No drilling fluid remaining in hole

Volume to be removed = 105 gallons

	Initial	1034	1050	1100	1117 (final)
T°	17.9		21.0	21.1	21.8
cond	62		77	75	79
pH	5.1		5.0	5.0	5.0

Water is turbid grayish-brown - clears up after 40 gallons removed

Pumped for 55 minutes = 165 gallons removed

Water is clear - sample taken 1128

1125 Final GWL = 17.00 - 0.76 = 16.34' below TOC

Final sediment = 25.2 ft below TOC

1/15/85 24 hr GWL = 17.00 - 1.19' = 15.81' below TOC

Continued on Page

Read and Understood By

L-20

1/21/85

OJECT MAXWELL AFB

Continued From Page______

A Evans 1/14/85

No drilling fluid remaining in hole

170 gallons to be removed

(17) Well 6-2

Well depth

Screen length

Installation Date

Development date

PVC stickup = 2.52'

One well volume = 34 gallons

Initial GWL @ 1412 32.00 - 7.48 = 29.52' below TOC

Sediment depth = 42.28' below TOC

Start pumping 1428 at rate of 7.9 gpm

		1432 (initial)	1444	1458	1515	final
SCT	T°	18.4	19.1	18.5	19.2	
	cond	278	247	239	239	
	pH	5.5	5.1	5.0	5.0	

Water is initially yellowish-brown, very turbid, clears up rapidly with pumping

1530 Final water level = 32.00 - 7.42

Final Sediment depth = ~~[illegible]~~ 42.77'

Pumped for 52 min = 410 gallons removed

Water is clear - sample taken 1530

1/15/85 24-hr. GWL = 32.00 - 7.46' = 29.54' below TOC

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L-21

[signature] 1/21/85

Signed Date

PROJECT MAXWELL AFB

Notebook No.

Continued From Page

AT Evans 1/15/85

Clear, breezy, cold

(20) Well 6-1

No drilling fluid remaining in hole

Submersible pump

166 gallons to be removed

Depth of well

Screen length

Installation date

Development date = 1/15/85

Initial GWL @ 1546 35.00' - 6.03' = 28.97' below TOC

Sediment depth 41.8' below TOC

PVC stickup = 2.18'

One well volume = 33.3 gallons

Submersible pump jammed at 1630 - attempted to free it up without success - will take it apart and clean it tonight

1/15/85 Start pumping 0903 at 10 gpm with submersible pump

SCT	0910 (Init)	0920	0932	0950
T°	16.3	17.0	18.1	18.2
Cond.	333	298	280	273
pH	5.4	5.7	5.5	5.5

Water is initially brownish - very turbid, clears rapidly with pumping

Pumped for 50 min - 500 gallons removed

Water is clear, sample taken 1000

Final GWL @ 1003 = 35.00 - 6.06' = 28.94' below TOC

Final sediment depth =

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APPENDIX M--MONITOR WELL, SURFACE WATER, AND SEDIMENT SAMPLING LOGS

WELL SAMPLING DATA

0128NA014 GN 850046

Well Sampling:

Well Number GW 1-1 Time 1400

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ______ (ft)
3. Wet length (before pumping) ______ (ft)
4. Distance to water (before pumping) 16.2 (ft)
5. Held length (after pumping) ______ (ft)
6. Wet length (after pumping) ______ (ft)
7. Distance to water (after pumping) ______ (ft)

Sampling Information: Sample Number 469200

1. Depth of well 25 (ft)
2. Diameter of well 4 (inches)
3. Method of collection Bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ______ (ft)
5. Appearance (clear, milky, color) ______
6. Approximate pumping rate: at start 5 (gpm)
   at finish 5 (gpm)
7. Total time pumped 25 (hr, min)
8. Total volume pumped ~~[illegible]~~ 125
9. Field analysis performed:

   Dissolved Oxygen ______ mg/l
   pH 6.6
   Conductivity 75 uhmos/cm
   Temperature 11.2 °C

Fractions Collected (circle): C CF 80 N M RP Cl RS H
O P O F S T R UP NF

JH
Signed [signature] Date 1/8/85

Read and Understood By:

Signed ______ Date ______

M-1

WELL SAMPLING DATA

0128 NA 014 GN 85 0047

Well Sampling:

Well Number GW 1-2 Time 1515

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ______ (ft)
3. Wet length (before pumping) ______ (ft)
4. Distance to water (before pumping) 5.5 (ft)
5. Held length (after pumping) ______ (ft)
6. Wet length (after pumping) ______ (ft)
7. Distance to water (after pumping) ______ (ft)

Sampling Information: Sample Number 469201

1. Depth of well 14 (ft)
2. Diameter of well 4 (inches)
3. Method of collection bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ______ (ft)
5. Appearance (clear, milky, color) clear
6. Approximate pumping rate: at start 5 (gpm)
   at finish 5 (gpm)
7. Total time pumped pumped dry 2x (hr, min)
8. Total volume pumped ______
9. Field analysis performed:
   Dissolved Oxygen ______ mg/l
   pH 4.8
   Conductivity 203 uhmos/cm
   Temperature 17.0 °C

Fractions Collected (circle): C CF S V M RP C1 RS H
O P Z F B T R UP NF

JMC

Signed ______ Date 1-18-85

Read and Understood By:

Signed ______ Date ______

WELL SAMPLING DATA

0128 NA 014 GN 850048

Well Sampling:

Well Number GW1-3 Time 1645

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ______ (ft)
3. Wet length (before pumping) ______ (ft)
4. Distance to water (before pumping) 8.1 TOC (ft)
5. Held length (after pumping) ______ (ft)
6. Wet length (after pumping) ______ (ft)
7. Distance to water (after pumping) ______ (ft)

Sampling Information: Sample Number 409202

1. Depth of well 22.3 (ft)
2. Diameter of well 4 (inches)
3. Method of collection Bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ______ (ft)
5. Appearance (clear, milky, color) ______
6. Approximate pumping rate: at start 5 (gpm)
   at finish 5 (gpm)
7. Total time pumped 42 (hr, min)
8. Total volume pumped 210 gal
9. Field analysis performed:
   Dissolved Oxygen ______ mg/l
   pH 5.8
   Conductivity 95 uhmos/cm
   Temperature 18.1 °C

Fractions Collected (circle): C CF S N M RP CI RS H
O P Z F B T R UP NF

MJG

Signed ______ Date

Read and Understood By:

Signed ______ Date

M-3

WELL SAMPLING DATA

0128NA014 GN85 0049

Well Sampling:

Well Number GW1-4 Time 1545

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ______ (ft)
3. Wet length (before pumping) ______ (ft)
4. Distance to water (before pumping) 7.4 (ft)
5. Held length (after pumping) ______ (ft)
6. Wet length (after pumping) ______ (ft)
7. Distance to water (after pumping) ______ (ft)

Sampling Information: Sample Number 469203

1. Depth of well 21.5 (ft)
2. Diameter of well 4 (inches)
3. Method of collection Bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ______ (ft)
5. Appearance (clear, milky, color) ______
6. Approximate pumping rate: at start 5 (gpm)
   at finish 5 (gpm)
7. Total time pumped 40 (hr, min)
8. Total volume pumped 800 gal
9. Field analysis performed:

   Dissolved Oxygen ______ mg/l
   pH 4.9
   Conductivity 11 uhmos/cm
   Temperature 17.5 °C

Fractions Collected (circle): C CF S N M RP CI RS H
O P Z F B T R UP NF

WJG

Signed [signature] Date 1/18/85

Read and Understood By:

Signed [signature] Date [illegible]

WELL SAMPLING DATA

0128 NA 008 GN 850014

Well Sampling: MW3-1

Well Number GW3-1 Time 1050

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ______ (ft)
3. Wet length (before pumping) ______ (ft)
4. Distance to water (before pumping) 17.7 TOC (ft)
5. Held length (after pumping) ______ (ft)
6. Wet length (after pumping) ______ (ft)
7. Distance to water (after pumping) ______ (ft)

Sampling Information: Sample Number 469500

1. Depth of well 37.3 (ft)
2. Diameter of well 4" (inches)
3. Method of collection ______ (bailer, hand pump, etc)
4. Depth or interval from which sample taken ______ (ft)
5. Appearance (clear, milky, color) ______
6. Approximate pumping rate: at start 10 (gpm)
   at finish 10 (gpm)
7. Total time pumped ______ (hr, min)
8. Total volume pumped 220 ~~LTE~~ gals
9. Field analysis performed:

   Dissolved Oxygen ______ mg/l
   pH 5.6
   Conductivity 91 uhmos/cm
   Temperature 13.0 °C

Fractions Collected (circle): C CF S N M RP Cl BS H
O P Z F B T R UP NE
8

MJG

Read and Understood By:

Signed [signature] 11/15/85 Date Signed [signature] Date [illegible]

0128 NA 008 GN 85 0015

WELL SAMPLING DATA

Well Sampling: GW 3-2

Well Number MW 3-2 Time 1530

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ______ (ft)
3. Wet length (before pumping) ______ (ft)
4. Distance to water (before pumping) 9.3 TOC (ft)
5. Held length (after pumping) ______ (ft)
6. Wet length (after pumping) ______ (ft)
7. Distance to water (after pumping) ______ (ft)

Sampling Information: Sample Number 469501

1. Depth of well 24.2 (ft)
2. Diameter of well 4" (inches)
3. Method of collection bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ______ (ft)
5. Appearance (clear, milky, color) clear
6. Approximate pumping rate: at start 5 (gpm)
   at finish 5 (gpm)
7. Total time pumped 51 (hr, min)
8. Total volume pumped 255 gals
9. Field analysis performed:

   Dissolved Oxygen ______ mg/l
   pH 5.2
   Conductivity 67 umhos/cm
   Temperature ~~[illegible]~~ 17.6 °C

Fractions Collected (circle): O CF S O M RP CI RS H
O P O F O T R JS NF

Signed [signature] 1/15/85 Date

Read and Understood By:

Signed ______ Date ______

WELL SAMPLING DATA

Well Sampling: GW 3-9 MW 5-3

Well Number ~~GW 3-3~~ Time 1145

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ____ (ft)
3. Wet length (before pumping) ____ (ft)
4. Distance to water (before pumping) 4.66 TOC (ft)
5. Held length (after pumping) ____ (ft)
6. Wet length (after pumping) ____ (ft)
7. Distance to water (after pumping) ____ (ft)

Sampling Information: Sample Number 469502

1. Depth of well 25.2 (ft)
2. Diameter of well 4 (inches)
3. Method of collection Bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ____ (ft)
5. Appearance (clear, milky, color) clear
6. Approximate pumping rate: at start 5 (gpm)
   at finish 5 (gpm)
7. Total time pumped 55 (hr, min)
8. Total volume pumped 275 gals
9. Field analysis performed:

   Dissolved Oxygen ____ mg/l
   pH 5.9
   Conductivity 264 uhmos/cm
   Temperature 16.4 °C

Fractions Collected (circle): C CF S V M RP CI RS H O P F B T R

Signed 1/15/85 Date

Read and Understood By:

Signed Date

M-7

WELL SAMPLING DATA

0128 NA 009 GN85 0017

Well Sampling:

Well Number GW 4-1 Time [illegible]

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) (ft)
3. Wet length (before pumping) 18.3 AKT (ft)
4. Distance to water (before pumping) ~~13.6~~ TOC (ft)
5. Held length (after pumping) (ft)
6. Wet length (after pumping) (ft)
7. Distance to water (after pumping) (ft)

Sampling Information: Sample Number [illegible]

1. Depth of well 26 (ft)
2. Diameter of well 4 (inches)
3. Method of collection bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken (ft)
5. Appearance (clear, milky, color)
6. Approximate pumping rate: at start 3 (gpm)
   at finish 3 (gpm)
7. Total time pumped 50 (hr, min)
8. Total volume pumped 150 ~~[illegible]~~ gals
9. Field analysis performed:

   Dissolved Oxygen mg/l
   pH 5.8
   Conductivity 149 umhos/cm
   Temperature 19.0 °C

Fractions Collected (circle): C CF S N M RP CI RS H
O P E F B T R UP NF X2

Signed [signature] 1/16 Date

Read and Understood By:

Signed [signature] Date [illegible]

WELL SAMPLING DATA

0128NA009 GN 85 0018

Well Sampling:

Well Number GW4-2 Time 1215

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ____ (ft)
3. Wet length (before pumping) ____ (ft)
4. Distance to water (before pumping) 14.2 TOC (ft)
5. Held length (after pumping) ____ (ft)
6. Wet length (after pumping) ____ (ft)
7. Distance to water (after pumping) ____ (ft)

Sampling Information: Sample Number 469504

1. Depth of well 26 (ft)
2. Diameter of well 4 (inches)
3. Method of collection bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ____ (ft)
5. Appearance (clear, milky, color) ____
6. Approximate pumping rate: at start 10 (gpm)
   at finish 10 (gpm)
7. Total time pumped 14 (hr, min)
8. Total volume pumped 140 gals
9. Field analysis performed:

   Dissolved Oxygen ____ mg/l
   pH 5.5
   Conductivity 88 uhmos/cm
   Temperature 19.9 °C

Fractions Collected (circle): C CF S N M RP Cl RS H
O P Z F B T R JP NP X 2

Signed ____ Date 1/16

Read and Understood By:

Signed ____ Date ____

M-9

WELL SAMPLING DATA

0128 NA 009 GN 850019

Well Sampling:

Well Number GW 4-3 Time 1030

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ______ (ft)
3. Wet length (before pumping) ______ (ft)
4. Distance to water (before pumping) ~~[illegible]~~ 13.6 (ft) 2Hc
5. Held length (after pumping) ______ (ft)
6. Wet length (after pumping) ______ (ft)
7. Distance to water (after pumping) ______ (ft)

Sampling Information: Sample Number 469505

1. Depth of well 26 (ft)
2. Diameter of well 4 (inches)
3. Method of collection bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ______ (ft)
5. Appearance (clear, milky, color) silty
6. Approximate pumping rate: at start 5 (gpm)
   at finish 5 (gpm)
7. Total time pumped ~~[illegible]~~ 32 (hr, min)
8. Total volume pumped 160 gals
9. Field analysis performed:

   Dissolved Oxygen ______ mg/l
   pH 5.2
   Conductivity 92 uhmos/cm
   Temperature 17.1 °C

Fractions Collected (circle): C CF S N M RP CI RS H
O P Z F B T R UP NP X[2]

Signed [signature] Date 1/16

Read and Understood By:

Signed [signature] Date [illegible]

WELL SAMPLING DATA

0128 NA 010 GNB50020

Well Sampling:

Well Number 5-1 Time 1800

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ______ (ft)
3. Wet length (before pumping) ______ (ft)
4. Distance to water (before pumping) 15 (ft)
5. Held length (after pumping) ______ (ft)
6. Wet length (after pumping) ______ (ft)
7. Distance to water (after pumping) ______ (ft)

Sampling Information: Sample Number 4109507

1. Depth of well ______ (ft)
2. Diameter of well 4 (inches)
3. Method of collection Bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ______ (ft)
5. Appearance (clear, milky, color) ______
6. Approximate pumping rate: at start 5 (gpm)
   at finish 5 (gpm)
7. Total time pumped 12 (hr, min)
8. Total volume pumped 60
9. Field analysis performed:

   Dissolved Oxygen ______ mg/l
   pH 5.7
   Conductivity 146 uhmos/cm
   Temperature 16.7 °C

Fractions Collected (circle): C CF S NS M RP Cl RS H
O P 7 F 5 T R UF NF
82

JHC

Signed J H Ch[illegible] Date 1-17-85

Read and Understood By:

Signed [illegible] Date [illegible]

0128 NA 010 GN850021

WELL SAMPLING DATA

Well Sampling:

Well Number GW5-2 Time 1645

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ____ (ft)
3. Wet length (before pumping) ____ (ft)
4. Distance to water (before pumping) 8.25 TOC (ft)
5. Held length (after pumping) ____ (ft)
6. Wet length (after pumping) ____ (ft)
7. Distance to water (after pumping) ____ (ft)

Sampling Information: Sample Number 469508

1. Depth of well 22.5 (ft)
2. Diameter of well 4 (inches)
3. Method of collection bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ____ (ft)
5. Appearance (clear, milky, color) clear
6. Approximate pumping rate: at start 3 (gpm)
   at finish 3 (gpm)
7. Total time pumped 60 min (hr, min)
8. Total volume pumped 180 gals
9. Field analysis performed:

   Dissolved Oxygen ____ mg/l
   pH 5.3
   Conductivity 186 umhos/cm
   Temperature 17.5 °C

Fractions Collected (circle): C CF S N M RP Cl RS H
O P C F B T R JP NS X2

Signed 1/16 Date

Read and Understood By:

Signed Date

WELL SAMPLING DATA

0128NA010 [redacted] GN85 0022

Well Sampling:

Well Number GW 5-3 Time 1600

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ________ (ft)
3. Wet length (before pumping) ________ (ft)
4. Distance to water (before pumping) 9.9 TOC (ft)
5. Held length (after pumping) ________ (ft)
6. Wet length (after pumping) ________ (ft)
7. Distance to water (after pumping) ________ (ft)

Sampling Information: Sample Number 469509

1. Depth of well 28 (ft)
2. Diameter of well 4" (inches)
3. Method of collection bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ________ (ft)
5. Appearance (clear, milky, color) clear/silty
6. Approximate pumping rate: at start 10 (gpm)
   at finish 10 (gpm)
7. Total time pumped 34 (hr, min)
8. Total volume pumped 340 gals.
9. Field analysis performed:
   Dissolved Oxygen ________ mg/l
   pH [redacted] 5.7
   Conductivity 170 uhmos/cm
   Temperature 18.1 °C

Fractions Collected (circle): C CF S N M RP Cl RS H
O P Z F B T R UP N X2

Read and Understood By:

Signed 1/16 Date | Signed Date

M-13

0128 NA 0.0 GN85 0023

WELL SAMPLING DATA

Well Sampling:

Well Number GW9-4 Time 1525

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ________ (ft)
3. Wet length (before pumping) ________ (ft)
4. Distance to water (before pumping) 4.0 (ft)
5. Held length (after pumping) ________ (ft)
6. Wet length (after pumping) ________ (ft)
7. Distance to water (after pumping) ________ (ft)

Sampling Information: Sample Number 469510

1. Depth of well 25.5 (ft)
2. Diameter of well 4" (inches)
3. Method of collection Bailer (bailer, hand pump,etc)
4. Depth or interval from which sample taken ________ (ft)
5. Appearance (clear, milky, color) ________
6. Approximate pumping rate: at start 5 (gpm)
   at finish 5 (gpm)
7. Total time pumped 45 min (hr, min)
8. Total volume pumped 225 gals
9. Field analysis performed:

   Dissolved Oxygen ________ mg/l

   pH 4.8

   Conductivity 79 uhmos/cm

   Temperature 16.6 °C

Fractions Collected (circle): Q CF S N M RP Cl RS H
O P Z F B T R UP NF
X

Read and Understood By:

Signed JAChatt 1-17-85 Date

Signed ________ Date ________

WELL SAMPLING DATA

0128NA010 GNB50024

Well Sampling: Existing site 5 GWS-5

Well Number well Time 1645

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ______ (ft)
3. Wet length (before pumping) ______ (ft)
4. Distance to water (before pumping) 5.5 (ft)
5. Held length (after pumping) ______ (ft)
6. Wet length (after pumping) ______ (ft)
7. Distance to water (after pumping) ______ (ft)

Sampling Information: Sample Number 469511

1. Depth of well 25 (ft)
2. Diameter of well ~~4~~ 2" (inches)
3. Method of collection Bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ______ (ft)
5. Appearance (clear, milky, color) ______
6. Approximate pumping rate: at start 5 (gpm)
   Bailed 60 bailers at finish 5 (gpm)
7. Total time pumped then pumped 19 (hr, min)
8. Total volume pumped 12 bailed + 95 gals pumped = 107 gals
9. Field analysis performed:
   Dissolved Oxygen ______ mg/l
   pH 4.6
   Conductivity 36 uhmos/cm
   Temperature 16.1 °C

Fractions Collected (circle): C CF S N M RP CI RS H
O P Z O F B T R UF NF

MJG

Signed [signature] Date 1-17-85

Read and Understood By:

Signed [signature] Date

WELL SAMPLING DATA

0128 NA 011 GN85 0025

Well Sampling:

Well Number GW 6-1 Time 1000

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ______ (ft)
3. Wet length (before pumping) ______ (ft)
4. Distance to water (before pumping) 29 (ft)
5. Held length (after pumping) ______ (ft)
6. Wet length (after pumping) ______ (ft)
7. Distance to water (after pumping) ______ (ft)

Sampling Information: Sample Number 469512

1. Depth of well 39.6 (ft)
2. Diameter of well 4 (inches)
3. Method of collection bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ______ (ft)
5. Appearance (clear, milky, color) ______
6. Approximate pumping rate: at start 10 (gpm)
   at finish 10 (gpm)
7. Total time pumped ~~[illegible]~~ 22 (hr, min)
8. Total volume pumped 220 gals
9. Field analysis performed:
   Dissolved Oxygen ______ mg/l
   pH 5.9
   Conductivity 430 uhmos/cm
   Temperature 17.2 °C

Fractions Collected (circle): G CF S N M RP Cl RS H
O P V G F B T R UP VE

MJG

Signed 1/17 Date

Read and Understood By:

Signed Date

WELL SAMPLING DATA

0128NA011 GN850026

Well Sampling:

Well Number GW6-2 Time 1230

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ____ (ft)
3. Wet length (before pumping) ____ (ft)
4. Distance to water (before pumping) 30.0 (ft)
5. Held length (after pumping) ____ (ft)
6. Wet length (after pumping) ____ (ft)
7. Distance to water (after pumping) ____ (ft)

Sampling Information: Sample Number 469513

1. Depth of well 39.7 (ft)
2. Diameter of well 4" (inches)
3. Method of collection Bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ____ (ft)
5. Appearance (clear, milky, color) ____
6. Approximate pumping rate: at start 10 (gpm)
   at finish 10 (gpm)
7. Total time pumped 20 min (hr, min)
8. Total volume pumped 200 gal
9. Field analysis performed:
   Dissolved Oxygen ____ mg/l
   pH 4.8
   Conductivity 241 uhmos/cm
   Temperature 18.2 °C

Fractions Collected (circle): C CF S N M RP CI RS H
O P C F B T R UP NF

MJG

Signed 1-17-85 Date

Read and Understood By:

Signed Date

WELL SAMPLING DATA

0128NA011 GN850027

Well Sampling: GW

Well Number 6-3 Time 11:15

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) (ft)
3. Wet length (before pumping) (ft)
4. Distance to water (before pumping) 29.5 (ft)
5. Held length (after pumping) (ft)
6. Wet length (after pumping) (ft)
7. Distance to water (after pumping) (ft)

Sampling Information: Sample Number 469314

1. Depth of well 40 (ft)
2. Diameter of well 4" (inches)
3. Method of collection bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken (ft)
5. Appearance (clear, milky, color) silty red/brown
6. Approximate pumping rate: at start 10 (gpm)
   at finish 10 (gpm)
7. Total time pumped 30 min (hr, min)
8. Total volume pumped 300 gals
9. Field analysis performed:

Dissolved Oxygen mg/l

pH 8.7

Conductivity 336 uhmos/cm

Temperature 18.3 °C

Fractions Collected (circle): G CF S N M RP Cl RS H
U P Z F B T R UF NF
O2

JHC

Signed [signature] Date 1-17-85

Read and Understood By:

Signed [signature] Date [illegible]

WELL SAMPLING DATA

0128NA013 GN850043

Well Sampling:

Well Number GW7-1 Time 1000

Water Level in Well:

1. Distance from top of pipe to ground 1.0 (ft)
2. Held length (before pumping) ______ (ft)
3. Wet length (before pumping) ______ (ft)
4. Distance to water (before pumping) 15.8 (ft)
5. Held length (after pumping) ______ (ft)
6. Wet length (after pumping) ______ (ft)
7. Distance to water (after pumping) ______ (ft)

Sampling Information: Sample Number 469515

1. Depth of well 24.3 (ft)
2. Diameter of well 4 (inches)
3. Method of collection bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ______ (ft)
5. Appearance (clear, milky, color) clear
6. Approximate pumping rate: at start 5 (gpm)
   at finish 5 (gpm)
7. Total time pumped 20 (hr, min)
8. Total volume pumped 100
9. Field analysis performed:

   Dissolved Oxygen ______ mg/l
   pH 4.0
   Conductivity 56 uhmos/cm
   Temperature 18.5 °C

Fractions Collected (circle): C CF G N M RP CI RS H
P P2 O F B T R UP NP

MJG

Signed [signature] Date 1/18/85

Read and Understood By:

Signed [signature] Date [illegible]

WELL SAMPLING DATA

0128 NA 013 GN 85 0044

Well Sampling:

Well Number GW7-2 Time 1130

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ______ (ft)
3. Wet length (before pumping) ______ (ft)
4. Distance to water (before pumping) 13.8 (ft)
5. Held length (after pumping) ______ (ft)
6. Wet length (after pumping) ______ (ft)
7. Distance to water (after pumping) ______ (ft)

Sampling Information: Sample Number 469516

1. Depth of well 22.3 (ft)
2. Diameter of well 4 (inches)
3. Method of collection bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ______ (ft)
5. Appearance (clear, milky, color) ______
6. Approximate pumping rate: at start 5 (gpm)
   at finish 5 (gpm)
7. Total time pumped 30 (hr, min)
8. Total volume pumped 150
9. Field analysis performed:

Dissolved Oxygen ______ mg/l

pH 4.8

Conductivity 102 uhmos/cm

Temperature 18.4 °C

Fractions Collected (circle): G CF S O M RP Cl RS H
D P Z F E T R U N

Signed [signature] Date 1/18

Read and Understood By:

Signed [signature] Date [illegible]

M-20

WELL SAMPLING DATA

0128NA013 GN85 0045

Well Sampling:

Well Number GW7-3 Time 1300

Water Level in Well:

1. Distance from top of pipe to ground 2.5 (ft)
2. Held length (before pumping) ____ (ft)
3. Wet length (before pumping) ____ (ft)
4. Distance to water (before pumping) 12.7 (ft)
5. Held length (after pumping) ____ (ft)
6. Wet length (after pumping) ____ (ft)
7. Distance to water (after pumping) ____ (ft)

Sampling Information: Sample Number 409517

1. Depth of well 22 (ft)
2. Diameter of well 4 (inches)
3. Method of collection bailer (bailer, hand pump, etc)
4. Depth or interval from which sample taken ____ (ft)
5. Appearance (clear, milky, color) ____
6. Approximate pumping rate: at start 5 (gpm)

   at finish 5 (gpm)
7. Total time pumped pumped dry 2x (hr, min)
8. Total volume pumped ____
9. Field analysis performed:

   Dissolved Oxygen ____ mg/l

   pH 5.9

   Conductivity 260 uhmos/cm

   Temperature 19.9 °C

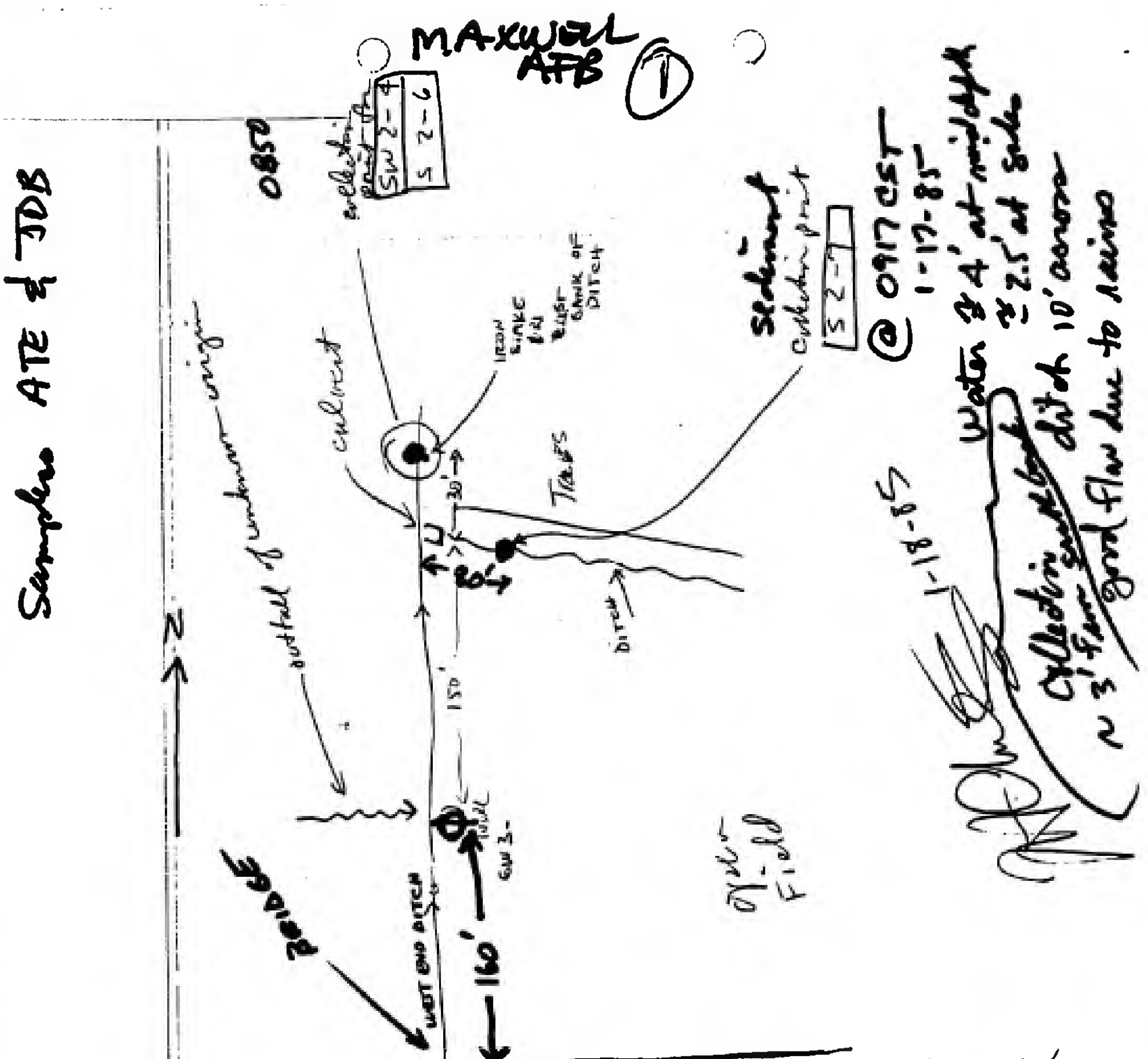
Fractions Collected (circle): C CF S N M RP Cl RS H O R Z F B T R UP NF X2

MJG

Signed 1/18/85 Date

Read and Understood By:

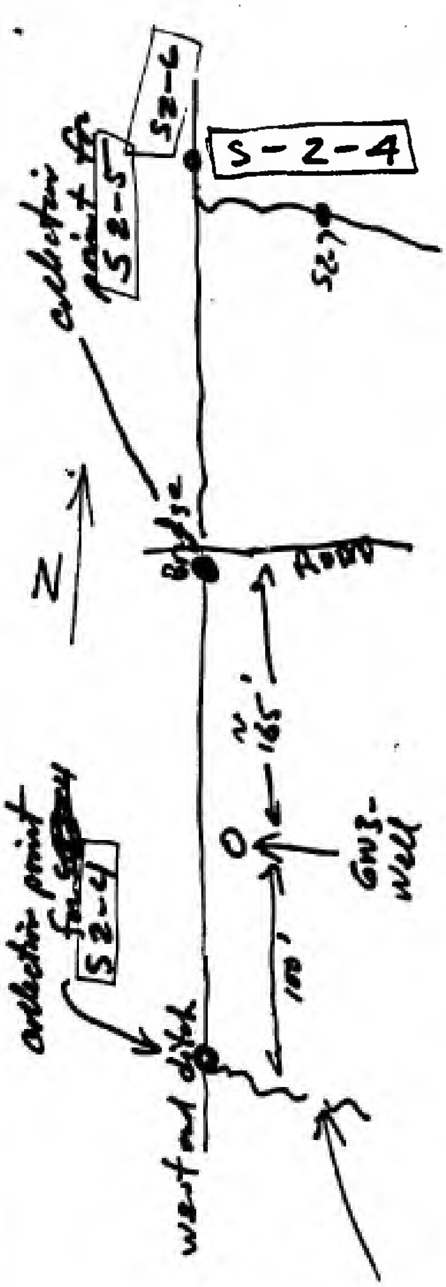
Signed Date



Samples collected at iron stake

Time 0850 HRS CST
Stream ≅ 4' depth in center, 2.5' on banks
Water very turbid, brown color
Water up due to rain
Overcast
Sediment samples collected under 2.5-3.0' water ≅ 1 meter from east bank
Water samples collected ≅ 1.3 meter from east bank

FTA 2 width ≈ 15'



sediment $\boxed{\text{S2-4}}$
collected at 0930 HRS CST
Stream ≅ 4' deep in center
swollen by rain 25',
stream width ≅ ~~[illegible]~~
Stream muddy, good flow
(not measured)
sample collected ≅ 3' from east bank under 2.5' of water

sediment $\boxed{\text{S2-5}}$
collected south of bridge,
adjacent to bridge at
0940 HR CST

FTA

stream conditions same
as $\boxed{\text{S2-4}}$
stream width ≅ 15'
under bridge
sediment collected ~~approx~~
3' from east bank of
ditch under 2.5' of water

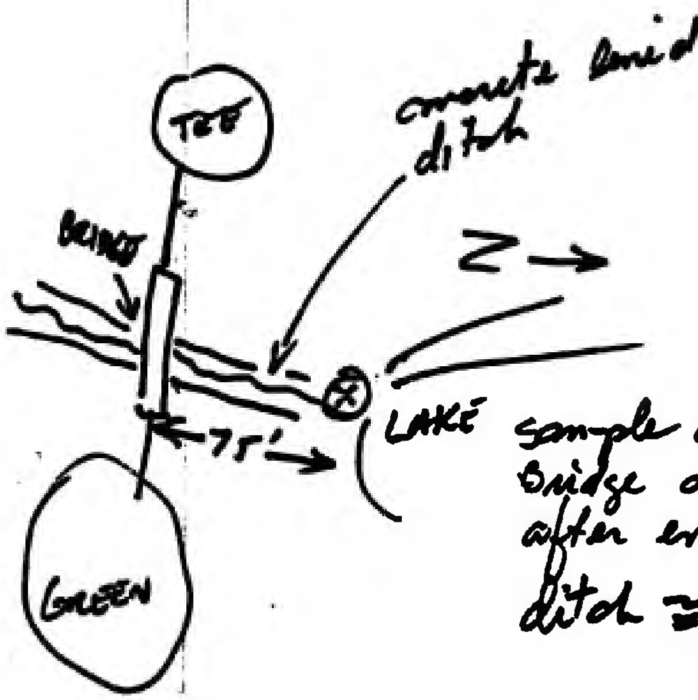
Surface runoff into West end ditch

[signature]
1-18-87

③

[redacted]

S 2-11 Sediment



collector time S 2-11 = 1025 CST

sample collected ≅ 75' N of bridge at point in ditch after end of concrete liner

ditch ≅ 20' wide
4.5' deep in center

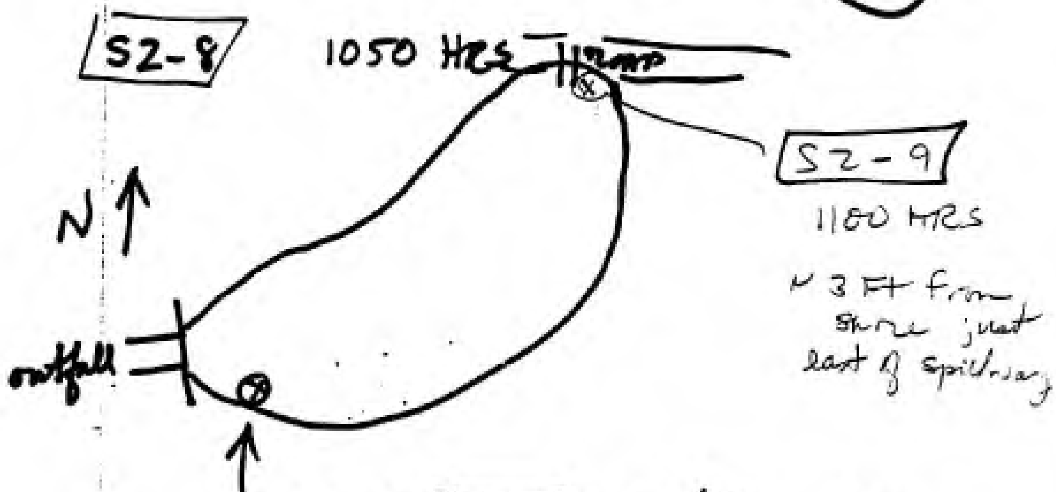
Sampled ≅ 3' from western bank

slow flow in stream (emergency [illegible])

overcast --
stream muddy, with oil sheen ~~[illegible]~~ on top and smell of oil

collectors = JD [redacted] & AT [redacted] 1-18-85

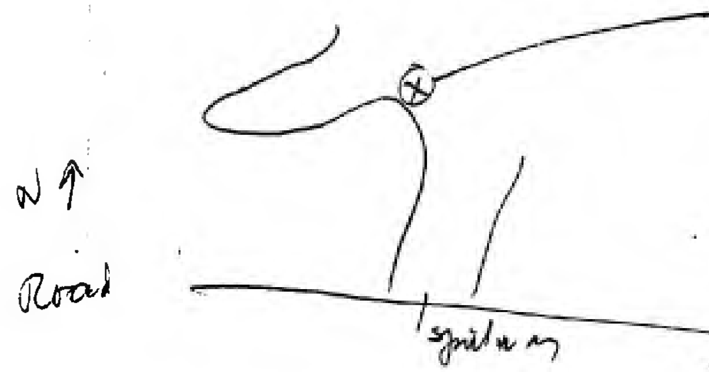
4



Sample S2-8 ~ 3' from shore
depth of water in pond unknown
sediments at depth of 2' under water

1-18-85

(5)



≅ 300' N of Road
in 3' water
≅ 3' from shore
stream calm
muddy
bottom clayey
on west bank
Time = [redacted]

SW 2-3 (surface water) S 2-3 Time = 1135 CST

in West end ditch directly west of GW 1-

Stream ≅ 1.5 → 2' deep
≅ 10 ft width

Water samples at mid depth
sed ≅ 3' from east bank

1-18-85

6

S 2-2 1150 HRS

in west end ditch
adjacent to Well 1-3

sediment collected ≅ 3' from east bank
silty sand,
depth ≅ 2'
width ≅ 15'
Trailer truck park on other side of ditch

S 2-1 1155 HRS

- in west end ditch ≅ 40' south of well 1-4
- ≅ 3' from east bank
≅ 12' width
- bottom very sandy
depth 2'

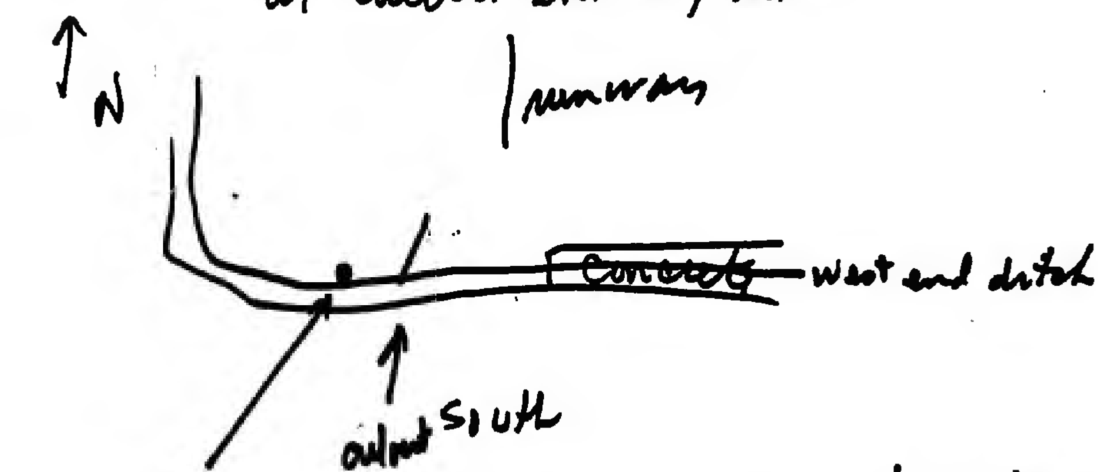
1-18-85

7

surface water

SW 2-2 1210 Hrs CST

≅ 250' west of concrete portion of ditch, at culvert entering ditch

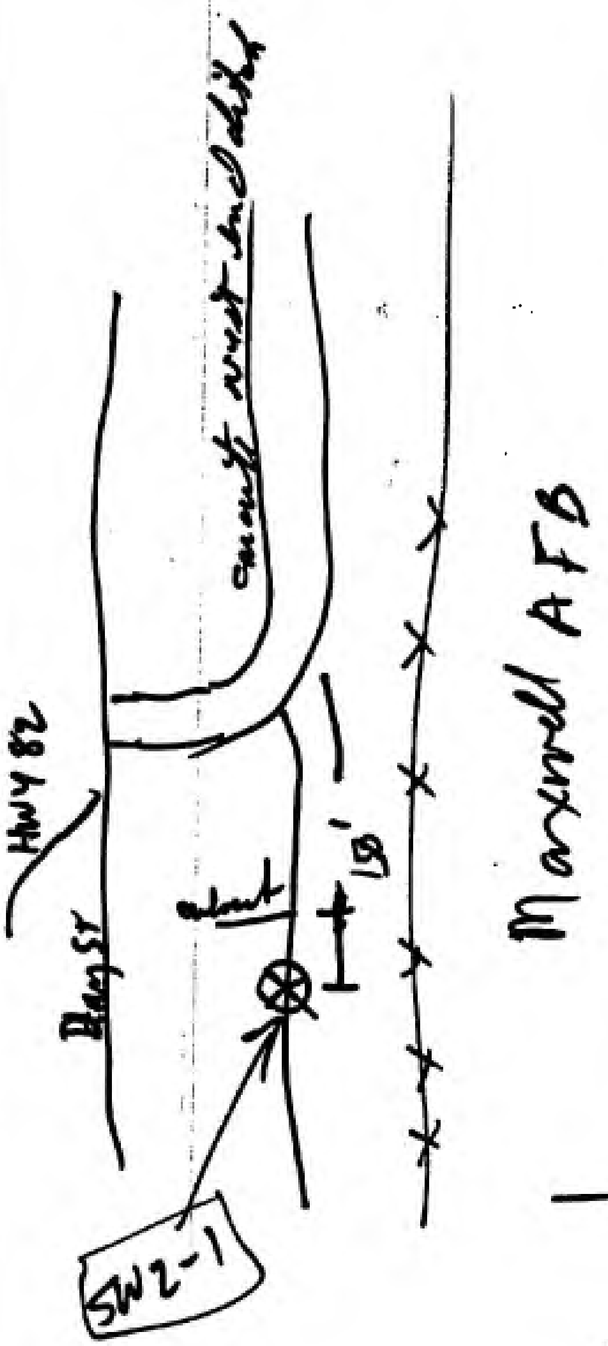


Stream ≅ 10' width
2' depth
muddy from rain on 1-16 and 1-17

[signature] 1-18-83

8

Surface Water $\boxed{\text{SW 2-1}}$ 1250 CST



N

ditch ≈ 2' deep

3' wide

low or no flow

standing water

water dirty from rains

one VOA bottle.

No septum

~~will collect sample later~~

collected 1400

1-18-89

APPENDIX N--CHAIN-OF-CUSTODY DOCUMENTATION

T#0062

ENVIRONMENTAL SCIENCE & ENGINEERING 01/08/85 *** FIELD LOGSHEET *** STORET MAP # 4577 GJA DD:
PROJECT NUMBER: 84425100 PROJECT NAME: MAXWELL AFB LAB COORD. TOM PARK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	AN. SUBSET	PH SU	COND UM/CM	W. TEMP C
							10	91	10
469200	GW1-1		B B C C N N / S S Z Z NF NF	1-18-85	1400		6.6	75	19.2
469201	GW1-2		B B C C N N / S S Z Z NF NF	1-18-85	1515		4.8	203	17.0
469202	GW1-3		B B C C N N / S S Z Z NF NF	1-18-85	1645		6.8	95	18.[illegible]
469203	GW1-4		B B C C N N / S S Z Z NF NF	1-18-85	1545		4.9	77	17.5
469204			B B C C N N / S S Z Z NF NF						
469205			B B C C N N / S S Z Z NF NF						

NOTE -CHANGE OR ENTER SITE ID*S AS NECESSARY; UP TO 6 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN LOGSHEETS WITH SAMPLES TO ESE

	RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	RECEIVED BY (NAME/ORGANIZATION/DATE/TIME)
1	[illegible signature] ESE ~~1-18-85~~ 1-19-85 1700	COLD ROOM Kelly Bugdoll/ESE/1-21-85/09
2		
3		

OTHER FIELD NOTES:

N-1

ENVIRONMENTAL SCIENCE & ENGINEERING 1/07/85 *** FIELD LOGSHEET *** STORET MAP # 4580 GWC DD:
PROJECT NUMBER: 844201.C PROJECT NAME: MAXWELL AFB LAB COORD. TOM PARK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	AN. SUBSET	PH SU	COND UM/CM	W. TEMP C
							[illegible]	[illegible]	[illegible]
469500	GW3-1		P B C C N N / O O S S UP UP / Z Z NF NF X X	1-15-85	1700		5.6	91	17.0
469501	GW3-2		P B C C N N / O O S S UP UP / Z Z NF NF X X	1-15-85	1530		5.2	67	17.6
469502	GW3-3		P B C C N N / O O S S UP UP / Z Z NF NF X X	1-15-85	1145		5.9	264	16.4
469503	GW4-1		P B C C N N / O O S S UP UP / Z Z NF NF						
469504	GW4-2		P B C C N N / O O S S UP UP / Z Z NF NF						
469505	GW4-3		P B C C N N / O O S S UP UP / Z Z NF NF						
469506	GW4-4		P B C C N N / O O S S UP UP / Z Z NF NF						
469507	GW5-1		P B C C N N / O O S S UP UP / Z Z NF NF						
469508	GW5-2		P B C C N N / O O S S UP UP / Z Z NF NF						
469509	GW5-3		P B C C N N / O O S S UP UP / Z Z NF NF						
469510	GW5-4		P B C C N N / O O S S UP UP / Z Z NF NF						
469511	GW5-5		P B C C N N / O O S S UP UP / Z Z NF NF						

ENVIRONMENTAL SCIENCE & ENGINEERING   01/0?/85   *** FIELD LOGSHEET ***   STORET MAP # 4593   GJE   DD:
PROJECT NUMBER: 84420102   PROJECT NAME: MAXWELL AFB   LAB COORD. TOM PARK

ESF #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	AN. SUBSET	PH SU	COND UM/CM	W. TEMP C	
469512	GW6-1		P B C C N N O D S S UP UP Z Z NF NF							
469513	GW6-2		P B C C N N O D S S UP UP Z Z NF NF							
469514	GW6-3		P B C C N N O D S S UP UP Z Z NF NF							
469515	GW7-1		P B C C N N O D S S UP UP Z Z NF NF							
469516	GW7-2		B B C C N N O D S S UP UP Z Z NF NF							
469517	GW7-3		B B C C N N O D S S UP UP Z Z NF NF							
469518			B B C C N N O D S S UP UP Z Z NF NF							
469519			B B C C N N O D S S UP UP Z Z NF NF							

NOTE -CHANGE OR ENTER SITE ID'S AS NECESSARY; UP TO 6 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD: IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN LOGSHEETS WITH SAMPLES TO ESE

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	RECEIVED BY (NAME/ORGANIZATION/DATE/TIME)
1 [signature] ESE 1/16/85	Federal Express - Tom Park ESE 1/17/85 1330hrs
2	
3	

OTHER FIELD NOTES:

T P O

ENVIRONMENTAL SCIENCE & ENGINEERING 01/09/85 *** FIELD LOGSHEET *** STORET MAP # 4586 GJC OD:
PROJECT NUMBER: 84420100 PROJECT NAME: MAXWELL AFB LAB COORD. TOM PARK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	AV. SUBSET	PH SU	COND UM/CM	W. TEMP C
							400	94	10
469500	GW3-1		P B C C N N / O O S S UP UP / Z Z NF NF						
469501	GW3-2		P B C C N N / O O S S UP UP / Z Z NF NF						
469502	GW3-3		P B C C N N / O O S S UP UP / Z Z NF NF						
469503	GW4-1		P B C C N N / O O S S UP UP / Z Z NF NF	1-16-85	1235		5.6	149	19.0
469504	GW4-2		P B C C N N / O O S S UP UP / Z Z NF NF	1-16-85	1215		5.5	88	19.9
469505	GW4-3		P B C C N N / O O S S UP UP / Z Z NF NF	1-16-85	1050		5.2	92	17.1
469506	GW4-4		P B C C N N / O O S S UP UP / Z Z NF NF						
469507	GW5-1		P B C C N N / O O S S UP UP / Z Z NF NF	1-17-85	1800		5.7	146	16.7
469508	GW5-2	rec'd Two Z's no O	P B C C N N / O O S S UP UP / Z Z NF NF	1-16-85	1645		5.3	186	17.5
469509	GW5-3		P B C C N N / O O S S UP UP / Z Z NF NF	1-16-85	1600		5.7	170	18.1
469510	GW5-4		P B C C N N / O O S S UP UP / Z Z NF NF	1-17-85	1545		4.8	79	16.6
469511	GW5-5		P B C C N N / O O S S UP UP / Z Z NF NF	1-17-85	1645		4.6	36	16.1

ENVIRONMENTAL SCIENCE & ENGINEERING   1/04/85   *** FIELD LOGSHEET ***   STORET MAP # 4523   GWC   DD:
PROJECT NUMBER: P442[illegible]   PROJECT NAME: MAXWELL AFB   LAB COORD. TOM PARK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	AN. SUBSET	PH SU	COND UM/CM	W. TEMP C	
469512	GW6-1		B B C C N N O O S S UP UP Z Z NF NF	1-17-85	1000		5.9	430	17.2	
469513	GW6-2 old Top cane off up only ≤ [illegible]		B B C C N N O O S S UP UP Z Z NF NF	1-17-85	1230		4.8	241	18.2	
469514	GW6-3		B B C C N N O O S S UP UP Z Z NF NF	1-17-85	1115		5.7	336	18.3	
469515	GW7-1		B B C C N N O O S S UP UP Z Z NF NF							
469516	GW7-2		B B C C N N O O S S UP UP Z Z NF NF							
469517	GW7-3		B B C C N N O O S S UP UP Z Z NF NF							
469518			B B C C N N O O S S UP UP Z Z NF NF							
469519			B B C C N N O O S S UP UP Z Z NF NF							

NOTE -CHANGE OR ENTER SITE ID'S AS NECESSARY; UP TO 6 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN LOGSHEETS WITH SAMPLES TO ESE

	RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	RECEIVED BY (NAME/ORGANIZATION/DATE/TIME)
1	[illegible] ESE 1/18/85 0830	Kelly Bergdoll ESE 1-21-85 0900
2		
3		

OTHER FIELD NOTES:

See note sample 469513, 469508

N-5

TA 005 ?

ENVIRONMENTAL SCIENCE & ENGINEERING 01/09/85 *** FIELD LOGSHEET ***
PROJECT NUMBER: 8442.1(6 PROJECT NAME: MAYWELL AFB

STORET MAP # 4583 GWC OD:
LAB COORD. TOM PARK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	AV. SUBSET	PH SU	COND UM/CM	W. TEMP C	
469512	GW6-1		P B C C N N / O O S S UP UP / Z Z NF NF				400	91	10	
469513	GW6-2		P B C C N N / O O S S UP UP / Z Z NF NF							
469514	GW6-3		P B C C N N / O O S S UP UP / Z Z NF NF							
469515	GW7-1 N label appears to be filtered		P B C C N N / O O S S UP UP / Z Z NF NF	1-18-85	1015		4.6	56	18.5	
469516	GW7-2		P B C C N N / O O S S UP UP / Z Z NF NF	1-18-85	1130		4.8	102	18.4	
469517	GW7-3		P B C C N N / O O S S UP UP / Z Z NF NF	1-18-85	1300		5.9	260	19.9	
469518			P B C C N N / O O S S UP UP / Z Z NF NF							
469519			P B C C N N / O O S S UP UP / Z Z NF NF							

NOTE -CHANGE OR ENTER SITE ID*S AS NECESSARY: UP TO 6 ALPHANUMERIC CHARACTERS MAY BE USED.
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN LOGSHEETS WITH SAMPLES TO ESE

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	RECEIVED BY (NAME/ORGANIZATION/DATE/TIME)
1 [signature] ESE 1-19-85 1700	Cold Room Kelly Bugdale/ESE
2	
3	

OTHER FIELD NOTES:

note sample 469515,

N-6

ENVIRONMENTAL SCIENCE & ENGINEERING 1/ /85
PROJECT NUMBER: 8942??1?0

*** FIELD LOGSHEET ***
PROJECT NAME: MAXWELL AFB

STORET MAP # 4573 SJF 30:
LAB COORD. TOM PARK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	AN. SUBSET	PH SU	W. TEMP C	COND UM/CM	
469400	SW2-1		B B C C V N / O O S S X X / X X Z Z	1-17-85	1400					
469401	SW2-2		B B C C V N / O O S S X X / X X Z Z	1-17-85	1210					
469402	SW2-3		B B C C V N / O O S S X X / X X Z Z	1-17-85	1135					
469403	SW2-4		B B C C V N / O O S S X X / X X Z Z	1-17-85	0850					
469404			B B C C V N / O O S S X X / X X Z Z							
469405			B B C C V N / O O S S X X / X X Z Z							

NOTE -CHANGE OR ENTER SITE ID'S AS NECESSARY; UP TO 6 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARDS IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN LOGSHEETS WITH SAMPLES TO ESE

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	RECEIVED BY (NAME/ORGANIZATION/DATE/TIME)
1 [signature] ESE 1/18/85 0800	Kelly Bergdoll /ESE/ 1-21-85/ 0900
2	
3	

OTHER FIELD NOTES:
S ... - box ...

N-7

ENVIRONMENTAL SCIENCE & ENGINEERING 12/22/85 *** FIELD LOGSHEET *** STORET MAP # 4734 MAXEP DD:
PROJECT NUMBER: 84427100 PROJECT NAME: MAXWELL AFB LAB COORD.

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	AN. SUBSET				
484900	W1-1A		C	12/19/84						
484901			C							
484902			C							

NOTE -CHANGE OR ENTER SITE ID'S AS NECESSARY; UP TO 6 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN LOGSHEETS WITH SAMPLES TO ESE

	RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	RECEIVED BY (NAME/ORGANIZATION/DATE/TIME)
1	G. Foster ESE	Tom Park ESE 12/21/84
2		
3		

OTHER FIELD NOTES:

ENVIRONMENTAL SCIENCE & ENGINEERING 01/09/85 *** FIELD LOGSHEET *** STORET MAP # 4578 SEDB DD:

PROJECT NUMBER: 84420160 PROJECT NAME: MAXWELL AFB LAB COORD. TOM PARK

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	AV. SUBSET	PH SJ			
469300	S2-1		C C rec'd	1-17-85	1155					
469301	S2-2		C C ~~ice~~ teed C's	1-17-85	1150					
469302	S2-3		C C	1-17-85	1135					
469303	S2-4		C C	1-17-85	0930					
469304	S2-5		C C	1-17-85	0950					
469305	S2-6		C C	1-17-85	0850					
469306	S2-7		C C	1-17-85	0917					
469307	S2-8		C C	1-17-85	1050					
469308	S2-9		C C	1-17-85	1100					
469309	S2-10		C C	1-17-85	1045					
469310	S2-11		C C	1-17-85	1025					
469311			C C							

NOTE -CHANGE OR ENTER SITE ID'S AS NECESSARY: UP TO 6 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE+TIME+FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD: IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN LOGSHEETS WITH SAMPLES TO ESE

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	RECEIVED BY (NAME/ORGANIZATION/DATE/TIME)
1 [signature] ESE 1/18/85 0800	Kelly Bugdall/ESE/1-21-85/0900
2	
3	

OTHER FIELD NOTES:

APPENDIX O--ADDITIONAL QA/QC DATA FOR CHEMICAL ANALYSES

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 95 0 SP.COND,LAB(UMHO/CM))

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
63.0000	63.0000	0.00			

TOTAL # OF REPLICATES 1

FGSUM REPORT FOR

SUMMARY REPORT FOR SPIKET 563 0 OILGR,IR(MG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
18.2575	17.5051	95.8788	18.2575	17.1275	93.8106
18.2575	17.4820	95.7526	18.2575	17.4193	95.4093

AVERAGE % RECOVERY= 95.21 STANDARD DEVIATION= 0.956 # OF SPIKES 4

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 630 0 NITROG,NO2+NO3(MG/L-AS N)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	Z RECOVERY	TARGET CONC.	FOUND CONC.	Z RECOVERY
0.1250	0.1225	98.0175	0.1250	0.1292	103.3374

AVERAGE Z RECOVERY= 100.68 STANDARD DEVIATION= 3.762 # OF SPIKES 2

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	Z DIFFERENCE	REPLICATE A	REPLICATE B	Z DIFFERENCE
0.0851	0.0851	0.00	0.5811	0.5933	2.09
3.9323	4.0489	2.92			

AVERAGE CONCENTRATION	AVERAGE Z DIFFERENCE	# OF VALUES
1.5543	1.6698	3

TOTAL # OF REPLICATES 3

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 680 0 CARBON,TOC(MG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
10.0000	10.5500	105.5000	40.0000	43.3400	108.3500
50.0000	52.9550	105.9100			

AVERAGE % RECOVERY= 106.59 STANDARD DEVIATION= 1.541 # OF SPIKES 3

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
3.5400	3.9300	10.44	1.6854	1.7264	2.40
37.8800	35.6800	6.21	3.1440	3.1960	1.64
1.6406	1.8450	11.73			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
9.4187	6.4839	5

TOTAL # OF REPLICATES 5

FGSUM REPORT FGR

SUMMARY REPORT FOR STORET 945 0 SULFATE (MG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
16.6667	-0.0891	-0.5348	16.6667	12.5398	75.2385
1.9608	1.7724	90.3932	3.8462	4.0798	106.0740
9.0909	10.7931	118.7240			

AVERAGE % RECOVERY= 77.98 STANDARD DEVIATION= 46.839 # OF SPIKES 5

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
20.5133	18.4065	10.82	5.3587	4.5167	17.05

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
12.1991	13.9333	2

TOTAL # OF REPLICATES 2

FGSUN REPORT FOR

SUMMARY REPORT FOR STORET 951 0 FLUORIDE (MG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.9901	1.1231	113.4361	0.9901	1.1173	112.8490
0.9901	0.9273	93.6608	0.9901	0.8910	89.9861
0.9901	0.8593	86.7933			

AVERAGE % RECOVERY= 99.35 STANDARD DEVIATION= 12.829 # OF SPIKES 5

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.3470	0.3511	1.17	1.4405	1.5352	6.36
0.0658	0.0605	8.41	0.8642	0.8406	2.78
0.0878	0.0868	1.22			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.5679	3.9876	5

TOTAL # OF REPLICATES 5

FOSUM REPORT FOR

SUMMARY REPORT FOR STORET 1000 0 ARSENIC,DISS(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
5.0000	5.4700	109.3993	5.0000	5.7332	114.6630
5.0000	4.9371	98.7423	5.0000	4.2447	84.8943
5.0000	3.8212	76.4239			

AVERAGE % RECOVERY= 96.82 STANDARD DEVIATION= 16.113 # OF SPIKES 5

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0286	0.0286	0.00	-0.1097	-0.1097	0.00
0.1857	0.1638	12.51			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.0312	4.1689	3

TOTAL # OF REPLICATES 5

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1002 0 ARSENIC,TOTAL(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
5.0000	5.4624	109.2478	5.0000	5.4707	109.4145

AVERAGE % RECOVERY= 109.33 STANDARD DEVIATION= 0.118 # OF SPIKES 2

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
-0.1097	-0.1097	0.00	0.0563	0.0563	0.00
0.1117	0.1117	0.00	0.2228	0.1673	28.49
0.7814	0.7814	0.00	24.8922	24.3151	2.35
47.8639	45.0068	6.15			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
10.2962	5.2836	7

TOTAL # OF REPLICATES 7

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1005 1 BARIUM,DISS(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
100.0000	37.3850	37.3850	100.0000	107.3000	107.3000
100.0000	104.4400	104.4400	100.0000	108.4900	108.4900
100.0000	93.7050	93.7050			

AVERAGE % RECOVERY= 90.26 STANDARD DEVIATION= 30.131 # OF SPIKES 5

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
871.4699	876.1299	0.53	27.6400	27.2200	1.53
49.2600	40.7800	18.84	30.1600	30.1200	0.13
25.4300	25.2600	0.67			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
200.3489	4.3403	5

TOTAL # OF REPLICATES 5

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1025 1 CADMIUM,DISS(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
100.0000	109.1950	109.1950	100.0000	119.0600	119.0600
100.0000	114.1700	114.1700	100.0000	119.7350	119.7350
100.0000	105.2950	105.2950			

AVERAGE % RECOVERY= 113.49 STANDARD DEVIATION= 6.247 # OF SPIKES 5

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
1.4900	1.0300	36.51	0.4400	1.8600	123.48
2.7100	0.0000	200.00	0.1500	1.2000	155.56
0.8500	0.2400	111.93			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.9970	125.4937	5

TOTAL # OF REPLICATES 5

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1027 1 CADMIUM,TOTAL(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
100.0000	109.1950	109.1950	100.0000	119.0600	119.0600
100.0000	114.1700	114.1700	100.0000	119.7350	119.7350
100.0000	105.2950	105.2950			

AVERAGE % RECOVERY= 113.49 STANDARD DEVIATION= 6.247 # OF SPIKES 5

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
1.4900	1.0300	36.51	0.4400	1.8600	123.48
2.7100	0.0000	200.00	0.1500	1.2000	155.56
0.8500	0.2400	111.93			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.9970	125.4937	5

TOTAL # OF REPLICATES 5

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1030 1 CHROMIUM,DISS (UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
100.0000	110.0000	110.0000	100.0000	105.0000	105.0000
100.0000	103.0000	103.0000	100.0000	86.1150	86.1150
100.0000	96.9850	96.9850	100.0000	90.8250	90.8250
100.0000	96.7500	96.7500	100.0000	82.8150	82.8150

AVERAGE % RECOVERY= 96.44 STANDARD DEVIATION= 9.444 # OF SPIKES 8

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0000	0.0000	0.00	0.3700	1.4000	116.38
0.0700	0.5200	152.54	1.5500	2.9100	88.72
0.0000	0.0000	0.00	0.1500	0.4000	90.91

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
1.1142	74.7591	6

TOTAL # OF REPLICATES 6

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1034 1 CHROMIUM,TOTAL(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
100.0000	86.1150	86.1150	100.0000	96.9850	96.9850
100.0000	90.8250	90.8250	100.0000	96.7500	96.7500
100.0000	82.8150	82.8150			

AVERAGE % RECOVERY= 90.70 STANDARD DEVIATION= 6.311 # OF SPIKES 5

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.3700	1.4000	116.38	0.0700	0.5200	152.54
7.5500	2.9100	88.72	0.0000	0.0000	0.00
0.1500	0.4000	90.91			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
1.3370	89.7109	5

TOTAL # OF REPLICATES 5

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1040 1 COPPER,DISS(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
100.0000	112.0000	112.0000	100.0000	110.0000	110.0000
100.0000	119.0000	119.0000	100.0000	97.0900	97.0900
100.0000	105.0850	105.0850	100.0000	99.8900	99.8900
100.0000	106.1950	106.1950	100.0000	93.4050	93.4050

AVERAGE % RECOVERY= 105.33 STANDARD DEVIATION= 8.398 # OF SPIKES 8

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0000	0.0000	0.00	1.7200	1.9500	12.53
0.9900	1.5800	45.91	17.2900	16.3400	5.65
0.7900	0.5600	34.07	0.0900	0.5800	146.27

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
3.4908	40.7402	6

TOTAL # OF REPLICATES 6

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1046 1 IRON,DISS (UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
100.0000	84.1700	84.1700	100.0000	100.6500	100.6500
100.0000	79.2250	79.2250	100.0000	68.7550	68.7550

AVERAGE % RECOVERY= 83.20 STANDARD DEVIATION= 13.290 # OF SPIKES 4

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
36.2400	37.9600	4.64	18.9400	16.7800	12.09
3964.8696	2960.5396	29.00	568.4698	569.6599	0.21
199.2500	200.1600	0.46			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
857.2866	9.2798	5

TOTAL # OF REPLICATES 5

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1049 0 LEAD,DISS (UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
6.2500	5.5661	89.0573	25.0000	19.4309	77.7236
25.0000	26.4304	105.7216			

AVERAGE % RECOVERY= 90.83 STANDARD DEVIATION= 14.083 # OF SPIKES 3

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.7438	0.7438	0.00	5.1262	5.1262	0.00
0.3073	0.3073	0.00			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
2.0591	0.0000	3

TOTAL # OF REPLICATES 3

FOSDN REPORT FOR

SUMMARY REPORT FOR STORET 1051 0 LEAD,TOTAL(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
25.0000	19.3621	77.4483	25.0000	23.4129	93.6518
25.0000	20.1571	80.6285			

AVERAGE % RECOVERY= 83.91 STANDARD DEVIATION= 8.586 # OF SPIKES 3

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
2.7067	2.2271	19.51	36.9715	32.2652	13.59
9.0279	7.0719	24.30	23.0095	23.0095	0.00
6.0978	7.0719	14.79			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
14.9461	14.4401	5

TOTAL # OF REPLICATES 5

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1065 1 NICKEL,DISS(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
100.0000	96.1150	96.1150	100.0000	97.0400	97.0400
100.0000	93.5450	93.5450	100.0000	101.6750	101.6750
100.0000	87.2500	87.2500			

AVERAGE % RECOVERY= 95.12 STANDARD DEVIATION= 5.293 # OF SPIKES 5

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
2.1900	1.4800	38.69	3.2200	2.1400	40.30
7.4000	3.9300	61.25	1.0700	4.8000	127.09
-0.2000	0.4600	507.69			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
2.6490	155.0046	5

TOTAL # OF REPLICATES 5

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1067 1 NICKEL,T,(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
100.0000	96.1150	96.1150	100.0000	97.0400	97.0400
100.0000	93.5450	93.5450	100.0000	101.6750	101.6750
100.0000	87.2500	87.2500			

AVERAGE % RECOVERY= 95.12 STANDARD DEVIATION= 5.293 # OF SPIKES 5

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
2.1900	1.4800	38.69	3.2200	2.1400	40.30
7.4000	3.9300	61.25	1.0700	4.8000	127.09
-0.2000	0.4600	507.69			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
2.6490	155.0046	5

TOTAL # OF REPLICATES 5

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1075 1 SILVER,DISS(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
100.0000	113.2100	113.2100	100.0000	120.7900	120.7900
100.0000	117.7250	117.7250	100.0000	124.4150	124.4150
100.0000	109.1350	109.1350			

AVERAGE % RECOVERY= 117.05 STANDARD DEVIATION= 6.043 # OF SPIKES 5

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
1.5600	0.0000	200.00	1.5600	1.3800	12.24
0.8100	0.1000	156.04	1.7300	0.9400	59.18
0.6300	1.1200	56.00			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.9830	96.6930	5

TOTAL # OF REPLICATES 5

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1090 I ZINC,DISS (UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
100.0000	111.0000	111.0000	100.0000	108.0000	108.0000
100.0000	121.0000	121.0000	100.0000	117.5150	117.5150
100.0000	110.5700	110.5700	100.0000	118.1200	118.1200
100.0000	101.9700	101.9700			

AVERAGE % RECOVERY= 112.60 STANDARD DEVIATION= 6.659 # OF SPIKES 7

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0000	0.0000	0.00	659.6798	662.2198	0.38
-3.5500	0.0000	0.00	109.9500	81.8100	29.35
48.7200	46.7800	4.06	21.3200	22.2300	4.18

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
137.4299	6.3292	6

TOTAL # OF REPLICATES 6

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1092 1 ZINC,TOTAL(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
100.0000	117.5150	117.5150	100.0000	110.5700	110.5700
100.0000	118.1200	118.1200	100.0000	101.9700	101.9700

AVERAGE % RECOVERY= 112.04 STANDARD DEVIATION= 7.539 # OF SPIKES 4

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
659.6790	662.2190	0.38	-3.5500	0.0000	0.00
109.9500	81.4100	29.35	48.7200	46.7800	4.06
21.3200	22.2300	4.18			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
164.9159	7.5951	5

TOTAL # OF REPLICATES 5

EGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1145 1 SELENIUM,DISS(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
5.0000	5.9658	119.3161	5.0000	5.3659	107.3171

AVERAGE % RECOVERY= 113.32 STANDARD DEVIATION= 8.485 # OF SPIKES 2

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.1322	0.1322	0.00	0.1322	0.1322	0.00
0.1322	0.1322	0.00			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.1322	0.0000	3

TOTAL # OF REPLICATES 3

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 32730 0 PHENOLS (UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
59.6421	63.8823	107.1093	5.9642	6.3826	107.0155
59.6421	61.2782	102.7432	59.6421	57.0505	95.6546
59.6421	64.1819	107.6116			

AVERAGE % RECOVERY= 104.03 STANDARD DEVIATION= 5.075 # OF SPIKES 5

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
6.0750	6.3043	3.70	3.7411	4.2174	11.97
8.8917	7.7457	13.78	1.5806	1.6541	4.55
9.3451	7.6980	19.33	2.1116	1.7407	19.25

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
5.0921	12.0961	6

TOTAL # OF REPLICATES 6

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 39340 0 BHC,G(LINDANE)(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.0230	0.0156	67.7364	0.0230	0.0178	77.6864

AVERAGE % RECOVERY= 72.71 STANDARD DEVIATION= 7.037 # OF SPIKES 2

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0010	0.0010	0.00			

TOTAL # OF REPLICATES 1

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 39390 0 ENDRIN (UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.0434	0.0342	78.7637	0.0434	0.0399	92.0721

AVERAGE % RECOVERY= 85.42 STANDARD DEVIATION= 9.410 # OF SPIKES 2

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0050	0.0050	0.00			

TOTAL # OF REPLICATES 1

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 39400 0 TOXAPHENE (UG/L)

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.1200	0.1200	0.00			

TOTAL # OF REPLICATES 1

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 39480 0 METHOXYCHLOR (UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.2317	0.2081	89.8387	0.2317	0.2082	89.8634

AVERAGE % RECOVERY= 89.85 STANDARD DEVIATION= 0.017 # OF SPIKES 2

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0300	0.0300	0.00			

TOTAL # OF REPLICATES 1

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 39730 0 2,4-D, TOTAL (UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.4060	0.3029	74.6159	0.4067	0.1701	41.8402

AVERAGE % RECOVERY= 58.23 STANDARD DEVIATION= 23.176 # OF SPIKES 2

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0303	0.0303	0.00	0.0303	0.0303	0.00

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.0303	0.0000	2

TOTAL # OF REPLICATES 2

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 39760 0 2,4,5-TP/SILVEX (UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.0940	0.0701	74.5665	0.0940	0.0655	69.6557

AVERAGE % RECOVERY= 72.11 STANDARD DEVIATION= 3.47% # OF SPIKES 2

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0000	0.0070	200.00	0.0070	0.0070	0.00

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.0052	100.0000	2

TOTAL # OF REPLICATES 2

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 70300 0 RESIDUE,DISS(MG/L)

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
1373.0000	1360.0000	0.95	88.0000	85.0000	3.41
51.6000	57.0000	11.11	65.0000	69.0000	5.97
123.0000	120.0000	2.47			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
339.1000	4.7940	5

TOTAL # OF REPLICATES 5

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 70353 0 TOX (UG/L-CL)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
2.4999	2.8300	113.2032	2.4999	2.8200	112.8029

AVERAGE % RECOVERY= 113.00 STANDARD DEVIATION= 0.283 # OF SPIKES 2

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
32.4000	31.3000	3.45	36.4000	24.2000	40.26

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
31.0750	21.8588	2

TOTAL # OF REPLICATES 2

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 71890 0 MERCURY,DISS.(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
5.0000	4.3133	86.2662	5.0000	4.6214	92.4287
5.0000	5.1265	102.5304			

AVERAGE % RECOVERY= 93.74 STANDARD DEVIATION= 8.211 # OF SPIKES 3

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0429	0.0429	0.00	0.0429	0.0429	0.00
0.0429	0.0429	0.00	0.0429	0.0429	0.00
-0.0058	0.0627	241.02			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.0400	48.2040	5

TOTAL # OF REPLICATES 5

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 71900 D MERCURY,TOTAL(UG/L)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
5.0000	5.0394	100.7881	5.0000	3.9468	78.9358

AVERAGE % RECOVERY= 89.86 STANDARD DEVIATION= 15.452 # OF SPIKES 2

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0318	0.0318	0.00	1.2536	1.1951	4.78

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.6281	2.3889	2

TOTAL # OF REPLICATES 2

EGSUM REPORT FOR

SUMMARY REPORT FOR STORET 721 0 CYANIDE,SED (UG/G- DRY)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
12.9870	9.9221	76.4000	15.1515	12.5000	82.5000

AVERAGE % RECOVERY= 79.45 STANDARD DEVIATION= 4.313 # OF SPIKES 2

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0600	0.1300	73.68	0.4000	0.7000	54.55

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.3225	64.1148	2

TOTAL # OF REPLICATES 2

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1003 0 ARSENIC,SED (UG/G- DRY)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.0050	0.0056	112.4292	0.0050	0.0061	121.3723

AVERAGE % RECOVERY= 116.90 STANDARD DEVIATION= 6.324 # OF SPIKES 2

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
3.9915	3.9915	0.00	7.3424	0.1912	189.85
3.2646	3.5320	7.87			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
3.7169	65.9041	3

TOTAL # OF REPLICATES 3

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1028 1 CADMIUM,SED (UG/G- DRY)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.1000	0.1011	101.1200	0.1000	0.1263	126.2850
0.1000	0.1086	108.6450	0.1000	0.1137	113.7000
0.1000	0.1288	128.8400	0.1000	0.1084	108.3850

AVERAGE % RECOVERY= 114.50 STANDARD DEVIATION= 10.917 # OF SPIKES 6

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0122	0.0139	12.70	0.0032	0.0019	50.78
0.0010	0.0009	11.64	0.0052	0.0047	8.91
0.0022	0.0025	13.11	0.0009	0.0038	123.77
0.0019	0.0009	68.06	0.0006	0.0003	65.17
0.0031	0.0023	29.85	-0.0001	0.0003	333.33
0.0146	0.0135	7.26	0.0073	0.0069	6.07
0.0021	0.0000	200.00	0.0011	0.0013	10.88
0.0017	0.0001	180.33	0.0001	0.0035	187.91
0.0008	0.0000	200.00	0.0007	0.0023	101.66
0.2699	0.2692	0.28	0.0016	0.0016	4.33
0.0054	0.0079	38.20	0.0101	0.0089	12.27
0.0053	0.0041	24.52	0.0119	0.0129	8.70
0.0233	0.0225	3.41	0.0084	0.0131	42.98
0.0302	0.0340	11.84	0.0197	0.0189	4.41
0.0237	0.0251	5.66	0.0086	0.0094	8.20
0.0089	0.0100	12.19	0.0116	0.0103	11.13

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.0157	56.2360	32

TOTAL # OF REPLICATES 32

FUSUM REPORT FOR

SUMMARY REPORT FOR STUKEI 1029 1 CHROMIUM,SED (UG/G- DRY)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.1000	0.0965	96.4900	0.1000	0.1207	120.6600
0.1000	0.1013	101.2750	0.1000	0.1058	105.7900
0.1000	0.1028	102.8300	0.1000	0.1112	111.1700

AVERAGE % RECOVERY= 106.70 STANDARD DEVIATION= 8.093 # OF SPIKES 6

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0162	0.0181	11.26	0.0016	0.0019	17.54
0.0037	0.0021	52.67	0.0051	0.0025	70.18
0.0060	0.0064	6.58	0.0120	0.0082	37.44
0.0059	0.0034	51.77	0.0038	0.0050	26.82
0.0025	0.0022	13.39	0.0008	0.0023	91.03
0.0161	0.0130	21.17	0.0197	0.0204	3.50
0.0035	0.0012	98.28	0.0009	0.0012	23.70
0.0031	0.0048	43.02	0.0041	0.0032	23.98
0.0031	0.0036	15.07	0.0121	0.0138	12.72
1.0686	1.0677	0.08	0.0638	0.0612	4.15
0.1471	0.1481	0.68	0.3005	0.3144	4.53
0.1062	0.1153	8.29	0.3692	0.3930	6.25
0.5142	0.5422	5.29	0.4594	0.4887	6.17
0.4793	0.4939	3.01	0.6699	0.6713	0.21
0.7176	0.7258	1.14	0.3872	0.3844	0.72
0.4729	0.4673	1.19	0.4482	0.4388	2.11

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.1992	20.7474	32

TOTAL # OF REPLICATES 32

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1043 1 COPPER,SED (UG/G- DRY)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.1000	0.0928	92.8500	0.1000	0.1128	112.8400
0.1000	0.0993	99.2950	0.1000	0.1033	103.3450
0.1000	0.1164	116.4000	0.1000	0.0937	93.6650

AVERAGE % RECOVERY= 103.40 STANDARD DEVIATION= 10.364 # OF SPIKES 6

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0280	0.0277	0.79	0.0046	0.0030	40.94
0.0004	0.0015	114.58	0.0018	0.0036	66.91
0.0101	0.0100	1.19	0.0913	0.0897	1.78
0.0100	0.0070	36.33	0.0107	0.0113	5.47
0.0036	0.0050	31.16	-0.0009	0.0000	0.00
0.0663	0.0660	0.48	0.0220	0.0216	2.16
0.0077	0.0096	22.56	-0.0029	0.0000	0.00
0.0076	0.0064	17.87	0.0159	0.0171	7.25
0.0165	0.0181	9.06	0.0698	0.0688	1.46
0.3950	0.3985	0.89	0.0361	0.0339	6.32
0.1775	0.1798	1.29	0.3367	0.3536	4.89
0.0874	0.0943	7.57	0.4660	0.4918	5.38
0.6963	0.7327	5.09	0.6816	0.7131	4.53
0.7966	0.8219	2.87	0.8076	0.8022	0.67
0.7291	0.7289	0.02	0.2366	0.2356	0.42
0.2375	0.2342	1.41	0.5250	0.5179	1.37

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.2075	12.5843	32

TOTAL # OF REPLICATES 32

FOSUM REPORT FOR

SUMMARY REPORT FOR STORET 1052 1 LEAD,SED (UG/G-DRY)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.1000	0.0869	86.9050	0.1000	0.1285	128.4900
0.1000	0.0939	93.9000	0.1000	0.1013	101.2599
0.1000	0.1053	105.2949	0.1000	0.0902	90.1600

AVERAGE % RECOVERY= 101.33 STANDARD DEVIATION= 14.750 # OF SPIKES 6

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.0086	0.0014	143.48	-0.0130	0.0000	0.00
-0.0002	0.0000	0.00	0.0172	0.0062	93.69
-0.0106	0.0055	0.00	0.0198	0.0225	12.72
0.0058	0.0000	200.00	-0.0077	0.0017	0.00
0.0132	0.0027	131.49	-0.0059	0.0000	0.00
0.1082	0.1051	2.90	0.1757	0.1608	2.89
-0.0240	0.0000	0.00	-0.0082	0.0000	0.00
0.0010	0.0000	200.00	0.0011	0.0115	163.69
0.0156	0.0110	35.13	0.0028	0.0207	152.32
5.8900	5.8335	0.96	0.1573	0.1753	10.62
1.1239	1.1530	2.56	1.5633	1.6664	6.39
0.3653	0.3696	1.16	3.3498	3.5919	6.98
2.4434	2.6270	7.27	1.1284	1.2119	7.14
3.4614	3.7327	7.54	9.3473	9.3271	0.22
7.0259	7.0556	0.38	1.2096	1.1809	2.40
1.3548	1.3270	2.08	2.3361	2.2168	5.24

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
1.3202	37.4826	32

TOTAL # OF REPLICATES 32

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1065 1 NICKEL,SED (UG/G- DRY)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.1000	0.0865	86.4750	0.1000	0.1189	118.8950
0.1000	0.1010	100.9550	0.1000	0.1003	100.2850
0.1000	0.1035	103.4600	0.1000	0.0974	97.3900

AVERAGE % RECOVERY= 101.91 STANDARD DEVIATION= 10.784 # OF SPIKES 6

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
0.1667	0.1616	3.13	0.0028	0.0031	12.52
0.0087	0.0083	5.18	0.0228	0.0219	4.02
0.0500	0.0517	3.34	0.0166	0.0165	9.69
0.0413	0.0400	3.05	0.0479	0.0456	4.81
0.0100	0.0079	23.96	-0.0005	0.0024	305.82
0.2830	0.2793	1.31	0.3519	0.3563	1.24
0.0070	0.0095	30.17	0.0048	0.0061	24.26
0.0087	0.0098	12.74	0.0056	0.0062	10.01
0.0089	0.0126	34.42	0.0344	0.0383	10.71
0.9432	0.9317	1.23	0.0267	0.0302	12.23
0.1750	0.1739	0.64	0.0508	0.0563	10.26
0.0195	0.0241	21.18	0.0978	0.1003	2.56
0.1865	0.1986	6.27	0.1473	0.1631	10.21
0.1891	0.1962	3.71	0.2741	0.2700	1.50
0.1871	0.1854	0.95	0.1226	0.1200	2.09
0.1586	0.1568	1.17	0.1413	0.1401	0.85

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
0.1190	17.9769	32

TOTAL # OF REPLICATES 32

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 1093 1 ZINC,SED (UG/G-DRY)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.1000	0.1134	113.3600	0.1000	0.0956	95.6350

AVERAGE % RECOVERY= 104.50 STANDARD DEVIATION= 12.533 # OF SPIKES 2

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
14.3118	14.3118	0.00	0.0264	0.0589	76.27
0.8421	0.8706	3.35	4.1203	4.1189	0.04
6.3492	6.4833	2.09	2.1780	2.1879	0.46
7.1965	7.1493	0.66	8.0081	8.0126	0.06
1.4469	1.4365	0.72	0.0106	0.0161	41.35
146.8278	144.7201	1.45	174.3127	174.0282	0.16
0.0283	0.9177	188.02	0.0844	0.7278	158.43
0.1554	0.8755	139.72	0.0195	0.6682	188.66
0.0464	0.6658	173.96	1.9076	2.4542	25.06
396.1058	396.3166	0.05	2.0324	1.8894	7.30
2.7576	3.0183	9.03	0.6861	0.7307	6.29
0.1865	0.2054	9.64	1.5133	1.6025	5.73
2.8726	3.0232	5.11	1.8077	1.9040	5.19
4.4618	4.7409	6.07	8.1190	8.0928	0.32
3.2451	3.2663	0.65	1.1612	1.1528	0.73
1.1287	1.1008	2.51	2.1727	2.1315	1.92

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
24.9219	33.1554	32

TOTAL # OF REPLICATES 32

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 70320 0 MOISTURE(%WET WT)

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
2.0000	2.0000	0.00	1.0000	1.0000	0.00
2.0000	2.0000	0.00	1.0000	1.0000	0.00
1.0000	1.0000	0.00			

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
1.4000	0.0000	5

TOTAL # OF REPLICATES 5

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 71921 1 MERCURY,SED (UG/G- DRY)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
0.1000	0.0812	81.2400	0.1000	0.1215	121.4700
0.1000	0.1064	106.4050	0.1000	0.1095	109.4800
0.1000	0.1023	102.3450	0.1000	0.1049	104.9150

AVERAGE % RECOVERY= 104.31 STANDARD DEVIATION= 13.130 # OF SPIKES 6

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
-0.0073	0.0000	0.00	-0.0106	0.0000	0.00
-0.0113	0.0000	0.00	-0.0130	0.0000	0.00
-0.0075	0.0000	0.00	-0.0126	0.0000	0.00
-0.0100	0.0000	0.00	-0.0103	0.0000	0.00
-0.0091	0.0000	0.00	-0.0159	0.0000	0.00
-0.0145	0.0000	0.00	-0.0144	0.0000	0.00
-0.0180	0.0000	0.00	-0.0100	0.0000	0.00
-0.0152	0.0000	0.00	-0.0091	0.0000	0.00
-0.0187	0.0000	0.00	-0.0037	0.0000	0.00
0.0050	0.0047	7.39	-0.0134	0.0000	0.00
-0.0109	0.0000	0.00	-0.0001	0.0000	0.00
-0.0079	0.0000	0.00	-0.0063	0.0000	0.00
0.0116	0.0057	69.13	-0.0023	0.0000	0.00
0.0008	0.0033	119.80	0.0076	0.0048	36.55
-0.0016	0.0015	0.00	-0.0070	0.0000	0.00
0.0002	0.0016	158.70	0.0064	0.0009	148.09

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
-0.0092	16.8644	32

TOTAL # OF REPLICATES 32

FGSUM REPORT FOR

SUMMARY REPORT FOR STORET 99344 0 TOE,SED (UG/G-DRY)

SPIKE ANALYSIS RESULTS

TARGET CONC.	FOUND CONC.	% RECOVERY	TARGET CONC.	FOUND CONC.	% RECOVERY
530.3030	549.3199	103.5860			

REPLICATE ANALYSIS RESULTS FOR REPLICATES > DET.LIMIT

REPLICATE A	REPLICATE B	% DIFFERENCE	REPLICATE A	REPLICATE B	% DIFFERENCE
353.5833	334.3923	5.58	183.0723	211.6788	14.49

AVERAGE CONCENTRATION	AVERAGE % DIFFERENCE	# OF VALUES
270.6816	10.0362	2

TOTAL # OF REPLICATES 2

APPENDIX P--ANALYTICAL RESULTS FOR GROUND WATERS AND SURFACE WATERS

ENVIRONMENTAL SCIENCE & ENGINEERING 04/11/85 STATUS: FINAL

PROJECT NUMBER 84420100
FIELD GROUP: GWA
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME MAXWELL AFB
PROJECT MANAGER: JOHN BONDS
FIELD GROUP LEADER: TOM PARK

SAMPLE NUMBERS

PARAMETERS	STORET #	METHOD #	GWI-1 469200	GWI-2 469201	GWI-3 469202	GWI-4 469203
DATE			1/18/85	1/18/85	1/18/85	1/18/85
TIME			1400	1515	1645	1545
PH,FIELD(STD UNITS)	400	0	6.60	4.80	5.80	4.90
CADMIUM,DISS(UG/L)	1025	0	<3.0	<3.0	<3.0	<3.0
CHROMIUM,DISS (UG/L)	1030	0	<6.0	<6.0	<6.0	<6.0
COPPER,DISS(UG/L)	1040	0	<3.0	<3.0	<3.0	<3.0
NICKEL,DISS(UG/L)	1065	0	<9.0	<9.0	<9.0	<9.0
ZINC,DISS (UG/L)	1090	0	<3.0	21.0	54.0	12.0
CARBON,TOC(MG/L)	680	0	2.5	5.1	2.7	4.4
PHENOLS (UG/L)	32730	0	12	4	4	7
RESIDUE,DISS(MG/L)	70300	0	54	153	26	80
SP.COND.,FIELD (UMHOS/CM)	94	0	75.0	203	95.0	77.0
WATER TEMP (C)	10	0	19.2	17.0	18.1	17.5
CYANIDE(UG/L)	99315		<10	<10	<10	<10

ENVIRONMENTAL SCIENCE & ENGINEERING 04/11/85 STATUS: FINAL

PROJECT NUMBER 84420100
FIELD GROUP: GWC
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME MAXWELL AFB
PROJECT MANAGER: JOHN BONDS
FIELD GROUP LEADER: TOM PARK

PARAMETERS	STORET # METHOD #	GW3-1 469500	GW3-2 469501	GW3-3 469502	GW4-1 469503	GW4-2 469504	GW4-3 469505	GW5-1 469507	GW5-2 469508	GW5-3 469509	GW5-4 469510
DATE		1/15/85	1/15/85	1/15/85	1/16/85	1/16/85	1/16/85	1/17/85	1/16/85	1/16/85	1/17/85
TIME		1700	1530	1145	1245	1215	1030	1800	1645	1600	1545
PH,FIELD(STD UNITS)	400 0	5.60	5.20	5.90	5.60	5.50	5.20	5.70	5.30	5.70	4.80
ARSENIC,DISS(UG/L)	1000 0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BARIUM,DISS(UG/L)	1005 0	30	19	33	74	32	22	19	41	25	26
CADMIUM,DISS(UG/L)	1025 0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
COPPER,DISS(UG/L)	1040 0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
CHROMIUM,DISS (UG/L)	1030 0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
IRON,DISS (UG/L)	1046 0	568	70	91	5	<4	<4	60	22	199	253
MERCURY,DISS.(UG/L)	71890 0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
NICKEL,DISS(UG/L)	1065 0	<9.0	<9.0	<9.0	<9.0	<9.0	<9.0	<9.0	<9.0	<9.0	<9.0
LEAD,DISS (UG/L)	1049 0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
SILVER,DISS(UG/L)	1075 0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
ZINC,DISS (UG/L)	1090 0	48.7	<3.0	17.8	5.6	<3.0	<3.0	<3.0	10.6	21.3	<3.0

NITROG,NO2+NO3(MG/L-AS N)	630 0	0.085	0.712	0.655	0.802	0.567	0.749	0.462	0.252	0.597	1.03
SULFATE (MG/L)	945 0	41	14	43	80	60	150	18	27	44	11
RESIDUE,DISS(MG/L)	70300 0	101	55	145	121	69	76	92	122	150	65
PHENOLS (UG/L)	32730 0	6	<1	6	8	1	3	3	2	5	2
OILEGR,IR(MG/L)	560 0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOX (UG/L-CL)	70353 0	32	25	21	26	20	16	34	32	36	49
CARBON,TOC(MG/L)	680 0	3.5	1.4	3.2	4.9	1.9	2.8	1.4	3.4	3.2	<1.4
ENDRIN (UG/L)	39390 0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

ENVIRONMENTAL SCIENCE & ENGINEERING 04/11/85 STATUS: FINAL

PROJECT NUMBER 84420100
FIELD GROUP: GWC
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME MAXWELL AFB
PROJECT MANAGER: JOHN BONDS
FIELD GROUP LEADER: TOM PARK

PARAMETERS	STORET # / METHOD #	GW3-1 469500	GW3-2 469501	GW3-3 469502	GW4-1 469503	GW4-2 469504	GW4-3 469505	GW5-1 469507	GW5-2 469508	GW5-3 469509	GW5-4 469510
		SAMPLE NUMBERS									
DATE		1/15/85	1/15/85	1/15/85	1/16/85	1/16/85	1/16/85	1/17/85	1/16/85	1/16/85	1/17/85
TIME		1700	1530	1145	1245	1215	1030	1800	1645	1600	1545
BHC,G(LINDANE)(UG/L)	39340 / 0	<0.001	1.3	0.17	<0.001	<0.001	<0.001	0.17	0.26	1.3	1.5
METHOXYCHLOR (UG/L)	39480 / 0	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027
TOXAPHENE (UG/L)	39400 / 0	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
2,4-D, TOTAL (UG/L)	39730 / 0	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
2,4,5-TP/SILVEX (UG/L)	39760 / 0	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
FLUORIDE (MG/L)	951 / 0	0.15	<0.10	0.11	<0.10	<0.10	0.12	0.14	<0.10	<0.10	<0.10
SP.COND.,FIELD (UMHOS/CM)	94 / 0	91.0	67.0	264	149	88.0	92.0	146	186	130	79.0
WATER TEMP (C)	10 / 0	17.0	17.6	16.4	19.0	19.9	17.1	16.7	17.5	18.1	16.6
SELENIUM,DISS(UG/L)	1145 / 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
CYANIDE(UG/L)	99315 / 0	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

ENVIRONMENTAL SCIENCE & ENGINEERING 04/11/85 STATUS: FINAL

PROJECT NUMBER 84420100
FIELD GROUP: GWC
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME MAXWELL AFB
PROJECT MANAGER: JOHN BONDS
FIELD GROUP LEADER: TOM PARK

PARAMETERS	STORET # / METHOD #	GW5-5 469511	GW6-1 469512	GW6-2 469513	GW6-3 469514	GW7-1 469515	GW7-2 469516	GW7-3 469517
		SAMPLE NUMBERS						
DATE		1/17/85	1/17/85	1/17/85	1/17/85	1/18/85	1/18/85	1/18/85
TIME		1645	1000	1230	1115	1015	1130	1300
PH,FIELD(STD UNITS)	400 / 0	4.60	5.90	4.80	5.70	4.60	4.80	5.90
ARSENIC,DISS(UG/L)	1000 / 0	<1	<1	<1	<1	<1	<1	<1
BARIUM,DISS(UG/L)	1005 / 0	23	50	252	120	49	31	117
CADMIUM,DISS(UG/L)	1025 / 0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
COPPER,DISS(UG/L)	1040 / 0	<3.0	<3.0	<3.0	<3.0	<3.0	3.1	<3.0
CHROMIUM,DISS (UG/L)	1030 / 0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
IRON,DISS (UG/L)	1046 / 0	<4	<4	<4	<4	<4	66	7200
MERCURY,DISS.(UG/L)	71890 / 0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
NICKEL,DISS(UG/L)	1065 / 0	<9.0	13	23	25	<9.0	<9.0	<9.0
LEAD,DISS (UG/L)	1049 / 0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
SILVER,DISS(UG/L)	1075 / 0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
ZINC,DISS (UG/L)	1090 / 0	3.8	26.7	62.6	38.2	<3.0	13.1	101

NITROG,NO2+NO3(MG/L-AS N)	630 0	0.360	0.604	3.78	1.50	2.43	1.37	0.581
SULFATE (MG/L)	945 0	30	14	48	226	7	23	65
RESIDUE,DISS(MG/L)	70300 0	74	304	262	224	51	71	136
PHENOLS (UG/L)	32730 0	3	3	2	3	1	3	3
OILEGR,IR(MG/L)	560 0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TOX (UG/L-CL)	70353 0	23	14	24	36	12	30	10
CARBON,TOC(MG/L)	680 0	<1.4	15.7	12.6	5.1	2.4	<1.7	3.9
ENDRIN (UG/L)	39390 0	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

ENVIRONMENTAL SCIENCE & ENGINEERING 04/11/85 STATUS: FINAL

PROJECT NUMBER 84420100
FIELD GROUP: GWC
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME MAXWELL AFB
PROJECT MANAGER: JOHN BONDS
FIELD GROUP LEADER: TOM PARK

PARAMETERS	STORET # / METHOD #	GW5-5 469511	GW6-1 469512	GW6-2 469513	GW6-3 469514	GW7-1 469515	GW7-2 469516	GW7-3 469517
		SAMPLE NUMBERS						
DATE		1/17/85	1/17/85	1/17/85	1/17/85	1/18/85	1/18/85	1/18/85
TIME		1645	1000	1230	1115	1015	1130	1300
BHC,G(LINDANE)(UG/L)	39340 0	0.34	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
METHOXYCHLOR (UG/L)	39480 0	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027
TOXAPHENE (UG/L)	39400 0	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
2,4-D, TOTAL (UG/L)	39730 0	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
2,4,5-TP/SILVEX (UG/L)	39760 0	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
FLUORIDE (MG/L)	951 0	<0.10	0.14	<0.10	<0.10	<0.10	0.11	1.09
SP.COND.,FIELD (UMHOS/CM)	94 0	36.0	430	241	336	56.0	102	260
WATER TEMP (C)	10 0	16.1	17.2	18.2	18.3	18.5	18.4	19.9
SELENIUM,DISS(UG/L)	1145 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
CYANIDE(UG/L)	99315 0	<10	<10	<10	<10	<10	<10	<10

ENVIRONMENTAL SCIENCE & ENGINEERING   04/11/85   STATUS: FINAL

PROJECT NUMBER 84420100
FIELD GROUP: SWB
PARAMETERS: ALL   SAMPLES: ALL

PROJECT NAME MAXWELL AFB
PROJECT MANAGER: JOHN BONDS
FIELD GROUP LEADER: TOM PARK

SAMPLE NUMBERS

PARAMETERS	STORET # METHOD #	SW2-1 469400	SW2-2 469401	SW2-3 469402	SW2-4 469403
DATE		1/17/85	1/17/85	1/17/85	1/17/85
TIME		1400	1210	1135	850
PH,FIELD(STD UNITS)	400 0	NA	NA	NA	NA
ARSENIC,TOTAL(UG/L)	1002 U	6.0	23	30	25
CADMIUM,TOTAL(UG/L)	1027 0	<3.0	<3.0	<3.0	<3.0
CHROMIUM,TOTAL(UG/L)	1034 0	<6.0	8.1	<6.0	7.5
MERCURY,TOTAL(UG/L)	71900 0	<0.2	<0.2	<0.2	0.7
NICKEL,T,(UG/L)	1067 0	<9.0	<9.0	<9.0	<9.0
LEAD,TOTAL(UG/L)	1051 0	26.1	25.0	30.2	37.0
ZINC,TOTAL(UG/L)	1092 U	57	117	66	110
RESIDUE,DISS(MG/L)	70300 0	67	87	82	68
PHENOLS (UG/L)	32730 0	8	8	6	11
OILGR,IR(MG/L)	560 0	<0.1	0.8	0.8	0.9
TOX (UG/L-CL)	70353 U	88	80	82	45

CARBON,TOC(MG/L)	680 0	11.9	12.8	12.9	13.5
SP.COND,LAB(UMHO/CM)	95 0	63.0	96.8	82.8	63.0
WATER TEMP (C)	10 0	NA	NA	NA	NA
SP.COND.,FIELD (UMHOS/CM)	94 0	NA	NA	NA	NA
CYANIDE(UG/L)	99315 0	<10	<10	<10	<10

ENVIRONMENTAL SCIENCE & ENGINEERING 04/11/85 STATUS: FINAL

PROJECT NUMBER 84420100
FIELD GROUP: SEDB
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME MAXWELL AFB
PROJECT MANAGER: JOHN BONDS
FIELD GROUP LEADER: TOM PARK

PARAMETERS	STORET # METHOD #	S2-1 469300	S2-2 469301	S2-3 469302	S2-4 469303	S2-5 469304	S2-6 469305	S2-7 469306	S2-8 469307	S2-9 469308	S2-10 469309
		SAMPLE NUMBERS									
DATE		1/17/85	1/17/85	1/17/85	1/17/85	1/17/85	1/17/85	1/17/85	1/17/85	1/17/85	1/17/85
TIME		1155	1150	1135	930	910	850	917	1050	1100	1045
PH,FIELD(STD UNITS)	400 0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MOISTURE(%WET WT)	70320 0	26.0	23.0	19.0	39.0	29.0	28.0	40.0	34.0	26.0	22.0
CADMIUM,SED (UG/G-DRY)	1028 0	0.3	0.2	0.4	0.9	0.3	1.0	0.8	0.9	0.3	0.3
CHROMIUM,SED (UG/G-DRY)	1029 0	9.8	3.3	11.2	20.8	16.0	16.0	27.6	26.1	13.0	15.1
COPPER,SED (UG/G-DRY)	1043 0	11	3	14	28	24	27	33	26	8	8
MERCURY,SED (UG/G-DRY)	71921 0	<0.07	<0.06	<0.06	0.47	<0.07	<0.07	<0.08	<0.07	<0.07	<0.06
NICKEL,SED (UG/G-DRY)	1068 0	2	0.6	3	8	5	6	11	7	4	5
LEAD,SED (UG/G-DRY)	1052 0	51	12	100	99	39	120	380	280	41	43
ZINC,SED (UG/G-DRY)	1093 0	22	6	46	116	63	149	334	118	39	36
CYANIDE,SED (UG/G-DRY)	721 0	<0.7	<0.6	<0.6	1	<0.7	0.7	0.8	0.8	0.8	<0.6
TOE,SED (UG/G-DRY)	99344 0	287	270	537	1590	207	511	226	11900	525	281
ARSENIC,SED (UG/G-DRY)	1003 0	7.4	3.6	4.0	7.1	2.0	7.3	3.6	3.4	1.1	1.4

PHENOLS,SED (UG/G-DRY)	61565 0	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
TOX,SED (UG/G-DRY) *	98610 0	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	5.70	<5.00	<5.00	<5.00
TOC,SED (UG/G-DRY) *	98611 0	1760	3120	4320	17400	5490	19600	7500	22300	6490	5380

ENVIRONMENTAL SCIENCE & ENGINEERING 04/11/85 STATUS: FINAL

PROJECT NUMBER 84420100
FIELD GROUP: SED8
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME MAXWELL AFB
PROJECT MANAGER: JOHN BONDS
FIELD GROUP LEADER: TOM PARK

SAMPLE NUMBERS

PARAMETERS	STORET # METHOD #	S2-11 469310
DATE		1/17/85
TIME		1025
PH,FIELD(STD UNITS)	400 0	NA
MOISTURE(%WET WT)	70320 0	26.0
CADMIUM,SED (UG/G-DRY)	1028 0	0.4
CHROMIUM,SED (UG/G-DRY)	1029 0	14.8
COPPER,SED (UG/G-DRY)	1043 0	17
MERCURY,SED (UG/G-DRY)	71921 0	0.21
NICKEL,SED (UG/G-DRY)	1068 0	5
LEAD,SED (UG/G-DRY)	1052 0	77
ZINC,SED (UG/G-DRY)	1093 0	72
CYANIDE,SED (UG/G-DRY)	721 0	<0.7
TOE,SED (UG/G-DRY)	99344 0	278
ARSENIC,SED (UG/G-DRY)	1003 0	1.5

PHENOLS,SED (UG/G-DRY)	615650	<1.00
TOX,SED (UG/G-DRY)	986100	<5.00
TOC,SED (UG/G-DRY)	986110	5810

APPENDIX Q--REFERENCES

REFERENCES

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