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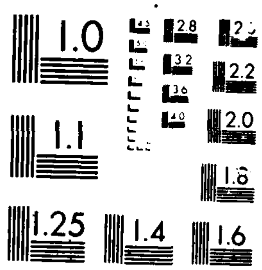
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INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 1

VOLUME I

CHANUTE AIR FORCE BASE
RANTOUL, ILLINOIS

Roy F. Weston, Inc.
West Chester, Pennsylvania 19380

OCTOBER, 1986

FINAL REPORT FOR PERIOD OCTOBER 1984 TO OCTOBER 1986

Approved for Public Release; distribution is unlimited

PREPARED FOR:

HEADQUARTERS AIR TRAINING COMMAND
COMMAND SURGEON'S OFFICE (HQATC/SGPB)
RANDOLPH AIR FORCE BASE, TX 78150

UNITED STATES AIR FORCE
OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY (USAF OEHL)
BROOKS AIR FORCE BASE, TX 78235-5501

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 1

VOLUME 1

FINAL REPORT

FOR

CHANUTE AIR FORCE BASE
RANTOUL, ILLINOIS

USAF AIR TRAINING COMMAND
RANDOLPH AIR FORCE BASE, TEXAS

OCTOBER, 1986

PREPARED BY

ROY F. WESTON, INC.
100 CORPORATE NORTH
BANNOCKBURN, ILLINOIS

USAF CONTRACT NO. F33615-80-D-4006
DELIVERY ORDER NO. 0047

USAFOEHL TECHNICAL PROGRAM MANAGER

MAJOR DENNIS BROWNLEY

PREPARED FOR

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

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19 ABSTRACT (Continue on reverse if necessary and identify by block number)
This report describes the Phase II, Stage 1 (Confirmation/Quantification) investigation performed at Chanute AFB, IL under the USAF Installation Restoration Program (IRP). The overall objective of the USAF IRP is to assess potential contamination at past hazardous waste disposal and spill sites at Air Force installations.

A problem confirmation study was performed at seven sites on Chanute AFB identified in the Phase I investigation as requiring further study (Fire Training Areas 1 and 2, Landfill Nos. 1,2,3 and 4, and Building 932 Fuel Oil Storage Area). The field investigation was conducted from October 1984 to June 1985 and included the installation of 25 monitor wells, collection and analysis of groundwater samples from monitor wells, and collection and analysis of soil samples from the Building 932 Area. Analytes include VOA, TOC, TDS, Oil and Grease, EP Toxicity, Ignitibility, Xylene, Phenol, Chromium, 2,4-D and 2,4,5-TP. Based on the hydrogeologic complexity of the physical setting and findings of the sampling and analytical work, follow-on investigations have been recommended at all seven sites.

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22a NAME OF RESPONSIBLE INDIVIDUAL Major Dennis D. Brownley	22b TELEPHONE (Include Area Code) 512-536-2158	22c OFFICE SYMBOL USAFOEHL/TS

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PREFACE

Roy F. Weston, Inc. (WESTON) has been retained by the U.S. Air Force Occupational and Environmental Health Laboratory (OEHL) under Contract F33615-80-D-4006, to provide general engineering, hydrogeological and analytical services. OEHL has authorized WESTON, under Task Order 0047 dated 24 September 1984, to conduct a Phase II Stage 1 Study for seven sites at Chanute AFB. The findings, conclusions, and recommendations of this study are contained herein.

The Phase II Stage I Confirmation Study at Chanute AFB was conducted under the auspices of staff personnel of Roy F. Weston, Inc. and was managed through WESTON's Bannockburn, Illinois office. The following personnel served lead functions in the performance of this project.

Mr. Peter J. Marks, Program Manager
Ms. Katherine A. Sheedy, P.G., Project Manager
Mr. Walter M. Leis, P.G., Geosciences QA Officer
Mr. Robert J. Karnauskas, P.G., P.HG., Project Coordinator
Mr. Jack Dowden, Senior Project Hydrogeologist
Dr. Earl Hansen, Laboratory Manager
Mr. Harry M. Ricketts, Assistant Project Geologist
Mr. Mark A. Hutson, Project Geologist

WESTON expresses sincere thanks to the Base personnel at Chanute AFB for their assistance and cooperation throughout this project. WESTON would also like to acknowledge the efforts of Soil Engineering and Exploration Co., Inc. (drilling contractor) and Sodemann and Associates, Inc. (surveying contractor).

This work was accomplished between October 1984 and June 1985. Major Dennis D. Brownley, Technical Services Division, USAF Occupational and Environmental Health Laboratory (USAFOEHL) was the technical monitor.

Peter J. Marks/KS
Peter J. Marks
Program Manager/
Vice President
ROY F. WESTON, INC.

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EXECUTIVE SUMMARY

ES 1.1 SCOPE OF WORK

This report describes the Phase II Stage 1 (Problem Confirmation) portion of the IRP effort conducted at Chanute Air Force Base, Rantoul, Illinois. Chanute Air Force Base occupies approximately 2,125 acres in northern Champaign County, Illinois. Since the beginning of military operations in 1917, activities at the Base, in support of mission operations, have resulted in the development of a number of areas suspected of potentially releasing hazardous substances to the environment.

The field investigation described in Task Order 0047 addressed the following seven areas:

- o Fire Protection Training Area 2
- o Landfill Site 2
- o Landfill Site 3
- o Landfill Site 1
- o Landfill Site 4
- o Fire Protection Training Area 1
- o Building 932 Sludge Disposal Area.

The location of these sites is shown on Figure ES-1.

The scope of the investigation included the following activities:

- o The installation of nineteen monitoring wells at the investigation sites.

- o Establishment of nine surface water sampling sites.

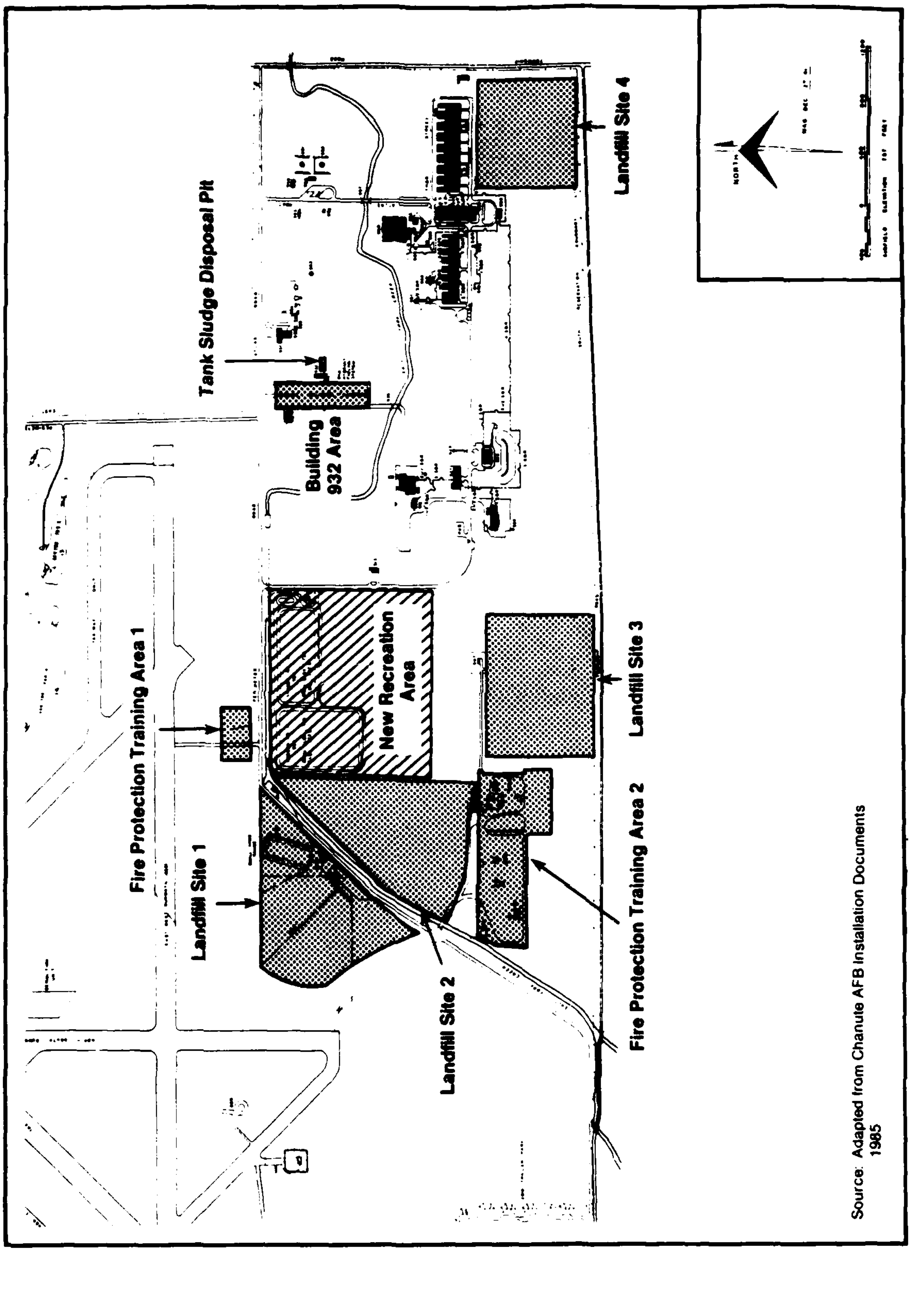
- o The installation of three monitoring wells to determine the regional hydraulic gradient of the shallow aquifer system.

- o The collection and analysis of two rounds of water quality samples from all groundwater monitoring wells and surface water monitoring sites.

- o The collection of three rounds of water-level measurements from each well and surface water monitoring site.

ES 2.1 MAJOR FINDINGS

Groundwater beneath the Chanute Air Force Base is encountered at shallow depths (less than 10 feet) within Wisconsinan stage glacial deposits. The hydraulic gradient of the shallow aquifer conforms to the surface topography at Chanute AFB. Salt Fork Creek receives the discharge of



Source: Adapted from Chanute AFB Installation Documents 1985

FIGURE ES-1 PHASE II - SITE LOCATIONS

groundwater from the study area and represents the major groundwater discharge area in the vicinity.

Concentrations of total dissolved solids in excess of the Illinois General Use Water Quality Standard of 1,000 mg/l were detected in eleven samples from five sites, including all the landfills and Fire Protection Training Area 2. High total dissolved solids concentrations were also observed in monitoring wells considered representative of background water quality suggesting shallow groundwater on the Base is locally mineralized.

Oil and grease concentrations were in excess of detectable concentrations in 64 of the 70 samples submitted for analysis. The detection limit for oil and grease is ten times the taste and odor threshold for this parameter.

The detected volatile organic compound concentrations were not in excess of any currently enforceable standards. However, the volatile organic concentrations in the groundwaters beneath Fire Protection Training Area 2 and Landfill Sites 3 and 4 may not conform to the anticipated Federal Maximum Contaminant Levels (MCLs). Volatile compounds detected tended to be potentially associated with fuel (benzene, toluene, xylene).

The detected concentrations of phenols, soluble lead and chromium were not in excess of state or Federal water quality standards.

Although TOC is a general indicator of contamination which is not associated with any standard, the elevated TOC concentrations at each of the landfills and at Fire Protection Training Area 2 warrant further quantification of the soluble organic fraction at these sites.

Oil was observed to be emanating from the sediments in Salt Fork Creek near Building 932. The source of this oil was not found. This observation may be an indicator of potential petroleum product contamination.

ES 3.1 CONCLUSIONS

Based on the results of the Phase II Stage 1 Contamination Study at the Chanute Air Force Base, the following key conclusions have been drawn.

ES 3.2 HYDROGEOLOGY

1. A water table aquifer occurs within 15 feet of the land surface in the southeastern portion of Chanute AFB. This aquifer occurs within Wisconsinan age glacial sediments.

2. Locally important water supply aquifers occur within 100 feet of the land surface in the Illinoian and Kansan age glacial deposits.

3. Groundwater in the shallow water table aquifer flows toward and discharges to Salt Fork Creek.

4. The Kansan and Illinoian aquifers are recharged by leakage from the overlying water table aquifer in the Champaign County area.

5. The presence of low permeability silt and clay deposits between the Wisconsinan and Illinoian aquifer minimizes the potential for contamination of locally important water supply aquifers.

ES 3.3 WATER QUALITY

1. Total dissolved solids concentrations were reported in excess of 0.01 mg/l at five of the eight investigation sites including each of the landfills.

2. Oil and grease concentrations were detected in excess of the 10 ug/L taste and odor threshold at all the landfills, both of the fire protection training areas and at two of the regional flow gradient wells.

3. Volatile organic contamination was found at Landfill Sites 3 and 4 and at Fire Protection Training Area 2, although the positive results were not confirmed by either second-column gas chromatographic analysis or by mass spectroscopy.

4. The generally higher second round concentrations of many parameters may be attributed to the absence of ground frost during the second sampling round. The recession of the ground frost enables water to percolate to the water table thereby mobilizing or remobilizing contaminants in the vadose zone.

5. The poorly-graded surface of the landfills promotes infiltration of precipitation and the generation of leachate at these sites.

6. The sludge pit behind Building 932 is classified as a Category III site requiring remedial action. Landfill Sites 1 through 4, Fire Protection Training Area 1, Fire Protection Training Area 2 and Salt Fork Creek downgradient of Building 932 require further investigation and are classified as Category II sites. There are no Category I sites warranting no further action.

ES 4.1 RECOMMENDATIONS

The findings of the Phase II Stage 1 Confirmation Study at the Chanute AFB indicate the need for follow-up investigation which should include:

1. Expansion of the monitoring and sampling program with an emphasis on evaluation of the nature and extent of contamination by Priority Pollutant compounds.

2. Development of a site-specific hydrologic balance.

A summary of the specific recommendations for further investigation actions at each site is presented in Table ES-1.

TABLE ES-1

SUMMARY OF RECOMMENDATIONS

Recommendation	Rationale
Fire Protection Training Area 2	
1. Two additional monitoring wells.	Assess magnitude and extent of contamination.
2. Soil boring and sampling within training area.	Assess integrity of liner and magnitude of soil contamination.
3. Sample and analyze for Priority Pollutant organics.	Contaminant characterization.
4. Perform piezometer tests on monitoring wells.	Characterization of migration pathways.
5. Develop site water balance.	Evaluate potential impact on water resources.
Landfill Site 2	
1. Two additional monitoring wells.	Assess magnitude and extent of contamination.
2. Sample and analyze for Priority Pollutants and landfill leachate indicators.	Contaminant characterization.
3. Perform piezometer tests on monitoring wells.	Characterization of migration pathways.
4. Grade surface of the landfill.	Promote runoff and slow leachate generation.
5. Develop site water balance.	Evaluate potential impact on water resources.
Landfill Site 3	
1. Two additional monitoring wells.	Assess magnitude and extent of contamination.
2. Sample and analyze for Priority Pollutants and landfill leachate indicators.	Contaminant characterization.

TABLE ES-1 (continued)

Recommendation	Rationale
3. Perform piezometer tests on monitoring wells.	Characterization of migration pathways.
4. Grade surface of the landfill.	Promote runoff and slow leachate generation.
5. Develop site water balance.	Evaluate potential impact on water resources.
Landfill Site 1	
1. Sample and analyze for Priority Pollutant and landfill leachate indicators.	Contaminant characterization.
2. Perform piezometer tests on monitoring wells.	Characterization of migration pathways.
3. Grade surface of the landfill.	Promote runoff and slow leachate generation.
4. Develop site water balance.	Evaluate potential impact on water resources.
Landfill Site 4	
1. Sample and analyze for Priority Pollutant and landfill leachate indicators.	Contaminant characterization.
2. Perform piezometer tests on monitoring wells.	Characterization of migration pathways.
3. Grade surface of the landfill.	Promote runoff and slow leachate generation.
4. Develop site water balance.	Evaluate potential impact on water resources.
Fire Protection Training Area 1	
1. Continue periodic groundwater monitoring	Establish a groundwater quality data base.
2. Collect four additional soil samples.	Characterize areas of FPTA-1 not already tested.

TABLE ES-1 (continued)

<u>Building 932 Sludge Disposal Area</u>	
1. Re-evaluation of existing information.	Characterization of potential sources.
2. Reconnaissance of Salt Fork Creek	Evaluate extent of contamination.
3. Establish additional sampling sites.	Evaluate extent of contamination.
4. Sample and analyze for oil and grease and Priority Pollutant organics.	Contaminant characterization.
5. Resampling of sludge and sampling of drainage ditch.	Confirmation of EP tox lead result and evaluation of extent of contamination.
<u>Regional Flow Gradient Control</u>	
Sample and analyze for Priority Pollutants.	Contaminant characterization.

SECTION 1

INTRODUCTION

1.1 INSTALLATION RESTORATION PROGRAM

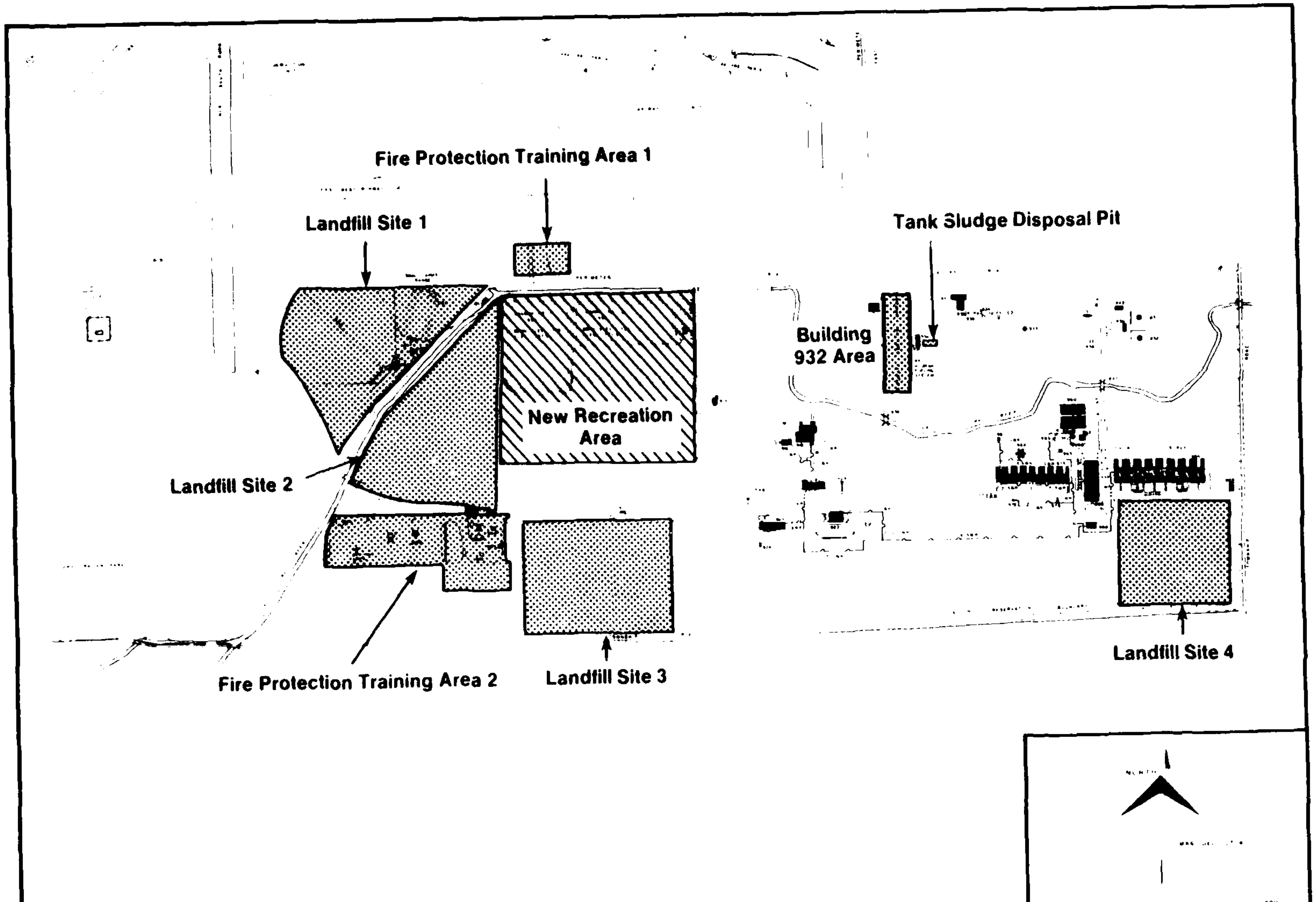
In 1976 the Department of Defense (DoD) devised a comprehensive Installation Restoration Program (IRP). The purpose of the IRP is to assess and control migration of environmental contamination that may have resulted from past operations and disposal practices on DoD facilities, and to assess the probable migration of hazardous contaminants. In response to the Resource Conservation and Recovery Act of 1976 (RCRA) and in anticipation of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA or "Superfund"), the DoD issued a Defense Environmental Quality Program Policy Memorandum dated June 1980 (DEQ 80-6) requiring the identification of past hazardous waste disposal sites on DoD agency installations. The U.S. Air Force (USAF) implemented DEQPPM 80-6 by message in December 1980. The program was revised by DEQPPM 81-5 (11 December 1981), which reissued and amplified all previous directives and memoranda on the IRP. The Air Force implemented DEQPPM 81-5 by message on 21 January 1982. The Installation Restoration Program has been developed as a four-phase program, as follows:

- Phase I - Problem Identification/Records Search
- Phase II - Problem Confirmation and Quantification
- Phase III - Technology Base Development
- Phase IV - Corrective Action

This report describes the Phase II Stage 1 Problem Confirmation portion of the IRP effort conducted at Chanute Air Force Base, Rantoul, Illinois. Terms, nomenclature, acronyms and units of measurement used in this report are defined in Appendix A.

1.2 BASE PROFILE

Chanute Air Force Base is located in east-central Illinois (Champaign County) in the Village of Rantoul (see Figures 1-1 and 1-2). The Base is bounded on the north by residential and commercial land, and agricultural lands on the east, south and west. A small tributary of the Vermilion River, Salt Fork Creek, flows along the southern perimeter and then through the southeastern corner of the Base.



rce: Adapted from Chanute AFB Installation Documents
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FIGURE 1-1 PHASE II - SITE LOCATIONS

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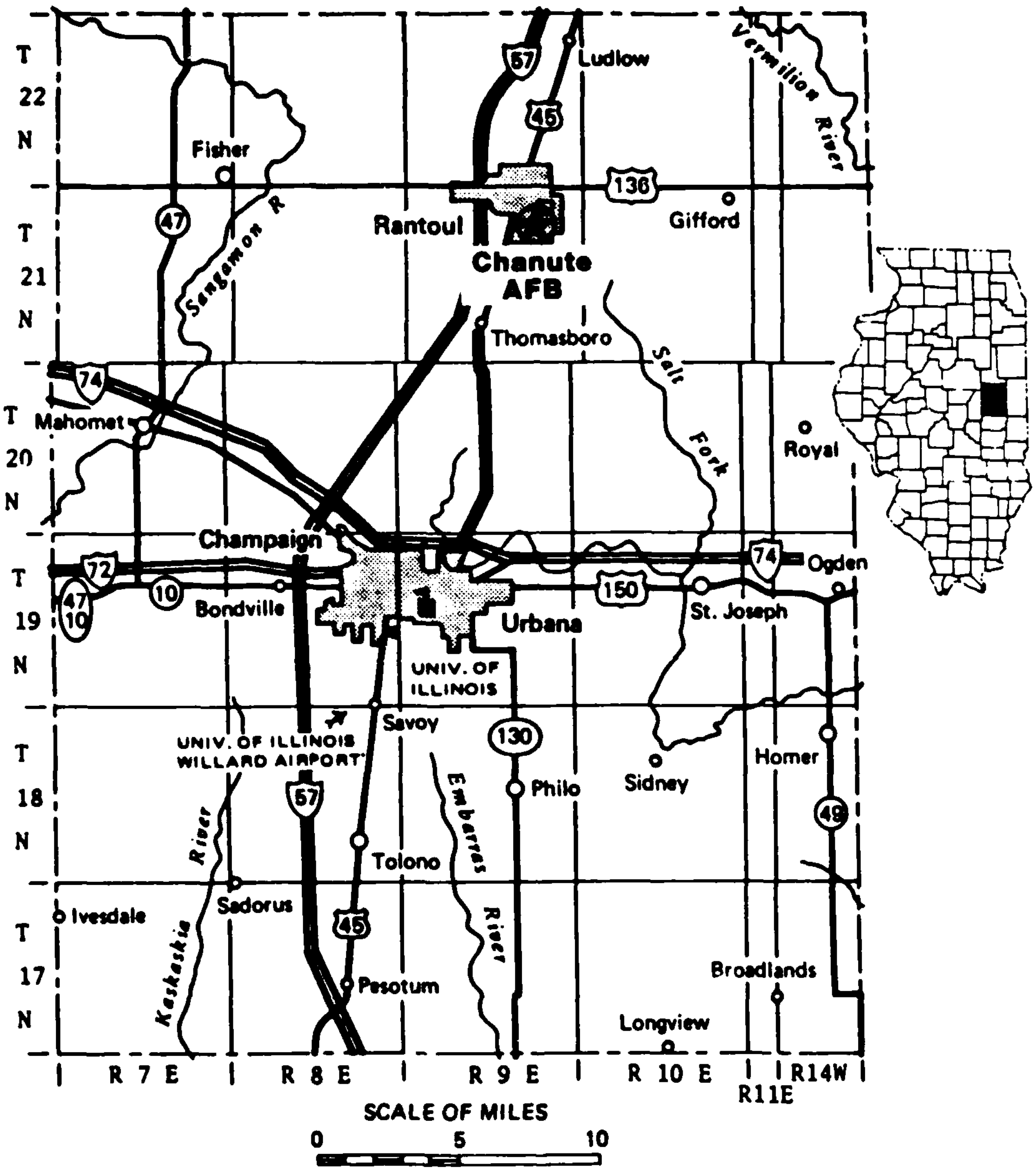

FIGURE 1-2 LOCATION OF CHANUTE AFB

Chanute AFB was constructed in 1917 on 640 acres of land located adjacent to Rantoul. Initially, the Base served as a training facility and storage depot for aircraft engines and paint. In the early 1920's, mechanical, photographic and communications training activities were transferred to Chanute. A technical training school for all Air Corps mechanics was established at Chanute AFB in 1929.

In 1938 major appropriations were authorized to modernize the technical training facilities and expand the Base to its present size of 2,125 acres. The Air Corps Technical Training Command established its first headquarters at Chanute Field in 1941. During World War II, aircraft maintenance, weather observation, life support and metallurgy training activities were conducted at the Base.

Military and technical training for aerospace weapon systems support personnel has been the primary mission of Chanute AFB since the war. In 1959, the installation was designated the Chanute Technical Training Center. The runways were closed for military operations in July 1971 resulting in Chanute's current designation as a nonflying-training facility. The current host unit at Chanute AFB is the 330th Technical Training Wing.

Current and past Air Force activities at Chanute AFB in support of operational and training missions have resulted in the occurrence of several hazardous waste utilization and disposal sites of potential concern which are suspected to contain hazardous materials.

The list of sites requiring Phase II evaluation, and the priority rankings are shown in Table 1-1. All of these sites are located in the southeast portion of the Base in what is referred to as the "900 Area." The "900 Area" and hazardous waste site locations are shown in Figures 1-3 and 1-4 respectively.

1.2.1 History and Description of Fire Protection Training Area 2 (FPTA-2)

Site 1, the Fire Protection Training Area 2, occupies approximately 9 acres in the southwestern portion of the 900 Area. The site is bounded on the north and east by former landfills, on the south by agricultural lands, and on the west by Salt Fork Creek. This facility was constructed in 1965 as part of the Chanute Technical Training Center Program.

The facility is constructed on a compacted gravel bed overlying native ground, and has a peripheral drainage and runoff collection ditch. The ditch is underlain by a compacted clay liner. From 1965 to 1981 the accumulated residuals in the ditch were drained to an open pit or pond

TABLE 1-1

List of Sites for Phase II Evaluation
and Priority Ranking
Chanute Air Force Base

Rank	Site
1	Fire Protection Training Area 2 (FPTA-2)
2	Landfill Site 2 (LF-2)
3	Landfill Site 3 (LF-3)
4	Landfill Site 1 (LF-1)
5	Landfill Site 4 (LF-4)
6	Fire Protection Training Area 1 (FPTA-1)
7	Building 932 Sludge Disposal and Fuel Spill Areas (932)

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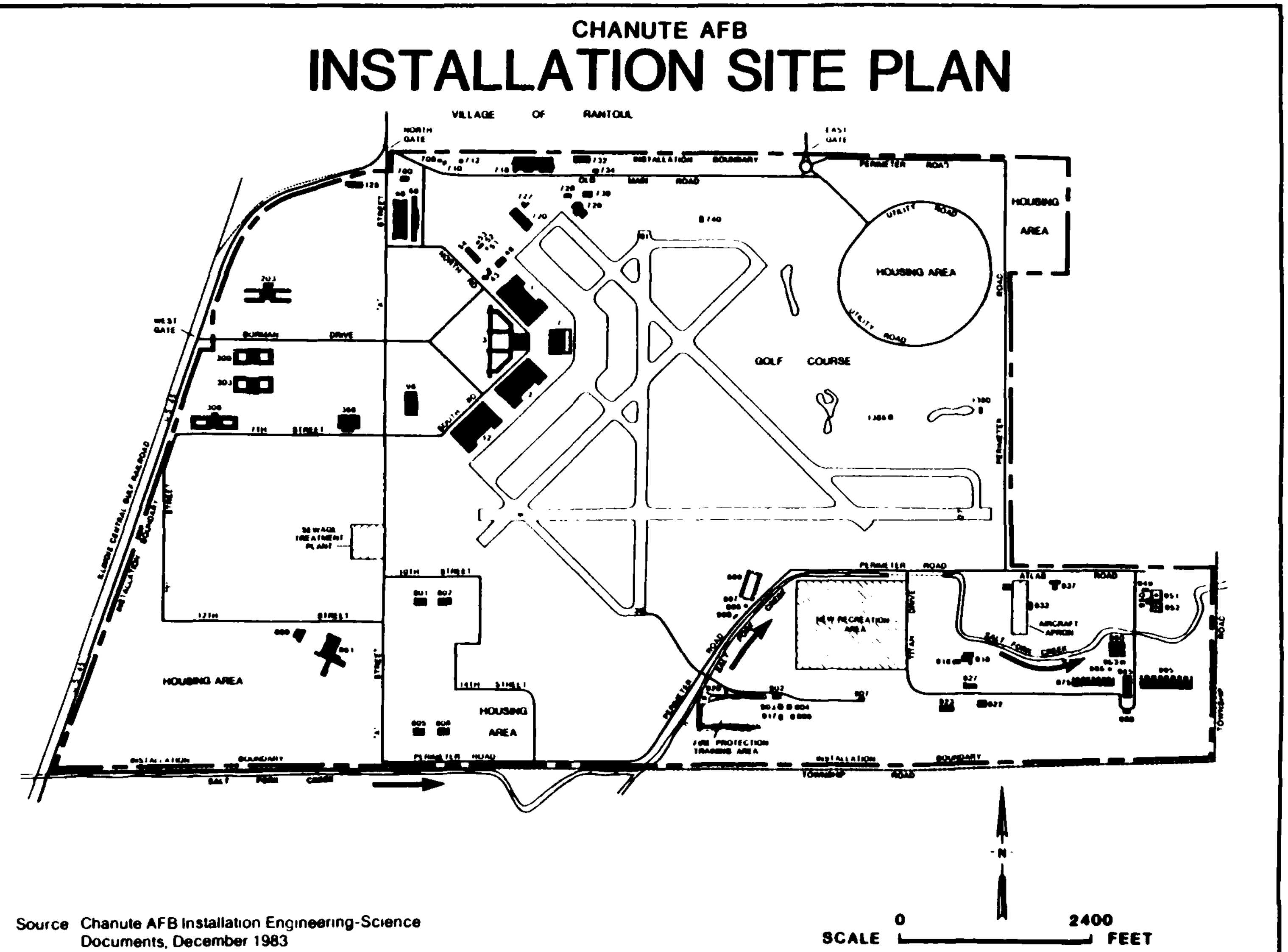
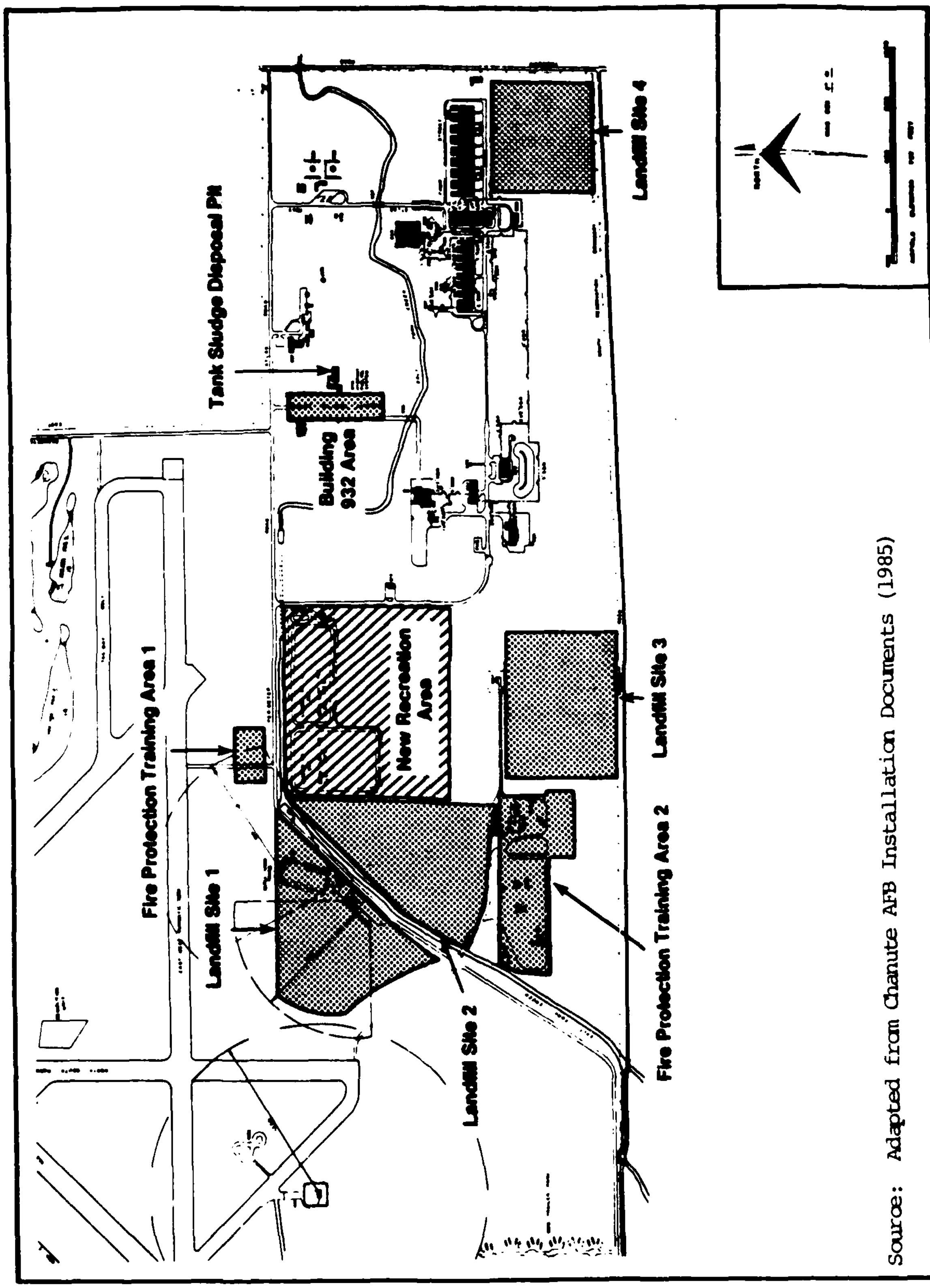


FIGURE 1-3 GENERAL PLAN FOR CHANUTE AFB



Source: Adapted from Chanute AFB Installation Documents (1985)

FIGURE 1-4 PHASE II - SITE LOCATIONS

on the northwest corner of the site, and the combustible agents were burned on a weekly basis. The water and noncombustible agents were periodically drained to Salt Fork Creek. In 1981 an oil-water separator was installed in the pond.

Prior to the late 1970's waste oils, solvents, hydraulic fluids, fuel filters and virgin JP-4 jet fuel were utilized as combustion agents. Since the 1970's JP-4 only has been utilized in order to comply with state and Federal air emission standards. A typical large training burn utilizes approximately 300 gallons of fuel, but prior to the promulgation of air emissions standards as much as 1,000 gallons is reported to have been used. Currently, 6 to 12 structural burns are conducted per week. However, prior to 1980, 9 to 18 burns were commonly conducted per week. Protein foam and carbon dioxide were the primary extinguishing agents utilized at the site until the early 1970's. The use of aqueous film-forming foam (AFFF) was initiated in 1972-1973 and dry chemicals and halon have been used since 1981.

1.2.2 History and Description of Landfill Site 2

Landfill Site 2 occupies an approximate 20-acre tract immediately north of FPTA-2. The landfill is bounded on the north and west by Salt Fork Creek and on the east by the new recreation area. This landfill was utilized from the early 1950's to 1965 to dispose of trash, shop residuals and construction debris. It is also suspected that four 55-gallon drums containing the herbicides 2,4-D and 2,4,5-T were buried in the landfill. The area fill method was utilized at this landfill with an average burial depth of 8 to 10 feet. Periodic burning also occurred at this site. The drainage from this area is to Salt Fork Creek.

1.2.3 History and Description of Landfill Site 3

Landfill Site 3, occupies approximately 20 acres south of the new recreation area. The site is bounded by agricultural lands on the east and south, and by the fire protection training complex on the west. This landfill was utilized from 1967 to 1970 to dispose of Base garbage, refuse, shop wastes, construction debris and demolition rubble. The previously-noted pesticide drums (refer to Subsection 1.3.2) may have been buried at this site. Wastes were buried at depths of 6 to 8 feet using the area fill method of placement. The site is unevenly graded and poorly drained. Overland runoff is conveyed to Salt Fork Creek via drainage ditches. The landfill has been revegetated with native prairie grasses.

1.2.4 History and Description of Landfill Site 1

Landfill Site 1 occupies 19 acres between the east-west runway and Landfill Site 2. The site is bounded on the north and west by agricultural lands, and on the south and east by Salt Fork Creek. This site was in operation from the late 1930's to 1960. Base garbage, paper, wood, metal, ashes, aircraft parts, unrinsed pesticide drums, shop wastes and construction/demolition debris were buried at depths of 8 to 10 feet at this landfill. Materials deposited at this site were routinely burned.

A small arms firing range, trap-shooting range and ancillary building have been constructed on this landfill since 1960. Native prairie grasses have been established on the undeveloped portion of the landfill. The undeveloped portion of the landfill is unevenly graded and poorly drained. All surface drainage is to Salt Fork Creek.

1.2.5 History and Description of Landfill Site 4

Landfill Site 4 occupies 16 acres in the extreme southeast corner of the 900 Area and the Base. From 1970 to 1974, garbage, refuse, shop residues and construction/demolition debris were buried at this site. These materials were placed at depths of 8 to 10 feet with both the trench and area fill methods. Burning at this site probably occurred less frequently than at the earlier fill sites. The filling operations have modified the orientation of the surface drainage from the north to the southeast. Runoff eventually reaches Salt Fork Creek via ditches along the southern and eastern perimeter of the site. Native prairie grasses have revegetated most of the site. Landscaping debris is currently disposed of in the northwest corner of the site. A simulated grenade launching facility and access road are currently being constructed on the southeastern and eastern portions of the landfill.

1.2.6 History and Description of Fire Protection Training Area 1 (FPTA-1)

Fire Protection Training Area 1 (FPTA-1) was located immediately northeast of the small arms firing range between the east-west runway and the Perimeter Road. Fire training exercises were conducted at this site from the early 1950's to 1965 when the existing fire training facility was constructed. Old planes and land vehicles were moved off the runway at this location and utilized for training activities. Waste fuels, paints, solvents and thinners were used as combustion agents at this site. Protein foam was utilized as the extinguishing agent.

The site is currently under agricultural cultivation. There is no direct physical evidence or stressed vegetation indicative of the past training practices.

1.2.7 History and Description of Building 932 Sludge Disposal Area

Fuel transfer and storage tank training activities are conducted in the immediate vicinity of Building 932. Since the mid-1950's fuel tank sludge has been disposed of in the small diked pit east of Building 932. Currently, this pit is used to temporarily store drums of sludge until their removal by a contractor.

Numerous fuel spills have occurred in this area. These spills are evident by the areas of dead vegetation (grass) around the building and along the edges of the pavement. A north-south trending drainage ditch runs east of the fueling areas and conveys surface drainage directly to Salt Fork Creek.

1.3 CONTAMINATION PROFILE

At Chanute AFB most of the products and wastes potentially containing hazardous substances have been associated with technical and routine Base maintenance activities. The primary products of concern are hydrocarbons, solvents and thinners, herbicides and pesticides. Other contaminants of lesser hazard have also been generated and disposed of in the past.

Information obtained through interviews with present and past Base personnel, Base records, shop folders, and field observations indicates that the hazardous wastes generated at Chanute AFB since 1974 have been properly handled and discarded. Prior to this time large quantities of fuels mixed with minor amounts of solvents, waste oils and lubricants were utilized for fire training exercises. The potential for contamination of shallow groundwater and nearby surface waters with unburned fuels and extinguishing agents is moderate to high. Small quantities of oil, lubricants, solvents, shop wastes and herbicides were buried along with refuse and garbage at the four landfill sites. Leachate seepage from these sites poses a moderate to high contamination hazard to nearby surface and near surface-water resources. In addition, fuels, oils and lubricants have entered the soil from spills, and the sludge disposal pit near Building 932 may also contribute to the introduction of contaminants to surface waters and groundwaters.

Based on Chanute AFB Phase I records search and the Phase II presurvey, the key contaminant indicator parameters applicable to the Base contamination profile are total dissolved solids (TDS), total organic carbon (TOC), volatile organics (VOA), phenols, oil and grease, heavy metals and herbicides. The potential contaminants and associated analytes for each site are presented in Table 1-2.

1.4 FACTORS OF CONCERN

The primary factor of concern at Chanute AFB is the potential for contamination of surface or near-surface water resources. This potential is considered moderate to high for the contamination sites in the 900 Area for the following reasons:

- Presence of a shallow water table aquifer that is in direct hydraulic communication with Salt Fork Creek and deeper aquifers of regional significance.
- Age and length of service of the contamination sources.
- Persistence and mobility of potential contaminants.

1.5 PROJECT TEAM

The Phase II Stage 1 Confirmation Study at Chanute AFB was conducted by and under the auspices of staff personnel of Roy F. Weston, Inc., and was managed through WESTON's Bannockburn, Illinois office. The following personnel served lead functions in the performance of this project:

Mr. Peter J. Marks, Program Manager: Corporate Vice President, Master of Science (M.S.) in Environmental Science, 18 years experience in laboratory analysis and applied environmental sciences.

Dr. Frederick Bopp, III, P.G., Project Manager (prior to April 1985): Manager of Geosciences Department, Doctor of Philosophy (Ph.D.) in Geology and Geochemistry, registered Professional Geologist, over 8 years experience in hydrogeology and applied geological sciences.

Ms. Katherine A. Sheedy, P.G. Project Manager (since April 1985): M.S. in Geology, registered Professional Geologist, over 10 years experience in hydrogeology and site investigations

Mr. Walter M. Leis, P.G., Geotechnical Quality Assurance Officer: Corporate Vice President, M.S. in Geological Sciences, registered Professional Geologist, over 11 years experience in hydrogeology and applied geological sciences.

TABLE 1-2

Summary of Analytical Protocol
Chanute AFB

Site	Potential Contaminants	Medium	Analytes
Fire Protection Training Area 2	Fuels, waste petroleum products, waste oils, lubricants, solvents.	Water	TDS, TOC, VOA, xylene, oil and grease, phenol
		Soil	EP characteristics.[3]
Landfill Site 2	Waste oils, lubricants, solvents, metals, waste herbicides.	Water	TDS, TOC, VOA, xylene, oil and grease, phenol, chromium, lead, herbicides.[1]
Landfill Site 3	Oils, lubricants, solvents, metals, waste herbicides.	Water	TDS, TOC, VOA, xylene, oil and grease, phenol, chromium, lead, herbicides.[1]
		Soil	EP characteristics.[3]
Landfill Site 1	Oils, lubricants, solvents, metals.	Water	TDS, TOC, VOA, xylene, oil and grease, phenol, chromium, lead, herbicides.[1]

[1] 2,4-D and 2,4,5-TP only
[3] Toxicity and Ignitability only

TABLE 1-2
(contd.)

Site	Potential Contaminants	Medium	Analytes
Landfill Site 4	Waste oils, lubricants, solvents, metals.	Water	TDS, TOC, VOA, xylene, oil and grease, phenol, chromium, lead.
Fire Protection Training Area 1	Waste oils, lubricants, solvents, fuels.	Water	TDS, TOC, VOA, xylene, oil and grease, phenol, chromium, lead
		Soil	EP characteristics.[3]
Building 932 Sludge Disposal and Fuel Spill Areas	Fuels, waste fuels, metals.	Water	TOC, VOA, xylene, phenol, lead[2]
		Soil	EP toxicity.[2]
Background Wells Perimeter Rd. at Taxiway 2010 Trailer Park 809 Area	None suspected	Water	TDS, TOC, VOA, xylene, oil and grease, phenol, chromium, lead, herbicides.[1]

1 2,4-D and 2,4,5-TP only
2 Lead only
3 Toxicity and Ignitability only

Mr. Robert J. Karnauskas, P.G., P.HG., Project Coordinator: Master of Science degrees in both Hydrogeology and Water Resource Management, registered Professional Geologist and Hydrogeologist, over 8 years experience in hydrogeology and evaluation of subsurface contamination.

Mr. Jack Dowden, Project Geologist: Master of Science in Hydrogeology, over 4 years experience in hydrogeology, geotechnical engineering and evaluation of subsurface contamination.

Dr. Earl Hansen, Laboratory Manager: Doctor of Philosophy (Ph.D.) in Chemistry, over 16 years experience in environmental sampling and analysis, including 3 years as laboratory quality assurance manager.

Mr. Harry M. Ricketts: Bachelor of Arts in Geology, over four years experience in geological investigations and geotechnical engineering.

1.5.1 Subcontracting

The soil borings and installation of monitoring wells were completed by the Soil Engineering and Exploration Company, Inc., of Orland Park, Illinois. The survey of the monitoring well elevations and locations was performed by Sodemann and Associates of Champaign, Illinois.

SECTION 2

ENVIRONMENTAL SETTING

2.1 GEOGRAPHY

Chanute AFB lies on the Bloomington Ridged Plain subdivision of the Central Lowlands Physiographic Province (see Figure 2-1). The morphology of the Bloomington Ridged Plain is characteristic of Wisconsinan Stage glaciation (Willman, et al., 1975) and is expressed by gently rolling topography, interrupted by low broad ridges known as moraines. The study area lies between the Rantoul Moraine northwest of the Base and the Urbana Moraine immediately southeast of the Base (see Figure 2-2). The two moraines represent the margins of separate advances of the Wisconsinan ice sheet during Woodfordian time (22,000 to 12,500 years ago). Ridges of gravel, sand, silt and clay were deposited as the ice sheet stabilized and then receded (the amount of melting at the edge of the ice sheet was balanced by the amount of ice moving in from behind) (R.C. Anderson, 1960).

Local topography is the product of glacial processes and stream development. The land surface at Chanute AFB slopes gently from 750 feet MSL at the northwest corner of the Base near Building 136 to an elevation of 710 feet MSL along Salt Fork Creek at the southeastern installation boundary. The study area centers around the 900 Area located at the southeastern portion of the Base (see Figure 2-3) and occupies an area of approximately 350 acres. In the western section of the study area, the topography is generally level with an elevation of approximately 730 feet MSL with a high of 735 feet MSL in the vicinity of Landfill 2. Eastward the topography tends to become hummocky, with elevations ranging from a high of 735 feet MSL in the extreme southeast corner of the 900 Area to 710 feet above feet MSL at the eastern perimeter of the Base (see Figure 2-4). Ground elevation varies between 720 and 725 feet MSL over the eastern half of the study area. Salt Fork Creek flows eastward from an elevation of approximately 730 feet above feet MSL near the 2010 Trailer Park to an elevation of less than 710 feet MSL where it exits the Base.

2.2 DRAINAGE

The headwaters of four river systems converge in the vicinity of Chanute AFB; the Sangamon to the west, the Kaskaskia to the southwest, the Embarras to the south and the Vermilion to the southeast. Surface flow from the Base is ultimately conveyed to the Wabash River Basin via the Vermilion River. On Base, all drainage discharges to Salt

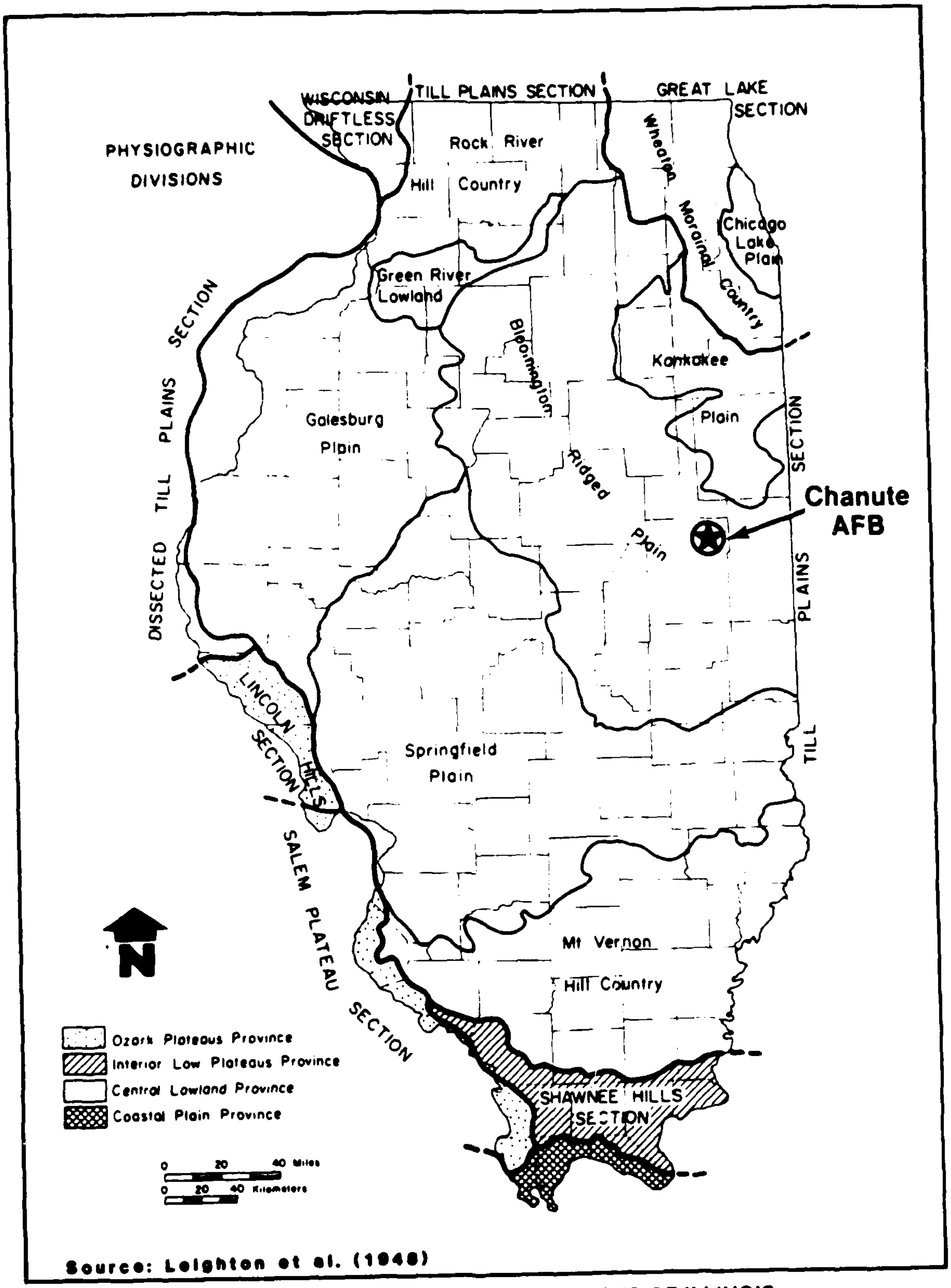


FIGURE 2-1 PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

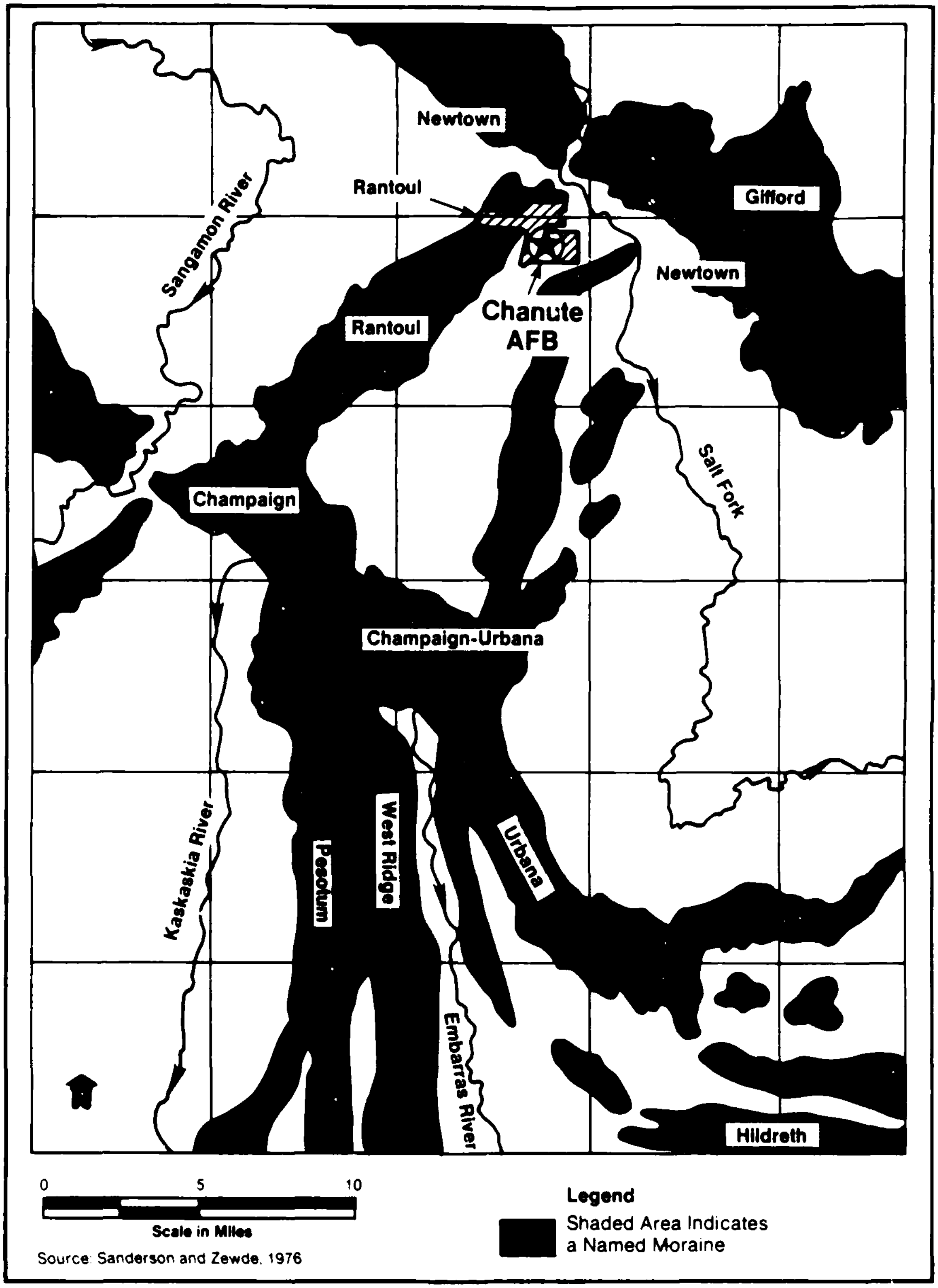


FIGURE 2-2 LOCATION OF GLACIAL MORAINES IN CHAMPAIGN COUNTY, ILLINOIS

WESTON

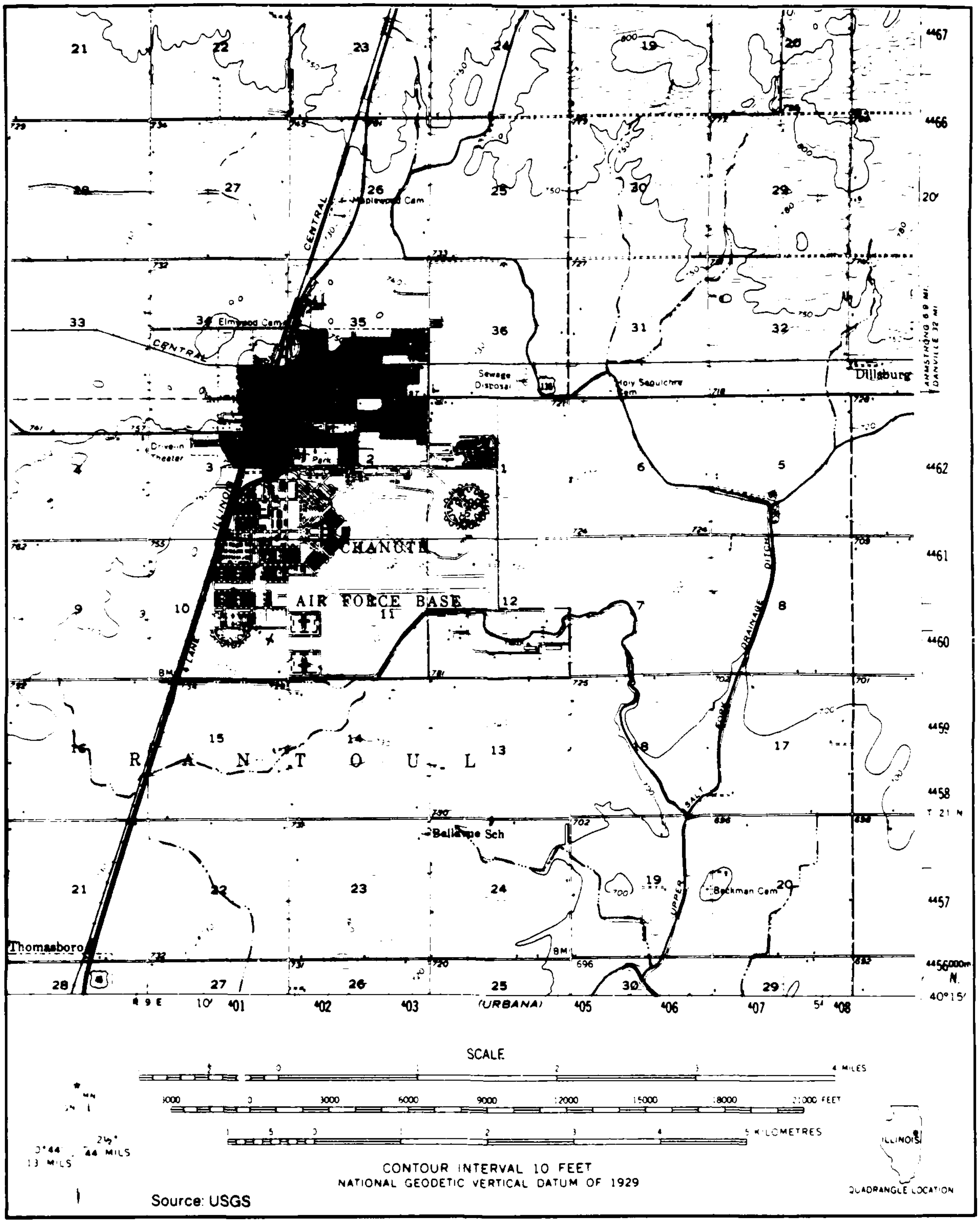
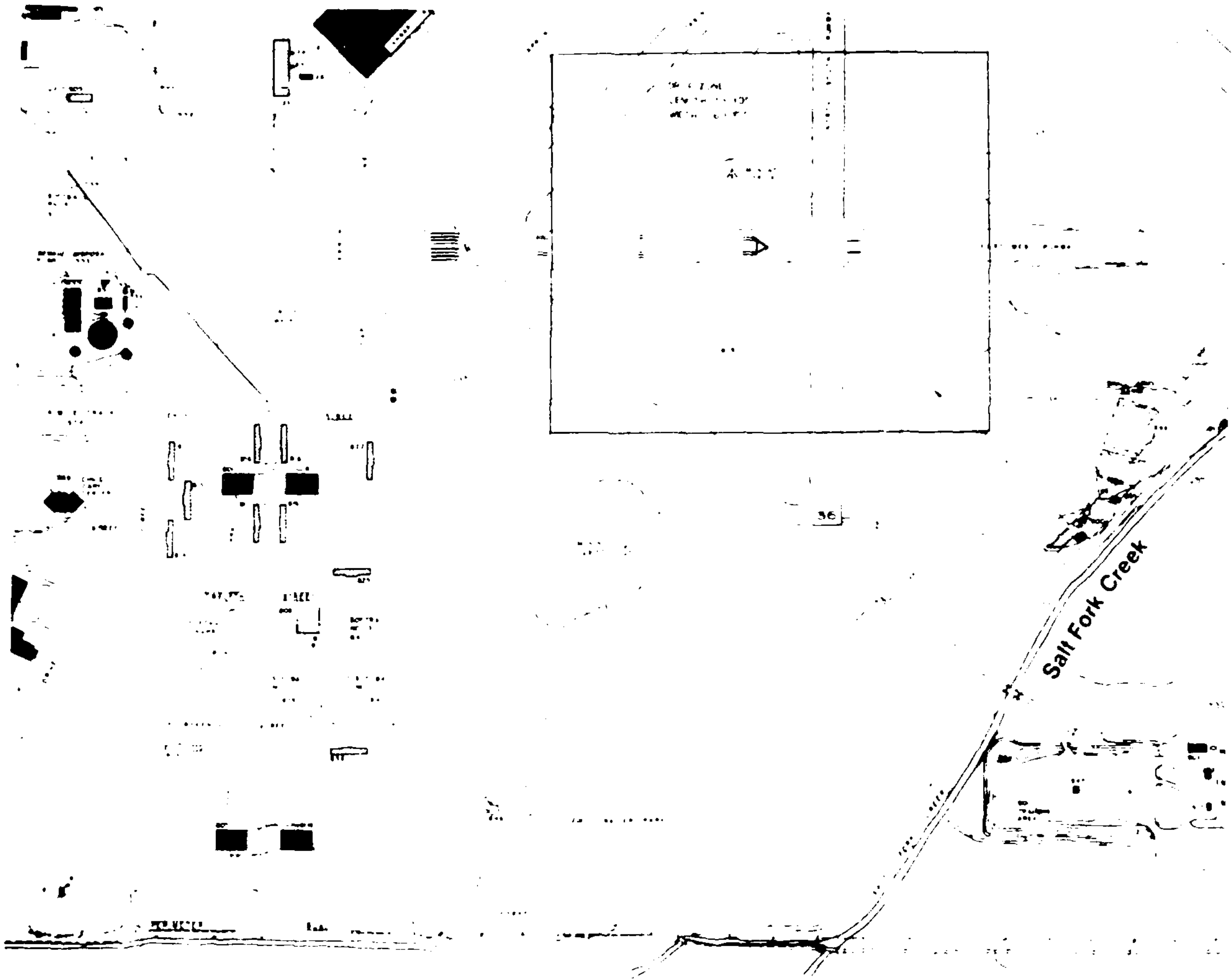


FIGURE 2-3 TOPOGRAPHY OF THE CHANUTE AFB AREA



Source: Chanute AFB Documents

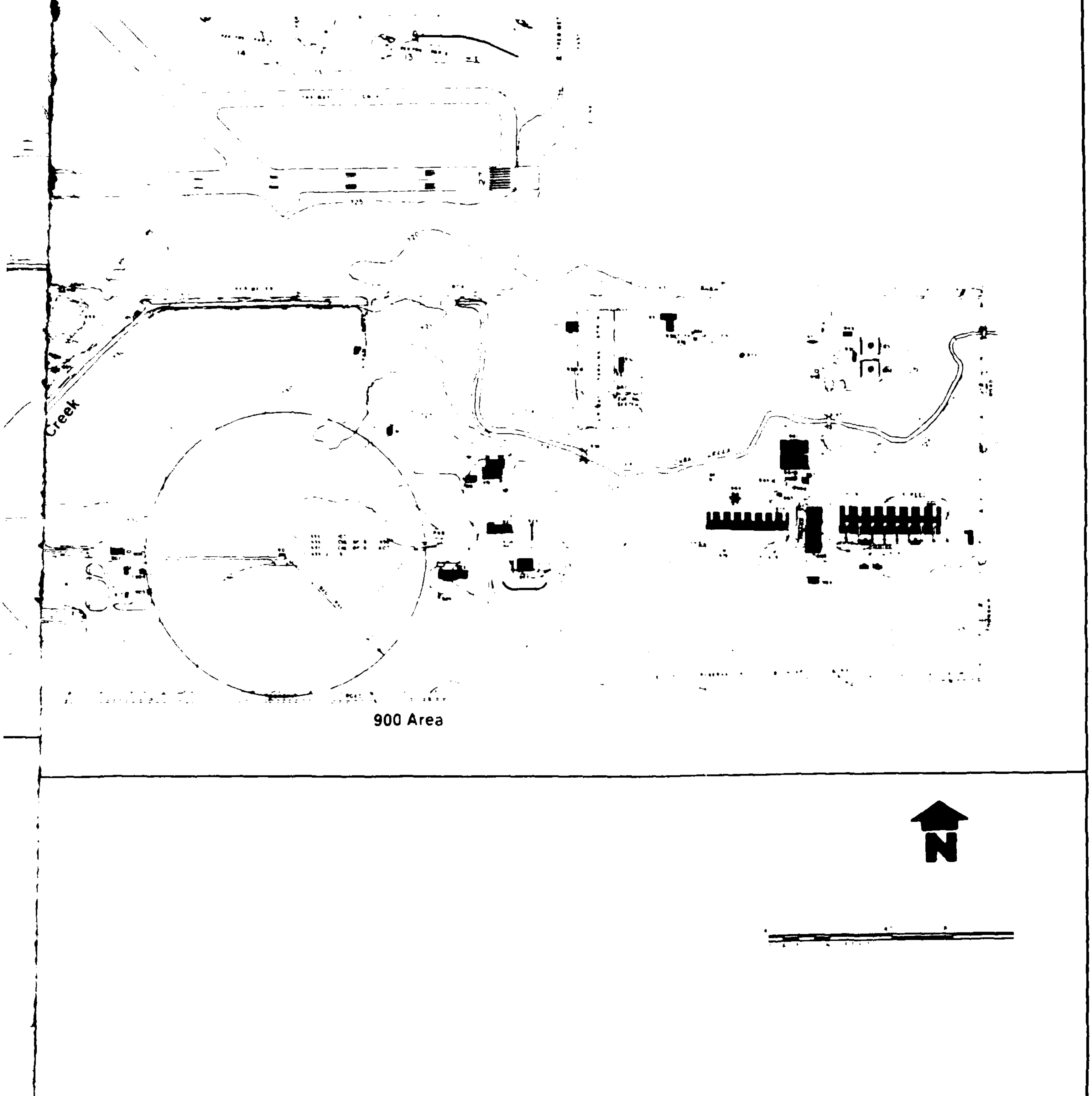


FIGURE 2-4 TOPOGRAPHY OF STUDY AREA AT CHANUTE AFB

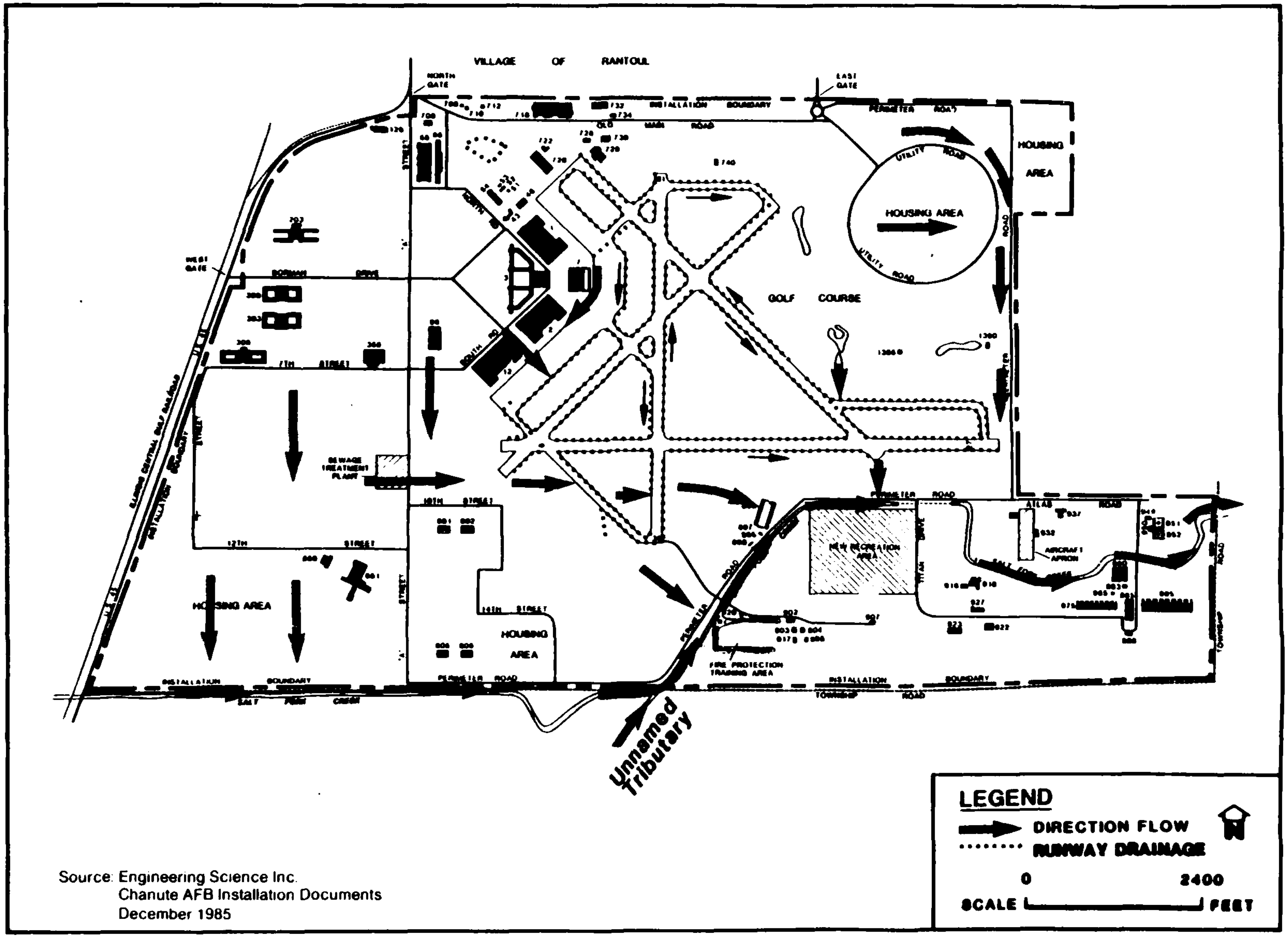
Fork Creek. Salt Fork Creek then conveys surface flow southeastward to the Upper Salt Fork Drainage Ditch and eastward to the Vermilion River. Drainage of Chanute AFB is accomplished by a combination of overland flow, ditches, french drains and sewers. Figure 2-5 depicts installation drainage features. A recreational lake is presently under construction in the "New Recreation Area". The new recreation lake is one of the surface water impoundments on base (other impoundments are the golf course ponds). The lake is not connected to any storm sewers and only provides surface drainage to the immediate area. Natural drainage on the Base is considered poor due to the presence of slow-draining soils at ground surface and little local relief (USDA, SCS, 1982).

2.3 GEOLOGY

The landscape at Chanute AFB is developed on several hundred feet of glacial drift that mantles the much older layered bedrock that is several thousand feet deep and underlain by ancient crystalline basement rocks.

The bedrock is composed of Silurian, Devonian, Mississippian and Pennsylvanian sedimentary rocks. These units are listed in stratigraphic sequence and briefly described in Figure 2-6. The upper bedrock unit in the study area consists mostly of Mississippian System, Kinderhookian Series shale (Willman et al., 1967). The depth to bedrock is approximately 300 feet. The distribution of bedrock units in the region are presented in Figure 2-7. The bedrock dips eastward and southward to form part of a bowl-like structure known as the Illinois Basin (Visocky and Schicht, 1969). Two miles east of Chanute AFB the bedrock has been warped and folded creating a north-south trending arch-like structure, known as the LaSalle Anticlinal Belt (see Figure 2-8).

Following deposition of the youngest rocks in the area, the upper part of the bedrock was eroded deeply (Kempton, Moose and Visocky, 1982). Prior to glaciation, a well-developed network of streams existed in Illinois. One of the most prominent stream valleys that developed was the Mahomet Valley, which trends northeast-southwest. Mahomet Valley represents the lower course of a master preglacial stream known as Teays River with headwaters in North Carolina and discharged into the ancient Mississippi River Valley (Visocky and Schict, 1969). Chanute AFB is situated above the southeast wall of Mahomet Valley. The proximity of this ancient stream valley to Chanute AFB (shown in Figure 2-9) is significant and has a direct bearing on the groundwater resources of northeastern Champaign County. Figure 2-10, a block diagram of the study area, illustrates the relationship of these geological features.



Source: Engineering Science Inc.
Chanute AFB Installation Documents
December 1985

FIGURE 2-5 CHANUTE AFB DRAINAGE

Glacial Drift Section

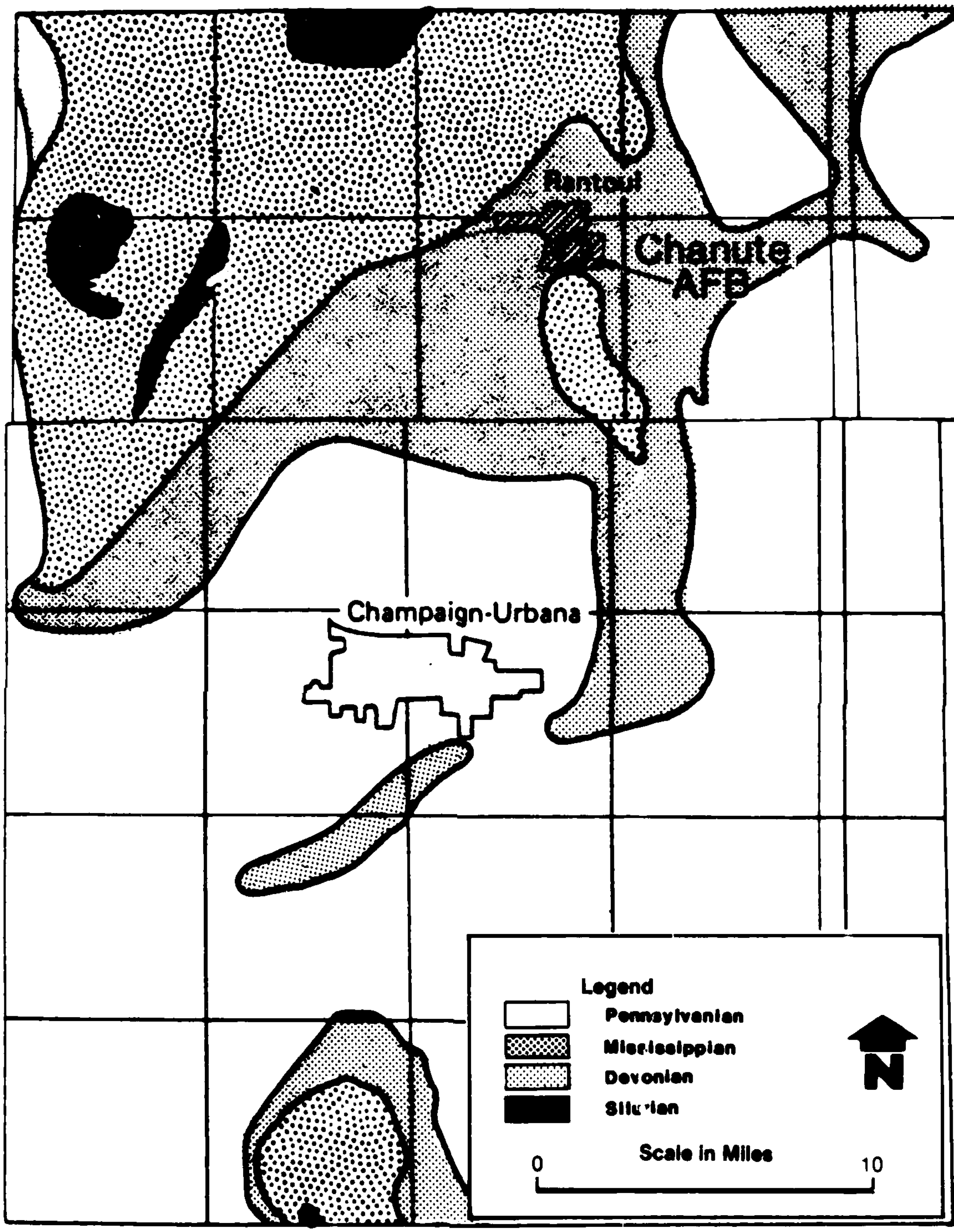
Time Stratigraphy			Principal Rock Stratigraphic Units		Graphic Log	Description of Units
Quaternary System	Pleistocene Series	Holocene Stage	Cahokia Alluvium			Mostly water-laid silt and sand, local gravel
		Wisconsinan Stage	Wedron Fm (15-140 ft)	Snyder till mbr		Gray clayey, silty till, NE part of county only, local sand and gravel at base and at till margin
				Batestown till mbr		Gray silty till, thin local sand at base
				Glen Burn till mbr		Grayish brown, thin, sandy, silty till, local thin basal sand
			Robein Silt			Organic silt
		Sangamonian Stage	Glasford Fm (10-155 ft)	Berry Clay mbr		Thin silty clay [illegible]
		Illinoian Stage		Radnor till mbr		Gray [illegible] till, local thin lenses of sand and gravel
				Vandalia till mbr		Brownish gray, sandy till, locally extensive sand and gravel at top and bottom
				Smithboro till mbr		Dark brown, dark gray silty till
		Yarmouthian Stage	Banner Fm (0 to 240 ft)	Lierle Clay mbr		Thin, silty clay (soil)
		Kansan Stage		Tilton till mbr		Brownish gray, sandy, silty till
				Hillery till mbr		Brown, reddish brown silty till
				Harmattan till mbr		Gray, olive gray silty till
				Hegeler till mbr		Greenish gray silty till
				Mahomet Sand		Fine, medium sand in upper part, grading to medium to coarse sand and gravel locally coarse at base

Upper Bedrock Section

Time Stratigraphy: System	Series or Group	Principal Rock Stratigraphic Units	Graphic Log	Description of Units
Pennsylvanian	McLeansboro Group	0-630 ft		Mainly shale with thin sandstone, limestone, coal beds
	Kewanee Group	0-350		
	McCormick Group	0-200		
Mississippian	Chesterian Series	0-150		Shale, limestone, and sandstone
	Valmeyeran Series	Ste. Genevieve Fm St. Louis Fm 0-170		Limestone
		Borden Fm 0-700		Limestone with intermediate shale, chert, in lower part
	Kinderhookian Series	0-[illegible]		Shale
Devonian	Upper Series Middle Series	0-130		Shale and limestone
Silurian	Niagaran Series	0-600		Dolomite and limestone
	Alexandrian Series	0-25		

Source: Adapted from Sanderson and Zewde, 1976

FIGURE 2-6 GEOLOGIC UNITS OF CHAMPAIGN COUNTY, ILLINOIS



Source: Modified from Sanderson and Zewde, 1976

FIGURE 2-7 BEDROCK GEOLOGY OF CHAMPAIGN COUNTY, ILLINOIS

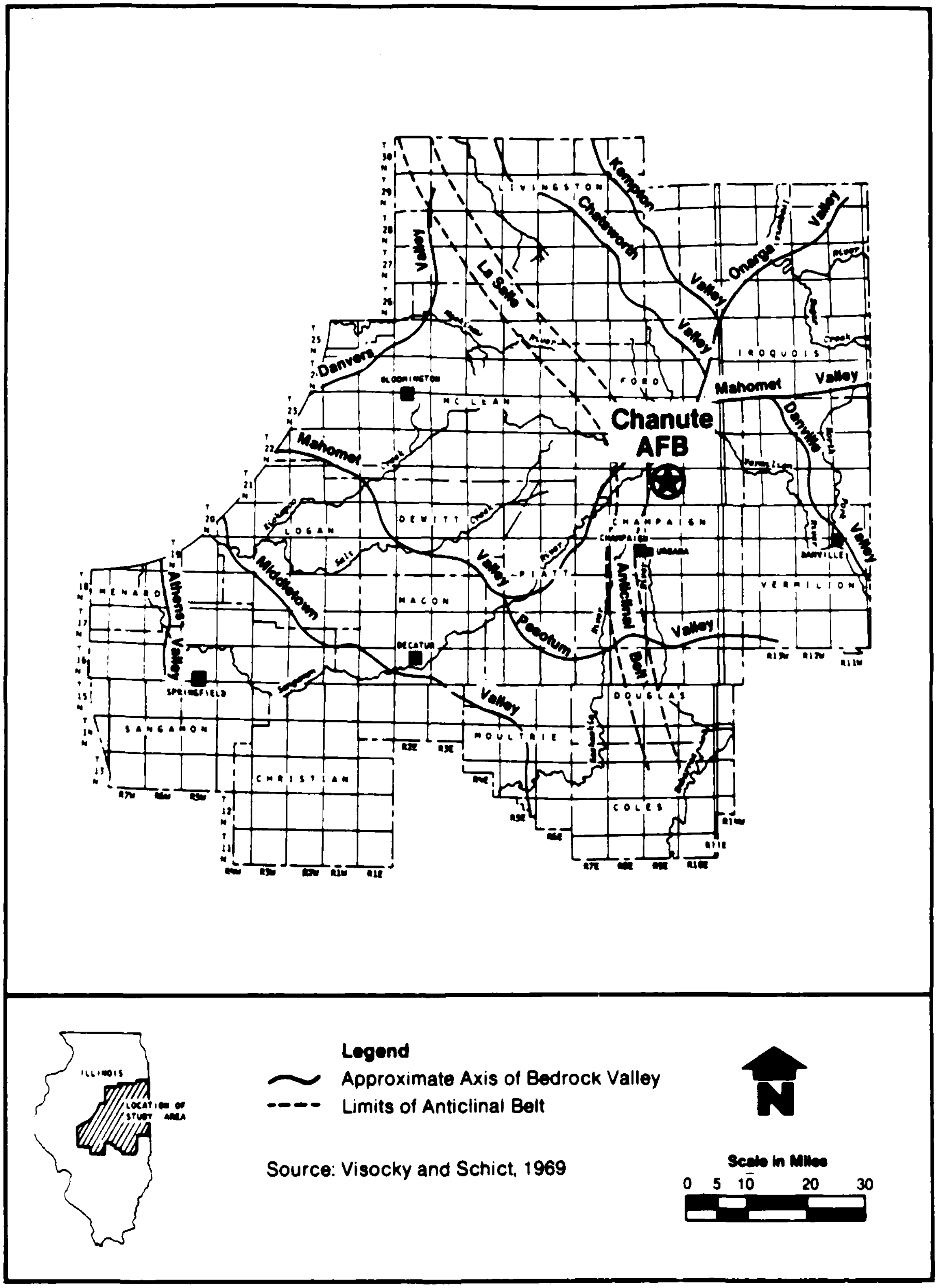


FIGURE 2-8 STRUCTURAL GEOLOGY OF EAST CENTRAL ILLINOIS

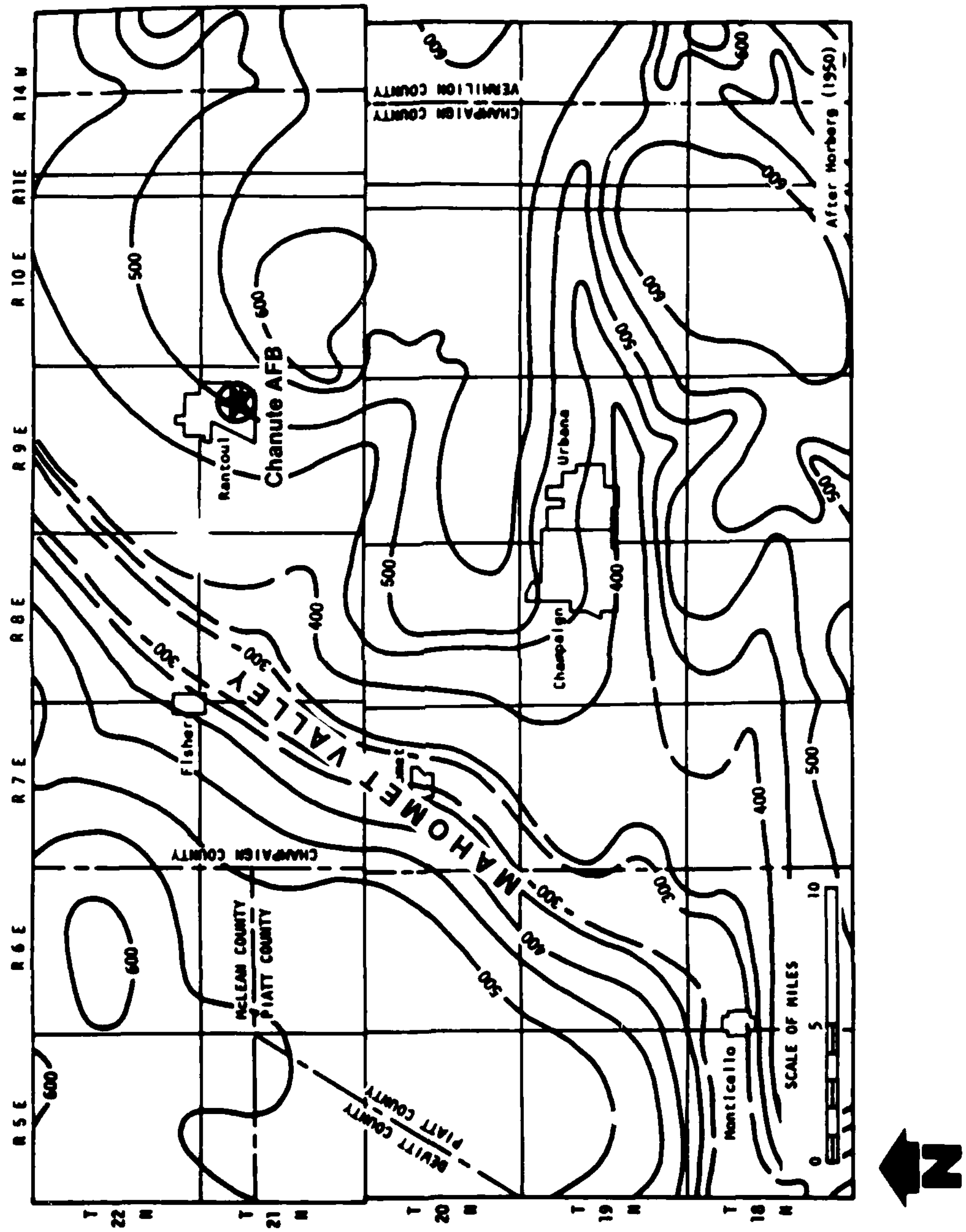
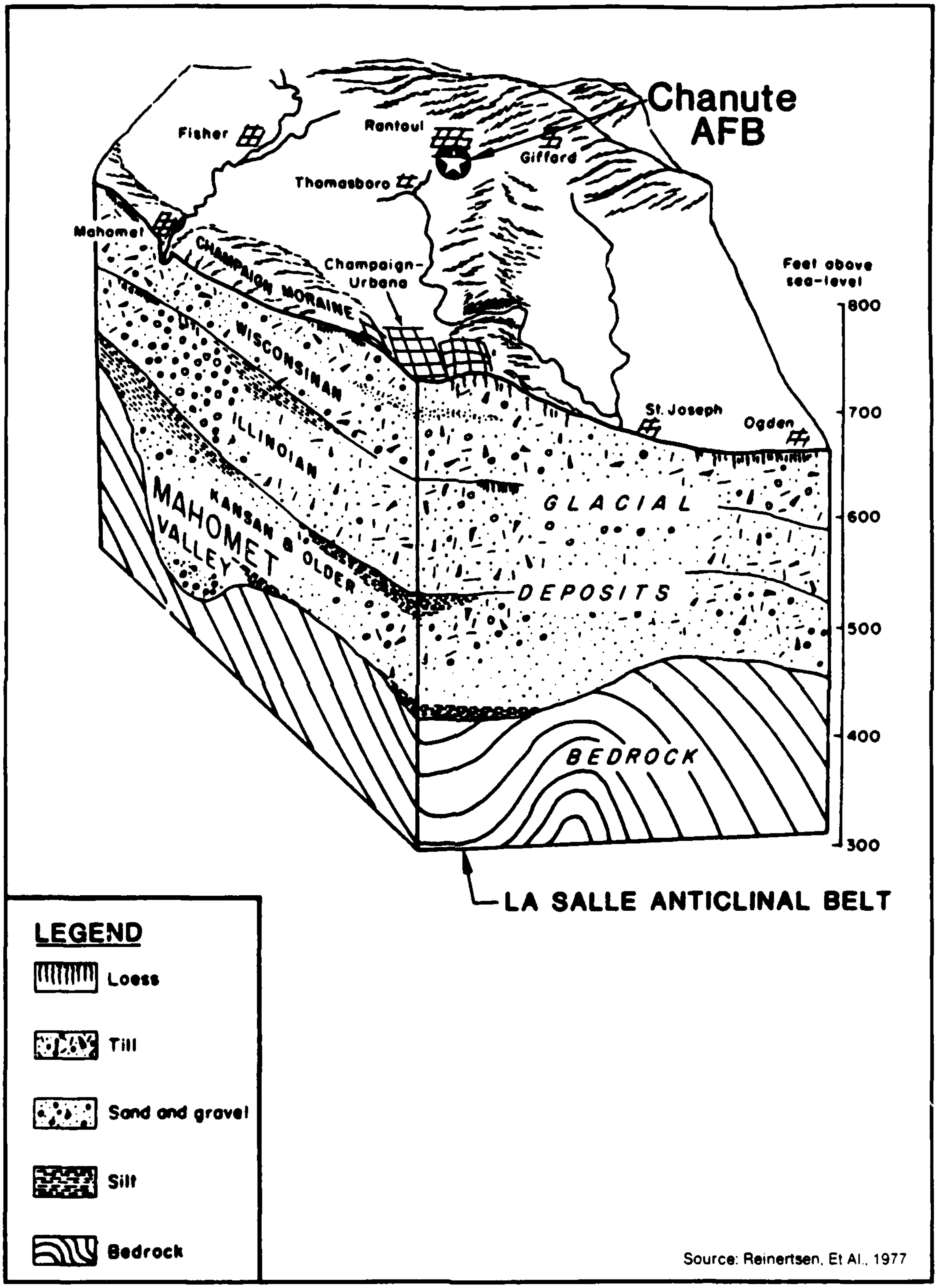


Figure 2-9 BEDROCK TOPOGRAPHY OF CHAMPAIGN COUNTY



Source: Reinertsen, Et Al., 1977

FIGURE 2-10 GEOLOGIC BLOCK DIAGRAM OF NORTHEASTERN CHAMPAIGN CO.

The bedrock in the vicinity of Chanute AFB is unconformably overlain by unconsolidated glacial deposits of the Pleistocene Series (see Figure 2-6). Generally these deposits are 200 feet thick in Champaign County. Due to the presence of the Mahomet Valley, glacial deposits in the region are 290 to 300 feet thick (Theodosis, 1973). Glacial drift, deposited by several advances of the continental glaciers that covered east-central Illinois, is composed principally of glacial till, which is a mixture of clay, silt, sand, gravel and scattered boulders. The deposits of meltwater streams that flowed from glaciers during warm periods are commonly called outwash (Kempton, Morse and Visocky, 1969).

The glacial deposits of east-central Illinois are assigned to three stages of continental glaciation; in ascending order: Kansan, Illinoian, and Wisconsinan. The deposits are also assigned to three formations: the Banner Formation (Kansan), Glasford Formation (Illinoian), and the Wedron Formation (Wisconsinan). Each formation includes several members composed mainly of glacial till and outwash. In the Chanute AFB area, and extensively in the Mahomet Valley, the Kansan deposits consist of yellow-brown to gray, pebbly, silty till underlain by thick beds of sand and gravel (the Mahomet sand member) that extend to bedrock. The Mahomet sand is up to 150 feet thick in the Champaign County area.

The Illinoian deposits overlie the Kansan deposits and range in thickness from 115 to 140 feet in the vicinity of Chanute AFB (Theodosis, 1973). The Illinoian is characterized by a relatively high proportion of outwash and by hard, silty, brownish gray or dark gray tills. Bands of sand and gravel are common at the base, in the middle and at the top of the Illinoian deposits (Piskin and Bergstrom, 1975).

Surficial geology in the study area is dominated by the Wisconsinan Stage glacial deposits of the Wedron Formation. Their distribution relative to Chanute AFB is shown in Figure 2-11. The thickness of the Wisconsinan drift ranges from 50 to 65 feet thick at Chanute AFB (Theodosis, 1973). The Wedron Formation was deposited during Woodfordian time (22,000 to 12,500 years ago) and can be divided into four distinct till members; in ascending order: the Oakland till member, the Fairgrange till member, the Piatt till member and the Batestown till member. The Wisconsinan tills are generally less compact, lighter in color, have a shallower profile of weathering than the older glacial deposits, and tend to be clayey to silty rather than sandy. Groundwater monitoring wells installed in the study area penetrated the ground surface to a depth of approximately 30 feet, therefore, only the Piatt and Batestown members have direct significance in this study. Both members have somewhat similar colors and clay/mineral content. However, the Piatt

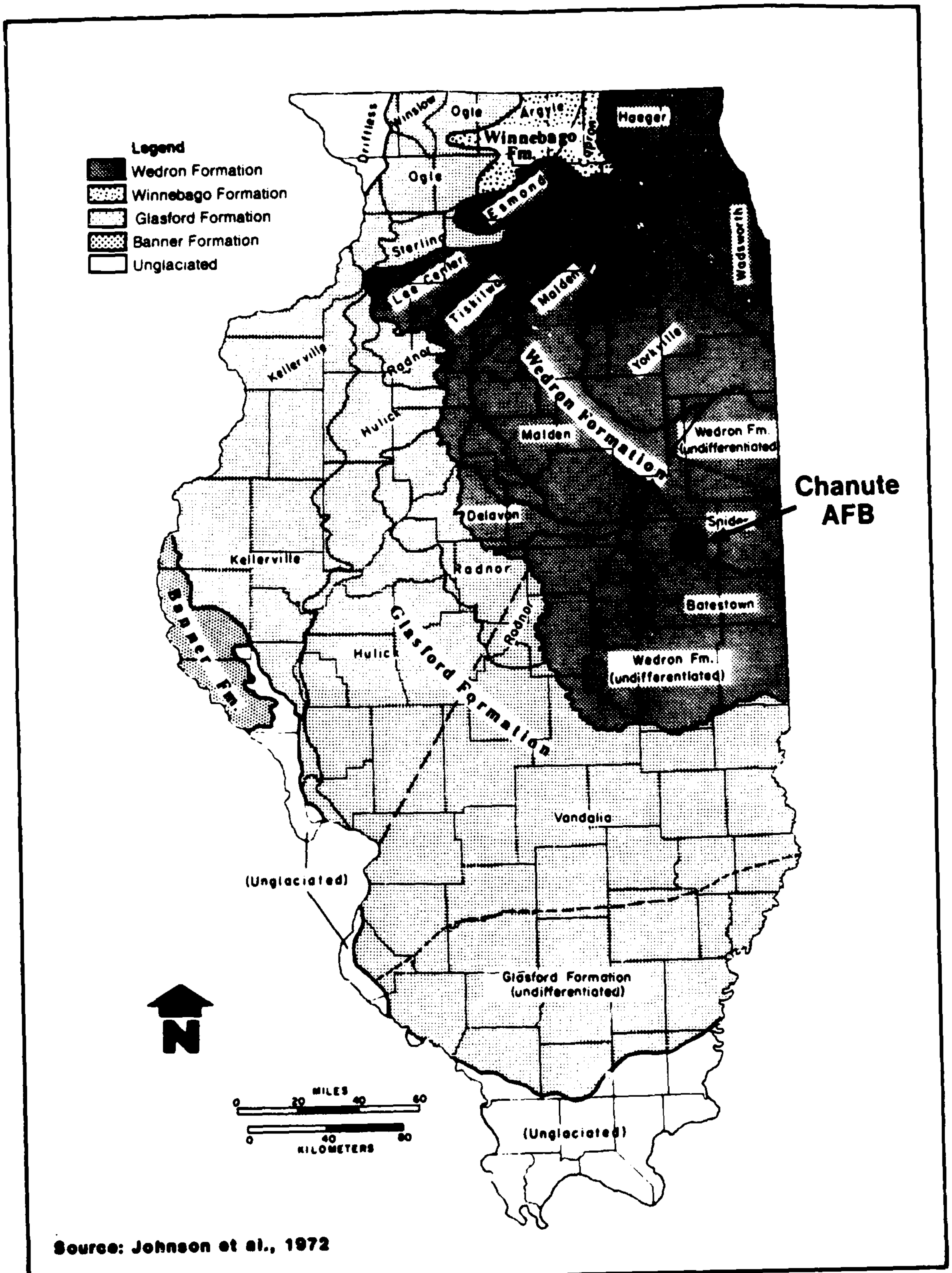


FIGURE 2-11 AREAL DISTRIBUTION OF THE DOMINANTLY TILL FORMATIONS AND MEMBERS IN ILLINOIS

till is slightly sandier than the Batestown till in texture. The tills are related to two separate advances of the Lake Michigan lobe of the Wisconsinan ice sheet. Lack of any oxidation between the two members suggests that a relatively short time span separated their deposition (Wickham, 1979).

A thin mantle of loess (wind-blown drift) blankets the Wedron till in the study area and constitutes the parent materials of the modern soils. Generally, the loess is 2 to 4 feet thick and appears as a massive yellowish to reddish-brown silt.

Most Base soils are fine grained and slow draining in the upper portion of their profile, and tend to be sandy and free draining in the lower section of a typical profile. Table 2-1 describes the principal characteristics of the 13 soil types found at Chanute AFB, and Figure 2-12 shows the distribution of these soil types. All of the units experience a seasonal high water table (less than 10 feet BLS) and have moderate to low permeabilities (USDA, Soil Conservation Service, 1982). Two units, urban land (533) and orthents (802) were not described in Table 2-1, as their profiles have been altered, buried or completely removed locally as a result of extensive site use modifications and Base construction.

2.4 HYDROGEOLOGY

Four major hydrogeologic units of local significance have been identified in the northeastern Champaign County area and include the following:

- Upper glacial drift unit, Wisconsinan Stage, Wedron Formation.
- Middle glacial drift unit, Illinoian Stage, Glasford Formation.
- Lower glacial drift unit, Kansan Stage, Banner Formation.
- Bedrock unit, Mississippian and Devonian limestones.

Municipal and domestic water supplies are most commonly obtained from the glacial drift units. These units are shown in cross-section in Figure 2-13. The Kansan aquifer accounts for the majority of the County's water supply and is the primary source for Chanute AFB. The Illinoian and Wisconsinan aquifers provide only a small percentage of the County's water supply. Groundwater from the glacial units is hard (250 to 600 milligrams per liter hardness as $CaCO_3$) and contains objectionable concentrations of iron (1 to 5 mg/L). However, these undesirable constituents can be

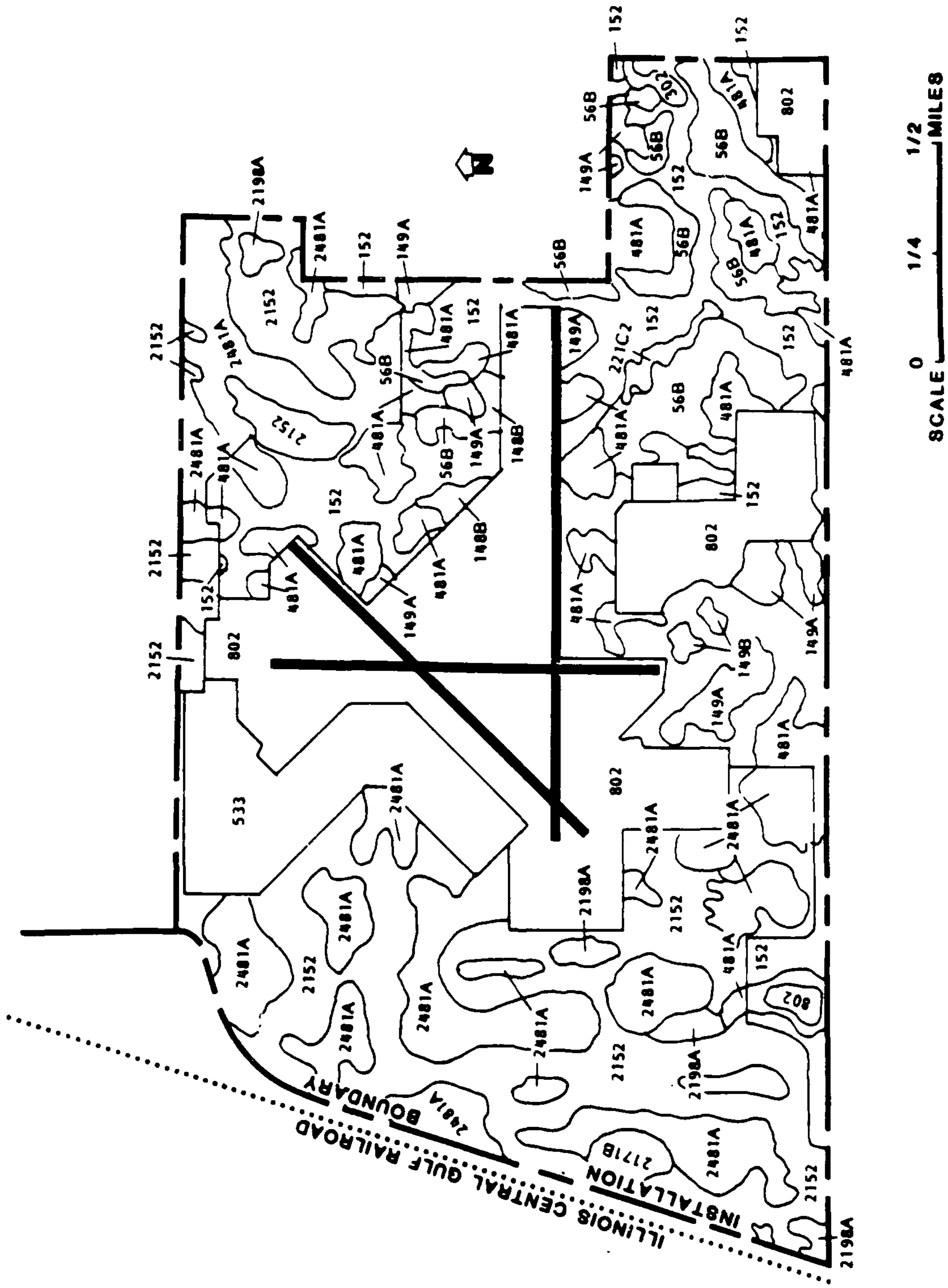
TABLE 2-1 SURFACE SOILS IN THE STUDY AREA AT CHANUTE AFB

Map Symbol	Unit Description	USDA Texture (Major Fraction)	Thickness (Inches)	Unified Classification (Major Fraction)	Unit Permeability (Inches/Hour)
56B	Dana silt loam, 2-5% slopes	Silt loam, silty clay loam, clay loam.	60	CL, ML	0.6 - 2.0
148B	Proctor silt loam, 1-5% slopes	Silt loam, silty clay loam, clay loam, sand.	66	CL, SC, SM, SC	0.6 - 6.0
149A	Brenton silt loam, 0-3% slopes	Silt loam, silty clay loam, loamy sand.	60	CL, ML, SC	0.6 - 2.0
152	Drummer silty clay loam	Silty clay loam, silt loam, clay loam.	60	CL, CH, SC	0.6 - 2.0
221C2	Parr silt loam, 5-10% slopes	Silt loam, clay loam, loam	60	CL, ML	0.6 - 2.0
302	Ambraw silty clay loam	Silty clay loam, clay loam, loam	60	ML, CL, SC, SM	0.2 - 2.0
481A	Raub silt loam, 0-3% slopes	Silt loam, silty clay loam, clay loam, loam.	60	CL, CH, ML, SC, SM	0.2 - 2.0
533	Urban land	*	*	*	*
802	Orthents, loamy	*	*	*	*
2152	Drummer - urban land complex, 0 - 2% slopes	Silty clay loam, silt loam, clay loam, loam	60	CL, CH, SC	0.6 - 2.0
2171B	Catlin - urban land complex, 2 - 7% slopes	Silt loam, silty clay loam, loam, clay loam	60	ML, CL, CH, OL	0.6 - 2.0
2198A	Elburn - urban land complex, 0 - 3% slopes	Silt loam, silty clay loam, loam, sandy loam, sand.	66	CL, SC, SM, SC	0.6 - 6.0
2481A	Raub - urban land complex, 0 - 3% slopes	Silt loam, silty clay loam, clay loam, loam.	60	CL, CH, ML, SC, SM	0.2 - 2.0

* Properties not estimated
Source: USDA, Soil Conservation Service, 1982.

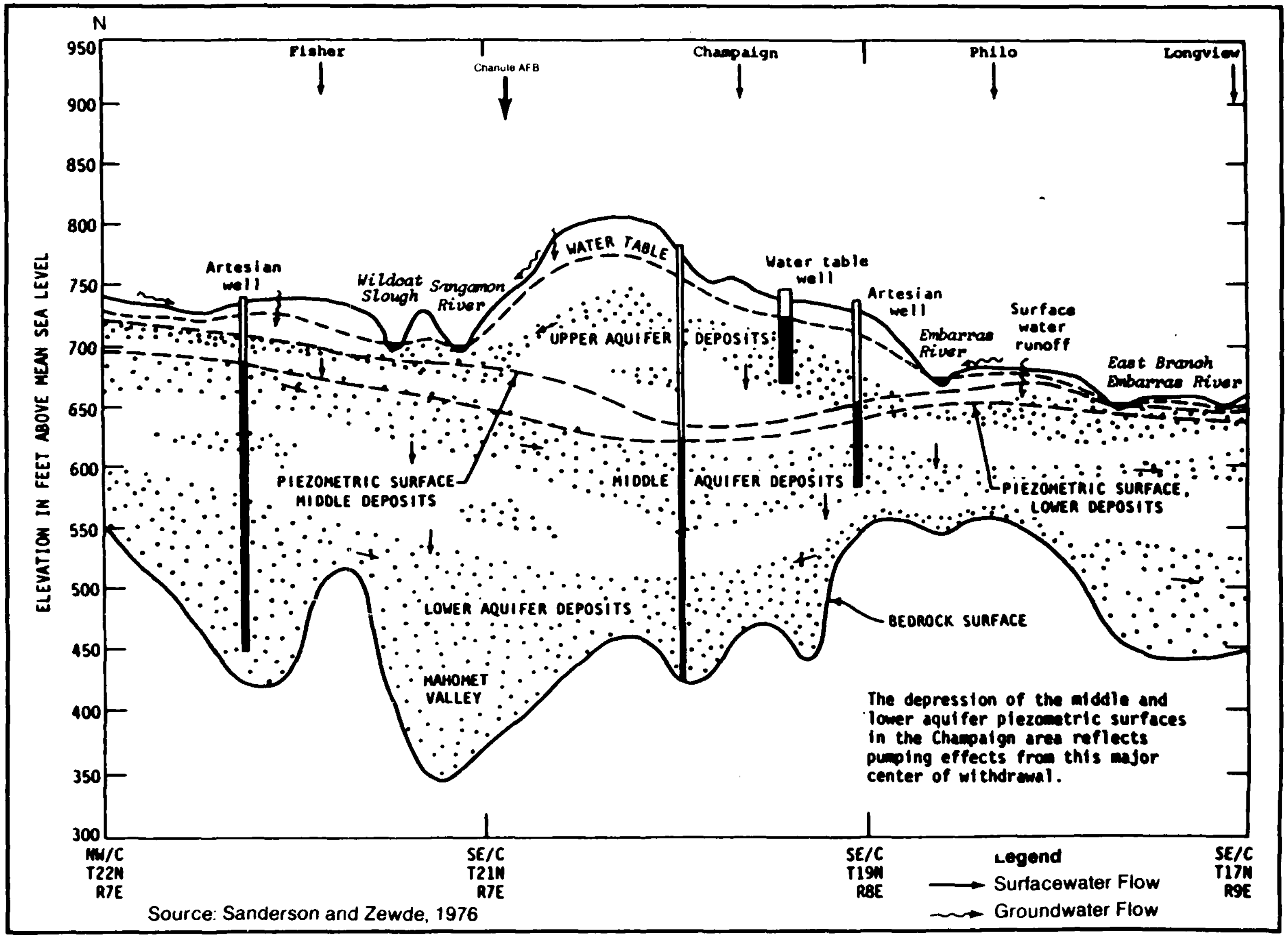
Abbreviations for the Unified Classification are continued in Appendix A

WESTON



SOURCE: USDA, SCS, 1982

FIGURE 2-12 SURFACE SOILS IN THE STUDY AREA AT CHANUTE AFB



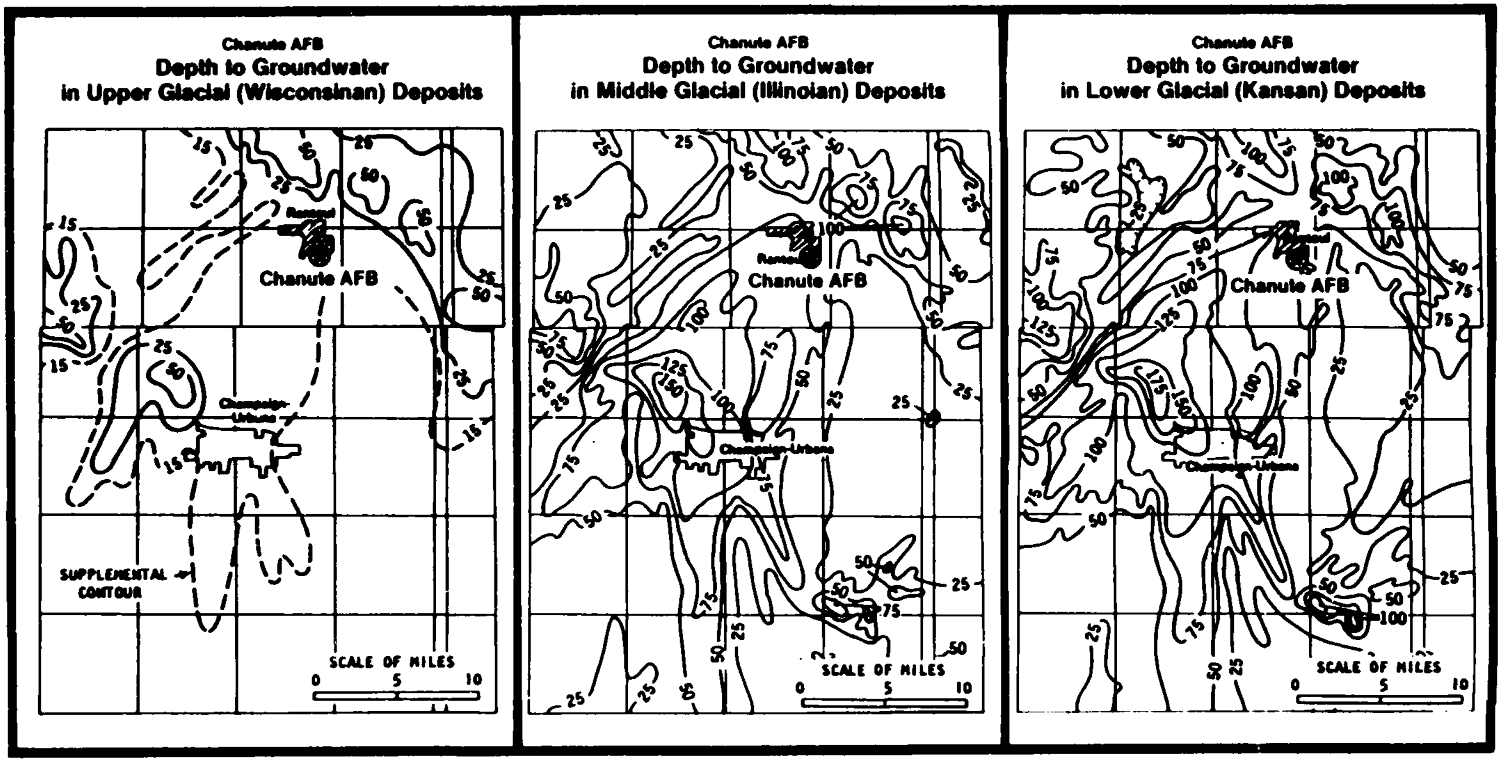
Source: Sanderson and Zewde, 1976

FIGURE 2-13 HYDROGEOLOGIC CROSS SECTION OF CHAMPAIGN COUNTY, ILLINOIS

successfully removed with home or municipal treatment units. Upper bedrock has only been tapped by a few wells, mostly in the southern portions of the county (Sanderson and Zewde, 1976).

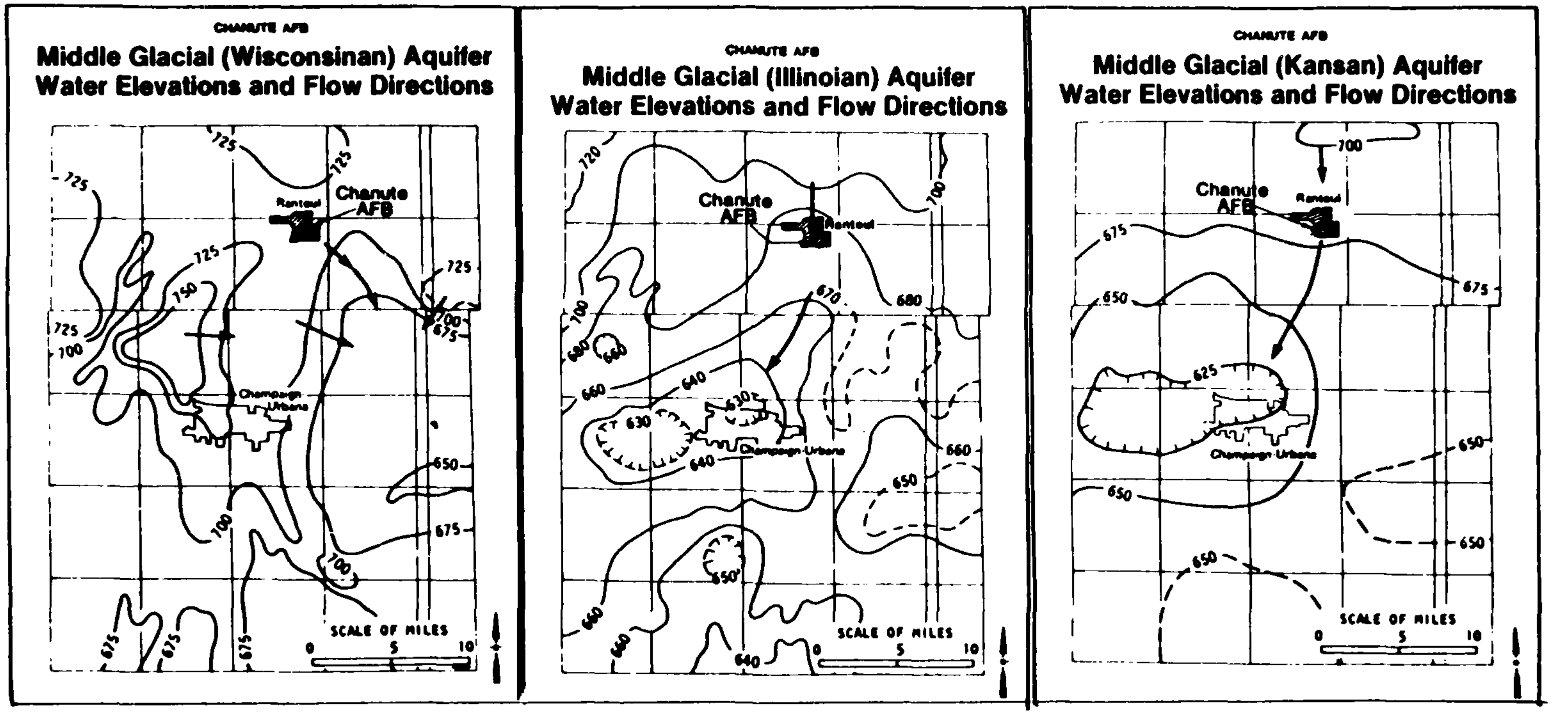
The Wedron Formation is the surficial glacial drift unit in the study area and averages 50 to 65 feet in thickness (Theodosis, 1973). Chanute AFB is situated in the recharge area for the Wedron Formation and receives water from precipitation falling on surface exposures. Sand and gravel aquifers within the Wedron Formation occur as scattered pockets within the drift, and as sheet-like deposits in the outwash areas of the moraines. Groundwater generally occurs under unconfined conditions at depths ranging from 5 to 25 feet BLS. Locally, seasonally perched water table conditions may exist at or near the ground surface. Figure 2-14 indicates that the depth to groundwater averages 15 feet BLS in the region. Seasonal fluctuations of 5 to 8 feet may be experienced in the shallower aquifers and will normally be less in deeper aquifers. Figure 2-15 depicts upper glacial aquifer water level elevations and flow directions. The yields of wells tapping the upper glacial aquifer range from 3 gpm for farm and domestic use, to 60 gpm from the municipal wells at Philo. Total groundwater pumpage is an estimated 0.5 mgd and provides about 2 percent of the County's water supply. Wells drilled into the upper glacial deposits near the Base range in depth from 25 to 100 feet BLS. The chemical quality of the groundwater obtained from the Wedron Formation varies considerably, primarily due to local pollution from nearby surface water areas (septic tanks, sewage disposal systems and feed lots) (Sanderson and Zewde, 1976), and indicates that the near-surface aquifer may easily become contaminated. Neither Chanute AFB nor the Village of Rantoul utilize groundwater from this upper aquifer due to the small volumes of water produced and unreliable water quality.

The Illinoian Stage, Glassford Formation, of the middle glacial deposits in the study area range from 115 to 140 feet thick (Theodosis, 1973). Water-bearing sands and gravels of the Vandalia till member within this unit occur as fairly continuous layers 35 to 50 feet thick in the upper half of the formation and form the Illinoian aquifer. A sandy clayey silt confining layer separates the Wisconsinan aquifers from the Illinoian aquifers. The confining layer has been shown to be leaky and discontinuous in Champaign County. The thickness of this aquifer is estimated to be 50 to 100 feet thick (Visocky & Schict, 1969). Groundwater occurs from 75 to 125 feet BLS (see Figure 2-14) under confined conditions. Groundwater level elevations and flow directions for this unit are shown on Figure 2-15. The middle glacial aquifer receives recharge from the upper



Source: Sanderson and Zewde, 1976

FIGURE 2-14 MAJOR HYDROGEOLOGIC UNITS AND DEPTHS TO GROUNDWATERS IN CHAMPAIGN COUNTY, ILLINOIS



Source: Sanderson and Zewde, 1976

FIGURE 2-15 MAJOR HYDROGEOLOGIC UNITS - WATER LEVELS AND FLOW DIRECTIONS, CHAMPAIGN COUNTY, ILLINOIS glacial aquifer. Yields of wells tapping this aquifer range from 5 gpm for farm and domestic use to 800 gpm for municipal use. Total groundwater pumpage from the middle glacial aquifer is roughly 3.1 mgd and 14 percent of the countywide total (Table 2-2).

The Kansan Stage, Banner Formation, forms the lower glacial deposits. The principal aquifer of this formation is the Mahomet sand member. Clean sands and gravels of the Mahomet sand are found in distinct 40- to 60-foot thick blanket-like lenses. The lower glacial drift varies in thickness from 60 to 100 feet with the sand and gravel units occurring 218 to 285 feet BLS (Theodosis, 1973). A leaky discontinuous confining layer approximately 40 feet thick separates the Kansan aquifer from the Illinoian aquifer, through which the lower glacial deposits receive recharge. Groundwater from the Kansan aquifer occurs under artesian conditions. Figure 2-14 illustrates depth to groundwater for the Kansan aquifer in the study area. Figure 2-15 illustrates water level elevations and direction of flow. During periods of heavy pumpage the water levels of the lower and middle aquifers decline and stabilize at approximately the same point, suggesting that during such periods of heavy drawdown the two aquifers may respond as one. The Kansan aquifer is the major source of most municipal water supplies in Champaign County and the sole source at Chanute AFB (Visocky & Schict, 1969). Up to 3,500 gpm have been pumped from an individual well drilled into the Kansan aquifer (a well of the Industrial Water Supply Company near Bondville). Maximum safe water yields are generally limited to 2,100 gpm (Sanderson & Zewde, 1976). Total groundwater pumpage is estimated to be 19.6 mgd and 84 percent of the Countywide total.

Limestone of Devonian System bedrock is capable of supplying small quantities of water from fractures and solution openings. However, since groundwater obtained from bedrock wells tends to be highly mineralized, these wells are not considered dependable sources of good quality water in the study area. The depth to bedrock in the vicinity of Chanute AFB is approximately 300 feet. Because ample water supplies are available in the overlying glacial drift deposits, no bedrock wells have been constructed in the vicinity of Chanute AFB.

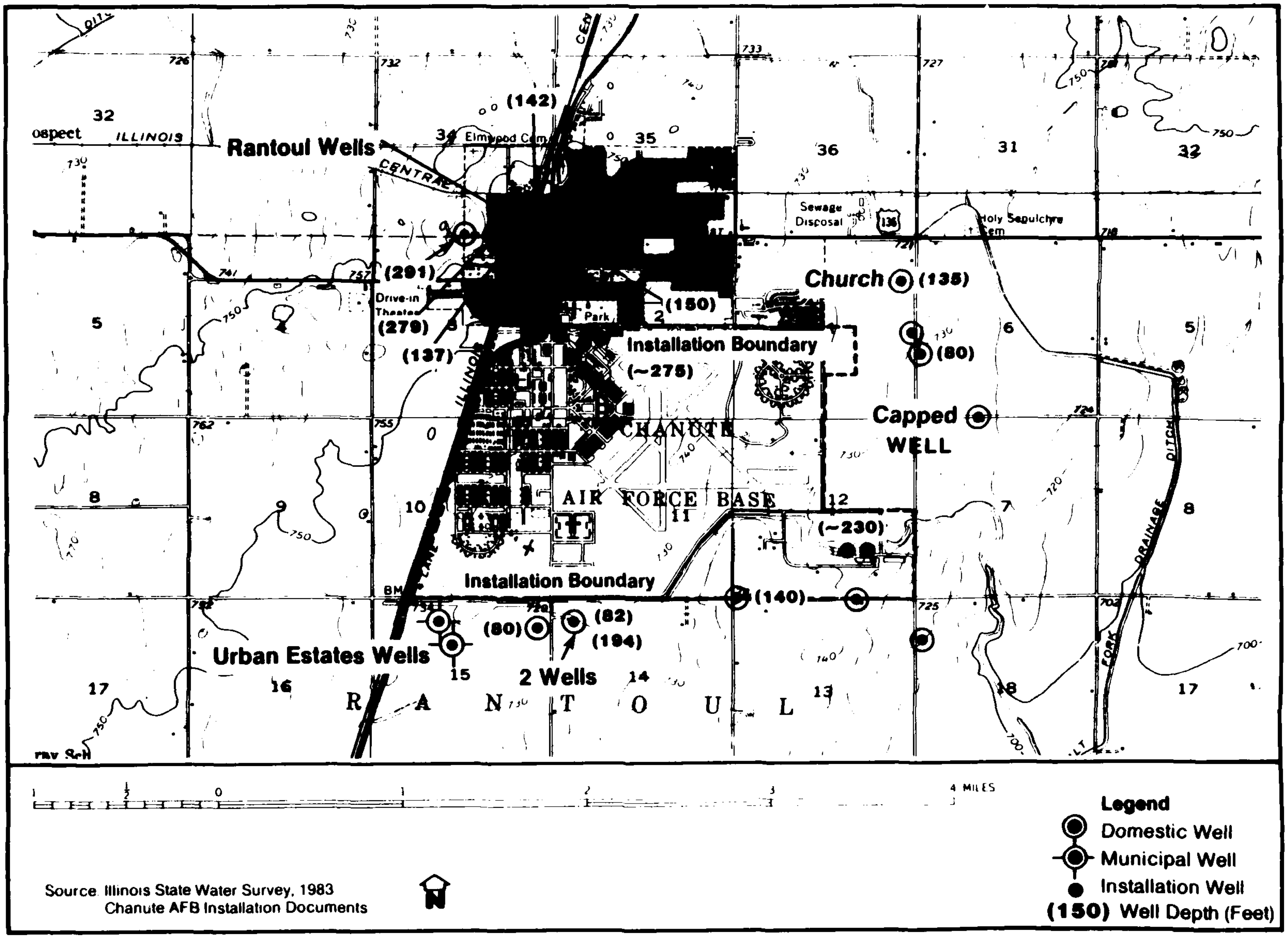
Municipalities and industries in Champaign County withdraw about 21.8 mgd of groundwater from sand and gravel aquifers in the glacial drift deposits (Sanderson & Zewde, 1976). Chanute AFB derives its water supply from a system of nine deep wells on the Base completed in the Kansan aquifer. The locations of these wells are shown in Figure 2-16. The Base supply system is cross-connected with the Village of Rantoul's municipal water supply system. Rantoul draws its

TABLE 2-2

Champaign County Groundwater Use

Aquifer	Percent of Total Consumers Domestic/Farm	Municipal	Estimated Production (mgd)
Upper Glacial	29	0.5	0.6
Middle Glacial	55	12.5	3.8
Lower Glacial	16	87	23.7
Bedrock	-	-	-

Source: Sanderson and Zewde, 1976



Source: Illinois State Water Survey, 1983
Chanute AFB Installation Documents

FIGURE 2-16 LOCATIONS OF MUNICIPAL, DOMESTIC, AND INSTALLATION WATER SUPPLY WELLS

water supply from five wells. Two of the wells are completed in the Kansan aquifer, while the remaining three are finished in the Illinoian aquifer. A second system of municipal wells exists to the south of the Base at Urban Estates. The two wells here are completed in the Illinoian aquifer. Figure 2-16 shows the locations of the municipal wells.

Immediately south and east of the Base, eight dwellings and one church derive their water supply from individual wells not connected to the Chanute AFB or Rantoul water supply systems. A study from the Illinois State Water Survey indicates that the individual domestic wells are completed into the Illinoian aquifer. The locations of these domestic wells are presented in Figure 2-16.

Figures for groundwater usage in Champaign County are presented in Table 2-2. This information indicates that the Kansan aquifer is by far the most favored source of municipal water supply in Champaign County. The Illinoian aquifer is favored by domestic and agricultural consumers (55 percent). The Wisconsinan aquifer supplies 29 percent of the domestic and agricultural consumers.

2.5 HYDROLOGY

The surface water hydrology at Chanute AFB is largely controlled by Salt Fork Creek. Essentially, all Base drainage flows to Salt Fork Creek. Approximately 70 percent of the wastewater produced by Chanute AFB is discharged from two sewage treatment plants to the creek. The discharges occur at a constant rate at the bend in the creek near the new recreation area and are a significant addition to the stream flow. However in spite of these discharges the flows in Salt Fork Creek are perennial except for periods of prolonged and severe drought. The upstream watershed is used primarily for agriculture, and the Salt Fork Creek is classified as an intermittent stream up to the point where it and an unnamed tributary enter the Base. The Salt Fork Creek is described as a perennial stream on Base.

Flooding of Salt Fork Creek is not a problem at Chanute AFB, and no data exists to define the 100-year flood levels. Salt Fork Creek is classified by the Illinois Environmental Protection Agency as a General Use stream. This classification provides for agricultural use, primary and secondary contact use, aquatic life and most industrial uses. Surface water sampling by Base personnel shows Salt Fork Creek water quality to be within the General Use classification. However, elevated levels of copper, chromium and mercury, which exceed the General Use classification, were noted in the Phase I report.

SECTION 3

FIELD INVESTIGATION

3.1 PROGRAM DEVELOPMENT

Task Order 0047 (Appendix B) was issued on the basis of the Phase I report recommendations and WESTON's Phase II presurvey site inspection and report. In addition to the six sites recommended for a Stage 1 Confirmation Study in the Phase I report (Engineering Science, Inc.), one additional site was recommended and approved for study during the Phase II Stage I Confirmation Study effort.

Section 3.1 presents the approved field investigation for all seven areas considered in this Phase II Problem Confirmation Stage 1 study report.

3.1.1 Purpose of Field Investigation

The purpose of the Phase II Stage 1 Problem Confirmation Study is to confirm the presence or absence of contaminants at those sites identified in the Phase I records search, and other sources, as having the greatest potential for environmental contamination by hazardous materials. Efforts to assess the vertical and horizontal extent of contamination, to quantify the amount of contaminant residuals in the subsurface, or to estimate the rate of contaminant migration are topics for more intensive and site-specific Stage 2 investigations. These investigations are only undertaken when environmental contamination is confirmed to exist during Stage 1.

3.1.2 Critical Assumptions

The work accomplished was based on the following assumptions:

- Agricultural activities reduce the amount of water available to recharge the aquifer. An extensive system of drainage tile is in place to drain the many areas of poorly drained soils and make dry land farming possible in the Rantoul area. These activities have the potential to affect regional water quality in the shallow aquifer.

- Base surface soils are fine-grained, slow draining and slowly permeable at the top of a typical soil profile. Soils become sandier, quicker draining and more permeable with depth.

- A shallow aquifer (Wisconsinan Stage, Wedron Formation) is present at or near ground surface.

The depth to the permanent water table in this aquifer is about 10 to 15 feet BLS. Smaller perched water-bearing zones may be present locally or on a seasonal basis.

- o Chanute AFB is located in the recharge zone of the shallow aquifer, which may easily become contaminated by surface activities. Groundwater moving through this aquifer may be discharged to local streams or as recharge to lower aquifers.

- o Two aquifers of regional significance (Kansan Stage, Banner Formation, and Illinoian Stage, Glasford Formation) underlie the shallow aquifer (Wisconsinan Stage, Wedron Formation) at Chanute AFB. They receive recharge from the overlying shallow aquifer. The regional aquifers furnish water supplies to Chanute AFB, the Village of Rantoul, Urban Estates municipal distribution systems, and the homes and farms proximate to the Base.

- o Nearly all surface drainage at the Base is toward Salt Fork Creek, which then conducts surface flow eastward to the Upper Salt Fork drainage ditch.

- o Water quality in Salt Fork Creek normally meets established standards for the Illinois general use classification.

3.1.3 Analytical Protocol

The analytical protocol is summarized in Table 1-3. The parameters chosen were specific and nonspecific indicators of contamination.

3.1.4 Formal Scope of Work

Task Order 0047 formalized the work proposed in the WESTON Phase II presurvey report and is included in Appendix B.

3.2 HYDROGEOLOGIC INVESTIGATION

A field investigation was conducted to define the hydrogeologic and geologic setting at Chanute AFB and to evaluate the potential presence of hazardous environmental contaminants that may have resulted from past product storage and handling practices or waste disposal operations at the Base. Information regarding potential or actual impacts of the seven sites on area groundwater was obtained from a total of 22 on-site monitoring wells, nine surface water staff gauge locations and one additional shallow soil boring.

During the drilling of monitoring wells split-spoon samples were taken at 5-foot intervals to obtain samples of the unconsolidated sediments in the unsaturated and saturated zones for visual inspection. The wells also provided measuring points for determining the hydraulic gradients at some of the sites. The field work is summarized on a site-by-site basis in Table 3-1.

3.2.1 Schedule of Activity

The field investigation of Chanute AFB commenced on 9 November 1984 and was completed on 8 April 1985. A summary of WESTON's field investigation schedule at Chanute AFB is presented in Table 3-2.

3.2.2 Drilling and Soil Sampling Program

The field program at Chanute AFB included the installation of 22 monitoring wells, establishment of nine surface water staff gauge locations and one soil boring. The locations were determined in the field on the basis of conditions existing at the time of the field investigation. All of the monitoring wells were completed within the unconsolidated glacial drift of the Wedron Formation. The drilling was accomplished by the drill crews of Soil Engineering and Exploration Company, Inc., Orland Park, Illinois. A central Mining Equipment Model 55 was used to drill and construct all of the monitoring wells.

At each monitor well location, test borings were advanced using hollow stem augers and sampling by split-spoon sampler. Representative soil samples were taken at 5 foot intervals throughout the unconsolidated glacial drift using the Standard Penetration Test (SPT) procedures in accordance with ASTM Test D-1586 (See Appendix E, Secton E-1.4.). An HNu photoinization meter was used to evaluate the presence or absence of organic vapors emanating at each site and from every soil sample collected. Boring logs were prepared concurrent with the drilling and sampling. These logs are presented in Appendix D.

Upon recovery from the borehole, the sampler was placed on a clean Teflon sheet and opened. As the spoon was opened, the sample material was qualitatively screened with HNu instruments and described by qualified geologist or geotechnical engineer. The instrument readings and sample description were entered into a sampling log book. The sample was split screened and retained in 2 inch by 5 inch glass jars. The equipment and storage containers were decontaminated using the standard protocol listed in Appendix E, Section E-1.3 where possible; however due to the wind and cold (drilling took place in January. 1985; daily conditions <25 degrees F

TABLE 3-1

Summary of Field Investigations
Chanute AFB

Site	Activity
Fire Protection Training Area 2	Installed six groundwater monitoring wells (W-1 through W-6) in the unconsolidated glacial drift formation. Established three surface water staff gauge locations (SS-1 through SS-3), two in the training area and one on Salt Fork Creek adjacent to the site. Sampled and analyzed for TDS, TOC, VOA, xylene, oil and grease, and phenol. Well 1 was sampled and analyzed for lead, chromium and herbicides. Sampled and analyzed one soil sample for EP characteristics. Performed well, water- table and surface water elevation surveys.
Landfill Site 2	Installed one groundwater monitoring well (W-10) in the unconsolidated glacial drift formation. Established five surface water staff gauge locations between FPTA2 and Titan Drive (SS-4 through SS-8). Sampled and analyzed for TDS, TOC, VOA, xylene, oil and grease, phenol, chromium, lead, and herbicides. Performed well, water table, and surface water elevation surveys.
Landfill Site 3	Installed three groundwater monitoring wells (W-11 through W-13) in the unconsolidated glacial drift formation. Sampled and analyzed for TDS, TOC, VOA, xylene, oil and grease, phenol, chromium, lead and herbicides. Performed well and water table elevation surveys.

Table 3-1
(contd.)

Site	Activity
Landfill Site 1	Installed three groundwater monitoring wells (W-7 through W-9) in the unconsolidated glacial drift formation. Sampled and analyzed for TDS, TOC, VOA, xylene, oil and grease, phenol, chromium, lead and herbicides. Performed well and water table elevation surveys.
Landfill Site 4	Installed four groundwater monitoring wells (W-16 through W-19) in the unconsolidated glacial drift formation. Sampled and analyzed for TDS, TOC, VOA, xylene, oil and grease, phenol, chromium and lead. Performed well and water table elevation surveys.
Fire Protection Training Area 1	Installed one groundwater monitoring well (W-14) in the unconsolidated glacial drift formation. Sampled and analyzed for TDS, TOC, VOA, xylene, oil and grease, phenol, chromium and lead. Performed well and water table elevation surveys. Collected one soil sample for EP characteristics.
Building 932 Sludge Disposal and Fuel Spill Areas	Installed one groundwater monitoring well (W-15) in the unconsolidated glacial drift and one surface water staff gauging station (SS-9) on Salt Fork Creek adjacent to the site. Sampled and analyzed for TOC, VOA, xylene, phenol and lead. Performed well, water table and surface water elevation surveys. Obtained four soil samples from the tank sludge disposal area and composited into one sample. Analyzed for EP toxicity.

TABLE 3-1
(contd.)

Site	Activity
Background Wells: Perimeter Rd. at Taxiway, 2010 Trailer Park and 809 Area	Installed three groundwater monitoring wells (W-20 through W-22) in the unconsolidated glacial drift formation for purposes of regional flow gradient control. Sampled and analyzed for TDS, TOC, VOA, xylene, oil and grease, phenol, chromium, lead and herbicides. Performed well and water table elevation surveys.

TABLE 3-2

Schedule of Field Investigation Accomplishments
Chanute AFB

Date	Activity
9 November 1984	Preconstruction visit to locate well sites and meet with Base officials.
8-21 January 1985	Drilling, construction and development of groundwater monitoring wells.
13-20 February 1985	First round of environmental sampling. Surface water staff gauge locations established and sampled. Ground and surface water level surveying.
19-26 March 1985	Second round of environmental sampling. Ground and surface water level surveying.
25 March 1985- 8 April 1985	Surveying location and elevation of groundwater monitoring wells and staff gauges.
28-29 April 1985	Resampling of selected surface water and groundwater monitoring well locations for VOA and TDS

and winds 10-30 knots), Alconox scrubbing was the most effective. The drill cuttings that were found to be contaminated, on the basis of HNu photoionization readings, were isolated, marked, and sampled for EP toxicity and EP ignitability analysis. All other cuttings were disposed of in the vicinity of LF-3 adjacent to FPTA-2.

At two sites there was evidence indicating that dumping, spilling, or leaking of chemical substances had occurred. To characterize the types of wastes, discrete soil samples from Building 932 sludge pit and the well cuttings from W-4 were retained for laboratory analysis.

The cuttings of well W-4 smelled of a strong fuel odor, especially those cuttings at 15 feet. These cuttings were placed in a 2 inch by 5 inch glass jar and retained to be laboratory analyzed.

The sludge sample taken at Building 932 sludge pit was sampled using a stainless steel spatula. Four scoops of sludge were taken from locations in the pit that were chosen to provide the most representative sample of the pit. Selection of scoop location was based on visual observation of potential hazardous materials (e.g. sludges, soil stains, etc.) supplemented by field instrumentation. The scoops were combined and thoroughly mixed in a stainless steel pan to make one representative sample. The spatula and pan were decontaminated using Alconox to scrub the equipment.

3.2.2.1 Monitoring Well Construction

The groundwater monitoring wells were established by advancing a 6 1/4-inch outside diameter hollow stem auger to the required depth (30 feet BLS). Then 20 feet of 2-inch diameter Diedrich[R] 0.010-inch continuous slot, stainless steel, flush-thread well screen and the appropriate length of 2-inch diameter schedule 40 PVC riser were assembled and inserted through the auger stem. No solvents or glues were used on any of the casing or screen couplings. The augers were then pulled up (not screwed out) to several feet above the screen as the sand filter pack (No. 2 medium sand) was poured into the annular space between the well pipe and the auger stem. The augers were then withdrawn from the well. Sand filter pack was then poured into the annular space between the well pipe and the borehole to at least 5 feet above the top of the well screen. Bentonite pellets were then placed on top of the filter pack to seal the screened interval from fluid migration through the annular space. The seal was completed by pouring Type 1 Huron[R], portland cement grout into the annular space up to ground level. Each well was completed with the installation of a 4-inch diameter protective steel casing which was set in the cement grout over the PVC riser pipe. Running sands and low strength silts were encountered in several of the wells. These materials would often collapse around the well screen before the filter pack could be installed. Several attempts were made to auger or wash these materials out of the borehole; however, this usually increased the instability of the borehole walls and resulted in the collapse of additional materials. The water samples obtained from the wells in which the boreholes collapsed were heavily laden with sediment. However, by the time of the second sampling round no measurable accumulations of sediment were detected in any of the monitor wells. It is not anticipated that any variations in water quality results can be attributable to these collapsed boreholes.

All of the groundwater monitoring wells were developed by bailing until a sand-free fluid was produced. Due to the predominantly silt/clay nature of the glacial drift formation all wells generally produce a cloudy fluid toward the bottom of the wells. The water levels in monitor wells W-3 through W-7, W-11, W-12, W-17, and W-21 rose above the top of the respective screened sections shortly after well installation and development. The only contaminant fraction that may be affected by this constructoin is the lighter-than-water fraction generally associated with petroleum hydrocarbon compounds. These compounds may not be able to enter those monitor wells with the screen below the water tables.

A schematic of the monitoring well construction is presented on Figure 3-1. Individual well completion details are presented in Appendix D and in Table 3-3.

3.2.2.2 Fire Protection Training Area 2 (Site FPTA-2)

Six monitoring wells and three surface water staff gauge locations were established at this site. The monitoring wells were screened in the upper 20 feet of the unconfined Wisconsinan aquifer. Monitoring wells W-1 and W-2 were established along the north perimeter of the Fire Protection Training Area 2 adjacent to the east-west trending fence enclosing the compound. Monitoring well W-3 was established at the west perimeter at FPTA-2 just outside the fenced-in compound. Monitoring wells W-4 and W-5 were established along the south perimeter adjacent to the east-west trending fence enclosing the compound. Monitoring well W-6 was established at the east perimeter, just outside the fenced-in compound but within FPTA-2. The locations of these wells are shown in Figure 3-2.

Initially, wells 5 and 6 were to be constructed within the compound. However, after subsequent discussions with Base civil engineering personnel, it was determined that no drilling should be conducted within the burn area because of

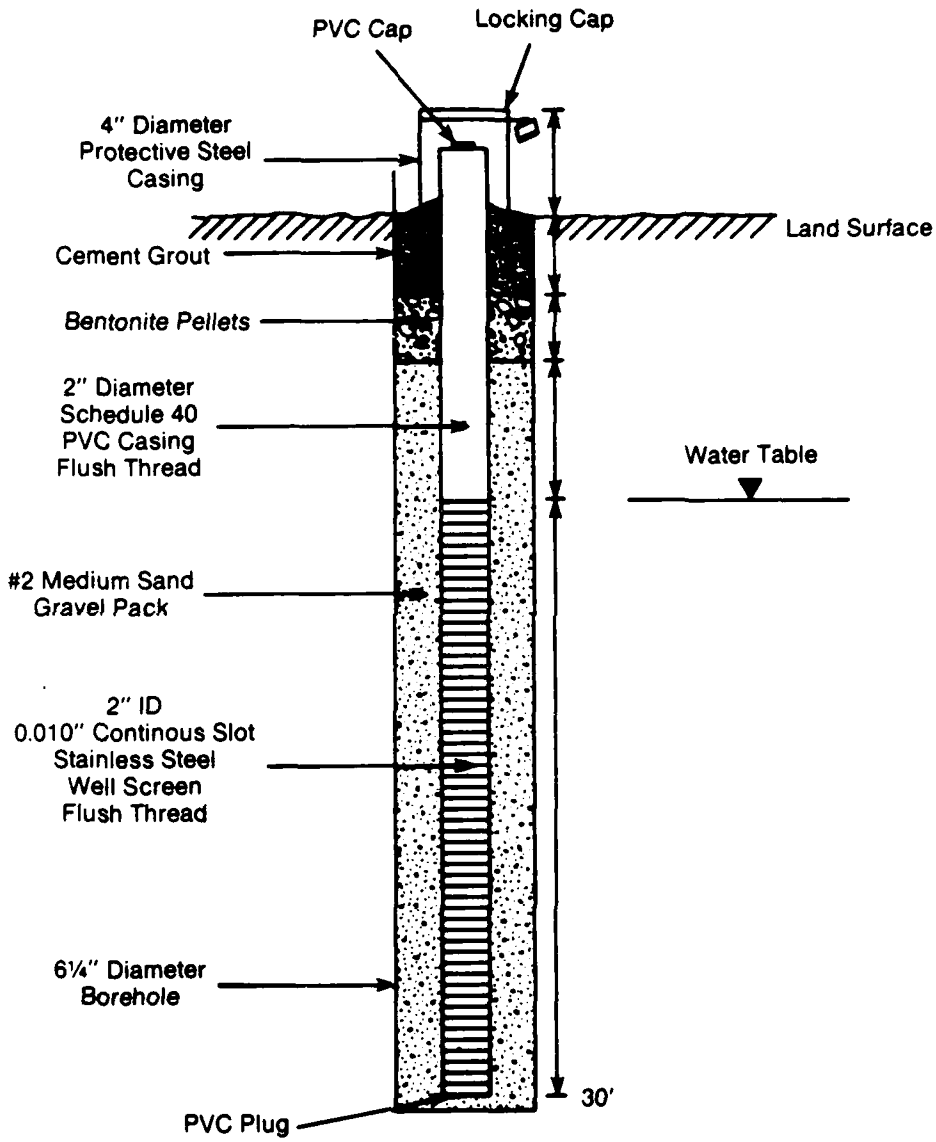


FIGURE 3-1 SCHEMATIC OF MONITORING WELL CONSTRUCTION

TABLE 3.3
SUMMARY OF MONITORING WELL CONSTRUCTION DETAILS
CHANUTE AFB

Site	Monitor Well Number	Land Surface Elevation (feet msl)	Elev of Top of Riser Casing (feet msl)	Screen/Open Hole Interval Depth (feet bls)	Sand Pack Interval Depth (feet bls)	Description of Prominent Lithology
FPTA 2	W-1	730.20	732.84	9.8 - 32.0	5.5 - 22.0	Light brown to medium gray clayey to sandy silt. Massive, trace orange mottling, scattered chert pebbles. Zones of brown, fine to medium grain sand, 13.0 to 32.0 feet bls.
	W-2	728.20	729.97	6.65 - 29.0	6.0 - 31.0	Olive brown to medium gray clayey to sandy silt. Trace orange mottles. Faint laminations, 13.0 to 13.95 feet bls.
	W-3	724.40	726.19	8.15 - 30.50	5.0 - 30.50	Olive brown to medium gray clayey to sandy silt. Massive,trace orange mottles,scattered chert pebbles. Zone of massive, fine sand 23.0 - 23.25 feet bls.
	W-4	726.30	727.80	8.5 - 30.85	5.0 - 30.85	Olive brown to medium gray clayey to sandy silt. Massive, trace orange mottling. Zone of massive,gravelly, medium grain sand 28.0 to 28.35 feet bls. Strong fuel odor in ground-water and visual presence in spoils.
	W-5	727.90	730.04	7.10 - 29.40	5.0 - 29.40	Olive brown to medium gray clayey to sandy silt. Massive, trace orange mottling and laminations,scattered chert pebbles. Clayey, massive fine grain sand 18.3 to 19.5 feet bls.
	W-6	729.20	731.44	8.0 - 30.30	5.0 - 31.0	Olive brown to medium gray clayey to sandy silt with zones of fine to coarse grain sand at depth. Massive, trace orange mottling, scattered pebbles.
LF-1	W-7	727.80	730.10	8.20 - 31.50	7.50 - 31.50	Olive brown to medium gray clayey to sandy silt. Massive, scattered orange to green mottles and scattered pebbles. Black oily leachate noted at 10 feet bls.
	W-8	730.40	732.78	6.70 - 30.0	5.50 - 35.0	Olive brown to gray clayey to sandy silt. Massive, trace orange mottling and occasional scattered gravel. Coarse gravelly sand from

TABLE 3.3
SUMMARY OF MONITORING WELL CONSTRUCTION DETAILS
CHANUTE AFB
Cont'd

Site	Monitor Well Number	Land Surface Elevation (feet msl)	Elev of Top of Riser Casing (feet msl)	Screen/Open Hole Interval Depth (feet bls)	Sand Pack Interval Depth (feet bls)	Description of Prominent Lithology
						28.0 to 29.5 feet bls.
	W-9	731.50	733.80	8.0 - 31.30	6.0 - 31.30	Light yellowish brown to gray clayey to sandy silt. Scattered zones of coarse gravelly sand throughout lower half of hole. Massive, trace orange mottling and pebbles. Oil film noted in drill returns at 23.0 feet bls.
LP-2	W-10	736.10	738.87	9.20 - 31.50	5.0 - 31.50	Black to olive to medium gray clayey to slightly sandy silt. Massive, occasional orange mottling and scattered pebbles. Strong, rapidly dissipating septic odor noted at 10.0 feet bls.
LP-3	W-11	731.70	733.03	9.0 - 32.30	4.0 - 32.30	Orange brown to medium gray clayey to sandy silt. Zones of clayey to gravelly sand 18.0 to 30.0 feet bls. Massive with occasional green to orange mottling.
	W-12	729.90	731.75	9.50 - 31.80	6.0 - 9.0	Orange brown to medium gray clayey to sandy silt. Zones of fine to medium grain sand 13.0 to 13.50 feet bls and 29.0 to 29.5 feet bls. Massive with scattered pebbles throughout.
	W-13	729.70	731.66	10.25 - 33.30	4.50 - 33.30	Dominantly light brown to medium gray clayey to sandy silt. Zones of fine to gravelly sand in lower half of hole. Massive with scattered pebbles throughout.
FPTA-1	W-14	726.0	728.63	8.50 - 32.0	5.70 - 32.0	Medium gray clayey silt. Massive, trace orange discoloration and scattered chert pebbles.
932	W-15	720.50	722.91	8.20 - 30.50	4.50 - 31.50	Dominantly gray/green to medium gray clayey to sandy silt with zones of clayey to gravelly sand. Massive, scattered green and orange mottles and pebbles.
LP-4	W-16	732.80	734.19	8.70 - 31.0	5.50 - 31.0	Olive green to medium gray clayey

TABLE 3.3
SUMMARY OF MONITORING WELL CONSTRUCTION DETAILS
CHANUTE AFB
Cont'd

Site	Monitor Well Number	Land Surface Elevation (feet msl)	Elev of Top of Riser Casing (feet msl)	Screen/Open Hole Interval Depth (feet bls)	Sand Pack Interval Depth (feet bls)	Description of Prominent Lithology
						to sandy silt. Massive, orange to gray mottling and scattered pebbles throughout. Medium gray sandy gravel zone encountered at 24.0 feet bls.
	W-17	734.20	736.37	9.70 - 32.0	5.0 - 31.0	Orange brown to medium gray clayey to sandy silt. Massive, trace orange mottling and scattered pebbles.
	W-18	726.40	728.60	8.70 - 31.0	4.50 - 31.0	Dominantly olive brown to medium gray clayey to sandy silt. Zones of clayey to silty medium to fine grain sand at 9.0 to 9.50 feet bls and at 28.0 to 29.50 feet bls. Massive, trace orange mottling and scattered pebbles.
	W-19	734.20	736.45	8.0 - 30.30	3.0 - 30.30	Light brown to medium gray clayey to sandy silt. Massive, trace orange mottling and scattered pebbles.
X-1	W-20	726.10	726.93	6.0 - 29.30	5.50 - 29.-0	Light olive brown to medium gray clayey to sandy silt. Zone of clayey gravelly sand at 15 feet bls. Massive, minor orange mottling and scattered pebbles.
	W-21	727.0	728.86	7.0 - 30.30	4.50 - 30.30	Olive brown to gray brown clayey to sandy silt. Massive, occasional orange discoloration and scattered limestone and chert pebbles. Encountered a zone of gravel from 27.25 feet bls to 28.0 feet bls.
	W-22	733.30	735.38	9.70 - 33.0	5.0 - 35.0	Dark gray clayey to sandy silt. Very coarse sand and gravel at 15.0 feet bls. Massive, occasional orange mottles and scattered gravel.

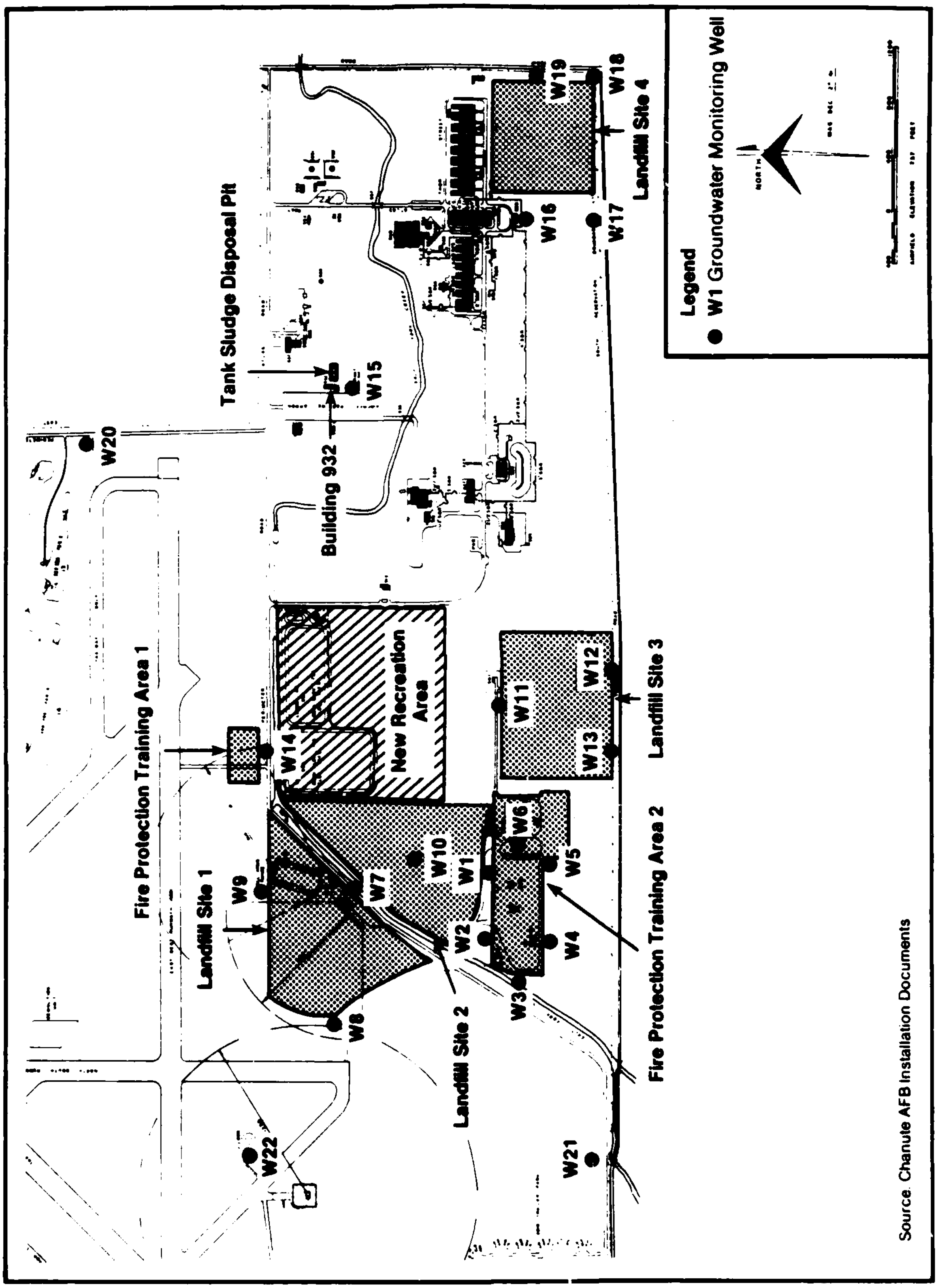


FIGURE 3-2 LOCATIONS OF GROUNDWATER MONITORING WELLS

buried fuel lines and utilities, the locations of which were not adequately depicted on Base as-built drawings. The final locations of wells 5 and 6 are depicted in Figure 3-2.

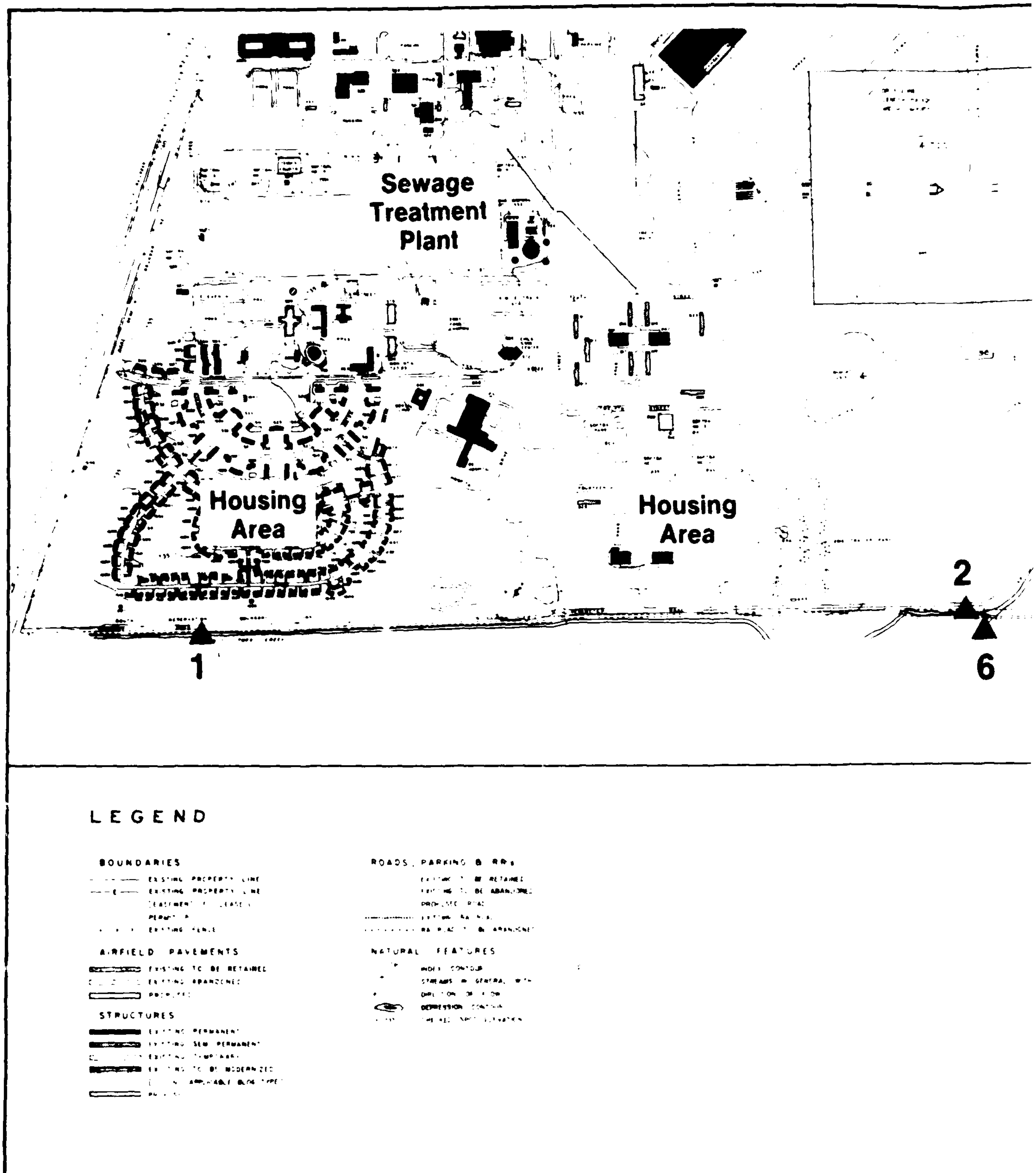
Three surface water staff gauge locations were established in and around FPTA-2. Surface water staff gauge locations SS-1 and SS-2 are located within the fenced-in compound along two east-west trending lagoons at the north end of the compounds. These lagoons serve as collection ponds for the oil/water separator unit located in the northwest corner of the compound. Surface water staff gauge location SS-3 is located west of FPTA-2 at Salt Fork Creek. A culvert protruding from the east bank of the creek was chosen as the staff gauge. The surface-water staff gauge locations are shown in Figure 3-3.

The monitoring wells ranged in depth from 27.0 feet to 32.0 feet BLS. Groundwater was encountered at depths ranging from 4 feet BLS at well W-4 to 12 feet BLS at well W-2. Silty clay to clayey silt predominates in monitoring wells W-1 through W-6. Lenses of medium grain sand were encountered in wells W-1, W-4, W-5 and W-6, generally from 20 to 25 feet BLS. Fine sands, where encountered, were very unstable and portions of the annular space in wells W-1 and W-6 collapsed around the screen (see Figure 3-4).

An HNu photoionization meter with a 10.2-electron volt ionization lamp was used to monitor air quality and vapors emanating from the drill cuttings during drilling and well construction. Ambient air concentrations did not exceed 2 ppm in the vicinity of FPTA-2. This background level was exceeded at wells W-4 and W-5 during drilling. The water and drill cuttings from these two wells displayed HNu concentrations ranging from 2 ppm to 72 ppm. A strong fuel odor was noted at well W-4 during drilling and fuel was visually present in drill cuttings from land/surface to a depth of 5 feet BLS. Cuttings from well W-4 were isolated from the other cuttings and a sample was submitted for EP characterization.

3.2.2.3 Landfill Site 2 (LF-2)

One groundwater monitoring well (W-10) and five surface water staff gauge locations (SS-4, SS-5, SS-6, SS-7 and SS-8) were established at this site. Gauge stations SS-7 and SS-8 were established for flow gradient purposes only and not sampled for water quality. Monitoring well W-10 was drilled to a depth of 31.5 feet BLS. The location of monitoring well W-10 was chosen to prevent destruction of the well by equipment involved in construction of the new recreation area and is shown in Figure 3-2. The surface water staff gauge locations were established along Salt Fork



Source: Modified Chanute AFB Installation Documents

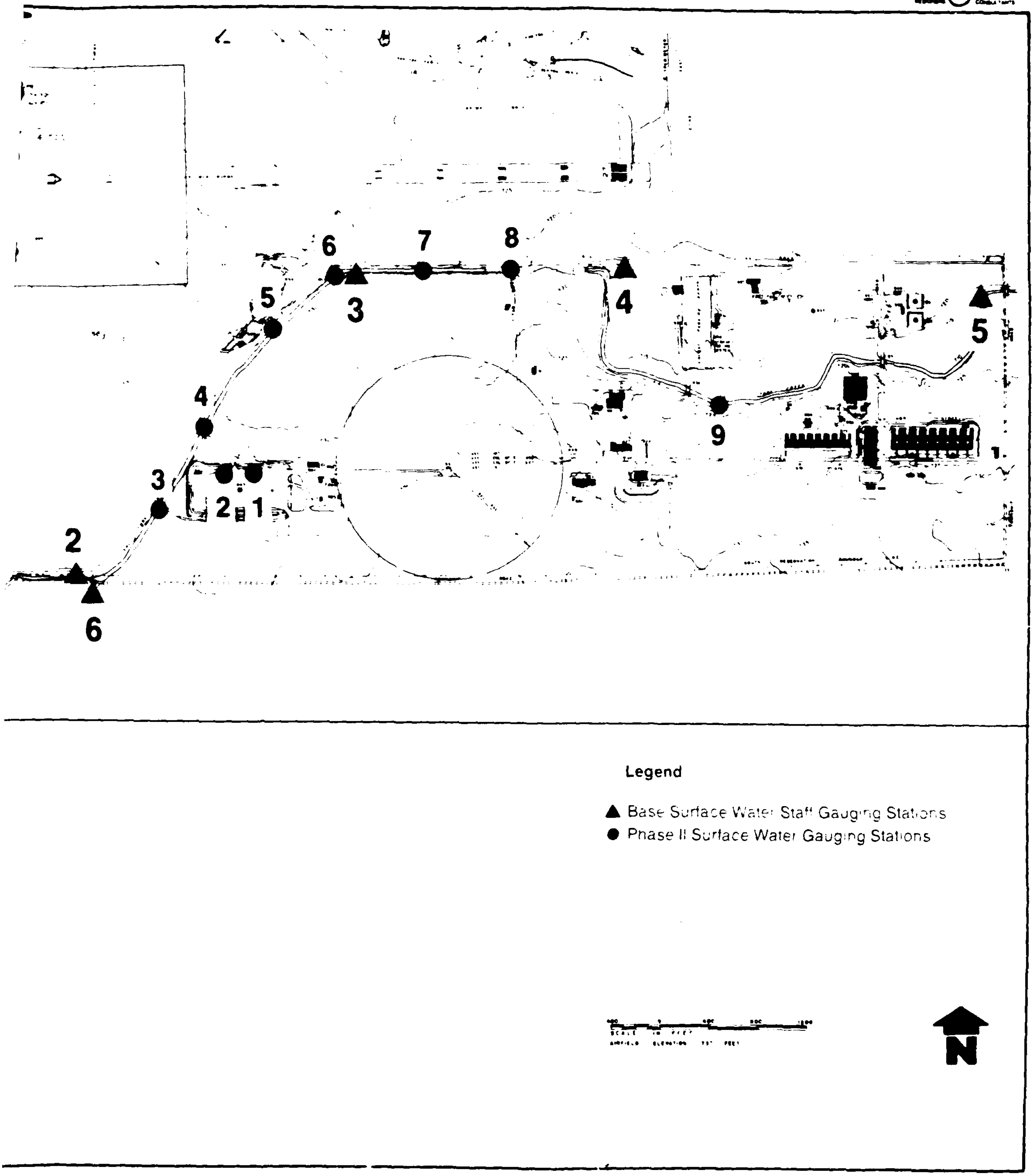


FIGURE 3-3 SURFACE WATER STAFF GAUGING STATIONS

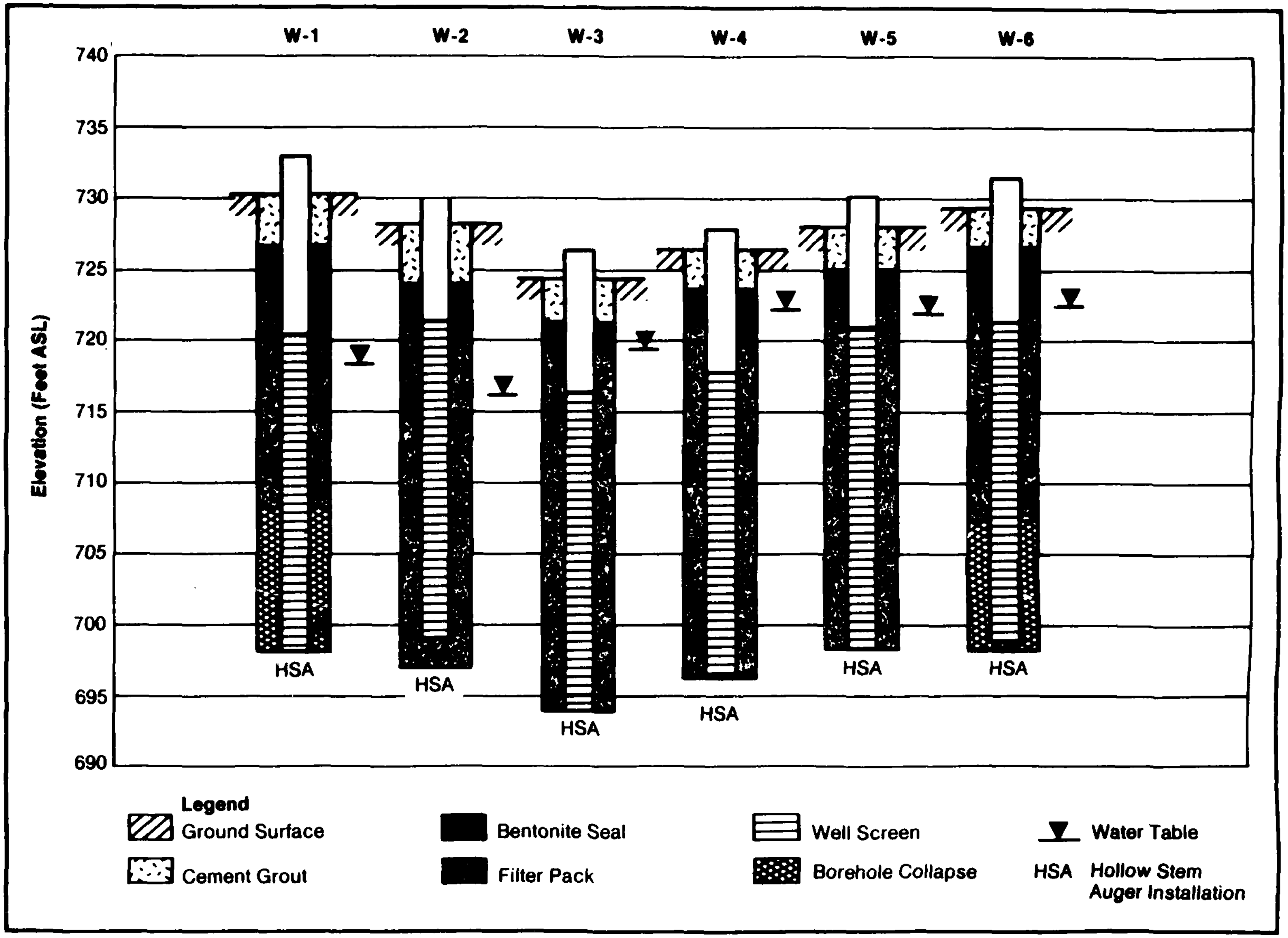


FIGURE 3-4 WELL CONSTRUCTION SUMMARY, FIRE PROTECTION TRAINING AREA 2

Creek, which forms the western and northern boundaries of Landfill Site 2 (see Figure 3.3).

During the drilling of monitoring well W-10 a strong septic odor was encountered at a depth of 6.5 feet BLS. Drilling continued to a depth of 10 feet BLS where an impenetrable object was encountered. This borehole was abandoned and sealed with cement grout. The drill rig was moved approximately 10 feet to the north, and a boring was completed to 31.5 feet without encountering resistance. No septic odor was detected in this boring. Silty clay predominates in this boring. An unstable lens of fine sand was encountered at 21 feet BLS. This material eventually collapsed around the well screen as the augers were withdrawn (see Figure 3.5). Groundwater was encountered at a depth of 9 feet BLS.

Photoionization meter readings of ambient air and drill cuttings did not exceed 2 parts per million (ppm). The septic odor emanating from the borehole of the first drilling attempt was the only field indicator of potential contamination at this site.

An attempt was made to locate leachate seeps emanating from this landfill site along its banks with Salt Fork Creek. However, no seeps were identified.

3.2.2.4 Landfill Site 3 (LF-3)

Three groundwater monitoring wells were established along the northern (W-11) and southern (W-12, W-13) perimeters of Landfill Site 3. The locations of these wells are shown on Figure 3-2. The wells were screened into the upper 20 feet of the unconsolidated Wisconsinan drift formation. The wells ranged in depth from 31.85 to 33.5 feet BLS. Groundwater was encountered from 4.5 to 5 feet BLS at wells W-11 and W-12 and 18 feet at well W-13. Clayey silt predominates in the monitoring well borings. Lenses of gravel and fine to medium sand are present, generally between 13 and 30 feet BLS. Running sands were encountered in wells W-12 and W-13 causing the annular space to collapse around the screen.

A graphic summary of the construction of these wells is presented in Figure 3-5. No surface water gauge locations were established at this landfill site.

There were no anomalous photoionization meter readings or other field indicators of potential contamination at these drilling sites.

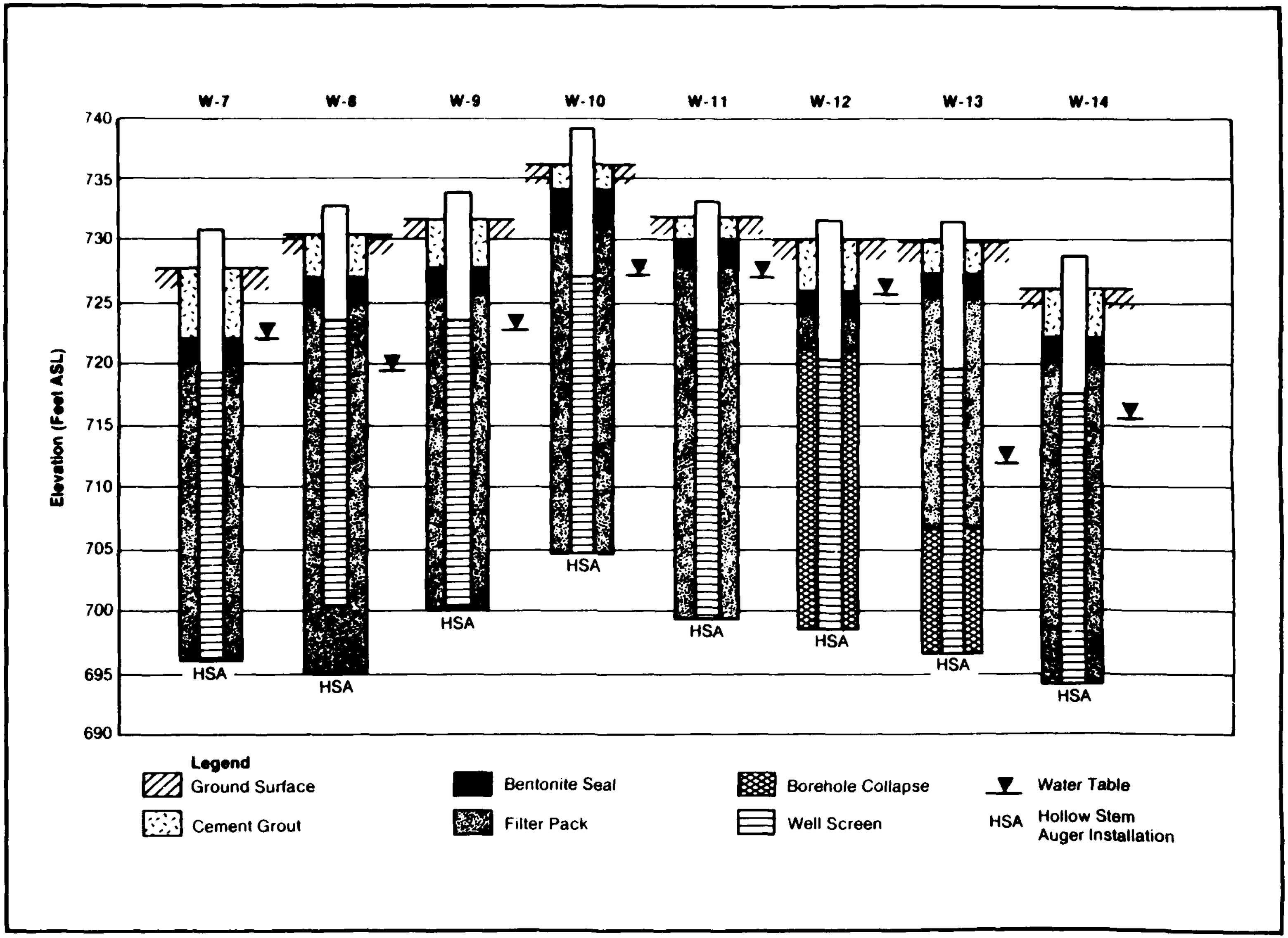


FIGURE 3-5 WELL CONSTRUCTION SUMMARY, LANDFILL 1, LANDFILL 2, LANDFILL 3, AND FIRE PROTECTION TRAINING AREA 2

3.2.2.5 Landfill Site 1 (LF-1)

Three groundwater monitoring wells were established at this site. The monitoring wells were screened into the upper 20 feet of the unconsolidated Wisconsinan drift formation. Monitoring well W-9 was installed at the northern perimeter, monitoring well W-8 at the western perimeter, and monitoring well W-7 along Perimeter Road, southeast of the site. The locations of these wells are shown in Figure 3-2. The wells were drilled to depths ranging from 31.5 BLS at wells W-7 and W-9 to 35 feet BLS at well W-8. Silty clay and clayey silt predominate in the boreholes with a lens of fine gravel 28 to 30 feet BLS in well W-8 and coarse sand and gravel lenses interspersed with clayey silt 23 to 30 feet BLS in well W-9. Groundwater was encountered at 6 feet BLS in well W-7, 11 feet BLS in well W-8 and at 9 feet BLS in well W-9. A graphic summary of these wells is presented in Figure 3-5.

During the drilling of well W-7, a black, oily liquid was noticed on the saturated auger cuttings. This occurred at approximately 10 feet BLS. A weak septic odor was noted from the borehole, and a slight oil film was seen floating on the surface of Salt Fork Creek. The oil film appeared to emanate from the west bank of the creek directly across from well W-7. However, during succeeding visits to this site no seepage was noted along the west bank of Salt Fork Creek under wet or dry conditions. Readings were taken of the W-7 borehole and the black liquid with the photoionization meter. No value higher than the ambient reading of 2 parts per million (ppm) was noted.

Other than the black substance noted at well W-7 there were no field indications of potential contamination in the Landfill Site 1 area.

3.2.2.6 Landfill Site 4 (LF-4)

Four groundwater monitoring wells were installed at this landfill and screened into the upper 20 feet of the unconsolidated Wisconsinan drift formation at depths ranging from 30.5 to 32 feet BLS. The locations of monitoring wells W-16, W-17, W-18 and W-19 are shown in Figure 3-2. The well construction schematic is shown in Figure 3-6.

Clayey silt predominated in these boreholes. Lenses of medium grain silty sands, however, were encountered in well W-18 at 10 feet BLS and again at 28 to 30 feet BLS. Groundwater occurred at 9 feet BLS in wells W-18 and W-19, 5.5 feet BLS at well W-17 and 11.5 feet BLS at well W-16.

No signs of subsurface contamination were observed in any of these wells. However, photoionization meter readings of the

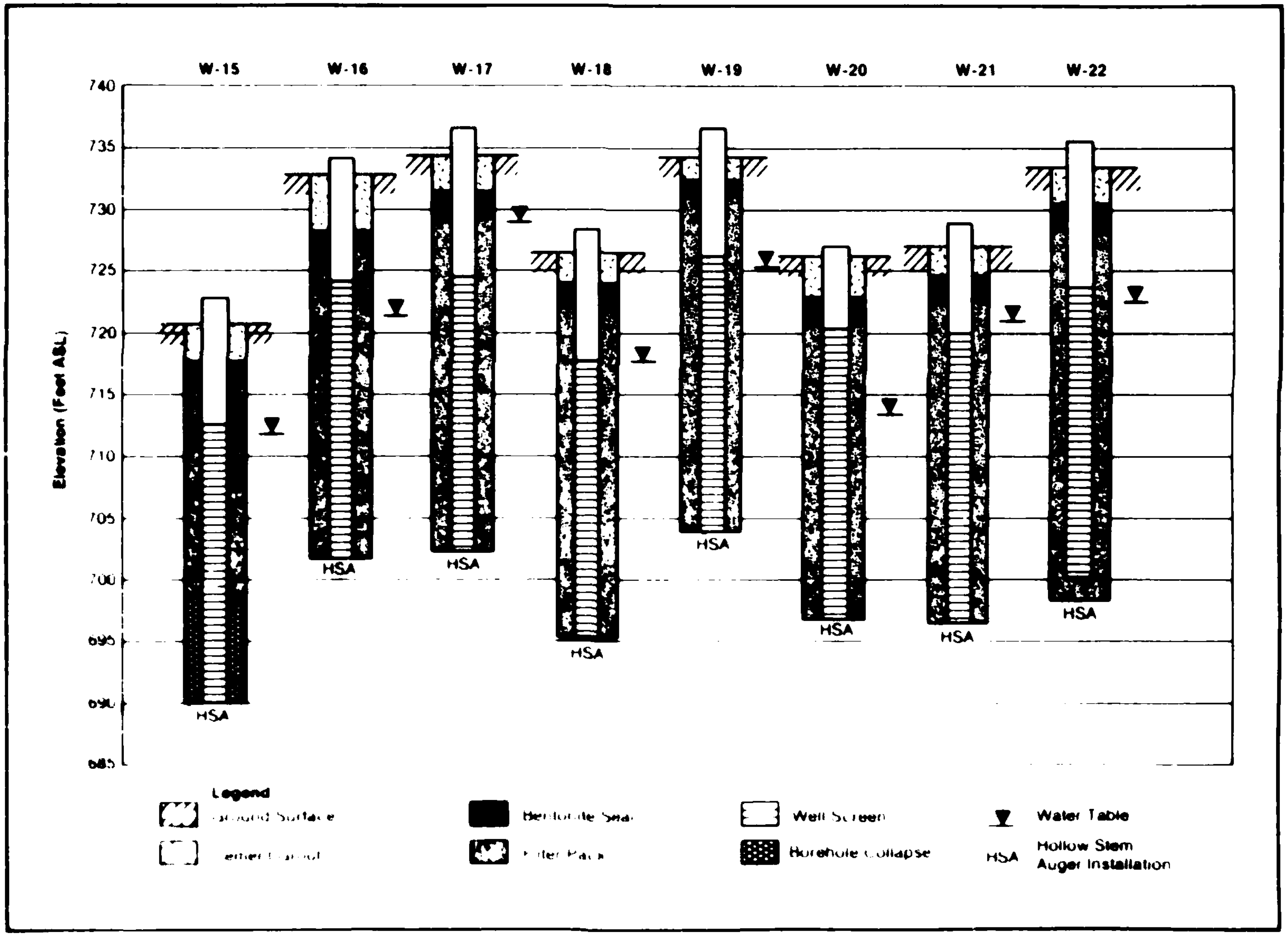


FIGURE 3-6 WELL CONSTRUCTION SUMMARY, 932 AREA, LANDFILL 4, X-1 BACKGROUND WELLS

cuttings from well W-18 displayed values of 30 parts per million (ppm) at 10 feet and 20 feet BLS relative to an ambient value of 2 ppm.

3.2.2.7 Fire Protection Training Area 1 (FPTA-1)

One groundwater monitoring well was installed at the southern perimeter of Fire Protection Training Area 1 and screened into the upper 20 feet of the unconsolidated Wisconsinan aquifer. The location of this site is shown in Figure 3-2. Monitoring well W-14 was drilled to a depth of 32 feet BLS and groundwater encountered at 10.5 feet BLS.

Silty clay and clayey silt predominated in the borehole. No sands were encountered, and consequently the well recharged relatively slowly. The well construction schematic for W-14 is presented in Figure 3-5.

There were no visible or measurable signs of subsurface contamination at this drilling location.

3.2.2.8 Building 932, Sludge Disposal and Fuel Spill Areas

A groundwater monitoring well and a surface water staff gauge were established in the 932 Area and one soil sample was taken from the tank sludge disposal area. The monitoring well was installed due south of Building 932, east of the aircraft parking apron. Monitoring well W-15 was drilled to a depth of 30.5 feet BLS and screened into the upper 20 feet of the unconsolidated Wisconsinan aquifer. The location of this well is shown in 3-2. Silty clay and clayey silt predominated in the borehole. Lenses of gravelly sands and clayey gravels were encountered at 13.7 to 14.25 feet BLS and 29.0 to 29.25 feet BLS. Fine sands were encountered at 18 feet BLS and as the augers were withdrawn, the borehole collapsed around the well screen below 22 feet BLS (see Figure 3.6). Groundwater was encountered at 9 feet BLS. No visible or measurable signs of subsurface contamination were detected at the well W-15 location.

Surface water staff gauge location SS-9 was established immediately south of the 932 Area at the confluence of Salt Fork Creek and an unnamed tributary which drains the 932 area. A fence post serves as the permanent marker for this location. This location is shown in Figure 3-3. During the second round of surface water sampling, a slight oil sheen was noted on the surface of the tributary's water. A trace amount of oil was also noted bubbling up from the sediment at the confluence. No other signs of surface water contamination were detected.

Four hand-augered soil samples were obtained from the tank sludge disposal area immediately east of Building 932 (see Figure 3-2). The disposal area is situated on a hillock overlooking the unnamed tributary to Salt Fork Creek, which flows between Building 932 and the tank sludge disposal area. The four soil samples were collected from a depth of 2 feet BLS and composited into one sample to be subjected to EP toxicity analysis for lead. No photoionization meter reading was taken at this site. However, an oil sheen was noted on the surface of the tributary flowing past this site. This may be an indication that tank sludge disposed of in the pit may be leaching through the soil and exiting at the tributary.

3.2.2.9 Regional Flow Gradient Control (Site X-1)

The groundwater monitoring wells (W-20, W-21 and W-22) were established at the locations shown in Figure 3-2. These wells were installed into the upper 20 feet of the unconsolidated Wisconsinan aquifer. The wells were drilled to depths of 29.5 to 35.0 feet BLS. Groundwater was encountered at depths ranging from 8 to 13 feet BLS. Clayey silt with minor sand lenses of fine to medium grain sand predominated in the boreholes. The sands, however, were competent and no collapse occurred during well construction. At well W-21, the formation became very resistant to sampling with the split spoon; 50 blows were expended driving the sampler from 29.5 to 30 feet where a hard, dry gravelly silt was encountered. A graphic summary of the construction of these wells is depicted in Figure 3.6.

There were no measurable or visible signs of subsurface contamination at any of these "background" well locations.

3.2.3 Water Quality Sampling

The purpose of the water quality sampling program was to identify, insofar as possible at the level of a confirmation survey, the location, concentration and areal extent of any contamination present in the hydrogeologic environment. To achieve these goals efficiently, specific field procedures were followed for purging the wells, collecting the samples, and ensuring the field quality control. The sampling and quality assurance plans used to accomplish these goals are contained in Appendix E. Sample chain-of-custody documentation is contained in Appendix F. Standard laboratory analysis protocols used in the analysis of these samples are contained in Appendix G.

Two identical rounds of groundwater and surface water samples were conducted at Chanute AFB. One soil sample was collected using a 3-inch diameter hand auger boring to a depth of 2 feet BLS during the first round of environmental sampling between 13 and 21 February 1985. The second round of samples were obtained between 13 and 20 February 1985. Both rounds of sampling were technically identical. Samples from each well and surface water location were packaged and preserved according to the analyses required at each location (see Table 1-3). A summary of field-tested water quality parameters is presented in Table 3-4.

3.2.4 Water Level Measurements

Three complete rounds of water level elevation measurements were conducted. The first and second rounds were performed at the time of the first water quality sampling round during 13 to 20 February 1985. The third round was performed at the time of the second round of water quality sampling during 19 to 26 March 1985. Several initial water level measurements were taken 8 to 21 January 1985 during the well construction and installation phase of this project. All water level readings were referenced to the top of the well casing using a Soil Test Model DR 706A water level probe. The depths to groundwater and corresponding water level elevations are presented in Table 3-3 and represent the static water level for the Wedron aquifer. The water supply wells at Chanute AFB tap the Kansan aquifer. Available information indicates that the static water level has decreased from 58 to 60 feet BLS in 1939 to 88 to 95 feet BLS in 1972.

3.2.5 Location and Elevation Survey

A survey was conducted 25 March to 8 April 1985 to determine the elevations of the tops of the well casings, protective casings, staff gauges and elevations of the surrounding ground surface.

The tops of the well steel casings and the PVC casings are surveyed to an accuracy of ± 0.005 foot relative to the United States Geological Survey (USGS) datum. Equivalent accuracy in the ground surface elevations was not possible. Drill cuttings that created mounds around the well casing made the determination of the actual ground surfaces difficult. They were therefore surveyed to a vertical accuracy of ± 0.1 foot. The elevations of the ground surface, tops of the well casings are presented in the well completion summary in Appendix D, in Table 3-5 and Table 3-6.

Table 3-4
Summary of Field Tested Water Quality Parameters for
Groundwater and Surfacewater
Chanute AFB

Well	Location	Temp (C) Round 1	Temp (C) Round 2	Specific Conductance umhos/cm Round 1	Specific Conductance umhos/cm Round 2	pH (units) Round 1	pH (units) Round 2	pH (units) Resample
W-1	Fire Protection Training Area 2	11	9	770	1090	DI	5.85	6.85
W-2	Fire Protection Training Area 2	11	8	610	675	DI	7.15	7.00
W-3	Fire Protection Training Area 2	9	7	600	825	DI	6.75	6.70
W-4	Fire Protection Training Area 2	8	8	330	700	DI	6.95	7.20
W-5	Fire Protection Training Area 2	9	7	380	725	DI	6.90	7.10
W-6	Fire Protection Training Area 2	11	7	470	400	DI	6.95	7.05
W-7	Landfill Site 1	11	9	1250	1450	DI	6.15	6.60
W-8	Landfill Site 1	9	8	375	460	DI	7.05	6.55
W-9	Landfill Site 1	8	7	700	975	DI	6.70	7.50
W-10	Landfill Site 2	11	12	1200	1700	DI	6.45	6.85
W-11	Landfill Site 3	11	7	1075	1375	DI	6.80	7.05
W-12	Landfill Site 3	10	11	320	400	DI	9.65	7.65
W-13	Landfill Site 3	11	8	1200	1790	DI	6.05	6.90
W-14	Fire Protection Training Area 1	11	10	590	1250	DI	6.50	7.05
W-15	Building 932	9	8	800	675	DI	6.35	7.45
W-16	Landfill Site 4	12	11	1100	2010	DI	6.50	6.85
W-17	Landfill Site 4	9	8	1100	991	DI	7.05	7.50
W-18	Landfill Site 4	9	10	1450	1100	DI	6.65	7.15
W-19	Landfill Site 4	10	11	1950	1580	DI	6.55	6.85
W-20	Perimeter Road at Taxiway X-1	9	11	430	425	DI	6.65	6.30
W-21	2010 Trailer Park X-1	10	8	720	900	DI	6.75	6.85
W-22	809 Area X-1	7	9.5	420	650	DI	6.65	6.55

Surfacewater Staff Gauging Station	Location	Temp (C) Round 1	Temp (C) Round 2	Specific Conductance Round 1	Specific Conductance Round 2	pH Round 1	pH Round 2	pH Resample
SS-1	Fire Protection Training Area 2	2	11	340	840	DI	6.80	7.80
SS-2	Fire Protection Training Area 2	2	10	110	775	DI	7.10	7.35
SS-3	Fire Protection Training Area 2	2	9	430	470	DI	7.20	7.70
SS-4	Landfill Site 2	5	9	375	500	DI	7.45	8.15
SS-5	Landfill Site 2	3	9	475	480	DI	7.40	8.15
SS-6	Landfill Site 2	6	9	620	620	DI	6.35	7.85
SS-9	Building 932	8	10	600	600	DI	7.45	7.70

Round 1 - Dates of sampling: 2/13/85 to 2/20/85
Round 2 - Dates of Sampling: 3/19/85 to 3/26/85
Resample - Dates of sampling: 4/28/85 to 4/29/85
DI - Data invalid due to meter calibration errors

Table 3-5
Summary of Water Level Elevation Survey
Chanute AFB

Well No.	Measuring Point	Elev at Measuring Point (ft)	1/16/85 WLE	1/17/85 WLE	1/18/85 WLE	2/13/85 WLE	2/14/85 WLE	2/15/85 WLE	2/16/85 WLE	2/18/85 WLE	2/19/85 WLE
W-1	2" PVC	732.84		725.24	725.19					725.09	
W-2	2" PVC	729.97		723.66	723.62					722.44	
W-3	2" PVC	726.19				719.87		719.87		719.97	
W-4	2" PVC	727.80				723.51	723.55			723.67	
W-5	2" PVC	730.04						724.3[illegible]	724.39	724.53	
W-6	2" PVC	731.44					724.18	724.[illegible]		724.28	
W-7	2" PVC	730.10	722.70	722.75	722.76	722.61					
W-8	2" PVC	732.78		727.97	728.00	726.95					
W-9	2" PVC	733.80	727.15	727.11	727.15					726.49	
W-10	2" PVC	738.87		724.47	725.14				724.60	723.65	
W-11	2" PVC	733.03	724.93	726.85	726.93	725.92					
W-12	2" PVC	731.75	728.02	727.24	727.18						726.51
W-13	2" PVC	731.66	726.59	726.63	726.73						725.74
W-14	2" PVC	728.63	718.76						716.89	716.52	
W-15	2" PVC	722.91					716.55				
W-16	2" PVC	734.19					726.96		727.07		726.97
W-17	2" PVC	736.97				730.57	730.55				
W-18	2" PVC	728.60				721.88	721.80				
W-19	2" PVC	736.45				729.30	729.31				
W-20	2" PVC	726.93	716.55	716.47			716.27				
W-21	2" PVC	728.86	722.93	723.02			722.48				
W-22	2" PVC	735.38	727.14	727.13			730.35				
Staff No.											
SS-1	Post	727.24						723.75			
SS-2	Post	727.86						724.88			
SS-3	Culvert	721.59						716.39			
SS-4	Culvert	721.98									
SS-5	Post	718.58							712.93		
SS-6	Wall	722.72							715.57		
SS-7	Post	717.19							713.89		
SS-8	Tunnel	720.87							712.67		
SS-9	Post	712.96						710.46			

WLE - Water Level Elevation

Data Specific Water Elevation (feet MSL)

Table 3-5
Cont'd

Summary of Water Level Elevation Survey
Chanute AFB

Well No.	Measuring Point	Elev at Measuring Point (ft)	2/20/85 WLE	3/19/85 WLE	3/20/85 WLE	3/21/85 WLE	3/22/85 WLE	3/23/85 WLE	3/24/85 WLE	3/25/85 WLE	3/26/85 WLE
W-1	2" PVC	732.84								725.29	
W-2	2" PVC	729.97							724.01		
W-3	2" PVC	726.19					721.05				
W-4	2" PVC	727.80					724.92				
W-5	2" PVC	730.04					725.00				
W-6	2" PVC	731.44							725.25		
W-7	2" PVC	730.10								724.52	
W-8	2" PVC	732.78				728.71					
W-9	2" PVC	733.88				728.99					
W-10	2" PVC	738.87			726.03						
W-11	2" PVC	733.03				727.60					
W-12	4" PVC	731.75			727.13						
W-13	2" PVC	731.66			727.74						
W-14	2" PVC	728.63									721.81
W-15	2" PVC	722.91	716.83				717.46				
W-16	2" PVC	734.19				727.90					
W-17	2" PVC	736.97	731.09	732.82							
W-18	2" PVC	728.60	722.01		722.66						
W-19	2" PVC	736.45	729.33		731.79						
W-20	2" PVC	726.93									716.53
W-21	2" PVC	728.86									722.28
W-22	2" PVC	735.38									726.58
Staff No.											
SS-1	Post	727.24					725.55				724.29
SS-2	Post	727.86					725.51				724.69
SS-3	Culvert	721.59						715.92			715.82
SS-4	Culvert	721.98						715.81			715.73
SS-5	Post	718.58						715.77			715.65
SS-6	Wall	722.72						716.21			715.65
SS-7	Post	717.19						714.06			713.94
SS-8	Tunnel	720.87						713.00			712.97
SS-9	Post	712.96						710.80			710.61

WLE = Water Level Elevation

Data Specific Water Elevation (feet MSL)

WESTON

TABLE 3-8 SUMMARY OF LOCATIONS AND ELEVATIONS OF MONITORING WELLS

WELL NUMBERS	HORIZONTAL CONTROL[A]		VERTICAL CONTROL		
	NORTH COORDINATE	EAST COORDINATE	GROUND ELEVATION	TOP OF PVC CASING	TOP OF STEEL CASING
W-1	1,317,945.80	554,357.82	730.2	732.835	732.950
W-2	1,317,960.79	553,849.40	728.2	729.965	730.045
W-3	1,317,749.47	553,537.01	724.4	726.185	726.365
W-4	1,317,461.79	553,872.73	726.3	727.795	728.000
W-5	1,317,476.99	554,334.17	727.9	730.035	730.160
W-6	1,317,742.71	554,474.65	729.2	731.435	731.565
W-7	1,318,976.65	554,124.93	727.8	730.095	730.220
W-8	1,319,159.35	553,473.28	730.4	732.780	732.815
W-9	1,319,628.96	553,884.83	731.5	733.800	734.005
W-10	1,318,774.40	554,746.48	736.1	738.870	739.015
W-11	1,317,926.15	555,443.17	731.7	733.030	733.105
W-12	1,317,028.15	555,822.11	729.9	731.750	731.890
W-13	1,317,022.46	555,275.66	729.7	731.655	731.750
W-14	1,319,600.02	555,115.83	726.0	728.630	728.750
W-15	1,318,930.37	557,845.95	720.5	722.910	723.095
W-16	1,317,689.48	559,204.66	732.8	734.185	734.300
W-17	1,317,111.48	559,181.08	734.2	736.365	736.700
W-18	1,317,111.61	560,185.35	726.4	728.600	728.735
W-19	1,317,794.91	560,198.30	734.2	736.450	736.745
W-20	1,320,903.48	557,427.35	726.1	726.930	726.985
W-21	1,317,177.85	552,274.24	727.	728.855	728.980
W-22	1,319,737.95	552,176.13	733.3	735.375	735.480

A - Coordinates referenced to Illinois State Ground Control Grid

The surface water staff gauge locations were established at two lagoons inside FPTA-2 and at seven locations along Salt Fork Creek using either permanent landmarks such as culverts or metal fence posts driven into the ground. The elevations and horizontal coordinates of these staff gauges are presented in Table 3-7. A description of the staff gauge locations shown in Figure 3-3 is provided in Table 3-8.

WESTON

TABLE 3-7 SUMMARY OF LOCATIONS AND ELEVATIONS OF STAFF GAUGE STATIONS AND MONUMENT STATIONS

STAFF STATION NUMBER	HORIZONTAL CONTROL A		ELEVATION	LOCATION
	NORTH COORDINATE	EAST COORDINATE		
SS-1	1,317,895.11	554,201.57	727.235	TOP OF STAKE
SS-2	1,317,890.43	553,826.21	727.855	TOP OF STAKE
SS-3	1,317,681.79	553,428.30	721.585	END OF C.M.P.
SS-4	1,318,234.14	553,710.51	721.980	END OF C.M.P.
SS-5	1,318,843.86	554,137.54	718.580	TOP OF STAKE
SS-6	1,319,471.55	554,789.99	722.720	TOP OF SHEET PILING
SS-7	1,319,504.11	555,425.41	717.190	TOP OF STAKE
SS-8	1,319,511.14	556,048.29	720.870	TOP OF HEADWALL
SS-9	1,318,486.62	557,859.97	712.945	TOP OF STAKE

MONUMENT STA. NO.	NORTH COORDINATE	EAST COORDINATE	ELEVATION
STA. 2	1,320,599.5526	552,354.2934	734.01
STA. 4	1,317,081.3426	551,445.8006	730.89
STA. 16			723.40
STA. 17			720.77
STA. 18			723.48
STA. 20			725.68
STA. 21			725.43
STA. 28			730.29

A - Coordinates referenced to Illinois State Ground Control Grid

TABLE 3-8 DESCRIPTION OF LOCATIONS FOR SURFACE WATER STAFF GAUGING STATIONS

Base Surface Water Staff Gauging Stations

1	Creek below trailer park 24" pipe
2	Creek before confluence
3	Outfall sewer carrying treatment plant effluent and storm drainage
4	Storm drainage pipe outlet
5	Creek
6	Creek before confluence

Phase II Surface Water Staff Gauging Stations

1	Fire Protection Training Area No 2 lagoon (east)
2	Fire Protection Training Area No 2 lagoon (west)
3	Fire Protection Training Area No 2 culvert at Salt Fork Creek
4	Landfill No 2 southeastern corner at Salt Fork Creek under drive to Fire Protection Training Area No 2
5	Landfill No 2 on north side at Salt Fork Creek, west side
6	Landfill No 2 at outfall sewer carrying treatment plant effluent and storm drainage
7	Landfill No 2 on north side at Salt Fork Creek
8	Landfill No 2 Salt Fork Creek culvert under Titan Drive at Perimeter Road
9	Building 932 area at Salt Fork Creek

SECTION 4

RESULTS

4.1 SITE GEOLOGY

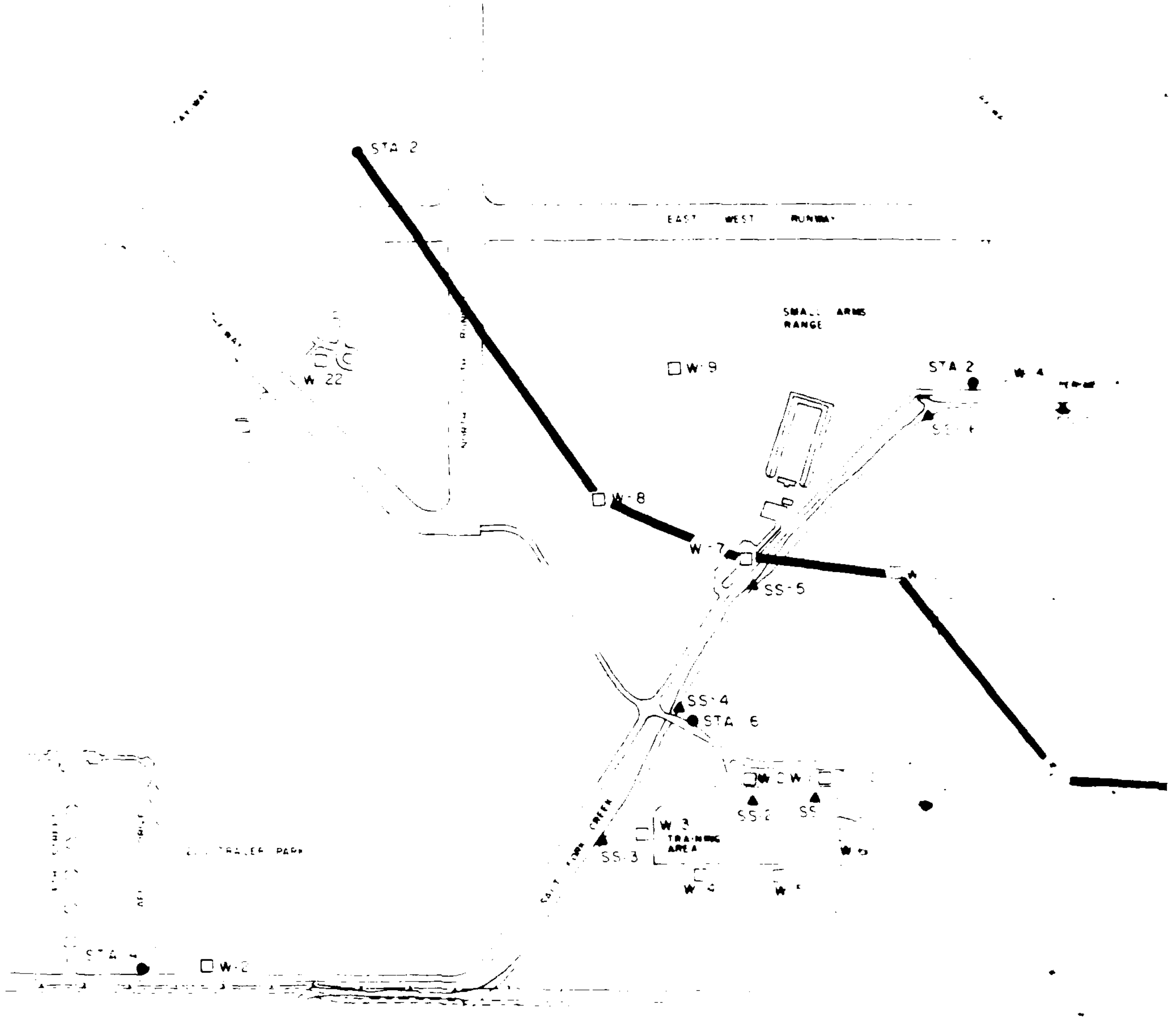
Analysis of the geologic information compiled during the Phase I Records Search, obtained from Illinois state publications and the subsurface data collected during the Phase II field program reveals that Chanute AFB is underlain by glacial tills unconformably overlying an eroded bedrock surface. The Paleozoic bedrock surface is characterized by stream cut valleys, the most notable of which is the Mahomet Valley, located immediately northwest of the Base. During the Pleistocene epoch this valley was filled with outwash sands and gravels of Kansan stage glaciation. The advance and retreat of succeeding glaciers deposited tills of the Illinoian and Wisconsinan stages. The most recent unconsolidated sediments belong to the Woodfordian substage of Wisconsinan glaciation. The surface trace of a hydrogeologic cross section of the study area is presented in Figure 4-1. The cross section, prepared from on-site borings, is presented in Figure 4-2.

The unconsolidated sediments in the vicinity of Chanute AFB consist of, in ascending order, the following mappable units:

- o Gray to buff till of the Banner formation with thick intercalated yellow, fine sands of the Mahomet Sand Member which coarsens downward to gravel. This unit was deposited by a lobe of Kansan stage glacial ice advancing from the northeast and occupies the deeper parts of the filled Mahomet Valley.

- o Dark gray to grayish brown, hard, calcareous compact sandy till intercalated with outwash sands and gravels known as the Glassford Formation. This unit was deposited by a lobe of the Illinoian stage ice sheet.

- o Gray sandy to silty till with lenses and beds of sand and gravel, known as the Wedron Formation, deposited from the Lake Michigan glacial ice lobe during the Wisconsinan stage. This unit is divided into four till members in east-central Illinois: Oakland, Fairgrange, Piatt and Batestown. This formation represents the last major glacial advance across this area.



Legend

Cross Section

Indicates Location of Groundwater ...

Indicated Location of Staff Stat...

Indicates Location of Base ...

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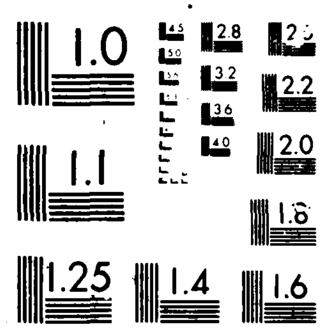
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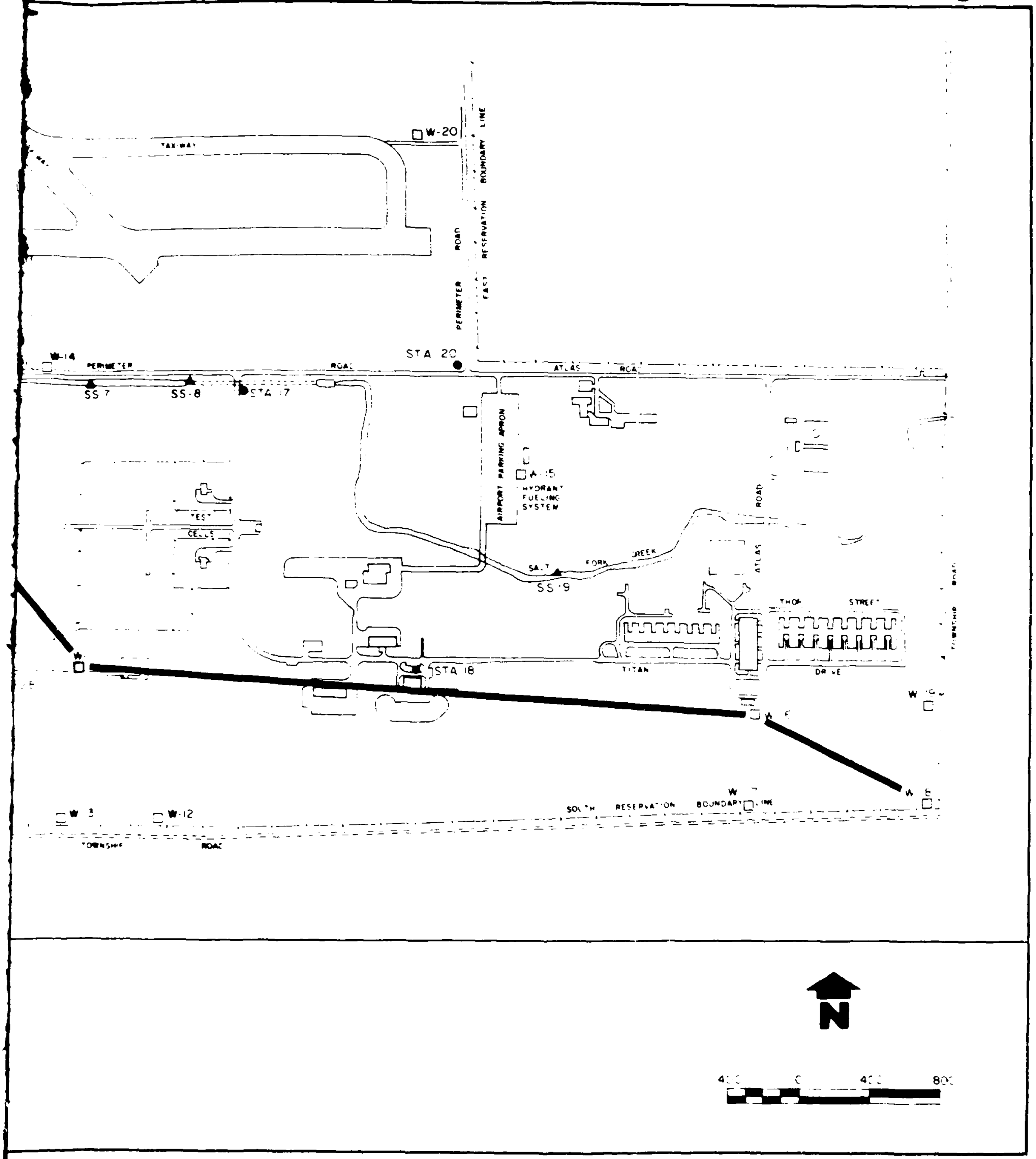


FIGURE 4-1 TRACE OF CROSS SECTIN A-A' ACROSS STUDY AREA AT CHANUTE AFB

WESTON

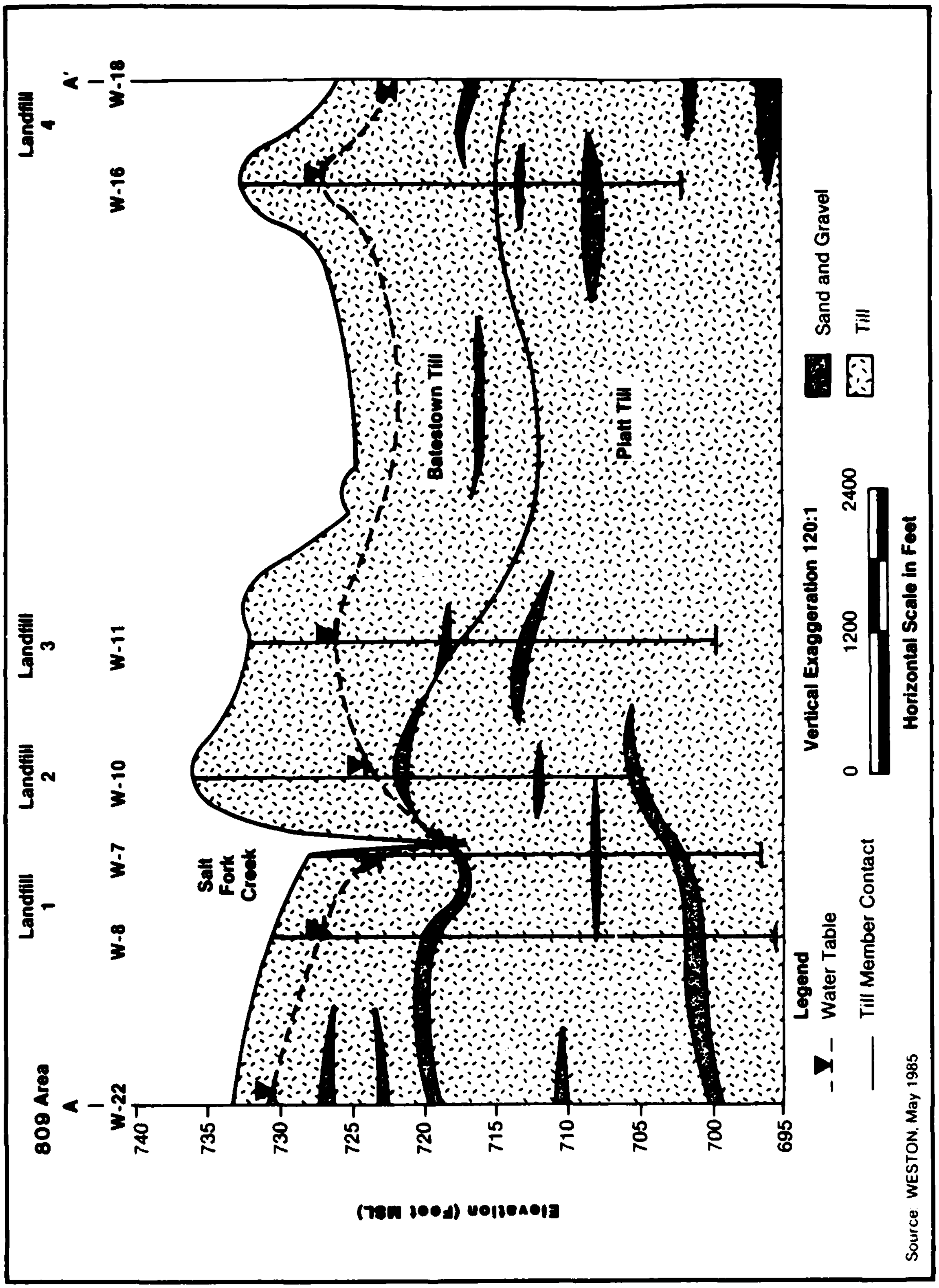


FIGURE 4-2 HYDROGEOLOGIC CROSS SECTION A-A'

- A thin veneer of loess in which modern soils have developed.

Borings during the Phase II program at Chanute AFB penetrated the two upper till members of the Woodfordian substage Wedron Formation. These units are characterized in ascending order in the following paragraphs.

The Piatt Till Member was encountered in all borings at Chanute AFB. The Piatt is a massive, gray, sandy till with scattered lenses and beds of outwash sands and gravels easily penetrated by auger. Stratigraphically, the Piatt conformably lies between the Fairgrange and overlying Batestown Till Members.

The Batestown is the surficial till unit at Chanute AFB and was encountered in all borings at the Base. The Batestown is a massive gray till altering to a light olive brown where oxidized and is siltier than the Piatt. Somewhat laterally continuous is a zone of outwash sands and gravels at the base of the Batestown, particularly in the south-central portion of the study area.

4.2 SITE GROUNDWATER CONDITIONS

Several distinct hydrogeologic units of local significance underlie the study area at Chanute AFB including the unconsolidated glacial deposits of the Kansan, Illinoian and Wisconsinan stage aquifers. Generally, water supplies for municipal and domestic use are obtained from the deep Kansan and Illinoian aquifers.

Chanute AFB obtains its water supply from 9 deep wells screened into the Kansan stage aquifer at a depth of approximately 250 feet BLS. The deep Kansan aquifer occurs under leaky artesian conditions and is overlain by a confining zone of silt and clay approximately 40 feet thick. A pressure differential between the Kansan aquifer below the confining zone and the Illinoian aquifer above induces water to move vertically downward through the silt and clay till. In the vicinity of Chanute AFB downward leakage is significant, especially during periods of heavy pumpage from the Kansan aquifer when water level in the Illinoian aquifer declines. Under this condition, the two aquifers may respond as one.

The shallow sand and gravel deposits of the Wedron Formation form the Wisconsinan stage aquifer and overlie the middle and lower aquifers of the Illinoian and Kansan glacial stages. Groundwater from this shallow aquifer occurs under water table conditions and is unconfined. The Wisconsinan aquifer is the uppermost aquifer in the study area. Depth to water occurs 1.5 to 12 feet BLS.

Seasonal groundwater level fluctuations of 0.4 to 10.6 feet can be expected with the maximum levels occurring in the late spring and early summer and the minimum levels occurring in the late winter.

The water table configuration of the shallow (Wisconsinan) aquifer system conforms to the overlying topographic surface as shown in Figures 4-3 and 4-4. The groundwater in this system generally flows perpendicular to the potentiometric contours toward Salt Fork Creek. The hydraulic gradient in the study area was calculated to be 0.012 and tends to steepen in the eastern section of the 900 Area.

Direct precipitation is the primary source of water recharging the shallow Wisconsinan aquifer in the study area. Although a portion of incident rainfall is lost to surface runoff and evapotranspiration, a major portion percolates downward to the level of the water table where water may be directed toward Salt Fork Creek as base flow or as to recharge to the lower Illinoian and Kansan aquifers.

That water which is not directed towards Salt Fork Creek as base flow continues to infiltrate downward charging the Illinoian (middle) and Kansan (deep) aquifers. Vertical leakage from the Wisconsinan (shallow) aquifer is the main recharge mechanism for the lower aquifers in the Chanute AFB area. Of the estimated annual net precipitation of 4.5 inches for the Chanute AFB area, Visocky and Schicht (1969) estimate that approximately 40 percent, or 2 inches, recharges the Illinoian aquifer annually.

From a review by Theodosis (1973) of groundwater conditions at Chanute AFB, static water level for the Kansan aquifer was determined to be 92 feet BLS. Static water level for the Illinoian aquifer is approximately 50 feet BLS (Sanderson and Zewde, 1976). Static water levels of 2 to 10 feet BLS were observed for the Wisconsinan aquifer during the Phase II field program. Hydrostatic head decreases with respect to depth for each of the three aquifers. Therefore, Chanute AFB is situated in an area of hydrologic recharge, the magnitude of which is dependent upon the thickness and permeability of the intervening confining zone between each aquifer.

In response to Task Order 0047, wells W-20, W-21 and W-22 were established to determine the regional flow gradient at

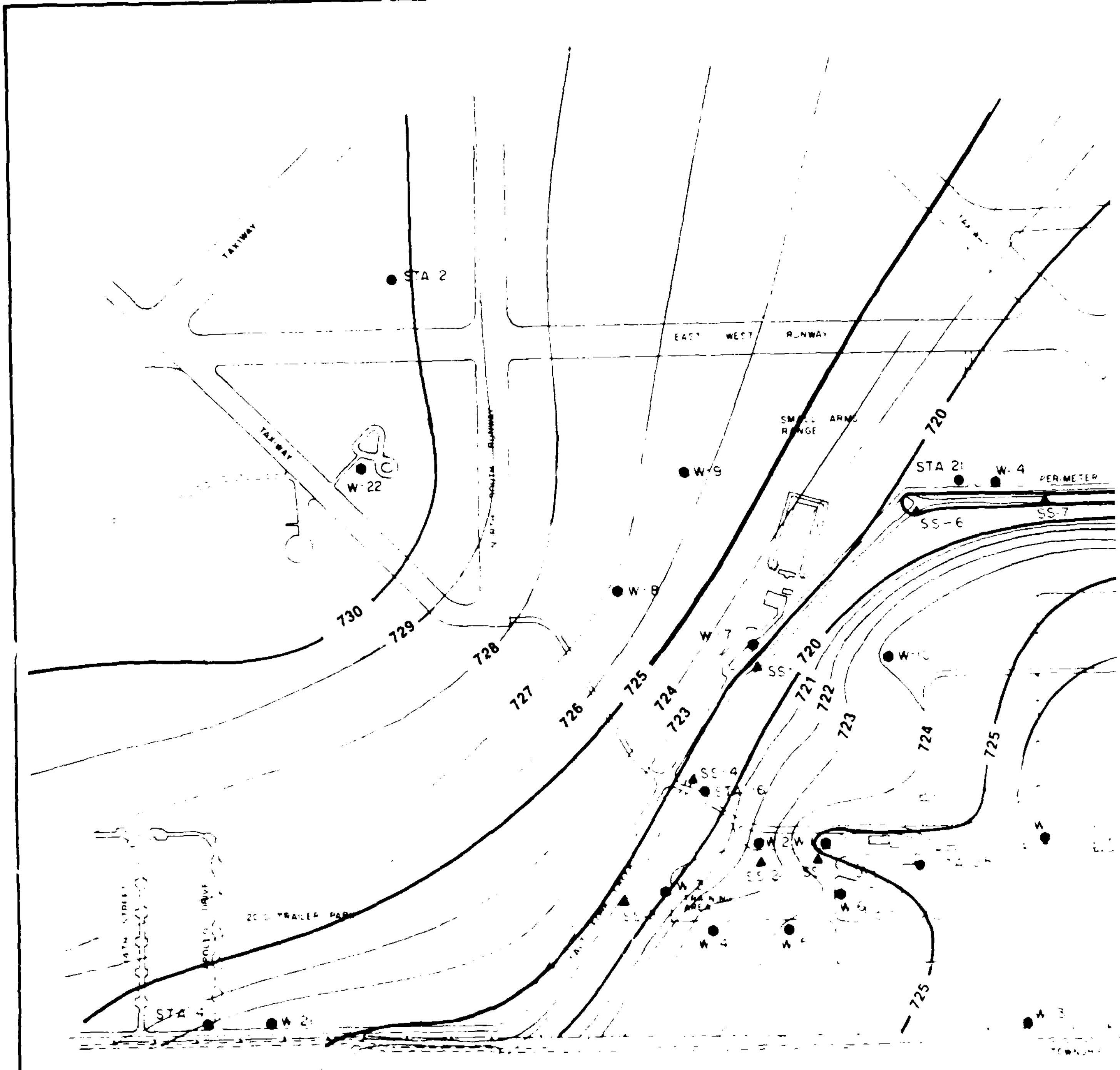
Chanute AFB. The location of these wells is shown in Figure 3-2. Based upon a three point solution, the hydraulic gradient over the south-central portion of the Base is 0.0033 at an orientation of S50^{o}E. This is consistent with general topographic gradient in the Rantoul area. Regionally groundwater flow is in an easterly direction.

Groundwater and surface water levels were measured and elevations were calculated for all monitoring wells and staff gauge locations and are tabulated in Table 3-5. This information was used to develop the water table elevation contour maps presented in Figures 4-3 and 4-4. Following is a site by site summary of groundwater conditions at each of the Phase II sites.

4.2.1 Groundwater Flow, Fire Protection Training Area 2

Groundwater beneath the Fire Protection Training Area occurs under water table conditions within outwash sand and gravels. The sand and gravel beds range in thickness from 1 to 5 feet in thickness and provide preferred zones of groundwater flow. A laterally continuous sand and gravel zone was encountered at approximately 20 feet BLS (700.0 feet MSL) in wells W-1, W-6 and W-5 located in the eastern and southern areas of the FPTA-2. The locations of these wells are shown in Figure 3-2. Groundwater occurs from 2 to 7 feet BLS, 720 to 725 feet MSL. Based upon water level elevations recorded in February and March 1985, the potentiometric surface maps shown in Figures 4-3 and 4-4 were developed. From the configuration of the water table in the FPTA-2 area, as shown in these maps, an average hydraulic gradient of 0.0064 was calculated, sloping west-northwest toward Salt Fork Creek. The hydraulic gradient steepens sharply adjacent to the creek suggesting that the conductivity of the glacial till is low (10^{-5} to 10^{-4} cm/sec). Wells W-1, W-5 and W-6 are upgradient of wells W-4, W-2 and W-3. Distinct groundwater mounding in the FPTA around W-1 in February 1985 is shown in Figure 4-3.

However, the March 1985 water table contours (Figure 4-4) show no mounding. Soils were still frozen in February and water table elevations were lower relative to the water table elevations recorded in March. It is possible that the infiltration of water associated with training activities in the vicinity of Buildings 902 and 906 is responsible for the acretion of this mound.



Legend

- ● Indicates Location of Groundwater Monitoring We
- ▲ Indicates Location of Staff Station
- ● Indicates Location of Base Control Monument Used as Basis for Location of We s
- ▬ 5 Foot Water Table Contour Interval
- — 1 Foot Water Table Contour Interval

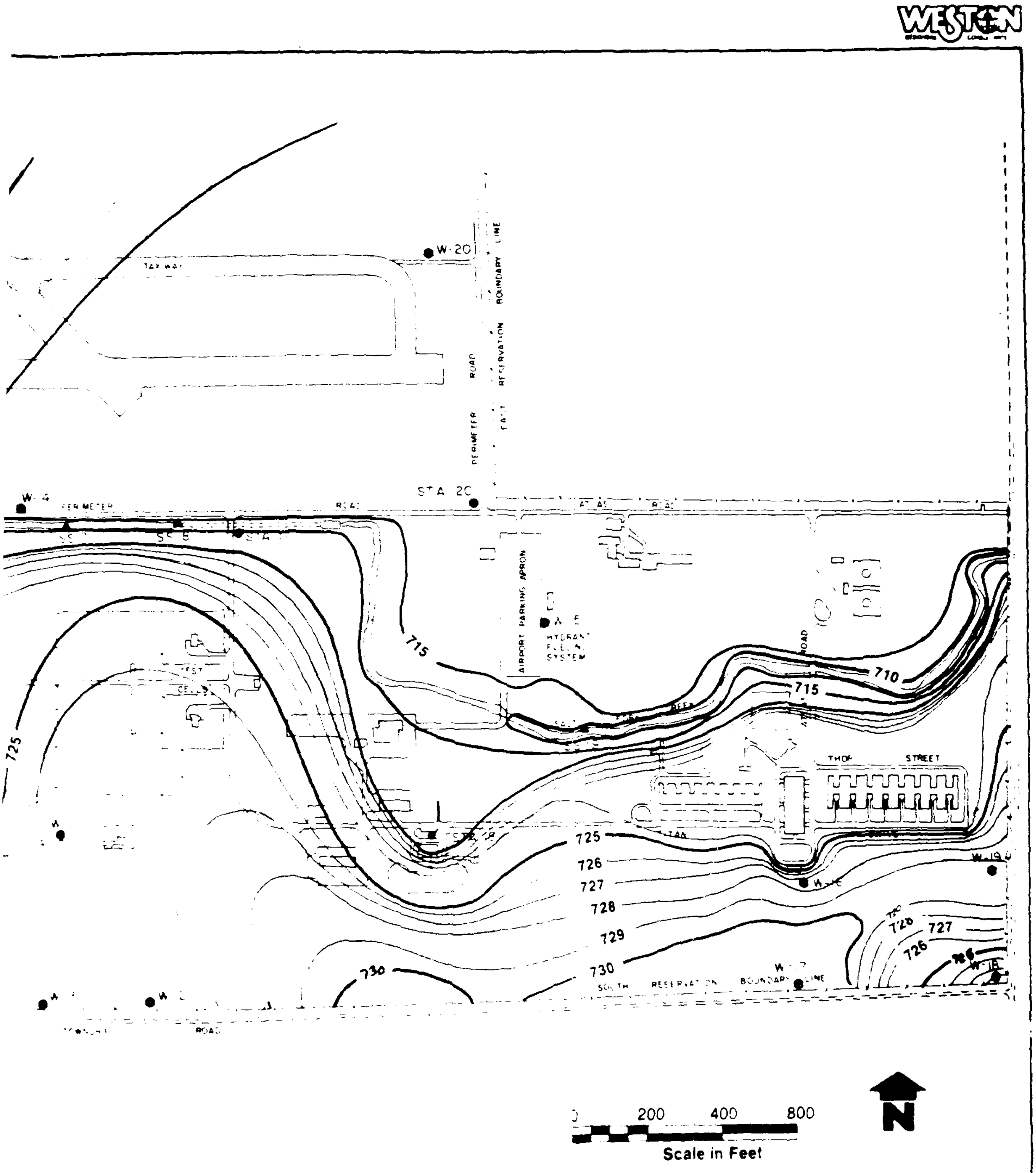
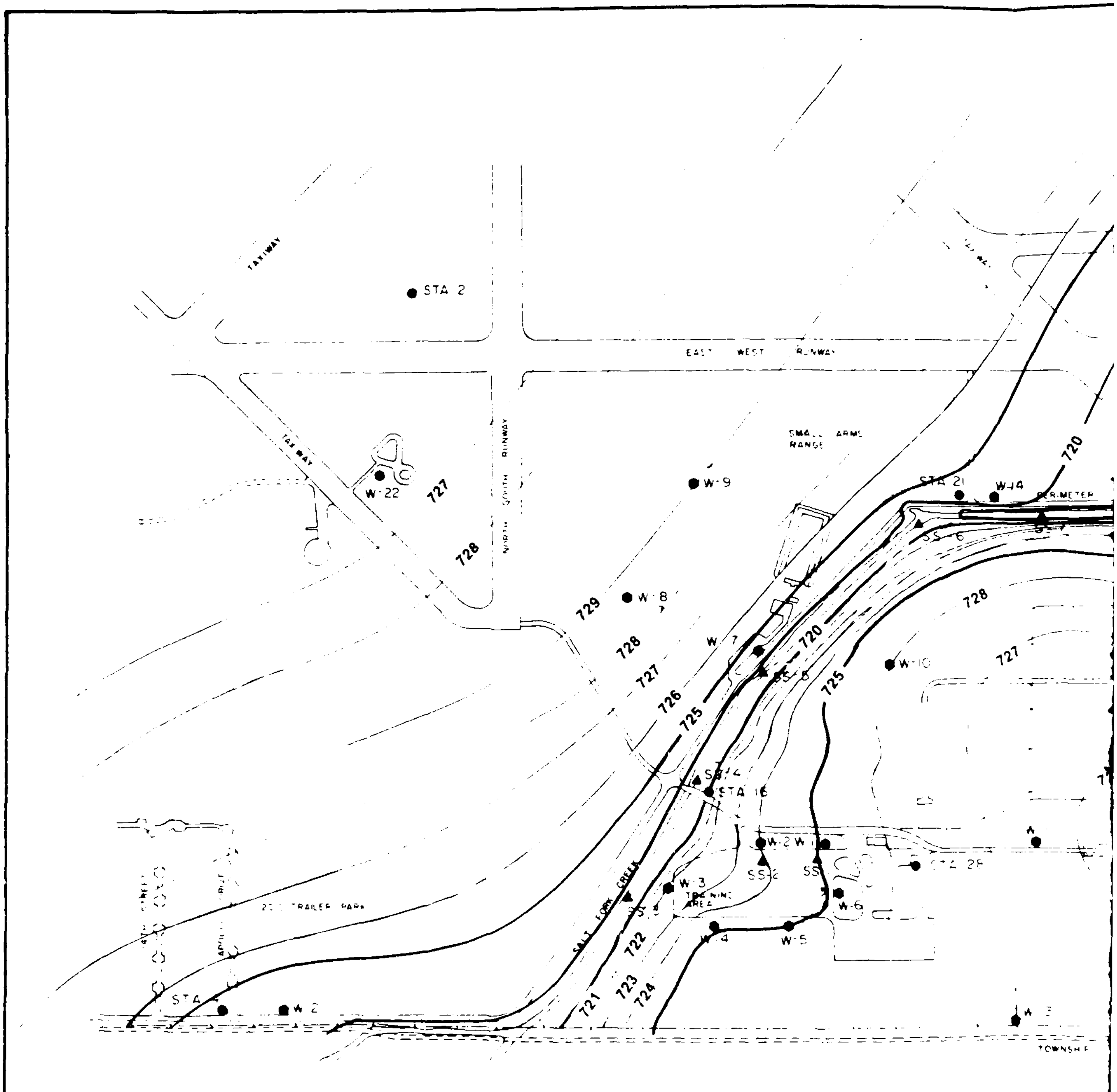


FIGURE 4-3 CONFIGURATION OF POTENTIOMETRIC SURFACE OF THE SHALLOW (UPPER) AQUIFER, 13-20 FEBRUARY 1985



Legend

- ● Indicates Location of Groundwater Monitoring Well
- ▲ Indicates Location of Staff Station
- ● Indicates Location of Base Control Monument Used as Basis for Location of Wells
- 5 Foot Water Table Contour Interval
- 1 Foot Water Table Contour Interval
- Groundwater Divide

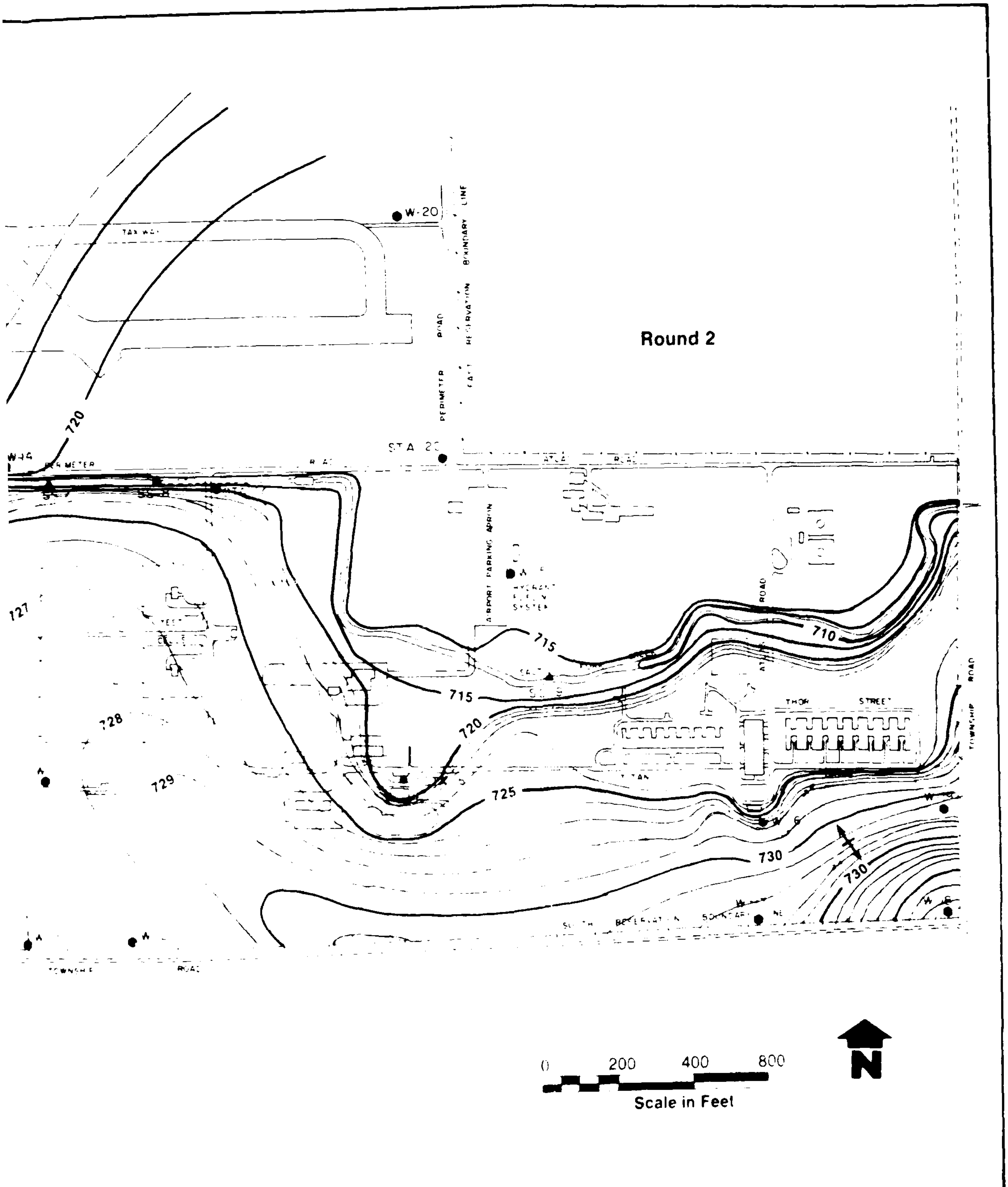


FIGURE 4-4 CONFIGURATION OF POTENTIOMETRIC SURFACE OF THE SHALLOW (UPPER) AQUIFER, 19-26 MARCH 1985

4.2.2 Groundwater Flow, Landfill Site 2

Groundwater in the vicinity of Landfill Site 2 occurs under water table conditions in the glacial till. The drift is characterized by interbedded sand and gravel zones and silty clay layers. The sand and gravel zones provided preferential zones of groundwater flow. Depth to groundwater ranged from 13 to 15 feet BLS (726 to 724 feet MSL) in well W-10. From the potentiometric surface maps (Figures 4-3 and 4-4) an average hydraulic gradient of 0.0103 to the west and north was calculated. Groundwater flow is toward Salt Fork Creek. The water table steepens sharply adjacent to Salt Fork Creek indicating that the conductivity of the tills is low. Extensive landscaping has taken place in the vicinity of Landfill Site 2 related to the construction of the new recreation area. A man-made pond has been created in the recreation area. The pond ranges in depth from approximately 22 to 7 feet and averages 13 feet. These figures are referenced from a surface elevation of approximately 733 feet MSL. At present, surface runoff and incident precipitation are the only sources of water for the pond. Occasionally the pond is pumped dry for construction purposes. No seeps or infiltration of groundwater into the clay-lined pond depression have been noted. No discharge point exists at present. Well W-11 from Landfill Site 3 serves as an upgradient well for W-10 as shown in Figure 3-2.

4.2.3 Groundwater Flow, Landfill Site 3

Groundwater in the vicinity of Landfill Site 3 generally occurs from 2 to 7 feet BLS (725 to 728 feet MSL). The hydraulic gradient as calculated from Figures 4-3 and 4-4 slopes to the west at approximately 0.0015. The water table is fairly flat over this section of the study area. Also, from these figures, it is seen that the wells in Landfill Site 3 are upgradient from those in Fire Protection Training Area 2.

4.2.4 Groundwater Flow, Landfill Site 1

Groundwater in the vicinity of Landfill Site 1 occurs from 4 to 5 feet BLS. Ground elevation is approximately 730 feet MSL. From Figures 4-3 an 4-4 a hydraulic gradient of approximately 0.1740 to the southeast was calculated. Once again, the gradient sharply steepens adjacent to Salt Fork Creek as shown in the hydrologic cross section (Figure 4-1), and illustrates the slow-draining nature of the till.

4.2.5 Groundwater Flow, Landfill Site 4

A groundwater ridge or divide runs diagonally southwest-northeast through Landfill Site 4. This ridge can be seen in the water table contour maps (Figures 4-3 and 4-4) and in the hydrologic cross section (Figure 4-1). This feature appears to be local in extent and related to the southwest-northeast topographic high in the vicinity of Landfill Site 4. The hydraulic gradient to the north-northwest is approximately 0.0075 toward Salt Fork Creek. The hydraulic gradient to the southeast slopes at approximately 0.0113 with groundwater flow conveyed to Salt Fork Creek southeast of Chanute AFB. This confirms that the hydraulic gradient of the shallow aquifer systems generally conforms to the gradient of the land surface. Groundwater beneath the Landfill Site 4 area occurs under water table conditions from 1.5 feet BLS (733 feet MSL) at well W-17 to 5 feet BLS (727 feet MSL) at well W-16.

4.2.6 Groundwater Flow, Fire Protection Training Area 1

The groundwater in the vicinity of Fire Protection Training Area 1 was monitored from one well (W-14) which is located in a downgradient direction from the old Fire Protection Training Area. Water level in well W-14 fluctuated from 716.5 feet MSL in February 1985 to 722.0 feet MSL by the end of March 1985 and represents the largest fluctuation in water level elevation of any of the sites investigated. The hydraulic gradient as determined from Figures 4-3 and 4-4 is 0.0125 toward Salt Fork Creek immediately to the south. The gradient steepens rapidly to the creek confirming the low permeability of the clay and silt tills in the study area.

4.2.7 Groundwater Flow, Building 932 Area

One groundwater monitoring well was established in the Building 932 Area. Depth to water at W-15 was 3 to 4 feet below the land surface elevation of 721 feet MSL. Groundwater occurs here under water table conditions. The hydraulic gradient gently slopes toward Salt Fork Creek at 0.0038 to the south.

4.3 RESULTS OF WATER QUALITY ANALYSES

The results of the first round of water quality analyses are summarized in Tables 4-1 and 4-2. These results include the analyses of the resampling round which was conducted because holding times were exceeded for first round VOA and selected TDS samples. The results of the second sampling round are presented in Tables 4-3 and 4-4. All of the analytical laboratory data are presented in Appendix H.

Table 4-1
Summary of Water Quality Results
Chanute AFB
Round 1

Analyte / SITE	REQUESTED LIMIT OF QUANTIFICATION	Fire Protection Training Area 2							Landfill No.1		
		W-1	W-2	W-3	W-4	W-4A	W-5	W-6	W-7	W-8	W-9
Total Organic Carbon (mg/l)	1.0	2.2	8.1	8.3	11.6	11.3	2.2	2.7	14.7	NQD	4.1
Oil and Grease (mg/l)	0.1	0.44	0.66	2.23	2.34	0.75	0.16	0.15	0.18	0.18	0.9
Total Phenolics (ug/l)	5	ND	ND	ND	10	9	ND	ND	ND	ND	ND
Total Disolved Solids (mg/l)	1.0	748.0	496.0	562.0	424.0	310.0	380.0	426.0	1080.0	280.0	738.0
Lead (ug/l)	20	NQD	NR	NR	NR	NR	NR	NR	ND	ND	NQD
Chromium (ug/l)	50	ND	NR	NR	NR	NR	NR	NR	ND	ND	ND
2,4-D (ug/l)	10	ND	NR	NR	NR	NR	NR	NR	ND	ND	ND
2,4,5-TP (ug/l)	1	ND	NR	NR	NR	NR	NR	NR	ND	ND	ND

A - Duplicate
K - Thousand
M - Million
ND - Not Detected (Less Than Detection Limit)
NR - Not Requested
NQD - Not Quantifiable but Detected

Table 4-1 Cont'd

Analyte / SITE	REQUESTED LIMIT OF QUANTIFICATION	Well Number: Landfill No.2 W-10	Landfill No.2 W-10A	Landfill No.3 W-11	Landfill No.3 W-12	Landfill No.3 W-13	PPTA 1 W-14	932 W-15
Total Organic Carbon (mg/l)	1.0	181	10.3	6.6	4.0	22.5	NQD	3.7
Oil and Grease (mg/l)	0.1	0.75	0.42	0.14	0.53	ND	0.12	NR
Total Phenolics (ug/l)	5	ND	ND	ND	17	ND	ND	ND
Total Disolved Solids (mg/l)	1.0	1100.0	1110.0	782.0	552.0	1000.0	468.0	NR
Lead (ug/l)	20	NQD	NQD	ND	ND	ND	NQD	ND
Chromium (ug/l)	50	ND	ND	ND	ND	ND	ND	NR
2,4-D (ug/l)	10	ND	ND	ND	ND	ND	NR	NR
2,4,5-TP (ug/l)	1	ND	ND	ND	ND	ND	NR	NR

Table 4-1 Cont'd

Analyte / SITE	REQUESTED LIMIT OF QUANTIFICATION	Well Number: Landfill No.4				X-1			FPTA 2		
		W-16	W-17	W-18	W-19	W-20	W-21	W-22	SS-1	SS-2	SS-3
Total Organic Carbon (mg/l)	1.0	7.8	1.6	7.4	10.1	NQD	3.2	1.6	213.0	26.0	1.9
Oil and Grease (mg/l)	0.1	6.49	ND	ND	ND	ND	2.45	0.21	35.0	68.4	0.1
Total Phenolics (ug/l)	5	ND	ND	ND	ND	ND	ND	ND	70	296	ND
Total Disolved Solids (mg/l)	1.0	348.0	587.0	694.0	892.0	436.0	682.0	510.0	388.0	428.0	390.0
Lead (ug/l)	20	NQD	ND	ND	ND	ND	ND	ND	NR	NR	NR
Chromium (ug/l)	50	ND	ND	ND	ND	ND	ND	ND	NR	NR	NR
2,4-D (ug/l)	10	NR	NR	NR	NR	ND	ND	ND	NR	NR	NR
2,4,5-TP (ug/l)	1	NR	NR	NR	NR	ND	ND	ND	NR	NR	NR

Table 4-1 Cont'd

Analyte / SITE	REQUESTED LIMIT OF QUANTIFICATION	Well Number: Landfill No.2 SS-4	Landfill No.2 SS-5	Landfill No.2 SS-6	932 SS-9
Total Organic Carbon (mg/l)	1.0	6.7	5.8	3.6	3.7
Oil and Grease (mg/l)	0.1	3.5	1.45	0.28	NR
Total Phenolics (ug/l)	5	ND	ND	ND	ND
Total Disolved Solids (mg/l)	1.0	398.0	482.0	532.0	NR
Lead (ug/l)	20	ND	ND	ND	ND
Chromium (ug/l)	50	ND	ND	ND	NR
2,4-D (ug/l)	10	ND	ND	ND	NR
2,4,5-TP (ug/l)	1	ND	ND	ND	NR

4.3.1 Water Quality, Fire Protection Training Area 2

Two rounds of water samples were obtained from six groundwater monitoring wells (W-1 through W-6) around the perimeter of FPTA-2, two surface impoundments within FPTA-2 (SS-1 and SS-2) and one point along Salt Fork Creek adjacent to the western edge of the training area (SS-3). These samples were analyzed for total dissolved solids, total organic carbon, volatile organic compounds, xylene, oil and grease and phenolics.

The concentration of total dissolved solids in the groundwater samples varied between 310 and 748 mg/l for the first round of samples and 292 to 728 mg/l for the second round. The TDS value exceed the conductivity values for the first round of samples in wells W-4 and W-5. In simple ionic solutions, this is not possible. However, it may be due to a number of organic contaminants which have both polar and ionic character. John Hem commented "when applied to natural water.... the conductance determination cannot be expected to be simply related to ion concentrations or to total dissolved solids,and a rigorous theoretical development of the meaning of conductivity is rarely justified" (U.S.G.S. Water Supply Paper 1473, 1976). In any case the specific conductance should be reviewed as a general indicator, which may be validated by laboratory TDS analysis. With the exception of W-2, the TDS concentrations decreased from the first round to the second round. There is no discernable pattern to the distribution of TDS concentrations indicative of a contaminant plume.

The reported TDS concentrations in samples SS-1 and SS-2 from impoundments were 388 and 428 mg/l in the first round and 402 and 1,490 mg/l in the second round for sample sites SS-1 and SS-2. The TDS concentration at the Salt Fork Creek sampling station adjacent to FPTA-2 varied between 390 and 282 mg/l between the first and second sampling round.

The Illinois EPA has established a General Use Water Quality Standard for TDS of 1000 mg/l.

Total Organic Carbon (TOC) concentrations were reported in excess of 1 mg/l in all the surface and groundwater samples collected from FPTA-1 in both sampling rounds. Six elevated TOC concentrations were reported in samples collected from the wells along the western end of FPTA-2, particularly near the southwestern perimeter (W-4). The maximum groundwater TOC concentration detected in monitoring well W-4 during the second round (63.7 mg/l) was above other representative values.

Table 4-2
Summary of Volatile Organic Analyses - Chanute AFB
Round 1 *

Volatile Compounds / SITE / Units of Concentration ug/L	REQUESTED LIMIT OF QUANTIFICATION	Well Number: Fire Protection Training Area 2							Landfill No.1		
		W-1	W-2	W-2A	W-3	W-4	W-5	W-6	W-7	W-8	W-9
Benzene	4.0	ND	ND	ND	ND	69	ND	ND	ND	ND	ND
Bromoform	8.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	2.0	ND	4.3	4.0	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobromomethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Trans Dichloroethylene	2.0	2.6	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,3-Dichloropropene	6.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cis-1,3-Dichloropropene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl Benzene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Trans Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	2.0	ND	ND	ND	ND	12	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	2.0	2.7	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylene	2.0	ND	ND	ND	ND	15	ND	ND	ND	ND	ND

* The positive identities of VOC's were not confirmed by either second-column gas chromatographic analysis or by mass spectroscopy.

ND - Not Detected - (Less Than Detection Limit)

A - Denotes duplicate sample

Table 4-2 Cont'd

Volatile Compounds / SITE / Units of Concentration ug/L	Detection Limit	Well Number									
		LF No.2	Landfill No.3				FPTA 1	932	Landfill No.4		
		W-10	W-11	W-12	W-13	W-13A	W-14	W-15	W-16	W-17	W-18
Benzene	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	8.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.5
2-Chloroethylvinyl Ether	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobromomethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Trans Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,3-Dichloropropene	6.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cis-1,3-Dichloropropene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl Benzene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Trans Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 4-2 Cont'd

Volatile Compounds SITE Units of Concentration ug/L	Detection Limit	Well Number											
			X-1			FPTA 2			Landfill No.2			932	
		W-19	W-20	W-21	W-22	SS-1 *	SS-2 *	SS-3	SS-4	SS-5	SS-6	SS-9	SS-9A
Benzene	4.0	4.9	ND	ND	ND	ND	45	ND	ND	ND	ND	ND	ND
Bromoform	8.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	2.0	3.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobromomethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Trans Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,3-Dichloropropene	6.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cis-1,3-Dichloropropene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl Benzene	2.0	4.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Trans Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	2.0	7.1	ND	ND	ND	ND	50.5	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylene	2.0	8	ND	ND	ND	ND	82	ND	ND	ND	ND	ND	ND

* - Method 601: Because of high concentrations of hydrocarbons and foaming during the purging process, a dilution of 1:5 was made on these two samples.

Table 4-3
Summary of Water Quality Results
Chanute AFB
Round 2

Analyte / SITE	REQUESTED LIMIT OF QUANTIFICATION	Well Number: Fire Protection Training Area - 2						Landfill No.1		
		W-1	W-2	W-3	W-4	W-5	W-6	W-7	W-8	W-9
Total Organic Carbon (mg/l)	1.0	4.5	8.8	9.1	63.7	4.7	5.9	11.0	3.0	14.4
Oil and Grease (mg/l)	0.10	0.14	0.36	0.57	0.39	0.21	0.39	0.15	0.27	0.18
Total Phenolics (ug/l)	5	ND	ND	7	14	ND	6	12	ND	9
Total Disolved Solids (mg/l)	1.0	728.0	506.0	396.0	358.0	354.0	292.0	1050.0	328.0	622.0
Lead (ug/l)	20	ND	NR	NR	NR	NR	NR	ND	ND	ND
Chromium (ug/l)	50	ND	NR	NR	NR	NR	NR	ND	ND	ND
2,4-D (ug/l)	10	ND	NR	NR	NR	NR	NR	ND	ND (2)	ND (2)
2,4,5-TP (ug/l)	1	ND	NR	NR	NR	NR	NR	ND	ND (2)	ND (2)

A - Duplicate
M - Million
K - Thousand
ND - Not Detected (Less Than Detection Limit)
NR - Not Requested
(1) Holding Time Exceeded By Four Days
(2) Holding Time Exceeded By One Day For Extraction Only

Table 4-3
Cont'd

Analyte / SITE	REQUESTED LIMIT OF QUANTIFICATION	-LF No.2-	--------Landfill No.3				|-FPTA 1-|	---932--|		
		W-10	W-11	W-11A	W-12	W-13	W-14	W-15	W-16	W-16A
Total Organic Carbon (mg/l)	1.0	5.8	7.2	8.2	3.4	8.4	2.2	2.5	8.3	8.1
Oil and Grease (mg/l)	0.10	0.35	.064	0.25	0.54	0.13	0.17	NR	0.45	0.58
Total Phenolics (ug/l)	5	7	6	ND	15	9	7	ND	8	5
Total Disolved Solids (mg/l)	1.0	1070.0	864.0	866.0	206.0	998.0	922.0	NR	1250.0	1280.0
Lead (ug/l)	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium (ug/l)	50	ND	ND	ND	ND	ND	ND	NR	ND	ND
2,4-D (ug/l)	10	ND	ND (2)	ND (2)	ND	ND	NR	NR	NR	NR
2,4,5-TP (ug/l)	1	ND	ND (2)	ND (2)	ND	ND	NR	NR	NR	NR

Well Number

Table 4-3
Cont'd

Analyte SITE	REQUESTED LIMIT OF QUANTIFICATION	Landfill No.4 W-17	W-18	W-19	X-1 W-20	W-21	W-22	FPTA 2 SS-1	SS-2	SS-3
Total Organic Carbon (mg/l)	1.0	2.6	7.1	21.6	2.2	3.4	2.7	41.4	5340.0	3.4
Oil and Grease (mg/l)	0.10	0.13	0.32	0.51	ND	0.14	0.13	10.1	16400	0.76
Total Phenolics (ug/l)	5	ND	ND	7	11	5	ND	98	43	8
Total Disolved Solids (mg/l)	1.0	498.0	718.0	926.0	232.0	712.0 (1)	1400.0(1)	402.0	1490.0	282.0
Lead (ug/l)	20	ND	ND	ND	ND	ND	ND	NR	NR	NR
Chromium (ug/l)	50	ND	ND	ND	ND	ND	ND	NR	NR	NR
2,4-D (ug/l)	10	NR	NR	NR	ND	ND	ND	NR	NR	NR
2,4,5-TP (ug/l)	1	NR	NR	NR	ND	ND	ND	NR	NR	NR

Well Number

Table 4-3
Cont'd

Analyte / SITE	REQUESTED LIMIT OF QUANTIFICATION	--------Landfill No.2		------	--932-- Well Number
		SS-4	SS-5	SS-6	SS-9
Total Organic Carbon (mg/l)	1.0	2.3	3.4	3.4	6.3
Oil and Grease (mg/l)	0.10	0.35	0.34	0.36	NR
Total Phenolics (ug/l)	5	ND	ND	ND	7
Total Disolved Solids (mg/l)	1.0	32.0	314.0	318.0	NR
Lead (ug/l)	20	ND	ND	ND	ND
Chromium (ug/l)	50	ND	ND	ND	NR
2,4-D (ug/l)	10	ND	ND	ND	NR
2,4,5-TP (ug/l)	1	ND	ND	ND	NR

Table 4-4
Summary of Volatile Organic Analyses - Chanute AFB
Round 2

Volatile Compounds SITE Units of Concentration ug/L	REQUESTED LIMIT OF QUANTIFICATION	Well Number: Fire Protection Training Area 2 W-1	W-2	W-3	W-4	W-5	W-6	Landfill No. 1 W-7	W-8	W-8A	W-9	LF 2 W-10	W-10A	Landfill 3 W-11	W-11A	W-12
Benzene	4.0	ND	ND	ND	71	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	22*
Bromoform	8.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	2.0	ND	4.1*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobromomethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Trans Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,3-Dichloropropene	6.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cis-1,3-Dichloropropene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	18*
Ethyl Benzene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Trans Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	2.0	ND	ND	ND	23*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	32*
1,1,1-Trichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	2.0	3.8*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylene	2.0	ND	ND	ND	28*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	96*

A - Duplicate
ND - Not Detected (Less Than Detection Limit)

* The positive identities of VOC's were not confirmed by either second-column gas chromatographic analysis or by mass spectroscopy.

Table 4-4
Cont'd

Volatile Compounds SITE	REQUESTED LIMIT OF QUANTIFICATION	Well Number														
			FPTA 1		932	Landfill No.4					X1			FPTA 2		
Units of Concentration ug/L		W-13	W-14	W-14A	W-15	W-16	W-16A	W-17	W-18	W-19	W-20	W-21	W-22	SS-1	SS-2	SS-3
Benzene	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	8.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	5.9	ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobromomethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Trans Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,3-Dichloropropene	6.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cis-1,3-Dichloropropene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	ND	ND
Ethyl Benzene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Trans Dichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	18	2<X<10	ND
Xylene	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 4-4
Cont'd

Volatile Compounds SITE Units of Concentration ug/L	REQUESTED LIMIT OF QUANTIFICATION	Well Number --Landfill No.2-- SS-4	 SS-5	 SS-6	 ----932---- SS-9	 SS-9A
Benzene	4.0	ND	ND	ND	ND	ND
Bromoform	8.0	ND	ND	ND	ND	ND
Bromomethane	4.0	ND	ND	ND	ND	ND
Carbon Tetrachloride	2.0	ND	ND	ND	ND	ND
Chlorobenzene	2.0	ND	ND	ND	ND	ND
Chlorodibromomethane	2.0	ND	ND	ND	ND	ND
Chloroethane	2.0	ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether	2.0	ND	ND	ND	ND	ND
Chloroform	2.0	ND	ND	ND	ND	ND
Chloromethane	4.0	ND	ND	ND	ND	ND
Dichlorobromomethane	2.0	ND	ND	ND	ND	ND
Dichlorodifluoromethane	4.0	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	3.0	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	3.0	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	3.0	ND	ND	ND	ND	ND
1,1-Dichloroethane	2.0	ND	ND	ND	ND	ND
1,2-Dichloroethane	2.0	ND	ND	ND	ND	ND
1,1-Dichloroethylene	2.0	ND	ND	ND	ND	ND
1,2-Trans Dichloroethylene	2.0	ND	ND	ND	ND	ND
1,2-Dichloropropane	2.0	ND	ND	ND	ND	ND
Trans-1,3-Dichloropropene	6.0	ND	ND	ND	ND	ND
Cis-1,3-Dichloropropene	2.0	ND	ND	ND	ND	ND
Ethyl Benzene	2.0	ND	ND	ND	ND	ND
Methylene Chloride	3.0	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	2.0	ND	ND	ND	ND	ND
Tetrachloroethylene	4.0	ND	ND	ND	ND	ND
1,2-Trans Dichloroethylene	2.0	ND	ND	ND	ND	ND
Toluene	2.0	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	2.0	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	2.0	ND	ND	ND	ND	ND
Trichloroethylene	2.0	ND	ND	3.2*	ND	ND
Trichlorofluoromethane	3.0	ND	ND	ND	ND	ND
Vinyl Chloride	4.0	ND	ND	ND	ND	ND
Xylene	2.0	ND	ND	ND	ND	ND

TOC values of 41.4 and 534 mg/l were obtained from sampling locations SS-1 and SS-2, respectively. These values were noticeably above the other representative surface water samples obtained from FPTA-2.

Total organic carbon concentrations in the surface impoundments within FPTA-2 varied between 26 and 534 mg/l over both sampling rounds. TOC concentrations at SS-3 increased from 1.9 mg/l during the first sample round to 3.4 mg/l during the second round. The concentrations at SS-3 are considered to be within the background levels for this parameter. TOC is a general contaminant indicator for which no water quality standard has been established.

The holding times for the volatile organic samples from the first round were exceeded, thereby invalidating the analytical results from those samples. Fresh samples were obtained and analyzed in late April. Volatile organic constituents were reported above detection limits in samples from wells W-1, W-2 and W-4, and in a sample from surface water sampling site SS-2. The organic solvents trichloroethylene and 1,2-Trans Dichloroethylene were detected in the sample from well W-1 at levels less than 0.003 mg/l. Chloroethane was detected in a duplicate sample from well W-2 at an approximate concentration level of 0.004 mg/l. Concentration levels of 0.069, 0.015 and 0.012 mg/l were reported for benzene, xylene and toluene in the sample from well W-4. The concentrations of these compounds in the sample from SS-2 were reported to be 0.045, 0.082 and 0.050 mg/l, respectively.

Volatile organic compounds associated with petroleum products were detected in wells W-2, W-4 and SS-1 in the second round of sampling. Concentration levels of 0.071, 0.028 and 0.023 mg/l were reported for benzene, xylene and toluene, respectively, in the groundwater water sample from well W-4. A chloroethane concentration of 0.0041 mg/l was detected in the sample from well W-2. Ethyl benzene and xylene concentrations of 0.0021 and 0.018 mg/l, respectively, were reported in the sample for the surface impoundment sampling station SS-1. The only other reported detection of a volatile compound from a FPTA-2 sampling point was a 0.0038 mg/l concentration of trichloroethylene in well W-1.

The U.S. EPA proposed a Maximum Contaminant Level (MCL) for trichloroethylene of 0.005 mg/l. Other criteria that U.S. EPA is using for trichloroethylene are discussed in Section 4.4.

It should be noted that the positive identities of the VOC's were not confirmed by either second column gas chromatograhic analysis or by mass spectroscopy.

Oil and grease concentrations from groundwater samples in FPTA-2 monitoring wells varied between 0.15 and 2.34 mg/l in the first round samples. In second round groundwater samples oil and grease concentrations were reported in samples from wells along the western perimeter of FPTA-2. A maximum oil and grease concentration of 16,400 mg/l was reported for surface impoundment sampling station SS-2. An oil-water separator is present at the discharge of this surface impoundment. The effluent from the separator is discharged to the sanitary sewer system. Concentrations of oil and grease in the Salt Fork Creek sampling station SS-3 were reported as 0.1 and 0.76 mg/l during the first and second sampling round, respectively.

The Illinois EPA has established a Maximum Secondary Contact and Indigenous Aquatic Life Water Standard of 15 mg/l for oil and grease.

Detectable phenol concentrations (>0.005 mg/l) were reported in samples from W-4, SS-1 and SS-2 in both sampling rounds and in first round samples from W-3, W-6 and SS-3. Detected groundwater concentrations varied between 0.006 and 0.014 mg/l. Phenol concentrations in samples from the FPTA-2 surface impoundments varied between 0.043 and 0.296 mg/l. The single detected phenol concentration at Salt Fork Creek sampling station SS-3 was 0.008 mg/l. As phenols can be generated by decomposition of organic compounds (a major industrial source of phenol is coal tar); therefore the detected concentrations cannot be construed to be strictly due to contamination. The analytical methods used cannot distinguish between phenol that is naturally occurring and phenol that is due to contamination.

The Illinois EPA has established a Maximum General Use Water Quality Standard of 0.1 mg/l and a Secondary Contact and Indigenous Aquatic Life Water Quality Standard of 0.3 mg/l for phenols.

Leachate analysis for EP TOX metals was run on cuttings from well W-4. The results of this characterization showed that arsenic, cadmium, chromium, lead, mercury, selenium, and silver were all below detection limits. The only EP TOX metal found in the sample was barium which was reported at a concentration of 0.07 mg/l (Table 4-5).

Table 4-5
Summary of Soil Quality Results
Chanute AFB

Analyte	REQUESTED LIMIT OF QUANTIFICATION (ug/l)	SITE / SAMPLE: Fire Protection Training Area 2 — W-4 Well Cuttings (ug/l)	Building 932 Sludge Pit — Sludge (mg/kg)
EP Toxicity Metals			
As	10	ND	NR
Ba	10	70	NR
Cd	10	ND	NR
Cr	10	ND	NR
Pb	10	ND	NR
Hg	0.5	ND	NR
Se	10	ND	NR
Ag	2.5	ND	NR
Ignitability		Not Ignitable	NR
Total Lead		NR	50

ND - Not Detected (Less Than Detection Limit)
NR- Not Requested

The Illinois EPA had adopted the Federal drinking water standard of 1.0 mg/l for barium. The results of the EP TOX characterization show that no EP TOX metals were present at or above Illinois EPA standards.

4.3.2 Water Quality, Landfill Site 2

Two rounds of water samples were obtained from a single monitoring well east of Landfill Site 2 (W-10) and at three points along Salt Fork Creek adjacent to the landfill. These samples were submitted for laboratory analysis of TDS, TOC, VOA, xylene, oil and grease, phenol, chromium, lead, 2,4-D and 2,4,5-TP. In addition, monitoring well W-1, north of FPTA-2 was sampled on two occasions for lead, chromium and herbicides as part of the assessment of Landfill Site 2. Six leachate seepage samples were scheduled to be collected over the course of the two sampling rounds. However, no leachate seepage was observed during either of the two sampling episodes.

Total dissolved solids concentrations of 1100 and 1070 mg/l were reported for groundwater samples from well W-10 in the first and second rounds, respectively. Total dissolved solids concentrations of first and second round samples from the three Salt Fork Creek sites varied between 310 and 430 mg/l.

Total organic carbon concentration in well W-10 was reported as 181 mg/l in the first sampling round and 5.8 mg/l in the second round. The first round TOC concentration was noticeably higher than other representative values. First round TOC concentrations for the Salt Fork Creek sampling stations varied between 1.4 and 3.6 mg/l. Similar concentrations in the second round samples varied between 2.3 and 3.4 mg/l.

A concentration of 0.0032 mg/l of trichloroethylene in a second round sample from Salt Fork Creek station SS-6 was the sole volatile organic compound reported in the Landfill Site 2 sampling sites. The positive identity of the trichloroethylene was not confirmed by either second-column gas chromatographic analysis or by mass spectroscopy.

A phenol concentration of 0.007 mg/l was reported in a second round sample from well W-10. No other phenol concentrations were reported in the Landfill Site 2 samples.

No detectable concentrations of the herbicides 2,4-D and 2,4,5-TP were reported in the samples from either round.

4.3.3 Water Quality, Landfill Site 3

Two rounds of water quality samples were collected from three groundwater monitoring wells (W-11 through W-13) installed along the southern and northern edges of the landfill. These samples were analyzed for TDS, TOC, VOC, xylene, oil and grease, phenols, chromium, lead, 2,4-D and 2,4,5-TP.

Total dissolved solids concentrations in the Landfill Site 3 monitoring wells varied between 206 and 1000 mg/l in the first and second round samples. The lowest TDS concentrations were noted in monitoring well W-12 which is the upgradient well at Landfill Site 3. In round one the TDS value exceeded the conductivity value in well W-12. This phenomenon was addressed in Section 4.3.1.

A similar variation was discernable in the TOC concentrations reported from the Landfill Site 3 groundwater samples. In the first round samples TOC concentrations increased from 4.0 mg/l at W-12 to 22.5 mg/l at W-13. The first round TOC concentration obtained from well W-13 was noticeably higher than other representative values. Second round samples exhibited concentrations ranging from 3.4 mg/l at W-12 to 8.4 mg/l at W-13. As noted previously, TOC is a general contaminant indicator and is not referenced to a water quality guideline or standard.

No phenolic concentrations were reported in the first round samples from Landfill Site 3. However, in the second round samples phenolic concentrations of 0.006, 0.015 and 0.009 mg/l were reported for wells W-11, W-12 and W-13, respectively. This distribution pattern is contrary to the pattern established by the TDS and TOC concentrations.

Volatile organic concentrations were not detected in any of the first round samples from Landfill Site 3. In the second round samples volatile organic concentrations of compounds normally associated with petroleum hydrocarbons were reported in a sample from W-12. These concentrations ranged from 0.018 mg/l for ethyl benzene to 0.096 mg/l for xylene. The positive identities of the second round VOC's were not confirmed by either second-column gas chromatographic analysis or by mass spectroscopy.

Oil and grease concentrations in the first round samples varied from not detected at W-13 to 0.53 mg/l at W-12. In the second round samples the oil and grease concentrations at well W-12 and W-13 remained approximately equal to the first round levels. However, the concentration at W-11 increased 0.64 mg/l. These concentrations are well within all of the Illinois EPA water quality standards for oil and grease. No detectable concentrations of the herbicides 2,4-D and 2,4,5-TP were reported in any of the first or second round samples.

No detectable lead or chromium concentrations were reported for any of the first or second round groundwater samples from Landfill Site 3.

4.3.4 Water Quality, Landfill Site 1

Two rounds of groundwater samples were obtained from three wells (W-11 through W-13) installed around the northern, western and southeastern edges of Landfill Site 1. These samples were submitted for laboratory analysis of TDS, TOC, VOA, oil and grease, phenolics, chromium, lead and the herbicides 2,4-D and 2,4,5-TP. Two rounds of samples were scheduled to be collected from three leachate seeps. However, between the time of the Phase II presurvey site visit and the Phase II field investigation, the slope where the leachate seeps had been observed was regraded. No leachate seepage was observed during either of the sampling rounds.

Total dissolved solids concentrations exhibited a notable increase between the upgradient and downgradient wells at Landfill Site 1. TDS concentrations varied between 346 and 738 mg/l in the upgradient wells and between 280 and 1,080 mg/l in the downgradient well (W-7). Well W-9 TDS value (round one) exceeded the conductivity value (round one). This phenomenon was addressed in text in Section 4.3.1.

The TOC concentrations of the first round samples exhibited a similar distribution pattern as the TDS concentrations. The first round samples showed a 4 to 16 fold increase between the upgradient wells and the downgradient wells. However, in the second sampling round the highest TOC concentration (14.4 mg/l) was detected in an upgradient well (W-9).

With the exception of low-level (<0.020 mg/l) concentrations of methylene chloride no volatile organic compounds were detected in any of the groundwater samples from either round. Methylene chloride is a common laboratory reagent and is not, on the basis of these results, considered to be a contaminant at Landfill Site 1.

No phenolic concentrations were reported in any of the first round samples. However, concentrations of 0.012 and 0.009

mg/l were reported in second round samples from W-7 and W-9, respectively.

Oil and grease concentrations varied between 0.18 and 0.9 mg/l in the first round samples and between 0.18 and 0.27 mg/l in the second round samples. There was no discernable trend in these reported concentrations.

No quantifiable concentrations of soluble lead was detected in any of the Landfill Site 1 samples.

No detectable concentrations of the herbicides 2,4-D and 2,4,5-TP were reported in any of the first or second round samples.

4.3.5 Water Quality, Landfill Site 4

Two rounds of groundwater samples were obtained from four wells (W-16 through W-19) installed near the corners of Landfill Site 4. These samples were analyzed for TDS, TOC, VOA, xylene, oil and grease, phenol, chromium and lead.

Total dissolved solids concentrations of first and second round samples varied between 348 mg/l and 1280 mg/l. The second round concentrations were greater than the first round TDS concentrations. No discernable spatial distribution pattern or trend is evident from the reported TDS concentrations.

Volatile organic concentrations were detected in first round (resampling round) samples from wells W-18 and W-19. Cloroethane at a concentration of 0.0085 was reported in the sample from well W-18. In the sample from well W-19, five petroleum hydrocarbon volatile organic compounds were detected at concentrations less than 0.010 mg/l.

A 0.0059 mg/l concentration of chloroethane in the sample from well W-18 was the only reported volatile organic occurrence in the second round of samples.

It should be noted that the positive identities of VOC's were not confirmed by either second-column gas chromatographic analysis or by mass spectroscopy.

No detectable phenol concentrations were reported for first round samples obtained from Landfill Site 4; however, phenol concentrations of 0.008 and 0.007 mg/l were detected in second round samples from wells W-16 and W-19, respectively.

Oil and grease concentrations in the first round samples varied between not detected (<0.1 mg/l) to 6.49 mg/l with the highest concentrations in well W-16. The oil and grease value report for W-16 was noticeably higher than other representative values. In the second round of samples the concentrations ranged from 0.13 to 0.51 mg/l with the highest concentration in well W-19.

No quantifiable concentrations of soluble lead or chromium were detected in any of the first or second round samples.

4.3.6 Water Quality, Fire Protection Training Area 1

Two rounds of samples were obtained from one groundwater monitoring well (W-14) south of FPTA-1. These samples were submitted for laboratory analysis of TDS, TOC, VOA, xylene, oil and grease, phenols and lead.

Total dissolved solids concentration in well W-14 samples increased from 468 mg/l in the first round to 922 mg/l in the second round. This is consistent with the specific conductance readings taken at this well (see Table 3-5).

Total organic carbon concentrations also exhibited an increase from 7 mg/l in the first round samples to 22 mg/l in the second round sample.

Volatile organic compounds including xylene were not detected in any of the ground or surface water samples from this site.

The concentration of oil and grease increased from 0.12 mg/l to 0.17 mg/l between the first and second sampling rounds. A similar increase from not detected to 0.007 mg/l was reported for phenols. Soluble lead was not detected in either of these samples.

4.3.7 Water Quality, Building 932 - Sludge Disposal Area

Two rounds of water samples were obtained from the well (W-15) installed south of Building 932 and at a point along Salt Fork Creek adjacent to the refueling area. These samples were analyzed for TOC, VOA, xylene, phenol and lead. In addition, a sludge sample was composited from the sludge disposal pit and submitted for EP lead analysis.

Total organic carbon concentration in samples from well W-15 decreased from 3.7 mg/l to 2.5 mg/l between the first and second sampling rounds. Concentrations of TOC at Salt Fork

Creek sampling station SS-9 increased from 3.7 mg/l in the first round to 6.3 mg/l in the second round.

Volatile organic compounds were not detected in any of ground or surface water samples from this site.

No phenolic concentrations were detected in the groundwater samples from this site; however, 0.007 mg/l of phenol was reported in a second round sample from SS-9.

Analysis of the sludge sample for EP lead showed a concentration of 50 mg/l (Table 4-5). Soluble lead was not detected in any of the water samples from this site.

4.3.8 Water Quality, Regional Flow Gradient Control

Two rounds of water samples were obtained from the three wells which were installed to estimate the regional flow gradient. These samples were submitted for TDS, TOC, volatile organics, xylene, oil and grease, phenol, chromium, lead and herbicides.

Total dissolved solids concentrations of first round samples ranged from 372 to 452 mg/l. The second round concentrations ranged from 232 to 1,400 mg/l. The highest concentrations were reported in samples from well W-22.

In round one the TDS values exceeded the conductivity values in wells W-20 and W-22. In round two this occurred at well W-22. This phenomenon was addressed in Section 4.3.1.

Total organic carbon concentrations ranged between 0.60 and 3.4 mg/l in samples obtained during both sampling rounds. The highest concentrations were detected in samples from well W-21.

Phenolic concentrations were not detected in any of the first round samples. Phenol concentrations of 0.011 and 0.005 mg/l were detected in second round samples from wells W-20 and W-21.

Oil and grease concentrations of 2.45 and 0.21 mg/l were detected in first round samples from wells W-21 and W-22, respectively. Second round concentrations from these wells were 0.14 and 0.13 mg/l, respectively. Oil and grease concentrations were detected in samples from well W-20.

No detectable concentrations of the herbicides 2,4-D and 2,4,5-TP were reported in any of the first or second round samples.

No concentrations of volatile organic compounds, lead and chromium were reported above detection limits in the samples from the regional flow gradient wells.

4.4 SIGNIFICANCE OF FINDINGS

4.4.1 Water Quality - General

The principal objective of the Phase II Stage 1 Confirmation Study was to determine whether past hazardous waste operations or disposal practices have resulted in the environmental degradation. The results of the Phase II Stage 1 study represent two rounds of sampling at selected surface water sites and newly installed monitoring wells and selected contaminant indicators. The conclusions drawn from this information should be evaluated within this context.

Appendix I contains a complete listing of Federal and State drinking water and human health standards, criteria and guidelines applicable in the State of Illinois. On November 28, 1980, the U.S. Environmental Protection Agency issued criteria for 64 toxic pollutants or pollutant categories which could be found in surface waters. The criteria established recommended maximum concentrations for acute and chronic exposure to these pollutants by both humans and aquatic life. The derivation of these exposure values was based upon cancer risk, toxic properties, and organoleptic properties.

The limits set for the cancer risk are not based upon a safe level for carcinogens in waters. The criteria state that for maximum protection of human health, the concentration should be zero. However, where this cannot be achieved, a range of concentrations corresponding to incremental cancer risks of from 1 in 10 million to 1 in 100,000 was presented (10^{-7} to 10^{-5}).

Toxic limits were established at levels for which no adverse effects would be produced. These are the health related limits which have been used in this report to evaluate potential impacts. It should be noted that the cancer risk column is based upon one cancer case in one million, (10^{-6}). The EPA's evaluation criteria under CERCLA (Annex XIII) for selecting contaminant levels to protect public health call for the remedial action to "attain levels of contamination which represent an incremental risk of contracting cancer between 10^{-5} and 10^{-6}." The 10^{-6} value was used to achieve the maximum protection to the public.

In addition to the cancer risk assessment criteria, the U.S. EPA Office of Drinking Water provides advice on health effects upon request, concerning unregulated contaminants found in drinking water supplies. This information suggests the level of a contaminant in drinking water at which adverse health effects would not be anticipated with a margin of safety; it is called a SNARL (Suggested No Adverse Response Level). Normally, values are provided for one-day, 10-day and longer-term exposure periods where available data exists. A SNARL does not condone the presence of a contaminant in drinking water, but rather provides useful information to assist in the setting of control priorities in cases when they have been found.

SNARLs are not legally enforceable standards. They are not issued as an official regulation, and they may or may not lead ultimately to the issuance of a national standard or Maximum Contamination Level (MCL). The latter must take into account occurrence and relative source contribution factors, in addition to health effects. The concentration set for SNARL purposes might differ from an eventual MCL. The SNARLs may also change as additional information becomes available. In short, SNARLs are offered as advice to assist those who are dealing with specific contamination situations to protect public health.

On June 12, 1984, the U.S. Environmental Protection Agency published a set of proposed rules under the Safe Drinking Water Act that would establish Recommended Maximum Contaminant Levels (RMCLs) for the following volatile organic chemicals (VOCs) in drinking water: trichloroethylene; tetrachloroethylene; carbon tetrachloride; 1,1,1-trichloroethane; vinyl chloride; 1,2-dichlorobenzene. RMCLs are nonenforceable health goals which are to be set at levels which would result in no known or anticipated adverse health effects with an adequate margin of safety. This proposal is the initial stage of rulemaking for the establishment of primary drinking water regulations for the VOCs. Following this proposal, Maximum Contaminant Levels (MCLs) and monitoring and reporting requirements will be established when the MCLs are promulgated. MCLs are enforceable standards and are to be set as close to the RMCLs as is feasible and are based upon health, treatment technologies, cost and other factors. It is anticipated that RMCLs for most of the above compounds would be set in the range of 5 to 50 ug/l. EPA anticipates proposing additional RMCLs for other VOC compounds in the near future.

The Illinois Environmental Protection Agency has promulgated water quality standards for general use, public and food processing, and secondary contact and indigenous aquatic life and ensure the aesthetic quality of the State's aquatic environment. The general use standards are the most stringent criteria promulgated by the IEPA. These standards establish specific maximum concentration for pH, phosphorous, dissolved oxygen, radioactivity, fecal coliform and several inorganic chemical constituents. For other nonspecific compounds which may be toxic, the IEPA has established a protocol of relating the maximum contaminant levels to the best available toxicity data on native fish species. For the general use water quality standard a substance toxic to aquatic life shall not exceed one-tenth of the 96-hour median tolerance limit (96-hr TLm). The secondary contact and indigenous aquatic life standard for toxic substances is one-half the 96-hr TLm.

4.4.2 Water Quality at Chanute AFB

The applicable guidelines for potential contaminant indicators of concern at Chanute AFB are summarized in Table 4-6 with additional reference materials included in Appendix I. Standards have not been established for the indicator parameter TOC.

Concentrations of total dissolved solids in excess of the Illinois General Use Water Quality Standard of 1,000 mg/l were detected in eleven samples from five sites, including all the landfills and Fire Protection Training Area-2.

Oil and grease concentrations were reported in excess of detectable concentrations in 64 of the 70 samples submitted for analysis. The detection limit for oil and grease is ten times the taste and odor threshold for this parameter.

The detected volatile organic compound concentrations were not in excess of any currently enforceable standards. However, the volatile organic concentrations in the groundwaters beneath Fire Protection Training Area 2 and Landfill Sties 3 and 4 may not conform to the anticipated Federal Maximum Contaminant Levels (MCLs) for drinking water. It should be noted that the positive identities of VOC's were not confirmed by either second-column gas chromatographic analysis or by mass spectroscopy.

The detected concentrations of phenols, soluble lead and chromium were not in excess of state or Federal water quality standards.

TABLE 4-6

APPLICABLE STANDARDS, GUIDELINES AND CRITERIA
FOR
CONTAMINATION INDICATORS OF CONCERN AT CHANUTE AFB

Detected Parameters	Water Quality Standards or Criteria*	Reference
TOC	None	General Indicator
TDS	1,000 mg/l	Illinois General Use Water Quality Standard
Oil and Grease	0.010 mg/l	Taste and Odor Threshold
Benzene	0.005 mg/l	Proposed MCL USEPA Levels
Chloroethane	100 mg/l	Illinois General Use Water Quality Standard
Ethyl Benzene	1 mg/l	Illinois General Use Water Quality Standard
Toluene	1 mg/l	Illinois General Use Water Quality Standard
Trichloroethylene	0.005 mg/l	Proposed MCL, USEPA Levels
Xylene	1 mg/l	Illinois General Use Water Quality Standard
1,2-Trans-Dichloroethylene	0.07 mg/l	Proposed RMCL, USEPA Levels
2,4-D	0.01 mg/l	Illinois Drinking Water Standards
2,4,5-TP	0.01 mg/l	Illinois Drinking Water Standards
Lead	5.0 mg/l	EP Toxicity Standard
Barium	100.0 mg/l	EP Toxicity Standard

* See Appendix I for a discussion of these criteria.

Although TOC is a general indicator of contamination which is not associated with any standard, the elevated TOC concentrations at each of the landfills and at Fire Protection Training Area 2 indicate the probability of soluble organic contaminants at this site. The significance of the observed discharge of oil to Salt Fork Creek (refer to Sub-section 3.2.2.8), near the Building 932 facility, could not be assessed by the water quality data. However, this observation should be interpreted as a potential indicator of petroleum hydrocarbon contamination.

4.4.3 Soil Quality at Fire Prevention Training Area 2 and Sludge Pit Building 932

Two areas were sampled for soil quality at Chanute AFB: the sludge pit at Building 932 and the Fire Prevention Training Area 2. The results of analysis of these samples have been presented on Table 4-5. The sludge sample was tested for total lead.

EPA Toxicity analyses was performed on the well cuttings taken from W-4 in the Fire Prevention Training Area 2 and were found to contain barium at 0.07 mg/l. The EP toxicity standard for barium is 100 mg/l.

4.5 CONCLUSIONS

Based on the results of the Phase II Stage 1 Contamination Study at the Chanute Air Force Base, the following key conclusions have been drawn.

4.5.1 Hydrogeology

1. A water table aquifer occurs within 15 feet of the land surface in the southeastern portion of Chanute AFB. This aquifer occurs within Wisconsinan-age glacial sediments.

2. Locally important water supply aquifers occur within 100 feet of the land surface in the Illinoian and Kansan-age glacial deposits.

3. Groundwater in the shallow water table aquifer flows toward and discharges to Salt Fork Creek.

4. The Kansan and Illinoian aquifers are recharged by leakage from the overlying water table aquifer in the Champaign County area.

5. The presence of low permeability silt and clay deposits between the Wisconsinan and Illinoian

aquifer minimizes the potential for contamination of locally important water supply aquifers.

4.5.2 Water Quality

1. Total dissolved solids concentrations were reported in excess of 1,000 mg/l at five of the eight investigation sites including each of the landfills.

2. Oil and grease concentrations were detected in excess of the 0.01 mg/l taste and odor threshold at all the landfills, both of the fire protection training areas and at two of the regional flow gradient wells.

3. Volatile organic contamination was found at Landfill Sites 3 and 4 and at Fire Protection Training Area 2, although the positive results were not confirmed by either second-column gas chromatographic analysis or by mass spectroscopy.

4. The generally higher second round concentrations of many parameters may be attributed to the absence of ground frost during the second sampling round. The recession of the ground frost enables water to percolate to the water table and allows the mobilization or remobilization of contaminants in the vadose zone.

5. The poorly-graded surface of the landfills promotes infiltration of precipitation and the generation of leachate at these sites.

6. The sludge pit behind Building 932 is classified as a Category III site requiring remedial action. Landfill Sites 1 through 4, Fire Protection Training Area 1, Fire Protection Training Area 2 and Salt Fork Creek downgradient of Building 932 require further investigation and are classified as Category II sites. There are no Category I site warranting no further action.

SECTION 5

ALTERNATIVES

5.1 GENERAL

The principal goal of the Phase II Stage 1 Confirmation Study at the Chanute AFB was to assess whether environmental degradation had occurred as a result of past material handling and disposal practices at the Base. The results presented in Section 4 confirm that the Base water quality has been slightly to moderately impacted by operations at each of the sites. Further verification and quantification actions are warranted at seven of the sites. Remedial action is warranted at one other site. A general description of the investigation alternatives is presented in Section 5. The specific recommendations are described in Section 6.

The evaluation of remedial action alternatives was not part of the Phase II Stage 1 scope of work. The alternative measures presented in Section 5 focus on the problem definition of the environmental quality situation at Chanute AFB. The results of the problem definition studies will provide the necessary input for the future evaluation of remedial alternatives. The problem definition alternatives are categorized into the following actions.

Action	Site
1. Expansion of Monitoring Network	Fire Protection Training Area 2 Landfill Site 2 Landfill Site 3 Building 932 - Salt Fork Creek
2. Expansion of Water Quality Monitoring at Existing Monitoring Points	Fire Protection Training Area 2 Landfill Site 2 Landfill Site 3 Landfill Site 1 Landfill Site 4 Regional Flow Gradient Control
3. Additional Soil Sampling and Analyses	Fire Protection Training Area 2 Landfill Site 3

Action	Site
4. Estimation of Water Balance	Fire Protection Training Area 2 Landfill Site 2 Landfill Site 3 Landfill Site 1 Landfill Site 4
5. No further investigation activities	Fire Protection Training Area 1

These alternative measures are discussed site-by-site in the following sections. Based on these possible alternative actions, specific implementation recommendations are presented in Section 6.

5.1.1 Alternatives, Fire Protection Training Area 2

The water quality monitoring results from Fire Protection Training Area 2 have indicated the presence of elevated TOC, volatile organic, constituent phenol and oil and grease concentrations in the western and southwestern portion of the training area. Although these concentrations are not considered to be acutely toxic, the proximity of the site to a potentially sensitive aquatic habitat (Salt Fork Creek) necessitates further characterization of the groundwater quality. This characterization effort would involve the installation of additional monitoring wells within and around the perimeter of the southwestern portion of the training area. Representative soil samples should be obtained and analyzed during the installation of these wells. The soil and water quality analyte suite would be expanded to include soluble lead and Priority Pollutant organic compounds. Additional hydrologic and hydrogeologic data would be collected to develop a hydrologic budget for this site.

5.1.2 Alternatives, Landfill Site 2

The results of the water quality analyses of samples from well W-10 indicate that the groundwater beneath Landfill Site 2 has been contaminated by leachate from the landfill. The character and extent of this contamination cannot be adequately assessed with the existing monitoring well coverage. Additional monitoring wells would be installed along the northern and northwestern edge of the landfill. In addition the water quality analyses would be expanded to include Priority Pollutant compounds and landfill leachate parameters. Site specific hydrologic and hydrogeologic information would be collected to develop a water balance.

5.1.3 Alternatives, Landfill Site 3

The water quality monitoring results from Site No. 3 indicate that in addition to the typical inorganic landfill leachate contamination, organic contamination has occurred in the southeast portion of the landfill. Additional monitoring wells would be installed in the eastern and southeastern portion of Landfill Site 3. Soil samples would be collected from the well borings in the southeastern portion of the landfill and analyzed for Priority Pollutant organics. The water quality monitoring should be expanded to include inorganic leachate constituents and Priority Pollutant compounds. Site specific data would be obtained to compute a hydrologic water balance for the site.

5.1.4 Alternatives, Landfill Site 1

The water quality monitoring results from Landfill Site 1 indicate that contamination of the shallow aquifer has occurred. However, the hazard presented by this contamination cannot be adequately assessed from the existing information. The list of analytes would be expanded to include characteristic inorganic landfill leachate parameters and Priority Pollutant compounds. Site specific data would be obtained to compute a water balance for this site.

5.1.5 Alternatives, Landfill Site 4

The results of the water quality analyses from Landfill Site 4 indicate contamination of the shallow aquifer. However, the results of the two sampling rounds were not consistent. Therefore, additional water quality monitoring is required to assess the impact of this landfill operation on the quality of the underlying groundwater. The suite of analytical parameters would be expanded to include characteristic inorganic landfill leachate parameters and priority pollutant organics. To develop a water balance for this site, data would be collected on hydrologic and hydrogeological site parameters.

5.1.6 Alternatives, Fire Protection Training Area 1

Considering the period of time that FPTA-1 was in use and the findings at FPTA-2, it is recommended that groundwater monitoring be continued. Four additional soil samples should be collected in areas of FPTA-1 which have not been characterized to date.

5.1.7 Alternatives, Building 932 Sludge Disposal Area

The results of the site investigation at the Building 932 facility suggest that further site investigations are warranted. These investigations would focus on the source of the petroleum product observed in Salt Fork Creek and if necessary, the extent and magnitude of contamination in the creek and the adjoining groundwater. The sampling and analysis of oil and grease and Priority Pollutant organics would be the primary investigation activity. On the basis of the EP Toxicity analyses of the sediment sample from the sludge disposal pit, the remedial action process should be initiated on this inactive disposal facility in accordance with DOD and U.S. EPA regulations.

5.1.8 Alternatives, Regional Flow Gradient Control

The results of the water quality monitoring conducted on the background monitoring wells indicate that the water quality monitoring program should be expanded to include U.S. EPA Priority Pollutants.

SECTION 6

RECOMMENDATIONS

6.1 GENERAL

The findings of the Phase II Stage 1 Confirmation Study at the Chanute AFB indicate the need for follow-up investigation which should include:

1. Expansion of the monitoring and sampling program with an emphasis on evaluation of the nature and extent of contamination by Priority Pollutant compounds.

2. Development of a site specific hydrologic balances.

The specific recommendations for further investigation actions at each site are presented in the following subsections. Subsection 6.1.1, 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. Subsection 6.1.2, Category II sites, are those requiring additional monitoring or work to quantify or further assess the extent of current or future contamination. Subsection 6.1.3, Category III sites, are sites that will require remedial IRP Phase IV actions. Recommendations for specific remedial actions, including the establishment of a long-term monitoring program, will be provided in the Phase II Stage 2 report.

6.1.1 Sites Recommended for Category I Classification

There are no sites classified as Category I where no further action is required.

6.1.2 Sites Recommended for Category II Classification

Landfill sites 1 through 4, Fire Protection Training Area 1, Fire Protection Area 2 and Salt Fork Creek downgradient of Building 932 require further investigation and are classified as Category II sites.

6.1.2.1 Recommendations, Site No. 4, Landfill Site 1

The following additional work is recommended for Landfill Site 1:

1. All site sampling points should be sampled and analyzed for U.S. EPA Priority Pollutants and the landfill leachate indicator parameters nitrate, iron, ammonia-nitrogen and boron.

2. Piezometer tests should be performed on all existing and additional monitoring wells to estimate the hydraulic conductivity of the shallow water table aquifer beneath the landfill.

3. A water balance should be developed to estimate the recharge to, the discharge through and the leakage from the shallow water table aquifer beneath the landfill.

6.1.2.2 Recommendations, Landfill Site 2

The following additional work is recommended for Landfill Site 2:

1. Two additional monitoring wells should be installed along the northwestern edge of Landfill Site 2 to assess the impact of leachate contamination on the groundwater beneath this facility.

2. All site sampling points should be sampled and analyzed for U.S. EPA Priority Pollutants and the landfill leachate indicator parameters nitrate, iron, ammonia-nitrogen and boron.

3. Piezometer tests should be performed on all existing and additional monitoring wells to estimate the hydraulic conductivity of the shallow water table aquifer.

4. The surface of Landfill Site 2 should be graded to promote runoff and slow leachate generation.

5. A water balance should be developed to estimate the recharge to, the discharge through and the leakage from the water table aquifer underlying the facility.

6.1.2.3 Recommendations, Landfill Site 3

The following additional work is recommended for Landfill Site 3:

1. Two additional monitoring wells should be installed in the southeastern portion of the landfill to assess the magnitude and extent of organic contamination in this area. These wells should be located along the eastern and southern edges of the landfill.

2. All site sampling points should be sampled and analyzed for U.S. EPA Priority Pollutants and the landfill leachate indicator parameters nitrate, iron, ammonia-nitrogen and boron.

3. Piezometer tests should be performed on all existing and additional monitoring wells to estimate the hydraulic conductivity of the shallow water table aquifer beneath the landfill.

4. The surface of Landfill Site 3 should be graded to promote runoff and slow leachate generation.

5. A water balance should be developed to estimate the recharge to, the discharge through and the leakage from the shallow water table beneath the landfill.

6.1.2.4 Recommendations, Landfill Site 4

The following additional work is recommended for Landfill Site 4:

1. All site sampling points should be sampled and analyzed for U.S. EPA Priority Pollutants and the landfill leachate indicator parameters nitrate, iron, ammonia-nitrogen and boron.

2. Piezometer tests should be performed on all existing and additional monitoring wells to estimate the hydraulic conductivity of the shallow water table aquifer beneath the landfill.

3. The surface of Landfill Site 1 should be generated to promote runoff and slow leachate generation.

4. A water balance should be developed to estimate the recharge to, the discharge through and the leakage from the shallow water table aquifer beneath the landfill.

6.1.2.5 Recommendations, Fire Protection Training Area 2

The following additional work is recommended for the Fire Protection Training Area 2.

1. Two additional monitoring wells should be installed around the southwestern perimeter of the training facility to assess the extent of organic contamination. Soil samples should be collected for laboratory analysis of Priority Pollutant organics during the installation of these wells.

2. Four soil borings should be completed in the western portion of the training facility to assess the integrity of the liner system and to collect soil samples for laboratory analysis of Priority Pollutant organics.

3. All site sampling points should be sampled and analyzed for U.S. EPA Priority Pollutant organics.

4. Piezometer tests (baildown or slug tests) should be performed on all existing and additional monitoring wells to estimate the hydraulic conductivity of the shallow water table aquifer.

5. A water balance should be developed to estimate the recharge to, the discharge through and the leakage from the water table aquifer underlying the facility.

6.1.2.6 Recommendations, Fire Protection Training Area 1

Considering the period of time that FPTA-1 was in use and the findings at FPTA-2, the following additinal work is recommended for FPTA-1:

1. Continue periodic groundwater monitoring.

2. Four additional soil samples should be analyzed from areas of FPTA-1 which have not been characterized to date.

6.1.2.7 Recommendations, Regional Flow Gradient Control

The following additional work is recommended for the Regional Flow Gradient wells:

> Monitoring wells W-21 and W-22 should be sampled and analyzed for U.S. EPA Priority Pollutants.

6.1.2.8 Recommendation, General 900 Area

In addition to the site-specific work described in Subsection 6.1.2.1 through 6.1.2.7, the following additional work is recommended for the 900 area in general:

1. Collection of the stream sediment samples from the Salt Fork Creek. These samples should be obtained at regularly spaced intervals along the creek from where it enters the Base at the Southwest corner of the 900 area to where it exits the Base along the eastern boundary. These samples should be analyzed for U.S. EPA Priority Pollutant Compounds.

2. Install five additional monitor wells along the northern bank of Salt Fork Creek from the re-fueling training area near Building 932 to the eastern Base boundary. An additional 4-6 wells should be installed along the southern bank at the Salt Fork Creek. At least two of three wells should be installed between the Creek and the area encompassing Buildings 900, 975 and 995. The remaining wells should be located near Building 918 and the northern edge of the New Recreation Area. Two background water quality monitor wells should be installed off-Base, south of the 900 area.

3. All water samples from these wells should be analyzed for U.S. EPA Priority Pollutants. The wells along the northern bank of Salt Fork Creek should also be analyzed for petroleum hydrocarbons.

4. Piezometer tests should be performed on all these monitor wells to estimate the hydraulic conductivity of the shallow aquifer system.

6.1.3 Sites Recommended for Category III Classification Building 932 Sludge Disposal Area be Classified as a Category III Site Requiring Remedial Action

6.1.3.1 Recommendations, Building 932 Sludge Disposal Area

We recommend that remedial actions be initiated at the sludge pits. However, we recommend the additional work at Building 932 facility focus not only on the area surrounding the sludge pit, but also on the source of the petroleum product observed in Salt Fork Creek. The following additional work is recommended for the Building 932 facility as part of remedial actions:

1. Re-examine existing Base records to determine locations and most recent status of petroleum product storage facilities and the ancillary transfer piping in the vicinity of Building 932.

2. Conduct visual reconnaissance of Salt Fork Creek downstream of surface water gauge station SS-8 (refer to Figure 3-3).

3. Establish at least two additional surface water gauging stations along Salt Fork Creek near SS-9.

4. Collect surface water and stream sediment samples and submit for analysis of oil and grease and Priority Pollutant organics.

5. Collect four soil samples from areas of stressed or dead vegetation. These soil samples should be analyzed for the presence of herbicides and oil and grease.

6. Collect confirmatory sample of sludge to test for EP Tox Lead and sample drainage ditch that is directly east of Building 932 Sludge Pit.

7. If the water quality sampling results indicate the presence of contamination, the utility of monitoring wells adjacent to the creek should be evaluated. This evaluation should address the number and location of additional wells.

6.1.4 Recommendations - Non-Site Specific

In addition to the site specific recommendations provided in Sections 6.1.2 and 6.1.3, the following activities are recommended to assess water quality and groundwater flow throughout the "900 Area."

1. Collection of ten stream sediment samples from the Salt Fork Creek. These samples should be obtained at regularly spaced intervals along the creek from where it enters the base at the southwest corner of the 900 Area to where it exits the base along the eastern boundary. These samples should be analyzed for U.S. EPA Priority Pollutant Compounds.

2. Install five additional monitor wells along the northern bank of Salt Fork Creek from the refueling training area near Building 932 to the Eastern Base boundary. An additional 4-6 wells should be installed along the southern bank of the Salt Fork Creek. At least two of these wells should be installed between the creek and the area encompassing Buildings 960, 975 and 995. The remaining wells should be located near Building 918 and the northern edge of the New Recreation Area. Two background water quality monitor wells should be installed off-base, south of the 900 Area.

3. All water samples from these wells should be analyzed for U.S. EPA Priority Pollutants. The wells along the northern bank of Salt Fork Creek should also be analyzed for petroleum hydrocarbons.

4. Piezometer tests should be performed on all these monitor wells to estimate the hydraulic conductivity of the shallow aquifer system.

6.2 SUMMARY OF RECOMMENDATIONS

The recommendations which have been made as a result of this Stage 1 study at Chanute AFB are summarized in Table 6-1.

TABLE 6-1

SUMMARY OF RECOMMENDATIONS

Recommendation	Rationale
Fire Protection Training Area 2	
1. Two additional monitoring wells.	Assess magnitude and extent of contamination.
2. Soil boring and sampling within training area.	Assess integrity of liner and magnitude of soil contamination.
3. Sample and analyze for Priority Pollutant organics.	Contaminant characterization.
4. Perform piezometer tests on monitoring wells.	Characterization of migration pathways.
5. Develop site water balance.	Evaluate potential impact on water resources.
Landfill Site 2	
1. Two additional monitoring wells.	Assess magnitude and extent of contamination.
2. Sample and analyze for Priority Pollutants and landfill leachate indicators.	Contaminant characterization.
3. Perform piezometer tests on monitoring wells.	Characterization of migration pathways.
4. Grade surface of the landfill.	Promote runoff and slow leachate generation.
5. Develop site water balance.	Evaluate potential impact on water resources.
Landfill Site 3	
1. Two additional monitoring wells.	Assess magnitude and extent of contamination.
2. Sample and analyze for Priority Pollutants and landfill leachate indicators.	Contaminant characterization.

TABLE 6-1 (continued)

Recommendation	Rationale
3. Perform piezometer tests on monitoring wells.	Characterization of migration pathways.
4. Grade surface of the landfill.	Promote runoff and slow leachate generation.
5. Develop site water balance.	Evaluate potential impact on water resources.
<u>Landfill Site 1</u>	
1. Sample and analyze for Priority Pollutant and landfill leachate indicators.	Contaminant characterization.
2. Perform piezometer tests on monitoring wells.	Characterization of migration pathways.
3. Grade surface of the landfill.	Promote runoff and slow leachate generation
4. Develop site water balance.	Evaluate potential impact on water resources.
<u>Landfill Site 4</u>	
1. Sample and analyze for Priority Pollutant and landfill leachate indicators.	Contaminant characterization.
2. Perform piezometer tests on monitoring wells.	Characterization of migration pathways.
3. Grade surface of the landfill.	Promote runoff and slow leachate generation.
4. Develop site water balance.	Evaluate potential impact on water resources.
<u>Fire Protection Training Area 1</u>	
1. Continue periodic groundwater monitoring.	Establish a groundwater quality data base.
2. Collect four additional soil samples	Characterize areas of FPTA-1 not already tested.

TABLE 6-1 (continued)

<u>Building 932 Sludge Disposal Area</u>	
1. Re-evaluation of existing information.	Characterization of potential sources.
2. Reconnaissance of Salt Fork Creek.	Evaluate extent of contamination.
3. Establish additional sampling sites.	Evaluate extent of contamination.
4. Sample and analyze for oil and grease and Priority Pollutant organics.	Contaminant characterization.
<u>Regional Flow Gradient Control</u>	
Sample and analyze for Priority Pollutants.	Contaminant characterization.

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