AD-A154 180 INSTALLATION RESTORATION PROGRAM PHASE I: RECORDS SEARCH LAUGHLIN AIR FORCE BASE TEXAS(U) ENVIRONMENTAL SCIENCE AND ENGINEERING INC DENVER CO MAR 85 1/2

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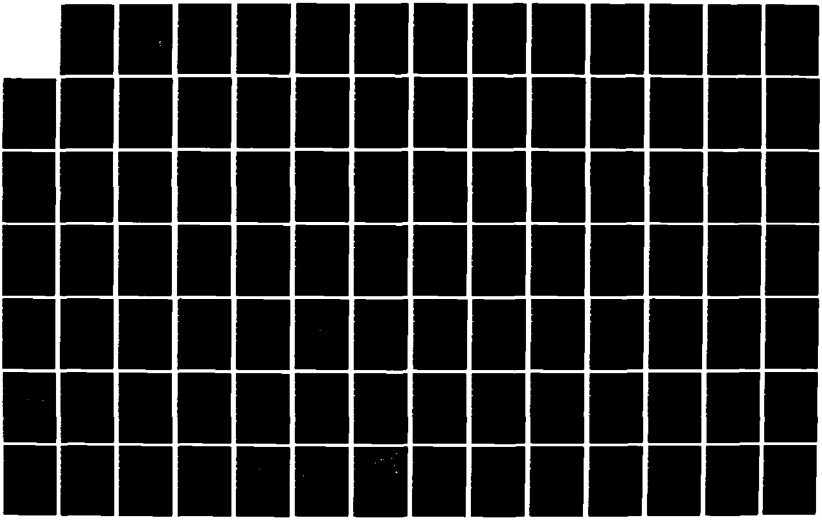

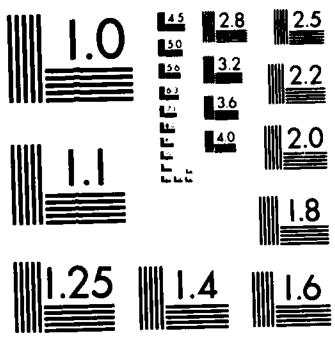
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AD-A154 180

INSTALLATION RESTORATION PROGRAM
PHASE I: RECORDS SEARCH

LAUGHLIN AIR FORCE BASE
TEXAS

Prepared for:

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March, 1985

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EXECUTIVE SUMMARY

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, control the migration of hazardous contaminants, and control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Initial Assessment/Records Search; Phase II, Confirmation and Quantification; Phase III, Technology Base Development/Evaluation of Remedial Action Alternatives; and Phase IV, Operations/Remedial Actions. The IRP will be the basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, Executive Order 12316, and 40 CFR 300 Subpart F (National Oil and Hazardous Substances Contingency Plan). CERCLA is the primary legislation governing remedial action at past hazardous waste disposal sites. Environmental Science and Engineering, Inc. was retained by the United States Air Force to conduct the Phase I, Initial Assessment/Records Search for Laughlin Air Force Base (LAFB) and its subinstallation, Eagle Pass Auxiliary Field (EPAux) under Contract No. F08637-83-G0010-5007.

METHODOLOGY

The methodology utilized in the LAFB records search began in September 1984 with a review of past and current industrial operations conducted at the base. Information was obtained from available records, such as shop files and real property files, as well as interviews with past and current base employees from the various operating areas. The next step in the activity review was to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various operations on the base. A ground tour of the identified sites were then made by the ESE Project Team to gather site-specific information. A decision was then made, based on all of the above information, regarding the potential for hazardous materials contamination at any of the identified sites.

INSTALLATION DESCRIPTIONS

LAFB is located in southwest Texas, Val Verde County, approximately 9 miles east of the city of Del Rio, Texas (Figure 2.1-1 through 2.1-4). The U.S.-Mexico border is approximately 6 miles south of LAFB and the nearest major metropolitan area (San Antonio) is located approximately 140 miles east-northeast (LAFB, 1978).

At present, LAFB consists of approximately 3,908 acres; all of which are owned by the U.S. Air Force (USAF). The EPAux, located 55 miles south-southest of LAFB consists of approximately 806 acres, a majority of which is held in lease from Maverick County.

LAFB is the home of the 47th Flying Training Wing (FTW). The primary mission of the wing is to conduct the undergraduate flight training program. Flight training is conducted by the 85th and 86th Flying Training Squadrons. Maintenance, supply, and engineering services are provided by squadrons within the 47th Wing. All other support and administrative services necessary to mission accomplishment are provided by divisions within the wing. LAFB trains over 400 pilots per year. The working population at the base is approximately 3,000. Air Force personnel and dependents living on base total approximately 2,500.

ENVIRONMENTAL SETTING

The climate of LAFB would be described as semiarid indicating the predominance of warm dry weather. The average annual maximum temperature is 80 degrees Fahrenheit (°F), the average annual minimum temperature is 59°F. The historical range is 8° to 110°F. Precipitation averages approximately 18 inches per year (in/yr), a majority as rain. Wind speeds average 7.6 knots. The prevailing wind direction is southeast-east/southeast.

LAFB lies within the Rio Grande Plain subdivision of the Gulf Coastal Plain physiographic province. The topography of LAFB is flat to gently rolling with very little relief. Elevations range from 1,038 feet (ft) [mean sea level (msl)] to 1,130 ft (msl). The lower elevations are found along the east/southeast boundary of the base and the higher elevations along the western boundary of the base.

No permanent streams exist on LAFB. Three drainageways (or intermittent streams) provide for the majority of surface water drainage on the base. The main drainage from the flightline and cantonment area is an improved ditch originally constructed as part of the industrial waste handling system. Currently, the ditch carries only stormwater flow and exits LAFB at its southeastern boundary, flowing approximately 3 miles south through an unnamed channel to its confluence with Sacatosa Creek.

The family housing area and southwest portions of the base drain through the golf course area, exiting LAFB through the former lake bed along the southwestern boundary.

The third drainage includes areas along the northern base boundary including the northern portion of the cantonment area. These areas drain to Zorro Creek, an intermittent stream which crosses the northwest corner of the base.

LAFB is located within the geologic province of the Devils River Uplift, a subsurface basement tectonic high of Late Paleozoic Age. The structure is some 60 miles long and 18 miles wide and trends northwest-southeast. Maximum subsurface displacement along the boundary faults ranges from 1,000 to 15,000 ft.

LAFB lies on a bedrock surface formed predominantly on the Cretaceous Buda Limestone and to a lesser extent, where drainage has eroded the Buda, the Del Rio Clay. The Uvalde Gravel mantles the surface and obscures the bedrock over most of the base. Along major drainages, alluvium of Quarternary Age covers the bedrock. Depth to bedrock is from less than a foot to some 15 ft. Regional dip is less than one degree.

EPAux lies within the geologic province of the Maverick Basin of the Gulf Coastal Plain. Rocks in the area represent the filling of the oceanic trench which resulted from continental break up in Late Precambian.

Landscapes at LAFB are formed in old alluvium over caliche and limy earth. Dominant soils belong to the Olmos-Acuna-Coahuila association and are characterized as very shallow, shallow and deep, clayey and loamy soils that are gravelly. The unit consists of nearly level to sloping soils on a series of old outwash deposits on nearly level to sloping valley fills and low hills. Other, less extensive components are Felipe, Vinegarroon, Valverde, Tobosa, Zapata, and Zorra soils. The Pintas clay is also present in the area.

Major water-bearing units in the area of LAFB are the limestones and dolomite rocks of Cretaceous Age and, to a lesser extent, Quarternary alluvium in the form of floodplain and terrace deposits. With the exception of the "Basement Sands" of the Trinity Group, the Del Rio Clay of the Washita Group and the Austin Chalk, the remaining Cretaceous strata yield water of various quantity and quality to wells in the area. Principal aquifers are prolific Lower Cretaceous West Nueces and Salmon Peak Formations.

Precipitation is the source of ground water recharge in the area of LAFB. Recharge to the major aquifers occurs mainly through a direct infiltration of precipitation on the land surface and by streamflow across the outcrop areas. Tectonic activity and the limy nature of the strata have formed a system characterized by solution-widened faults, fractures and joints in the subsurface as well as a karst surface expression. The features represent a network which readily permits infiltration of ground water. Some minor recharge is accomplished locally through interformational leakage.

Data regarding ground water quality at LAFB is limited as water wells drilled on the base were only sampled for a short time after their completion. Chemical analyses indicate the water is fresh but very hard. No anomalous concentrations of any of the dissolved minerals analyzed for was observed. Samples were obtained from the Salmon Peak aquifer.

No federal threatened or endangered species are know to occupy LAFB. There are no indications that present activities on LAFB have an adverse impact upon existing biota (LAFB, 1978).

FINDINGS

All the major current and past industrial operations at LAFB relate to aircraft maintenance, primarily in support of pilot training. The different levels of maintenance and the various operations are conducted by several different organizations at a number of locations on the base. Operations include engine repairs/overhauls; electrical, hydraulic, and fuel system repairs; painting; metal plating/finishing; and support equipment maintenance. No industrial activities are conducted at EPAux.

The basic mission of LAFB has remained essentially the same since the base was first activated, with the exception of 1957 to 1961, when it was used by Strategic Air Command (SAC). The type of aircraft used in pilot training has changed several times over the years. Between 1942 and 1956, propeller-driven aircraft were used. These were followed by the T-33 between 1956 and 1960. The T-37 was introduced in 1960 and was joined by the T-38 in 1964. SAC used the base to fly high altitude reconnaissance, primarily with the U-2. The materials, construction, and maintenance requirements of these earlier aircraft differed from those currently in use. Thus, the specific equipment and materials used in current maintenance operations may not reflect the years prior to 1961, although the categories of maintenance being performed and locations where they are conducted have changed little.

The main types of industrial waste generated at LAFB are fuel, oils and solvents, paints and paint strippers, and metal plating/treatment solutions. Waste fuel, oil and solvents include JP-4, engine oil, PD680, trichloroethylene (TCE), and methyl ethyl ketone (MEK), which are derived primarily from periodic maintenance and engine repair operations, but are generated in small quantities at almost all the maintenance shops. Waste consisting of paint residue, strippers and thinner is generated by the parts and aircraft painting operations. The aircraft painting operation, which is one of the largest waste generators on the base, was begun in

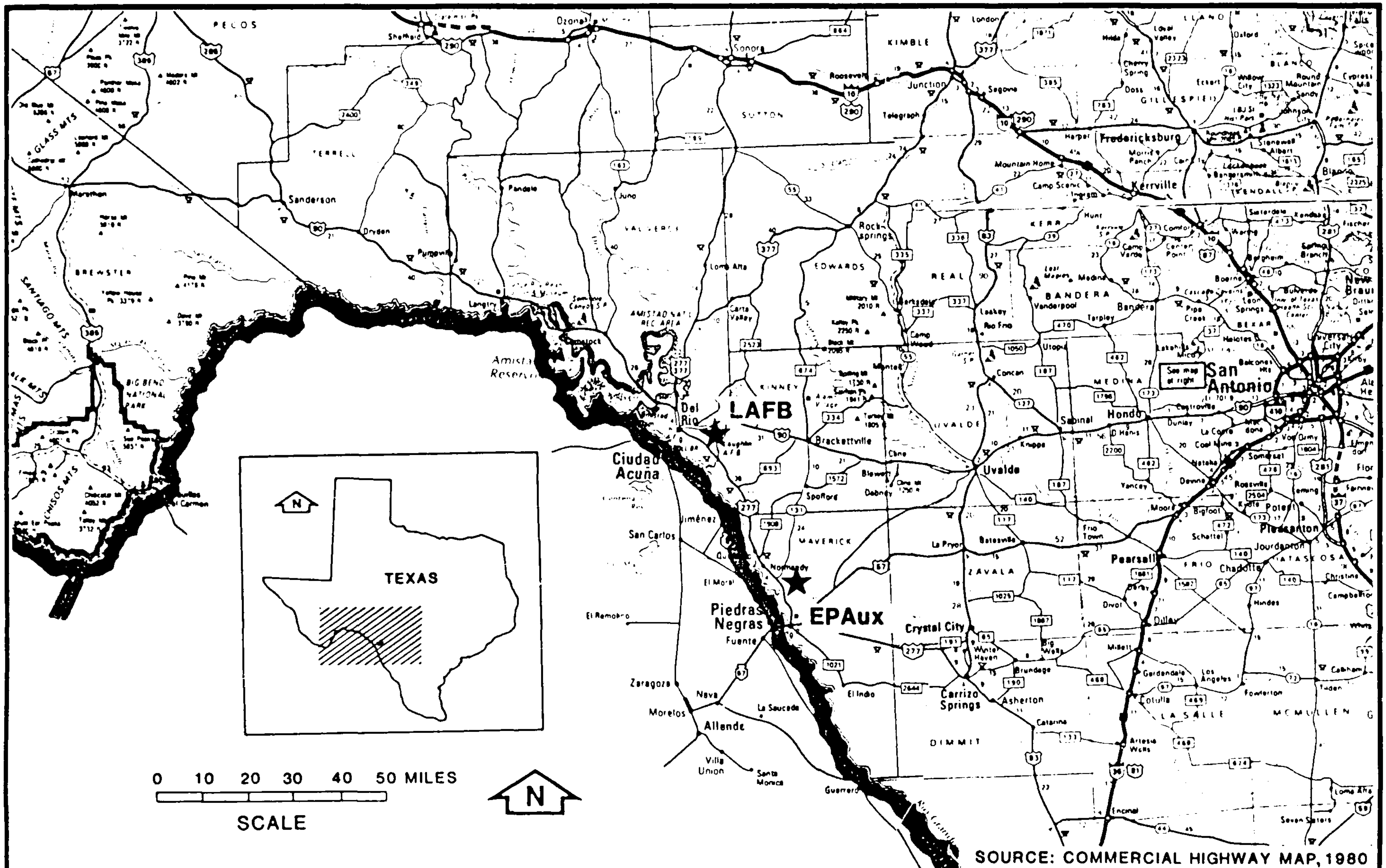


Figure 2.1-1
LOCATION MAP - LAFB AND EPAux

INSTALLATION RESTORATION PROGRAM
Laughlin Air Force Base

2.0 INSTALLATION DESCRIPTION

2.1 LOCATION/SIZE

LAFB is located in southwest Texas, Val Verde County, approximately 9 miles east of the city of Del Rio, Texas (Figure 2.1-1 through 2.1-4). The U.S.-Mexico border is approximately 6 miles south of LAFB and the nearest major metropolitan area (San Antonio) is located approximately 140 miles east-northeast (LAFB, 1978).

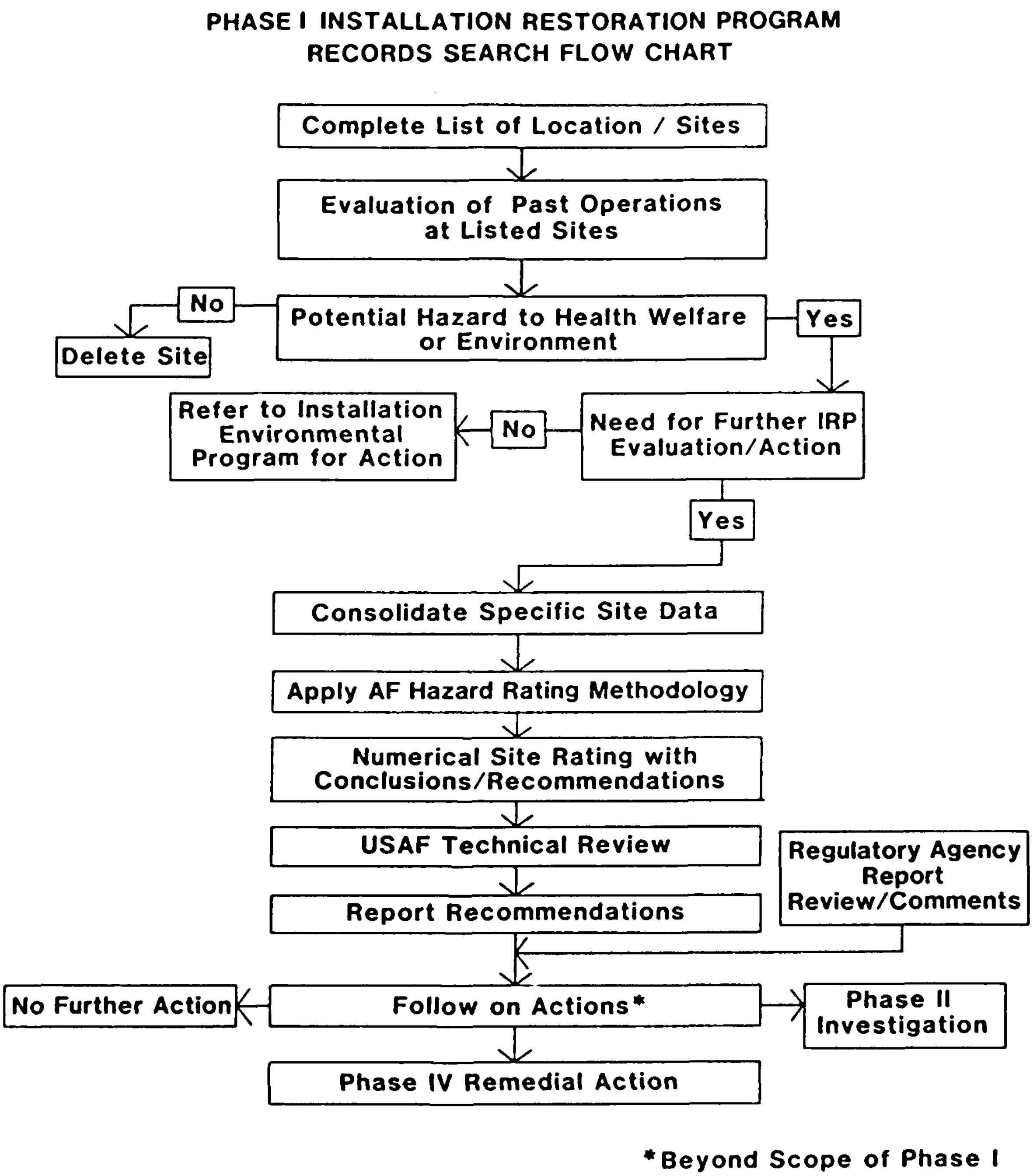
At present, LAFB consists of approximately 3,908 acres; all of which are owned by the USAF. The EPAux, located 55 miles south-southeast of LAFB consists of approximately 806 acres a majority of which is held in lease from Maverick County.

2.2 HISTORY

The following are key milestones in the history of LAFB and its missions (LAFB, 1978):

1. In 1942, LAFB was activated as an advanced pilot and crew training school.
2. From 1945 to 1952, LAFB was placed on inactive status.
3. In 1952, LAFB was reactivated with the activation of the 3646th Pilot Training Wing (later changed to 3445th Combat Crew Training Wing-Fighter); basic mission of jet fighter training.
4. In 1953, the base mission changed to jet transition and basic fighter-gunnery training which was limited to classroom instruction and static firing of guns for sighting purposes.
5. In 1955, LAFB mission became basic single engine pilot training, under command of Flying Training Air Force.
6. From 1957 to April 1962, LAFB operated under command of Strategic Air Command (SAC) with the primary mission of high altitude weather and intellegence reconnaisance.
7. In April 1962, the ATC assumed command of LAFB, activating the 3645th Pilot Training Wing (later designated 3646th Pilot Training Wing). The pilot training mission reactivated, and EPAux was activated during 1962.

were no further environmental concerns, the site was deleted. If the potential for contaminant migration was considered significant, the site was evaluated and prioritized using the Hazard Assessment Rating Methodology (HARM). A discussion of the HARM system is presented in Appendix F. The sites, which were evaluated using the HARM procedures, were also reviewed with regard to future land use restrictions.



SOURCE: AFESC, 1984

Figure 1.3-1
IRP RECORD SEARCH FORMAT

INSTALLATION RESTORATION PROGRAM
Laughlin Air Force Base

- Keith C. Govro, Ecologist, 9 years of professional experience.
- David H. Stephens, Geologist, 8 years of professional experience.

Detailed information on these individuals is presented in Appendix B.

1.3 METHODOLOGY

The methodology utilized in the LAFB records search began in September 1984 with a review of past and current industrial operations conducted at the base. Information was obtained from available records, such as shop files and real property files, as well as interviews with past and current base employees from the various operating areas. Interviewees included current and past Air Force personnel, and civilian employees. A list of interviewees by position and approximate years of service is presented in Appendix C.

The next step in the activity review was to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various operations on the base. Included in this part of the activities review was the identification of all known past disposal sites and other possible sources of contamination, such as spill areas.

A ground tour of the identified sites were then made by the ESE Project Team to gather site-specific information including: (1) visual evidence of environmental stress; (2) the presence of nearby drainage ditches or surface water bodies; and (3) visual inspection of these water bodies for any obvious signs of contamination or leachate migration.

Using the process shown in Figure 1.3-1, a decision was then made, based on all of the above information, regarding the potential for hazardous material contamination at any of the identified sites. If no potential existed, the site was deleted from further consideration. If potential for contamination was identified, the potential for migration of the contamination was assessed based on site-specific conditions. If there

Phase III - Technology Base Development

Phase IV - Operations/Remedial Actions

Environmental Science and Engineering, Inc. (ESE) conducted the records search at Laughlin Air Force Base (LAFB) and its subinstallation, Eagle Pass Auxiliary Field (EPAux), with funds provided by the Air Training Command (ATC). This report contains a summary and evaluation of the information collected during Phase I of the IRP and recommendations for any necessary Phase II action.

The objective of Phase I was to identify the potential for environmental contamination from past waste disposal practices at LAFB and EPAux and to assess the potential for contaminant migration. Activities performed in the Phase I study included the following:

1. Review of site records;
2. Interviews with personnel familiar with past generation and disposal activities;
3. Inventory of wastes;
4. Determination of estimated quantities and locations of current and past hazardous waste treatment, storage and disposal;
5. Definition of the environmental setting at the base;
6. Review of past disposal practices and methods;
7. Performance of field and aerial inspections;
8. Gathering of pertinent information from federal, state, and local agencies;
9. Assessment of potential for contaminant migration; and
10. Development of conclusions and recommendations for follow-on action.

ESE performed the onsite portion of the records search during September 1984. The following team of professionals was involved:

- Bruce N. McMaster, Ph.D., Senior Chemist and Project Manager, 16 years of professional experience.
- William G. Fraser, P.E., Environmental Engineer and Team Leader, 9 years of professional experience.

1.0 INTRODUCTION

1.1 BACKGROUND

Due to its primary mission, the U.S. Air Force (USAF) has long been engaged in operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of disposal sites and take action to eliminate the hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of the Act, Federal Agencies are directed to assist the U.S. Environmental Protection Agency (EPA) and under Section 3012, state agencies are required to inventory past disposal sites and make the information available to the requesting agencies. To assure compliance with these hazardous waste regulations, the Department of Defense (DOD) developed the Installation Restoration Program (IRP). The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated December 11, 1981, and implemented by USAF message, dated January 21, 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the IRP. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination and to control hazards to health and welfare that resulted from these past operations. The IRP will be the basis for response action on USAF installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as clarified by Executive Order 12316, and 40 CFR 300 Subpart F (National Oil and Hazardous Substances Contingency Plan). CERCLA is the primary legislation governing remedial action at past hazardous waste disposal sites.

1.2 PURPOSE, AUTHORITY, AND SCOPE OF THE ASSESSMENT

The IRP has been developed as a four-phase program, as follows:

Phase I - Initial Assessment/Records Search

Phase II - Confirmation and Quantification

Table ES-2. Summary of Recommended Monitoring for LAFB Phase II Investigations.

Site	HARM Score	Recommended Sampling	Recommended Analysis
Base Landfill	64	Three wells downgradient; One well upgradient; Water and sediment samples from drainage channel on north side.	Hydrocarbons, Solvents, Metals, PCB's, Pesticides
Old Industrial Waste Pond	63	Three boundary wells One upgradient well	Hydrocarbons Solvents
Defuel Pit	59	None	NA
DPDO	57	None	NA
Firefighter Training Area	52	Soil samples to six foot depth on line crossing pits and wells if significant contamination found.	Hydrocarbons, PCB's, Metals, Solvents
New Industrial Waste Pond	51	Soil samples from within ponds; Water and sediment from drainage channel at base boundary and south end of flightline.	Metals PCB's Pesticides
Sludge Disposal Area	44	Soil samples to six foot depth on line crossing area and wells if significant contamination found.	Hydrocarbons, metals
South Boundary Dike	41	None	NA
Supply Storage Area	39	None	NA

Source: ESE, 1984.

Supply Storage Area

The storage yard adjacent to Building 47 is used by base supply for material storage. Between 1973 and 1981, this area was used to store stocks of DDT which were on hand when use was discontinued. Approximately 40 drums of application strength liquid was held on the site. Correspondence files from this period indicate recurrent problems with the drums deteriorating and on several occations a transfer to new drums was required. Some limited leakage occurred. However, base personnel were aware of the potential hazard, the drums were inspected regularly, and no significant spills were reported. This site received a HARM rating of 39.

RECOMMENDATIONS

Table ES-2 summarizes recommendations for Phase II investigations at LAFB. No Phase II action is recommended for the South Boundary Dike, Defuel Pit, DPDO, or the Supply Storage Area. Limitations of the HARM rating system, most importantly the limited choices for containment factor result in these sites rating quite high. These ratings, when compared to those for the other areas, are not necessarily representative of relative hazards. This issue is discussed further in Section 4.4.

reported, and examination of the area produced not evidence of such incidents. HARM score for this site is 57.

Firefighter Training Area

The area utilized a surface depressions as firefighter training sites until 1983 when the current, fully contained, site was constructed. Fuels used in exercises included MOGAS, AVGAS, JP-4, JPTS, engine oil, transformer oil, and solvents. Surface soil permeability is 0.6 to 2.0 in/hr. Ground water conditions are not clearly defined. Soil contamination is likely, and some potential for migration exists. The HARM rating for this site is 52.

New Industrial Waste Pond

This pond was used to retain liquid waste and drainage from the flightline from 1972 to 1976. It was also used as a dumping area for chemical cleaning and plating shop wastes. Permeability of surface soils is 0.6 to 2.0 in/hr. Ground water conditions are unclear. Potential for migration exists, primarily for solvents and metals and possibly for oil and pesticides. The HARM score for this site is 51.

Sludge Disposal Area

This is a shallow, diked area which has historically been used as a dumping area for sludge generated during tank cleaning operations. Soil permeability is 0.6 to 2.0 in/hr. Ground water conditions are unclear. Soil contamination is likely, primarily from metals. Some potential for migration exists for JP-4 and metals. The HARM rating for this site is 44.

South Boundary Dike

Site of a one time dumping incident of three or four barrels of acetone, paint thinner, and waste paints in approximately 1974. The pond holds water intermittently and conditions at the time of dumping are unknown. No evidence of vegetative stress or surface strains were observed. HARM rating for this site is 41.

Table ES-1. Summary of HARM Scores

Rank	Site	Receptors Subscore	Waste Characteristics Subscore	Pathways Subscore	Waste Management Factor	Total Score
1	Base Landfill	61	75	56	1.0	64
2	Old Industrial Waste Pond	46	100	43	1.0	63
3	Defuel Pit	49	100	37	0.95	59
4	DPDO	62	80	37	0.95	57
5	Firefighter Training Area	43	75	48	0.95	52
6	New Industrial Waste Pond	46	60	48	1.0	51
7	Sludge Disposal Area	62	30	41	1.0	44
8	South Boundary Dike	46	34	43	1.0	41
9	Supply Storage Area	62	30	30	0.95	39

Source: ESE, 1984

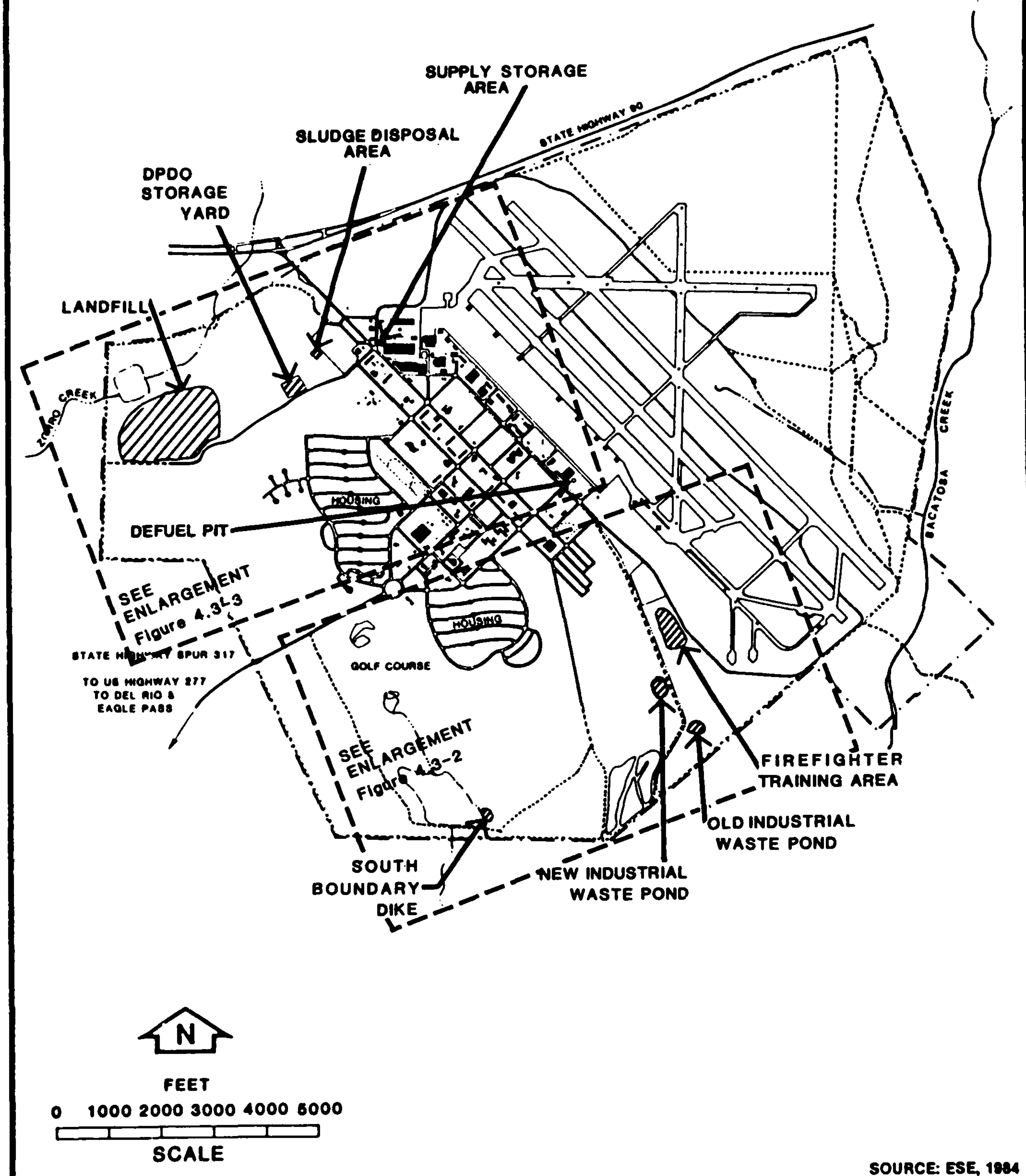


Figure ES-1 AREAS OF POTENTIAL CONTAMINATION	INSTALLATION RESTORATION PROGRAM Laughlin Air Force Base

handling and disposal practices. These sites are illustrated in Figure ES-1.

Of the nine areas of potential contamination identified, five were recommended for Phase II investigation. HARM Ratings for all sites are summarized in Table ES-1.

Base Landfill

This large area in the northwest corner of the base was used as a general purpose trench and fill landfill from the 1940's until 1974. It is located adjacent to an alluvial channel where subsurface movement of water across the base boundary is indicated. Some disposal of industrial liquid waste was reported. Potential exists for migration of solvents, oils, metals, and pesticides. Soil permeability ranges from <0.6 to 2.0 in/hr and the presence of fractured limestones and solution channels is probable. This site scored 64 on HARM.

Old Industrial Waste Pond

This borrow pit adjacent to the main flightline drainage channel was used as an industrial waste retention pond from at least 1952 to 1976. It continued to be used as a dumping area for liquid waste until 1980. Permeability of soils is 0.6 to 2.0 inches per hour (in/hr). Ground water conditions are unclear. Potential exists for contaminant migration, primarily involving metal plating and paint wastes and some oil, solvent, and pesticides. The HARM score for this site is 63.

Defuel Pit

Underground steel tank which was apparently part of the original base construction. Used as a container for various waste liquids and fuels. Condition of the tank is unknown and no leak check records were found. Based on the available evidence the HARM score is 59.

DPDO Storage Yard

This area is listed as potentially contaminated due to the storage of hazardous waste. The existing storage area consists of a concrete pad equipped for runoff control. No spills or contaminant release were

1967, but only reached the current level of activity in 1977 when a program to repaint the entire fleet was initiated. Metal plating/treatment waste is generated at the metal finishing and chemical cleaning shops and consists of chromic acid, potassium permanganate, cadmium, and descaling solutions.

The general trend in waste disposal practices over the years since LAFB first began operation has been from largely unsegregated disposal in the base landfill toward extensive waste segregation and contract disposal. Prior to 1961, it was reported that no systematic waste segregation was practiced, and containerized liquids from industrial operations were routinely buried in the base landfill.

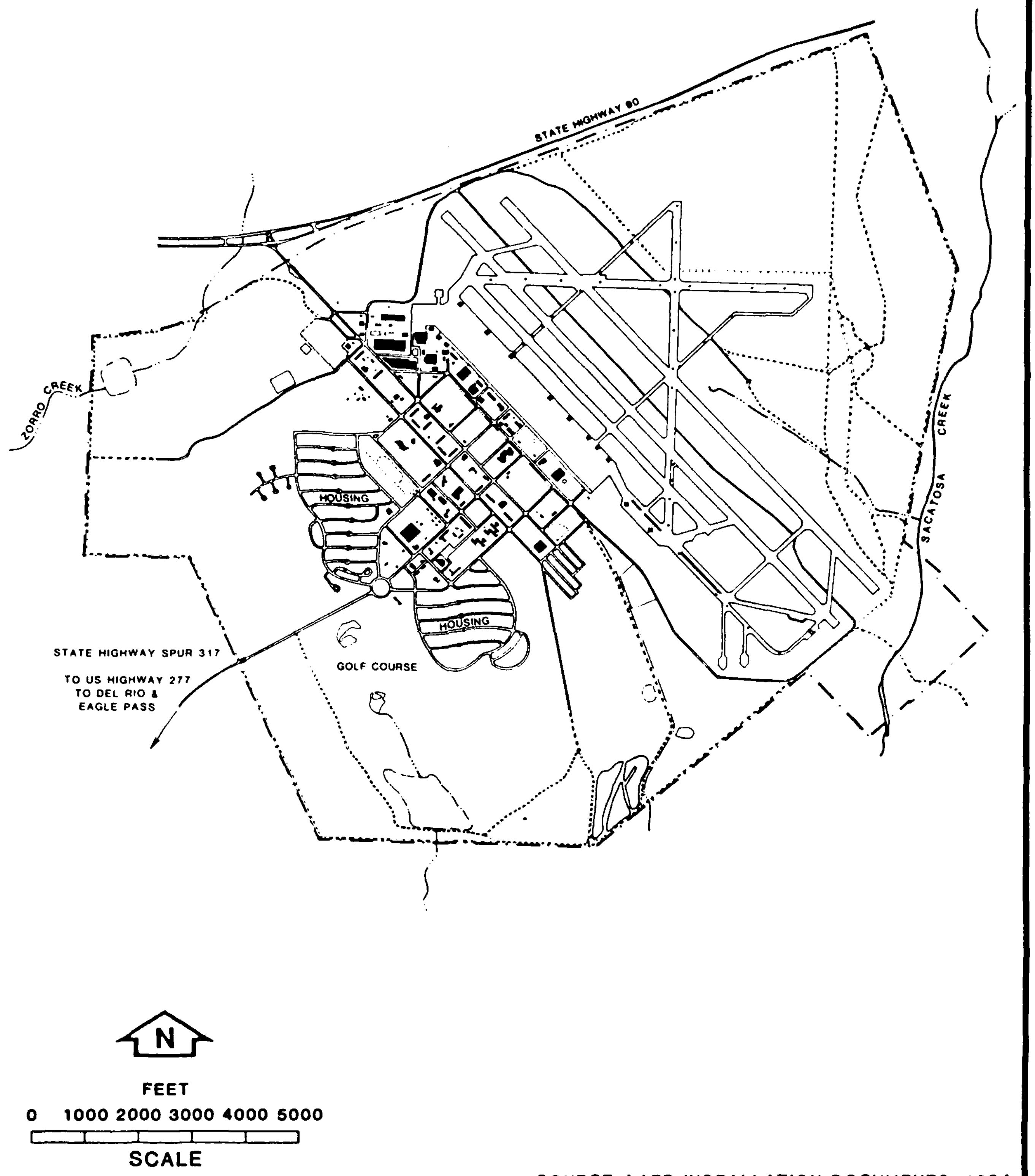
During the period of 1957 to 1961, disposal pits were sometimes dug in the base landfill area. The material disposed of in these pits reportedly consisted of some drummed waste and bulk liquids. Landfilling on the base was restricted to rubble only as of 1974.

Waste disposal practices at LAFB changed substantially during the 1970's. Collection of waste fuel, oils, and solvents for contract reclamation off-base was initiated, and the current system for contract disposal of unusable quantities began. In 1974, flammable liquids used in fire training was restricted to JP-4 only, and the existing lined firefighter training pit was constructed in 1983.

By approximately 1980, the present system of solid waste segregation and disposal eliminated the need for on base disposal of industrial waste. Wastes are containerized in 55 gallon drums, labeled according to Department of Transportation (DOT) and U.S. Environmental Protection Agency (EPA) regulations, and held at the hazardous waste storage area in the Defense Property Disposal Office (DPDO) compound.

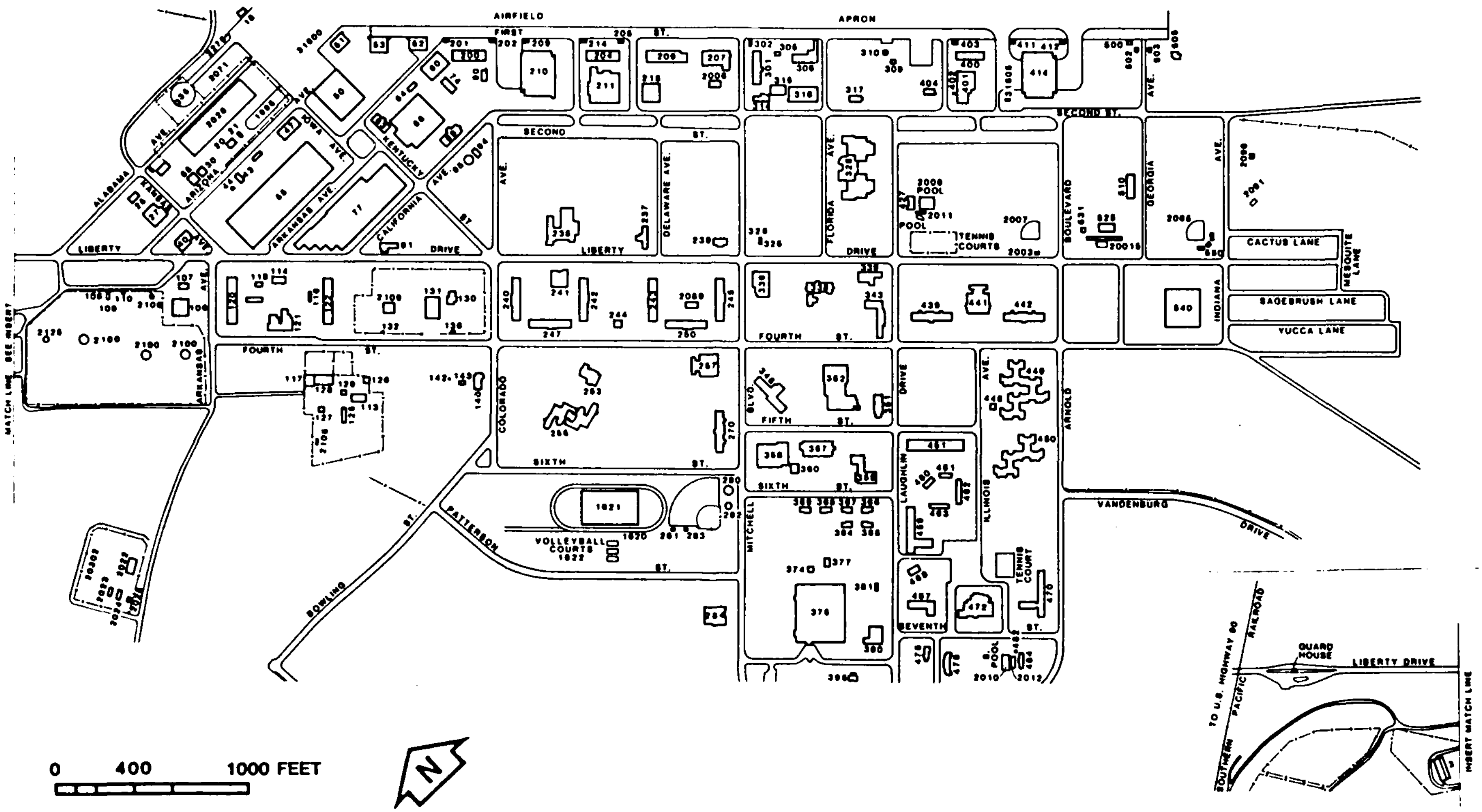
CONCLUSIONS

This study identified nine areas on LAFB subject to potential contamination by industrial and/or hazardous waste as a result of



SOURCE: LAFB INSTALLATION DOCUMENTS, 1984

Figure 2.1-2 SITE PLAN - LAFB	INSTALLATION RESTORATION PROGRAM Laughlin Air Force Base



SOURCE: LAFB INSTALLATION DOCUMENTS, 1984

Figure 2.1-3
OPERATING AREA - LAFB

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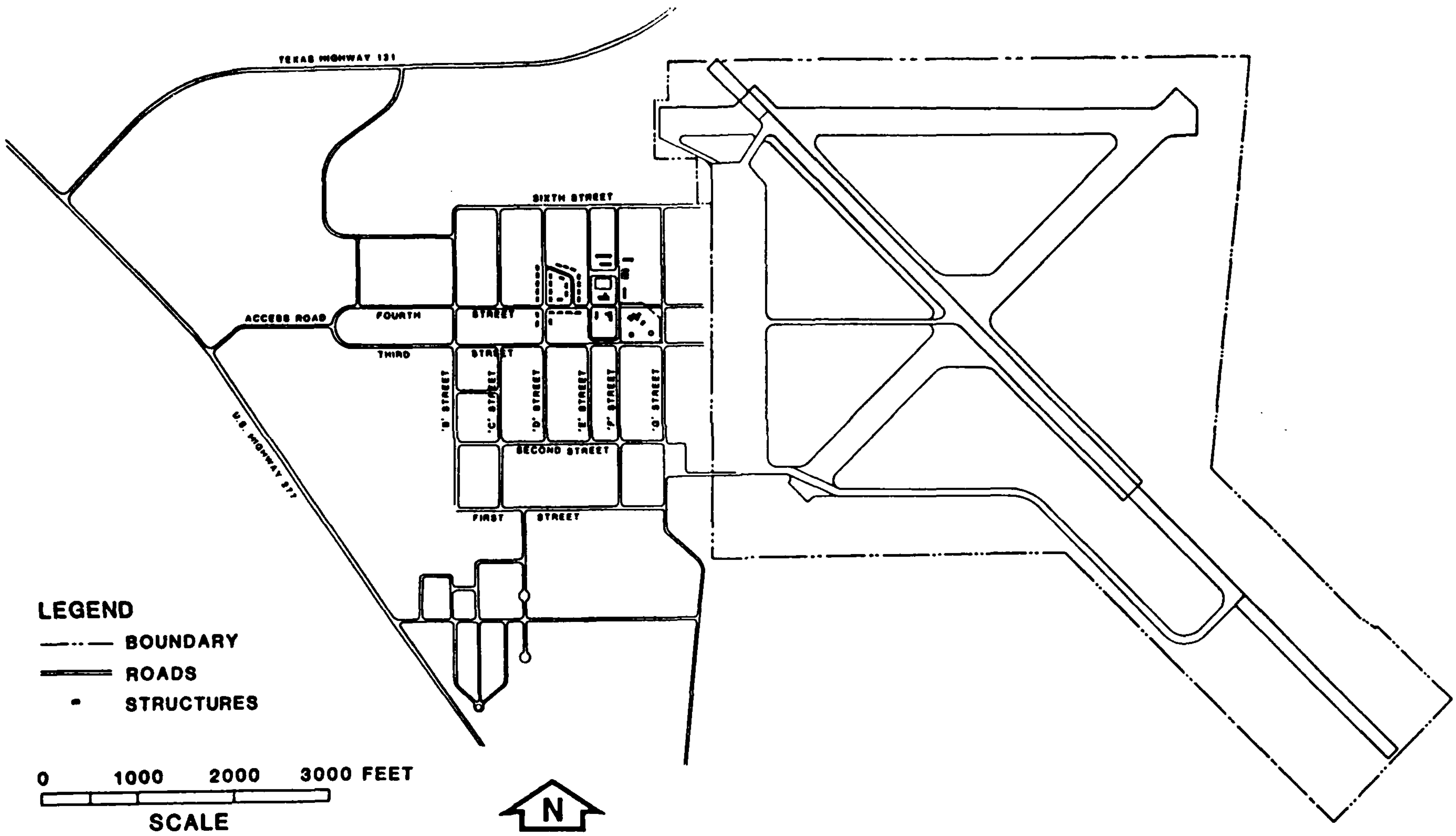

SOURCE: LAFB INSTALLATION DOCUMENTS, 1984

Figure 2.1-4
GENERAL SITE PLAN - EPAux

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8. In 1972, the 47th Flying Training Wing was activated, and the 3646th Pilot Training Wing inactivated.

Since April 1962, the primary mission of LAFB has been pilot training. The only significant changes in mission-related operations have been in training load and in airplane types.

There have been no changes in LAFB boundaries or acreage since activation in 1942. EPAux was acquired and activated in 1962, with 100 acres purchased by the USAF and 706 acres leased from Maverick County.

2.3 ORGANIZATION AND MISSION

The primary mission of the wing is to conduct the undergraduate flight training program. Flight training is conducted by the 85th and 86th Flying Training Squadrons. Maintenance, supply, and engineering services are provided by squadrons within the 47th Wing. All other support and administrative services necessary to mission accomplishment are provided by divisions within the wing (LAFB, 1978).

The 11-month undergraduate pilot training program consists of 175 hours of flying, 367 hours of academic training, and 134 hours of officer training, the accumulation of which qualifies the student as an Air Force pilot. Students start their academic instruction with flight physiology and aircraft systems training. Jet flying starts during the fourth week of training. In the second phase, the students fly the Cessna T-37, a small twin engine jet trainer with a top speed of 350 miles per hour (mph) and a ceiling of 25,000 feet (ft). Each student receives 32 hours of instrument flight simulator training during the T-37 phase. The five-month third phase of training is given in the Northrop T-38 Talon jet trainer. It is a supersonic plane with a top speed of 800 mph and a ceiling of 39,000 ft. The academic and flying training in the third phase includes 34 hours in the T-38 instrument flight simulator.

LAFB trains over 400 pilots per year. The working population at the base is approximately 3,000. Air Force personnel and dependents living on base total approximately 2,500.

2.4 MAJOR TENANTS

The following are brief mission statement for the major tenants at LAFB (LAFB, 1978):

Detachment 1014 - Air Force Office of Special Investigations - Provides criminal counterintelligence, internal security and special investigative services for all Air Force activities.

Area Defense Counsel - Provides independent defense counsel for military personnel involved with military justice problems.

2108 Communications Squadron - Provides communications electronic services, air traffic control services, and air navigational aids systems to LAFB.

Defense Investigative Service - Conducts, directs, and controls personal security investigations.

Detachment 410 - Field Training Detachment - provides training on weapons systems and associated aerospace ground equipment.

Detachment 9/3314 Management Engineering Squadron - Provides manpower and management consultant services to LAFB operation personnel.

Defense Property Disposal Office - Receives and disposes of excess or surplus government property.

Detachment 20, 24 Weather Squadron - Provides meteorological services to LAFB.

3.0 ENVIRONMENTAL SETTING

3.1 METEOROLOGY

The climate of LAFB would be described as semiarid, indicating the predominance of warm dry weather. The average annual maximum temperature is 80 degrees Fahrenheit (°F), the average annual minimum temperature is 59°F. The historical range is 8 to 110°F. In general, July and August are the warmest months while January and February are the coolest. On the average there are only 14 days per year on which the temperature falls below 32°F (LAFB, 1979).

Precipitation averages approximately 18 inches per year (in/yr), a majority as rain. Only traces of snow and an occasional hailstorm occur. Approximately one-quarter of the precipitation falls in May and June, with the winter months being the driest months (LAFB, 1979).

Wind speeds average 7.6 knots. The prevailing wind direction is southeast-east/southeast (LAFB, 1979). Meteorologic data is summarized in Table 3.1-1.

3.2 GEOGRAPHY

3.2.1 PHYSIOGRAPHY

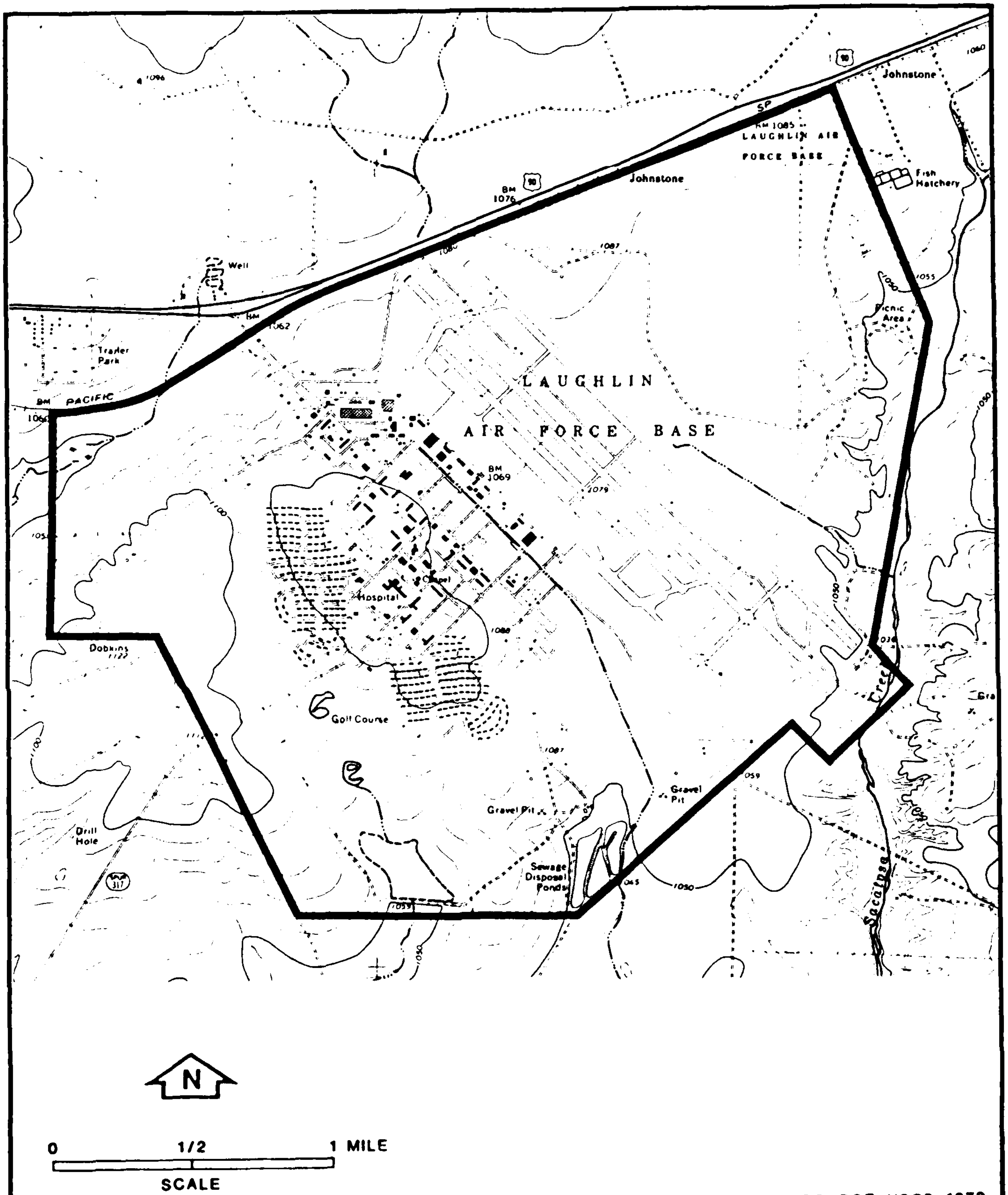
LAFB lies within the Rio Grande Plain subdivision of the Gulf Coastal Plain physiographic province. The topography of LAFB is flat to gently rolling with very little relief (Figure 3.2-1). Elevations range from 1,038 ft [mean sea level (msl)] to 1,130 ft (msl). The lower elevations are found along the east/southeast boundary of the base and the higher elevations along the western boundary of the base.

The airfield and cantonment areas are generally quite level and flat, due primarily to construction grading. Outlying areas exhibit more topography, especially in the northwest corner of the site.

Table 3.1-1. LAFB Climatic Summary

Month	Mean Daily		Precipitation (in)
	Minimum	Maximum	Mean
January	41	62	0.8
February	45	67	1.1
March	52	75	0.6
April	60	83	1.7
May	67	88	2.2
June	73	93	2.3
July	75	96	1.9
August	75	95	1.9
September	70	90	2.1
October	61	81	2.3
November	49	70	0.7
December	43	63	0.6
Annual	59	80	18.1

Source: LAFB Master Plan 1981, Attachment No. 15--Meteorological Data.



SOURCE: USGS, 1972

Figure 3.2-1
TOPOGRAPHIC MAP OF LAFB,
DEL RIO, TEXAS

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3.2.2 SURFACE HYDROLOGY

No permanent streams exist on LAFB. Three drainageways (or intermittent streams) provide for the majority of surface water drainage on the base (Figure 3.2-2).

The main drainage from the flightline and cantonment area is an improved ditch originally constructed as part of an industrial waste handling system. Currently, the ditch carries only stormwater flow and exits LAFB at its southeastern boundary, flowing approximately 3 miles south through an unnamed channel to its confluence with Sacatosa Creek. Eastern portions of the base flow are directed to Sacatosa Creek through a number of poorly defined surface channels. Sacatosa Creek flows due south approximately 9 miles to a confluence with the Rio Grande.

The family housing area and southwest portions of the base drain through the golf course area, exiting LAFB through the former lake bed along the southwestern boundary. This unnamed channel continues south for approximately 7 miles before reaching the Rio Grande.

The third drainage includes areas along the northern base boundary including the northern portion of the cantonment area. These areas drain to Zorro Creek, an intermittent stream which crosses the northwest corner of the base. Zorro Creek flows generally south-southwest approximately 7 miles to the Rio Grande.

3.3 GEOLOGY

3.3.1 GEOLOGIC SETTING

LAFB is located within the geologic province of the Devils River Uplift, a subsurface basement tectonic high of late Paleozoic Age (Figure 3.3-1). The structure is some 60 miles long and 18 miles wide and trends northwest-southeast (Figure 3.3-2). Maximum subsurface displacement along the boundary faults ranges from 1,000 to 15,000 ft (Figure 3.3-3).

Rocks of the Precambrian Age are the oldest rocks associated with the Devils River Uplift. Igneous and sedimentary rocks which were metamorphosed during the Paleozic form the core of the structure and

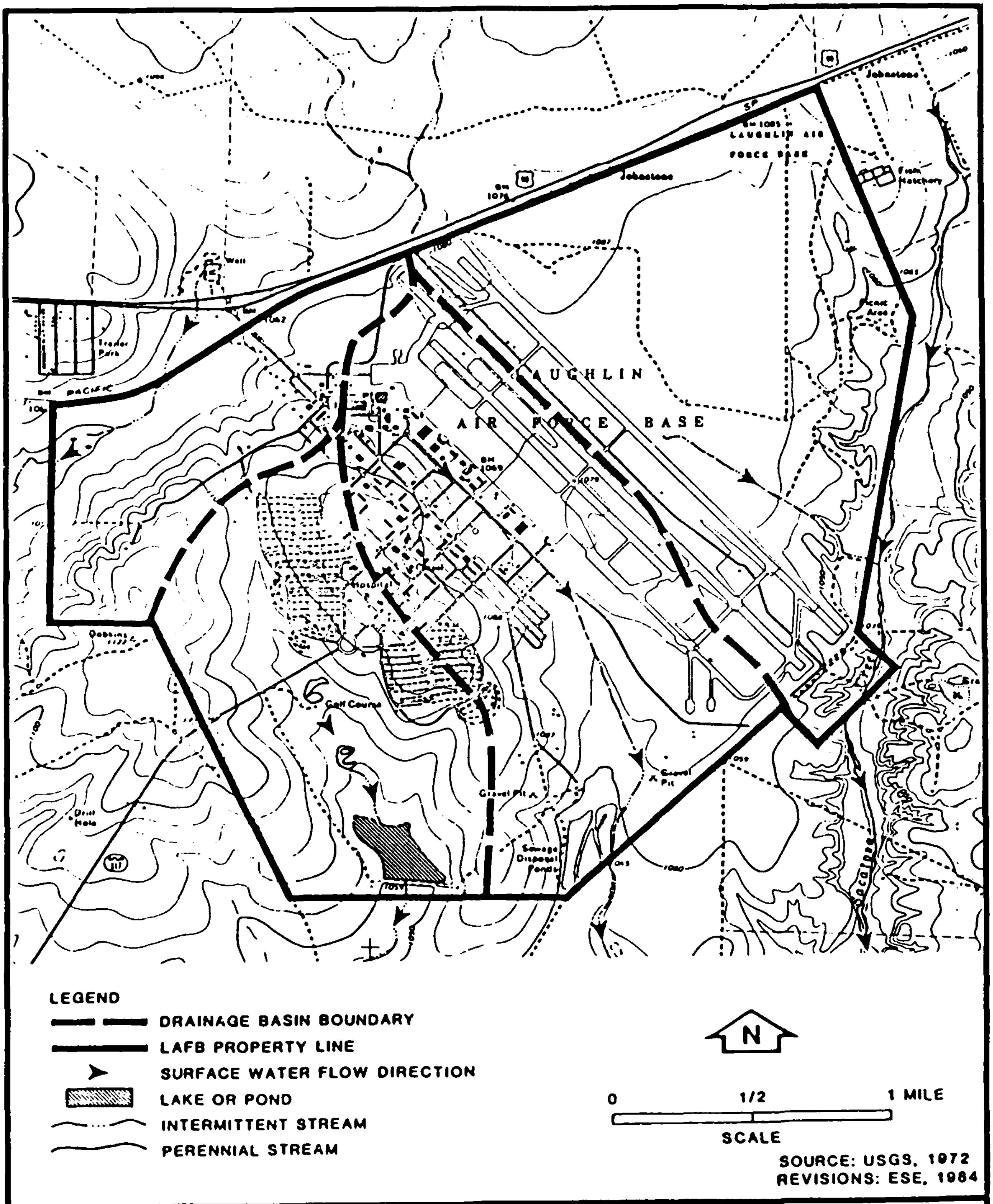

Figure 3.2-2
SURFACE WATER DRAINAGE
LAFB, DEL RIO, TEXAS

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ERA	SYSTEM and PERIOD	SERIES and EPOCH	STAGE and AGE: North American	STAGE and AGE: Europe	ABSOLUTE AGE
Cenozoic	Quaternary	Recent			(Duration in years[1] Approximately the last 10,000 years
		Pleistocene	In glaciated regions (Glacial stages underlined)		
			Wisconsin Wurm		10,000 ± to 35,000 years ago
			Sangamon Illinoisan Yarmouth Kansan Aftonian Nebraskan	Wurm-Riss Riss Riss-Mindel Mindel Mindel–Gunz Gunz	
	Tertiary	Pliocene	(Atlantic and Gulf Coast)[6] Upper	(Europe) Astian	(Million of years ago)
			Lower	Plaisancian	
		Miocene	Upper	Sarmatian: Pontian, Samatian	21
			Middle	Tortonian Helvetian	
			Lower	Burdigalian Aquitanian	
		Oligocene	Upper Middle Lower	Chattian Rupelian Tongrian	
		Eocene	Jackson	Ludian Bartonian	39
			Claiborne	Auversian Lutetian	
			Wilcox	Cuisain Ypresian	
		Paleocene	Midway	Thanetian Montian	60
Mesozoic	Cretaceous	Upper (Late)	No accepted classification for North America generally. These European names commonly used in North America also	Maestrichtian Campanian Santonian Coniacian Turonian Cenomanian	70 70 90
		Lower (Early)		Albian Aptian Hauterivian Valanginian Berriasian	
	Jurassic	Upper (Late)		Purbeckian Portlandian Kimeridgian Oxfordian	140
		Middle (Middle)		Callovian Bathonian Bajocian	
		Lower (Early)		Toarcian Pliensbachian Sinemurian Hettangian	
	Triassic	Upper (Late) Middle (Middle)		Rhaetian Norian Carnian Ladinian Anisian	
		Lower (Early)		Scythian	

SOURCE: AMERICAN GEOLOGIC INSTITUTE, 1965

Figure 3.3-1
GEOLOGIC TIME SCALE
(PAGE 1 OF 2)

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ERA	SYSTEM and PERIOD	VARIED SUBDIVISIONS			ABSOLUTE AGE (Millions of years ago)
		SERIES & EPOCH	STAGE and AGE		
Paleozoic	Permian	(West Texas) Ochoa Guadelupe Leonard Wolfcamp	Not established in North America	(Russia) Kazanian Kungurian Artinskian Sakmarian	220
Paleozoic	Carboniferous Systems: Pennsylvanian	(Central North America) Virgil Missouri Des Moines Atoka Morrow	Not established	(Europe) Stephanian Westphalian Upper Namurian	
Paleozoic	Carboniferous Systems: Mississippian	Chester Meramec Osage Kinderhook	Not established	Lower Namurian Visean Tournaisian	
		SERIES & EPOCH		STAGE and AGE	
Paleozoic	Devonian	(Eastern United States) Bradfordian Chautauquan Senecan Erian Ulsterian	Conewango Cassadaga Chemung Finger Lakes Taghanic Tioghnioga Cazenovia Onesquethaw Deerpark Helderberg	(Europe) Famennian Frasnian Givetian Eifelian Coblenzian Gedinnian	270
		SERIES & EPOCH		STAGE and AGE	
Paleozoic	Silurian	(North America) Cayugan Niagaran Albion	(Britian) Downtonian Ludlovian Weniockian Valentian	Not established	
		SERIES & EPOCH	STAGE and AGE	SERIES and EPOCH	
Paleozoic	Ordovician	(North American) Cincinnatian Champlainian Canadian	Gamachian Richmondian Maysvillian Edenian Moawkian Chazyan Not established	(Britain) Ashgillian Caradocian Llandeilian Skiddavian Tremadocian	375
Paleozoic	Cambrian	Croixan Albertan Waucaban	Not established	Not established	440 470
Precambrian	(No bases for worldwide divisions)	Latest Precambrian (?) (Wichita Mountains, Oklahoma)			550
Precambrian	(No bases for worldwide divisions)	(Minnesota Scale) Keweenawan Group Pre-Keweenawan orogeny Animikie Group Algoman orogeny Knife Lake Group "Laurentian" orogeny Keewatin Group			1100 1700 2300 2700
Precambrian	(No bases for worldwide divisions)	Oldest radiogenic date reported (Southern Rhodesia)			3310

SOURCE: AMERICAN GEOLOGIC INSTITUTE, 1965

Figure 3.3-1
GEOLOGIC TIME SCALE
(PAGE 2 OF 2)

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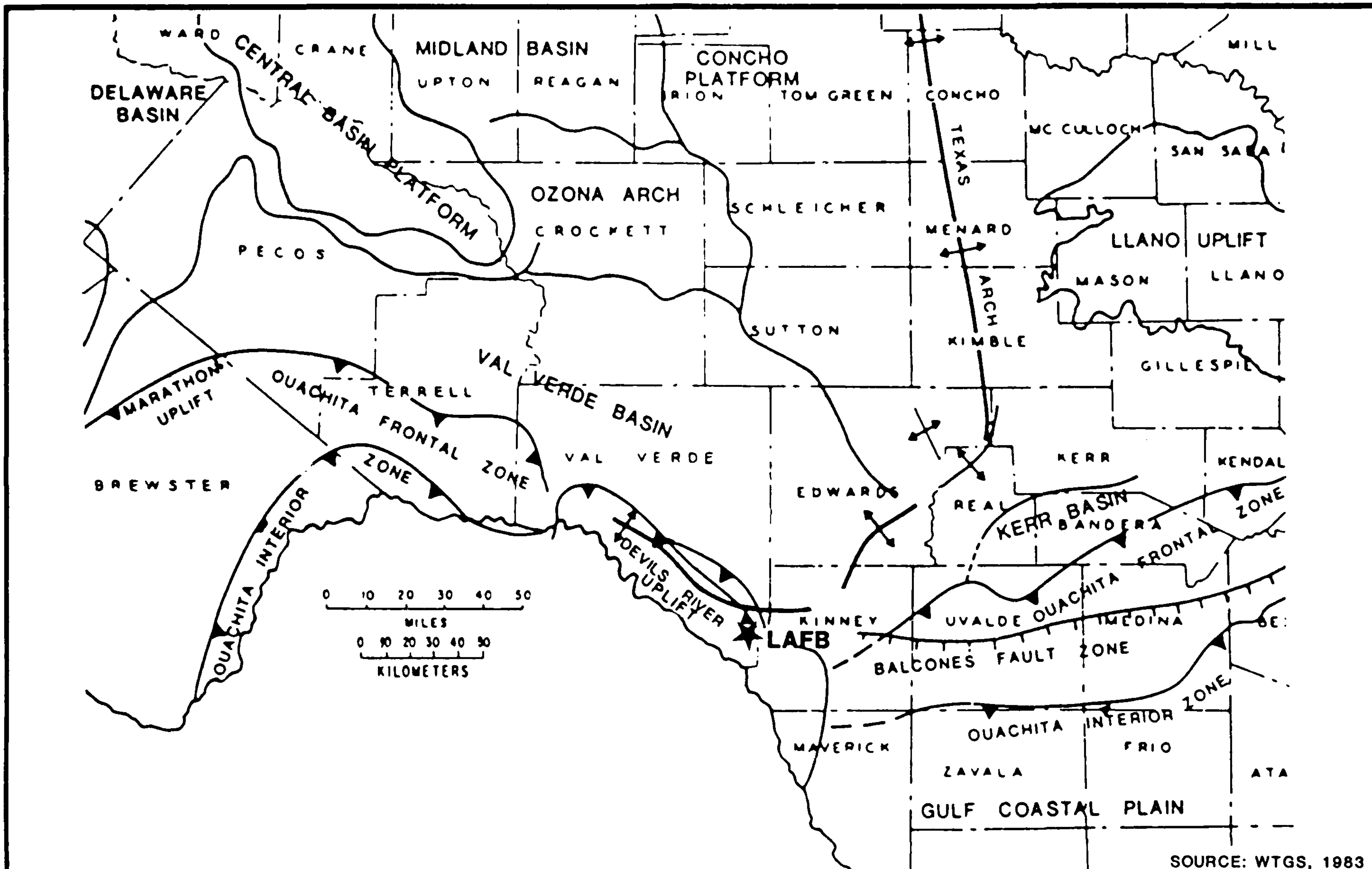

Figure 3.3-2
MAJOR STRUCTURAL ELEMENTS OF
SOUTHWEST TEXAS

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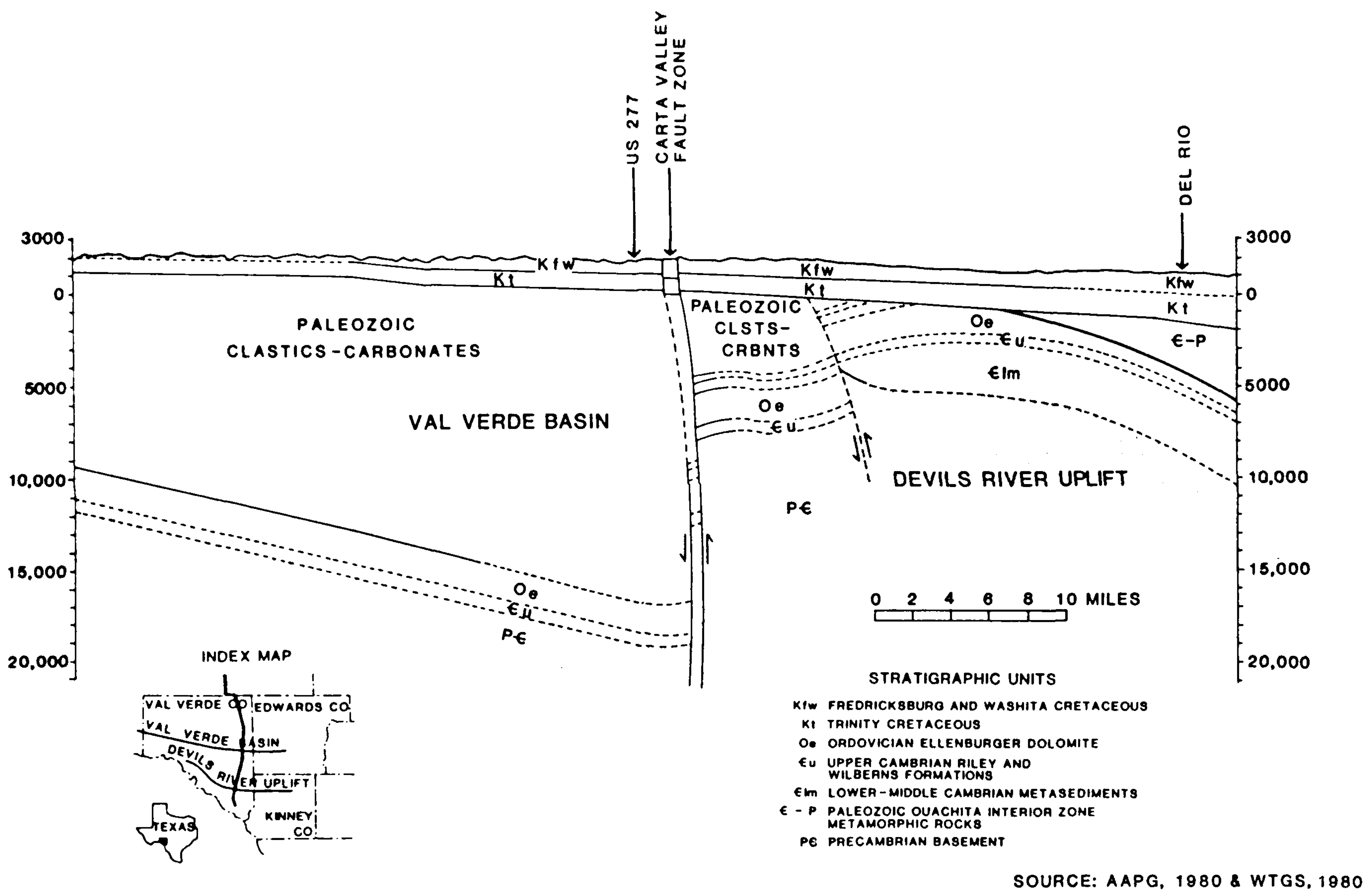

Figure 3.3-3
CROSS SECTION OF VAL VERDE BASIN - DEVILS RIVER UPLIFT

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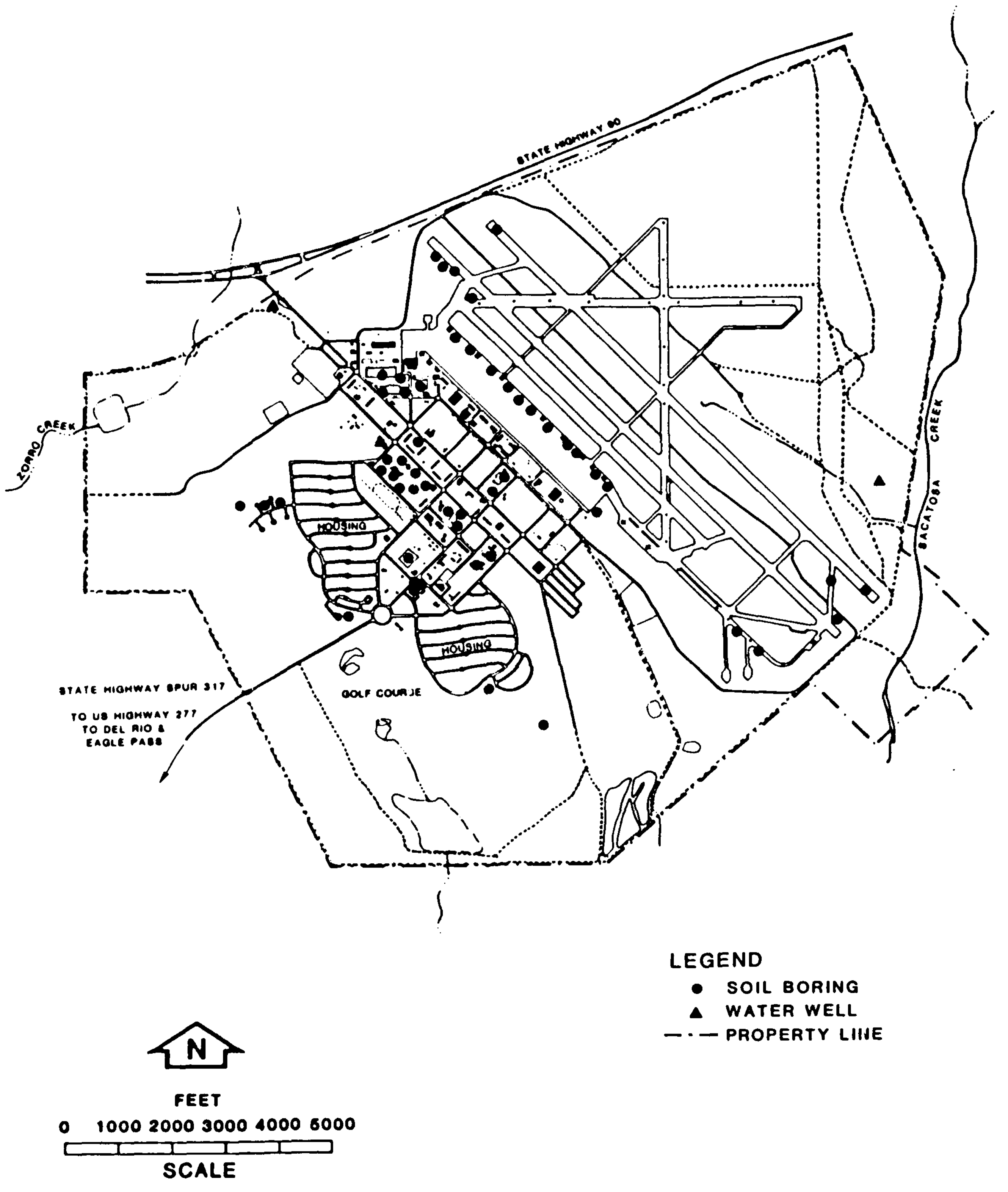
Table 3.3-2. Stratigraphic Units and Their Water-Bearing Properties (Page 1 of 2)

System	Series or Group	Stratigraphic Unit	Approximate Maximum Thickness (ft)	Character of Rocks	Water-Bearing Properties
Quaternary	Pleistocene or Holocene	Alluvium	50	Clay, silt, sand and gravel.	Yields very small to moderate quantities of fresh water to a few domestic and livestock wells along the major streams.
Cretaceous	Gulf Series				
		Austin Halk	200	Thin to thick-bedded limestone and thin beds shaly limestone.	Not known to yield water to wells Val Verde County.
		Boquillas Flags	258+	Thin- to medium-bedded sandy limestone and thin beds of black calcareous shale.	Yields very small quantities of fresh to slightly saline water to a few livestock wells
	Comanche Series				
	Washita Group				
		Buda Limestone	90	Hard, porcelaneous and marly limestones.	Yields very small quantities of fresh water to a few domestic and livestock wells in Val Verde and Kinney Counties.
		Del Rio	136+	Shale and thin beds of arenaceous limestone and sandstone.	Not known to yield water to wells.
		Salmon Peak	500+	Hard, massive limestone with thin stringers of shale; contains chert nodules and pyrite.	One of the principal aquifers in the county. Yields very small to large quantities of fresh water to livestock, domestic, irrigation, industrial and public supply wells in the southern part of the county.
	Comanche Series				
	Fredericksburg Group				
		McKnight	283	Shaly limestone, calcareous shale, chert, and gypsum.	Generally yields small quantities of slightly to moderately saline water in the southern part of the county. Fresh water may be obtained from wells near the up-dip limits of the formation.



SOURCE: LAFB INSTALLATION DOCUMENTS, 1984

Figure 3.3-8
LOCATION MAP-SOIL BORINGS AND WATER WELLS - LAFB, DEL RIO, TEXAS

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Table 3.3-1. Soil Characteristics and Properties

	% Clay <2mm	Permeability(1) In/Hr	Available Water Capacity(2) In/In	pH(3)	Hydrologic(4) Unit
Olmos	18-34	0.6-2.0	0.05-0.10	7.9-8.4	C
Acuna	35-55	0.6-2.0	0.12-0.20	7.9-8.4	C
Coahulia	25-50	0.6-2.0	0.12-0.17	7.9-8.4	B
Felipe	32-55	<.06-0.6	0.07-0.20	7.9-8.4	D
Vinegarroon	20-40	0.6-2.0	0.12-0.18	7.9-8.4	C
Valverde	22-40	0.6-2.0	0.15-0.20	7.9-8.4	B
Tobosa	35-60	<.06	0.10-0.18	7.9-8.4	D
Zapata	18-34	0.6-2.0	0.10-0.15	7.9-8.4	C
Zorra	19-34	0.6-2.0	0.03-0.11	7.9-8.4	D
Pintas	35-55	0.6-2.0	0.15-0.20	7.9-8.4	B

(1) Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour thatwater moves through the soil. Terms describing permeability are very low (less that 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

(2) Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

	Inches
Very Low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

(3) pH value. A numerical designation of acidity and alkalinity in soil.

(4) Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential.a They are mainly deep, well drained, and sandy or gravelly. In Group D, at the other extreme, are soils having a very slow inflitration rate and thus a high runoff potential. They have a clay pan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artifically drained and part is undrained.

Source: USSCS, 1982.

Soil characteristics and properties are summarized in Table 3.3-1.

Subsurface data obtained from some fifty-four soil borings scattered across the base tend to support the above discussions (Figure 3.3-8). Borings were completed at various times during base operation and inconsistancies in information are somewhat common. In general, the borings indicate predominantly clayey and loamy soils with occassional gravel sequences formed on limy (caliche or limestone) surfaces. Soils are moderately alkaline, possess very slow to moderate permeabilities ranging from 0.06 to 2.0 in/hr and exhibit moderate to high runoff potentials (see Table 3.3-1).

3.3.3 GEOHYDROLOGY

Major water-bearing units in the area of LAFB are the limestone and dolomite rocks of Cretaceous Age and, to a lesser extent, Quarternary alluvium in the form of floodplain and terrace deposits. With the exception of the "Basement Sands" of the Trinity Group, the Del Rio Clay of the Washita Group and the Austin Chalk, the remaining Cretaceous strata yield water of various quantity and quality to wells in the area (Table 3.3-2). Principal aquifers are the prolific Lower Cretaceous West Nueces and Salmon Peak Formations.

Precipitation is the source of ground water recharge in the area of LAFB. Recharge to the major aquifers occurs mainly through a direct infiltration of precipitation on the land surface and by streamflow across the outcrop areas. Tectonic activity and the limy nature of the strata have formed a system characterized by solution-widened faults, fractures and joints in the subsurface as well as a karst surface expression. The features represent a network which readily permits infiltration of ground water. Some minor recharge is accomplished locally through interformational leakage.

The regional hydraulic gradient is to the south-southwest and is dictated by the dip (40 to 70 ft/mile) of the water bearing formations (Figures 3.3-9 and 3.3-10). Ground water travels down the hydraulic gradient under the influence of gravity through a system of interconnected voids microdepressions. Distance between the microknolls and microdepressions ranges from 12 to 24 ft. When the soil is dry, cracks 0.5- to 1.5-in wide extend from the surface into the AC horizon. Pressure faces on peds begin at a depth of 20- to 30-in.

Zapata: The Zapata series consists of gravelly and loamy soils on uplands. These soils are very shallow and well drained. They formed in loamy outwash sediment over thick beds of caliche. Slope ranges from 1 to 5 percent. The solum thickness, or depth to indurated or strongly cemented caliche, ranges from 2- to 10-in. Calcium carbonate equivalent in the fine earth fraction is 40 to 60 percent. The fine earth fraction is 20 to 40 percent total clay and 5 to 25 percent noncarbonate clay.

Zorra: The Zorra series consists of very stony and stony loamy soils on uplands. These soils are very shallow and shallow and are well drained. They are underlain by a thin layer of caliche above limestone bedrock. Slope ranges from 1 to 40 percent. The solum thickness, or depth to indurated caliche, is 4- to 20-in. Carbonate accumulations smaller than 20 mm make up more than 40 percent by weight of the whole soil. The fine earth fraction of the control section is 15 to 40 percent total clay and 15 to 32 percent noncarbonate clay.

Pintas: The Pintas series consists of deep, somewhat poorly drained soils on bottom lands. The soils formed in calcareous clayey alluvium. The water table fluctuates between depths of 1 to 6 ft. Slope ranges from 0 to 1 percent. The solum ranges from 22- to 40-in in thickness. Calcium carbonate equivalent in the 10- to 40-in control section is 40 to 70 percent. The control section is 50 to 70 percent total clay and 35 to 50 percent noncarbonate clay. Secondary carbonates in the form of threads, films, soft masses, and concretions make up less than 5 percent by volume of any horizon that has its upper boundary within 16-in of the surface.

Felipe: The Felipe series consists of very gravelly clayey soils on the side of hills on uplands. These soils are shallow and well drained. They formed in shaly clay. Slope ranges from 8 to 40 percent. The solum thickness, or depth to shale or shaly silty clay, ranges from 10- to 20-in. Calcium carbonate equivalent in the control section is 15 to 39 percent. The fine earth fraction of the control section is 40 to 60 percent total clay and 35 to 55 percent noncarbonate clay.

Vinegarroon: The Vinegarroon series consists of gravelly and loamy soils on uplands. These soils are shallow and well drained. They formed in loamy outwash sediment over thick beds of caliche. Slope ranges from 1 to 5 percent. The solum thickness, or depth to indurated caliche, ranges from 10- to 20-in. Calcium carbonate equivalent is 40 to 60 percent of the material less than 20 mm in size. The fine earth fraction of the control section is 20 to 40 percent total clay and 5 to 25 percent noncarbonate clay. Coarse fragments make up 0 to 30 percent by volume of the control section. The A and B horizons are loam, clay loam, gravelly loam, or gravelly clay loam.

Valverde: The Valverde series consists of deep, well drained soils on uplands. These soils formed in calcareous loamy outwash sediment over limestone bedrock. Slope ranges from 0 to 3 percent. The solum thickness, or depth to limestone or interbedded limestone, marl, and shale, ranges from 40- to 60-in. Calcium carbonate equivalent in the 10- to 40-in control section is 40 to 60 percent. The control section is 30 to 55 percent total clay and 18 to 35 percent noncarbonate clay.

Tobosa: The Tobosa series consists of clayey soils in narrow drainageways and shallow depressions on uplands. These soils are deep and well drained. They formed in calcareous, clayey alluvium. These soils crack when dry and have gilgai microrelief. Slope ranges from 0 to 1 percent. The solum ranges from 40- to 60-in in thickness. The fine earth fraction of the control section is 50 to 70 percent total clay and 45 to 60 percent noncarbonate clay. Some pedons contain 5 to 15 percent by volume limestone gravel. In undisturbed areas, gilgai microrelief consists of microknolls that are 3- to 8-in higher than the level to sloping soils on a series of old outwash deposits on nearly level to sloping valley fills and low hills. Other, less extensive components are Felipe, Vinegarroon, Valverde, Tobosa, Zapata, and Zorra soils. The Pintas clay is also present in the area. Detailed descriptions of the soils series present at LAFB are taken from Golden, Gabriel and Stevens (USSCS, 1982).

Olmos: The Olmos series consists of very gravelly and loamy soils on uplands. These soils are very shallow to shallow and are well drained. They formed in old outwash sediments over thick beds of caliche. Slope ranges from 1 to 8 percent. The solum thickness, or depth to indurated caliche, ranges from 4- to 20-inches (in). Carbonate accumulations smaller than 20 millimeters (mm) make up more than 40 percent by weight of the whole soil. Calcium carbonate equivalent in the fine earth fraction is 25 to 40 percent. The fine earth fraction is 22 to 35 percent total clay and 10 to 20 percent noncarbonate clay.

Acuna: The Acuna series consists of deep, well drained soils on stream terraces and low uplands. These soils formed in calcareous, clayey alluvium from limestone hills. Slope ranges from 0 to 3 percent. The solum ranges from 40- to more than 60-in in thickness. Calcium carbonate equivalent in the 10- to 40-in control section is 40 to 55 percent. Depth to distinct accumulations of calcium carbonate is 16- to 40-in; 5 to 30 percent of this is treads, films, soft masses, and concretions. The control section is 35 to 50 percent total clay and 20 to 35 percent noncarbonate clay.

Coahuila: The Coahuila series consists of deep, well drained soils on old stream terraces and low uplands. These soils formed in calcareous loamy alluvium derived from limestone. Slope ranges from 0 to 3 percent. The solum ranges from 60 to more than 80-in in thickness. Calcium carbonate equivalent in the 10- to 40-in control section is 40 to 60 percent. The control section is 30 to 50 percent total clay and 18 to 34 percent noncarbonate clay.

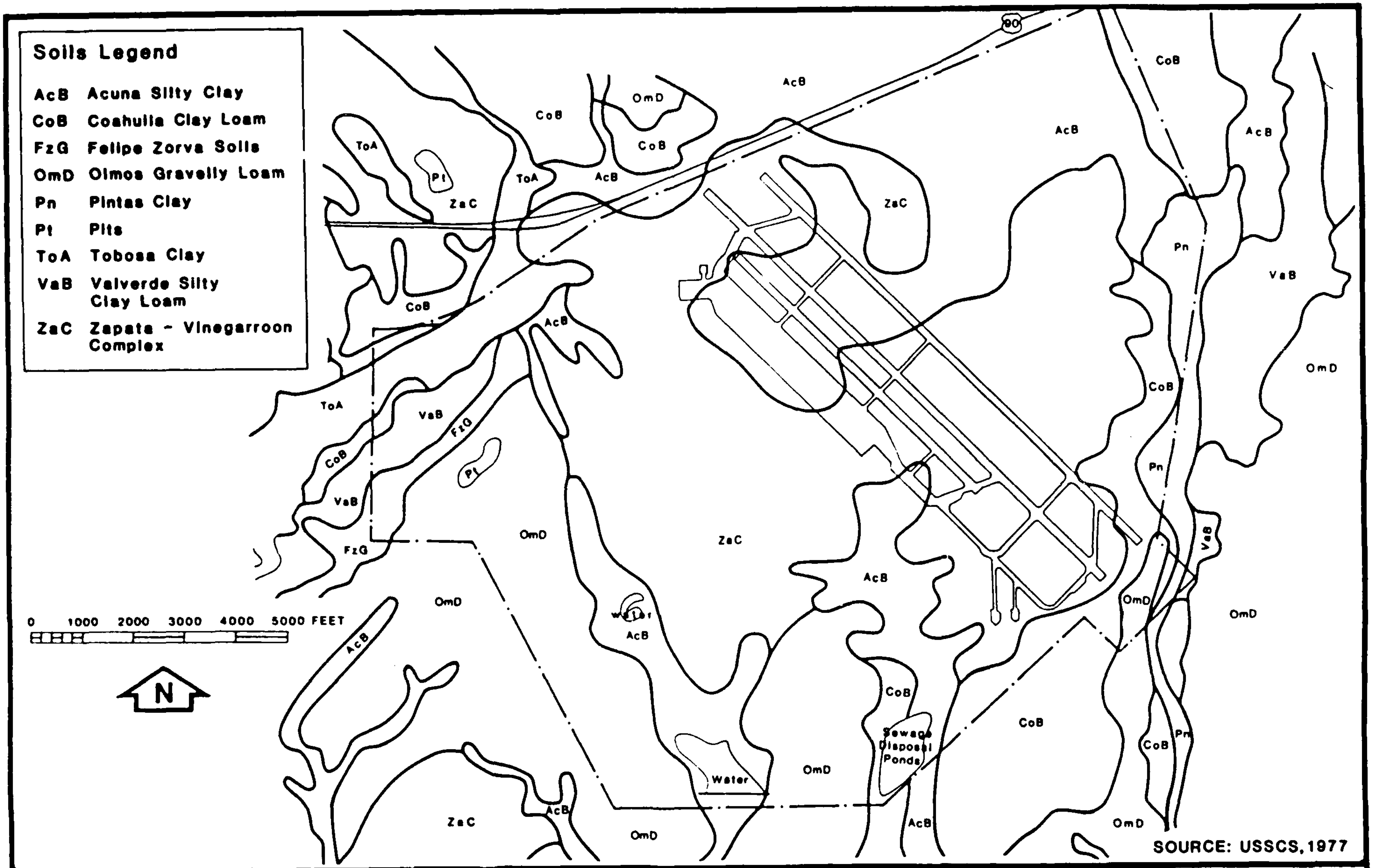

Figure 3.3-7
SOILS MAP - LAFB, DEL RIO, TEXAS

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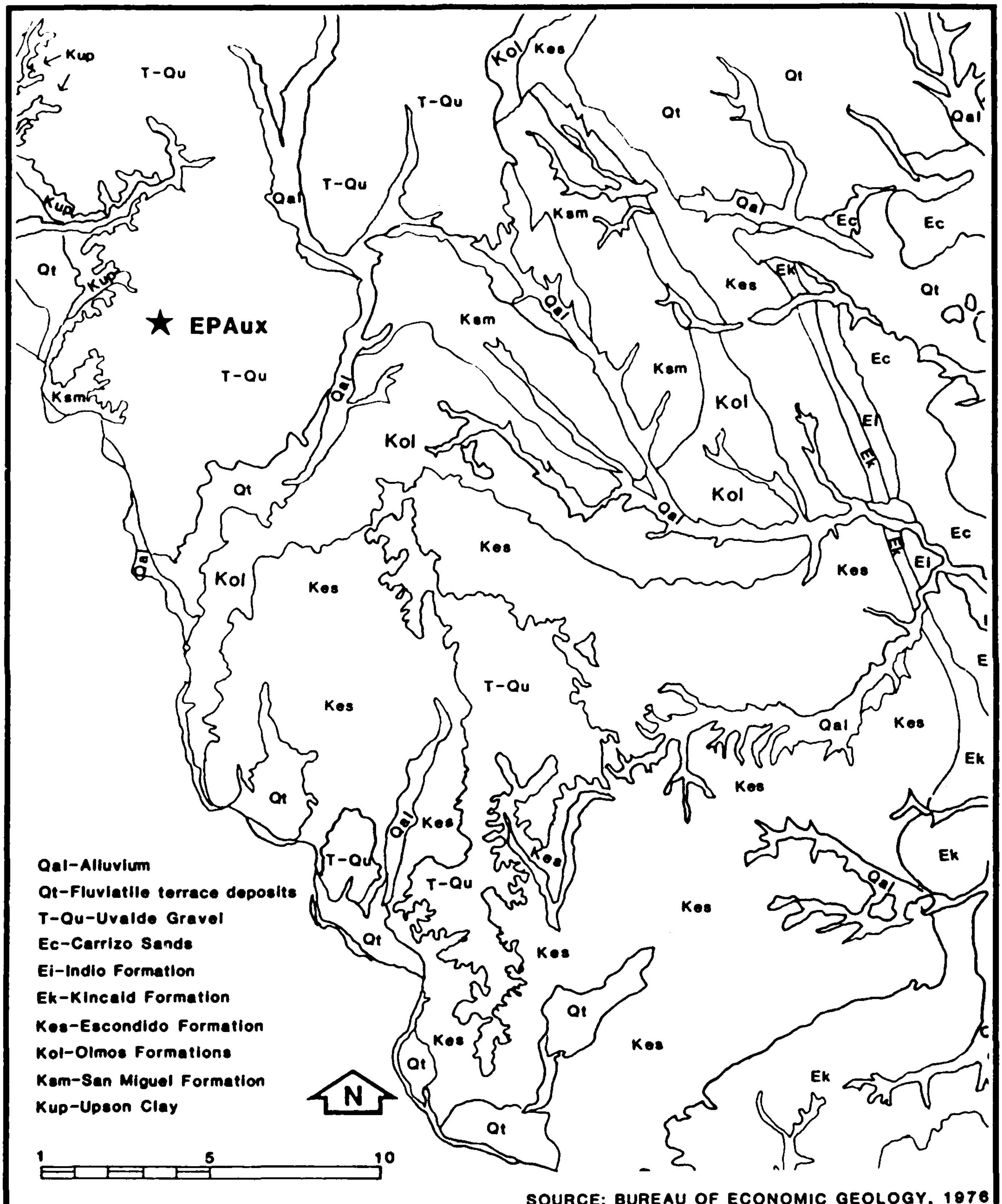

Figure 3.3-6
SURFICIAL GEOLOGIC MAP-EPAux

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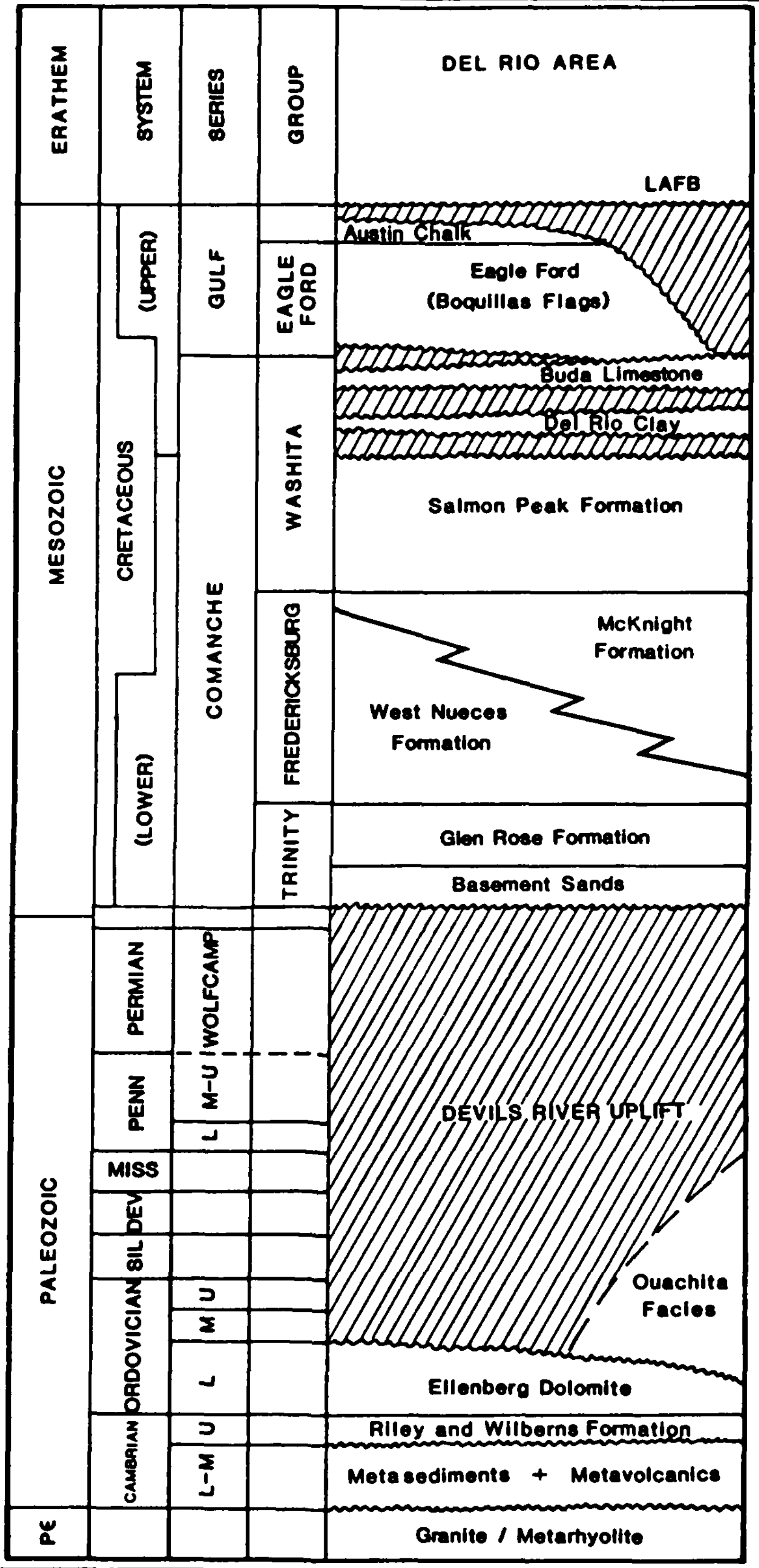

SOURCE: WTGS, 1983

Figure 3.3-5
STRATIGRAPHIC SECTION - DEL RIO, TEXAS AREA

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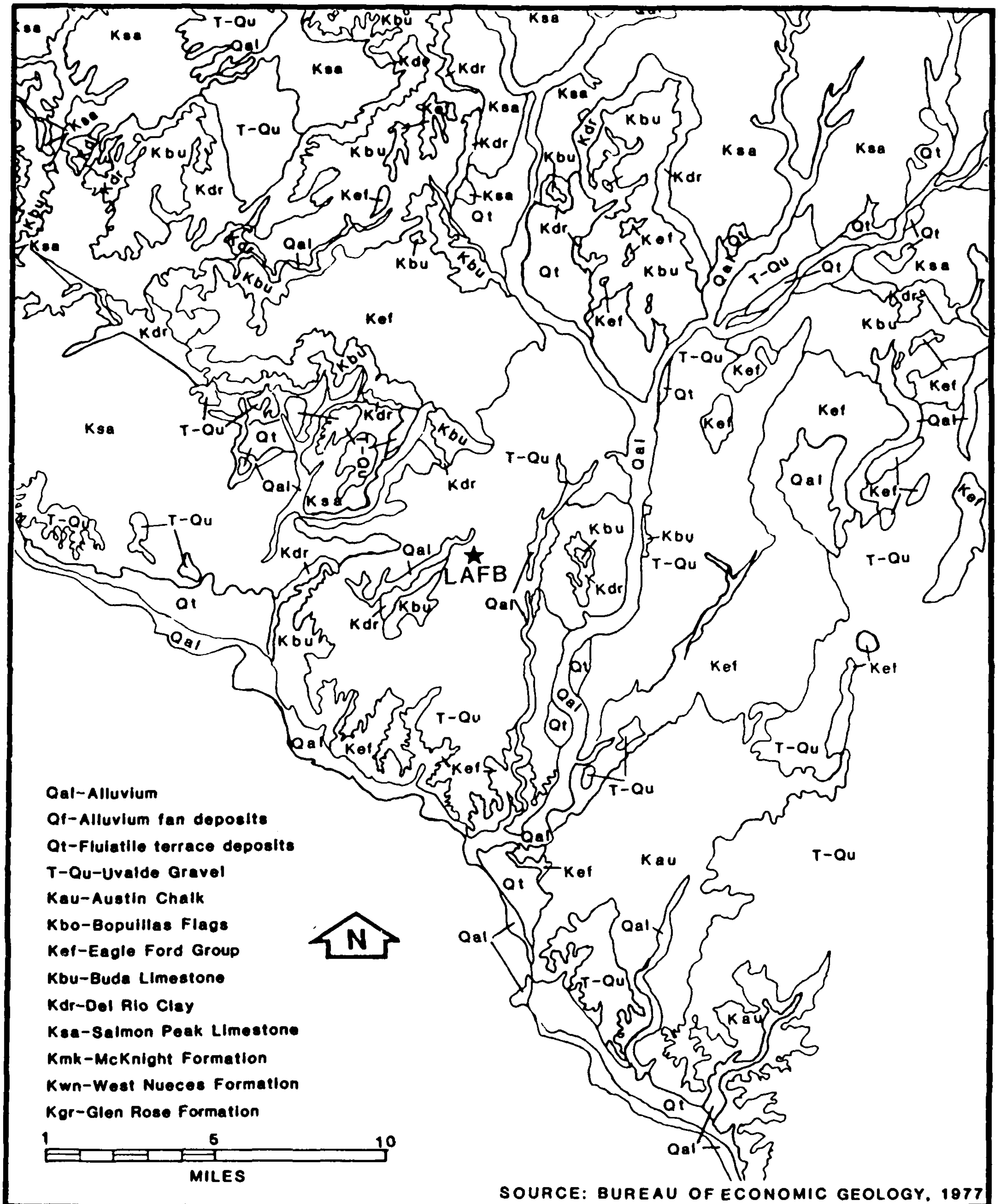

Figure 3.3-4
SURFICIAL GEOLOGIC MAP-
DEL RIO, TEXAS AREA

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It is likely that younger Gulf Series rocks were deposited, but due to erosion since the close of the Cretaceous the rocks have not been preserved.

The only tertiary deposit in the area is the Uvalde Gravel of the Pliocene Age. The formation consists of caliche cemented gravels formed from the erosion of Createceous rocks uplifted during the Laramide orogeny.

The Quaternary is represented by alluvium and colluvium of Pleistocene and recent time.

LAFB lies on a bedrock surface formed predominantly on the Cretaceous Buda Limestone and to a lesser extent, where drainage has eroded the Buda, the Del Rio Clay. The Uvalde Gravel mantles the surface and obscures the bedrock over most of the base. Along major drainages, alluvium of Quarternary Age covers the bedrock (Figure 3.3-4). Depth to bedrock is from less than a foot to some 15 ft. Regional dip is less than one degree. The stratigraphic section present at LAFB is detailed in Figure 3.3-5.

EPAux lies within the geologic province of the Maverick Basin of the Gulf Coastal Plain. Rocks in the area represent the filling of the oceanic trench which resulted from continental break up in Late Precambrian. The trench filled with sediments derived from highlands to the north and west (Devils River Uplift). The strata in the area depicts the ongoing erosion of these highlands and the process of continental margin building. Stratigraphically the area is generally similar to the Devils River Uplift but with a more complete section. The geology of the EPAux area is illustrated in Figure 3.3-6.

3.3.2 SOILS

Landscapes at LAFB are formed in old alluvium ov aliche and limy earth (Figure 3.3-7). Dominant soils belong to the Olmos-Acuna-Coahuila association and are characterized as very shallow, shallow and deep, clayey and loamy soils that are gravelly. The unit consists of nearly the Comanche Series and Gulf Series dominate the rock record during this time.

Basal Cretaceous rocks belong to the Trinity Group of the Comanche Series and consist of a clastic sequence with minor carbonates interbedded. The rocks are referred to as the "Basement Sands" of the Trinity Group and are conformably overlain by marl and limestone beds of the Glen Rose Formation, the upper unit of the Trinity Group.

Following a brief regression, the sea readvanced and deposition of the Fredricksburg-Lower Washita Group sequence of the Comanche Series commenced. In the area of LAFB three distinct carbonate units were conformably deposited.

The West Nueces Formation consists of a lower transgressive unit and an upper sequence of massive carbonate mudstones, mudstones, and limestones. The series is overlain by the thin-bedded mudstones, cherts and anhydrites of the McKnight Formation. This is followed by the massive calcareous mudstones and limestone of the Salmon Peak.

Regression of the Cretaceous sea led to the development of the unconformity prior to deposition of the Del Rio Clay. The Del Rio is composed mostly of limy claystone with minor siltstone and coquina limestone beds and was deposited as a northward thinning wedge.

Following a short regression, the Buda limestone was unconformably deposited on the Del Rio Clay. The Buda accumulated in a warm, clear sea favoring deposition of calcareous mudstone. The formation thins northward and represents the uppermost unit of the Washita Group.

After a short erosional period at the close of the Comanchean, the sea readvanced northward depositing the Boquillas Formation of the Eagle Ford Group. The formation contains four distinct facies of flaggy, clastic limestones with the upper most grading conformably into the overlying Austin Chalk, a series of hard chalk beds intercalated with thin, gray-white marly limestone.

represent the land surface of a Precambrian super-continent. The area was relatively tectonically inactive until Late Precambrian time when the episode of continental rifting resulted in the break-up of the super-continent. The activity opened the Proto-Atlantic Ocean between North America and the South America-Africa craton.

Rifting continued into Lower-Middle Cambrian time. The rift valley formed by the separation of the super-continent filled with sediments shed from the North America craton as well as from volcanic sources formed along the mid ocean spreading center. Sediments were deposited unconformably on the Precambian and were subsequently metamorphosed during the same Paleozoic episode that altered the core.

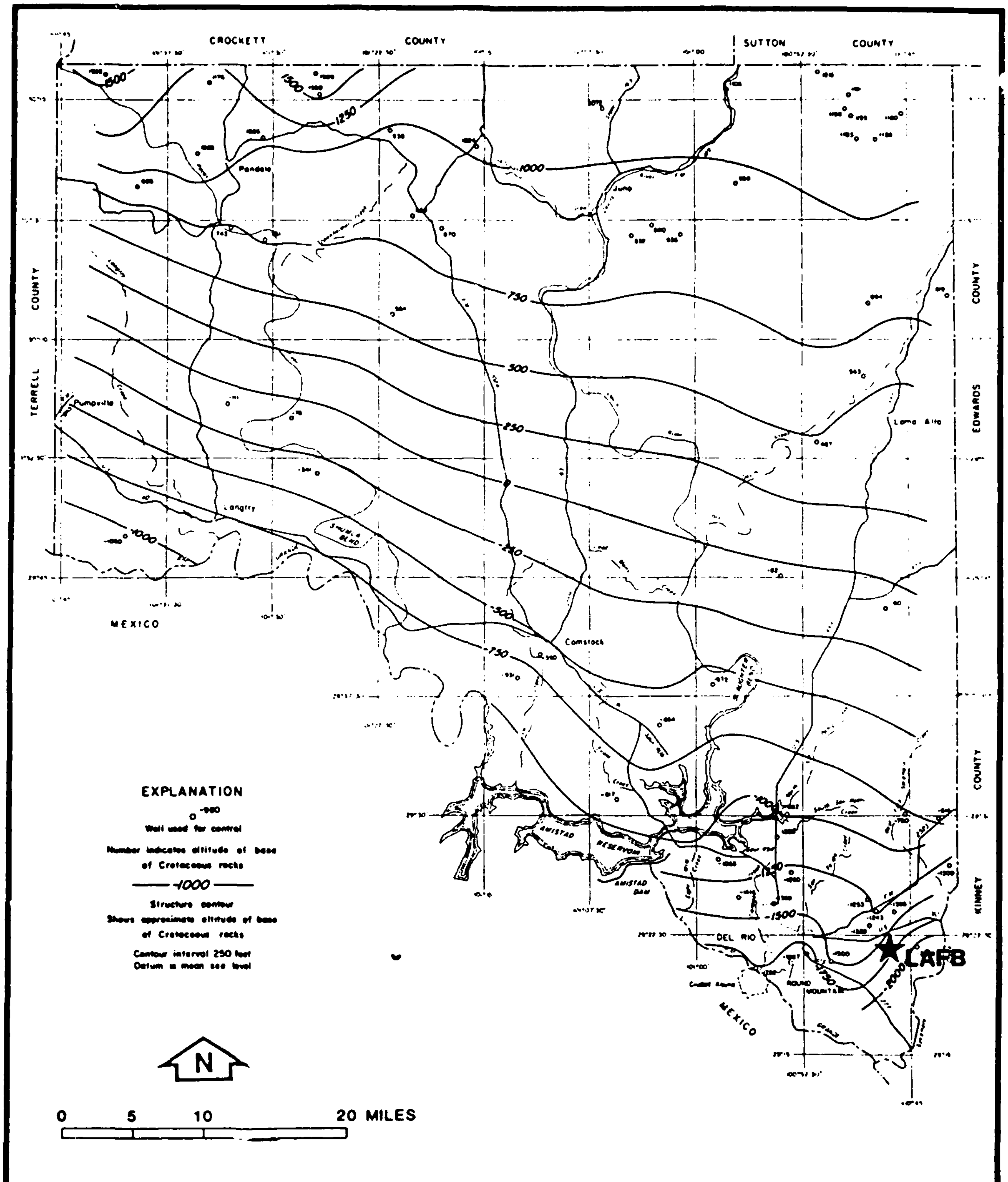
Two events dominated the geologic record through the remainder of the Paleozoic. Following the tectonic activity of the Lower-Middle Cambrian, epeiric deposition prevailed until the Pennsylvanian. South of the uplift, sediments of the Ouachita system accumulated in a deep water trough. North of the area, deposition of a predominantly carbonate foreland sequence of Upper Cambrian through Mississippian rocks took place. With the onset of the Ouachita orogeny in Pennsylvanian, and continuing into Middle Permian, the sediment accumulation in the eugeosynclinal trough south of the uplift was folded, metamorphosed, and thrust over the Paleozoic cratonic and foreland rocks and against the rising Devils River Uplift. Erosion dominated the remainder of the Permian and resulted in the thinning or complete truncation of most of the Paleozoic section in the area. What remains is a sequence of Upper Cambrian and Lower Ordovician marine sediments that unconformably overlay older Cambrian metasediments and metavolcanics. The sequence is comprised of the basal sandstones of the Riley Formation which grade upward into the sandstone, limestone and dolomite of the Wilberns Formation. The Wilberns is in turn conformably overlain by the Ellenburger Dolomite, the youngest Paleozoic rock remaining in the area.

Erosion continued into the Mesozoic until a shallow sea transgressed the area and deposition was renewed at the start of the Cretaceous. Rocks of

Table 3.3-2. Stratigraphic Units and Their Water-Bearing Properties

System	Series or Group	Stratigraphic Unit	Approximate Maximum Thickness (ft)	Character of Rocks	Water-Bearing Properties
		West Nueces	400	Hard, massive, cherty limestone and some dolomite with marly, nodular limestone in lower part.	One of the principal aquifers in the county. Yields very small to large quantities of fresh water to livestock, domestic, and irrigation wells in most of the county.
	Comanche Series				
	Trinity Group	Glen Rose Limestone	1,320	Shale, shaly limestone, limestone, and sand.	Yields very small to moderate quantities of water to livestock and domestic wells; much of the water is slightly saline.
		Basement sand	445	Sand, sandstone, shale, shaly limestone, and dolomite.	Not known to yield water to wells in Val Verde County.

Source: TDWR, 1977.



SOURCE: TDWR, 1973

Figure 3.3-9
STRUCTURE CONTOURS BASE OF THE CRETACEOUS - VAL VERDE COUNTY, TEXAS

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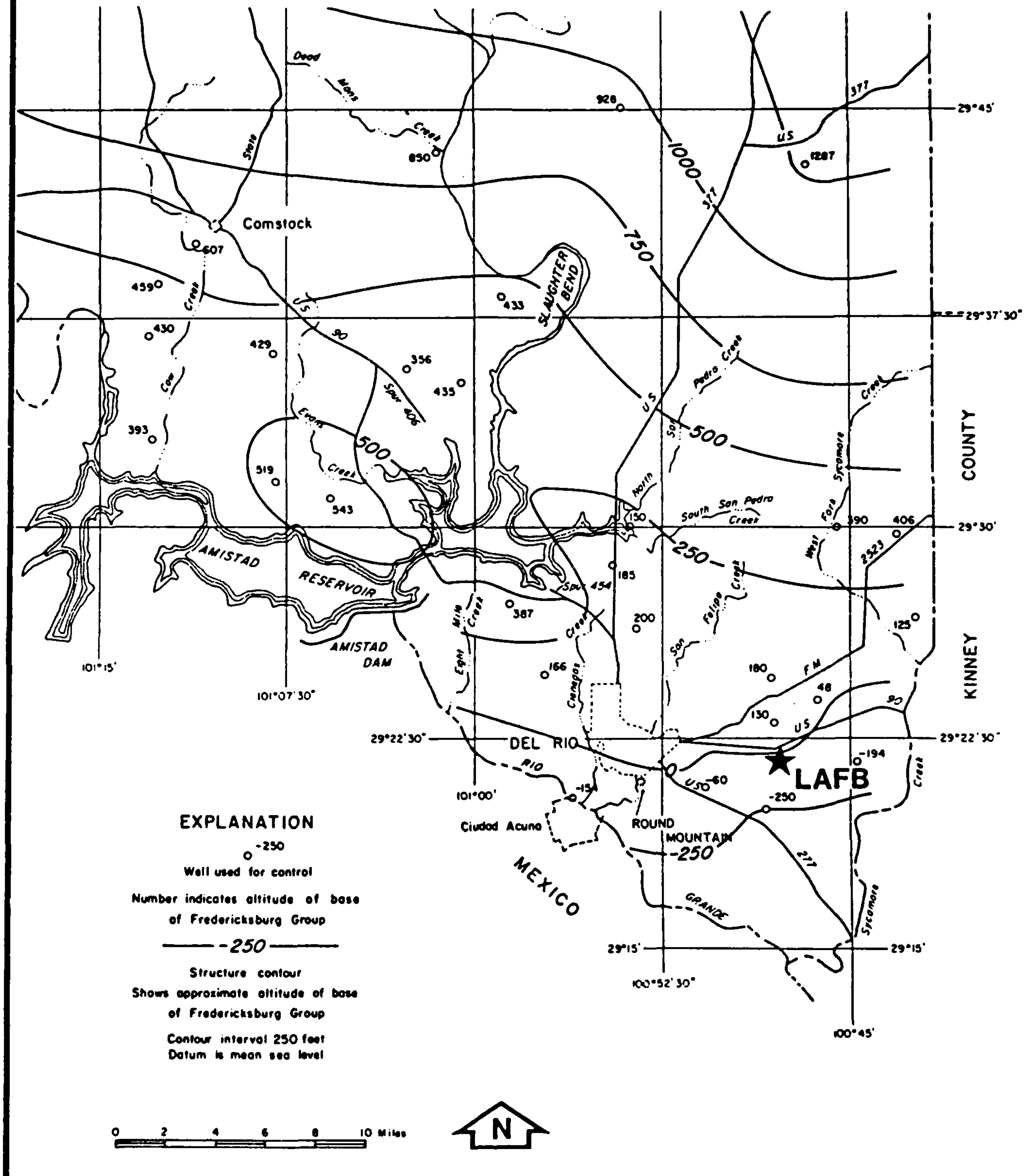


SOURCE: TDWR, 1973

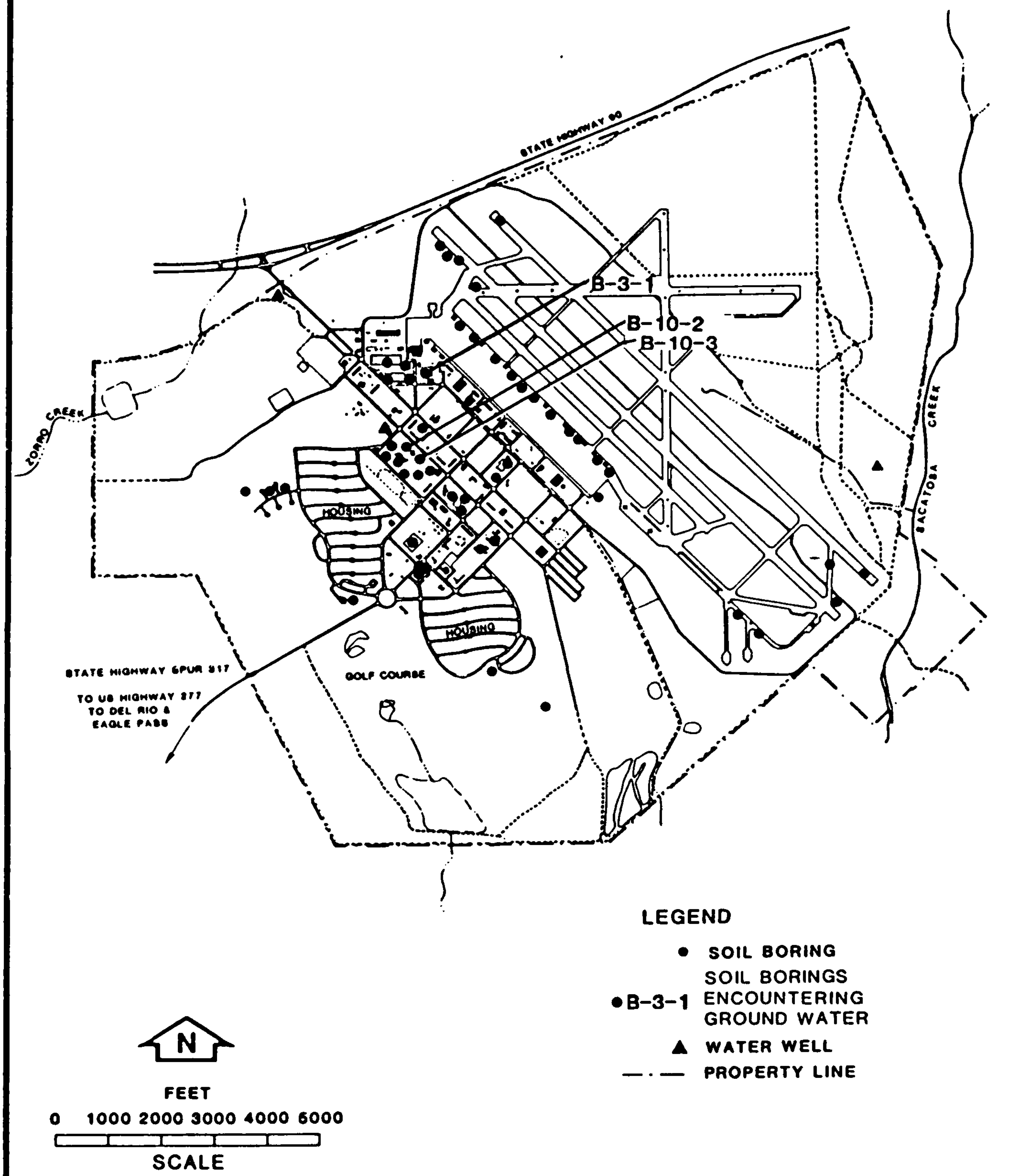
Figure 3.3-10 STRUCTURE CONTOURS BASE OF THE FREDERICKSBURG GROUP IN THE AREA OF LAFB, DEL RIO, TEXAS	INSTALLATION RESTORATION PROGRAM Laughlin Air Force Base

along faults, joints, and bedding planes to discharge areas along stream valleys.

Discharge of ground water to the surface is accomplished through springs and seeps, by evapotranspiration where the water table is near the surface, and by wells. Subsurface discharge occurs chiefly by interformational seepage into aquifers having a lower hydrostatic head. The quantity of water discharge by wells is very small compared to that discharged by springs and seeps. In the area of LAFB, San Felipe Springs accounts for some 58,000 acre ft annually (IBWC, U.S. and Mexico, 1967).

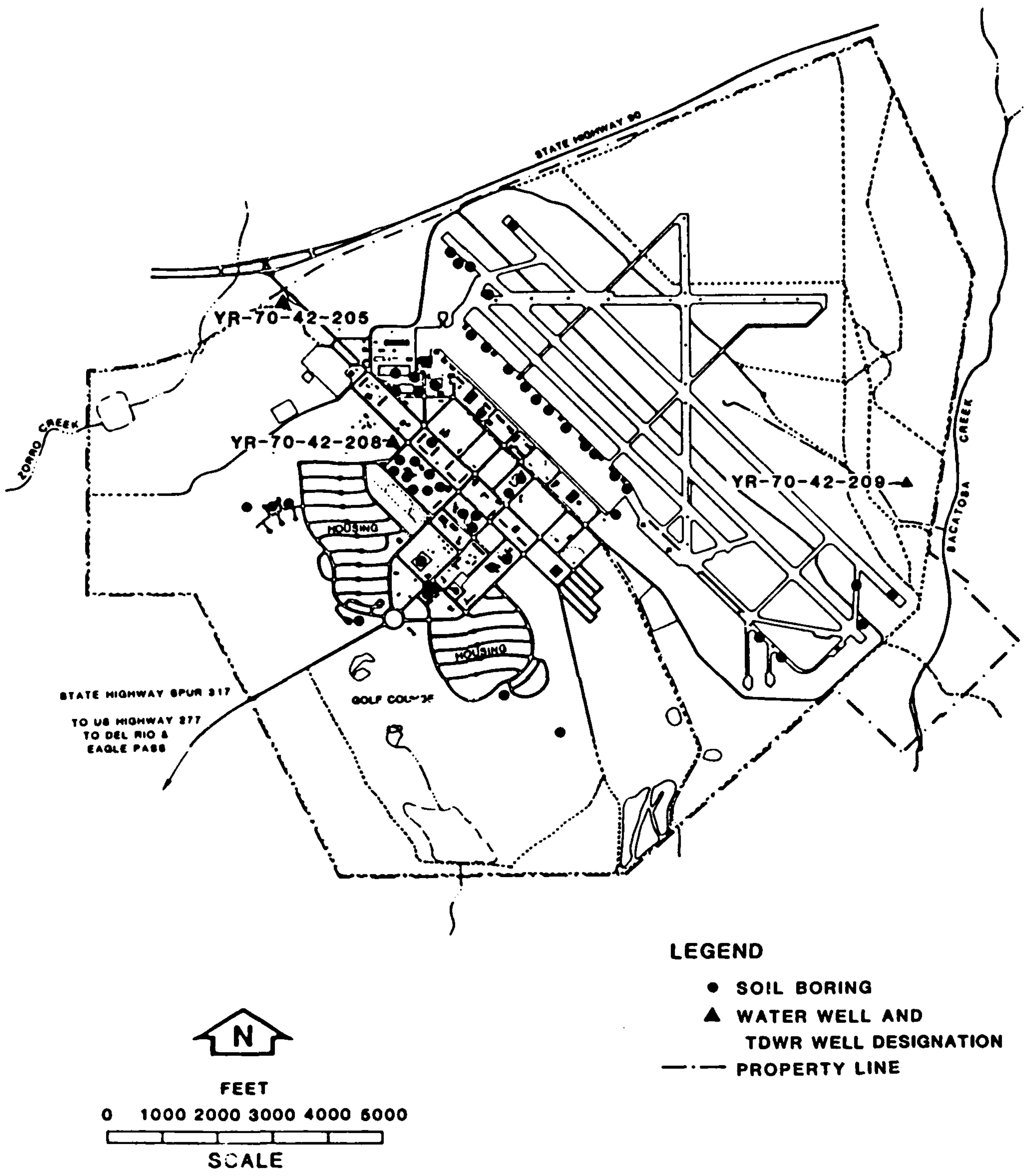
The above discussion is taken largely from TDWR (1973) and outlines the geohydrology of the Cretaceous and Quarternary aquifers in the area of LAFB. Information regarding the water-bearing properties of rocks of pre-Cretacerous Age is limited. Few wells have been drilled which penetrate these rocks. All indications are that the rocks contain water too highly mineralized for most uses.

Information regarding on base ground water resources at LAFB is quite scarce. Of the fifty-four soil borings completed only three yield any geohydrologic data (Figure 3.3-11). In addition, three water wells, completed in 1942 but never used, contribute little to an understanding of the subsurface hydrologic regime (Figure 3.3-12). Based on the available data, indications are that three, and possibly four, aquifers are present at LAFB. The deepest water-bearing unit encountered was in the McKnight Formation penetrated by well YR-70-42-209. The water was reported to be highly mineralized. Well YR-70-42-205 was drilled into the McKnight also but no record of water is made. A second water bearing unit was encountered in the Salmon Peak Formation by all three wells. Completion records indicate the aquifer is under some degree of confinement as the static water level is considerably above the water bearing unit. The water reportedly emanated a pungent "rotten egg" odor. No evidence of shallow aquifers was found in data concerning the water wells, but the three bore logs do indicate the presence of at least one and possibly two. The water bearing unit appears to be in the Buda Limestone near the contact with overlying surface material. Water level



SOURCE: LAFB INSTALLATION DOCUMENTS,1984

Figure 3.3-11 SOIL BORINGS ENCOUNTERING GROUND WATER - LAFB, DEL RIO, TEXAS	INSTALLATION RESTORATION PROGRAM Laughlin Air Force Base



SOURCE: LAFB INSTALLATION DOCUMENTS, 1984

Figure 3.3-12
GROUND WATER WELLS -
LAFB, DEL RIO, TEXAS

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in borings B-10-2 and B-10-3 is between 1,090 and 1,095 msl while in Boring B-3-1 water level in 1,050 msl. Sufficient data is lacking to make any determination on the nature and extent of the shallow aquifer(s). It should be noted however, that a shallow aquifer recharge system is possible in the area of the sewage treatment ponds. Also, in the area north of the base landfill visual evidence indicates the possible presence of a shallow aquifer as marshy conditions persist despite mostly dry weather. It appears that wet areas may be caused by the intersection of the ground water table with the topographic surface. Table 3.3-3 summarizes the available geohydrologic data for LAFB.

3.4 WATER QUALITY

3.4.1 SURFACE WATER

Surface water quality monit,ring at LAFB is restricted to STP influent and effluent. The effluent is of particular concern as it is discharged into a tributary of Sacatosa Creek and is used for irrigation and livestock purposes. Water quality data from an expanded STP analysis is summarized in Table 3.4-1. Routine monitoring is limited to flow, BOD, TSS, and pH, which are the NPDES parameters.

The Rio Grande River lies some 9 miles to the southwest. Drainage from the base eventually makes its way to the river through Zorro Creek, Sacatosa Creek, and an unnamed creek. Water quality data regarding the Rio Grande is summarized in Table 3.4-2.

Two areas of possible surface water-ground water interaction have been identified at LAFB. Both sites are in proximity of areas of potential contamination. Along Zorro Creek, the presence of wetland type vegetation, topographic change, and suspected shallow aquifer exsistence evidence possible interaction. The second site is the oxidation ponds associated with the sewage treatment system. The ponds are unlined, and the potential for downward percolation into the suspected shallow aquifer is reasonable.

Table 3.3-3. Geohydrologic Data - LAFB (Page 1 of 2)

Boring Well No.	Depth (ft)	Water-Bearing Unit	Water Level (Below Surface)	Log: Lithology	Log: Depth Bottom
B-3-1	28.2	Kbu	22.7	Clay-caliche	21.0
				Limestone	28.2
B-10-2	20.2	Kbu	14.3	Clay-gravel	7.0
				Limestone	20.2
B-10-3	21.0	Kbu	11.1	Gravel-sand	7.0
				Limestone	21.0
YR-70-42-205	860.0	Ksa	62.6	Caliche and gravel	14.0
				Clay, yellow, blue shale	143.0
				Limestone, gray	433.0
				Limestone	486.0
				Limestone with shale	599.0
				Limestone and shale	610.0
				Chert	628.0
				Rock,hard	639.0
				Shale, red and green	644.0
				Shale, black	674.0
				Chert	703.0
				Shale	707.0
				Limestone and shale	746.0
				Limestone, hard	836.0
				Limestone	848.0
				Limestone, hard	860.0
YR-70-42-208	635.0	Ksa	80.0	Caliche	5.0
				Clay, yellow and dark-blue shale	120.0
				Shale, dark-blue	141.0
				Limestone, gray	380.0
				Limestone, gray and dark-gray shale streaks	575.0
				Limestone, gray	625.0
				Limestone, light-gray to yellow-brown	627.0
				Limestone, light-gray to yellow-brown, chert	635.0

Table 3.3-3. Geohydrologic Data - LAFB (Continued, Page 2 of 2)

Boring Well No.	Depth (ft)	Water-Bearing Unit	Water Level (Below Surface)	Log: Lithology	Log: Depth Bottom
YR-70-42-209	710.0	Ksa	129.5	Caliche	11.0
		Kmk	*	Limestone, light-tan to light-gray, dense	62.0
				Shale, dark-blue	205.0
				Limestone, light-gray	242.0
				Limestone, light-gray with dark-gray shale streaks	604.0
				Limestone, gray with dark-gray shale streaks	650.0
				Shale, dark-gray to dark-brown	708.0
				Cavity	710.0

* - Encountered Water - Depth Unknown.

Source: LAFB, 1967.
LAFB, 1978.
TDWR, 1973.

Table 3.4-1. STP Water Quality Data (Sample 23 April, 1984)

Parameter	Influent	Effluent
Chemical Oxygen Demand	430.0 mg/l	200.0
Total Organic Carbon as C	89.0 mg/l	27.0
Oil and Grease	59.2 mg/l	7.8
Ammonia as N	28.0 mg/l	5.0
Nitrate as N	0.2 mg/l	0.2
Total Kjeldahl Nitrogen as N	28.4 mg/l	9.0
Phosphorus as P	7.0 mg/l	1.9
Phenols	0.100 mg/l	0.016
Cadmium	<0.010 mg/l	<0.010
Chromium	0.091 mg/l	<0.050

Source: LAFB BES, 1984.
STP Analysis Results, April 23, 1984.

Table 3.4-2. Water Quality Data, Water Year October 1981 to September 1982 (Page 1 of 2)
Rio Grande Below Amistad Dam, Del Rio, Texas (20 miles Northwest of LAFB)

Date	Time	Streamflow Instantaneous (cfs)	Specific Conductance (umhos)	pH (Units)	Temperature (°C)	Hardness (mg/l as $CaCO_3$)	Hardness Noncarbonate (mg/l $CaCO_3$)	Calcium, Dissolved (mg/l as Ca)	Magnesium, Dissolved (mg/l as Mg)
Oct 21	0722	218	1020	8.2	21.5	256	136	73	18
Nov 18	0815	1870	1050	8.0	18.5	264	144	76	18
Dec 17	0820	1750	1010	8.0	18.5	264	144	76	18
Jan 20	0825	4410	1010	8.1	15.5	247	127	71	17
Feb 17	0813	88	987	8.2	10.0	252	132	73	17
Mar 17	0820	2550	985	8.1	16.0	255	135	74	17
Apr 21	0830	2150	988	8.1	18.0	255	125	74	17
May 19	0720	4940	1020	7.9	20.5	257	127	75	17
Jun 18	0710	3020	1040	8.0	25.0	252	132	73	17
Jul 21	0715	1540	1040	8.0	26.0	251	141	71	18
Aug 18	0725	48	1030	8.1	26.5	249	129	70	18
Sep 15	0720	1620	1030	8.0	26.0	251	141	71	18

Table 3.4-2. Water Quality Data, Water Year October 1981 to September 1982 (Continued, Page 2 of 2)
Rio Grande Below Amistad Dam, Del Rio, Texas (20 miles Northwest of LAFB)

Date	Time	Sodium Dissolved (mg/l as Na)	Sodium Adsorption Ratio	Potassium Dissolved (mg/l as K)	Alkalinity Field (mg/l as $CaCO_3$)	Sulfate Dissolved (mg/l as SO_4)	Chloride Dissolved (mg/l as Cl)	Silica Dissolved (mg/l as SiO_2)	Solids sum of Constituents Dissolved (mg/l)
Oct 21	0722	110	3.1	4.9	120	220	110	17	625
Nov 18	0815	110	3.1	5.2	120	240	110	18	649
Dec 17	0820	110	3.1	4.9	120	220	110	18	629
Jan 20	0825	110	3.2	6.0	120	230	110	18	634
Feb 17	0813	110	3.1	5.2	120	220	110	17	624
Mar 17	0820	100	2.8	4.7	120	220	100	16	604
Apr 21	0830	100	2.8	5.0	130	220	96	16	606
May 19	0720	110	3.1	5.1	130	210	120	16	631
Jun 18	0710	110	3.1	4.7	120	220	120	17	634
Jul 21	0715	110	3.1	5.0	110	220	120	17	627
Aug 18	0725	120	3.4	4.7	120	220	120	18	643
Sep 15	0720	110	3.1	5.0	110	210	120	17	617

Source: USGS, 1982.

3.4.2 GROUND WATER

Data regarding ground water quality at LAFB is limited as water wells drilled on the base were only sampled for a short time after their completion. Chemical analyses indicate the water is fresh but very hard. No anomalous concentrations of any of the dissolved minerals analyzed for was observed. Samples were obtained from the Salmon Peak aquifer.

As examination of the ground water quality in the area of LAFB follows. The discussion is taken from TDWR (1973) and provides additional information which may be applied to the ground water quality at the base.

The chemical analyses of selected wells and springs (Figure 3.4-1) are given in Appendix H. The dissolved solids, sulfate, and chloride content of the water from all wells and springs sampled (207 wells, 17 springs) are shown on Figure 3.4-2. A line above a well or spring number on Figure 3.4-2 indicates that a chemical analysis is given in Appendix H.

Water having a chloride content exceeding 250 milligrams per liter (mg/l) may have a salty taste. The chloride content exceeded 250 mg/l in samples from 11 wells of a total number of 309 samples taken from 223 wells and springs. Water with a high chloride content was primarily obtained from wells in the western part of the county. Such water is not characteristic of any one part of the county or of any one aquifer; but in general, samples from wells tapping the Glen Rose Limestone, West Nueces, McKnight, and Salmon Peak Formations in the western part of the county had the highest concentration of chloride.

The upper limit of fluoride concentration for a given community depends on climatic conditions because the amount of water (and consequently the amount of fluoride) consumed is influenced principally by air temperature. The presence of fluoride in water in Val Verde County in average concentrations greater than 0.05 mg/l would constitute grounds for rejection of the supply (EPA, 1979; EPA, 1981).

A fluoride concentration of 0.7 mg/l in drinking water may reduce the incidence of tooth decay, especially in children, when the water is used

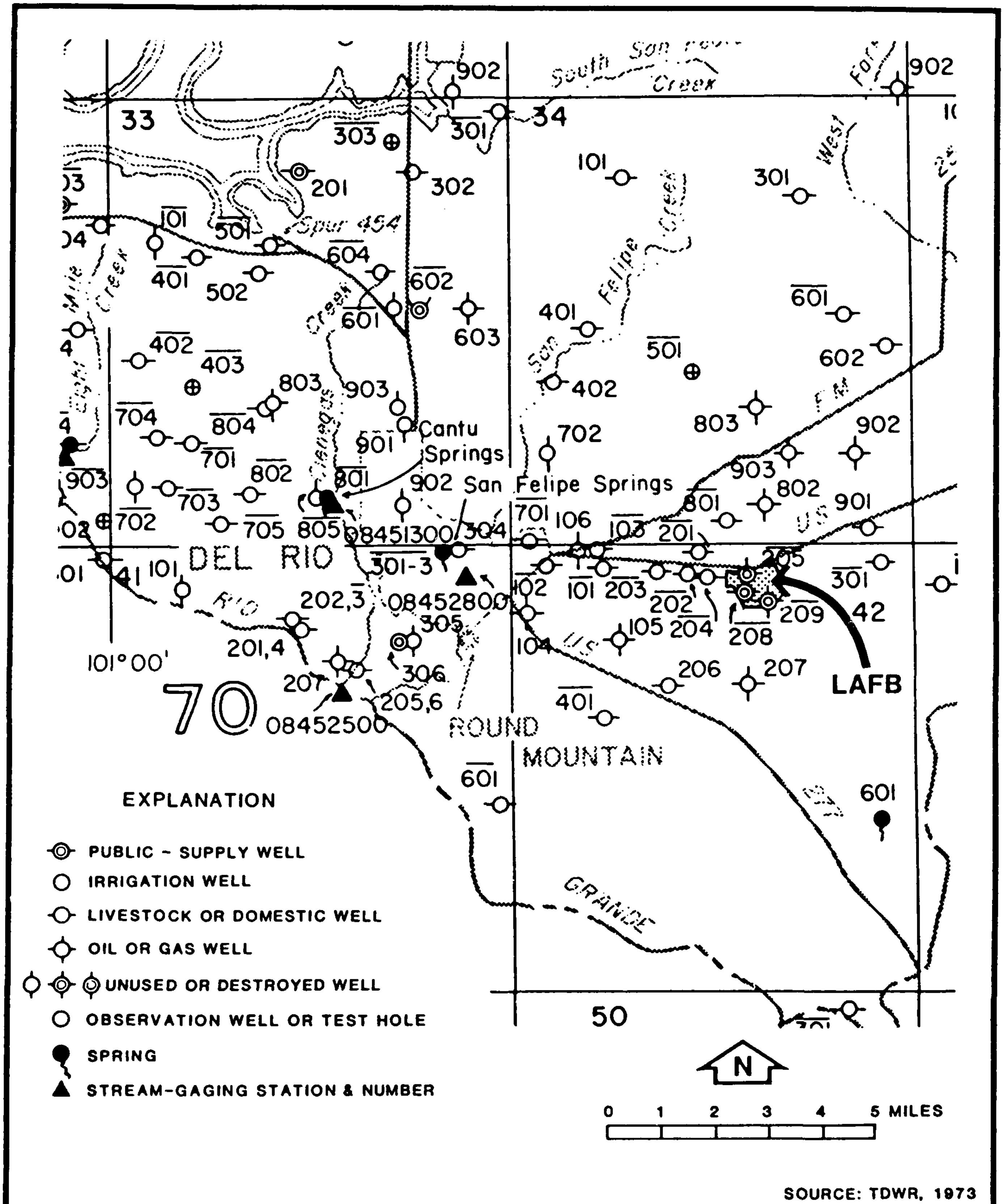

Figure 3.4-1
SELECTED WELLS AND SPRINGS
DEL RIO, TEXAS AREA

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Table 4.2-1. Industrial Operations (Shops)--Waste Generation (Page 1 of 2)

Shop Name	Location Past	Location Present	Waste Material	Waste Quantity*	Disposal Methods (1950–1980)
47th FMS					
Aero Systems					
Environmental Systems		210	JP-4	215	FTA; FTA/REUSE
			PD-680	200	IWP; CD
			TCE	25	IWP; CD
			Oil	25	Landfill/FTA; CD
Pneudraulic		211	PD-680	150	IWP/FTA; CD
Wheel and Tire		50	PD-680	600	IWP/FTA; CD
Fabrication Branch					
Corrosion Control		51	MEKetone	4,125	IWP; CD
			TCE	50	IWP; CD
			Thinner	15	IWP; CD
NDI		52	Penetrant	1,000	CD
			TCE	25	CD
Metal Finishing	Destroyed	68	Chromic Acid Solution	400	IWP; CD
			Cadmium Solution	400	IWP; CD
Chemical Cleaning	Destroyed	68	Ethanolomine	825	IWP; CD
			Descaler	550	IWP; CD
			Permanganate	550	IWP; CD
			Carbon Remover	550	IWP; CD
			TCE	55	IWP; CD
			Paint Stripper	825	Landfill/IWP
Machine	Destroyed	68	MIBK	1	IWP; CD
Propulsion	Destroyed	68	Oil	55	Landfill/FTA; CD
			JP-4	150	FTA; FTA/REUSE
			PD-680	55	IWP/FTA; CD
Support Engineering		206	PD-680	60	IWP/FTA; CD
			JP-4	50	FTA; FTA/REUSE
			Oil	1,000	Landfill/FTA; CD
Test Cell		18	JP-4	3,600	FTA; FTA/REUSE
47th OMS					
T-37 Maintenance		414	JP-4	55	FTA; FTA/REUSE
			Oil	55	FTA; CD
			PD-680	60	FTA/IWP; CD

of 45 drums and several other containers of DDT were stored onsite. Information indicates that the DDT and lead arsenate were removed from LAFB on December 3, 1981.

4.1.4 PCB HANDLING AND STORAGE

Analyses are routinely performed on transformers and other electrical items as they are taken out of service, some of these have been found contaminated with polychlorinated biphenyls (PCB) at levels between 50 and 500 parts per million (ppm). Items awaiting analysis results are currently stored in storage area north of Building 125. Based on a label search, all potential PCB items have now been taken out of service. Electric shop personnel reported that until the late 1970's, transformer oil was changed annually. The used oil was dumped in the defuel pit at Building 414. The defuel pit was normally pumped out and used to fuel fire training exercises.

4.2 HAZARDOUS WASTE GENERATION/DISPOSAL

4.2.1 GENERATING OPERATIONS

LAFB personnel provided a hazardous waste inventory and RCRA Part B application. These were used as the basis for identifying shops on the base and making a preliminary assessment of the types and quantities of waste generated by the various operations. Interviews were conducted with personnel from each of the major waste generation points. Telephone contacts were made with smaller operations. In each interview, personnel were asked to verify or update the types and quantities of waste generated. By locating personnel who had long employment histories, information was obtained on how waste generation patterns had changed over the years. These interviews also provided the information on disposal methods presented in Section 4.2.2. No information was acquired which indicated any waste generation at EPAux.

Information obtained on the major waste generating operations is summarized in Table 4.2-1. Not all the wastes listed are hazardous wastes as defined by EPA, but have been included to provide a complete picture of the range and quantity of waste generated which require

Table 4.1-2. One Quarter Usage of Pesticides/Herbcides on LAFB

Pesticide/Herbicide	Active Ingredients (lbs)
Baygon	3
Diazinon	11
Malathion	1
Organophosphates	19
Chlordane	2

Source: Pest Control Summary Report, April-June, 1984.

During the SAC years of 1957 to 1961 the major fuel used was jet propellant thermally stable (JPTS). Information regarding the handling and storage of the fuel was unavailable but conversations with current SAC personnel indicate that procedures for JPTS are similar to those for JP-4.

Refueling of aircraft is performed on the flight line. Fuel is transported from the storage tanks in tank trucks with capacities of 3,000 to 5,000 gal. Trucks are filled from a transfer point at the north end of the flight line. No secondary containment is provided at this location. All planes on the flight line are normally kept full of fuel. The T-37 holds 309 gal and the T-38 holds 583 gal. Personnel from base fuels operate and maintain the fuel storage and distribution system. Storage tanks, valves, and piping are inspected daily to check for conditions which pose a fire or spill hazard.

4.1.3 PESTICIDE/HERBICIDE HANDLING AND STORAGE

All pesticide/herbicide application and storage is consolidated on LAFB. Building 800 is used for storage of all pesticide/herbicides used on LAFB. The area adjacent to Building 800 is used for equipment storage, cleaning and mixing.

Current pesticide operations generate no liquid wastes. All excess solution is containerized and retained for use as future dilution water. Initial rinse water from equipment cleaning is also containerized; rinse water from subsequent rinses drains into the sanitary sewer system.

Table 4.1-2 provides type and quantities of pesticides/herbicides used during one quarter at LAFB. Types and amounts of pesticides/herbicides applied are generally consistent throughout the year.

The only potentially significant source of pesticide/herbicide contamination is the past storage of DDT and lead arsenate in an open storage area by Building 47. Information indicates that during the storage period (approximately 1964 to 1982) there were several incidents of drums (generally DDT) leaking and spilling onto the ground. A total

Table 4.1-1. POL Storage Location - LAFB

Facility Number	Capacity (Gal)	Above/Under Ground	Contents
18	210	UG	JP-4
18	560	UG	JP-4
87	300	UG	DF-2
94	1,000	UG	DF-2
108	300	UG	DF-2
207	100	UG	MOGAS
306	100	UG	MOGAS
310	325	UG	DF-2
326	300	UG	DF-2
328	150	UG	DF-2
339	300	UG	DF-2
375	6,000	UG	DF-2
375	9,500	UG	DF-2
505	1,000	UG	DF-2
650	290	UG	DF-2
655	500	UG	DF-2
670	290	UG	DF-2
680	290	UG	DF-2
800	100	UG	MOGAS
820	1,000	UG	DF-2
1706	300	UG	DF-2
1711	300	UG	DF-2
2110	(2 @ 10,000)	UG	MOGAS
1995	(6 @ 25,000)	UG	JP-4
2276	180	UG	MOGAS
2279	150	UG	MOGAS
6002	290	UG	DF-2
6003	300	UG	DF-2
6004	290	UG	DF-2
6012	290	UG	DF-2
Eagle Pass	(2 @ 290)	UG	DF-2
2100 A-1	550,000	AG	JP-4
2100 A-2	550,000	AG	JP-4
2100 A-3	825,000	AG	JP-4
2125	220,000	AG	DF-2
Eagle Pass	1,040	AG	DF-2
Eagle Pass	1,040	AG	MOGAS
2104	10,000	AG	ASPHALT
18	4,000	AG	JP-4
Amistad	2,000	AG	MOGAS

Source: LAFB, 1983

in the T-37 and T-38 maintenance shops located in Building 50. Heavy and nonscheduled maintenance for these aircraft is performed at separate facilities in Buildings 414 and 210. Engines requiring major repair or overhaul are removed from the aircraft and taken to Building 68, which is equipped with facilities and equipment for such operations. Aircraft are painted in Building 51, and parts painting is done in Building 68. Paint shops are equipped with liquid curtain spray booths, and Building 51 is specially fitted to accommodate the large scale stripping operation required for complete aircraft repainting. Metal treatment operations are conducted in the chemical cleaning and plating shops in Building 68.

Other major industrial activities at LAFB include vehicle and facilities maintenance. Vehicles maintenance is conducted at Building 47 for fire trucks, Building 30 for fuel trucks, and Building 131 for other vehicles. Shops under 47th Civil Engineering Squadron (CES) which provide facilities maintenance include refrigeration (Building 122), Entomology (Building 800), Paint (Building 120), Electric (Building 122), Small Engine (Building 125), and NDI Lab (Building 52).

Training activities at LAFB in addition to pilot training include firefighter training. Fire training exercises are conducted regularly using JP4 as fuel and using water and AFFF as suppressants.

4.1.2 FUELS/OILS HANDLING AND STORAGE

The main fuel used at LAFB is JP-4 jet fuel. Additional fuels and oils stored and used in quantity are motor gasoline (MOGAS), diesel fuel (DF-2), and engine oil. The largest storage point is the 2100 area Tanks located adjacent to the main gate. These tanks provide above ground storage of JP4 and normally contain a combined quantity of approximately 1,500,000 gallons (gal). The fourth tank in the 2100 area is used to store DF-2, and normally contains approximately 200,000 gal. Secondary containment at this location is provided by an asphalt-sealed earthen berm enclosing an unlined area. Various underground tanks ranging in capacity from 3,000 to 25,000 gal are used to store the other products (see Table 4.1-1).

4.0 FINDINGS

This chapter presents information for LAFB on wastes generated by activity, describes past waste disposal methods, identifies the disposal and spill sites located on the base, and evaluates the potential for environmental contamination. This information was obtained by a review of files and records, interviews with present and former Air Force and base employees, and site inspections. Building locations are shown on Figure 2.1-3.

4.1 ACTIVITY REVIEW

4.1.1 INDUSTRIAL OPERATIONS

All the major current and past industrial operations at LAFB relate to aircraft maintenance, primarily in support of pilot training. The different levels of maintenance and the various operations are conducted by several different organizations at a number of locations on the base. Operations include engine repairs/overhauls; electrical, hydraulic, and fuel system repairs; painting; metal plating/finishing; and support equipment maintenance. No industrial activities are conducted at EPAux.

The basic mission of LAFB has remained essentially the same since the base was first activated, with the exception of 1957 to 1961, when it was used by SAC. The type of aircraft used in pilot training has changed several times over the years. Between 1942 and 1956, propeller-driven aircraft were used. These were followed by the T-33 between 1956 and 1960. The T-37 was introduced in 1960 and was joined by the T-38 in 1964. SAC used the base to fly high altitude reconnaissance, primarily with the U-2. The materials, construction, and maintenance requirements of these earlier aircraft differed from those currently in use. Thus, the specific equipment and materials used in current maintenance operations may not reflect the years prior to 1961, although the categories of maintenance being performed and locations where they are conducted have changed little.

Scheduled maintenance, including oil and fluids changes and other routine items, is performed by the 47th Organizational Maintenance Squadron (OMS)

- Franklin's groundsquirrel; and
- Whitetail deer.

In addition a number of mice and mole species would be present, especially in the more open noncantonment areas.

The herpetofauna of LAFB is represented by a number of relatively common snakes, including (LAFB, 1978; ESE, 1984):

- Western diamondback rattlesnake;
- Prairie rattlesnake;
- Bullsnake;
- Rat snake; and
- Desert kingsnake.

The Texan horned lizard is also found on LAFB. The ponds found on LAFB likely support a number of frogs and turtles; however, no specific information is available.

No federal threatened or endangered species are known to occupy LAFB. There are no indications that present activities on LAFB have an adverse impact upon existing biota (LAFB, 1978).

The variety of vegetation types available does provide habitat for a reasonably diverse fauna, especially birds. Birds common in the cantonment area are the typical of suburban residential areas. These include (LAFB, 1978; ESE, 1984):

- o Common grackle;
- o Boat-tailed grackle;
- o Northern cardinal;
- o Northern mockingbird;
- o American robin;
- o Scissor-tailed flycatcher;
- o Cedar waxwing;
- o Barn swallow;
- o Mourning dove; and
- o White wing dove.

In the noncantonment area, the above species are common, as are several other species, including:

- o Turkey vulture;
- o Black vulture;
- o Red-tailed hawk;
- o Western meadowlark; and
- o Roadrunner.

Additional species would occur as migrants or temporary transients on LAFB.

A number of mammals are found on LAFB. Most are more common in noncantonment area and include (LAFB, 1978; ESE, 1984):

- o Opossum:
- o Striped skunk;
- o Spotted skunk;
- o Badger;
- o Raccoon;
- o Ringtail;
- o Nine-banded armadillo;
- o Eastern cottontail;
- o Blacktail jackrabbit;

3.5 BIOTA

In terms of vegetation, two distinct areas are found on LAFB. The improved lands encompass appproximately 25 percent of the base (the cantonment area) and are characterized by planted and maintained habitats. Unimproved and semi-improved lands make up approximately 75 percent of LAFB and are characterized by more natural vegetative communities (LAFB, 1978).

The unimproved portion of LAFB is dominated by grasslands, with some interspersion of desert scrubland. Common grasses include cone bluestem, sideoats gramma, Arizona cottontop, plains bristle, and Johnson grass (LAFB, 1978).

Habitats in the improved portion of LAFB are primarily maintained lawns, with some marginal grasslands in areas of reduced maintenance. Trees and schrubs include ashes, oaks, pecan, redbud and a variety of ornamentals (LAFB, 1978).

Semi-improved grounds are planted with Bermuda grass, Johnson grass, Lehmann lovegrass, and King Ranch bluestem.

Wetland or aquatic habitats are limited on LAFB. The only permanent water bodies are ponds on the golf course and those associated with the sewage treatment plant. These do allow the growth of more lush shoreline vegetation and support some fish communities and herpetofauna.

The natural drainageway of Zorro Creek in the northwest corner of the base does support some wetland habitat. Although there is very little permanent water supply present, indications are that the ground water is relatively shallow and soil moisture is sufficient to allow the growth of relatively lush vegetation, some of which consists of wetland type vegetation (e.g., cattails, willows).

Table 3.4-3. Hardness Range

Milligrams Per Liter	Classification
60 or less	Soft
61 to 120	Moderately Hard
121 to 180	Hard
More than 180	Very Hard

Source: TDWR, 1973.

well), the sulfate exceeded the established limit of 250 mg/l in 24 wells. Nearly all of the samples from wells tapping the Glen Rose Limestone contained sulfate in excess of 250 mg/l. Most of the samples from the Edwards and associated limestones containing more than 250 mg/l of sulfate were from wells south of the dashed line on Figure 3.4-1.

The dissolved-solids content of 251 water samples ranged from 114 to 7,898 mg/l. Of the 198 determinations tabulated (not more than one per well or spring), the dissolved-solids content was less than 500 mg/l in 160 samples, between 500 and 1,000 mg/l in 16 samples, and more than 1,000 mg/l in 22 samples.

Calcium and magnesium are the principal dissolved constituents that cause hardness of water in Val Verde County. Hard water increases soap consumption and forms scales in hot water heaters, water pipes, and teakettles. Commonly accepted standards and classifications of water hardness are shown in Table 3.4-3.

The water in Val Verde County is generally very hard. The hardness indicated by analyses of 297 samnples ranged from 91 to 1,942 mg/l and was less than 180 mg/l in only 23 of the samples from 220 wells and springs tabulated.

Another factor used in assessing the suitability of water for drinking purposes is the presence of pesticides. During the investigation, water samples collected form three wells (YR-70-41-203, YR-71-03-301, and YR-71-23-101) and one spring (YR-40-41-301) were analyzed for pesticides (nine insecticides and three herbicides). The concentrations of each pesticide was less than 0.005 micrograms per liter (µg/l), in the water samples collected from the wells and were not tabulated. The sample collected from the spring contained 0.01 µg/l of dichlorodiphenyltrichloroethane (DDT). However, the concentration of DDT in a second water sample collected from the spring was less than 0.005 µg/l, which was the lowest detectable concentration.

during the period of enamel calcification. However, fluoride in excessive concentrations may cause mottling of the teeth (Maier, 1950). The fluoride content in samples collected from 122 wells and springs in the county ranged from 0.1 to 6.2 mg/l. It exceeded 0.7 mg/l in 50 wells and 1.4 mg/l in 32 wells. High fluoride content is found primarily in samples from wells tapping the West Nueces Formation, McKnight Formation, Salmon Peak Formation, and the Glen Rose Limestone in the western part of the county.

The use of water containing iron in excess of 0.3 mg/l and manganese in excess of 0.05 mg/l may cause reddish-brown or dark gray stains on clothes, plumbing fixtures, and utensils. In 30 samples (three from the same well), the iron content ranged from 0 to 12 mg/l and exceeded 0.3 mg/l in 12 wells. The samples having a high iron content were from wells tapping the West Nueces Formation, McKnight Formation, Salmon Peak Formation and the Glen Rose Limestone in the northern and western parts of the county; however, near Amistad Dam, the iron content locally exceeds 0.3 mg/l. High iron concentrations usually can be reduced by aeration and filtration. Only one of three analyses for manganese showed a concentration greater than 0.05 mg/l, the standard of the EPA, and it was 0.23 mg/l.

Concentrations of nitrate in excess of 45 mg/l as NO_3 in water used for infant feeding have been related to the incidence of infant cyanosis (methemoglobinemia or "blue baby" disease), a reduction of oxygen content in the blood constituting a form of asphyxia (Maxcy, 1950,). High concentrations of nitrate may be an indication of pollution from organic matter. The nitrate content in 233 determinations from 191 wells and springs exceeded 45 mg/l in only one well. The highest nitrate concentration was 58 mg/l from well YR-70-50-301, completed in the Boquillas Flags, and the next highest concentration (41 mg/l) was from well YR-70-41-601, completed in alluvium.

Water containing sulfate in excess of 250 mg/l may produce a laxative effect. The sulfate, as determined in 307 samples, ranged from 3 to 4,050 mg/l. Of the 221 determinations tabulated (not more than one per

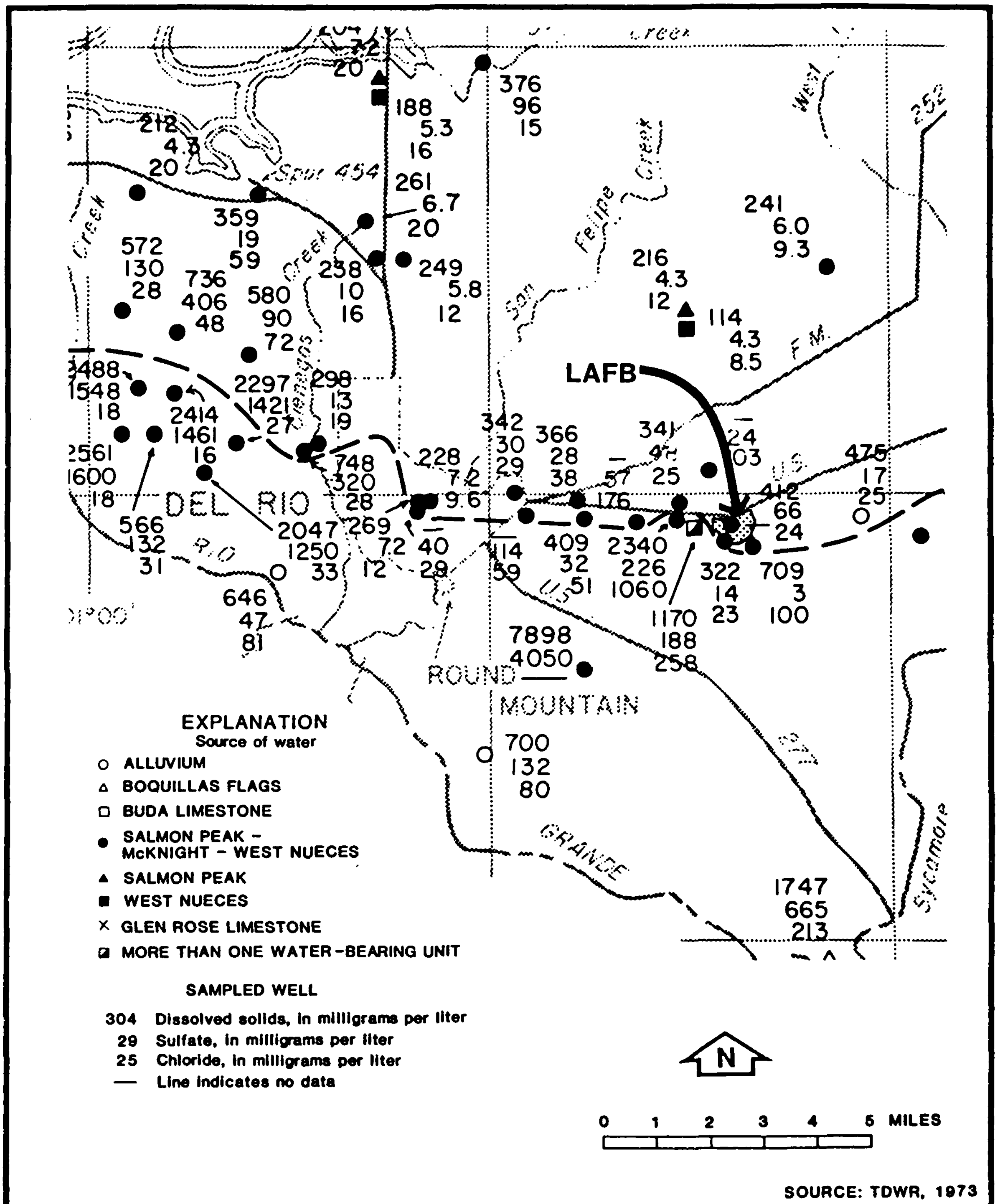

Figure 3.4-2
CHEMICAL QUALITY OF GROUND WATER
DEL RIO, TEXAS AREA

INSTALLATION RESTORATION PROGRAM
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Table 4.2-1. Industrial Operations (Shops)--Waste Generation (Continued, Page 2 of 2)

Shop Name	Location Past	Location Present	Waste Material	Waste Quantity*	Disposal Methods (1950–1980)
T-38 Maintenance		210	JP-4	500	FTA, FTA/REUSE
			Oil	55	FTA, CD
			PD-680	60	FTA/IWP, CD
Repair and Reclamation		210	PD-680	60	FTA/IWP, CD
MWR					
Auto Hobby		525	Waste Oil	1,320	FTA/IWP, CD
Transportation					
Fire Truck Maintenace		47	Waste Oil		
Vehicle Maintenance		131	Waste Oil	900	FTA/IWP, CD
Refuel Truck Maintenace		30	Waste Oil		
47th CES					
Refrigeration		122	TCE	50	Landfill, CD
Paint		120	PD-680	700	STD, CD
Electric		122	Transformer Oil	50	FTA, CD
Small Engine Repair		120	Waste Oil	220	FTA/Landfill, CD
SVE					
Service Station		91	Waste Oil	480	FTA/Landfill, CD
LGSF					
Fuels			Tank Sludge	660	SDA, CD

* All quantities expressed in gal/yr.
CD - Contract Disposal via DPDO or Service Contract for Recycling.
Landfill - Buried in/at Base Landfill.
FTA - Firefighter Training Area.
REUSE - Added to Bulk Storage Supply.
SDA - Dumped in Sludge Disposal Area.
IWP - Industrial Waste Pond.
STD - Storm Drain.
——— Data confirmed by Shop Personnel.
- - - - Estimated from Secondary Sources.

controlled disposal. A master list of facilities and shops at LAFB and their waste generation status is presented in Appendix D.

The main types of industrial waste generated at LAFB are fuel, oils and solvents, paints and paint strippers, and metal plating/treatment solutions. Waste fuel, oil and solvents include JP-4, engine oil, PD680, trichloroethylene (TCE), and methyl ethyl ketone (MEK), which are derived primarily from periodic maintenance and engine repair operations, but are generated in small quantities at almost all the maintenance shops. Waste consisting of paint residue, strippers and thinner is generated by the parts, and aircraft painting operations. The aircraft painting operation, which is one of the largest waste generators on the base, was begun in 1967, but only reached the current level of activity in 1977 when a program to repaint the entire fleet was initiated. Metal plating/treatment waste is generated at the metal finishing and chemical cleaning shops and consists of chromic acid, potassium permanganate, cadmium, and descaling solutions.

The fire suppressants currently employed at LAFB and EPAux are AFFF, HALON 1211, and dry chemicals. Available information suggests that, at least in some applications, carbon tetrachloride may have been employed until approximately the mid-1950s. The use of chlorobromomethane may have followed carbon tetrachloride and may have been utilized until the early 1970s. The extent to which these suppressants were utilized and the manner of their disposal at LAFB and EPAux could not be substantiated.

4.2.2 DISPOSAL METHODS

The information obtained on waste disposal practices is summarized graphically in Table 4.2-1. The general trend over the years since LAFB first began operation has been from largely unsegregated disposal in the base landfill toward extensive waste segregation and contract disposal. Prior to 1961, it was reported that virtually no systematic waste segregation was practiced, and containerized liquids from industrial operations were routinely buried in the base landfill. However, over this same period, the firefighter training area was used as a general disposal area for fuel, oil, and solvents, so it is not known exactly how much of this material ever reached the landfills. Until 1972, the storm drainage system for the flightline was used as an industrial waste drain, routing flows to an Industrial Waste Pond (IWP). This system received flows from washracks, floor drains, and maintenance areas, including liquid from paint, plating, and entomology shop which was also sometimes dumped directly in the pond. Information from early periods is difficult to substantiate. It is likely that quantities of liquids were disposed of in the sewers or dumped on surface soils.

During the period of 1957 to 1961, disposal pits were sometimes dug in the base landfill area. The material disposed of in these pits reportedly consisted of some drummed waste and bulk liquids. Landfilling on the base was restricted to rubble only as of 1974.

Waste disposal practices at LAFB changed substantially during the 1970's. Collection of waste fuel, oils, and solvents for contract reclamation off-base was initiated, and the current system for contract disposal of unusable quantities began. In 1974, flammable liquids used in fire training was restricted to JP-4 only, and the existing lined firefighter training pit was constructed. In 1972, the IWP overflowed during an abnormally wet period. This resulted in a release of liquid wastes across the base boundary. In 1973, a second IWP was built, with the intention of providing additional retention/evaporation capacity. At the same time, steps were initiated to eliminate discharge of paints, strippers, plating solutions and other liquid waste to the storm drainage system. By 1976, this process was completed, although dumping of drummed waste into the IWP's reportedly continued for two or three more years.

By approximately 1980, the present system of waste segregation and disposal eliminated the need for on base disposal of industrial waste. Wastes are containerized in 55 gallon drums, labeled according to DOT and EPA regulations, and held at the hazardous waste storage area in the Defense Property Disposal Office (DPDO) compound. Ultimate disposal is arranged through LAFB's designated DPDO at Kelly AFB, Texas. Sludge from the treatment plant has been analyzed and found non hazardous using EPA toxicity procedures. A Sludge Management Plan is being prepared.

4.2.3 SPILLS OR INCIDENTAL DISCHARGES

The LAFB SPCC plan indicates no record of fuel spills except minor losses during fueling of aircraft. Base fuels personnel confirmed this, reporting no spills requiring emergency response or cleanup efforts. One spill of PCB containing fluid from a capacitor bank near Building 505 occurred in December 1981. Contaminated soil was removed and placed in drums. These were being held in the DPDO hazardous waste storage area awaiting contract disposal at the time of the site visit.

4.2.4 OFFBASE DISPOSAL SITES

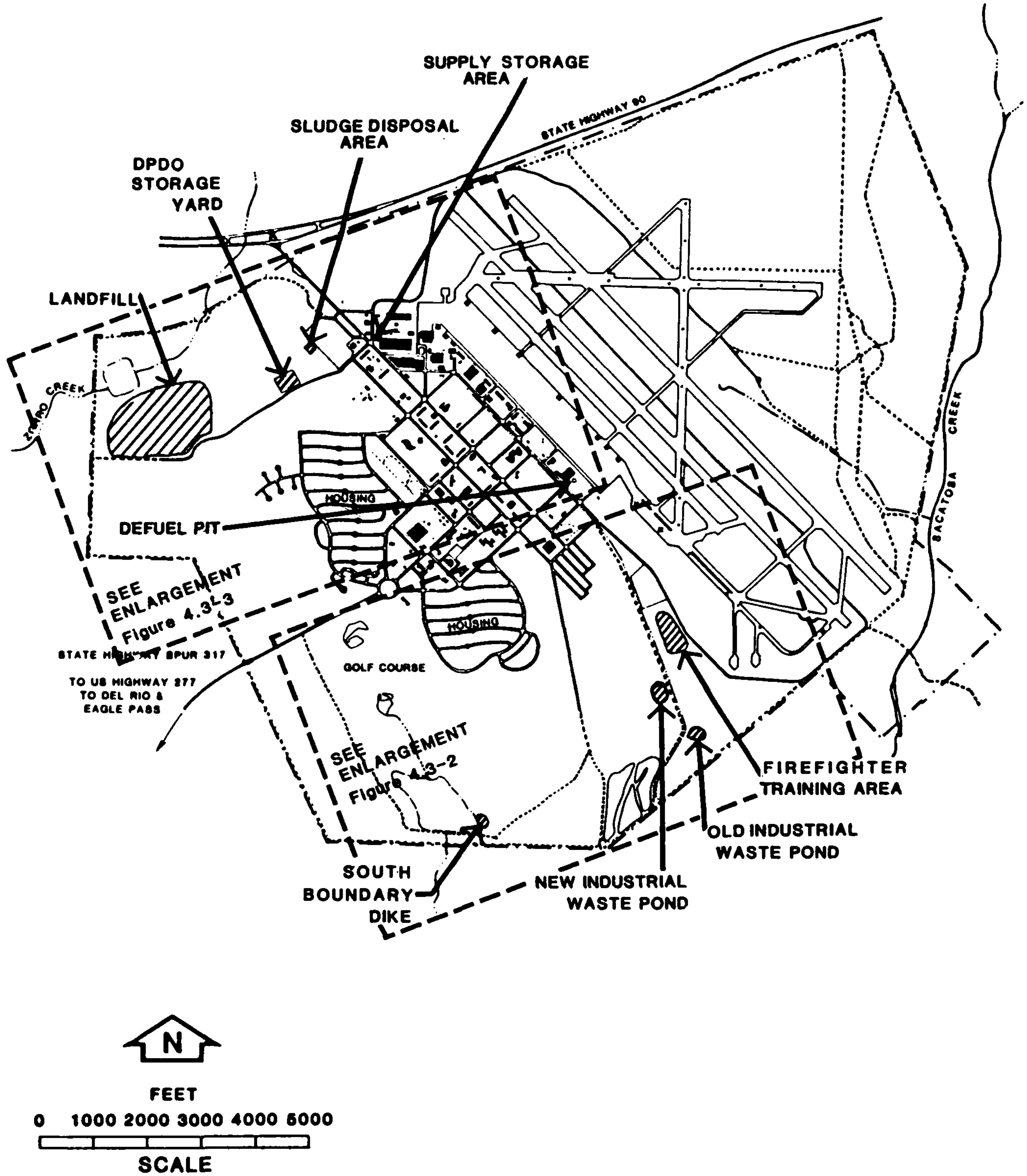
Available information indicates that materials originating at LAFB are currently directed to several disposal sites. Domestic solid waste is transported to the city of Del Rio landfill through a local contract. Hazardous and liquid waste are disposed of through arrangement with Kelly AFB DPDO. Ultimate disposal of these materials differs based on the quantity and type of material. Before 1980, LAFB contracted for waste disposal at the Conservation Chemical Company landfill in Kansas City, Missouri. This site is under study as part of the EPA Superfund program.

4.3 AREAS OF POTENTIAL CONTAMINATION

This study identified nine areas on LAFB subject to potential contamination by industrial and/or hazardous waste as a result of handling and disposal practices. Figures 4.3-1 through 4.3-3 illustrates the location of these areas. Aerial photographs of each site are included in Appendix E. No areas of potential contamination were found at EPAux.

Base Landfill

Landfilling of solid waste on the base probably began when it was first activated. The earliest available documentation was air photographs from 1952 showing landfilling underway in the northwest corner of the base near the existing rubble dump. In subsequent years, a large area was utilized for trench and cover landfilling. Materials disposed of



SOURCE: ESE, 1984

Figure 4.3-1 AREAS OF POTENTIAL CONTAMINATION	INSTALLATION RESTORATION PROGRAM Laughlin Air Force Base

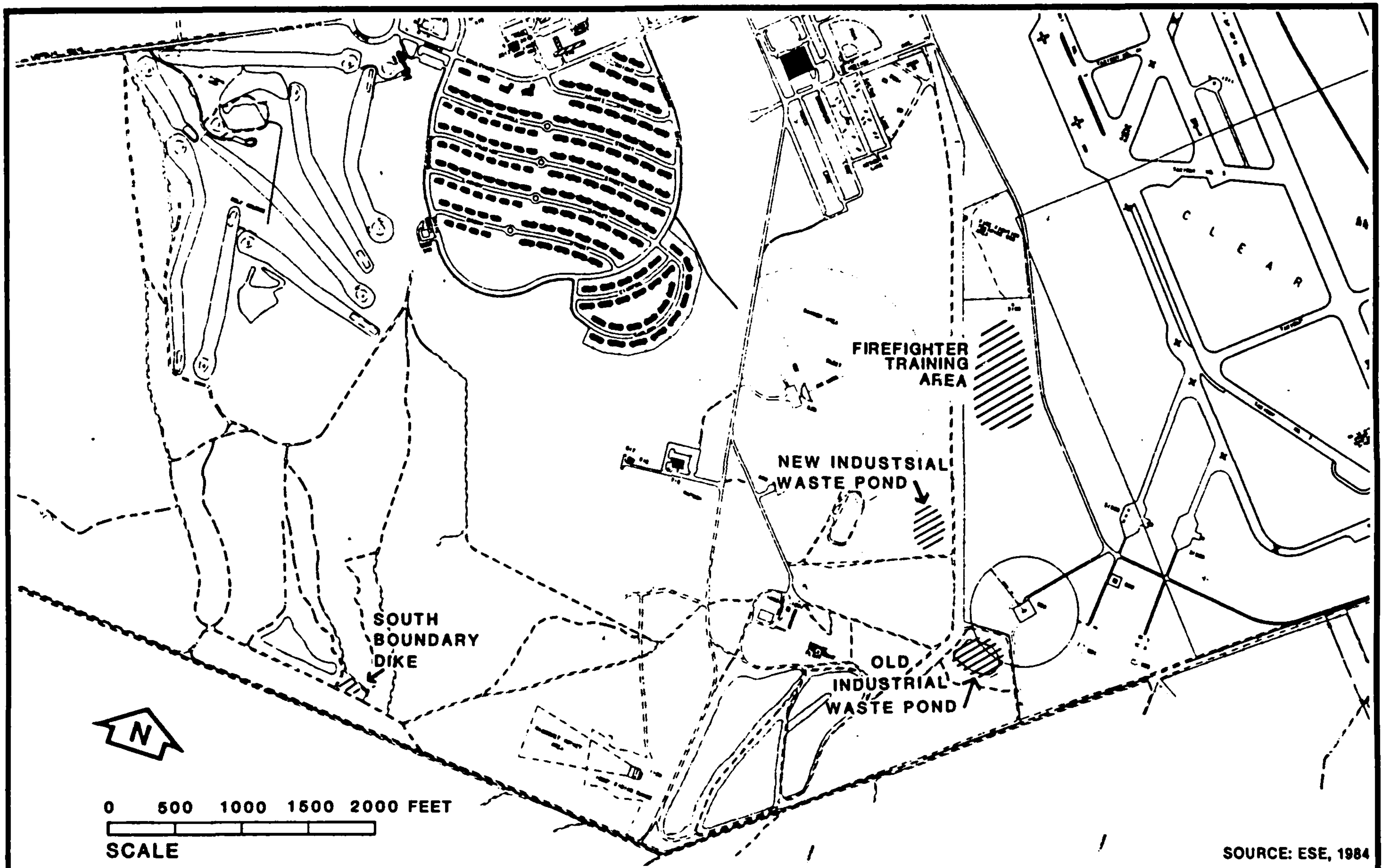


Figure 4.3-2
ENLARGEMENT OF POTENTIAL CONTAMINATION
(SOUTHWEST SECTION)

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Laughlin Air Force Base

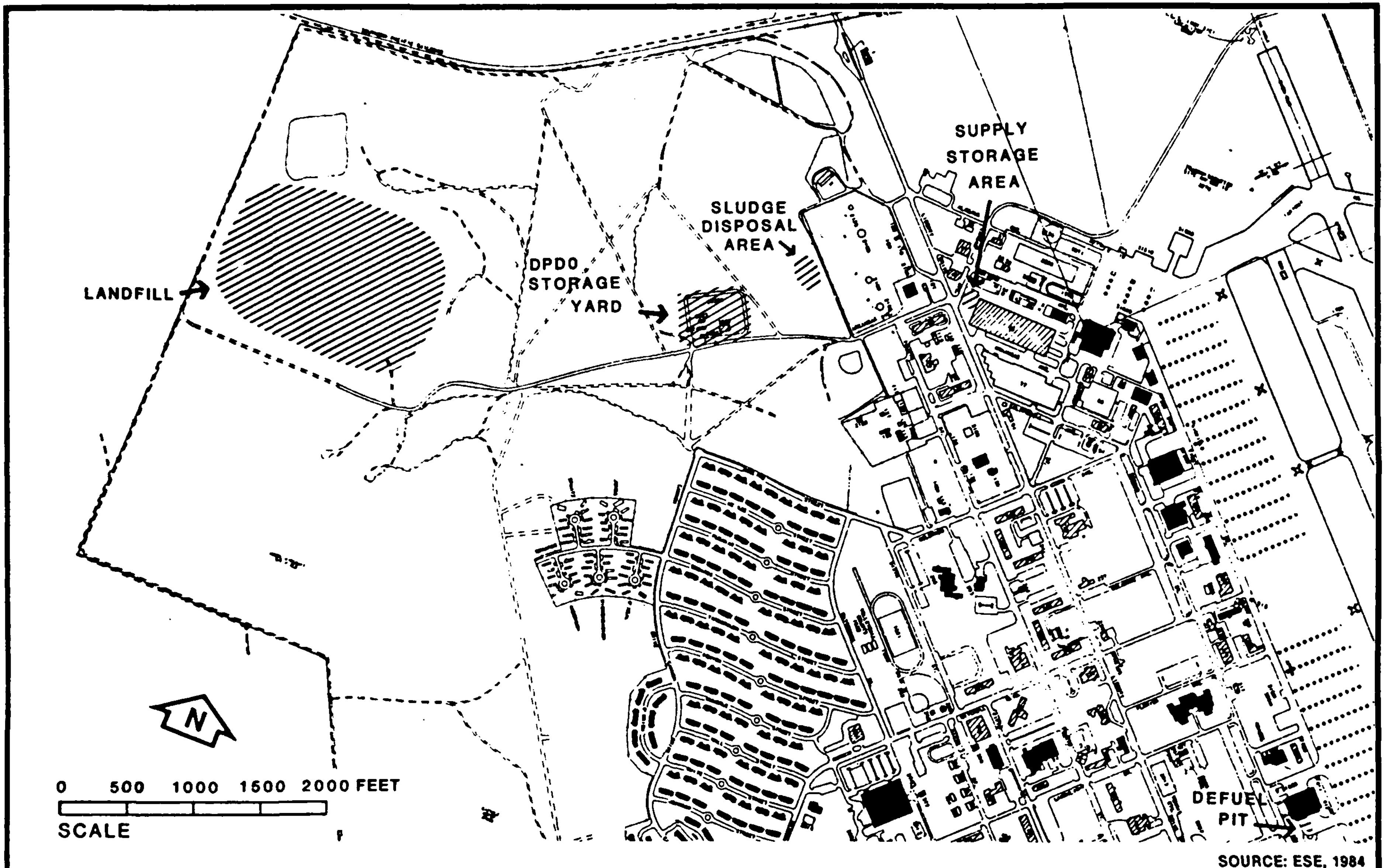

Figure 4.3-3
ENLARGEMENT OF POTENTIAL CONTAMINATION
(NORTHWEST SECTION)

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included large volumes of household solid waste and significant amounts of industrial waste, including containerized liquids. It was also reported that special trenches were sometimes dug in the area for disposal of bulk liquids and unidentified wastes. This practice was reported most common between 1957 and 1961 when the base was operated by SAC. A one time incident was reported of dumping several drums of DDT and one additional incident of dumping a canister of sodium cyanide crystals. The landfill was officially closed in 1974, and has since been used as a rubble dump.

Old Industrial Waste Pond

This area was originally used as a borrow pit during the years before 1952. It was situated adjacent to the main drainage ditch for the flightline area and was subsequently converted into a retention basin. This basin was intended to retain all dry weather flow, including flows from wash racks, floor drains and tanks within the flightline industrial areas. Liquid wastes were also routinely dumped directly in the pond. During an abnormally wet period in 1972, the basin overflowed, resulting in a release of industrial wastewater across the southern base boundary. The pond was abandoned in 1976, but continued to be used as a dumping area for liquid waste from the corrosion control and chemical cleaning shops until 1980.

Firefighter Training Area

Starting in at least 1952 and possibly earlier, firefighter training exercises were conducted in an unlined pit just south of the current pit. During the early years, this pit may have been used as much as once a week, with several hundred gallons of mixed flammable liquids burned at each exercise. The pit was abandoned in 1974 with the construction of the current firefighter training area. Initially the new site consisted of a shallow bermless pit. Firefighting training exercises utilized this facility until 1983 when the pit was remodeled and brought to standards with the addition of the concrete berm pit liner and oil/water separator. Liquids used over the years in the FFTA included MOGAS, AVGAS, JP-4, JPTS, engine oil, solvents, and transformer oil. Currently spent, unreclaimable JP-4 is used in training exercises.

New Industrial Waste Pond

This pond was constructed in 1973 by diking off an area to the west of the main drainage ditch feeding the old pond. A diversion was placed in the ditch such that flows up to a certain magnitude would be routed into the new pond. The idea was to provide greater retention capacity and thus avoid the problem of overflowing which occurred in 1972. This system reportedly never functioned quite as planned, and the new pond rarely retained any liquid. It was used as a dumping area for waste from the corrosion control and chemical cleaning shops. The pond was abandoned as a retention basin in 1976, when the industrial discharges were routed through oil/water separators and into the sanitary sewer system. Soil samples from this area were analyzed for volatile hydrocarbons in 1983. All components analyzed for were below detectable limits.

Sludge Disposal Area

This area is located immediately west of the main fuel storage area. It consists of a shallow diked area used for runoff control. It has also been historically used as a dumping area for sludge generated during tank cleaning operations. It is not known how long this practice was in use before it was discontinued in 1983.

Supply Storage Area

The storage yard adjacent to Building 47 is used by base supply for material storage. Between 1973 and 1981, this area was used to store stocks of DDT which were on hand when use was discontinued. Approximately 40 drums of application strength liquid were held on the site. Correspondence files from this period indicate recurrent problems with the drums deteriorating and on several occasions a transfer to new drums was required. Some limited leakage occurred. However, base personnel were aware of the potential hazard, the drums were inspected regularly, and no significant spills were reported.

Defuel Pit

Known locally as the Defuel Pit, the facility adjacent to Building 414 (Hanger 3), reportedly consists of a 1,000 gal underground steel tank which was part of the original base construction. It is accessed by a covered and locked metal grate. Prior to 1974, the pit was used for dumping a variety of waste liquids including oils, solvents, and waste fuel. At present the tank is used strictly for defueling aircraft and the contents are restricted to JP-4. Based on chemical analysis, the spent JP-4 is either reclaimed or used at the FFTA. Condition of the tank is unknown and no leak checking records were found. No history of spills or leakage was reported. Investigations of tank condition and potential leakage are being initiated.

South Boundary Dike

Base personnel reported a one-time episode of dumping on the east side of the dike at the south boundary pond. Three or four barrels of acetone, paint thinner, and waste paints were emptied on the ground surface. The pond holds water intermittently, and it was not clear what conditions existed when the dumping took place in approximately 1974. Examination of the area produced no evidence of vegetative stress or surface strain.

DPDO Storage Yard

This area is listed as potentially contaminated due to the storage of hazardous waste. The existing storage area consists of a concrete pad equipped for runoff control built in 1982, within a large yard used for material salvage since the early years at LAFB. No spills or contaminant release were reported, and examination of the area produced no evidence of such incidents. This area is used for temporary storage of items awaiting disposal through LAFB's designated DPDO at Kelley AFB, Texas.

4.4 HAZARD ASSESSMENT

Of the nine areas of potential contamination identified, five were recommended for Phase II investigations based on the decision tree present in Figure 1.3-1. The Supply Storage Area, Defuel Pit, South Boundary Dike, and DPDO yard areas were not recommended for further IRP action due to the lack of potential for contamination and migration. The South Boundary Dike represents a one-time disposal of largely volatile and/or mobile compounds some years in the past. It is doubtful that a Phase II effort of reasonable size at this site could identify a contaminant source. Further, the cost effectiveness and technical feasibility of any cleanup effort is very low. The Supply Storage Area represents a possible DDT spill area of limited magnitude. Since the pesticide was routinely applied in the area, the possibility of obtaining significant analytical results is limited. Further, the land use and the limited nature of possible residual contamination do not justify Phase II recommendations. For the Defuel Pit and DPDO sites, a problem arose in applying the waste management factor, as described below.

Each of the sites discussed in Section 4.3 was rated using the HARM. The HARM scores are summarized in Table 4.4-1. The process of rating potential hazards using the HARM system is described in detail in Appendix F. Basically the method uses numerical ratings for a number of discrete variables to calculate subscores for three categories. These categories represent the risk of human exposure (Receptors), the nature and quantity of waste (Waste Characteristics), and the potential migration routes (Pathways).

Waste characteristics were evaluated based on information obtained in interviews with base personnel. In cases where the waste was a mixture of substances with differing characteristics, the most critical waste was used for each variable. For example, a mixture of metal treatment sludges and waste solvents might be rated high for flammability due to the solvents and high for persistence due to the metals in the sludge. This is based on the guidance provided for HRS.

For the Pathways subscore, environmental factors such as rainfall intensity and net precipitation were evaluated using standard references such as the Climatic Atlas of the United States (USDC, 1979). Erosion potential was based on direct observation, while depth to ground water was based on available boring logs, geologic data, and interviews. A multiplication factor to account for Waste Management Practices is applied to the average of the three subscores to yield a final score. HARM provides only three choices, 1.0, 0.95, and 0.1, to indicate no containment, limited containment, and fully contained and in full compliance. This limitation made it difficult to accurately represent

Table 4.4-1. Summary of HARM Scores

Rank	Site	Receptors Subscore	Waste Characteristics Subscore	Pathways Subscore	Waste Management Factor	Total Score
1	Base Landfill	61	75	56	1.0	64
2	Old Industrial Waste Pond	46	100	43	1.0	63
3	Defuel Pit	49	100	37	0.95	59
4	DPDO	62	80	37	0.95	57
5	Firefighter Training Area	43	75	48	0.95	52
6	New Industrial Waste Pond	46	60	48	1.0	51
7	Sludge Disposal Area	62	30	41	1.0	44
8	South Boundary Dike	46	34	43	1.0	41
9	Supply Storage Area	62	30	30	0.95	39

Source: ESE, 1984

the situation at the Defuel Pit and DPDO yard. The defuel pit tank represents more than limited containment, which is normally used to indicate unlined earthen impoundments or similar situations. Yet, the condition of the tank is undocumented and does not qualify as "fully contained and in full compliance". Similar circumstances exist at the DPDO yard where additional conforming storage has been programed. Thus the ratings for these sites may not be representative of the relative hazard.

5.0 CONCLUSIONS

The goal of the IRP Phase I study is to identify sites where there is potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contaminant migration from these sites. The conclusions are based on the assessment of the information collected from the Project Team's field inspection, review of records and files, review of the environmental setting, and interviews with base personnel, past employees, and state and local government employees.

Base Landfill

This large area in the northwest corner of the base was used as a general purpose trench and fill landfill from the 1940's until 1974. It is located adjacent to an alluvial channel where subsurface movement of water across the base boundary is indicated. Some disposal of industrial liquid waste was reported. Potential exists for migration of solvents, oils, metals, and pesticides. Soil permeability ranges from <0.6 to 2.0 in/hr and the presence of fractured limestones and solution channels is probable. The HARM score for this site is 64.

Old Industrial Waste Pond

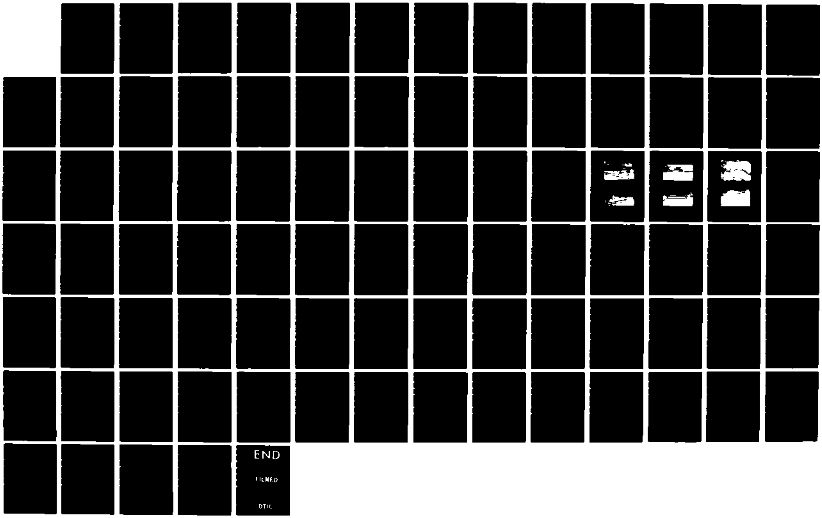
This borrow pit adjacent to the main flightline drainage channel was used as an industrial waste retention pond from at least 1952 to 1976. It continued to be used as a dumping area for liquid waste until 1980. Permeability of soils is 0.6 to 2.0 inches per hour (in/hr). Ground water conditions are unclear. Potential exists for contaminant migration, primarily involving metal plating and paint wastes and some oil, solvent, and pesticides. The HARM score for this site is 63.

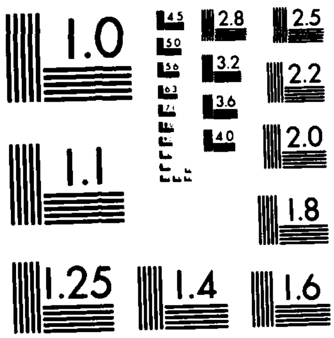
Defuel Pit

Underground steel tank in use since at least the 1950's as a container for various waste liquids, currently used to capture waste fuels. Condition of the tank is unknown and no leak check records were found. The HARM score for this site is 59.

AD-A154 180 INSTALLATION RESTORATION PROGRAM PHASE I: RECORDS SEARCH LAUGHLIN AIR FORCE BASE TEXAS(U) ENVIRONMENTAL SCIENCE AND ENGINEERING INC DENVER CO MAR 85

UNCLASSIFIED F08637-83-G-0010 F/G 13/2 NL





DPDO Storage Yard

This area is listed as potentially contaminated due to the storage of hazardous waste. The existing storage area consists of a concrete pad equipped for runoff control. No spills or contaminant release were reported, and examination of the area produced not evidence of such incidents. The HARM score for this site is 57.

Firefighter Training Area

The area utilized a surface depressions as firefighter training sites until 1983 when the current, fully contained, site was constructed. Fuels used in exercises included MOGAS, AVGAS, JP-4, JPTS, engine oil, transformer oil, and solvents. Surface soil permeability is 0.6 to 2.0 in/hr. Ground water conditions are not clearly defined. Soil contamination is likely, and some potential for migration exists. The HARM rating for this site is 52.

New Industrial Waste Pond

This pond was used to retain liquid waste and drainage from the flightline from 1972 to 1976. It was also used as a dumping area for chemical cleaning and plating shop wastes. Permeability of surface soils is 0.6 to 2.0 in/hr. Ground water conditions are unclear. Potential for migration exists, primarily for solvents and metals and possibly for oil and pesticides. The HARM score for this site is 51.

Sludge Disposal Area

This is a shallow, diked area which has historically been used as a dumping area for sludge generated during tank cleaning operations. Soil permability is 0.6 to 2.0 in/hr. Ground water conditions are unclear. Soil contamination is likely, primarily from metals. Some potential for migration exists for JP-4 and metals. The HARM score for this site is 44.

South Boundary Dike

Site of a one time dumping incident of three or four barrels of acetone, paint thinner, and waste paints. The pond holds water intermittently and conditions at the time of dumping are unknown. No evidence of vegetative stress or surface strain. The HARM score for this site is 41.

Supply Storage Area

The storage yard adjacent to Building 47 is used by base supply for material storage. Between 1973 and 1981, this area was used to store stocks of DDT which were on hand when use was discontinued. Approximately 40 drums of application strength liquid was held on the site. Correspondence files from this period indicate recurrent problems with the drums deteriorating and on several occations a transfer to new drums was required. Some limited leakage occurred. However, base personnel were aware of the potential hazard, the drums were inspected regularly, and no significant spills were reported. The HARM score for this site is 39.

6.0 RECOMMENDATIONS

The information gathered through interviews and research was sufficient to locate and categorize the on-base disposal sites. A Phase II monitoring program is recommended to accomplish the following objectives:

1. Obtain information regarding aquifer characteristics below LAFB. Such information would include stratigraphy, direction of ground water flow, and permeability.
2. Determine the nature and extent of surface water, ground water, soil, and sediment contamination that might have resulted from past storage, handling, and disposal practices.

In addition, recommendations are made regarding facilities and procedures currently utilized in the handling, storage, and disposal of hazardous materials.

6.1 PHASE II MONITORING RECOMMENDATIONS

The following actions are recommended to further assess the potential for environmental contamination from waste disposal areas at LAFB. The recommended actions are intended to be used as a general guide in the development and implementation of the Phase II study. The recommendations include the approximate number of ground water monitoring wells, type(s) of samples to be collected (e.g., soil, water, sediment) and suspected contaminants for which analyses should be performed. The number of ground water monitoring wells recommended corresponds to the number of wells required to adequately determine whether contaminants are migrating from a given source. The final number of ground water monitoring wells required to determine the extent of and define the movement of contaminants from each site will be determined as part of the Phase II investigation.

Recommended ground water monitoring should be performed periodically in order to assess contaminant migration under different ground water conditions. After monitoring, the data should be evaluated to determine the need for further action (if any). All drilling activities should be conducted by a driller experienced in hazardous waste investigations. All monitor wells should be constructed of threaded-joint casing and factory-slotted screen. Under no circumstances should PVC primer or PVC glue be used for the construction of well casing or bailers. The wells should be installed to the depth of bedrock, and the screen should extend over the entire saturated interval and approximately 1 foot above the water table. The wells need to be screened above the water table to detect nonmiscible, floating contaminants, such as petroleum products. Borehole geophysical logging of all LAFB wells is recommended to facilitate stratigraphic analysis. During drilling, Shelby tube samples should be taken to provide soils data and vertical permeability measurements. The top of the filter pack should be bentonite-sealed, and the annulus should be grouted to the surface. The well should be protected with pipe fitted with locking caps. The well should be developed to the fullest extent possible and surveyed both vertically and horizontally by a registered surveyor to obtain accurate well location distances and water level elevations. Water levels should be measured after recovery from well development and at the time of sampling. Slug tests should be conducted to determine horizontal permeability and to provide data for evaluation of flow rates.

Prior to initiation of any Phase II field activities, a detailed work plan should be prepared. This work plan should provide specific procedures to be followed in well construction, well logging, well installation, well development, surveying, water level measurements, aquifer testing, sampling, laboratory analysis, quality control, and reporting. All water samples should be analyzed at a minimum for total petroleum hydrocarbons, halogenated and nonhalogenated solvents, dissolved metals, PCBs, and pesticides, using EPA-approved procedures. The solvent analytes should include at a minimum TCE, benzene, MIBK, carbon tetrachloride, MEK, methylene chloride, and acetone. The recommended parameters include those compounds known or suspected to have been placed in the disposal sites. In addition, certain additional parameters for which drinking water standards exist are included. It is recommended that chemical analysis for metals include dissolved fractions to quantify which metals are mobile. Because the oil and grease analysis by EPA Method 413.2 does not differentiate between extractables of biological origin or the mineral oils and greases of POL origin, the EPA Infrared (IR) Spectrophotometric Method for total recoverable petroleum hydrocarbons (EPA Method 418.1) is recommended for assessing POL contamination. Halogenated and nonhalogenated solvents, PCBs, and pesticides may be analyzed by EPA Methods 624 and 625 or comparable methods. All water samples should be analyzed for pH and conductivity at the time of sampling.

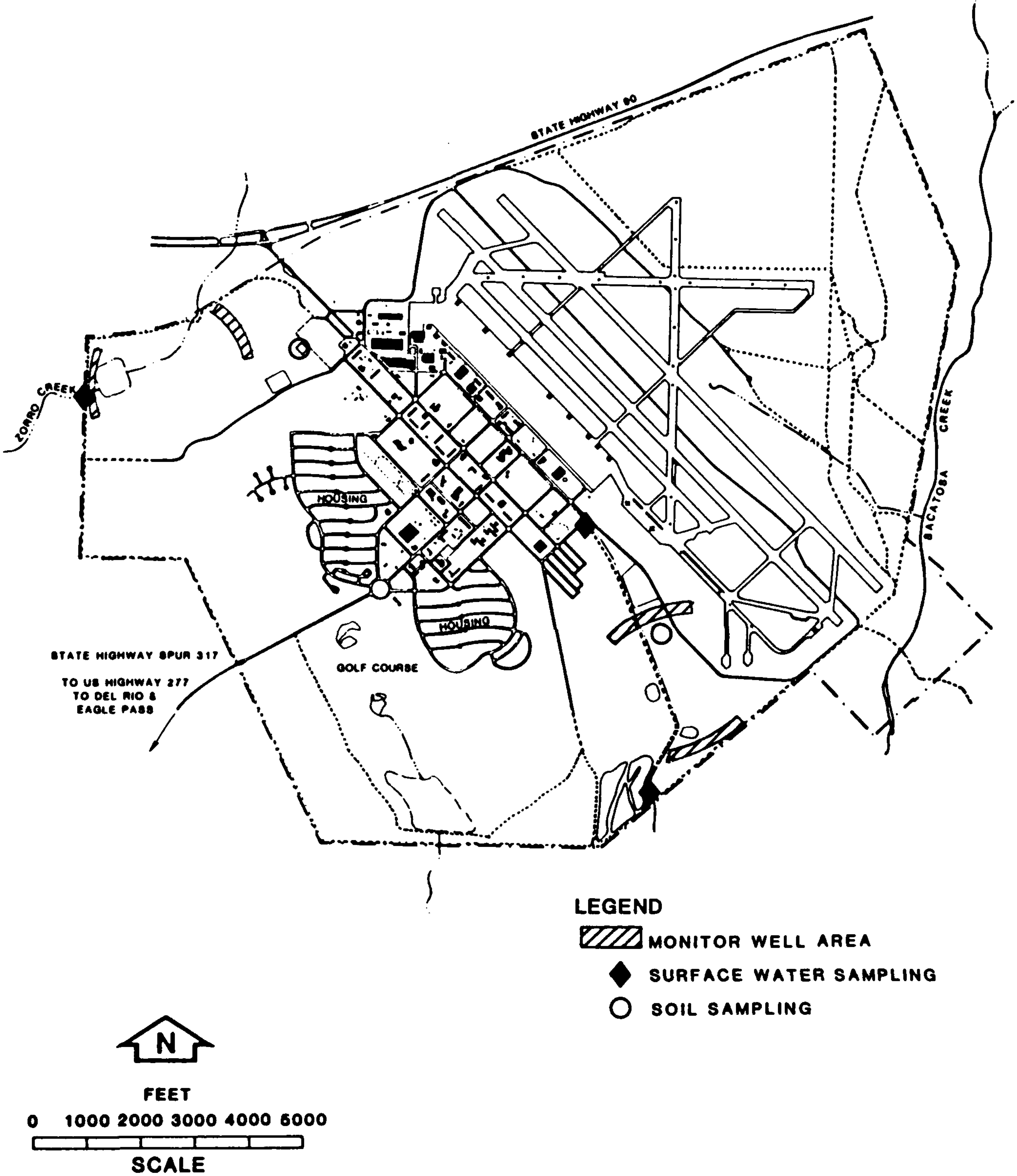
For the landfill, it is recommended that four monitoring wells be installed around the known fill area (see Figure 6.1-1). In addition, it is recommended that water and sediment samples be taken from the drainage ditch on the north side of the site, at the base boundary.

The two industrial waste ponds are close together and similar in content. Thus, it is recommended that ground water monitoring in this area examine the aggregate effect of these sites. Initially, one well should be installed north of the disposal sites and three wells on the south between the sites and the boundary. Wells can be spaced evenly and located as necessary to accommodate obstacles. The drainage ditch running south from the flightline which previously ran into the ponds should be sampled at the boundary and at its upstream end. Water and sediment should be sampled at each location, preferably after the ditch has been flowing for at least 24 hours.

It is recommended that a composite soil sample be obtained from the upper 6 ft of soil in the Firefighter Training and Sludge Disposal sites. These samples will be used to evaluate the potential hazard posed by near surface soil contamination in view of present and future uses of these sites.

The installation of wells at these sites may be added during Phase II based on soil analysis results.

Table 6.1-1 summarizes the recommended monitoring for LAFB Phase II investigations.



SOURCE: ESE, 1984

Figure 6.1-1 MONITOR WELL LOCATION AREAS AND SAMPLING SITES	INSTALLATION RESTORATION PROGRAM Laughlin Air Force Base

Table 6.1-1. Summary of Recommended Monitoring for LAFB Phase II Investigations

Site	HARM Score	Recommended Sampling	Recommended Analysis
Base Landfill	64	Three wells downgradient; One well upgradient; Water and sediment samples from drainage channel on north side.	Hydrocarbons, Solvents, Metals, PCB's, Pesticides
Old Industrial Waste Pond	63	Three boundary wells One upgradient well	Hydrocarbons Solvents
Defuel Pit	59	None	NA
DPDO	57	None	NA
Firefighter Training Area	52	Soil samples to six foot depth on line crossing pits and wells if significant contamination found.	Hydrocarbons, PCB's, Metals, Solvents
New Industrial Waste Pond	51	Soil samples from within ponds; Water and sediment from drainage channel at base boundary and south end of flightline.	Metals PCB's Pesticides
Sludge Disposal Area	44	Soil samples to six foot depth on line crossing area and wells if significant contamination found.	Hydrocarbons, metals
South Boundary Dike	41	None	NA
Supply Storage Area	39	None	NA

Source: ESE, 1984.

6.2 EXISTING FACILITIES/PROCEDURES

The site visit and conversations with LAFB personnel identified one area requiring attention to insure regulatory compliance and guard against possible future contamination. The underground tank at the Defuel Pit at Building 414 was used to store a variety of wastes in the past. The condition and integrity of the tank are not known. A detailed work plan should be prepared for evaluating this tank. If evidence of leakage is found, sampling and analysis should be undertaken to define the extent of contamination.

6.3 LAND USE GUIDELINES

Careful consideration should be given to the uses made of the disposal areas for the following reasons:

1. To provide the continued protection of human health, welfare, and the environment;
2. To insure that the migration of potential contaminants is not promoted through improper land uses;
3. To facilitate the compatible development of future USAF facilities; and
4. To allow for identification of property which may be proposed for excess or outlease.

In general, activities which would tend to disrupt the waste cells should be avoided so as not to facilitate contaminant migration. Such activities include foundation and drainage ditch construction. To avoid trapping any volatile compounds that may be released from the disposal areas, structures should not be placed over the sites.

Soil from the IWP's should not be disturbed or removed until chemical analysis results are available and proper procedures instituted.

Recommended land use restrictions are summarized in Table 6.3-1 and 6.3-2.

Table 6.3-1. Recommended Guidelines at Potential Contamination Sites for Land Use Restrictions
LAFB, Del Rio, Texas

	Recommended Guidelines for Future Land Use Restrictions (1)											
	Construction on the Site	Excavation	Well Construction on or near the site	Agri-cultural Use	Silvi-cultural Use	Water Infiltration (run-on, Ponding, Irrigation)	Recreational Use	Burning or Ignition Source	Disposal Operations	Vehicular Traffic	Material Storage	Housing on or Near the Site
Base Landfill	R	R	R	R	NR	R	R	R	R(2)	NR	NR(3)	R
Old Industrial Waste Pond	R	NR	R	R	NR	R	R	NR	R(2)	NR	NR(3)	R
Defuel Pit	NR	NR	R	R	NR	R	NR	R	R(2)	NR	NR(3)	R
DPDO	NR	NR	R	R	NR	R	NR	R	R(2)	NR	NR(3)	R
Firefighter Training Area	NR	NR	R	R	NR	R	NR	NR	R(2)	NR	NR(3)	R
New Industrial Waste Pond	R	NR	R	R	NR	R	R	NR	R(2)	NR	NR(3)	R
Sludge Disposal Area	NR	NR	R	R	NR	NR	NR	R	R(2)	NR	NR(3)	R
South Boundary Dike	NR	NR	R	NR	NR	NR	NR	NR	R(2)	NR	NR(3)	R
Supply Storage Area	NR	NR	R	R	NR	R	NR	NR	R(2)	NR	NR(3)	R

(1) See Table 6.3-2 for description of guidelines.
Note the following symbols in this table:
R = Restrict the use to the site for this purpose.
NR = No restriction of the site for this purpose.

(2) Restrict for all wastes except for construction/demolition debris.

(3) No restriction for solid materials but liquids undesirable.

Table 6.3-2. Description of Guidelines for Land Use Restrictions (Page 1 of 2)

Guideline	Description
Construction on the site	Restrict the construction of structures which make permanent (or semi-permanent) and exclusive use of a portion of the site's surface.
Excavation	Restrict the disturbance of the cover of subsurface materials.
Well Construction on or near the site	Restrict the placement of any wells (except for monitoring purposes) on or within a reasonably safe distance of the site. This distance will vary from site to site, based on prevailing soil conditions and groundwater flow.
Agricultural use	Restrict the use of the site for agricultural purposes to prevent food chain contamination.
Silvicultural use	Restrict the use of the site for silvicultural uses (root structures could disturb cover or subsurface materials).
Water infiltration	Restrict water run-on, ponding and/or irrigation of the site. Water infiltration could produce contaminated leachate.
Recreational use	Restrict the use of the site for recreational purposes.
Burning or ignition sources	Restrict any and all unnecessary sources of ignition, due to the possible presence of flammable compounds.
Disposal operations	Restrict the use of the site for waste disposal operations, whether above or below ground.
Vehicular traffic	Restrict the passage of unnecessary vehicular traffic on the site due to the presence of explosive material(s) and/or of an unstable surface.

Table 6.3-2. Description of Guidelines for Land Use Restrictions (Continued, Page 2 of 2)

Guideline	Description
Material storage	Restrict the storage of any and all liquid or solid materials on the site.
Housing on or near the site	Restrict the use of housing structures on or within a reasonably safe distance of the site.

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APPENDIX C

LIST OF INTERVIEWEES AND OUTSIDE CONTACTS

ESE

PROFESSIONAL RESUME

DAVID H. STEPHENS, B.S.
Associate Scientist

SPECIALIZATION

Geologic Evaluations, Geophysical/Geochemical Techniques, Hazardous Waste Site Assessment, Hydrology

RECENT EXPERIENCE

Toxic and Hazardous Materials Assessment Study, Team Geologist--Geologic and hydrologic study of offpost contamination in the area of the Rocky Mountain Arsenal, Denver, Colorado. Tasks included inventory and compilation of geologic and ground water data base, design and maintenance of ground water monitoring and sampling network, and development of subsurface geologic models to aid in the location of additional test borings and construction of hydrologic models.

Geologic and Geohydrologic Evaluation of Air Force Facilities, Team Geologist--Phase I records search as part of installation restoration program. Installations include Laughlin Air Force Base, Del Rio, Texas and Goodfellow Air Force Base, San Angelo, Texas.

Uranium Exploration, Development Drilling, Project Manager--Responsible for entire project management including safety and reclamation activities. Included supervision and monitoring of refuse and waste disposal at onsite locations and compliance with state and federal regulations regarding radioactive materials.

EDUCATION

B.S. 1975 Geological Sciences Lehigh University

ASSOCIATIONS

American Association of Petroleum Geologists--Energy Minerals Division
Society of Mining Engineers of AIME

DHS/HZ/0884.1
08/13/84

ESE
PROFESSIONAL RESUME

KEITH C. GOVRO, M.S.
Group Leader, Ecology

SPECIALIZATION

Ecosystem Impacts from Hazardous Waste Disposal Practices, Wildlife Biology, Fisheries Biology, Water Quality

RECENT EXPERIENCE

Assessment of Hazardous Waste Management/Disposal Practices at U.S. Army Installations, Team Scientist - Performed on-site inspections with regard to the presence of toxic and hazardous materials, the potential for off-site migration of contaminants, and both on-site and off-site waste disposal practices. Evaluations based on review of existing data bases, records and site surveys. Findings used to determine the necessity for confirmatory sampling/analysis and decontamination activities.

Delineation of Habitat Types through Aerial Photo Interpretation, St. Paul District, Corps of Engineers, Project Manager - Delineated habitat types within a 20,000-acre section of the Kickapoo River watershed in southwestern Wisconsin through aerial photo interpretation. Computed acreage for each habitat type by 20-foot contour interval. Resulting data used to determine potential habitat losses associated with the construction of the proposed LaFarge Reservoir.

IQ-ID Contract for Ecological Services, St. Paul District, Corps of Engineers, Project Manager - Contract involves providing aquatic and terrestrial ecological services to the St. Paul District on a work order basis. Past work orders have involved ecological analysis of candidate sites for dredged material placement with Pools 8 and 9 of the Upper Mississippi River.

Biological Inventory of Federal Coal Reserve Area in Southeastern Oklahoma, Bureau of Land Management, Subproject Manager - Conducted field surveys of the vegetation, wildlife and fisheries resources within the 372,000-acre area to provide a data base for assessment of future impacts from mining operations.

Aquatic Ecosystem Surveys, Midwestern Rivers and Reservoirs - Served as Project Manager and/or Project Biologist for numerous aquatic ecology surveys within major Midwestern drainages such as the Mississippi, Illinois, Kaskaskia, Des Moines, Missouri, Wabash and Iowa Rivers and reservoirs such as Lake Hamilton, Lake St. Louis, Lake Springfield, and Newton Lake.

Bioassay of Dredge Spoil Impacts on Aquatic Organisms, U.S. Army Corps of Engineers, Project Scientist - Participated in static and flow-through bioassays assessing impacts to aquatic organisms from exposure to dredge spoils.

EDUCATION

M.S.	1977	Fisheries Biology	Iowa State University
B.S.	1975	Wildlife and Fisheries Biology	Iowa State University

ESE

PROFESSIONAL RESUME

WILLIAM G. FRASER, B.S., P.E.
Senior Associate Engineer

SPECIALIZATION

Water Quality/Resources Engineering, Environmental Impact Assessment, Groundwater Hydrology, Siting and Environmental Studies

RECENT EXPERIENCE

USAF Installation Assessment - Currently evaluating present and historical waste disposal practices at Vance Air Force Base, Oklahoma.

Navy Installation Assessments - Worked as the Environmental Engineer on a project team examining historical waste handling practices and disposal sites at several Naval Bases. Studied waste types and quantities, and assessed disposal site suitability based on hydrogeologic characteristics, neighboring land use, and contaminant migration potential.

Siting Studies - Worked as staff member performing hydrologic, water quality and air quality studies related to siting and licensing of major mining and power facilities.

Field Investigations - Streamflow measurement, water sampling, dam site investigations, and groundwater testing at numerous sites in Colorado and the West.

USATHAMA Installation Assessments - Worked as the Environmental Engineer on a project team examining waste disposal practices at several Army Bases, including Ft. Carson, Colorado. Examined various industrial operations and an industrial waste treatment plant handling oily wastewater.

USATHAMA Environmental Survey - Evaluated the nature and extent of contaminant migration from abandoned landfill sites containing solvents, POL, pesticides, and medical supplies. Reviewed surface and groundwater analytical data and calculated pollutant mass influx at installation boundary based on surface runoff and groundwater flow.

EDUCATION

B.S.	1975	Civil/Environmental Engineering	University of Connecticut

REGISTRATION

Registered Professional Engineer, State of Colorado, 1983

ASSOCIATIONS

American Society of Civil Engineers
American Water Resources Association

BRUCE N. McMASTER, Ph D.
Senior Chemist/Project Manager

ESE PROFESSIONAL RESUME

SPECIALIZATION

Toxic and Hazardous Waste Disposal, Hazardous Waste Site Investigations, Pollutant Fate Studies, Environmental Chemistry, Water Quality

RECENT EXPERIENCE

Records Search for U.S. Army Toxic and Hazardous Materials Agency, Project Manager--Assessing environmental quality of 65 Army installations with regard to the use, storage, treatment and disposal of toxic and hazardous materials; define contaminants present, potential for off-site migration, and potential impacts on receptors; recommend sampling and analysis surveys for quantitative delineation of contamination problems; evaluate compliance status with all applicable environmental regulations.

Environmental Contamination Surveys for the U.S. Army Toxic and Hazardous Materials Agency, Project Manager--Investigating 7 U.S. Army installations to confirm the presence of toxic and hazardous contaminants, and to define the extent of contamination and contaminant migration. Surveys include sampling and analysis of surface waters, ground water, soil, sediments, sewers, and buildings. Conduct alternative analyses for potential mitigative measures.

Initial Assessment Studies for the Naval Energy and Environmental Support Activity, Project Manager--Evaluating 4 Naval installations with regard to past hazardous waste generation, storage, treatment, and disposal practices. Investigations include records review, aerial and ground site surveys, employee interviews, and limited sampling and analysis including geophysical techniques. Determine extent of contamination at former disposal/spill sites, potential for contaminant migration, and potential effects on human health and the environment.

EDUCATION

Post-Doctoral	1977-78	Environmental Engineering/Science	University of Florida
Ph.D.	1976	Chemistry	University of Florida
B.S.	1968	Chemistry	University of Delaware

REGISTRATIONS/ASSOCIATIONS

American Chemical Society, Member
American Defense Preparedness Association, Member

PUBLICATIONS

Approximately 20 hazardous waste site investigations of U.S. military installations.

D-MR1MS.1/BNM-HZ.1
04/27/84

APPENDIX B

TEAM MEMBER BIOGRAPHICAL DATA

APPENDIX A
(Continued, Page 7 of 7)

sedimentary	Rocks formed from consolidation of loose sediment.
SPCC	Spill Prevention Control Countermeasures.
Spill	An unplanned release or discharge of a hazardous waste onto or into air, land, or water.
STP	Sewage Treatment Plant
TCE	Trichloroethylene, a commonly used degreasing solvent; toxic to aquatic life and a suspected human carcinogen.
TDWR	Texas Department of Water Resources
UG	underground
unconformity	Break in the depositional record due to uplift and erosion
Upgradient	In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of ground water.
USAF	U.S. Air Force
USGS	U.S. Geological Survey
USDC	U.S. Department of Commerce
USSCS	U.S. Soil Conservation Service
Water table	Surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.
WTGS	West Texas Geological Society

loam	Soil material of varible clay, silt and snad compositions.
MEK	Methyl ethyl ketone, a solvent used in paint thinner, stripper, and a wide variety of industrial applications; suspected to be toxic to humans at high levels; potentially toxic to aquatic life.
MTBK	Methyl isobutyl ketone similar in use and effect to MEK.
Metamorphic	Rocks formed from other rock types due to intense temperature and pressure.
µg/l	micrograms per liter
µmho/cm	micromhos per centimeter
mg/l	milligrams per liter
mm	millimeters
MOGAS	motor gasoline
mph	miles per hour
msl	mean sea level
OMS	Organizational Maintenance Squadron
orogeny	uplift
PCB	Polychlorinated biphenyls, liquid used as a dielectric in electrical equipment; suspected human carcinogen; bioaccumulates in the food chain and causes toxicity to higher trophic levels.
POL	petroleum, oils, lubricants
ppm	parts per million
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
SAC	Strategic Air Command

	having a low runoff potential. They are mainly deep, well drained, and sand or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artifically drained and part is undrained.
IBWC	International Boundary and Water Commission
Igneous	Rock solidified from molten material
in	inches
in/hr	inches per hour
in/yr	inches per year
Infiltration	Movement of water through the soil surface into the ground.
Interformational leakage	Movement of ground water from one aquifer to another due to changes of hydraulic head.
IRP	Installation Restoration Program
JP-4	Jet fuel used in T-37 and T-38 aircraft.
JPTS	Jet Propellant Thermally Stable used in U-2 aircraft.
karst	Topography characterized by depressions or sinkholes caused by solution dissolve of underlying carbonate rocks.
LAFB	Lauglin Air Force Base
Lead	An additive to gasoline and used in other industrial applications; toxic to humans and aquatic life; bioaccumulates.
Leachate	A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water.

ESE	Environmental Science and Engineering, Inc.
Eugeosyncline	A large scale structural depression in which volcanism is associated with clastic deposition.
ft	feet
FFT	Firefighter Training
Forland	A stable area marginal to a tectonic belt toward which the rocks of the belt were thrust or overfolded.
gal	gallon
gilgai	microrelief structures in soils.
Ground water	Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure.
HALON	A fire suppressant
HARM	Hazard Assessment Rating Methodology
Hazardous waste	As defined in RCRA, a solid waste or combination of solid wastes which become of its quantity, concentration, or physical, chemical, or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.
Hydrologic Soil Group	Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and

Coquina	Limestone made up of shells and shell fragments.
Craton	The part of the earth's crust which has attained stability.
DDT	Dichlorodiphenyltrichloroethane, pesticide commonly used in 1960's.
Deposition	The lying down of rock forming material.
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DF-2	Diesel fuel
Disposal of hazardous waste	Discharge, deposit, injection, dumping, spilling, or placing of any hazardous waste into or on land or water so that such waste or any constituent thereof may enter the environment, be emitted into the air, or be discharged into any waters, including ground water.
DOD	Department of Defense
Downgradient	In the direction of decreasing hydraulic static head; the direction in which ground water flows.
DPDO	Defense Property Disposal Office
°F	Degrees Fahrenheit
Effluent	Liquid waste discharged in its natural state or partially or completely treated from a manufacutring or treatment process.
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
EPAux	Eagle Pass Auxiliary Field
Epeiric	Shallow sea conditions on the continental shelf or within the continent.
Erosin	The breakdown of terrestrial material by natural processes.

BMW	Bombardment Wing
Cadmium	A metal used in batteries and other industrial applications; highly toxic to humans and aquatic life.
Carbon tetrachloride	A solvent commonly in use until the 1960s; a suspected human carcinogen.
Carbonate	A sediment formed by the organic or inorganic precipitation from aqueous solutions of calcium, magnesium and iron.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CES	Civil Engineering Squadron
Chert	Dense cryptocrystalline sedimentary rock.
Chromium	A metal used in plating, cleaning, and other industrial applications; highly toxic to aquatic life at low concentrations, toxic to humans at higher levels.
Clastic	Sedimentary rock derived from fragments derived from pre-existing rocks.
Colluvium	Loose material at the base of a steep slope or cliff.
Concretions	Hard, compact material of mineral matter formed by precipitation from aqueous solution.
Conformity	Undisturbed relations of strata deposited in order with little or no time lag, continuous.
Contaminated fuel	Fuel which does not meet specifications for recovery or recycle.
Contamination	Degradation of natural water quality to the extent that its usefulness is impared; degree of permissible contamination depends on intended use of water.
Continental rifting	The spreading of continents due to tectonic movement of earth plates.

APPENDIX A

GLOSSARY OF TERMINOLOGY, ABBREVIATIONS, AND ACRONYMS

A Horizon	The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material
AFB	Air Force Base
AFFF	Aqueous Film Forming Foam--Fire Suppressant
AFS	Air Force Station
AG	aboveground
AGE	Aerospace Ground Equipment
AGI	American Geological Institute
Alluvium	Unconsolidated material deposited by stream action.
Analytes	Specific elements and/or compounds analyzed for.
Aquiclude	Geologic unit which impedes ground water flow
Aquifer	A geologic formation, group of formations, or part of a formation capable of yielding water to a well or spring.
ATC	Air Training Command
B Horizon	The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as 1) accumulation of clay, sesquioxides, humus, or a combination of these; 2) prismatic or blocky structure; 3) redder of browner colors than those in the A horizon; or 4) a combination of these. The combined A and B horizons are generally called solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.
BEG	Bureau of Economic Geology, University of Texas at Austin
BES	Bioenvironmental Engineering Services

APPENDIX A

GLOSSARY OF TERMINOLOGY, ABBREVIATIONS, AND ACRONYMS

APPENDIX C

List of Interviewees

(Page 1 of 3)

Position	Years of Service
Heavy Equipment Operator	26
Environmental Coordinator (DEEV)	7
Former OIC DEEV	2
Bio Environmental Services	4
Electric Shop Foreman	15
Plans-Mobility-Resource Man	20
47th FMS Fabrication Chief	4
Non-Destructive Inspection	8
Chemical Cleaning	25
47th FMS Hazardous Waste Monitor	4
Judge Advocate	2
Defense Property Disposal Office	4
Vehicle Maintenance Chief	10
Fuels Management Officer	4
Fire Department	10
Fire Department	1
Entomology	2
POL Storage	12
Historian	--
Real Property	--
Public Affairs	--

APPENDIX C

Outside Contacts

(Continued, Page 2 of 3)

Soil Conservation Service
Del Rio, Texas
(512) 775-3183

U.S. Geological Survey
Hiway 277
Del Rio, Texas
(512) 774-4331

Jim Smith
International Boundary and Water Commission
Star Route 2, Box 37, Hiway 90W
Del Rio, Texas
(512) 775-2437

Val Verde County Library
300 Washington at Spring
Del Rio, Texas
(512) 774-3622

Bernie Baker
Texas Department of Water Resources
P.O. Box 13087
Austin, Texas 78711
(512) 475-7036

Texas Department of Health
1100 W. 94th
Austin, Texas 78756
(512) 458-7271

APPENDIX C

Outside Contacts

(Continued, Page 3 of 3)

U.S. Geological Survey Library
1526 Cole Blvd
Denver, Colorado 80225
(303) 236-1000

Roland Mida
Real Property
Goodfellow AFB
San Angelo, TX 76908
(915) 657-3231

Captain G.E. Seeley
SGPAB
Beale AFB
Maryville, CA.
(916) 634-4724

Lt. Col R.L. Schiller
SGPAB
Randolph AFB
Universal City, TX
(512) 652-5271

National Park Service
Amistad Recreation Area
P.O. Box 420367
Del Rio, TX 78842-0367
(512) 775-6722

APPENDIX D

MASTER LIST OF SHOPS AND LABS

APPENDIX D
MASTER SHOP LIST
(Page 1 of 5)

Facility/Shop	Location	Handles Hazardous Materials	Produces Hazardous Waste	Comments
47th FMS				
Aero Systems				
Battery	50	Yes	No	
Electric	211	Yes	No	
Environmental Systems	210	Yes	Yes	See Table 4.2-1.
Fuels System	53	No	No	
Pneudraulic	211	Yes	Yes	See Table 4.2-1.
Wheel and Tire	50	Yes	Yes	See Table 4.2-1.
Avionics				
Instrument	211	Yes	No	Some consumptive use of solvents.
PMEL	211	Yes	No	

APPENDIX D
MASTER SHOP LIST
(Page 2 of 5)

Facility/Shop	Location	Handles Hazardous Materials	Produces Hazardous Waste	Comments
Fabrication				
Corrosion Control	51	Yes	Yes	See Table 4.2-1.
NDI	52	Yes	Yes	See Table 4.2-1.
Metal Finishing	68	Yes	Yes	See Table 4.2-1.
Chemical Cleaning	68	Yes	Yes	See Table 4.2-1.
Survival Equipment	74	Yes	No	See Table 4.2-1.
Machine	68	Yes	Yes	See Table 4.2-1.
Propulsion				
T-37 engine	68	Yes	Yes	See Table 4.2-1.
T-38 engine	68	Yes	Yes	See Table 4.2-1.
Test Cell	18	Yes	Yes	Most waste JP-4 reused.
Support Equipment	306	Yes	Yes	See Table 4.2-1.

APPENDIX D
MASTER SHOP LIST
(Page 3 of 5)

Facility/Shop	Location	Handles Hazardous Materials	Produces Hazardous Waste	Comments
Transient Maintenance	309	Yes	Yes	See Table 4.2-1.
47th OMS				
T-37	414	Yes	Yes	See Table 4.2-1.
T-38	210	Yes	Yes	See Table 4.2-1.
Repair and Reclamation	218	Yes	Yes	See Table 4.2-1.
SVE				
Service Station	91	Yes	Yes	See Table 4.2-1
LGSF				
Fuels	20	Yes	Yes	See Table 4.2-1.
MWR				
Auto Hobby	525	Yes	Yes	See Table 4.2-1.

APPENDIX D
MASTER SHOP LIST
(Page 4 of 5)

Facility/Shop	Location	Handles Hazardous Materials	Produces Hazardous Waste	Comments
47th STUS				
Photo	314	Yes	No	Waste Solution goes to Sanitary Sewers.
Transportation				
Vehicle Maintenance	131	Yes	Yes	See Table 4.2-1.
Fire Truck Maintenance	47	Yes	Yes	See Table 4.2-1.
Refuel Truck Maintenance	30	Yes	Yes	See Table 4.2-1.
47th CES				
Refrigeration	122	Yes	Yes	See Table 4.2-1.
Electric	122	Yes	Yes	See Table 4.2-1.
Small Engine	125	Yes	Yes	See Table 4.2-1.
Entomology	800	Yes	Yes	See Table 4.2-1.

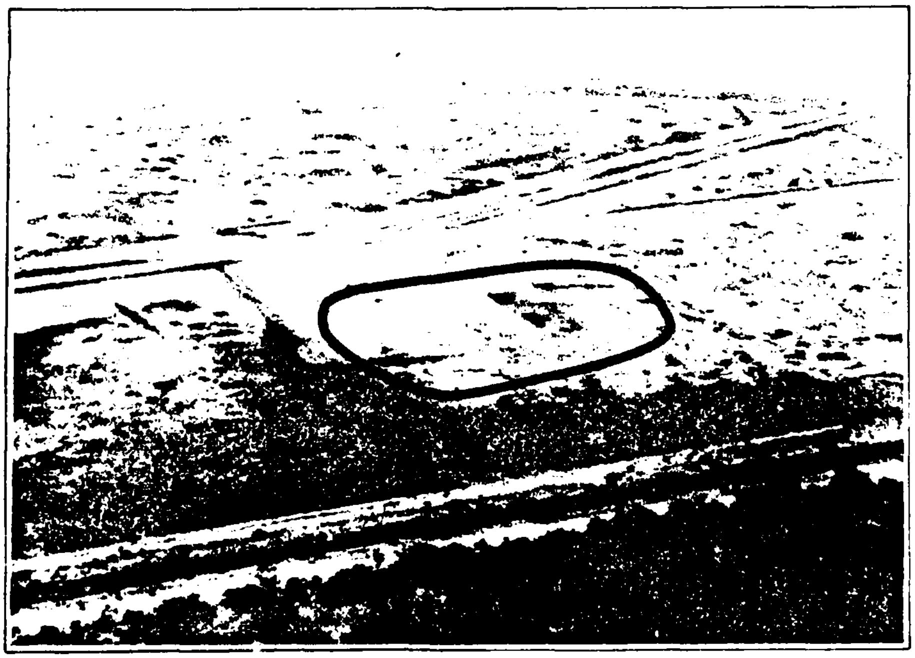
APPENDIX D
MASTER SHOP LIST
(Page 5 of 5)

Facility/Shop	Location	Handles Hazardous Materials	Produces Hazardous Waste	Comments
<u>47th CES</u>				
Sanitation	121	No	No	
Fire Protection	207	No	No	
Paint	120	Yes	Yes	See Table 4.2-1.

APPENDIX E

PHOTOGRAPHS OF DISPOSAL/SPILL SITES

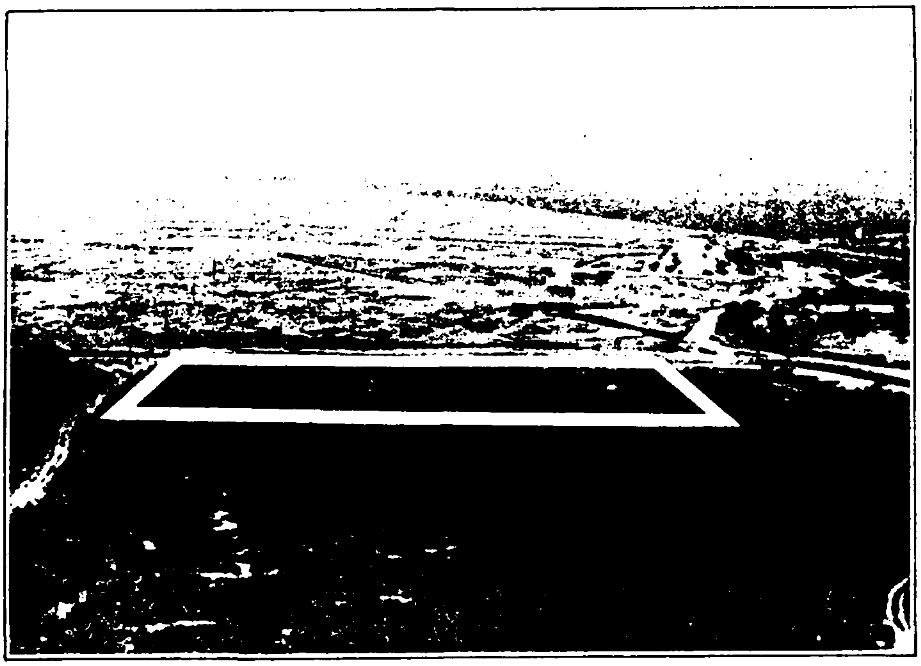
EXISTING FFTA



OLD FFTA

AREAS OF POTENTIAL CONTAMINITION	INSTALLATION RESTORATION PROGRAM Laughlin Air Force Base

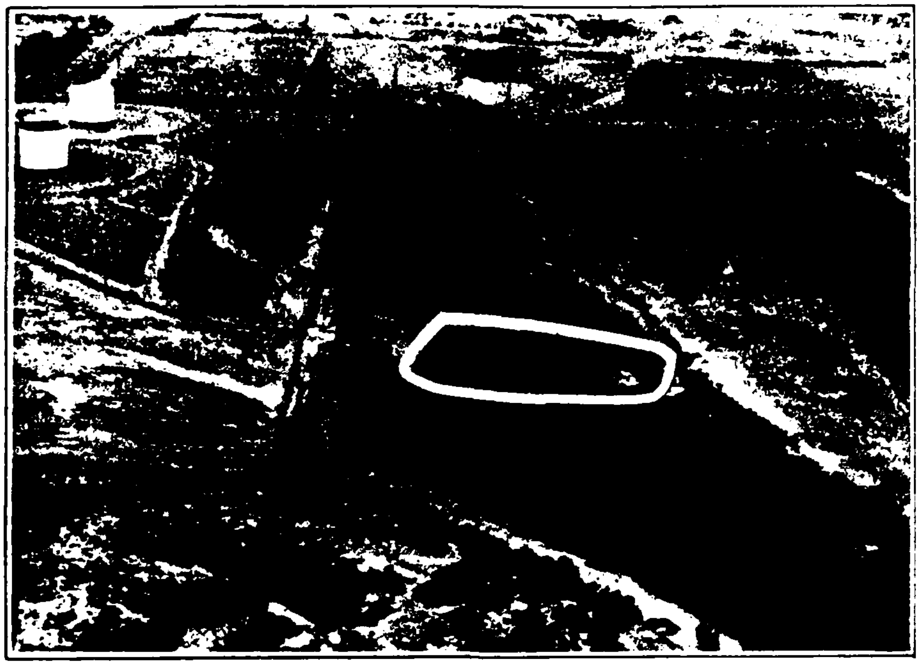
OLD IWP



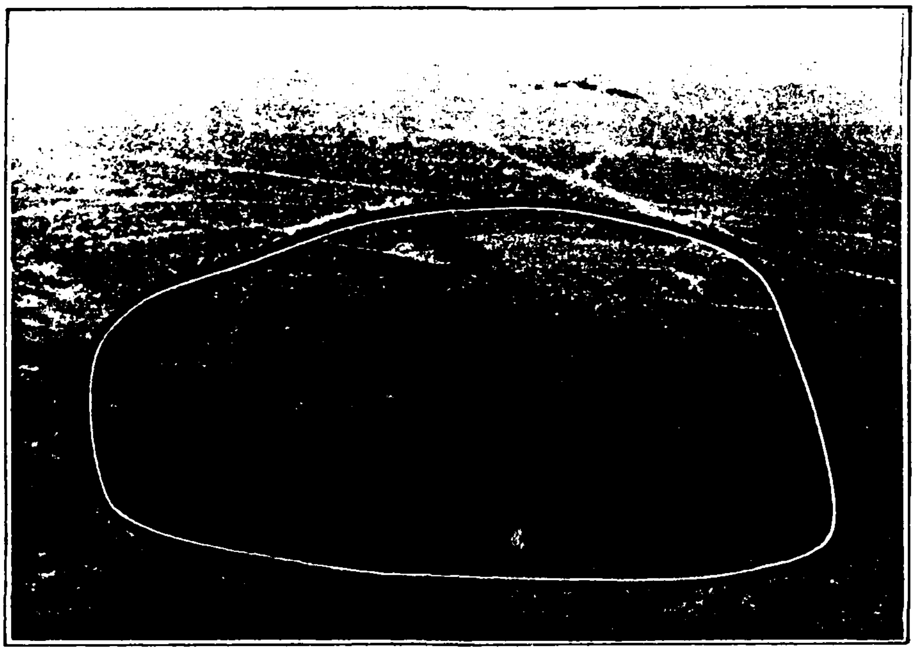
NEW IWP

AREAS OF POTENTIAL CONTAMINATION

INSTALLATION RESTORATION PROGRAM
Laughlin Air Force Base



SLUDGE DISPOSAL AREA



BASE LANDFILL

AREAS OF POTENTIAL CONTAMINATION

INSTALLATION RESTORATION PROGRAM
Laughlin Air Force Base

APPENDIX F

USAF IRP HAZARD ASSESSMENT RATING METHODOLOGY

HAZARD ASSESSMENT RATING METHODOLOGY FORM
(Continued, Page 2 of 2)

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists, proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for three potential pathways: surface water migration, flooding, and ground water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
SUBTOTALS			60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
SUBTOTALS			32	114
Subscore (100 x factor score subtotal/maximum score subtotal)				28

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above. Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	61
Waste Characteristics	75
Pathways	56
TOTAL	192 divided by 3 = 64 Gross total score

B. Apply factor for waste containment from waste management practices. Gross total score x waste management practices factor = final score.

64 x 1.0 = 64

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Base Landfill

Location: Northwest corner of base - 2,000' FWL; 1,500' FNL

Date of Operation or Occurrence: 1952 to present

Owner/Operator: LAFB - USAF

Comments/Description: General purpose now used for construction waste disposal

Site Rated By: D.H. Stephens

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1-mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1-mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	2	6	12	18
I. Population served by ground water supply within 3 miles of site	3	6	18	18
SUBTOTALS			109	180
Receptors subscore (100 x factor score subtotal/maximum score subtotal)				61

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) L
2. Confidence level (1=confirmed, 2=suspected) C
3. Hazard rating (1=low, 2=medium, 3=high) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor:
Factor Subscore A x Persistence Factor = Subscore B
100 x 1.0 = 100

C. Apply physical state multiplier:
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
100 x .75 = 75

APPENDIX G

HAZARD ASSESSMENT RATING METHODOLOGY FORMS

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. WASTE MANAGEMENT PRACTICES FACTOR

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Fire Proection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III-B-3, then leave blank for calculation of factor score and maximum possible score.

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION

Rating Factor	Rating Scale Levels				Multiplier
	0	1	2	3	
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8

B-2 POTENTIAL FOR FLOODING

Rating Factor	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1

B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION

Rating Factor	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:

For a site with more than one hazardous waste, the waste quantities may be added using the following rules:

Confidence Level

- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating

- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCM = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (<5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (>20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records.
- o Knowledge of types and quantities of wastes generated by shops and other areas on base.
- o Based on the above, a determination of the types and quantities of waste disposed of at the site.

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records.
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site.

A-3 Hazard Rating

Hazard Category	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

TABLE 1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1 - 25	26 - 100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1 mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1 mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination.	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands.	10
F. Water quality/use designation of nearest surface water body	Agricultural or industrial use.	Recreation, propagation and management of fish and wildlife.	Shellfish propagation and harvesting.	Potable water supplies	6
G. Ground-Water use of uppermost aquifer	Not used, other sources readily available.	Commercial, industrial, or irrigation, very limited other water sources.	Drinking water, municipal water available.	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available.	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1 - 50	51 - 1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1 - 50	51 - 1,000	Greater than 1, 000	6

FIGURE 2 (Continued)

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
Subtotals			______	______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		
Subtotals			______	______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = [ ]

FIGURE 2

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE ______________________

LOCATION ______________________

DATE OF OPERATION OR OCCURRENCE ______________________

OWNER/OPERATOR ______________________

COMMENTS/DESCRIPTION ______________________

SITE RATED BY ______________________

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		
		Subtotals	______	______

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ______

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix) ______

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

______ X ______ = ______

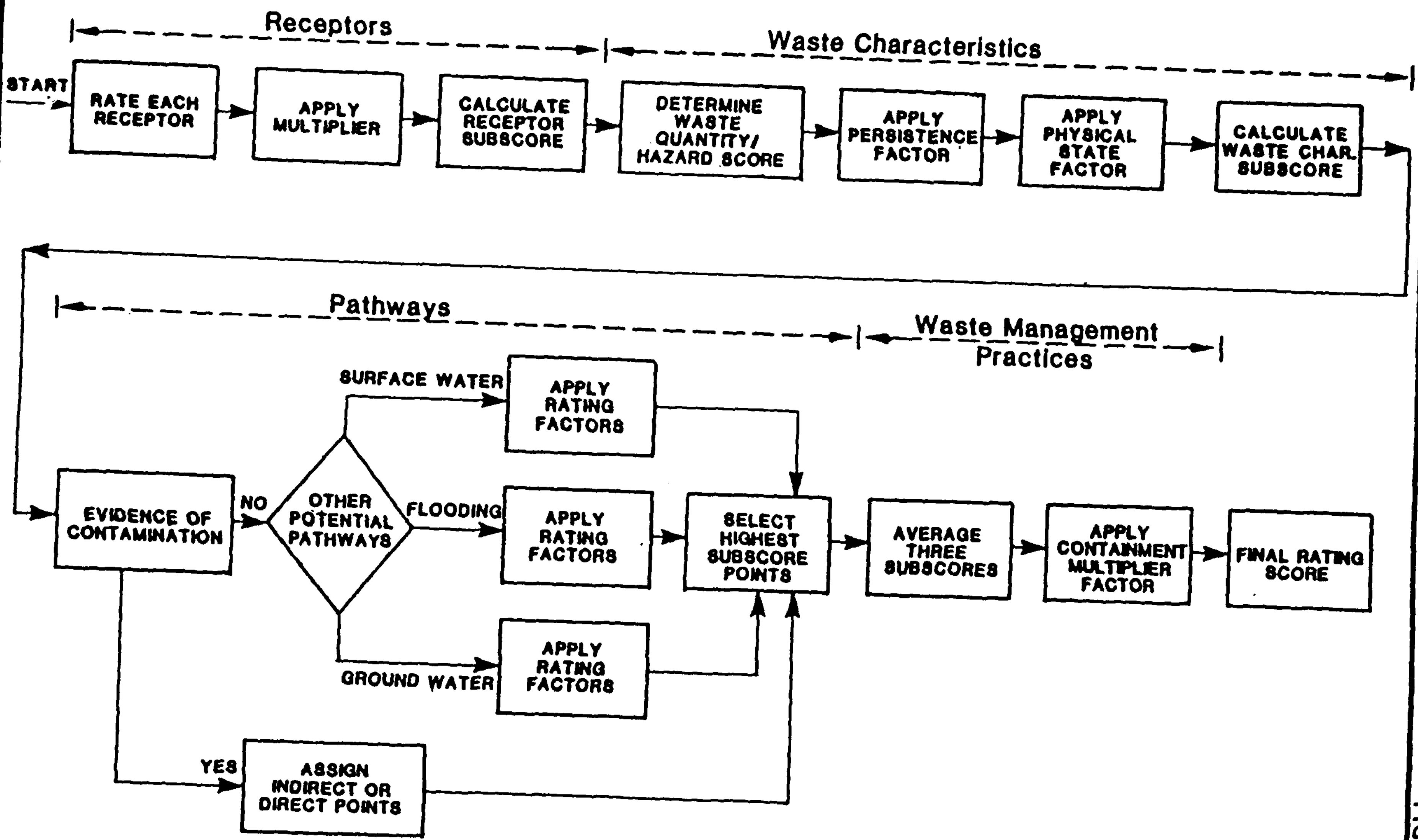
C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

FIGURE 1

HAZARD ASSESSMENT RATING METHODOLOGY FLOW CHART



The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface water migration, flooding, and ground-water migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Sites at which there is no containment are not reduced in score. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste managment practices category factor to the sum of the scores for the other three categories.

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DOD program needs.

The model uses data readily obtained during the Record Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DOD properties.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant and adding the weighted scores to obtain a total category score.

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

The Department of Defense (DOD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DOD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with representatives from USAF Occupational Environmental Health Laboratory (OEHL), Air Force Engineering Services Center (AFESC), Engineering-Science (ES) and CH_2M Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, Engineering Science, and CH_2M Hill met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Old Industrial Waste Pond
Location: South end of base - 500' ESL; 5,000' FEL
Date of Operation or Occurrence: 1952-1980
Owner/Operator: LAFB - USAF
Comments/Description: Borrow pit converted to industrial waste pond
Site Rated By: D.H. Stephens

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1-mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1-mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	1	6	6	18
I. Population served by ground water supply within 3 miles of site	3	6	18	18
SUBTOTALS			83	180
Receptors subscore (100 x factor score subtotal/maximum score subtotal)				46

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) — L
2. Confidence level (1=confirmed, 2=suspected) — C
3 Hazard rating (1=low, 2=medium, 3=high) — H

Factor Subscore A (from 20 to 100 based on factor score matrix) — 100

B. Apply persistence factor:
Factor Subscore A x Persistence Factor = Subscore B — 100 x 1.0 = 100

C. Apply physical state multiplier:
Subscore B x Physical State Multiplier = Waste Characteristics Subscore — 100 x 1.0 = 100

HAZARD ASSESSMENT RATING METHODOLOGY FORM
(Continued, Page 2 of 2)

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists, proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for three potential pathways: surface water migration, flooding, and ground water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
SUBTOTALS			46	108
Subscore (100 x factor score subtotal/maximum score subtotal)				43
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
SUBTOTALS			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above. Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	46
Waste Characteristics	100
Pathways	43
TOTAL	189 divided by 3 = 63 Gross total score

B. Apply factor for waste containment from waste management practices. Gross total score x waste management practices factor = final score.

63 x 1.0 = 63

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Defuel Pit

Location: Building 414

Date of Operation or Occurrence:

Owner/Operator: LAFB-USAF

Comments/Description: Contained for Various Waste Liquids

Site Rated By: D.H. Stephens

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1-mile radius	3	3	9	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1-mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	1	6	6	18
I. Population served by ground water supply within 3 miles of site	3	6	18	18
SUBTOTALS			89	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 49

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) L
2. Confidence level (1=confirmed, 2=suspected) C
3. Hazard rating (1=low, 2=medium, 3=high) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor:
Factor Subscore A x Persistence Factor = Subscore B
100 x 1.0 = 100

C. Apply physical state multiplier:
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
100 x 1.0 = 100

HAZARD ASSESSMENT RATING METHODOLOGY FORM
(Continued, Page 2 of 2)

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists, proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for three potential pathways: surface water migration, flooding, and ground water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
SUBTOTALS			40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	2	8	16	24
SUBTOTALS			40	114
Subscore (100 x factor score subtotal/maximum score subtotal)				35

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above. Pathways Subscore 37

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	49
Waste Characteristics	100
Pathways	37
TOTAL	186

TOTAL 186 divided by 3 = 62 Gross total score

B. Apply factor for waste containment from waste management practices. Gross total score x waste management practices factor = final score.

62 x 0.95 = 59

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: DPDO

Location: Northwest Corner of Base, 2,000' FNL, 4,000' FWL

Date of Operation or Occurrence:

Owner/Operator: LAFB - USAF

Comments/Description:

Site Rated By: D.H. Stephens

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1-mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1-mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	2	6	12	18
I. Population served by ground water supply within 3 miles of site	3	6	18	18
SUBTOTALS			111	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 62

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) M
2. Confidence level (1=confirmed, 2=suspected) C
3. Hazard rating (1=low, 2=medium, 3=high) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor:
Factor Subscore A x Persistence Factor = Subscore B
80 x 1.0 = 80

C. Apply physical state multiplier:
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
80 x 1.0 = 80

HAZARD ASSESSMENT RATING METHODOLOGY FORM
(Continued, Page 2 of 2)

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists, proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for three potential pathways: surface water migration, flooding, and ground water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water	3	8	0	24
Net precipitation	3	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
SUBTOTALS			40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
SUBTOTALS			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above. Pathways Subscore 37

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	62
Waste Characteristics	80
Pathways	37
TOTAL	179 divided by 3 = 60 Gross total score

B. Apply factor for waste containment from waste management practices. Gross total score x waste management practices factor = final score.

60 x 0.95 = 57

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Firefighter Training Area

Location: West of Runway Complex - 3,200' FSL; 5,500' FEL

Date of Operation or Occurrence: 1952-present

Owner/Operator: LAFB-USAF

Comments/Description: Burned Fuel, Waste Oil, Solvents, and Transformer Oils

Site Rated By: D.H. Stephens

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1-mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1-mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	1	6	6	18
I. Population served by ground water supply within 3 miles of site	3	6	18	18
SUBTOTALS			77	180
Receptors subscore (100 x factor score subtotal/maximum score subtotal)				43

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) L
2. Confidence level (1=confirmed, 2=suspected) C
3. Hazard rating (1=low, 2=medium, 3=high) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor:
Factor Subscore A x Persistence Factor = Subscore B
100 x 1.0 = 100

C. Apply physical state multiplier:
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
100 x 0.75 = 75

HAZARD ASSESSMENT RATING METHODOLOGY FORM
(Continued, Page 2 of 2)

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists, proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for three potential pathways: surface water migration, flooding, and ground water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
SUBTOTALS			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground water migr.ion				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
SUBTOTALS			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above. Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	43
Waste Characteristics	75
Pathways	48
TOTAL	166

TOTAL 166 divided by 3 = 55 Gross total score

B. Apply factor for waste containment from waste management practices. Gross total score x waste management practices factor = final score.

55 x 0.95 = 52

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: New Industrial Waste Pond

Location: South end of base - 1,200' FSL; 5,600' FEL

Date of Operation or Occurrence: 1973 - 1975

Owner/Operator: LAFB - USAF

Comments/Description: Designed to retain DRT flows - used as chemical cleaning waste dum

Site Rated By: D.H. Stephens

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1-mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1-mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	1	6	6	18
I. Population served by ground water supply within 3 miles of site	3	6	18	18
SUBTOTALS			83	180
Receptors subscore (100 x factor score subtotal/maximum score subtotal)				46

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) M
2. Confidence level (1=confirmed, 2=suspected) C
3. Hazard rating (1=low, 2=medium, 3=high) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor:
Factor Subscore A x Persistence Factor = Subscore B
80 x 1.0 = 80

C. Apply physical state multiplier:
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
80 x 0.75 = 60

HAZARD ASSESSMENT RATING METHODOLOGY FORM
(Continued, Page 2 of 2)

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists, proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for three potential pathways: surface water migration, flooding, and ground water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
SUBTOTALS			52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
SUBTOTALS			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above.

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	46	
Waste Characteristics	60	
Pathways	48	
TOTAL	154	divided by 3 = 51 Gross total score

B. Apply factor for waste containment from waste management practices. Gross total score x waste management practices factor = final score.

51 x 1.0 = 51

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Sludge Disposal Area

Location: Northwest corner of base - 4,300' FWL; 1,400' FNL

Date of Operation or Occurrence: 1952 - 1983

Owner/Operator: LAFB - USAF

Comments/Description: Primary drainage control for tank cleaning sludge

Site Rated By: D.H. Stephens

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1-mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1-mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	2	6	12	18
I. Population served by ground water supply within 3 miles of site	3	6	18	18
SUBTOTALS			111	180
Receptors subscore (100 x factor score subtotal/maximum score subtotal)				62

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) — L
2. Confidence level (1=confirmed, 2=suspected) — C
3. Hazard rating (1=low, 2=medium, 3=high) — L

Factor Subscore A (from 20 to 100 based on factor score matrix) — 50

B. Apply persistence factor:
Factor Subscore A x Persistence Factor = Subscore B

50 x 0.8 = 40

C. Apply physical state multiplier:
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 0.75 = 30

HAZARD ASSESSMENT RATING METHODOLOGY FORM
(Continued, Page 2 of 2)

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists, proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for three potential pathways: surface water migration, flooding, and ground water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
SUBTOTALS			44	108
Subscore (100 x factor score subtotal/maximum score subtotal)				41
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
SUBTOTALS			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above. Pathways Subscore 41

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	62
Waste Characteristics	30
Pathways	41
TOTAL	133 divided by 3 = 44 Gross total score

B. Apply factor for waste containment from waste management practices. Gross total score x waste management practices factor = final score.

44 x 1.0 = 44

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: South Boundary Dike

Location: Southewest Corner of Base - 500'FSL; 3,000' FWL

Date of Operation or Occurrence: 1974

Owner/Operator: LAFB-USAF

Comments/Description: One-time Dumping of Acetone, Paint Thinner & Waste Paint

Site Rated By: D.H. Stephens

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1-mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1-mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	1	6	6	18
I. Population served by ground water supply within 3 miles of site	3	6	18	18
SUBTOTALS			83	180
Receptors subscore (100 x factor score subtotal/maximum score subtotal)				46

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) S
2. Confidence level (1=confirmed, 2=suspected) C
3. Hazard rating (1=low, 2=medium, 3=high) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor:
Factor Subscore A x Persistence Factor = Subscore B
50 x 0.9 = 45

C. Apply physical state multiplier:
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
45 x 0.75 = 34

HAZARD ASSESSMENT RATING METHODOLOGY FORM
(Continued, Page 2 of 2)

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists, proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for three potential pathways: surface water migration, flooding, and ground water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
SUBTOTALS			46	108
Subscore (100 x factor score subtotal/maximum score subtotal)				43
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
SUBTOTALS			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above. Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	46
Waste Characteristics	34
Pathways	43
TOTAL	123 divided by 3 = 41 Gross total score

B. Apply factor for waste containment from waste management practices. Gross total score x waste management practices factor = final score.

41 x 1.0 = 41

TELCON SIGN-OFF PROBLEMS (Terminal is polling)

*PROBLEM: If >$$SOFF is entered and transmitted but TELCON does not respond with
* "INACTIVE TERMINAL"

ACTION: 1. Check if the SOE (>) is present and data is correct. If incorrect, clear wait light, correct error and transmit.

2. If the SOE is present and data is correct, the terminal is already signed-off from TELCON.

TELCON MESSAGES (Terminal is polling)

If the communicating software between the host and the FEP goes down, the following message will be displayed:

"*SESSION PATH DOWN: POSSIBLE LOSS OF INPUT*"

This message will only be displayed if the terminal is signed-on to TELCON. Polling will not stop. After the software problem has been "fixed," the message

"*SESSION PATH RE-OPENED: INPUT ALLOWED*
SESSION PATH OPEN"

is displayed. If you are already signed-on to DROLS, a new sign-on need not be performed. Check the previous command entered. The command may need to be re-entered. If not signed-on to DROLS, perform DROLS sign-on.

POLLING STOPS

If working in DROLS and the terminal stops polling, there is probably a problem with the FEP or your communications line. When the terminal resumes polling, sign-on to TELCON (>$$SON and your sign-on code). Signing-on to DROLS again should not be necessary. The response from a command should return to you after the TELCON sign-on. If you receive the message:

"MSG DI10 LAST INPUT NOT PROCESSED - PLEASE RETRANSMIT LAST MESSAGE"

You must retransmit your last entry again.

OTHER PERTINENT INFORMATION

1. After a command is entered and transmitted, "MESSAGE RECEIVED" followed by the cursor (and a beep) will appear at the bottom of the terminal screen to indicate that DROLS has received and is processing the command. NOTE: The blinking cursor will not return to the top left corner of the screen unless the terminal is in continuous display mode.

*New

SYNCHRONOUS
FRONT-END PROCESSOR
Helpful Hints

Since your site has been/will be interfaced to the Front-End Processor (FEP), there are several "differences" between the previous method of terminal operation thru the new FEP.

The following helpful hints should serve as a guide to clear up possible problem areas until you, as a user, become familiar with FEP/terminal operation.

TELCON SIGN-ON (Terminal is polling)

PROBLEM: After entering >$$SON XXXXXX (your sign-on code) and transmitting and TELCON does not respond with:

SPERRY-UNIVAC TELCON (X.XXX.X) DCP=DCP1
SESSION PATH OPEN TO: TIP

ACTION: 1. Check if SOE (>) is present and data is correct.
If incorrect, clear wait light, correct error and transmit again.

2. If TELCON responds with a SOE, you are already signed on to TELCON.
Clear wait light, sign-on to DROLS (>SGNONS/XXXXXX) and transmit.

PROBLEM: If you transmit anything or use any *DROLS* commands prior to signing on to the DROLS system (>SGNONS/XXXXXX) the following message is displayed:

"MSG ON8 USER TERMINAL NOT SIGNED ON TO DROLS SYSTEM.
PLEASE REFER TO SIGN-ON PROCEDURES.

Perform DROLS sign-on (>SGNONS/XXXXXX)

CONTINUOUS DISPLAYS

PROBLEM: If a continous display is interrupted by hitting the transmit rather than the message waiting key, the following message will be displayed:

"MSG DI4 DROLS PROCESSING - LAST INPUT IGNORED"

ACTION: Wait until the display returns and hit the message waiting key.

The following familiar message

"--COMMAND HAS BEEN ABORTED

--END <<ENTER NEXT COMMAND>> END"

will be displayed.

*New

SYNCHRONOUS DEDICATED PROCEDURES

Activation

1. Power on equipment.

2. When connected, identify your terminal to the network by entering:

   >$$SON XXXXXX (enter your sign-on identification code for XXXXXX)
   (Example: >$$SON AA1234) D $$SON EK0115

3. The system will respond with:

   * SPERRY - UNIVAC TELCON (X.XXX.X) DCP=DCP1
   * SESSION PATH OPEN TO: TIP

4. Identify your site to the DROLS system by transmitting the following:

   >SGNONS/TERMINAL ID
   (Example: >SGNONS/ABCDE) D SGNONS/RTIS04

5. The system will respond with:

   *MSG ON1 SIGN-ON ACCEPTED

6. Enter your terminal ID as in the past. Entering the terminal ID at this point will be eliminated in the near future.

7. DROLS commands remain the same.

Termination

1. Enter @TERM@ and transmit.

2. The system will respond with:

   THIS TERMINAL HAS BEEN TERMINATED

   CONNECT TIME = ON--HHMMSS OFF--HHMMSS

   *MSG DO7 PLEASE SIGN OFF TERMINAL

3. Disconnect (sign-off) from the network by transmitting

   >$$SOFF

4. The system will respond with:

   * INACTIVE TERMINAL

5. Power off equipment.

*New

Encl 1

Appendix H. Chemical Analyses of Water from Wells and Springs in the Area of LAFB (Continued, Page 8 of 8)

Well	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved Solids	Hardness as ($CaCO_3$)	Percent Sodium	Sodium Adsorption Ratio (SAR)	Residual Sodium Carbonate (RSC)	Specific Conductance (µmho at 25 °C)	pH
[11] 40-302	63	0.7	29	0.3	451	280	27	1.2	0.0	743	7.1
302	24	--	--	--	--	--	--	--	--	524	7.8
[4] 303	24	--	3.1	--	184	105	21	0.5	--	281	8.0
[4] 303	18	--	26	--	354	270	9	0.5	--	569	7.6
303	29	--	--	--	--	--	--	--	--	607	--
[11/14] 303	46	0.6	1.0	0.12	432	256	29	1.3	0.0	701	7.0
[4] 501	20	--	0.6	--	390	274	--	0.3	--	565	8.2
[4] 501	21	--	1.2	--	298	191	--	0.7	--	471	8.2
[4] 901	14	--	--	--	2,406	1,633	2	0.1	--	2,380	7.5
[4] 901	15	--	--	--	2,462	1,681	2	0.1	--	2,430	7.4
[4] 901	21	--	0.6	--	2,459	1,696	2	0.1	--	2,390	7.2
[4] 901	18	--	3.1	--	2,479	1,688	--	0.1	--	2,500	7.3
[4] TR-71-40-901	34	--	0.6	--	2,275	1,524	4	0.3	--	2,260	7.9
[4] 901	15	--	--	--	2,529	1,755	2	0.1	--	2,500	7.3
[4] 901	23	--	--	--	2,519	1,733	2	0.1	--	2,450	7.4
[4] 901	18	--	1.2	--	2,558	1,752	--	0.1	--	2,540	7.3
[4] 903	23	--	5.6	--	498	363	6	0.2	--	711	7.7
[4] 903	21	--	6.2	--	489	365	6	0.2	--	706	7.8
903	21	--	3.1	--	497	369	6	0.2	--	688	8.6
[4] 904	20	--	[3]	--	2,188	1,656	--	--	--	--	--
[4] 904	5	2.4	--	--	2,578	1,751	2	--	--	2,510	7.2
[4] 904	18	--	--	--	2,504	1,746	2	0.1	--	2,440	7.3
					Kinney County						
RP-70-35-801	151	--	--	--	--	354	--	--	0.0	1,010	7.3

1 Where one value is present, sodium and potassium are calculated as sodium (Na).
2 Sulfate (SO_4) less than 10 milligrams per liter.
3 Nitrate (NO_3) less than 20 milligrams per liter.
4 Analyzed by U.S. Salinity Laboratory.
5 Includes the equivalent of any carbonate (CO_3) present.
6 Residue at 180°.
7 Iron in solution.
8 Sample collected at this depth was from Edwards Limestone.
9 Sample collected at this depth was from Georgetown Limestone.
10 Sample collected at this depth was from Kiamichi Formation.
11 Determination for phosphate (PO_4) is 0.00.
12 Determination for manganese (Mn) is 0.03.
13 Determination for manganese (Mn) is 0.00.
14 Determination for manganese (Mn) is 0.23.

Source: TDWR, 1973.

Appendix H. Chemical Analyses of Water from Wells and Springs in the Area of LAFB (Continued, Page 7 of 8)

Well	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved Solids	Hardness as ($CaCO_3$)	Percent Sodium	Sodium Adsorption Ratio (SAR)	Residual Sodium Carbonate (RSC)	Specific Conductance (µmho at 25 °C)	pH
204	258	3.9	28	--	1,170	528	45	3.8	0.0	1,810	7.3
205	24	0.5	0.0	--	412	356	--	--	--	--	--
208	32	0.6	0.0	--	421 [6]	260	--	--	--	--	7.5
208	32	--	0.0	--	1,333 [6]	260	--	--	--	--	7.3
208	23	0.2	0.0	--	322	263	--	--	--	--	7.3
209	103	--	--	--	--	--	--	--	--	--	--
209	100	2.8	0.0	--	709 [6]	452	--	--	--	--	7.4
209	13	--	--	--	--	--	--	--	--	--	--
301	25	0.3	8.6	--	425	358	9	0.4	0.0	720	7.4
[4] 401	--	--	--	--	7,898	1,940	66	18	--	8,780	7.1
43-101	31	--	--	--	2,723	1,942	--	--	--	--	--
[4] 50-301	213	--	58	--	1,747	860	34	3.0	--	2,260	7.6
[4] 31-101	18	--	--	--	260	189	16	0.5	--	430	8.0
101	25	--	3.7	--	304	232	12	0.4	--	505	7.6
201	15	--	[3]	--	252	218	--	--	--	--	--
[4] 301	34	--	3.7	--	279	215	15	0.5	--	490	7.9
[4] 301	33	--	1.2	--	286	224	17	0.6	--	522	8.1
[4] 401	18	--	5.0	--	299	224	10	0.3	--	476	8.0
[4] 401	13	--	9.9	--	238	200	7	0.2	--	424	7.9
801	86	0.6	0.3	--	587	292	40	2.3	0.0	917	7.9
31-101	63	--	[3]	--	338	252	--	--	--	--	--
102	18	0.6	[3]	--	230	218	--	--	--	--	--
201	59	--	[3]	--	394	329	--	--	--	--	--
301	18	1.6	[3]	--	311	281	--	--	--	--	--
301	14	--	--	--	--	215	--	--	0.0	444	7.6
401	17	--	[3]	--	231	224	--	--	--	--	--
401	14	0.5	5.1	--	252	212	9	0.3	0.0	440	7.5
701	13	0.4	[3]	--	--	--	--	--	--	--	--
801	16	0.4	[3]	--	251	226	--	--	--	--	--

Appendix H. Chemical Analyses of Water from Wells and Springs in the Area of LAFB (Continued, Page 6 of 8)

Well	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved Solids	Hardness as ($CaCO_3$)	Percent Sodium	Sodium Adsorption Ratio (SAR)	Residual Sodium Carbonate (RSC)	Specific Conductance (µmho at 25 °C)	pH
4 802	27	--	0.6	--	2,297	1,589	--	--	--	2,350	8.1
4 804	72	--	3.1	0.21	580	369	19	--	--	861	7.7
4 805	28	--	12.0	--	748	550	--	0.3	--	995	8.3
4 34-501	12	--	--	--	216	177	7	0.2	--	363	8.0
4 501	8.5	--	8.7	--	114	91	12	0.3	--	274	8.0
601	9.3	0.2	5.0	--	241	216	5	0.1	0.0	415	7.1
701	29	0.5	4.9	0.06	342	297	7	0.2	0.0	586	7.7
801	103	--	--	--	422	--	--	--	0.0	914	7.0
41-203	81	1.2	1.5	--	646	434	26	1.4	0.0	1,000	7.1
301	10	--	3	--	220	195	--	--	--	--	--
301	10	0.2	6.9	--	256 9	211	9	0.3	--	434	7.3
4 301	12	--	6.2	--	269	218	5	0.2	--	431	8.0
4 301	10	--	7.4	--	257	210	5	0.2	--	430	7.5
4 YR-70-41-301	9.6	--	9.9	--	228	201	5	0.1	--	394	7.8
302	8.7	--	--	--	--	--	--	--	--	422	8.0
301	9.4	--	--	--	--	--	--	--	--	347	--
302	11	--	8.5	0.09	280 6	224	5	--	--	464	7.2
4 302	15	--	1.2	--	273	230	6	0.2	--	464	7.6
4 302	12	--	5.0	--	269	211	6	0.2	--	440	7.4
302	--	--	--	--	--	--	--	--	--	479	7.8
303	29	--	--	--	--	--	--	--	--	582	7.8
303	28	--	--	--	--	--	--	--	--	549	--
4 601	80	--	41	--	700	171	70	6.3	--	1,120	7.7
42-101	51	1.2	0.1	--	409	352	9	0.4	0.0	707	7.8
102	59	--	--	--	--	471	--	--	0.0	948	7.7
103	38	0.8	8.3	--	366	310	9	0.3	0.0	644	7.2
201	25	0.8	3	--	341	279	--	--	--	--	--
202	1,060	2.1	14	--	2,340	1,240	40	4.6	0.0	4,030	7.4
203	176	--	--	--	--	472	--	--	0.0	1,140	7.5

Appendix H. Chemical Analyses of Water from Wells and Springs in the Area of LAFB (Continued, Page 5 of 8)

Well	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved Solids	Hardness as ($CaCO_3$)	Percent Sodium	Sodium Adsorption Ratio (SAR)	Residual Sodium Carbonate (RSC)	Specific Conductance (µmho at 25 °C)	pH
25-501	17	0.4	6.5	0.09	243	193	12	0.4	0.00	715	7.4
601	17	0.5	[3]	--	251	258	--	--	--	--	--
601	56	--	--	--	--	215	--	--	0.00	548	7.6
604	10	0.2	[3]	--	217	222	--	--	--	--	--
801	24	2.5	[3]	--	406	360	--	--	--	--	--
26-201	21	0.3	7.4	--	270	209	12	0.4	0.00	460	7.8
202	24	0.6	5.0	0.09	297	230	12	0.4	0.00	509	7.1
[4] 33-101	20	--	5.6	--	212	155	12	0.3	--	362	7.9
301	15	2.7	0.0	--	376	309	6	0.2	0.00	601	7.0
[4] 303	20	--	9.3	--	204	158	12	0.4	--	365	8.1
[4] 303	16	--	6.8	--	188	149	12	0.3	--	348	8.1
[4] 402	28	--	--	--	572	407	9	--	--	813	7.7
[4] 403	48	--	--	0.47	736	435	16	--	--	1,010	7.5
501	59	0.4	15.0	--	359	224	28	1.2	0.00	619	7.2
[4] 601	16	--	--	--	238	193	8	0.2	--	372	8.5
[4] 602	12	--	12.0	--	249	208	7	0.2	--	416	7.8
604	29	0.4	[3]	--	286	190	--	--	--	--	--
[4] 604	20	--	6.2	--	261	217	8	0.3	--	--	7.8
701	19	--	[3]	--	2,337	1,686	--	--	--	--	--
[4] 701	19	--	--	--	2,404	1,677	2	0.1	--	2,360	7.2
[4] 701	16	--	0.6	--	2,414	1,686	2	0.1	--	2,390	7.2
[4] 702	18	--	--	--	2,561	1,757	2	0.2	--	2,440	8.2
[4] 702	20	--	--	--	2,427	1,652	2	0.2	--	2,380	7.6
[4] 703	31	--	--	0.14	566	408	9	--	--	821	7.5
[4] 704	16	--	0.6	--	2,477	1,696	2	0.1	--	2,420	7.9
[4] 704	18	--	0.6	--	2,488	1,724	2	0.1	--	2,420	7.3
[4] 705	33	--	1.9	--	2,047	1,504	3	0.3	--	2,180	7.7
801	14	0.1	[3]	--	238	--	--	--	--	--	--
[4] 801	19	0.1	[3]	--	298	238	9	0.3	--	489	8.2

Appendix H. Chemical Analyses of Water from Wells and Springs in the Area of LAFB (Continued, Page 4 of 8)

Well		Sampling Depth or Depth of Well (Feet)	Date of Collection	Water-Bearing Unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium Na	Sodium and Potassium K	Bicarbonate (HCO_3)	Sulfate (SO_4)
11	40-302	455	Jan. 26, 1967	Kea	30	--	100	7.3	48	0.9	280	34
	302	455	May 22, 1969	Kea	--	--	--	--	--	--	216	19
4	303	480	Oct. 24, 1964	Kea	11	--	35	4.4	13	1.2	114	8.6
4	303	480	July 22, 1968	Kea	16	--	105	1.9	12	0.8	293	10
	303	480	May 19, 1969	Kea	--	--	--	--	--	--	--	82
11/14	303	480	Aug. 22, 1969	Kea	18	0.037[7]	88	8.7	49	2.7	254	93
4	501	425[9]	June 3, 1964	Kea	12	--	76	20	11	1.6	175[5]	122
4	501	761[8]	June 19, 1964	Kea	10	--	53	14	21	0.4	146[5]	84
4	901	373[9]	Mar. 22, 1965	Kea	9	--	584	43	12	1.6	104	1,515
4	901	373[9]	May 31, 1965	Kea	10	--	610	39	12	2.0	198	1,500
4	901	373[9]	July 22, 1968	Kea	11	--	605	45	12	2.0	174	1,516
4	901	373[9]	Sept 19, 1968	Kea	12	--	607	42	12	1.6	195	1,496
4	TR-71-40-901	753[8]	Apr. 1, 1965	Kea	10	--	566	27	27	2.0	186	1,347
4	901	753[8]	May 31, 1965	Kea	10	--	644	36	12	1.6	189	1,558
4	901	753[8]	July 22, 1968	Kea	11	--	649	28	12	1.6	189	1,518
4	901	753[8]	Sept 19, 1968	Kea	13	--	646	33	13	1.6	177	1,575
4	903	Spring	Feb. 9, 1966	Kea	10	--	129	10	9.9	1.2	192	184
4	903	Spring	May 11, 1966	Kea	10	--	129	10	11	23.0	238	156
4	903	Spring	Sept 21, 1966	Kea	8	--	132	92	11	1.2	237[5]	163
	904	520	Apr. 10, 1939	Kea	--	--	610	27	9[1]	--	134	1,456
4	904	520	Apr. 25, 1950	Kea	26	--	647	33	13[1]	--	207	1,530
4	904	520	Mar. 14, 1966	Kea	11	--	643	32	12	1.6	177	1,548
							Kinney County					
RP-70-35-801		80	Aug. 5, 1968	Kbu	--	--	122	12	--	--	268	75

Appendix H. Chemical Analyses of Water from Wells and Springs in the Area of LAFB (Continued, Page 3 of 8)

Well	Sampling Depth or Depth of Well (Feet)	Date of Collection	Water-Bearing Unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium		Bicarbonate (HCO_3)	Sulfate (SO_4)
								Na	K		
204	285	Aug. 20, 1969	KQ,Kea	100	0.17	96	70	200[1]	--	452	188
205	750[9]	July 11, 1942	Kea	15	0.08	110	20	11[1]	--	336	66
208	575[9]	Aug. 10, 1942	Kea	--	0.06	53	31	41[1]	--	317	41
208	635[9]	Aug. 15, 1942	Kea	--	0.06	78	16	22[1]	--	295	21
208	635[9]	Nov. 13, 1942	Kea	18	0.18	84	13	14[1]	--	299	14
209	605[9]	July 20, 1942	Kea	--	--	--	--	--	--	496	--
209	650[9]	July 25, 1942	Kea	11	--	71	67	106[1]	--	649	3
209	710[10]	Aug. 25, 2942	Kea	--	--	--	--	--	--	289	1,259
301	60	Aug. 20, 1969	KQ	19	--	131	7.4	17[1]	--	406	17
[4] 401	1,600	June 25, 1965	Kea	38	--	405	221	1,810	70	--	4,050
43-101	3,507	July 27, 1939	Kea	--	--	585	117	86[1]	--	256	1,726
[4] 50-301	100	June 25, 1965	Kbo	22	--	296	30	204	2.0	326	665
[4] 31-101	582[9]	June 12, 1965	Kea	12	--	44	19	17	0.4	183	43
101	871[8]	June 24, 1965	Kea	11	--	66	16	15	1.2	238	29
201	580	Apr. 12, 1939	Kea	--	--	69	13	11[1]	--	262	15
[4] 301	715[9]	July 8, 1965	Kea	15	--	56	18	17	1.2	207	32
[4] 301	1,000[8]	July 19, 1965	Kea	9	--	54	21	21	2.0	217	45
[4] 401	496[9]	Dec. 17, 1964	Kea	10	--	70	12	12	1.6	257	9.1
[4] 401	920[8]	Feb. 4, 1965	Kea	8	--	63	10	6.9	2.4	220	7.2
801	410	Aug. 14, 1969	Kea	25	--	102	9.0	89[1]	--	250	152
31-101	640	July 24, 1939	Kea	--	--	83	11	32[1]	--	250	26
102	650	July 24, 1939	Kea	--	--	65	13	6[1]	--	238	11
201	525	July 24, 1939	Kea	--	--	108	15	20[1]	--	293	48
301	620	July 20, 1939	Kea	--	--	83	18	18[1]	--	256	56
301	620	July 20, 1939	Kea	--	--	63	14	-0-	--	232	18
401	525	Aug. 1, 1939	Kea	--	--	66	15	3[1]	--	232	16
401	525	Aug. 14, 1969	Kea	15	--	65	12	9.9[1]	--	236	14
701	451	Aug. 1, 1939	Kea	--	--	80	6	2[1]	--	244	10
801	650	Aug. 1, 1939	Kea	--	--	74	10	11[1]	--	262	11

Appendix H. Chemical Analyses of Water from Wells and Springs in the Area of LAFB (Continued, Page 2 of 8)

Well	Sampling Depth or Depth of Well (Feet)	Date of Collection	Water-Bearing Unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium Na	Sodium and Potassium K	Bicarbonate (HCO_3)	Sulfate (SO_4)
[4] 802	250	June 18, 1964	Kea	12	--	505	79	20	3.1	136	1,421
[4] 804	240	May 18, 1951	Kea	30	--	101	28	40	1.2	310	90
[4] 805	126	June 3, 1964	Kea	11	--	182	23	14	2.3	237[5]	320
[4] 34-501	581[9]	Apr. 5, 1965	Kea	9	--	59	7.1	5.8	0.8	204	4.3
[4] 501	825[8]	Apr. 12, 1965	Kea	8	--	26	6.2	6.0	0.8	98	4.3
601	291	Aug. 13, 1968	Kea	12	--	76	6.3	4.8	1.1	244	6.0
701	135	Aug. 2, 1968	Kea	15	--	86	20	9.8	1.2	296	30
801	120	Aug. 1, 1968	Kea	--	--	146	14	--	--	356	74
41-203	50	Aug. 20, 1969	EQ	43	--	121	32	69[1]	--	508	47
301	Spring	Mar. 31, 1939	Kea	--	--	66	7	11[1]	--	238	2
301	Spring	June 4, 1956	Kea	13	0.01	74	6.5	9.3[1]	--	251	5.5
[4] 301	Spring	Feb. 4, 1966	Kea	10	--	76	6.9	5.8	0.8	250	5.8
[4] 301	Spring	May 25, 1966	Kea	9	--	74	6.1	3.5	2.3	241	4.3
[4] YR-70-41-301	Spring	Sept 21, 1966	Kea	9	--	72	5.5	4.4	0.8	226	7.2
301	Spring	May 21, 1969	Kea	--	--	--	--	--	--	242	6.8
301	Spring	Jan. 13, 1970	Kea	--	--	--	--	--	--	--	6.6
302	Spring	Mar. 18, 1952	Kea	12	--	76	8.3	5.9[1]	--	257	8
[4] 302	Spring	May 25, 1966	Kea	10	--	81	6.8	6.7	1.9	256	11
[4] 302	Spring	Sept 21, 1966	Kea	9	--	79	5.8	6.0	1.2	253	7.2
302	Spring	May 21, 1969	Kea	--	--	--	--	--	--	260	14
303	Spring	May 21, 1969	Kea	--	--	--	--	--	--	264	40
303	Spring	Jan 23, 1970	Kea	--	--	--	--	--	--	--	33
[4] 601	150	June 25, 1965	EQ	14	--	--	--	188[1]	--	376	132
42-101	134	Aug. 8, 1968	Kea	19	0.00	85	34	17	1.8	342	32
102	125	Aug. 8, 1968	Kea	--	--	103	52	--	--	402	114
103	200	Aug. 20, 1969	Kea	17	--	88	22	14[1]	--	306	28
201	500	July 29, 1939	Kea	--	--	62	30	26[1]	--	305	48
202	205	Aug. 3, 1968	Kea	64	--	248	150	373	3.4	406	226
203	280	Aug. 7, 1968	Kea	--	--	110	48	--	--	342	57

Appendix H. Chemical Analyses of Water from Wells and Springs in the Area of LAFB (Page 1 of 8)

	Well	Sampling Depth or Depth of Well (Feet)	Date of Collection	Water-Bearing Unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium: Na	Sodium and Potassium: K	Bicarbonate (HCO_3)	Sulfate (SO_4)
	25-501	600	Jan. 25, 1967	Kea	18	0.04[1]	65	7.6	12	0.6	211	7.2
	601	480	Sept. 5, 1939	Kea	--	--	83	12	5[1]	--	244	12
	601	480	Aug. 11, 1969	Kea	--	--	73	8.0	--	--	220	11
	604	500	Sept. 5, 1939	Kea	--	--	71	11	5[1]	--	220	12
	801	220	July 26, 1939	Kea	--	--	104	24	9[1]	--	287	101
	26-201	420	Aug. 14, 1968	Kea	15	--	80	2.2	13	2.5	240	11
	202	1,100	Aug. 22, 1969	Kea	15	0.03	86	3.6	15	1.1	244	27
4	33-101	472	Oct. 30, 1964	Kea	10	--	52	6.1	9.7	1.2	171	4.3
	301	450	Aug. 14, 1968	Kea	13	0.04	113	6.6	9.0	1.4	241	96
4	303	653[9]	Mar. 4, 1965	Kea	10	--	51	7.4	10	1.2	168	7.2
4	303	1,000[9]	Mar. 16, 1965	Kea	9	--	47	7.8	9.7	1.2	165	5.3
4	402	180	May 18, 1951	Kea	19	--	122	25	19	3.5	323	130
4	403	423	June 4, 1952	Kea	5	--	134	24	41	5.5	490	406
	501	410	June 4, 1969	Kea	20	--	78	7.3	41[1]	--	241	19
4	601	510	June 2, 1966	Kea	8	--	65	7.4	7.8	1.2	219[5]	10
4	602	242	Feb. 10, 1967	Kea	8	--	74	5.6	6.0	1.2	238	5.8
	604	554	July 24, 1939	Kea	--	--	93	11	3[1]	--	281	12
4	604	554	July 22, 1968	Kea	11	--	74	8	9	1.2	238	6.7
	701	520	Apr. 6, 1939	Kea	--	--	630	27	40[1]	--	183	1,531
4	701	520	Mar. 14, 1966	Kea	12	--	628	27	12	1.6	214	1,465
4	701	520	July 22, 1968	Kea	13	--	627	30	12	1.6	214	1,461
4	702	772	Aug. 25, 1964	Kea	8	--	636	36	16	2.3	128	1,600
4	702	972	Aug. 27, 1964	Kea	10	--	590	44	17	2.7	153	1,505
4	703	262	Jan. 1, 1951	Kea	21	--	123	24	19	3.9	330	132
4	704	306	Mar. 13, 1967	Kea	9	--	617	38	13	2.3	140	1,535
4	704	306	July 22, 1968	Kea	13	--	626	39	13	2.3	162	1,548
4	705	97	Aug. 4, 1964	Kea	15	--	515	53	23	3.1	260	1,250
	801	Spring	Apr. 6, 1939	Kea	--	--	--	--	--	--	244	11
4	801	Spring	Sept 23, 1966	Kea	8	--	84	7.1	11	0.8	262	13

APPENDIX H

CHEMICAL ANALYSES OF WATER FROM WELLS AND SPRINGS IN THE AREA OF LAFB

HAZARD ASSESSMENT RATING METHODOLOGY FORM
(Continued, Page 2 of 2)

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists, proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for three potential pathways: surface water migration, flooding, and ground water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
SUBTOTALS			32	108
Subscore (100 x factor score subtotal/maximum score subtotal)				30
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
SUBTOTALS			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore

Enter the highest subscore value from A, B-1, B-2, or B-3 above. Pathways Subscore 30

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	62
Waste Characteristics	30
Pathways	30
TOTAL	122

divided by 3 = 41 Gross total score

B. Apply factor for waste containment from waste management practices. Gross total score x waste management practices factor = final score.

41 x 0.95 = 39

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Supply Storage Area

Location: Storage Yard Adjacent to Bldg. 47

Date of Operation or Occurrence: 1973-1981

Owner/Operator: LAFB-USAF

Comments/Description: DDT Storage

Site Rated By: D.H. Stephens

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1-mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1-mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface ater supply within 3 miles downstream of site	2	6	12	18
I. Population served by ground water supply within 3 miles of site	3	6	18	18
SUBTOTALS			111	180
Receptors subscore (100 x factor score subtotal/maximum score subtotal)				62

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) S
2. Confidence level (1=confirmed, 2=suspected) C
3. Hazard rating (1=low, 2=medium, 3=high) L

Factor Subscore A (from 20 to 100 based on factor score matrix) 30

B. Apply persistence factor:
Factor Subscore A x Persistence Factor = Subscore B
30 x 1.0 = 30

C. Apply physical state multiplier:
Subscore B x Physical State Multiplier = Waste Characteristics Subscore
30 x 1.0 = 30

2. If after "transmit" is depressed, the cursor appears to the top left of the screen and the wait light remains on, there is a problem on the host system (i.e., disk errors, etc.). No action need be taken. The information will return when the problem is "fixed."

3. The polling light is no longer a positive sign of the DROLS system being operational because polling now comes from the FEP.

*4. Broadcast is a new feature recently incorporated into the TELCON Operating System. This feature will allow DTIC to keep the DROLS users apprised of the host system condition. When a BROADCAST is performed at DTIC <u>and</u> your terminal is signed on to the FEP ($$SON), your terminal will 'BEEP' signifying a message has been sent. To display the message, key in $$SEND and transmit. To turn off the 'BEEP', depress the Message Waiting Key.

*New

DROLS
TERMINAL USER CONDITION MESSAGE DESCRIPTION

TERMINAL MESSAGE	DESCRIPTION	USER ACTION
ON		
*MSG ON1 SIGN-ON ACCEPTED	DROLS System has validated the user and allowed access.	N/A
*MSG ON2 SIGN-ON REJECTED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG ON3 SIGN-ON REJECTED *REVIEW SIGN-ON PROCEDURES	Sign on errors.	Check for data error If correct, call DTIC Tech Control Office
*MSG ON4 SIGN-ON REJECTED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG ON5 THIS TERMINAL IS CURRENTLY ACTIVE WITH DROLS *PLEASE CONTINUE WITH NEXT DROLS COMMAND	Terminal is already active.	Continue with next DROLS command
*MSG ON6 SIGN-ON REJECTED *REVIEW SIGN-ON PROCEDURES	Illegal Terminal ID used.	Check for data error If correct, call DTIC Tech Control Office
*MSG ON7 SIGN-ON REJECTED *NOTIFY DTIC TECH CONTROL	Terminal has been disabled.	Call DTIC Tech Control Office
*MSG ON8 User terminal not signed on to DROLS system. Please refer to sign on procedures.	Sign on error.	Identify your terminal with DROLS sign on command
*MSG ON9 SIGN-ON REJECTED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG ON10 SIGN-ON REJECTED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG ON11 INITIALIZATION ERROR; PLEASE SIGN-ON AGAIN	DROLS System error.	If continuous, call DTIC Tech Control Off
*MSG ON12 SIGN-ON REJECTED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG ON13 SIGN-ON REJECTED	DROLS System error.	Call DTIC Tech Control Office

DROLS

TERMINAL USER CONDITION MESSAGE DESCRIPTION

TERMINAL MESSAGE	DESCRIPTION	USER ACTION
OF		
*MSG OF1 TERMINAL INACTIVE	DROLS System termination error.	Call DTIC Tech Control Office
DI		
*MSG DI1 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG DI2 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG DI3 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG DI4 DROLS PROCESSING - LAST INPUT IGNORED	Terminal is in output mode.	Wait for data to return
*MSG DI5 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG DI6 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG DI7 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG DI8 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG DI9 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG DI10 LAST INPUT NOT PROCESSED - PLEASE RETRANSMIT LAST MESSAGE	FEP or Communication Line Failure	RE-ENTER Last Command NOTE: Async Users - Re-enter last line Sync Users - Re-transmit last scre

DROLS

TERMINAL USER CONDITION MESSAGE DESCRIPTION

TERMINAL MESSAGE	DESCRIPTION	USER ACTION
DO		
*MSG DO1 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG DO2 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG DO3 USER TERMINATED	DROLS System terminating this user.	Standby for Broadcast or call Voice Recor
*MSG DO4 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System terminating this user.	Call DTIC Tech Control Office
*MSG DO5 CANNOT INITIALIZE SITE *NOTIFY DTIC TECH CONTROL	DROLS System will not allow this site.	Call DTIC Tech Control Office
*MSG DO6 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG DO7 PLEASE SIGN OFF TERMINAL	Normal termination request.	N/A
*MSG DO8 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System error.	Call DTIC Tech Control Office
*MSG DO9 USER TERMINATED *NOTIFY DTIC TECH CONTROL	DROLS System error	Call DTIC Tech Control Office

END

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DTIC