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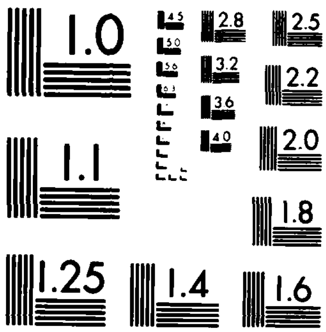

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AD-A150 122

Installation Restoration Program.

PHASE I - RECORDS SEARCH

For Air Force Reserve and Air National Guard Facilities at General Billy Mitchell Field Milwaukee, Wisconsin

November 1984

Prepared for:
United States Air Force Reserve
Robins AFB, Georgia 31098

WESTON
DESIGNERS CONSULTANTS

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

AD A 150 122

REPORT DOCUMENTATION PAGE

1a REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS NONE
2a SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT UNCLASSIFIED/UNLIMITED
2b DECLASSIFICATION/DOWNGRADING SCHEDULE N/A	
4 PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S) 84-0026
6a NAME OF PERFORMING ORGANIZATION ROY F. WESTON, INC 6b. OFFICE SYMBOL (If applicable)	7a NAME OF MONITORING ORGANIZATION Air Force Engineering and Services Center
6c ADDRESS (City, State and ZIP Code) 1 Weston Way West Chester, PA 19380	7b ADDRESS (City, State and ZIP Code) HQ AFESC/DEV Tyndall AFB FL 32403
8a NAME OF FUNDING/SPONSORING ORGANIZATION HQ Air Force Reserve 8b. OFFICE SYMBOL (If applicable) DEPV	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER F08637-83-G0009
8c ADDRESS (City, State and ZIP Code) Robins AFB GA 31098-6001	10 SOURCE OF FUNDING NOS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO / WORK UNIT NO.
11 TITLE (Include Security Classification) Phase I, Records Search Gen Billy Mitchell Field	

12. PERSONAL AUTHOR(S)
Katherine Sheedy

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Yr., Mo., Day)	15. PAGE COUNT
FINAL	FROM 84/04/01 TO 84/11/01	84/11/01	126

16. SUPPLEMENTARY NOTATION

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB. GR	

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

A Phase I initial assessment under the Installation Restoration Program was conducted for U.S. Air Force Reserve and Wisconsin ANG facilities located at Gen Billy Mitchell Field, Milwaukee, Wisconsin. Past and current employees were interviewed, records were reviewed, regulatory agencies were contacted, and a ground reconnaissance was conducted. Past waste handling and disposal practices were evaluated, and eight past waste and spill sites were identified. Four sites were deleted because there was no potential for migration of contamination. Four sites were assessed using the Hazard Assessment Rating Methodology (HARM); Phase II monitoring programs were recommended for the four sites.

20 DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. XX DTIC USERS ☐	21 ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED	
22a NAME OF RESPONSIBLE INDIVIDUAL LARRY S. GARRETT	22b TELEPHONE NUMBER (Include Area Code) (912)926-5755	22c OFFICE SYMBOL HQ AFRES/DEPV

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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, to control the migration of hazardous contaminants, and to 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 Operations/Remedial Actions; and Phase IV, Cleanup. Roy F. Weston, Inc. was retained by the United States Air Force to conduct the Phase I, Initial Assessment/Records Search for the Air Force Reserve Facility and the Wisconsin Air National Guard Facility at General Billy Mitchell Field under Contract No. F08637-83-G0009.

INSTALLATION DESCRIPTION

Both the Air Force Reserve Facility and the Wisconsin Air National Guard Facility are located at General Billy Mitchell Field, Milwaukee, Wisconsin. General Billy Mitchell Field is a commercial airport, owned by Milwaukee County, located in the southeastern corner of Wisconsin seven miles south from the center of the City of Milwaukee and approximately three miles west of Lake Michigan. The field is bounded on all sides by urban development, including the City of Milwaukee to the north, the City of South Milwaukee to the east, the City of Oak Creek to the south, and the City of Cudahy to the northeast. Development is generally less dense south and southwest of the field.

The U.S. Air Force owns a 99.24-acre parcel in the southwest corner of the airport, and leases the airport facilities (under Lease Agreement No. DA-11-032-ENG-2221, as supplemented) for the activities of the 440th Tactical Airlift Wing.

The Wisconsin Air National Guard has leased two parcels from the U.S. Air Force since 1962: a 5-1/2-acre parcel occupied by the 128th Tactical Control Squadron, and a 58-1/2-acre parcel occupied by the 128th Air Refueling Group. The Lease Agreement (No. DA-11-032-ENG-9461) terminates 31 July 2012. The small parcel is located adjacent to the northeastern corner of the USAF's 440th TAG site. The larger parcel is located in the east-central portion of the airport property.

ENVIRONMENTAL SETTING

The following environmental conditions are important when evaluating past hazardous waste disposal practices at the two facilities:

1. The net precipitation is 9-1/2 inches per year; the 1-year, 24-hour rainfall event is estimated to be 2.4 inches. These data indicate there is moderate potential for precipitation to infiltrate surface soils on the bases.

2. The natural soils on the bases are predominantly clay and clay loams with low to moderate permeability. The infiltration rate is estimated to range from 0.2 to 0.8 inches per hour.

3. Surface drainage is controlled by open ditches and storm sewers. No natural surface water features are located on the property.

4. Unconsolidated glacial deposits, 150 to 300 feet thick overlie bedrock on the bases. The im ortant aquifers include:

   - Glacial sand and gravel deposits (suited for small users).

   - The Niagara (dolomite) Aquifer.

   - The Sandstone Aquifer.

   Groundwater resources are abundant in the area; however, municipal and industrial users rely on Lake Michigan for their water supplies. There are a few unplugged domestic wells in the area, but no reliable records were found to determine if they are still being used.

5. There are no endangered or threatened species on the USAF or Air National Guard

property. However, Michael F. Cudahy Nature Preserve, a material area of statewide significance, is located immediately south of the base property.

METHODOLOGY

During the course of this project at both bases, interviews were conducted with base personnel (past and present) familiar with past waste disposal practices; file searches were performed for past waste activities; interviews were held with local, state and Federal agencies; and field reconnaissance inspections were conducted at past waste activity sites. At the U.S. Air Force Reserve Facility four sites were identified as having the potential to effect the environment. These sites were evaluated using the Hazard Assessment Rating Methodology (HARM) which takes into account factors such as site characteristics, waste characteristics, potential for contaminant migration and waste management practices. The details of the rating procedure is designed to indicate the relative need for follow-on action in Phase II of the IRP Program.

FINDINGS AND CONCLUSIONS

The four sites were determined to have some potential for causing environmental impact and additional investigations are warranted to determine if significant contamination occurs at these sites.

Locations of these sites are shown on Figure ES-1. Table ES-1 presents the results of HARM score rating and indicates the contaminant of concern at each site.

RECOMMENDATIONS

The recommendations shown in Table ES-2 are made for work to be performed in Phase II (Confirmation and Quantification). The recommended actions are generally one-time sampling and analytical programs. They are designed on a site-by-site basis to verify the presence or absence of contamination at a site,and to further assess the potential for adverse environmental impact from contamination should it be present at a site.

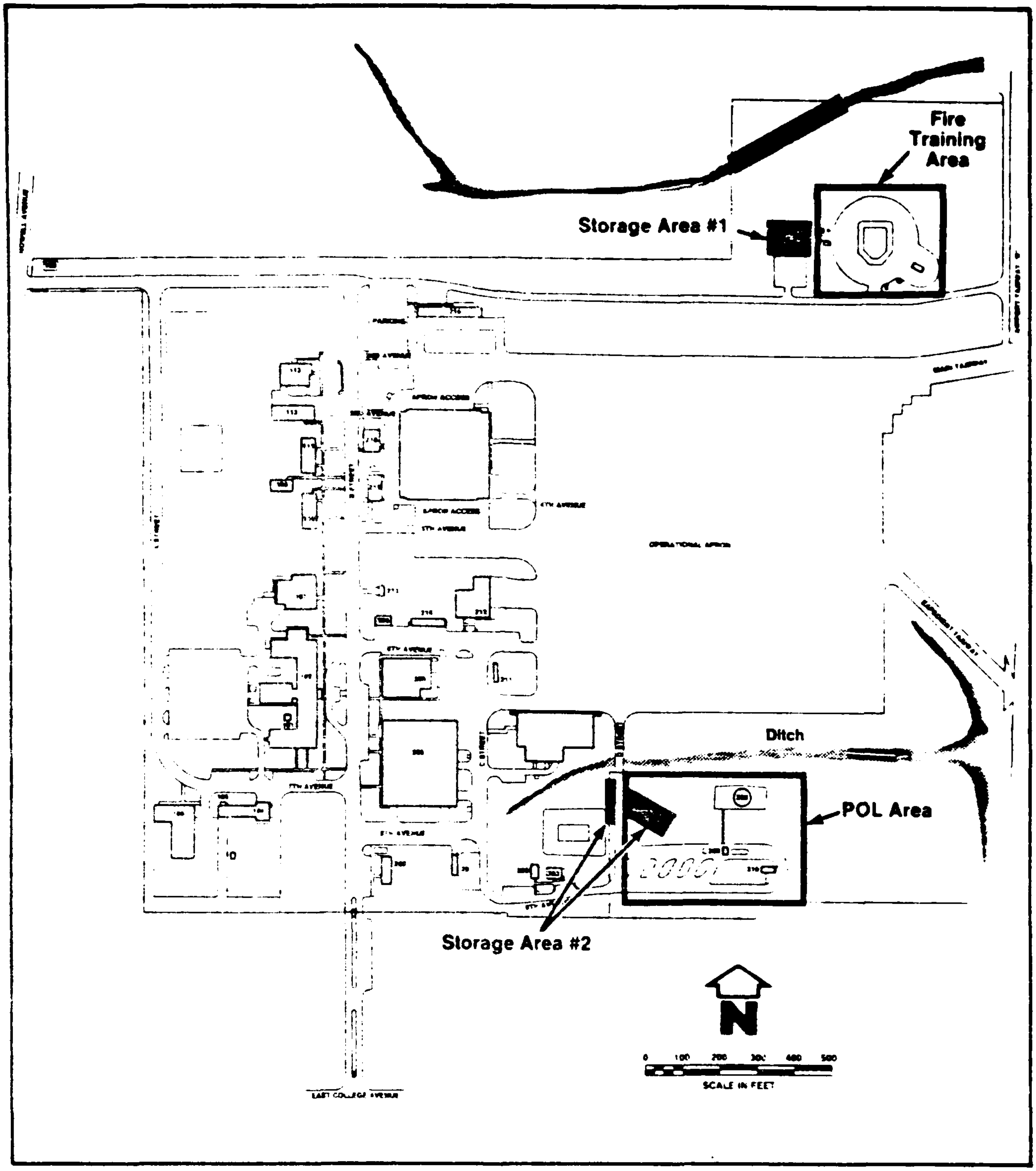


FIGURE ES-1 **SITES SUBJECTED TO HARM RATING**
U.S. AIR FORCE RESERVE

TABLE ES-1

SUMMARY OF HARM RATINGS

Site Name	[illegible]	HARM Rating	Contaminant of Concern
[illegible]		[illegible]	Fuel
[illegible]		[illegible]	Petroleum based solvents and fuel
		[illegible]	Petroleum based solvents
		[illegible]	Petroleum based solvents

TABLE ES-2

SUMMARY OF RECOMMENDATIONS

Site Name	Recommendation
P.O.L. Area	Sample 5 soil borings
	Install and sample three ground water monitor wells
	Three sediment samples from the drainage ditch
Fire Protection Training Area	Install and sample three ground water monitor wells
	Sediment samples at four locations in the northern drainage ditch.
Storage Area 1	Sample three soil borings
	Sample three ground water monitor wells
Storage Area 2	Sample eight soil borings

SECTION 1

INTRODUCTION

1.1 BACKGROUND AND AUTHORITY

The United States Air Force, due to the nature of its primary mission, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. This circumstance, coupled with the enactment of environmental legislation at the Federal, state, and local levels of government, has required action to be taken to identify and eliminate hazards related to past disposal sites in an environmentally responsible manner.

The primary Federal legislation governing the disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA), as amended. Under Section 6003 of the Act, Federal agencies are directed to assist U.S. EPA and make available information on past disposal practices. Section 3012 of RCRA requires each state to inventory disposal sites and make information available to requesting agencies. To assure compliance with these hazardous waste regulations, Department of Defense (DoD) issues Defense Environmental Quality Program Policy Memoranda (DEQPPM), which mandated a comprehensive Installation Restoration Program (IRP).

The current DoD IRP policy is contained in DEQPPM No. 81-5, dated 11 December 1981, and implemented by the Air Force message, dated 21 January 1982. DEQPPM No. 81-5 reissues, consolidates, and amplifies all previous directives and memoranda on the Installation Restoration Program. DoD policy is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites, to control migration of hazardous contamination from Air Force facilities, and to control hazards to health or welfare that resulted from past operations. The IRP will be the basis for U.S. Air Force response actions under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, and directed by Executive Order No. 12316 and 40 CFR 300, Subpart F, National Contingency Plan (NCP). CERCLA is the primary legislation governing remedial action of past hazardous waste disposal sites.

1.2 PURPOSE AND SCOPE OF THE ASSESSMENT

The Installation Restoration Program has been developed as a four-phased program:

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

WESTON was retained by the U.S. Air Force to conduct the Phase I, Records Search at General Billy Mitchell Field under Contract No. F08637-83-G0009. Two facilities were included in this records search: the Air Force Reserve Facility (440th TAW) and the Wisconsin Air National Guard Facility. The two facilities, which together occupy 163 acres, are entirely separate operations and are housed at separate locations. This report contains a summary and an evaluation of the information collected during Phase I of the IRP.

The objective of the first phase of the program is to identify the potential for environmental contamination from past waste disposal practices at General Billy Mitchell Field, to assess the probability for contaminant migration and to develop conclusions and recommendations for follow-on actions. The Phase I program included a pre-performance meeting, an on-site base visit, a review and analysis of the information collected, and preparation of this report.

The pre-performance meeting for both facilities was held at General Billy Mitchell Field on 24 April 1984. The purpose of this meeting was to define responsibilities of the project participants, establish a program schedule, transfer information to the project contractor, and to tour the base facilities.

WESTON's team conducted the on-site visit at both bases 18-22 June 1984. Activities performed during the on-site visit included a detailed search of installation records, tour of the installation, and interviews with past and present base personnel. At the conclusion of the on-site base visits, an outbriefing was held with representatives of the Reserve and the Air National Guard to discuss preliminary findings.

The following individuals comprised WESTON's Records Search Team:

- o Katherine A. Sheedy, Project Manager, (M.S., Geology, 1975).

- David Russell, Environmental Engineer, (B.S., Environmental Engineering, 1980).

- Michael F. Coia, Chemical Engineer, (M.S., Environmental Engineering, 1981).

Resumes of these key team members are provided in Appendix A.

1.3 METHODOLOGY

The records search at the Reserve and Guard facilities began with a review of past and present military operations and was conducted at the base. Information was obtained from available records, such as shop files and real property files, and from interviews with past and present base employees from the various operating areas. A list of 40 Air Force and Guard interviewees is presented in Appendix B by area of knowledge and approximate years of service.

Prior to the base interviews, the applicable Federal, state, and local agencies were contacted for pertinent base-related environmental data. The agencies are also listed in Appendix B.

The next step in the activity review process was to identify all hazardous waste generators and to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various Air Force Reserve (AFR) and Air National Guard operations on the bases. 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 general ground tour of the identified sites was also made by the WESTON Records Search Team to gather site-specific information, including general site conditions, visual evidence of environmental stress, and the presence of nearby drainage ditches or surface water bodies. These water bodies were inspected for any obvious signs of contamination or leachate migration.

A decision was then made, based on all of the above information, whether a potential exists for hazardous material contamination at any of the identified sites using the record search flow chart shown in Figure 1-1. If no potential existed, the site was deleted from further consideration. If minor operations and maintenance deficiences were noted during the investigation, the conditions were reported to the Base Environmental Coordinator for remedial action.

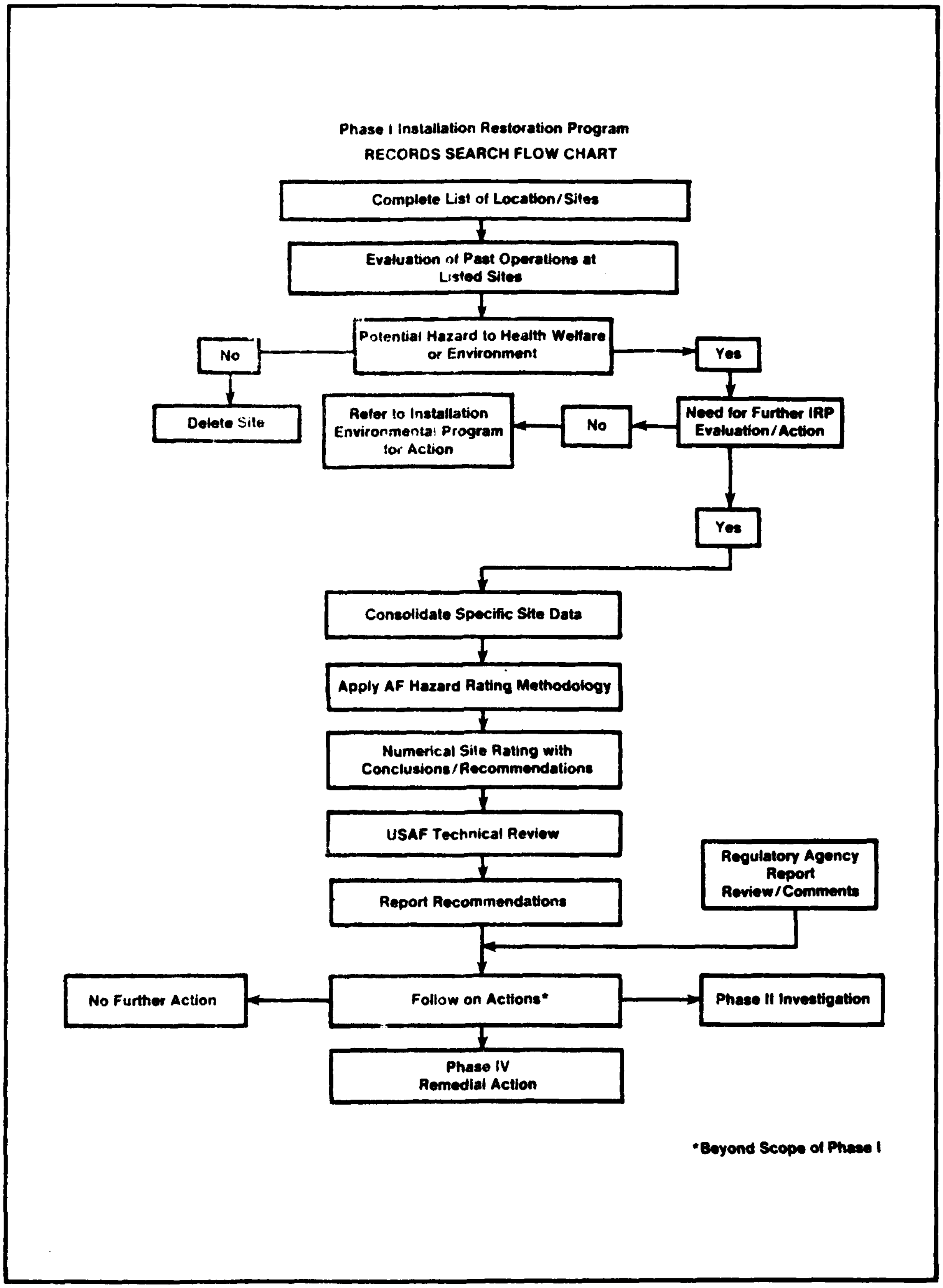


FIGURE 1-1 PHASE I INSTALLATION RESTORATION PROGRAM

For those sites where a potential for contamination was identified, the potential for migration of the contamination across installation boundaries was evaluated by considering site-specific ground- and surface-water conditions. If there is a potential for on-base contamination or other environmental concerns, the site was referred to the Base Environmental Coordinator for further action. If the potential for contaminant migration is considered significant, the site was evaluated and prioritized using the Hazard Assessment Rating Methodology (HARM) and recommendations are developed.

Recommendations may vary from no action to a complete monitoring and sampling program for the sites receiving a high HARM score. A limited Phase II program may be recommended for sites receiving a low to moderate HARM rating to confirm that hazardous materials are not migrating from the site. The site rating methodology is described in Appendix D.

SECTION 2

INSTALLATION DESCRIPTION

2.1 LOCATION, SIZE, AND BOUNDARIES

Both the Air Force Reserve Facility and the Wisconsin Air National Guard Facility are located at General Billy Mitchell Field, Milwaukee, Wisconsin. General Billy Mitchell Field is a commercial airport owned by Milwaukee County. The airport is located in the southeastern corner of Wisconsin, seven miles south from the center of the City of Milwaukee and approximately three miles west of the Lake Michigan. The landing area is 1,500 acres in size. An additional 585 acres have been purchased north, west, and south of the site for controlled approach zone. The field is bounded on all sides by urban development, including the City of Milwaukee to the north, the City of South Milwaukee to the east, the City of Oak Creek to the south, and the City of Cudahy to the northeast. Development is generally less dense south and southwest of the field.

The U.S. Air Force owns a 99.24-acre parcel in the southwest corner of the airport, and leases the airport taxi-ways and limited services (under Lease Agreement No. DA-11-032-ENG-2221, as supplemented) for the activities of the 440th Tactical Airlift Wing.

The Wisconsin Air National Guard has leased two parcels from Milwaukee County since 1962: a 5-1/2-acre parcel occupied by the 128th Tactical Control Squadron, and a 58-1/2-acre parcel occupied by the 128th Air Refueling Flight. The Lease Agreement (No. DA-11-032-ENG-9461) terminates 31 July 2012. The smaller parcel is located adjacent to the northeastern corner of the U.S. Air Force (ARF) 440th TAW site. The larger parcel is located in the east-central portion of the airport property.

The facilities used by the U.S. Air Force Reserve (AFR) and Wisconsin Air National Guard are the focus of the Phase I records search. Figure 2-1 shows the facility locations.

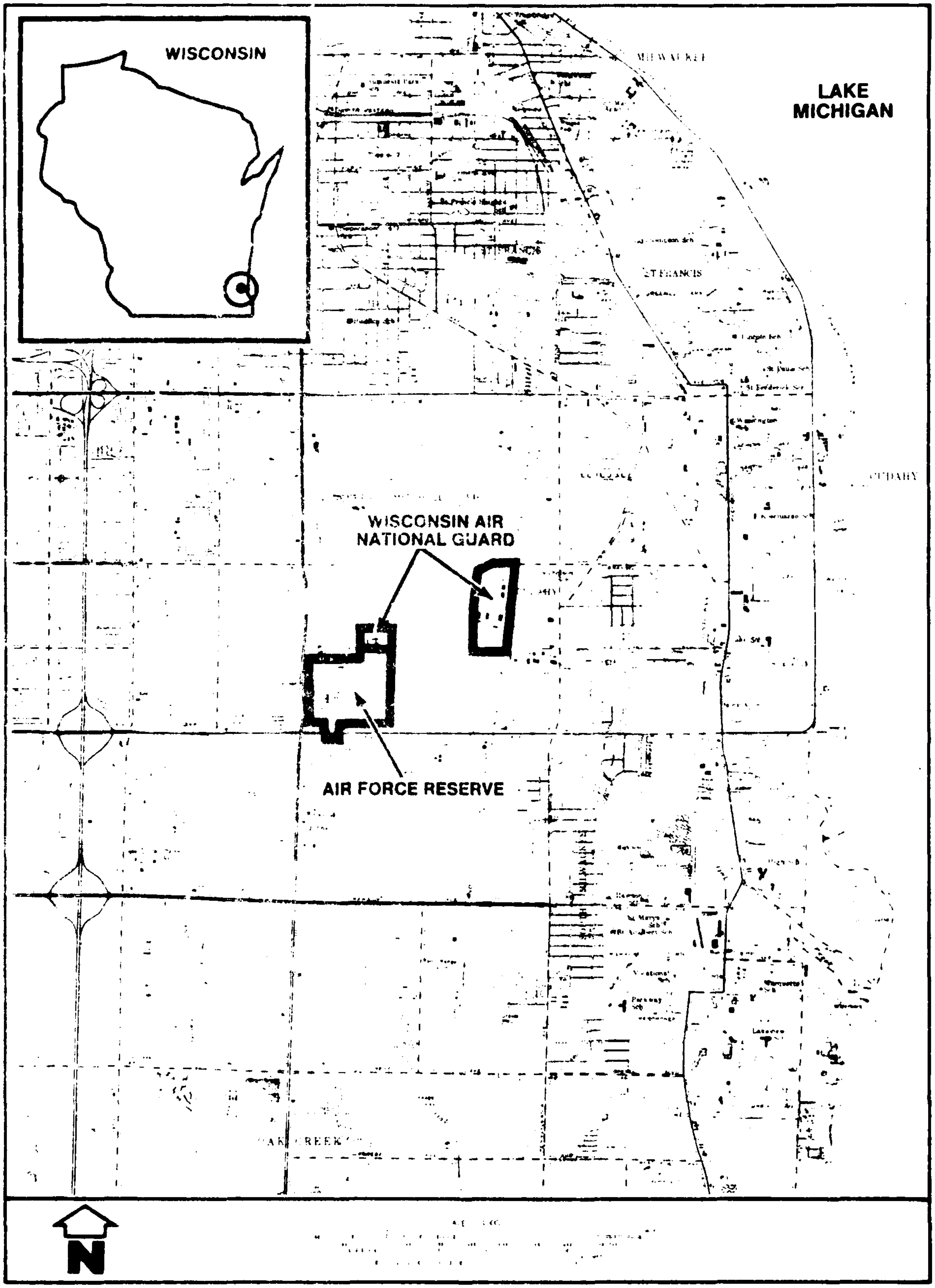


FIGURE 2.1 AREA LOCATION MAP

2.2 BASE HISTORY

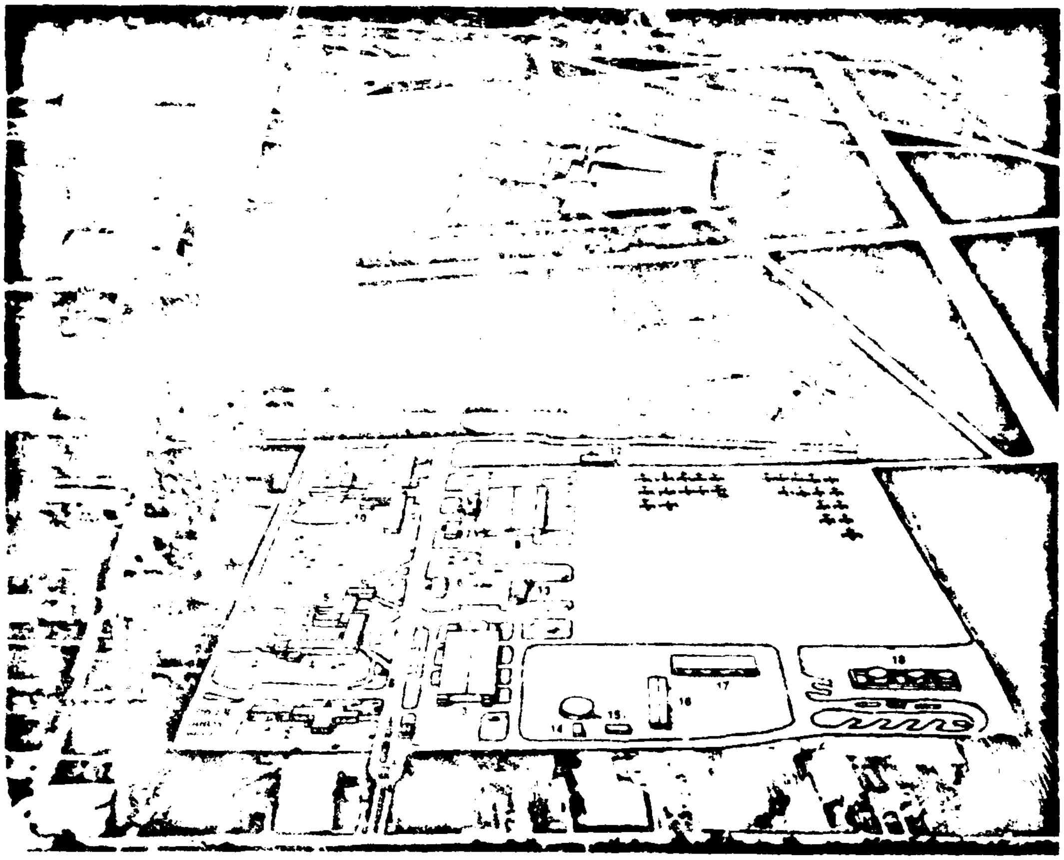
In 1926, Milwaukee County Park Commission purchased a 160-acre site known as Hamilton Field. The control, maintenance, and operation of the airport was later transferred to the Highway Committee of the Milwaukee County Board of Supervisors. As air traffic increased, the field was expanded, and reached an area of one square mile in 1942. The field was officially named General Billy Mitchell Field by the U.S. Air Force, in consideration of Mitchell Air Force Base in New York.

The Milwaukee County Board of Supervisors adopted the first airport plan in 1944 to address needs beyond 1960. This airport plan was last revised in 1977 to meet needs until 1995. As a result of this plan, General Billy Mitchell Field was developed to its present status.

In February 1952, the 924th Reserve Training Wing was activated at Billy Mitchell Field. On 1 July 1952, it was redesignated as the 438th Fighter Bomber. It was again redesignated as the 247th AFRTC with F-80 and T-33 aircraft assigned. In 1954, it was authorized to construct reserve training facilities at Billy Mitchell Field, and began acquiring land in the southwest corner of the airport area. The first buildings were accepted in 1956. In November 1957, the 247th AFRTC was deactivated, and the 440th Troop Carrier Wing was transferred to Milwaukee from Minneapolis. At that time, C-119 aircraft were assigned to the Wing. In 1971, the C-119 aircraft were replaced by C-130A aircraft. Other than 1977 prop conversion, the aircraft have remained the same since that time.

The 440th Tactical Airlift Wing had developed from a group designated as the 440th Troop Carrier Group, which began in 1943 at Bear Field, Indiana. The group was engaged over Normandy on D-Day, 6 June 1944, and was deactivated in October 1945. The 440th Troop Carrier Wing was reactivated on 26 August 1947 in Minneapolis as a reserve organization and expanded in 1949.

The original planned layout of the Reserve facility is shown in Figure 2-2.



Legend

1 Gatehouse
2 Air installations
3 Base Warehouse
4 Administration and Training Building
5 Flight Surgeon Clinic
6 Squadron Supply
7 Boiler House
8 Aircraft Maintenance Hangar and Shops
9 Parachute Building
10 Airmen's Dormitory and Mess
11 Officer's Quarters and Mess
12 Wash Rack
13 Fire Crash Station
14 Reservoir and Pumping Station
15 Reclamation Salvage Shed
16 Lumber Shed
17 Storage
18 Fuel Storage System

FIGURE 2.2 ORIGINAL PLANNED LAYOUT OF AIR FORCE RESERVE FACILITY (440TH TAW) AT GENERAL BILLY MITCHELL FIELD

The first Wisconsin Air National Guard Unit was established at Billy Mitchell Field in 1947, and included the 126th Fighter Squadron, the 126th Utility Flight and Weather Station, and the 228th Air Service Group. In November 1950, a major reorganization occurred, and the 128th Fighter Interceptor Wing and the 128th Fighter Interceptor Group were given Federal recognition. In 1961, the 128th Air Refueling Group received Federal recognition, and has operated at the present site since 1962. Since 1947, the Guard had been located at 4840 South Howell Avenue; this property lacked space for expansion. In March 1962, an agreement was reached between Milwaukee County and the State of Wisconsin, which resulted in exchange of the old facility and its land for the 58-1/2-acre site on the east perimeter of the airport. Construction began immediately. The first facilities constructed were a taxiway, aircraft parking apron, ramps, and wash racks. A second phase of construction began in June 1963. This included two aircraft docks, base heating plant, parking lots, and utilities. An administration building, aircraft maintenance shop, and POL area were added in 1964. The POL storage area had a capacity for 50,000 gallons of JP-4 and 100,000 gallons of Avgas. In 1969, additional support buildings, including the fire station were added. All the new facilities were occupied and the old facility at 4840 South Howell Avenue was turned over to Milwaukee County in September 1970. The facility layout is shown in Figure 2-3.

The first aircraft assigned to the 128th TAG were KC-97, which were delivered in 1962. In 1976, the 128th was assigned to the Strategic Air Command. As a result, the KC-97 aircraft were replaced with K-135 aircraft in 1977.

The layout of the ANG facility is shown in Figure 2.4.

2.3 ORGANIZATION AND MISSION

2.3.1 440th Tactical Airlift Wing

The present mission of the 440th Tactical Airlift Wing is combat-airlift support; paratroop and equipment drops; airlift of troops and equipment to forward areas; and aeromedical evacuation. Information on the organization and mission of the Air Force Reserve Units at General Billy Mitchell Field is summarized below.

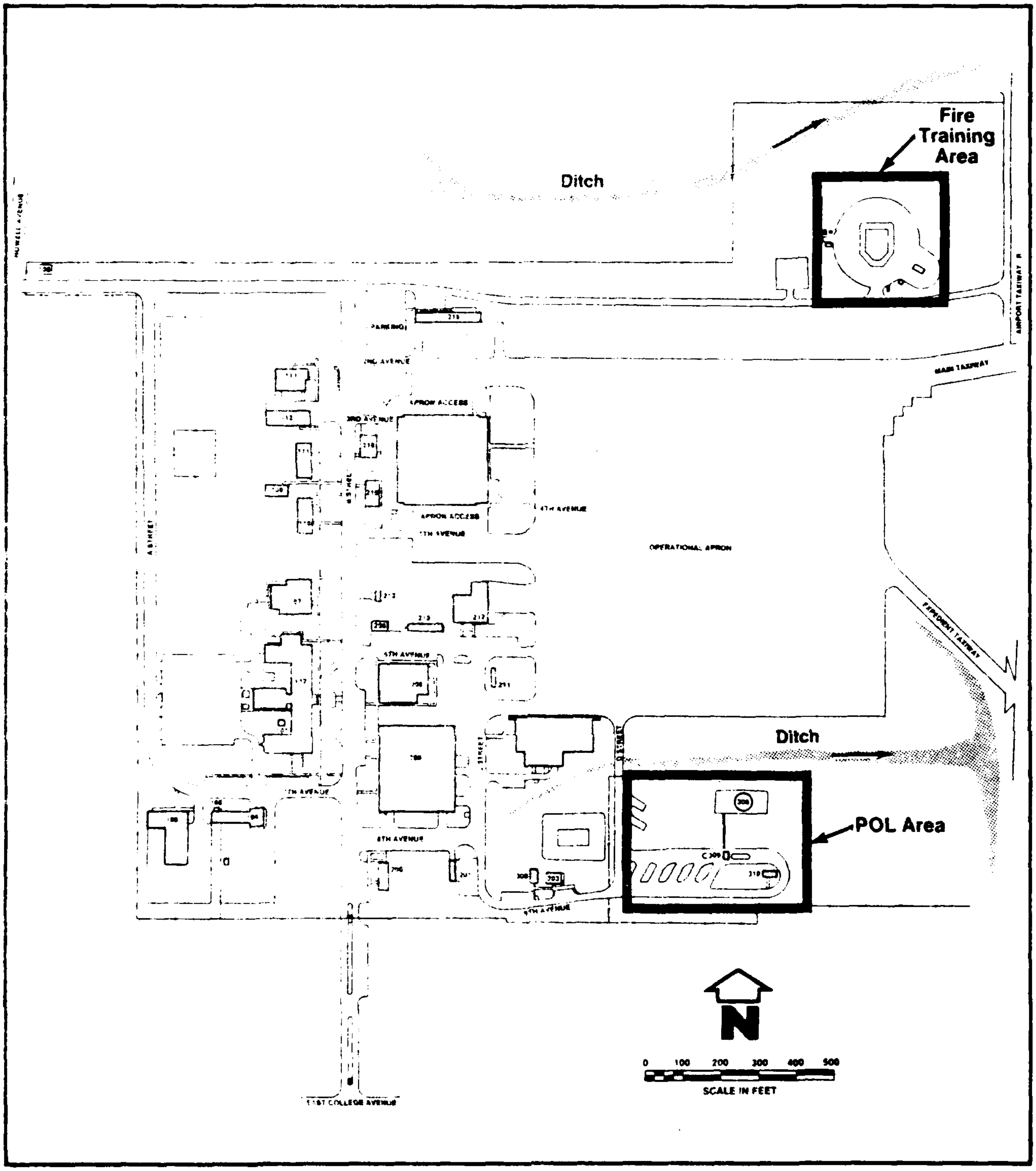


FIGURE 2.3 FACILITY LAYOUT - U.S. AIR FORCE RESERVE

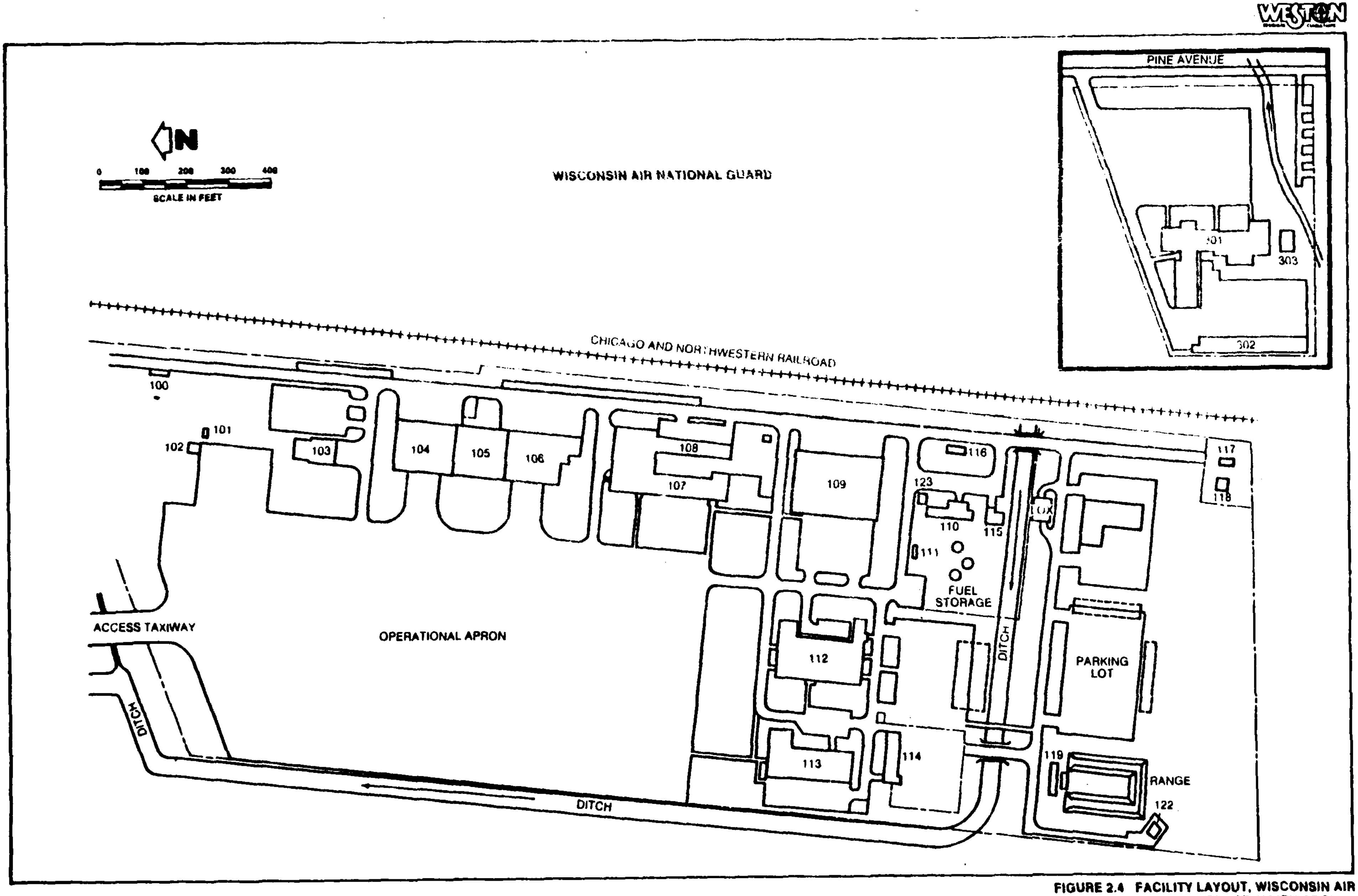


FIGURE 2.4 FACILITY LAYOUT, WISCONSIN AIR NATIONAL GUARD (128TH ARG)

Assigned Units

Headquarters, 440th Tactical Airlift Wing
440th Tactical Hospital
440th Combat Support Group
440th Civil Engineering Squadron
440th Weapon Systems Security Flight
440th Communications Flight
34th Mobile Aerial Port Squadron
95th Aerial Port Squadron
95th Tactical Airlift Squadron
440th Mobility Support Flight
440th Consolidated Aircraft Maintenance Squadron

	Authorized	Assigned
Strength as of July 1983		
ART Officers	14	14
ART Airmen	124	116
Civilians	209	191
Total	347	321
Attached		
1963/1964 CommDet - Tenants (Active Duty)	3	3
8576th Recruiting Group (Active Duty)	1	1
Total	4	4
Reserve Strength		
Officers	120	103
Airmen	716	806
Total	836	909

2.3.2 Wisconsin Air National Guards 128th Air Refueling Group

The present mission of the Wisconsin Air National Guard's 128th Air Refueling Group is air refueling with a fleet of eight KC-135 aircraft. This unit has 930 personnel.

SECTION 3

ENVIRONMENTAL SETTING

3.1 METEOROLOGY

Milwaukee, Wisconsin has a continental climate that is moderated by Lake Michigan, particularly in the summer months. Winters are long, cold and snowy, with streams and small lakes generally frozen from late November to early April. The ground usually begins freezing in early November and stays frozen until early April. The depth of soil freezing depends on both temperature and depth of snow cover. In years with light snowfall and low temperature, the soil may freeze to a depth of 36 inches or more; however, if heavy snowfall occurs early in November, the soil may freeze to a depth of just a few inches (USDA, SCS, 1971).

Temperatures vary greatly from season-to-season and from day-to-day, in response to shifts in wind direction. July is the warmest month, with an average temperature of 70.7°F. January is the coldest month, with an average temperature of 20.9°F (U.S. Department of Commerce, NOAA, 1974). Climatic data is summarized in Table 3-1.

On the average, about 30 inches of precipitation fall in the county each year. About two-thirds of the annual rainfall occurs during the growing season. The average annual snowfall is about 46 inches, but this amount varies greatly from year-to-year (NOAA, 1974).

Net precipitation and rainfall intensity are two climatic features of interest in determining the potential for movement of contaminants. Net precipitation is equal to the difference between precipitation and evapotranspiration and is an indicator of the potential for leachate generation. The net precipitation at General Billy Mitchell Field is 9-1/2 inches. The mean annual precipitation is 30 inches (NOAA, 1974), and the average evapotranspiration is about 20.5 inches (Skinner, 1973). Mean annual lake evaporation is 29 inches. Rainfall intensity is an indicator of the potential for excessive runoff and erosion, and is gauged by the one year, 24-hour rainfall event, which, at General Billy Mitchell Field is approximately 2.4 inches (NOAA, 1962).

Table 3-1

Temperature and Precipitation at Billy Mitchell Field
Milwaukee, Wisconsin

(Station is at an elevation of 672 feet.
Data based on a 30-year record in the period 1921 to 1950)

	Temperature			Precipitation	
	Average Daily Maximum (°F)	Average Daily Minimum (°F)	Average (°F)	Average (inches)	Average Snowfall or Sleet (inches)
January	29.2	14.5	21.9	1.58	11.5
February	31.8	16.6	24.2	1.27	6.3
March	40.8	25.7	33.3	2.19	8.1
April	52.8	35.8	44.3	2.39	.6
May	63.9	44.7	54.3	2.98	Trace
June	75.1	54.7	64.9	3.22	0
July	81.2	61.4	71.3	2.43	0
August	79.2	60.5	69.9	2.62	0
September	71.8	53.3	62.6	3.33	Trace
October	60.3	42.4	51.4	1.97	Trace
November	44.7	29.9	37.3	2.11	3.1
December	32.7	18.7	25.7	1.48	9.5
Year	55.3	38.2	46.8	27.57	39.1

Source: U.S. Department of Commerce, NOAA, Climates of the United States, 1974.

3.2 GEOGRAPHY

3.2.1 Topography

Milwaukee County has level to rolling topography, which has resulted from bedrock deposition and subsequent glacial action. The topography ranges from approximately 640 feet above sea level along Lake Michigan (three miles east of Billy Mitchell Field), to more than 700 feet above sea level in western Milwaukee County (USGS Survey, 1971).

Development and construction have influenced the natural topography of Milwaukee County. The topography of Billy Mitchell Field is level, with elevations varying less than 30 feet within the airport boundaries. The lowest elevation of approximately 676 feet is found along the drainageway which flows west to east along the northern edge of the site. The highest point is 720-feet, and is found in the southwestern corner of the site near the main entrance and parking lot. In general, elevations increase from the northeast to southwest on the site.

3.2.2 Soils

The soils of General Billy Mitchell Field are classified as a single mapping unit, clayey land, a miscellaneous land type that consists of fill area and cut or borrow areas (USDA, SCS, 1971). The material in this land type is mainly clay to clay loam. In areas where original soils have been removed, the material is generally silty clay, loam, and glacial till that contains pockets of loamy or silty material. The material is variable in texture in fill areas, and contains debris and some loamy or gravelly material.

The surface of the clayey land type is generally compacted. As a result, most rainfall runs off the surface and the soil is poorly suited for agriculture. The soil suitability for engineering use is highly variable and can be determined only after detailed site investigations.

The predominance of clay in the area soils is confirmed by records of soil borings completed at the Reserve facility. Similar records provided for the ANG facility, however, indicate that the soils at that location are more variable; soil texture ranges from clay to gravel with sandy silt and silt sand being the commonest textures encountered.

Soil permeability is the soil property of concern in assessing the potential for surface water infiltration (e.g., potential for movement of contaminants). As mentioned previously, the USDA, SCS recommends detailed site investigations to determine permeability and other engineering properties of the clayey land category. No such data is available; however, information on soil permeability for general classes of soil is available from the U.S. Geological Survey (USGS). The USGS provides soil permeabilities for soils in the vicinity of Billy Mitchell Field, which are developed on loess or sandy, silty drift, and reportedly have a low infiltration rate, ranging from 0.2 to 0.8 inches per hour. The low infiltration rate corresponds to low soil permeability and to rapid runoff (Skinner, 1973). This infiltration rate is for the least permeable soil horizon in the area. Based on examination of boring logs at the ANG base the infiltration rate would be expected to be faster at some locations.

3.3 SURFACE WATER RESOURCES

General Billy Mitchell Field is located in the Lake Michigan drainage basin. There are no natural surface water features on the base. Instead, drainage is controlled by man-made ditches and culverts. General Billy Mitchell Field drains into two watersheds: the Kinnickinnic River Watershed to the north and the Oak Creek Watershed to the south. Surface runoff from the U.S. Air Force property in the southwestern corner of the airport flows east into the Oak Creek watershed and then into Lake Michigan. Surface runoff from the Air National Guard Base drains to Wilson Park Creek, a tributary of the Kinnickinnic River, and eventually into Lake Michigan. Information on surface water discharge, quality, and usage is provided in the following paragraphs. Drainage features are shown in Figure 3-1.

3.3.1 Surface Drainage

All surface runoff from the U.S. Air Force Reserve (AFR) property is collected in the storm drainage system which consists of two main drainage ditches. One ditch is located along the northern property boundary line. This ditch receives the majority of the storm sewer system discharge and surface runoff. The second ditch is located north of the POL area. This ditch receives discharges from within the POL area. Contents of the fuel storage tank dike are discharged after being processed through an oil/water separator system that was put on line in August 1984.

WESTON

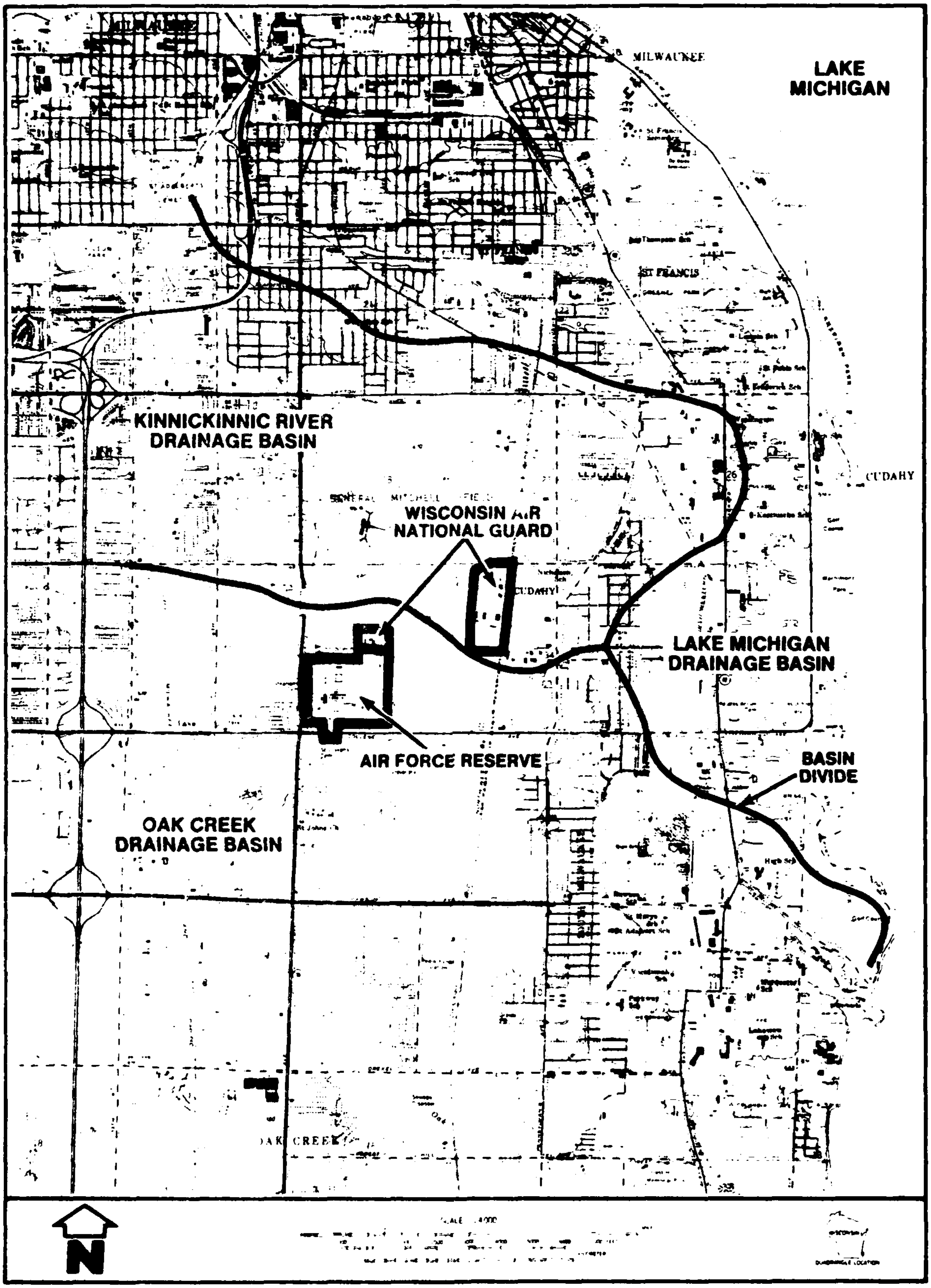


FIGURE 3.1 DRAINAGE BASIN MAP

Surface water drainage exits the Air Force property at two locations. The larger drainage ditch runs off the property at the northeast corner of the base. The smaller ditch, located in the P.O.L. area, drains to the southeast corner of the base. Drainage from the base is discharged into the Lake Michigan water basin via tributary to Oak Creek. This tributary is culverted under the existing airport runway.

Surface runoff and storm sewer drainage from the Air National Guard property is collected in a main drainage ditch. This ditch runs from the southeast corner directly west across the width of the base, and turns north along the operations apron to a wetland at the northern edge of the base. This marshy area discharges off base into a road drainage ditch at the northeast corner of the base property, and drains into the Wilson Park Creek, a tributary of the Kinnickinnic River.

The marshy drainage area is large in size and acts as a holding basin for drainage. There are large quantities of vegetative growth throughout this area. Infiltration of runoff and drainage waters would occur in this area.

3.3.2 Surface Water Quality

There are no natural surface water bodies on the base. Drainage ditches carry runoff to tributaries that discharge into the Oak Creek.

Surface waters are sampled during controlled discharges into the drainage ditches. These incidents occur during washing activities. The NPDES permit granted to the base has discharge limitations for flow (2,000 gpd) and oil and grease (15 mg/L).

Samples were taken at seven locations along the drainage ditches. The samples collected indicated that oil and grease levels during discharge periods are escalated; however, data from the extraneous locations of the drainage ditches, just prior to discharge for the base indicated no detectable levels. A summary of the analysis results is shown in Tables 3-2 and 3-3, and sample locations are shown in Figure 3-2.

Table 3-2

U.S. Air Force Reserve
Surface Water Quality Results
Drainage Ditch Points Nos. 1, 2, and 3

Sampling Date	Location Number	Flow mgd	Oil and Grease mg/L
8 March 1983	1	2,000	8
18 March 1983	1	2,000	92
9 April 1983 (0830)	1	2,000	20.4
(1100)		2,000	142.6
(1530)		2,000	258.7
19 May 1983	1	2,000	107
11 August 1983	2	2,000	92
	3	2,000	179
17 August 1983	2	2,000	122
	3	2,000	104
20 September	2	2,000	77.3
	3	2,000	9.7
4 October 1983	1	2,000	2.57
	2	2,000	3.4
	3	2,000	2.73
12 October 1983	1	2,000	0.38
	2	2,000	0
	3	2,000	0
23 November 1983	1	2,000	0
	2	2,000	0
	3	2,000	0
28 November 1983	1	2,000	3.9
	2	2,000	0
	3	2,000	1.5
22 May 1984	1	2,000	2.36
	2	2,000	1.43
	3	2,000	0.3
Effluent limitations	1, 2, 3	---	15

Note: Samples were collected during rain storms.

Source: U.S. Air Force Reserve (AFR) records.

Table 3-3

U.S. Air Force Reserve
Drainage Ditch Points Nos. 4, 5, and 6

Sampling Date	Location Number	pH	Temperature °C	Ammonia mg/L	Nitrate mg/L	Oil and Grease mg/L	Orthophosphate mg/L	Total Phosphorus mg/L	Phosphate mg/L	Sulfite mg/L	Surfactants mg/L
15 January 1984	4	7	1	5.0	0.4	0.3	0.47	0.48	0.01	2	0.3
	5	---	---	---	---	---	---	---	---	---	---
	6	7.5	1	30.0	0.7	0.3	0.82	0.93	0.11	2	0.2
15 April 1984	4	6	6	0.67	1.2	0.3	0.20	0.24	0.04	---	0.1
	5	6	7	3.4	2.5	0.3	0.10	0.10	---	---	0.1
	6	6	7	4.3	3.5	0.5	0.10	0.12	0.02	---	0.1

Source: U.S. Air Force Reserve (AFR) records.

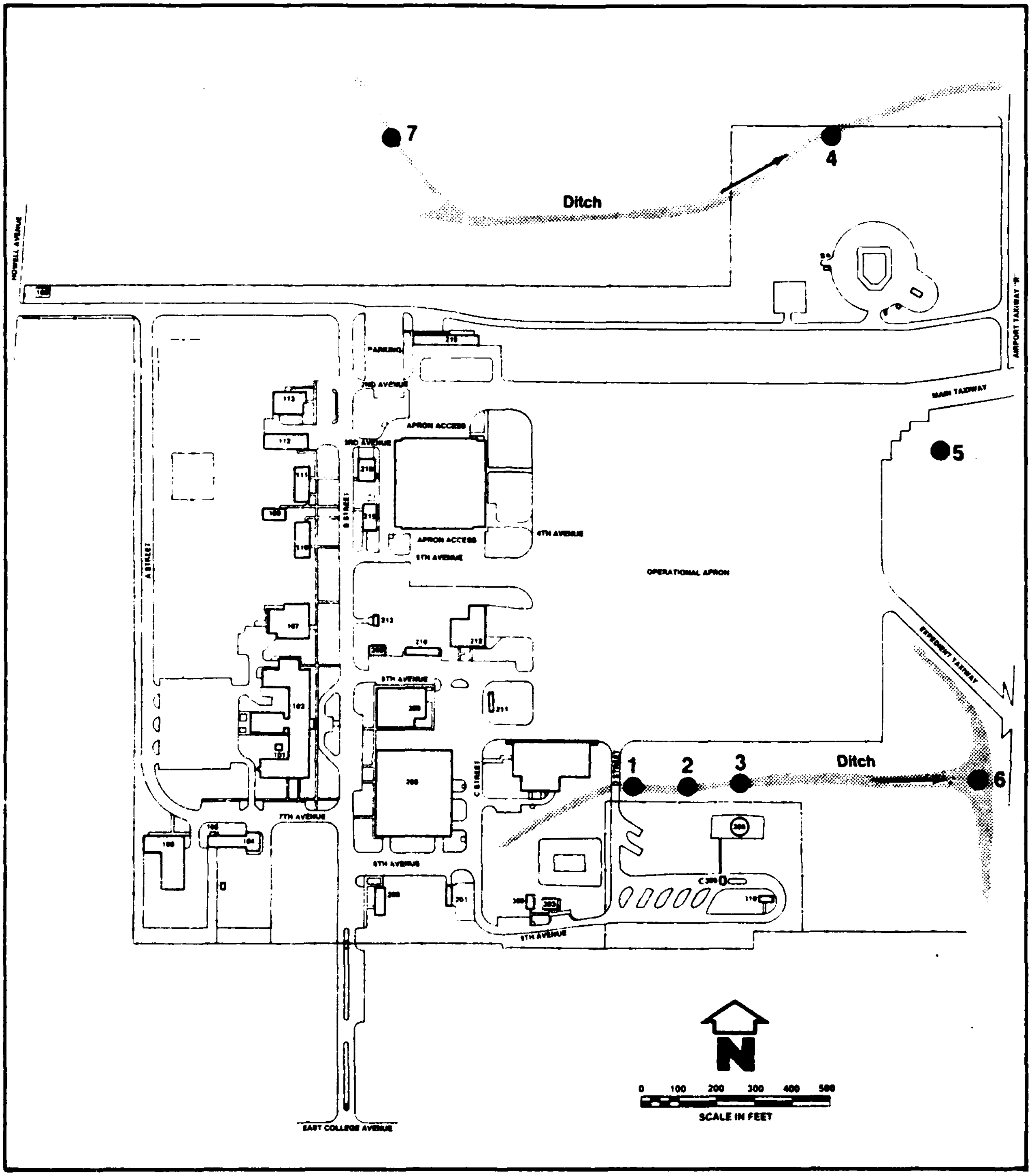


FIGURE 3.2 SURFACE WATER SAMPLE LOCATION U.S. AIR FORCE RESERVE

The overall surface water quality of the receiving tributary of Oak Creek is known to be heavily polluted by sewage. Nutrients are present in problem amounts that vary, indicating several sources. Biochemical Oxygen Demand (BOD) levels further evidenced sewage contamination. There is no indication that the surface water quality is degraded due to the drainage discharged from either base (U.S. Air Force Reserve (AFR), 1979).

In 1977, the Wisconsin Department of Natural Resources conducted a water quality study of runoff from the commercial airport at General Billy Mitchell Field. Both discharge quantity and quality were monitored for the calendar year 1977. This study concluded that the primary locations contributing pollutants were automobile parking areas and the aircraft aprons. The use of aircraft de-icing fluid was found to affect seasonal pollutant loadings; the highest concentrations of all pollutants, with the exception of suspended solids, was found to occur in a winter snow melt event. These results were attributed to de-icing fluids which are high in nutrients and exert a strong oxygen demand.

Results from site Nos. 1 and 4 are presented on Tables 3-4 and 3-5, respectively.

Site No. 1 received drainage from 411.12 hectares of airport land uses and 137 hectares of urban land uses. Site No. 4 located upstream of site No. 1, drained 137 hectares of urban area and 65.2 hectares of the Wisconsin Air National Guard.

3.3.3 Surface Water Use

The Wisconsin-Lake Michigan Basin (including all areas draining into Lake Michigan), withdrew about 560 billion gallons of water in 1968. Ninety-seven percent (1,479 million gallons per day (mgd)) came from Lake Michigan, and the remainder from groundwater aquifers. Cooling condensers in steam-powered generating plants are the largest users of surface water: 1,262 mgd (86 percent of surface water). The second largest category of surface water users is public water supply, which consumed 216.1 mgd in 1968. Private supplies also use a limited amount of surface water (1.2 mgd in 1968) for industrial, commercial, and farm uses (Skinner, 1979).

The water supply for Billy Mitchell Field is provided by the City of Milwaukee. The City of Milwaukee withdraws an average of 156 mgd from Lake Michigan (Skinner, 1973). The lack of surface water features on the base property precludes other surface water uses, such as recreation, navigation, or irrigation.

Table 3-4

Seasonal and Annual Loadings (kg/ha) and Confidence Intervals

Site No. 1
(west side of commercial airport)

	Total Solids	Suspended Solids	Total P	Soluble P	Organic N	NH_3	NO_2-NO_3	Cl^-	TOC*	BOD_5
Winter kg/ha	238 ± 20.8	25 ± 2.5	.22 ± .02	.11 ± .02	.94 ± .14	.31 ± .02	.31 ± .02	43 ± 10	NA	32 ± 10
±%	9	10	9	18	15	6	6	23	---	32
Spring kg/ha	232 ± 121	168 ± 144	.19 ± .10	.07 ± .03	.74 ± .32	.04 ± .05	.27 ± .07	10 ± 6.2	NA	7.6 ± 4.1
±%	52	85	52	42	43	125	25	62	---	53
Summer kg/ha	573 ± 72	318 ± 32	.28 ± .02	.04 ± .003	1.11 ± .07	.03 ± .003	.35 ± .005	4.05 ± 85	9.15 ± .53	4.47 ± .23
±%	12	10	7	7	6	10	1	20	6	5
Fall kg/ha	183 ± 28	137 ± 29	.20 ± .02	.02 ± .01	.58 ± .11	.02 ± .003	.16 ± .01	2.06± .65	7.9 ± 1.5	3.8 ± .62
±%	15	21	10	50	19	15	6	31	19	16
Annual kg/ha	1,226 ± 241.8	648 ± 207.5	.89 ± .16	.24 ± .06	3.37 ± .64	.40 ± .076	1.09 ± .105	59.11 ± 17.7	17.05 ± 2.03	47.87 ± 15
±%	19	32	17	24	18	19	10	30	11	31
Base Flow kg/ha/yr	357	10.66	0.05	0.01	0.28	0.10	0.28	37	NA	2.67

NA = Not applicable.
*Summer and fall only.
Adapted from: Wisconsin Department of Natural Resources, 1977.

Table 3-5

Seasonal and Annual Loadings (kg/ha) and Confidence Intervals

Site No. 4
(east side of commercial airport)

	Total Solids	Suspended Solids	Total P	Soluble P	Organic N	NH_3	NO_2-NO_3	Cl^-	TOC*	BOD_5
Winter kg/ha	85 ± 17	30 ± 12	.10 ± .03	.026 ± .004	.39 ± .14	.01 ± .02	.11 ± .01	NA	4.4 ± .8	2.6 ± .79
±%	20	40	30	16	36	100	9	---	18	30
Spring kg/ha	112 ± 40	24 ± 13.6	.22 ± .03	.15 ± .02	.86 ± .10	.19 ± .19	.38 ± .28	20.1 ± .19	NA	9.3 ± .15
±%	36	56	13	13	12	16	75	1	---	157
Summer kg/ha	251 ± 8.8	95 ± 5.9	.30 ± .01	.11 ± .003	1.19 ± .05	.08 ± .02	.53 ± .02	13.6 ± 1.4	8.9 ± 1.4	4.3 ± .31
±%	3	6	2	3	4	25	4	10	4	7
Fall kg/ha	124 ± 10	5.3 ± 1.4	.06 ± .008	.03 ± .007	.23 ± .01	.04 ± .01	.37 ± .03	14. ± 2.4	2.8 ± .14	2.0 ± .11
±%	8	26	13	23	4	25	8	17	5	5
Annual kg/ha	572 ± 76	153.3 ± 33	0.68 ± .07	0.32 ± .03	2.7 ± .30	.33 ± .12	1.4 ± .34	47.7 ± 4	16.1 ± 1.27	13.4 ± 16.2
±%	13	21	9	10	11	69	24	1	110	113
Base Flow kg/ha/yr	7.68	.01	.001	.002	.01	.01	.01	1.12	.15	.13

NA = Not applicable.
*Summer and fall only.
Adapted from: Wisconsin Department of Natural Resources, 1977.

3.4 GROUNDWATER RESOURCES

3.4.1 Background Geology

The geology of southeastern Wisconsin consists of unconsolidated glacial deposits, which overlie a thick sequence of layered sedimentary rocks and Precambrian crystalline bedrock.

Glacial deposits in southern Milwaukee County consist of ground and end moraine ranging from approximately 150- to nearly 300-feet thick. Ground moraine is composed primarily of clayey, silty till, and contains deposits of stratified sand and gravel. End moraines form discontinuous bands of hills parallel to Lake Michigan, and are composed primarily of low permeability till (Skinner, 1973).

The uppermost bedrock layers consist of undifferentiated Devonian and Silurian dolomite ranging from 0- to 750-feet thick. This dolomite is underlain by a thick sequence of Ordovician sedimentary rocks, including Maquoketa Shale; the undifferentiated Galena-Platteville Unit (consisting mostly of dolomite); St. Peter Sandstone; and the Prairie du Chien (dolomite) group. Undifferentiated Cambrian sandstones underlie the Prairie du Chien Group, and crystalline bedrock of Precambian Age is the basement bedrock formation.

3.4.2 Hydrogeologic Units

Southeastern Wisconsin has abundant groundwater resources. Major aquifers include glacial sand and gravel deposits, the Niagara Aquifer, and the Sandstone Aquifer. Large users, such as municipalities and industries, rely primarily on the Niagara and Sandstone Aquifers, while the sand and gravel aquifer is important in localized areas. Groundwater resources are summarized in Table 3-6.

Regionally, sand and gravel deposits occur both at the surface and buried beneath less permeable overburden. In southwestern Milwaukee County, buried deposits are predominant and are most important when the beds are over 50-feet thick. Wells in buried deposits are drilled 50- to 480-feet deep with a maximum reported yield of 125 gpm (Skinner, 1973).

Table 3-6

Summary of Groundwater Resources and Characteristics

Aquifer	Age	Rock Unit	Thickness (feet)	Yield (gpm)	Well Depths (feet) (feet)	Notes
Sand and gravel	QUATERNARY	Surface sand and gravel (mostly outwash and and beach sand).	0 - 235	Large yields from conventional wells. Maximum reported yield is 1,200 gpm (5,500 from collector units)	30 - 120	Not predominant in Milwaukee County. Not used extensively. Easily polluted.
		Buried sand and gravel	0 - 300	Small to moderate yields, generally not more than 125 gpm.	50 - 480	Not used extensively. Generally not subject to pollution except locally.
Niagara		Dolomite (undifferentiated)	0 - 750	Highly variable yields, ranging from adequate for small domestic use to as much as 1,200 gpm.	60 - 700	Used extensively. Good quality - generally very hard. Water table generally 50 to 100 feet deep. Locally artesian. Subject to pollution.
(Not an aquifer)		Maquoketa Shale	0 - 400	Although not generally classed as an aquifer, a few wells obtain small quantities of water from dolomite and limestone in the upper part of this unit.		
Sandstone		Galena Dolomite, Decorah Formation, and and Platteville Formation, undifferentiated	100 - 340	No well is known to pump water from this unit exclusively. However, it is commonly used in combination with sandstone and Niagara Aquifers. This unit probably yields only a few tens of gallons per minute within the basin.		Artesian - used for high capacity wells. Quality is variable but adequate, except for saline water in local areas.
		St. Peter Sandstone	0 - 330	600	875 - 1,300	
		Prairie du Chien Group	0 - 140	No well is known to pump water from this unit exclusively. However, it is commonly used in combination with sandstone and Niagara Aquifers. This unit probably yields only a few tens of gallons per minute within the basin.		
		Trempealeau Formation				
		Franconia Sandstone				
		Galesville Sandstone	0 - 3,500	1,500	315 - 2,010	
		Eau Claire Sandstone				
		Mount Simon Sandstone				
(Not an aquifer)		Crystalline rocks	Unknown	No well is known to pump water from this unit.		

Source: Skinner and Borman, 1973.

The Niagara Aquifer is comprised of Silurian and Devonian dolomite, and is the most widely used aquifer in the region. Wells depths range from 60- to 700-feet, and yields are highly variable, depending on the size and number of solution cavities (Skinner, 1973). Most of the groundwater in the Niagara Aquifer is unconfined, but in some areas it is confined in fractures and by overlying glacial clays. Groundwater movement in the Niagara Aquifer generally conforms to the surface drainage system. Flow is from high points toward low areas, where it discharges into streams, wetlands, and drainage ditches occur. Flow is induced into wells in local areas of pumpage. Pollution of Niagara Aquifer has occurred in heavily urbanized areas of the southeastern Wisconsin (Green, 1975).

The Sandstone Aquifer includes the Ordovician and Cambrian Units between the Maquoketa Shale and Precambrian crystalline bedrock. The St. Peter Sandstone and Cambrian Sandstone are the most productive aquifers, although all the units in the aquifer contribute some water. The Sandstone Aquifer is a principal source for municipal, industrial, and commercial uses. Wells must be drilled to achieve considerable depths to achieve large yields: 875- to 1,300-feet for the St. Peter Sandstone (maximum yields of 600 gpm) and 315- to 2,010-feet for the Cambrian Sandstone (maximum yields of 1,500 gpm) (Skinner, 1973).

The flow in the Sandstone Aquifer does not conform to the surface drainage pattern. Discharge is primarily in wells in the Milwaukee and Chicago areas and into Lake Michigan. Due to heavy withdrawals, a "cone of depression" has formed in the Milwaukee and Chicago areas. Because of heavy withdrawals, poor recharge through the Maquoketa Shale, and slow lateral movement of groundwater, the water level in the Sandstone Aquifer (located in the Milwaukee area) has declined (Green, 1975).

3.4.3 Groundwater Quality

Groundwater in southeastern Milwaukee County is generally of good quality and is suitable for most purposes. Hardness is a common problem in all aquifers, while salenity, iron, manganese, nitrate, and fluoride are problems in localized areas.

Sulfate concentrations in much of east central Milwaukee County range from 250- to 400-ppm. The water is of inferior quality, but is suitable for most uses. Chloride concentrations are low, ranging from 0- to 100-ppm. The dissolved solids concentration usually correlates to sulfate concentration and ranges from 501- to 1,000-ppm in most of Milwaukee County (Ryling, 1961).

In general, the Sandstone Aquifer contains water that is more mineralized than that of the Niagara, sand and gravel aquifers. As would be expected, the dolomite in the Niagara Aquifer contains the most alkaline water (Skinner, 1973).

3.4.4 Groundwater Use

As mentioned previously, the water supply for Billy Mitchell Field is provided by the City of Milwaukee and is derived from Lake Michigan. There are no groundwater supply wells on either base, although groundwater monitoring wells have been installed at the periphery of the facility as a result of a 1983 spill from a commercial interstate fuel pipeline.

The WiANG Tactical Control Squadron, adjacent to the northeast corner of the Air Force Reserve base, uses a well for water supply. According to base records the well is three hundred feet deep and pumps from dolomite bedrock. The well is cased to 105 feet below the surface. Location of the well is shown on Figure 3-3.

Most municipalities in Milwaukee County rely on surface water, specifically Lake Michigan, for domestic water supplies. There are no major municipal groundwater suppliers in the area; the closest public groundwater supply is in Franklin, which is approximately six miles southwest of General Billy Mitchell Field. Private industrial groundwater wells located north of General Billy Mitchell Field in the City of Milwaukee, withdraw 5- to 10-mgd (Skinner, 1973).

There are some remaining unplugged domestic wells in the areas served by the public water; however, there are no reliable records which indicate which wells remain in use.

3.5 BIOTIC ENVIRONMENT

The native vegetation on General Billy Mitchell Field is small shrubs, grasses, and scattered small trees. The soil type and land use pose severe limitations to tree growth, and maintenance of existing vegetation is the recommended management practice (USDA, SCS, 1971).

Wetland vegetation is found in the man-made marsh area just north of the ANG base.

The natural habitat of wildlife in the eastern part of the Milwaukee County has been changed or destroyed by development and industrialization. Remaining tree stands are generally too small for deer and other large game animals, although some species of small mammals and birds are found. Representative species which may be found in the vicinity of Billy Mitchell Field are upland game birds, such as pheasant and partridge; song birds; and animals such as deer, raccoon, fox, cottontail rabbit, and squirrel.

Wetland wildlife, such as ducks, muskrats, geese, etc., are uncommon due to limited availability of water/wetland habitats in the vicinity of the airport.

An environmental area of statewide or greater significance, Michael F. Cudahy Nature Preserve, is located immediately south the U.S. Air Force Reserve (AFR) property. Location of the preserve is shown on Figure 3-3.

The 60-acre site is an upland hardwood forest, in part old growth, with a rich herbaceous layer and several local and rare species. Two major forest types, separated by a small stream are found on the property. A dry-mesic forest of oak, cherry, and hickory is found north of the stream. To the south, there is an old growth forest of American beech, sugar maple, and red oak. Habitat for Solidgo caesia, blue-stemmed golden rod, a state endangered species, is also found on the site (Southeastern Wisconsin Regional Planning Commission, 1979).

3.6 SUMMARY OF ENVIRONMENTAL CONDITIONS

The following environmental conditions are important when evaluating past hazardous waste disposal practices at General Billy Mitchell Field:

- The net precipitation is 9-1/2 inches per year; the 1-year, 24-hour rainfall event is estimated to be 2.4 inches. These data indicate there is moderate potential for precipitation to infiltrate surface soils on the base.
- The natural soils on both bases are predominantly clay and clay loams with low to moderate permeability. The infiltration rate is estimated to range from 0.2 to 0.8 inches per hour.
- Surface drainage is controlled by open ditches and storm sewers. No natural surface water features are located on the property.

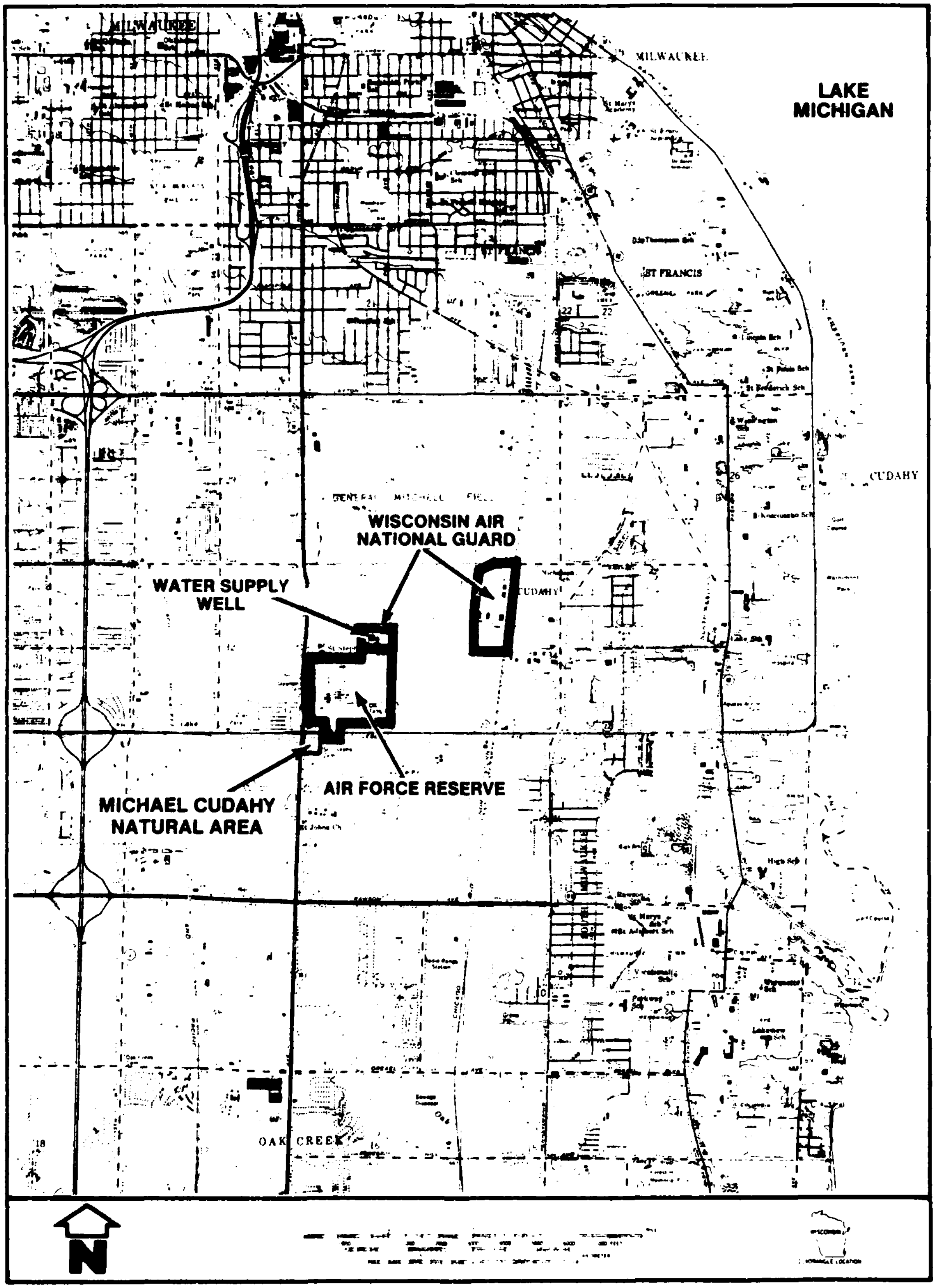


FIGURE 3.3 LOCATION OF WATER SUPPLY WELL AND MICHAEL CUDAHY NATURAL AREA

- Unconsolidated glacial deposits, 150 to 300 feet thick, overlie bedrock in the airport area. The important aquifers include:

  - Glacial sand and gravel deposits (suited for small users).

  - The Niagara (dolomite) Aquifer.

  - The Sandstone Aquifer.

  Groundwater resources are abundant in the area; however, municipal and industrial users rely on Lake Michigan for their water supplies. There are a few unplugged domestic wells in the area, but no reliable records were found to determine if they are still being used.

- There are no endangered or threatened species on the USAFR or Air National Guard property. However, Michael F. Cudahy Nature Preserve, a natural area of statewide significance, is located immediately south of Reserve base property.

SECTION 4

FINDINGS

4.1 INTRODUCTION

This section presents information for the 440th Tactical Airlift Wing (440th TAW) of the Air Force Reserve and the Wisconsin Air National Guard (ANG) activities at General Billy Mitchell Field in Milwaukee, Wisconsin. The information describes past and present activities which resulted in the generation, storage, disposal of industrial wastes; identifies disposal and spill sites located on the two bases; and evaluates the potential for environmental site contamination. This section is arranged to outline separately the individual practices and environmental concerns at each base.

In order to describe past and present industrial waste activities, a review was conducted of waste generation, handling, storage, and disposal methods. This activity consisted mainly of interviews with current and former base employees, a review of pertinent files and records, and site inspections.

The sources of most hazardous wastes on the two bases can be associated with the following general activities:

- Industrial shop operations (440th Reserve and ANG).
- Hazardous waste storage areas (440th Reserve and ANG).
- Fuels management (440th Reserve and ANG).
- Spills (440th Reserve and ANG).
- Fire protection training area (440th Reserve).
- Pesticide utilization (440th Reserve).

4.2 440th TACTICAL AIRLIFT WING

4.2.1 Industrial Operations

Industrial operations of the 440th TAW consist of aircraft maintenance and repair activities, and ground vehicle maintenance operations. These Air Force Reserve mission operations generate potential hazardous waste streams at distinct shop locations on the base. A review of the Bioenvironmental Engineering (BEE) Office files was used as the basis for describing past industrial waste generation and hazardous waste disposal practices. The information provided in the BEE files summarize current operations only, and a series of shop personnel interviews was necessary to elaborate upon past waste generation and disposal. Based upon the shop files, records, and interviews, hazardous waste quantities were developed for 27 shops and work areas. Table 4-1 represents a list of industrial shops identifying building locations, waste material types and quantities, and past/present disposal practices.

The following were identified to be the primary hazardous waste generated through industrial operations:

- Methyl ethyl ketone (MEK).
- Trichloroethane.
- Acetone.
- Toluene.

While no direct dumping or intentional discharges of hazardous waste were known to occur at the 440th TAW, site contamination may have resulted from contaminated surface runoff, periodic spills of fuels and waste oils, and maintenance facility discharges. Six areas were identified on the base as potentially contaminated receptors. Each discharge area is discussed individually herein.

Fire Protection Training Area

The base fire department has operated a fire protection training area (FPTA) at its present location since initiation of base activities (see Subsection 4.2.3 for a complete discussion of fire training operations). The original fire training facility (used until about 1980) was an unlined circular pit where combustible waste liquids were periodically burned to train base and local firefighters. The normal procedure at the FPTA was to flood the pit with water then pour fuel on top of the water and burn it. Waste chemicals were accumulated in 55-gallon drums at an adjacent hazardous waste storage area until fire training exercises were conducted. Without a containment liner, the potential was high for continued discharge of waste chemicals from the training area into the underlying site soils. No visual observations of contamination were possible since the original training area has been replaced by an engineered contained fire training pit with an oil/water separator.

Table 4-1

Materials/Waste Management Practices - 440th TAW

Shop Name	Building Number	Material	Quantity Used	Quantity Disposed	Waste Management Practices 1950	1960	1970	1980
AIRCRAFT MAINTENANCE								
Environmental Shop	217	Lubricating Oil	1.5 qt/month	1 to 2 qt/month	- - - -Drains to separators to contractor			
Flight Line	217	Hydraulic Fluid	18 gal/month	10 to 18 gal/month	- - - -Disposal to contractor - - - -			-55-gallon drum to supply
		Sealing Compound	5 pt/month	15 qts/year	- - - -Dumpster			
		Nitrite Rubber Adhesive	0.5 pt/month	6 pt/year	- - - -Dumpster			
		Lubricating Oils	108 gal/month	1.5 drums/month	- - - -To fire pit or contractor- - -			-DPDO
		Cleaning Compound	75 gal/month	75 gal/month	- - - -Runoff from fire pit to sewer-			-Floor drain to sanitary sewer
Pneudraulic	217	Hydraulic Fluid	15 gal/year	10 gal/year	- - - -To fire pit or contractor- - -			-DPDO
		B&B Stripper	12 gal/year	10 gal/year	- - - -To fire pit or contractor- - -			-DPDO
Propulsion and Engine	208	Cleaning Compounds	90 gal/year	90 gal/year	- - - -Evaporation			
		Stoddard Solvent	5 gal/month	60 gal/year	- - - -To fire pit or contractor- - -			-DPDO
		JP-4	1 gal/month	12 gal/year	- - - -To fire pit or contractor- - -			-DPDO
		Hydraulic Fluid	0.5 gal/month	6 gal/year	- - - -To fire pit or contractor- - -			-DPDO
Repair and Reclamation	217	Paint Stripper	165 gal/year	165 gal/year	- - - -To fire pit or contractor- - -			-DPDO
		Stoddard Solvent	50 gal/year	50 gal/year	- - - -To fire pit or contractor- - -			-DPDO
MAINTENANCE								
Paint	106	Alodine 1200	1 qt/year	1 qt /year	- - - -To fire pit or contractor- - -			-DPDO
		Thinners	10 gal/year	10 gal/year	- - - -To fire pit or contractor- - -			-DPDO
		Dryer Coat	4 oz/year	4 oz/year	- - - -To fire pit or contractor- - -			-DPDO
		Denatured Alcohol	4 gal/year	4 gal/year	- - - -To fire pit or contractor- - -			-DPDO

Table 4-1
(continued)

Shop Name	Building Number	Material	Quantity Used	Quantity Disposed	Waste Management Practices 1950 1960 1970 1980
Roads and Grounds	106	Stoddard Solvent	45 gal/year	40 to 45 gal/year	- - - -To fire pit or contractor- - - -DPDO
		Denatured Alcohol	2 gal/year	1 to 2 gal/year	- - - -Reclaimed by contractor
SUPPORT					
AGE	219	Stoddard Solvent	100 gal/year	100 gal/year	- - - -To fire pit or contractor- - - -DPDO
		Oils	250 gal/year	250 gal/year	- - - -To fire pit or contractor- - - -DPDO
Corrosion Control	219	Toluene	1 gal/week	50 gal/year	- - - -To fire pit or contractor- - - -DPDO
		Naphtha Aromatic	1 gal/week	50 gal/year	- - - -To fire pit or contractor- - - -DPDO
		Methyl Ethyl Ketone	4 gal/month	50 gal/year	- - - -To fire pit or contractor- - - -DPDO
		Primer Coating	0.25 gal/month	3 gal/year	- - - -To contractor- - - - - - - - - -DPDO
		Polyurethane	2 gal/month	12 gal/year	- - - -To fire pit or contractor- - - -DPDO
Survival	112	Lacquers	15 oz/year	1 to 10 oz/year	- - - -Dumpster
Vehicle Maintenance	104	Stoddard Solvent	20 gal/month	20 gal/month	- - - -To contractor- - - - - - - - - -Drums to DPDO.
		Hydraulic Fluid	10 gal/week	10 gal/week	- - - -To pit drain - - - - - - - - - -Drums to DPDO.
		Brake Fluid	5 gal/month	1 to 5 gal/month	- - - -To pit drain - - - - - - - - - -Drums to DPDO.
Battery	108	Sulfuric Acid	2 gal/month	2 gal/month	- - - -Neutralized to sanitary sewer
NDI	218	Developer	25 gal/year	25 gal/year	- - - -To silver recovery
		Hardener	1.25 gal/year	1.25 gal/year	- - - -To silver recovery
		Kodak Photo-F/O 600 Solution	0.5 gal/year	0.5 gal/year	- - - -Diluted to sanitary sewer
		Penetrant	150 gal/year	150 gal/year	- - - -Diluted to sanitary sewer.

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Table 4-1
(continued)

Shop Name	Building Number	Material	Quantity Used	Quantity Disposed	Waste Management Practices 1950 1960 1970 1980
Supply	205	Solvent Cleaning Compound	9 qt/year	9 qt/year	- - - -Rags to trash- - - - - - - - - -Rags to DPDO
		Carbon Removing Compound	20 to 25 gal/year	20 gal/year	- - - -Diluted to sanitary sewer- - - -Drums to DPDO
Petroleum, Oils,	303	Potassium Dichromate	40 ml/month	480 ml/year	- - - -Drains to separators contractor
		JP-4	90 gal/month	720 gal/year	- - - -Waste fuel tank to fire pit
		Gasoline	1 gal/year	12 gal/year	- - - -Waste fuel tank to fire pit

Original Material/Waste Storage Area

Prior to installation of waste oil/water separators with sanitary sewer lines at the industrial shops, liquid materials/wastes were containerized predominantly in 55-gallon drums and stored at an uncontained storage area located adjacent to the fire training area. Periodic chemical spills and leaking drums were known to have occurred at this original hazardous waste storage area. The potential was high for the contamination of underlying site soils, as well as the migration of contaminated surface runoff. The number of drums reported to be at this location at any one given time varies from 10 to 50.

Northern Drainage Ditch

The northern drainage ditch is located north of the aircraft apron and the fire training area, with drainage flowing generally easterly towards the county airfield. This area has received runoff from the apron/aircraft maintenance shop storm drains (prior to utilization of oil/water separators and sanitary sewers), as well as from contaminated leachate from the old hazardous waste storage area and the unlined fire training pit.

This area also received runoff from aircraft washing operations prior to 1984. Table 4-2 shows analytic results from this operation.

POL Fuels Maintenance Area

The POL area has an above-ground 420,000-gallon aviation fuel storage tank and three underground steel 5,000-gallon fuel tanks. A more detailed description of the POL area is included in Subsection 4.3). The POL area was identified as a discharge contaminant area due to an underground line leak of AVGAS which occurred in the mid 1960's (estimated at greater than 1,000 gallons). The line leak occurred in the 8-inch fuel issue line, traversing between the pump house (Building No. 309) and the storage tank (Tank No. 308), and was evidenced through odors and fuel reaching the ground surface. In addition, petroleum odors and stained sediments were reported to have been observed during ground excavations in at least three locations at the POL area during the 1970's.

Table 4-2

Aircraft Wash Discharge - Analytical Results
Air Force Reserve

Discharge Date	Flow gpd	TSS mg/L	Oil and Grease mg/L	BOD_5 mg/L	pH	Total Chromium mg/L	Total Copper mg/L	Total Zinc mg/L	Total Lead mg/L
22 February 1983	14,400	38.6	67.2	1,260	8.7	0.22	0.34	0.33	0.23
22 March 1983	14,400	140	93	1,060	8.5	0.49	0.22	0.72	0.36
20 April 1983	14,400	200	133	1,130	9.0	0.87	0.38	1.48	0.66
3 May 1983	14,400	338	18.6	1,460	7.5	---	---	---	---
[illegible] June 1983	14,400	200	254	4,760	10.0	---	---	---	---
Effluent Limitations	---	30	20	---	6.9	---	---	---	---

Note - WPDES Permit No. WI-0045195-1

POL Storage Area

Containerized waste chemicals have been stored at the POL area since the mid-1970's at two locations. One storage area, located on the ground surface directly west of "D" Street, represented an early storage area for nonflammable waste materials awaiting off-site contractor disposal. The second area, located on an uncontained paved area directly east of "D" Street, is currently used as the 440th TAW's hazardous waste accumulation point. Contamination of underlying soil and migration of drum leaks and spills represent environmental concerns over this discharge area.

Southern Drainage Ditch

The southern drainage ditch is located between the aircraft apron and POL area and receives storm water drainage from the POL and Base Supply areas (Building Nos. 205, 208, and 302). Contaminated runoff from the storage area, direct effluent drainage from the POL containment area (through an oil/water separator), and waste oil/water separator would be transported along the southern drainage ditch.

4.2.3 Fire Protection Training Area

The base fire department has operated the fire protecting training area since the activation of the 440th TAW. The original fire training area consisted of a single-unlined pit of approximately 50 feet in diameter (native silty-clay underlying soils). This gravel and stone filled pit was surrounded by a circular gravel apron in the same location as the present fire training area. Figure 4-1 presents an illustration of the original fire training area. The fire pit area was used about 8 to 10 times per year by the 440th TAW Fire Department, and occasionally used by the County Fire Department for training exercises. Containerized flammable liquids, including waste oils, fuels, and waste solvents were stored adjacent to this training pit. Drummed wastes would be poured on top and lighted (approximately 500 to 1,200 gallons per training exercise). Until the early 1970's, AFFF protein foam was used to extinguish fires.

The present fire training pit has been used since used since 1980 for exercises involving the 440th TAW and the ANG personnel. Contaminated JP-4 is transferred from bowsers to an underground 2,000 gallons storage tank for use in the training activtieis. The pit was constructed directly over the original training area with a portion of the original pit being excavated during placement of the concrete lining and sidewalls. The lined fire pit was designed with injection water and fuel nozzles. The

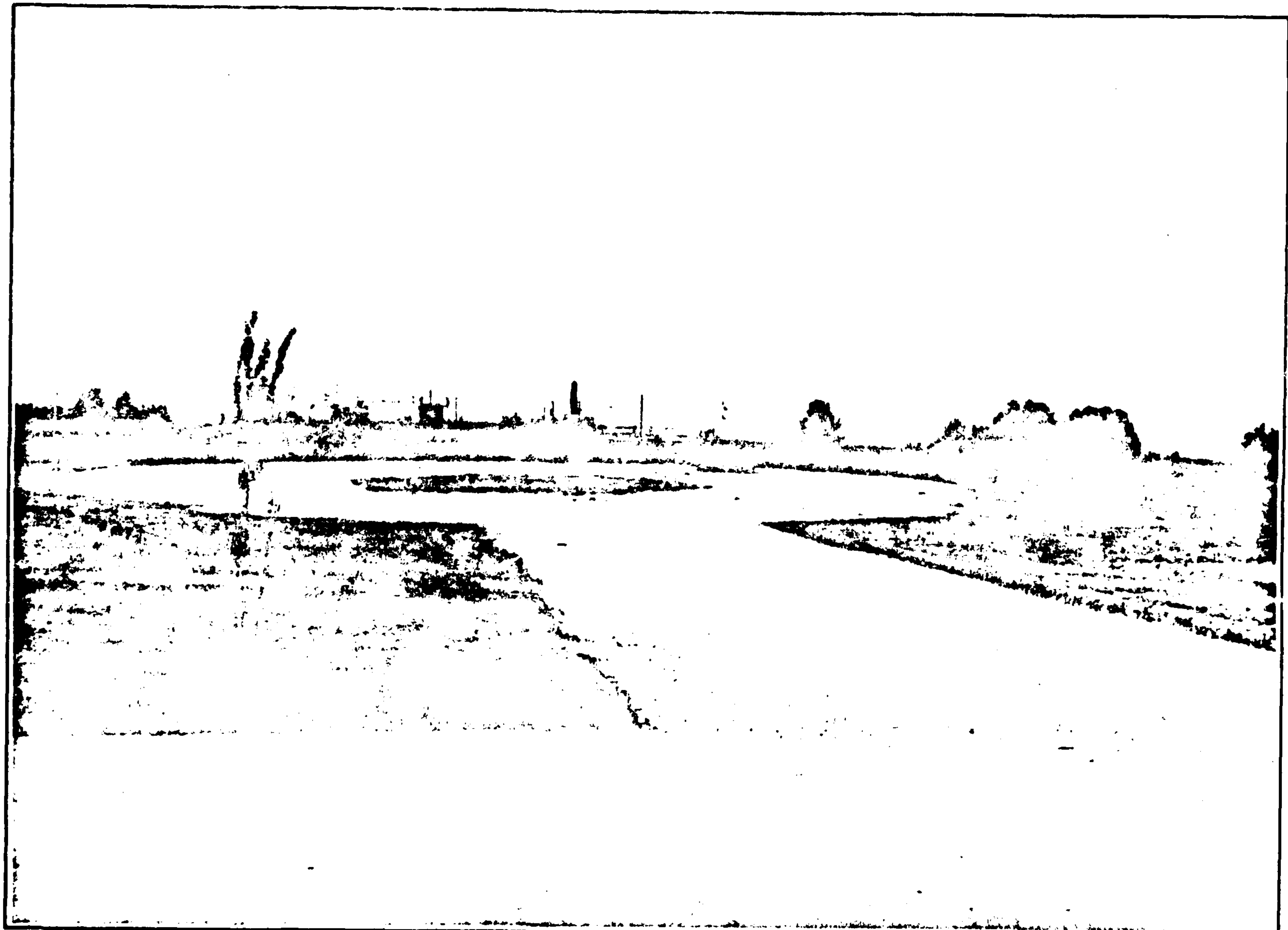

FIGURE 4.1 FIRE TRAINING AREA (440TH TAW) PRIOR TO CONSTRUCTION OF NEW, UPGRADED FACILITY

rock materials are flooded with water, and 1,000 to 1,200 gallons of contaminated fuel are floated and ignited. Following the training exercises, water, residual fuel, and firefighting foam are drained through the water/fuel separator with the wastewater effluent flowing into the sanitary sewer system. Only contaminated JP-4 fuel is presently utilized at the fire protection training area; no waste oils or other flammable liquid wastes are burned. Approximately 20 to 25 fire training exercises per year are performed at the pit area (this includes ANG operations).

4.2.4 Pesticide Utilization

The 440th TAW has contracted off-base for pest control operations since the early 1970's. Therefore, there has been no storage or handling of pesticides on the base since that time. Records were not available documenting pesticide use prior to the early 1970's.

4.2.5 Past Temporary Material/Hazardous Waste Storage and Disposal

Four areas throughout the 440th TAW have been designated for the storage of hazardous waste since activation of the base. In the past, many of the hazardous wastes such as oils and solvents have been temporarily stored in drums and bowsers at the point of generation. When sufficient quantities of these wastes were accumulated, they were transferred to designated bulk waste storage areas. Three uncontained hazardous waste storage areas were utilized during distinct periods at the base. These storage areas are outlined below and shown in Figure 4-2.

- Fire Training Storage Area (Area No. 1): 55-gallon drum storage of flammable waste liquids, including contaminated fuel (AVGAS), waste engine and lubricating oils, hydraulic fluid, solvents, paints and thinners, etc.; used until the late 1970's; disposal through off-base contractor, as well as periodic burning in the original fire training pit.

- Original POL Storage Area (Area No. 2A): 55-gallons drum storage of predominantly inflammable wastes; used until about 1980; and disposal through off-base contractor.

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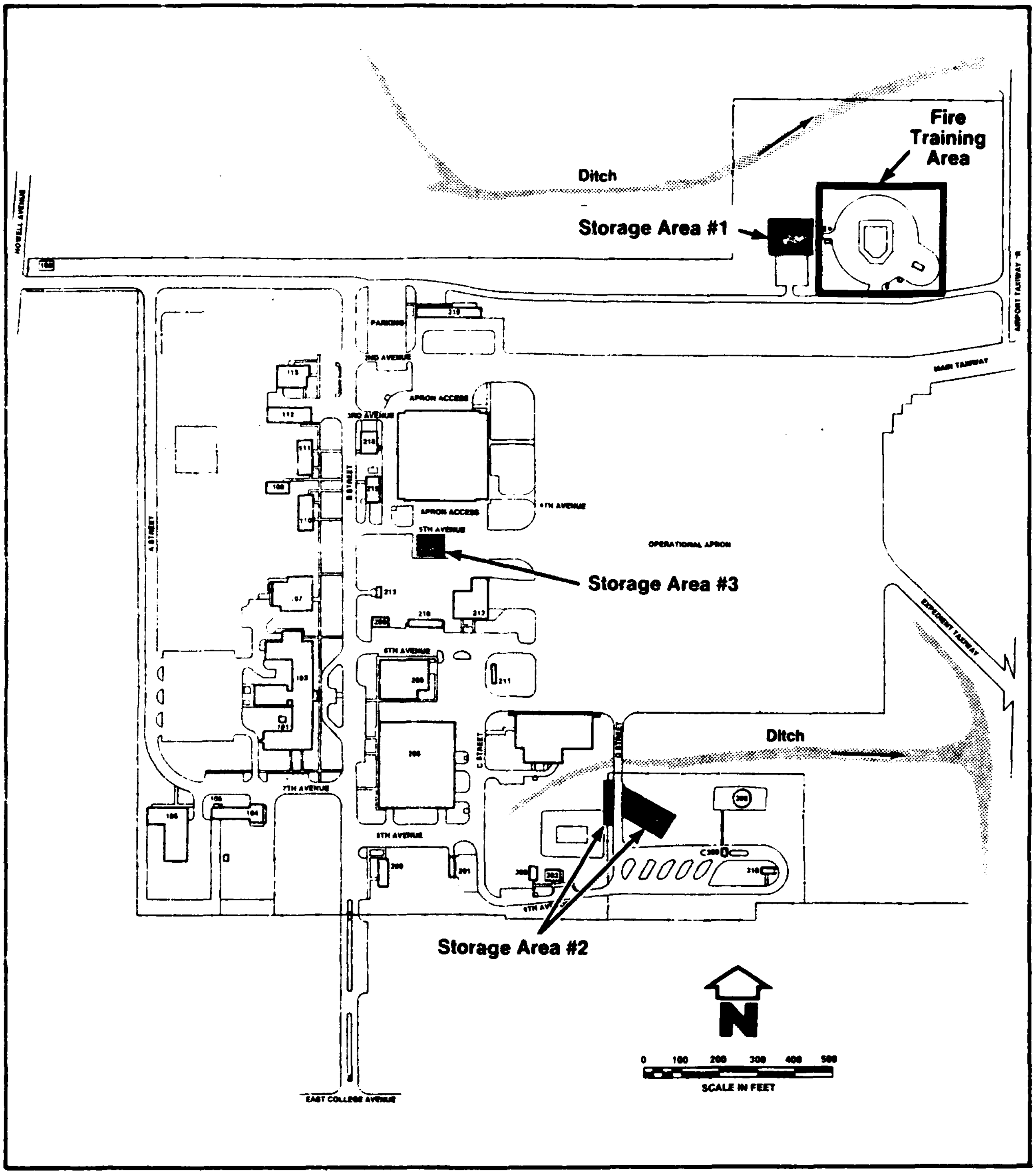

FIGURE 4.2 STORAGE AREAS (440TH TAW)

- Present POL Storage Area: 55-gallons drum storage of liquid hazardous wastes and paint residues, excluding contaminated JP-4 (stored at the fire training area) and some waste oils (collected in the oil/water separators); used since about 1980; and temporary storage of a maximum of 1,000 gallons prior to DPDO disposal operations.

- Aircraft Maintenance Area: This area was used during the 1960's and 1970's as an intermediate storage area. Liquid waste waste from the aircraft maintenance area was brought to this location. Waste were removed from the area by the base contractor or taken to storage area No. 1 for removal by contractor or burning in the fire pit.

4.3 FUELS MANAGEMENT (440TH TAW)

4.3.1 POL Fuel Area

The fuel management system at the 440th TAW comprises the POL area which is located in the southeastern section of the base. POL consists of one concrete-contained aircraft fuel tank (380,000 gallons), two unloading fuel stands, one fuel filling station, and three underground 5,000 gallons for ground vehicle fuels. A complete listing of fuel storage tanks on the base is provided in Table 4-3. The present above-ground storage tank has always been used for aircraft fuel. The present use of JP-4 was initiated in 1971 when the conversion was made from AVGAS. The original POL unloading stations and fill stands are currently used, with all aircraft fueling activities being performed from 5,000-gallon tank trucks.

Containment and pollution control at the POL area consisted solely of a concrete base with berms surrounding the jet fuel storage tank and fuel/water separator on a storm sewer line at the tank truck storage area. In August 1984 a fuel/water separator was installed on the effluent pipe draining the tank containment dike area directly into the southern drainage ditch. The existing concrete tank containment area was completed in 1983. Previous containment was accomplished through earthen berms and base.

Tank cleaning operations have been contracted off-base since activation of the facility. At present, tank cleaning is accomplished approximately every six years. Remaining fuel at the base of the tank is pumped into tank trucks for on-site use. Residual fuel/sludge mixtures are pumped into tanks for disposal at the fire training area. Tank bottom sludges are hauled off-base in drums by the contractor, and washing wastewater were pumped into the adjacent drainage ditch.

4.3.2 Fuel Spills

Small fuel spills have occurred at many areas throughout the Air Force Reserve (AFR) base, predominantly on the flightline and aircraft apron. These spills (usually less than 5 to 10 gallons) result from fuel transfers and aircraft refueling operations. Small fuel spills on paved areas have been typically washed down with resulting wastewater flowing through storm sewer lines.

Table 4-3

Fuel Storage Tanks

General Billy Mitchell Field
U.S. Air Force Reserve

Location	Fuel Type	Capacity (gal)	Above or Below Ground	Containment/Protection
308	JP-4	380,000	Above	Past - earth dike/ Present - concrete dike
101	Diesel	300	Below	Cathodic protected
112	No. 2 Heating Oil	1,500	Below	Cathodic protected
113	No. 2 Heating Oil	2,000	Below	Cathodic protected
107	No. 2 Heating Oil	570	Below	Cathodic Protected
200	Diesel	1,000	Below	Cathodic protected
206	No. 2 Heating Oil	250	Above	None
215	No. 2 Heating Oil	15,000 (2)	Below	Cathodic protected
		20,000 (1)	Below	Cathodic protected
302	No. 2 Heating Oil	20,000	Below	Cathodic protected
303	No. 2 Heating Oil	550	Below	Cathodic Protected
212	Diesel	1,000	Below	Cathodic protected
104	MOGAS	10,000	Below	Cathodic protected
300	MOGAS	500	Above	Diked area
8601	Contaminated JP-4	2,000	Below	Cathodic protected
8002	Diesel, Regular and Unleaded Gasoline	5,000 (3)	Below	Cathodic protected
219	MOGAS	6,000	Below	Cathodic protected
Tank Trucks	JP-4 Jet Fuel	5,000 (3)	Mobile	
Bowsers	JP-4 Jet Fuel, Solvent	500 (2)	Mobile	

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Only one significant fuel spill has occurred at the POL area in the mid-1960's when AVGAS was stored at the base. No records of the spill quantity were kept, but estimates of greater than 1,000 gallons have been reported from an underground leak in the main 8-inch feed line between the POL pump station and the storage tank. The leak was evident only through seepage of fuel to the ground surface and the resulting odors. The location of the spill is shown in Figure 4-3.

4.4 WISCONSIN AIR NATIONAL GUARD

4.4.1 Industrial Operations

Industrial operations at the Wisconsin ANG consist primarily of aircraft/vehicle maintenance and repair activities. These and other mission support operations generate potentially hazardous materials at several of the industrial shops. During shop interviews, estimated waste quantities used and disposal methods were acquired. From this information, a master list of industrial shops was prepared showing building locations, waste material types and quantities, and past/present disposal practices. This list appears as Table 4-4 and addresses only those activities at the presently leased base.

A general review of the waste disposal practices that occurred at Wisconsin ANG is discussed below. Locations of waste storage areas and holding tanks are shown in Figure 4-4.

1960's to Mid-1970's

During this initial period of Guard operations, waste oils and solvents were stored of in a waste tank located at the Aerospace Ground Equipment Shop (AGE). The contents of this 500-gallon underground tank were pumped out by contractors. Rinse wastes emanating from operations were disposed of in drains connected to oil separators. Oil wastes collected from the separators were removed by outside contractors. Contaminated fuels were stored in tanks for use in fire protection training. All fire training exercises were performed at the 440th Reserve facility. All solid waste was removed by a refuse contractor.

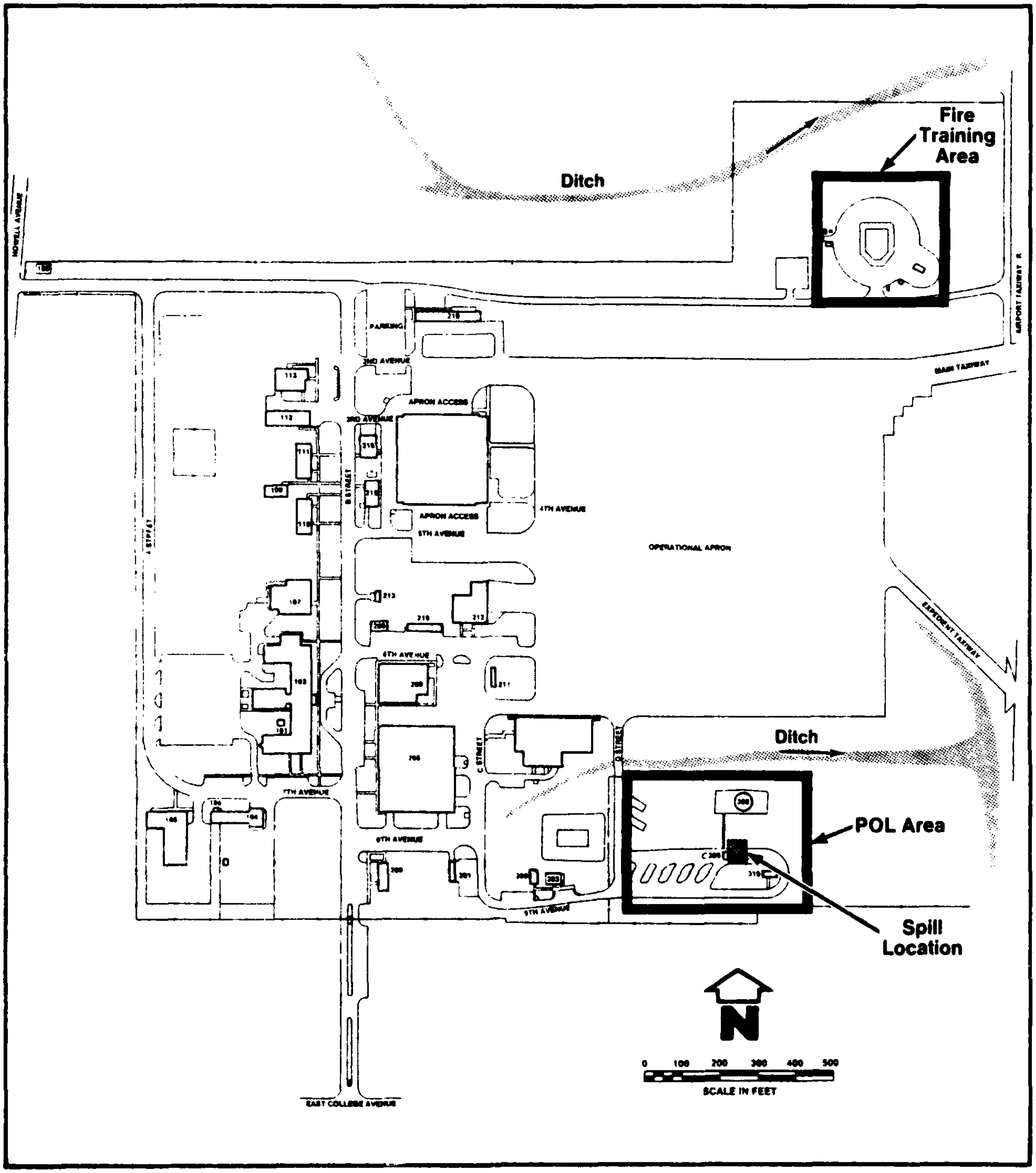

FIGURE 4.3 LOCATION OF SPILL (440TH TAW)

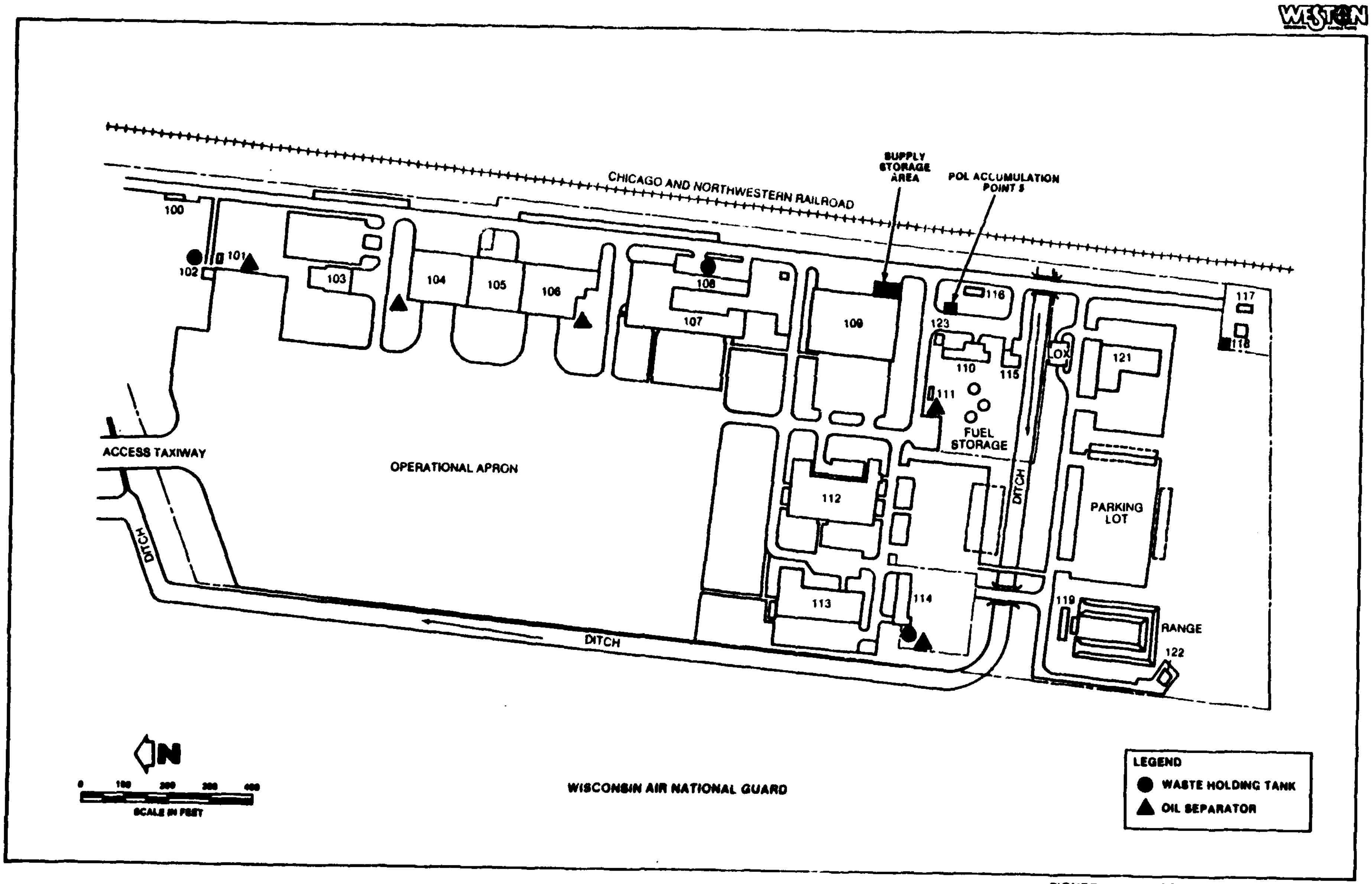

FIGURE 4.4 WISCONSIN ANG WASTE STORAGE AREAS AND HOLDING TANKS

Table 4-4

Waste Disposal Practices - Wisconsin Air National Guard

Shop Name	Building Number	Material	Waste Quantity	Waste Management Practices: Past Practices 1960 - 1970	Waste Management Practices: Present Practices 1980 to Present
AGE	108	PD-680 Solvent Oils	120 gal/year	Solvent Waste Tank	
		Oils	440 gal/year	Solvent Waste Tank	Oil Waste tank
Corrosion Control	105	PD-680 Solvent	30 to 50 gal/month	Solvent Waste Tank	
		Methyl Ethyl Ketone	110 gal/year	Solvent Waste Tank	
		Paints	70 gal/year	Storm Drain to Separator	Drums to DPDO
		Lacquer Thinners	100 gal/year	Storm Drain to Separator	Drums to DPDO
		Enamel and Polyurethane Paints	30 gal/year	Storm Drain to Separator	Drums to DPDO
		Primers	10 gal/year	Storm Drain to Separator	Drums to DPDO
		Paint Removers	220 gal/year	Storm Drain to Separator	Drums to DPDO
Engine Repair	107	PD-680 Solvent	500 gal/year (Past) 100 gal/year (Present)	Solvent Waste Tank	
		Lubricating Oils	75 gal/year	Solvent Waste Tank	Oil Waste Tank
		Oil Penetrants	1 gal/year	Evaporation	
Fire Department	103	Foam	180 gal/year	Fire Training Exercises	
		Bromochlorodifluoromethane	1,000 lb/year (pressurized cylinders)	Fire Training Exercises	
		Potassium Fluoride Powder	350 to 700 lb/year	Fire Training Exercises	
Fuel Cell Repair	106	PD-680 Solvent	10 gal/year	Evaporation	
		Methyl Ethyl Ketone	7 gal/year	Evaporation	
		Sealants	6 lb/year	Evaporation	
		Four-Part Solvent	10 gal/year	Evaporation	

Table 4-4
(continued)

Shop Name	Building Number	Material	Waste Quantity	Waste Management Practices: Past Practices 1960 - 1970	Waste Management Practices: Present Practices 1980 to Present
Aircraft Maintenance	104	PD-680 Solvent	250 gal/year	Solvent Waste Tank	
		Detergents	3 gal/month	Drain Separator	Drain to Separator
		Grease	50 gal/year	Solvent Waste Tank	Oil Waste Tank
		Lubricating Oils	25 gal/year	Solvent Waste Tank	Oil Waste Tank
Medical Center	113	X-Ray Liquid Solution	80 gal/year	Silver Recovery	Silver Recovery to DPDO
		Solid Wastes Unknown		Dumpster	Biohazard Bags to Dumpster
Motor Pool	114	Transmission Fluids	60 gal/year	Waste Solvent Tank	Waste Oil Tank
		Lacquer	24 gal/year	Usage	
		Ethylene Glycol	110 gal/year	Usage	
		Lubricating Oils	550 gal/year	Waste Solvent Tank	Waste Oil Tank
		Sulfuric Acid	60 gal/year	55-gallon Drums for removal	Neutralization sink removal
		Thinners	100 gal/year	Waste Solvent Tank	55-gallon Drums to DPDO
		Enamels	75 gal/year	Drain to separator	55-gallon Drums to DPDO
		Grease	32 gal/year	Usage	
Nonpowered Support	106	PD-680 Solvent	60 gal/year	Waste Solvent Tank	
		Methyl Ethyl Ketone	2 gal/year	Waste Solvent Tank	
		Thinners	6 gal/year	Drain - Separator	55-gallon Drums to DPDO
		Paints	8 gal/year	Drain - Separator	55-gallon Drums to DPDO
		Lubricating Oils	8 gal/year	Waste Solvent Tank	Waste Oil Tank
Sheet Metal/Welding	106	Methyl Ethyl Ketone	1 gal/year	Evaporation	
		Resins	3 gal/year	Usage	
		Adhesives	1 gal/year	Usage	
		Zinc Chromate Primer	2 gal/year	Usage	
		Trichloroethylene (TCE)	0.5 gal/year	Evaporation	

Mid-1970's to Present

During the mid-1970's, waste oils were separated and contained in either a waste oil tank located at the Motor Pool or 55-gallong drums for removal by an off-site contractor. Waste solvents continued to be disposed of in the waste solvent tank (AGE) and removed by an off-site contractor. Oil separators continued to be used with the waste oils removed by the contractor, and the effluent from these separators was redirected from the storm sewer to the sanitary sewer during this period. Hazardous waste and waste oils are stored in an area outside the supply building in preparation for removal. The Defense Property Disposition Office (DPDO) currently is responsible for hazardous waste removal. In the past year, the hazardous waste storage area has been moved to a contained area in the Petroleum, Oil, and Lubrication Compound (POL).

4.4.2 Materials/Waste Storage

Areas on ANG base have been used in the past or are used currently for waste storage. Many of the wastes such as oils, paints, and thinners are temporarily stored in drums and pails at the points of generation. When a sufficient quantity of wastes has been accumulated, it is transferred to the designated accumulation point.

Until 1983, the accumulation point was located in front of the supply building. Wastes were stored in 55-gallon drums awaiting disposition. The present accumulation is located within the POL compound. All wastes are currently transferred to this site for transfer to DPDO or removed by contractor.

Used oil is stored in a waste oil tank located near the Motor Pool (Building 114) and waste solvent is stored in a waste solvent tank located near the AGE shop. These tanks are pumped by an off-site contractor.

4.4.3 Fuel Management

The fuel management system at the Wisconsin ANG consists of a central bulk fuel storage area. This area consists of storage tanks, fill stands, and a hydrant system installed in 1979. Prior to 1979, aircraft were refueled by tankers using fill stands. Currently, the hydrant system is primarily used for aircraft refueling. The POL facility has three main storage tanks. All three tanks currently hold JP-4 fuel. In the past, No. 2 tank has contained AVGAS. Other fuels stored on base include diesel, gasoline, and No. 2 fuel oil. Table 4-5 gives a listing of storage tanks on the ANG property and Figure 4-5 show tank locations.

The three main JP-4 storage tanks are inspected every three years and have been cleaned once. Tank sludge was shoveled into 55-gallon drums and disposed of by an off-site contractor. Final rinses from the cleaning process are drained into the dike area and then through oil separators to the drainage ditch adjacent to the POL compound. Past cleaning procedure included discharge of the final rinse from a dirt berm area into the drainage ditch through a oil/water separator.

Fuel Spills

Small fuel spills of several gallons each have occurred. The spills are primarily attributed to fuel transfer and aircraft refueling operations. These have occurred in POL compound and along the flightline. Spills occurring on paved areas were immediately cleaned up. In past years, the fire department would wash down the spilled fuel. Currently, the fire department uses an absorbent material to soak up the spill and dispose the remains in containers for normal refuse removal. Spill locations are shown in Figure 4-6.

Two large fuel spills have occurred at the ANG base. In 1979, No. 2 JP-4 storage tank leaked approximately 5,000 gallons into the diked area. This leak was due to sight gauge eruption. The spill was contained within the diked area. Booms were also placed in the drainage ditch receiving the dike are drainage. A spill associated with the hydrant system occurred in the past few years. This spill, at the No. 6 refueling pit on the flightline, was absorbed with oil absorbent and foam. The residual absorbent was spread out on base property and allowed to dry. This absorbent is still present on ANG property.

Table 4-5

Storage Tanks

Wisconsin Air National Guard

Map No.	Location	Fuel Type	Capacity (gal)	Above Ground or Below Ground	Containment/Protection
1	P.O.L. Compound	No. 1 JP-4	50,000	Above	Post - earth dike/ Present (1982) - concrete berm
2	P.O.L. Compound	No. 2 JP-4 (AVGAS)	100,000	Above	Post - earth dike/ Present (1979) - concrete berm
3	P.O.L. Compound	No. 3 JP-4	150,000	Above	Present (1982) - concrete berm
4	Motor Pool	Diesel	5,000	Below	Fiberglass Tanks
5	Motor Pool	Gasoline	5,000	Below	Fiberglass Tanks
6	Motor Pool	Gasoline	5,000	Below	Fiberglass Tanks
7	Motor Pool	MOGAS (Past)	10,000	Below	Steel Tank - Removed in 1983
8	Jet Engine Test Stand	JP-4	1,500	Above	Concrete Dike
9	Aircraft Wash Rack	Detergent	500	Below	Not in Use
10	P.O.L. Compound Building 115	De-Icer	1,500 (4 Tanks)	Above	Drains to Separator
11	Power Plant	No. 2 Fuel Oil	15,000	Below	Emergency Use Only
12	Maintenance Hangar	PD-680 Solvent	?	Above	None

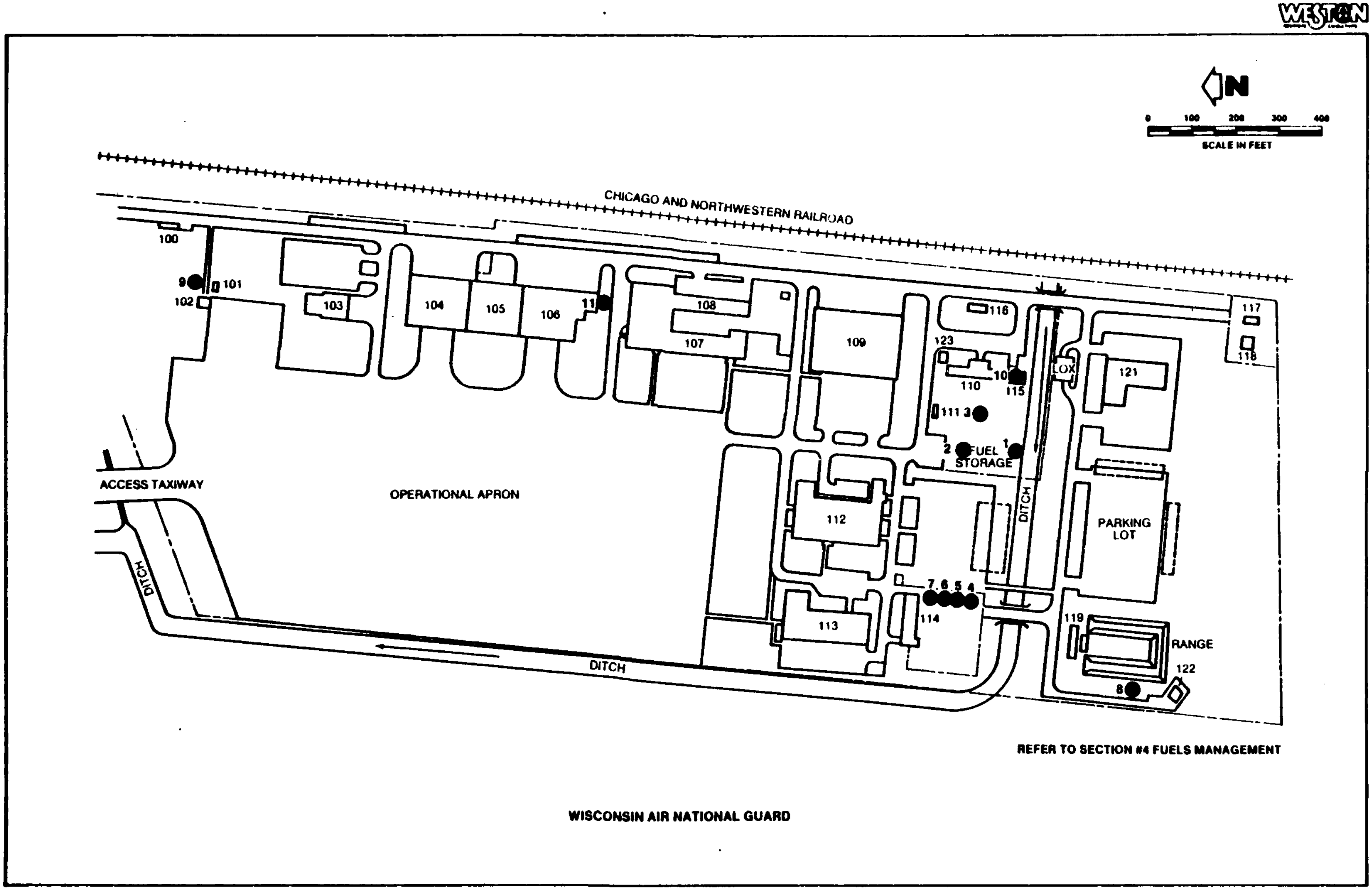

FIGURE 4.5 WISCONSIN ANG STORAGE TANK LOCATIONS

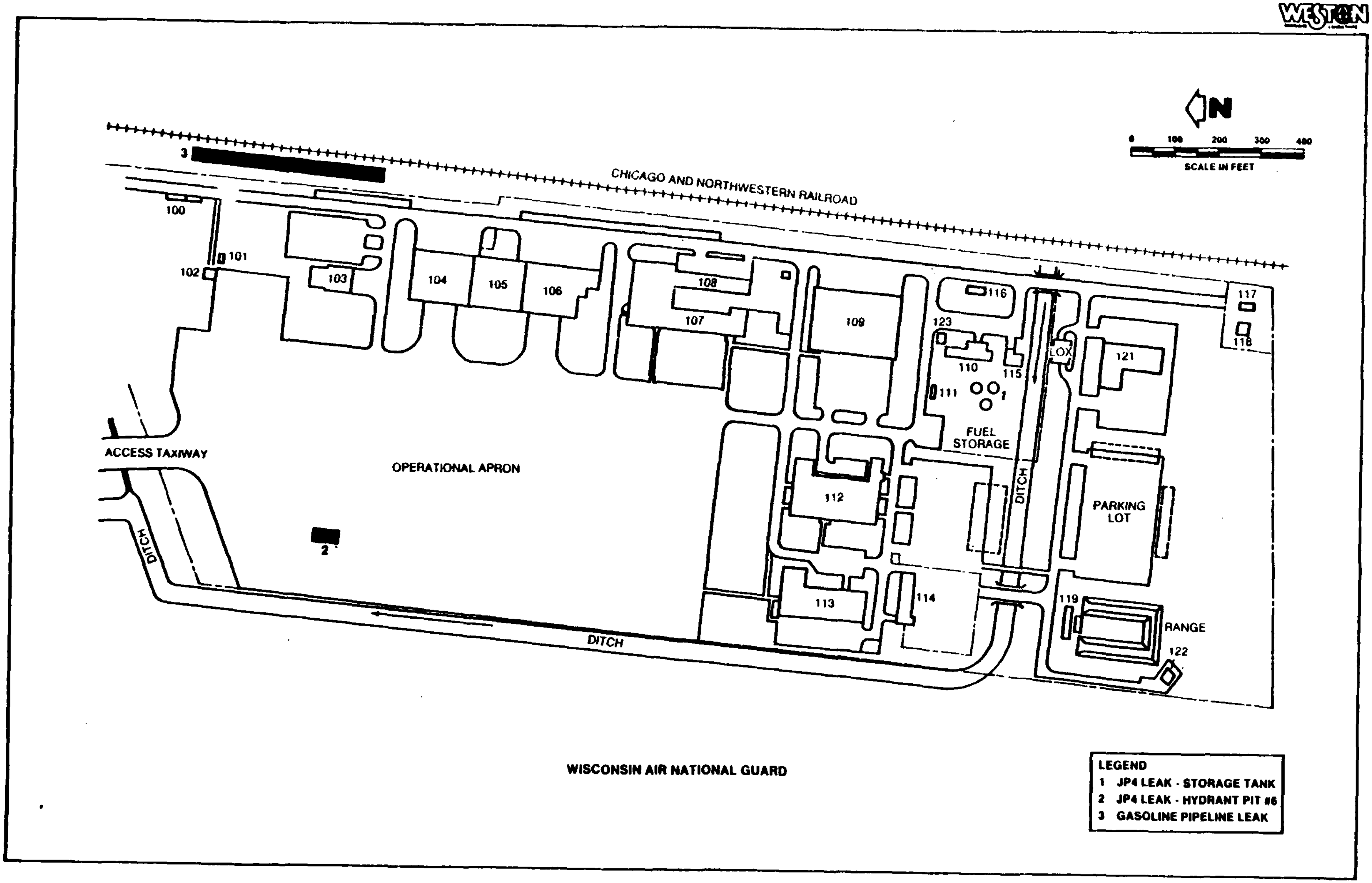

FIGURE 4.6 FUEL SPILL LOCATIONS

On 22 August 1968, a large gasoline pipeline leak occurred on the eastern boundary of the ANG property. The pipeline owner was the West Shore Pipeline Company; the pipeline had been installed on the property prior to the lease and occupation of ANG. ANG continued to honor the pre-existing right-of-way. Estimates of the quantity of gasoline lost ranged from 100,000 to 600,000 gallons. Estimated quantity of gasoline that infiltrated into the ground ranged from 86,000 to 400,000 gallons. Following the spill, 17 test holes were dug in the area; a test hole west of the ANG administration building contained 8-1/2 inches of gasoline above the water table, an additional hole located 150 feet north (downgradient) of the previously mentioned test hole showed 1/4-inch of product. There are no other available data regarding distribution of the gasoline in the subsurface. Correspondence at the time regarding the incident indicates that it was not considered possible to remove all the gasoline from the subsurface.

It must be emphasized that although the leak occurred on ANG leased property, ANG was not responsible for the leak and neither owned nor operated the pipeline. The pipeline crossed the ANG property on a pre-existing right-of-way.

It is reasonable to assume that the residual gasoline that entered the ground at the time of the spill remains in the ground at the present time.

4.4.4 Other Activity Areas

The ANG has several operational areas that should be noted. The jet engine test stand, located in the southwest corner of the ANG property has been in use since 1977. This stand is used 6 or 7 times a year for engine testing. A 1,500-gallon fuel tank is present with hose hook-up for engine runs.

In past years, an aircraft wash area was used at the north end of the flight apron. This area included a drainage system through an oil separator with a waste oil tank and a detergent storage tank. The detergent was mixed with solvent to clean aircrafts through a hydrant system located on the wash area. Due to washing logistic problems, this area was not often used and has now been disconnected from any further use since approximately 1964.

4.5 EVALUATION OF PAST ACTIVITIES

Review of past operations and waste management practices at the USAF Reserve and Wisconsin ANG bases at the General Billy Mitchell Field has resulted in the identification of 8 sites of environmental concern. The site where the 1968 gasoline spill occurred at the ANG facility was not considered as part of the Installation Restoration Program since the spill occurred from a commercial interstate pipeline that was unrelated to Guard operations and activities. All other sites were evaluated according to the flow chart shown in Figure 1-1. Based on that evaluation, sites determined to have no potential for contamination were removed from further consideration. Table 4-6 summarizes the results of applying the flow chart for the U.S. Air Force Reserve sites and Figure 4-7 shows site locations. Storage area No. 3 was determined to have no potential for contamination because the storage area was on a portion of the apron that is underlain by concrete with a raised curb at the edge. The concrete pad and curb were considered to have been sufficient containment to prevent migration of spills into the environment.

Table 4-7 presents the results of applying the flow chart for the Wisconsin ANG facility, and Figure 4-8 shows site locations. The jet engine test stand was considered to be well contained and, therefore, does not have the potential for contamination. Dripping from the solvent storage tank was considered to have no potential for migration because of the small amount of dripping and the volatile nature of the solvent. It is however, recommended that the tank be placed on an impermeable base with provision for collecting dripped solvent.

4.6 SITES RATED BY HARM

The past storage area at the Wisconsin ANG base was considered to have little or no potential for contamination and contaminant migration. Drums were stored on pavement which would prevent infiltration of drips and minor spills into the ground. Disposal Area No. 1 was also considered to have little or no potential for contamination because of the small quantity and the volatile nature of the waste. The site is located in the back of the open area between the Civil Engineering area and the base boundary. Site use was reported limited to a single occurance in 1979. During the fuel spill from Hydrant No. 6, absorbant material was used for product collection. The absorbant material was taken to Disposal Area No. 1. It has been reported that the material was allowed to dry on the aircraft apron prior to removal.

Table 4-6

Summary of Flow Chart for Areas of
Initial Environmental Concern

Air Force Reserve Facility

Site Description	Potential for Contamin-ation	Potential for Contaminant Migration	Potential for Other Environmental Concern	HARM Scores
Storage Area 1	Yes	Yes	No	Yes
Storage Area 2	Yes	Yes	Yes	Yes
Storage Area 3	No	No	No	No
Fire Protection Training Area	Yes	Yes	No	Yes
P.O.L. Area	Yes	Yes	No	Yes

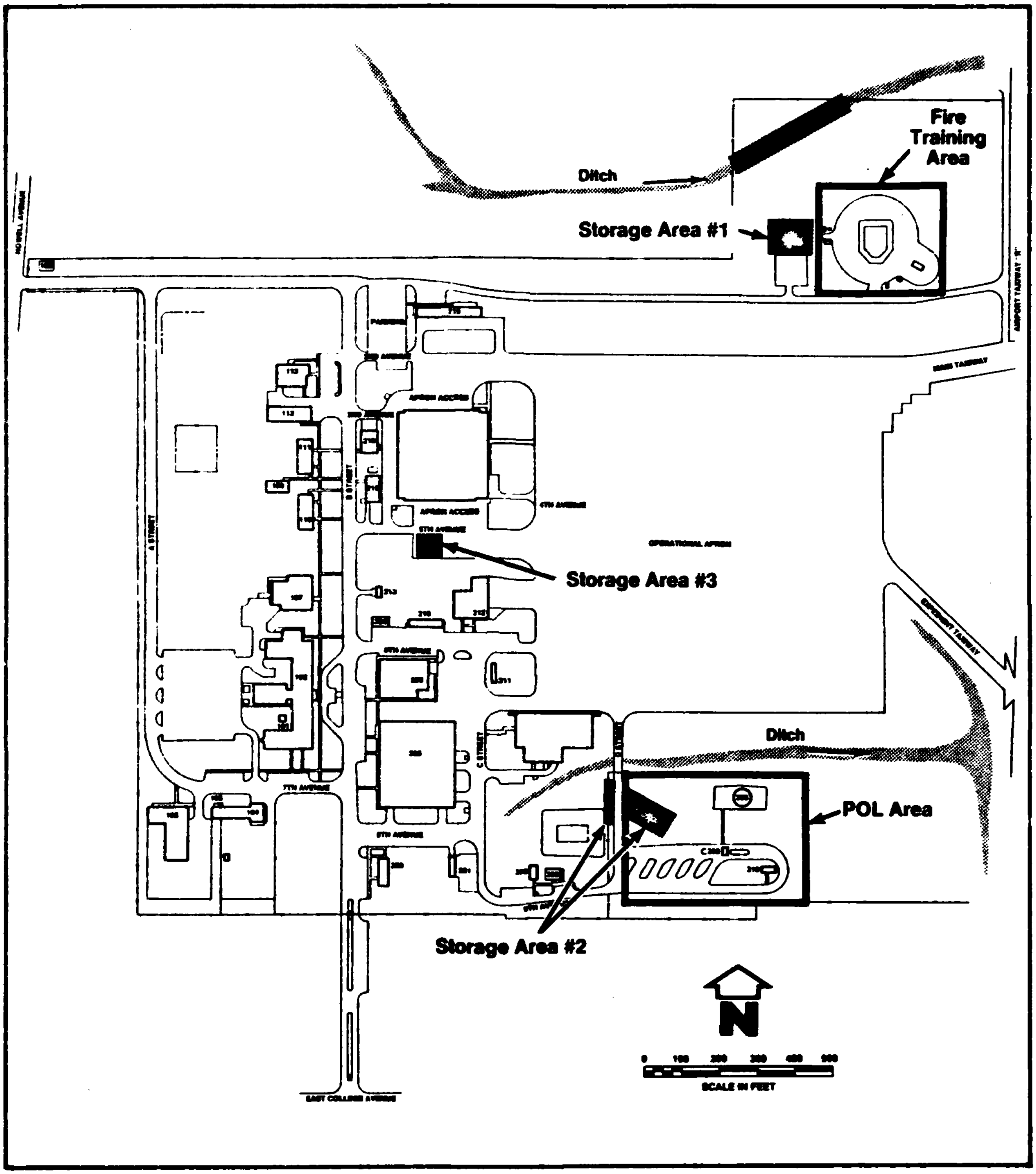

FIGURE 4.7 AREAS OF INITIAL ENVIRONMENTAL CONCERN (440TH TAW)

Table 4-7

Summary of Flow Chart for Areas of Initial Environmental Concern

Wisconsin Air National Guard

Site Description	Potential for Contamin-ation	Potential for Contaminant Migration	Potential for Other Environmental Concern	HARM Scores
Past Storage Area	No	No	No	No
Solvent Storage Tank	Yes	No	Yes	No
Disposal Area 1	No	No	No	No

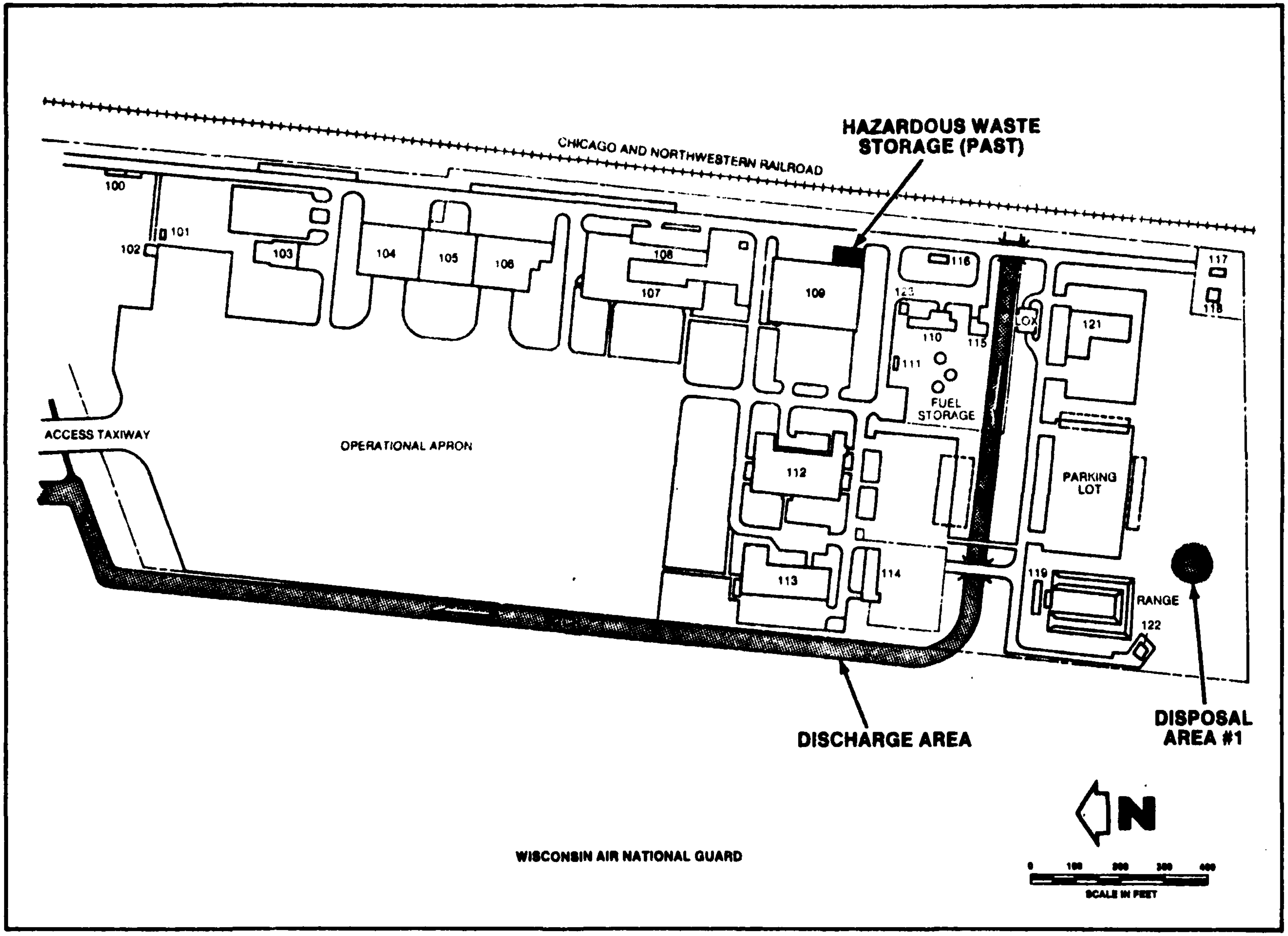

FIGURE 4.8 AREAS OF INITIAL ENVIRONMENTAL CONCERN - ANG

The Wisconsin ANG base drains to a drainage ditch that enters the site from the City of Cudahy at First Street between Civil Engineering and POL areas. The ditch exits the base at the end of the aircraft apron. Based on review of records and interviews with base personnel, there is evidence to indicate that there is the potential for small amounts of contaminants to have entered the ditch. The potential sources include:

- o Small fuel spills (less than 10 gallons each) on the aircraft apron that were washed into the storm system.
- o Discharge of solvent (PD-680) in small spills on the flight line.
- o Reported periodic discharge of methyl ethyl ketone (MEK) to the storm system prior to 1970.

The receptor of concern for the contaminants is the sediment in the bottom of the ditch. The ditch has been periodically cleaned of vegetation and debris; it has been reported that no unusual odors or staining were noted during the clean-out activities. Because the quantity of waste discharged has been small the ditch is maintained and there is no visible evidence of contamination, this site is not considered to be a threat to health or the environment.

In total, four sites (at the U.S. Air Force Reserve base) were determined to have a potential for environmental contamination and migration and were, therefore, evaluated using the Hazard Assessment Rating Methodology (HARM). The HARM process considers the potential contaminant receptors, waste characteristics, migration pathways, and waste management practices in use at the site. The details of the rating system are presented in Appendix D; rating sheets for specific sites are presented in Appendix E. The HARM system is designed to indicate the relative need for follow-on action and the resulting ratings are intended for assigning priorities for further investigation in order to more fully evaluate the sites identified. Table 4-8 is a summary of the HARM scores for the sites at the U.S. Air Force Reserve base.

Table 4-8

Summary of HARM Scores

Rank	Site	Receptor Subscore	Waste Characteristics Subscore	Pathways Subscore	Waste Management Factor	Score
Air Force Reserve Sites						
1	P.O.L. Area	70	64	80	1.0	71
2	Fire Protection Training Area	72	72	59	1.0	68
3	Storage Area 1	72	54	59	0.95	59
4	Storage Area 2	64	60	80	0.95	65

4.6.1 POL Area

Based on the examination of records and interviews with Reserve personnel, there is sufficient evidence that the POL area has a potential for environmental contamination. As described in Subsection 4.3.2, only one large spill has been reported in the POL area. The fuel spilled was AVGAS and the quantity estimated by the base personnel is approximately 1,000 gallons. Because the leak was underground, it is not known how long it existed prior to its discovery. There is no evidence that any subsurface clean-up activities were initiated besides the fact that the leak was repaired. Interviews with base personnel reported that during excavation in the POL area, visual evidence of fuel and fuel odors have been observed in the subsurface.

There are two additional sources of contamination in the POL area: drips and minor spills from the filling stand and discharges from the tank cleaning operations as described in Subsection 4.3.1. Both of these sources have resulted in unknown quanties of discharge. A quantity can however be assumed for the tank cleaning operations. The tank cleaning has occurred approximately every six years. Tank draining was into containers and sludge removal was accomplished by the cleaning contractor. The tank rinse was allowed to collect in the bermed tank area and released to the southern drainage area through an outlet in the berm. The residual fuel was either discharged with the rinse water or infiltrated into the unlined base of the tank area. Assuming that 10 gallons of fuel was contained in the rinse water, the total quantity of fuel that entered the environment is estimated at 30 gallons.

Soil borings that have been completed in the POL area and vicinity shows that they are underlain primarily by clay and clayey silt. These materials would be low permeability soils and, therefore, somewhat restrict vertical migration of contaminants. Depth to groundwater in the area is apparently greater than 10 feet, but less than 50 feet. This site received a HARM score of 71.

4.6.2 Fire Protection Training Area

Based on the examination of records and interviews with base personnel, there is sufficient evidence that the fire protection training area has the potential for environmental contamination.

The area of concern is located at the present fire training area, however, the activities of concern are associated with past operations prior to upgrading the fire training area to an engineered and contained facility (Figure 4-1 shows the old fire training area). During the 1960's and 1970's, the primary area for hazardous waste storage on the base was adjacent to the fire training pit. Each time a training session occurred, flammable liquids from the storage area were poured onto the training area and ignited. Reports vary as to whether the area was flooded with water first. The training area was reported to have had a clay base, however, the utility of such a base as a liner would have been seriously compromised by the heat and the solvents used in the fire training area both of which can result in cracking of the clay liner. It has also been reported that saturated absorbant material and solvent soaked rags burned in the fire training area.

The potentially affected media are local soil, groundwater, and water and sediment in the northern drainage area. Examination of construction plans for the new fire training facility indicate that little soil was removed from the area for construction. Based on drawings and interviews, most of the preconstruction grading consisted of filling the peripheral area. It should be be noted that some of the fill used was sediment from the drainage ditch that may have been contaminated by runoff from the site, Storage Area No. 1 and the aircraft apron. Natural soils underlying the area are primarily clay and silt with low permeability.

The liquids used in the fire training area include contaminated fuel, waste oils, solvents, and paint thinners. The quantity can be estimated but the proportion of the various liquids is unknown. Assuming that training sessions were conducted 10 times per year, 1,000 gallons of liquid used each time, and 80 percent of the liquid was consumed in the fire, approximately 40,000 gallons of liquid could have been released to the environment. This site received a HARM score of 68.

4.6.3 Storage Area No. 1

Interviews with base personnel have provided sufficient evidence to determine that this storage area (located west of the fire training area and behind the present fenced area) has the potential for affecting the environment. During the 1960's and 1970's, this area was used as the central storage for waste. Liquid wastes were brought to this area and poured into 55-gallon drums. As described in Subsection 4.2.5, final disposal was accomplished by burning the liquid in the fire training pit or by a contractor who pumped out the drums. The potential source of contamination is the result of drum spillage, overfilling, and leaky drums and their quantities can only be approximated. Assuming a combined loss of all liquids of 100 to 200 gallons per year, the quantity discharged to the environment would be 2,200 to 4,400 gallons. Waste oil, contaminated fuel, hydraulic fluid, paint thinners, and solvents were stored in this area.

Potential receptors for contaminant migration from this area are the northern drainage ditch (receptor for contaminated runoff and groundwater. According to soil borings from the area, the site underlain by clay and silt with limited permeability.

This site received a HARM score of 59.

4.6.4 Storage Area No. 2

Based on site inspection and personnel interviews, there is sufficient evidence to indicate the potential for environmental contamination.

This site includes two waste storage areas located on either side of "D" Street at the western end of the POL area. The old site is on the western side of "D" Street and the more recent site is on the eastern side. Both sites have been used for storage as described in Subsection 4.2.5. The sources of potential contamination include drips, drum spills and leakage. The primary receptors for contamination would be soil and groundwater. At both parts of the site there is visible staining on the surface of the soil. It should be noted that drums are stored on a concrete pad. It is not known how much liquid has has been discharged via spillage, but it is assumed to be much smaller than the quantity stored in area No. 1 because term usage is shorter and there was greater care taken in maintaining the area.

Soils in the area are clay and silt with a low prmeability inhibiting vertical migration of contaminants. This site received a HARM score of 58.

SECTION 5

CONCLUSIONS

5.1 INTRODUCTION

The objective of this Installation Restoration Program (IRP) Phase I study is to identify sites which have the potential for environmental contamination resulting from past disposal practices and to determine the potential for contaminant migration from these sites. The conclusions presented in this section are based on review of records and files; interviews with retired/present employees; interviews with Federal, state, and local agency personnel; field inspections of each base; and consideration of the environmental setting of each site. Table 5-1 presents a list of the potential contamination sources identified at the USAF Reserve base. Site locations are shown in Figure 5-1. Descriptions of each site are presented in the following sections. Recommendations for follow-on investigations are presented in Section 6.

5.2 U.S. AIR FORCE RESERVE

5.2.1 POL Area

Based on the examination and review of records and interviews with Reserve personnel, there is sufficient evidence that the POL area has a potential for environmental contamination and that further investigation is warranted to determine if contamination has, in fact, occurred.

The potential contaminant used for calculation of the HARM score was 1,100 gallons of fuel. The critical element in the HARM calculation was the fact that the appearance and odor of fuel have been seen in excavation within the POL area. The score was also affected by the presence of the water supply well on the WiANG property and the Michael F. Cudahy Nature Preserve south of the base.

The contaminant pathways of concern are groundwater and surface water via groundwater discharge.

The HARM score calculated for the POL area is 71.

Table 5-1

Sites Evaluated Using the Hazard Assessment
Rating Methodology

U.S. Air Force Reserve

Rank	Site	Operating Period	Final HARM Score
1	POL Area	1950's to Present	71
2	Fire Training Area	1950's to 1981	68
3	Storage Area No. 1	1950's to Late 1970's	59
4	Storage Area No. 2	Late 1970's to Present (Limited use since 1970)	58

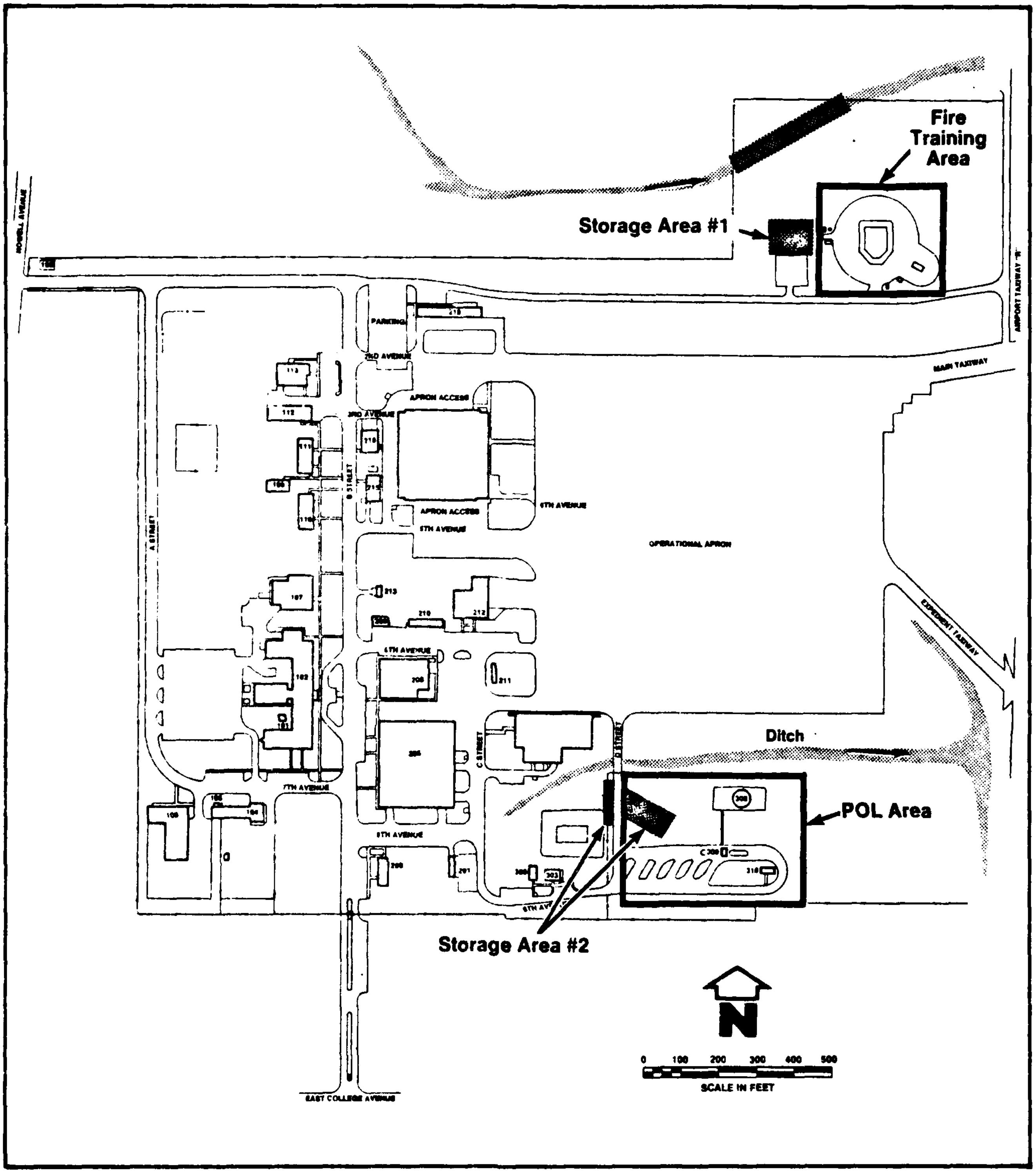

**FIGURE 5.1 SITES SUBJECTED TO HARM RATING
U.S. AIR FORCE RESERVE**

5.2.2 Fire Protection Training Area

Based on the examination and review of records and interviews with Reserve personnel, there is sufficient evidence that the fire protection training (FPTA) area has the potential for environmental contamination and additional investigation is warranted. In calculation of the HARM score for this site it was assumed that up to 40,000 gallons of liquid may have been released to the environment; it was further assumed that this liquid consisted primarily of the petroleum based solvents and fuel. The critical elements in calculation of the HARM score were waste characteristics and receptors, particularly the water supply well north of the site. The well is pumping from the bedrock aquifer and is cased through the shallow aquifer and may, therefore, be somewhat protected from contamination in the shallow water table aquifer, which would be the immediate receptor for contamination.

Also of concern as a contaminant receptor is the drainage ditch north of the FPTA and south of the well. This drainage ditch is the discharge area from the FPTA and may also receive groundwater discharge from the site. There are nonmilitary potential contaminant sources that may discharge to the same ditch upgradient of the Reserve discharges. These upgradient potential sources include an automobile rental agency with maintenance facilities. Contaminants from this potential source would be similar to those that may have resulted from Reserve activities.

In addition, both the rental car agency and the Reserve have reportedly used the bank of the ditch for fill areas. The Reserve placed some rubble on the southern bank of the ditch in order to stabilize the bank. This activity took place primarily outside (west) of that portion of the ditch that is on Reserve property. The rental car agency has also been reported to have filled in the southern bank, but the nature of the material used is unknown. Because of the potential for contamination discharging to the ditch upgradient of the Reserve, the selection of upgradient (background) sampling location is, as described in Section 6, critical.

The FPTA received a HARM score of 68.

5.2.3 Storage Area No. 1

Based on interviews with base personnel there is sufficient evidence of the potential for contamination to warrant a follow-on investigation to determine if this site is a contaminant source. The site is located adjacent to the old FPTA and, therefore, has the potential to impact the same receptors.

In calculating the HARM score for this site the waste used was petroleum based solvent. The waste quantity was determined on the basis of 10 percent spillage from the drums stored on-site.

The HARM score for Storage Area No. 1 is 59.

5.2.4 Storage Area No. 2

This site has been identified as warranting follow-on investigation based on site inspection and personnel interviews. The HARM score calculation was based on 10 percent spillage from the drums. The relatively high HARM score results from the receptors category and surface water migration. The surface water migration calculation does not take into account the relatively flat topography of the site area, which would mitigate migration of contaminants via runoff. The quantity of waste that may have been spilled at the site and the immediate site environment leads us to believe? that the HARM score appears to be out of proportion when compared to the other sites on the Reserve base.

This site received a HARM score of 58.

SECTION 6

RECOMMENDATIONS

6.1 INTRODUCTION

Four sites have been identified at General Billy Mitchell Field as having the potential for environmental contamination and warranting follow-on actions or investigations. The four sites are at the U.S. Air Force Reserve Base. It is recommended that these sites be noted on the base Comprehensive Plan and that their presence be considered before planning any activity at these sites.

The investigations have been designed to determine if contamination does exist and to further assess the potential for environmental contamination at each of the identified sites. The recommended actions are generally a one time sampling program using indicator parameters for the detection of suspected contaminants. Should contamination be identified at a particular site, the sampling program may need to be expanded to further define the extent of contamination. Table 6-1 summarizes the actions recommended for sites on the USAF Reserve Base.

Based on the available data, it is not possible to accurately determine local groundwater flow directions. Regional groundwater flow is toward Lake Michigan and the groundwater gradient in the water table aquifer is relatively flat.

It is recommended that prior to installation of groundwater monitoring wells, geophysical surveys be conducted at certain sites in order to delineate leachate plumes migrating from the site. The recommended geophysical techniques are electrical resistivity and/or electromagnetic conductivity. The results of these surveys should be used to finalize the selection of monitoring well locations. During well drilling, it is recommended that the cuttings/samples should be examined with an organic vapor analyzer or similar instrument to provide further data on presence or absence of contamination. In addition, appropriate safety precautions should be taken during drilling and sampling. The minimum well requirements are presented in Table 6-2. The analysis parameters for soil sampling are shown in Table 6-3 and analysis parameters for groundwater samples are shown in Table 6-4.

WESTON

Table 6-1

Summary of Recommendations
U.S. Air Force Reserve

Rank	Site Name	HARM Score	Recommended Monitoring	Analysis List	Comments
1	P.O.L. Area	71	Sample five soil borings, install and sample one upgradient well and two downgradient wells. Three samples of sediment from the drainage ditch.	Soil - Table 6-3 Wells - Table 6-4 Sediment - Table 6-3	If oil is found on the water table, additional wells may be needed to determine extent.
2	Fire Training Area	68	Install and sample one upgradient well and two downgradient wells. Sediment sampling in the drainage ditch at two upgradient and two downgradient locations.	Wells - Table 6-4 Sediment - Table 6-3	Upgradient well location will also be used for Storage Area 1. Expand monitoring downgradient if analysis indicates contamination contributed by Air Force Reserve.
3	Hazardous Waste Storage Area 1	59	Sample three soil borings; sample upgradient well; install and sample two downgradient wells.	Soil - Table 6-3 Wells - Table 6-4	
4	Storage Area 2	58	Sample eight soil borings.	Soil - Table 6-3	If contamination of soil is shown, groundwater monitoring may be required.

Table 6-2

Recommended Minimum Well Construction Requirements

Item	Description
Casing	PVC with nonglue fittings.
Minimum Casing Diameter	Four inches.
Screen	PVC wound with nonglue connectors and bottom cap.
Top of Screen	5 feet above the water table.
Gravel Pack	2 feet above top of the screen.
Bentonite Seal	A 2-foot bentonite seal should be placed above the gravel pack.
Grout	Six to one bentonite/cement mix to 2 feet below surface. Grout emplaced with a grout pipe. Grout pumped through pipe to the bottom of the open annulus (above the seal).
Protective Cover	5-foot length of black iron pipe extending 3 feet above the ground surface and set in cement grout. Pipe diameter must be at least 2 inches greater than casing diameter.
Cap	A secure locking cap should be provided.
Survey	Locations and elevations of all wells should be surveyed.

Table 6-3

Recommended Analysis for Soil and Sediment Samples

Oil and Grease
Volatile Organic Constituents (VOC)
Total Organic Halogens (TOH)
Lead

Table 6-4

Recommended Analysis for Groundwater Samples

pH
Specific Conductivity
Oil and Grease
Volatile Organic Constituents (VOC)
Total Organic Halogens (TOH)

6.2 RECOMMENDED INVESTIGATIONS

6.2.1 POL Area

This area has the potential for soil and groundwater contamination and an additional investigation in the form of soil and groundwater sampling is recommended. The predominant contaminant concern is JP-4, although AVGAS is also of concern. In order to determine if fuels are present in the subsurface soil, it is recommended that five soil borings be completed to the top of the water table. Borings should be accomplished using continous split spoon sampling. Each sample shall be examined to determine if there is visual evidence of contamination; it is assumed that five spoon samples shall be collected from each boring. Each sample shall be analyzed for the parameters listed on Table 6-4. Recommended locations for the borings are three locations between the bermed tank area and Building No. 309 and two borings south of Building No. 309.

It is further recommended that three groundwater monitoring wells be installed to determine if groundwater is being affected. Groundwater samples shall be analyzed for those parameters indicated on Table 6-5. Each well shall be constructed so that, at a minimum, the upper 10 feet of the aquifer is screened. The suggested location of the upgradient well is the southern boundary of the Reserve property at the end of "D" Street. This location could also serve as a background well for hazardous waste storage area No. 2 if groundwater monitoring becomes necessary in this area. Downgradient well locations are recommended between the tank berm area and the fill stands; two of the soil borings could be used as well locations.

In order to determine if contamination has reached the drainage ditch, three sediment samples are recommended for analysis for parameters on Table 6-3. One sediment sample should be upgradient, one sample upgradient of the discharge through the tank berm, and the third sample downgradient of the discharge.

6.2.2 Fire Training Area

The old fire training area (located at the site of the present training area) has the potential for causing release of contaminants into the environment and further investigation is recommended. Because the area has been regraded and filled soil sampling is not recommended as being useful at this site.

Installation of three groundwater monitoring wells is recommended. One well shall be at an upgradient location, south of the training area, and north of the main taxiway. Two downgradient locations are recommended between the training area and the drainage ditch. The wells shall be installed to screen the entire upper aquifer to allow for vertical sampling to determine vertical distribution of contaminants in the aquifer. The recommended analysis parameters are shown on Table 6-4.

Additional sampling is recommended for the sediment in the drainage ditch north of the FPTA. Because there are potential contaminant sources upgradient of the Reserve, sediment samples from at least two upgradient discharges are recommended: one above the rental car location and the other immediately below the rental car location. Three downgradient locations are also recommended: immediately north of Building No. 219, at the western boundary of the base, and at the northeastern boundary of the base. The parameters for analysis of these samples are shown in Table 6-3. It is recommended that three samples be collected across the ditch at each location, and that these three samples be composited to obtain a sample representative of the cross-section of the ditch. The samples should be collected from a depth of 18 inches since the sediments of concerns are those that have been deposited from the 1950's to the late 1970's.

It must be emphasized that there is a probability that there is an upgradient contamination source. Analysis of sampling results should focus on increments of contamination above contaminant levels found in the background samples.

6.2.3 Storage Area No. 1

This site has the potential for being a source of environmental contamination and is recommended for additional investigation to determine if contamination exists. The recommended investigation includes completion of three soil borings and three monitoring wells. The soil borings shall be completed and sampled as described in Subsection 6.2.1. The boring locations should be north of the fenced area, but within 100 feet of the fence; analysis parameters are shown on Table 6-3.

The upgradient monitor well can be the same upgradient well described in Subsection 6.2.2 for the fire training area. The two downgradient locations are approximately 100 feet north of the fence. These locations are recommended to avoid drilling through potentially contaminated soil and transferring contaminant to groundwater; however, it is recommended that the wells be located close to the potential contaminant source in order to assist in differentiating between the storage area and the fire training area as the source.

6.2.4 Storage Area No. 2

The site has been determined to be a potential contaminant source. The recommended follow-on investigation to determine if contamination exists is the completion and sampling of eight soil borings. Each boring shall be completed to the water table and continuously sampled with a split spoon; five samples are assumed for each boring. Analysis parameters are shown on Table 6-3. Four borings shall be completed on each side of "D" Street in the storage area. Should soil contamination be identified, it may be necessary to install and sample groundwater monitoring wells to determine if contamination has migrated to the water table.

APPENDIX A

RESUMES OF WESTON TEAM MEMBERS

5178A

Katherine A. Sheedy

Fields of Competence

Geologic investigation and site evaluation; environmental impact assessment, quantitative and qualitative groundwater analysis, design of groundwater monitoring systems.

Experience Summary

Nine years experience in geological investigations including environmental impact analysis in geology, groundwater, and soils; hydrogeologic investigations of hazardous waste sites, preparation and delivery of expert testimony; assessment and mitigation of low-level radioactive contamination of groundwater and soils; migration of low-level radioactive contamination of groundwater and soils; migration of radionuclides in groundwater; site stability in limestone terrains; development of evaluation criteria for site search and selection projects; pre-mine opening hydrologic investigations for surface and underground coal mines; development of clean-up strategies for hazardous and radioactive waste disposal sites; Environmental Impact Statement preparation and review; site suitability investigations of waste disposal facilities for industrial and residential developments.

Credentials

B.A.—Queens College, CUNY (1969)

M.S., Geology—University of Delaware (1975)

American Geophysical Union

Geological Society of America

National Water Well Association, Technical Division

Employment History

1974-Present	WESTON
1972-1974	University of Delaware

Key Projects

Preparation of RCRA Part B permit application for facilities in the Midwest and on the West coast.

Initial Assessment Studies to identify possible contamination resulting from past practices at military installations.

Assessment of groundwater contamination from a municipal landfill in the Atlantic Coastal Plain including aquifer simulation to determine migration 10, 20 and 30 years in the future.

Hydrogeologic assessment of a multi-source military installation. The project includes groundwater modeling for the installation and for areas outside the installation in conjunction with State and Federal agencies.

Design of monitoring systems for a large industrial complex in Montana.

Assessment of regulatory requirements for hazardous waste lagoon closure in over forty states.

Assessment and analysis of emerging trends in groundwater research as applied to the utility industry.

Preparation of EPA Remedial Action Master Plans for five uncontrolled hazardous waste sites.

Principal investigator for geology, soils and groundwater portion of an Environmental Impact Statement for the decontamination of a radioactive waste disposal site in Canonsburg, Pennsylvania.

Project manager and principal investigator on clean-up of a site contaminated by pharmaceutical wastes in New Jersey.

Project manager and principal investigator for assistance in EIS preparation for five synthetic fuel plants in east-central United States.

Evaluation of environmental impact and operation of 23 municipal landfills in the Atlantic Coastal Plain.

Hydrogeologic investigations at mine sites prior to, during and after mining operations in Illinois.

Hydrogeologic investigations to determine site suitability for landfills, sewage sludge disposal, spray irrigation and industrial waste disposal.

Principal investigator on a dredge material disposal site feasibility study for Interstate Division for Baltimore City. This project was conducted to evaluate the feasibility of specific sites for disposal of 5 million cubic yards of

Professional Profile

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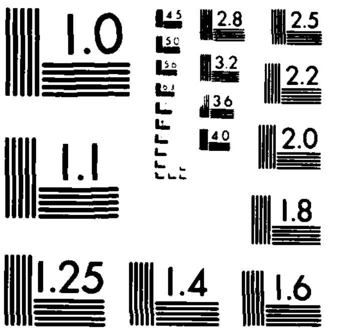

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

material dredged from the Fort McHenry Tunnel in Baltimore. The evaluation included examination of costs, engineering feasibility, site stability, impact on biology and groundwater and ultimate use of the site as an inner-city park.

Supervision of an investigation to determine groundwater quality, delineate the extent of groundwater pollution and develop a groundwater-quality management program for a six-county area. Evaluated the adequacy of existing groundwater-quality standards and interacted with regulatory agencies.

Evaluation of groundwater quality, quantity and facilities; impact on groundwater for sites in semi-arctic environments and within the Columbia River Basin Project area.

Environmental assessment for a 200,000-BPCD refinery on a semi-arid island with extensive groundwater use in the West Indies.

Evaluation of structural stability problems in limestone solution area in Pennsylvania.

Supervision of a leachate collection system and groundwater monitoring program for an industrial landfill.

Investigation of potential sources of petroleum product found to be discharging through the subsurface, at the sho' of Lake Erie.

Development of a state-of-the-art study and environmental analysis of the geothermal steam industry.

Publications

Sheedy, K. A., 1979, "Three-Phase Approach to Determination of Site Stability in Limestone". Presented at Association of Engineering Geologists 1979 Annual Meeting, Chicago, Illinois.

Sheedy, K. A., Schoenberger, R. J., Haderer, P., Dovey, R., 1979, "Solid Waste Disposal in the Coastal Plain: A Case Study." Presented at Association of Engineering Geologists 1979 Annual Meeting, Chicago, Illinois.

Sheedy, K. A., Leis, W., Thomas, A., 1980, "Land Use in Limestone Terrain, Problems and Case Study Solutions". In *Applied Geomorphology*, (The "Binghamton" symposia; 11) George Allen and Unwin, 1982.

Sheedy, K. A., Leis, W. Bopp, F., Anderson, J., "Use of Ground Penetrating Radar in Limestone Terrain". American Geographers Association, 1981.

Sheedy, K. A., "Methodology for the Selection of Low-Level Radioactive Waste Disposal Sites". American Nuclear Society, 1982.

Michael F. Coia

Fields of Competence

Solid and hazardous waste management: hazardous waste site remedial actions; radioactive waste management; site characterization, field investigations, and environmental sampling of groundwater, soil, and surface water media; solid waste collection, storage and disposal, and resource recovery unit operations.

Experience Summary

Three years of civil and environmental engineering experience in the fields of hazardous and solid waste management including: industrial and hazardous waste treatment, storage and disposal technologies; hazardous waste site remedial action alternatives; the engineering responses of clay soils to the presence of hazardous waste chemicals; modelling and evaluation of complex cover systems for application at hazardous waste disposal facilities; radioactive waste disposal strategies; resource recovery and refuse to energy technologies.

Credentials

B.S., Civil Engineering—Duke University (1980), Cum Laude

M.S., Environmental Engineering—Duke University (1981)

Chi Epsilon

Employment History

1981-Present	WESTON
1980-1981	Duke University

Key Projects

Served as Project Engineer for the following WESTON hazardous and solid waste management projects:

Development of a remedial action clean-up program under "Superfund" for Bruin Lagoon, a 3-acre acidic oil sludge lagoon located in western Pennsylvania. Prepared the design of a complex cover system, groundwater controls, and sludge dewatering/stabilization methodology for an in-situ closure alternative. Development of bench-scale testing and field pilot study protocols for the in-situ stabilization of the oily sludge waste at Bruin Lagoon. Prepared contractor bid specifications.

Evaluation of clean-up scenarios at an existing industrial complex of over 2,000 acres in California contaminating the soil and groundwater quality through storage, spillage, and deep-well injection of organic and halogenated compounds.

Development of regulatory and technology guidelines for the closure of inactive explosive waste lagoons at over 40 U.S. Army installations. Analyzed the waste lagoon characteristics and installation area characteristics and installation area characteristics, as well as the Federal and state regulatory requirements for closure of inactive land disposal facilities. Evaluated in-place closure technologies for application with groundwater isolation and pumping, surface soil capping, and explosive waste desensitization.

Assessment of available hazardous waste management technologies for implementation on a provincewide scale for Ontario, Canada. Analyzed appropriate chemical and physical treatment strategies, incineration technologies, fixation/stabilization approaches, and ultimate disposal alternatives for application to Ontario's industrial waste streams.

Evaluation of potential remedial action clean-up strategies under Superfund for Matthews Electroplating, a site where soil and groundwater contamination resulted from chromium plating operations. Conducted the site characterization field work, environmental sampling, and geologic soils investigations. Prepared the engineering feasibility study for the selected remedial action alternative.

Evaluation of a municipally-operated refuse-to-energy resource recovery system for Salem County, New Jersey. Prepared the system design based on Countywide waste stream characterization, identification of potential energy markets, evaluation of incineration technologies, and cost-effective analysis.

Professional Profile

Development of a remedial action cleanup program at a major industrial site on Lake Michigan where massive PCB spills and discharges have contaminated soil and surface water quality.

As a Research Assistant at Duke University, supervised the following projects in solid, hazardous, and radioactive waste management:

Analysis of permeability rate and other structural alterations in clays and clay soils when exposed to industrial and hazardous waste leachates in completion of a Master's degree thesis in environmental engineering.

Prepared the methodology for evaluation of a potential low-level radioactive waste disposal facility in Research Triangle Park, North Carolina.

Evaluation of resource recovery applications in North Carolina, including the potential use of a shredding operation at the Durham sanitary landfill.

Publications

"The Effect of Electroplating Wastes Upon Clay As An Impermeable Boundary to Leaching," M.S. Thesis by M.F. Coia.

"The Leaching of Electroplating Wastes Through Clay Liners," by M.F. Coia, J.J. Peirce, and P.A. Vesilind. Presented at the 1981 AIChE 74th National Conference.

"Bruin Lagoon: Remedial Clean-Up of Hazardous Waste Sites Under Superfund," by M.F. Coia and J.W. Thorsen. Presented at the 1982 Mid-Atlantic Industrial Waste Conference.

"Remedial Superfund Actions: Procedures and Results," by J.W. Thorsen and M.F. Coia. Presented at the 1982 National Conference of ASCE, Environmental Engineering Division.

"Remedial Actions at Industrial Waste Sites: A Case History, Bruin Lagoon," by M.F. Coia. Presented at the 1982 Engineering Foundation Conference: Industry Response to the Hazardous Waste Challenge.

"In-Place Stabilization and Closure of Oily Sludge Lagoons," by A.A. Metry, M.F. Coia, M.H. Corbin, and A.L. Lentne. Presented at 1983 WPCAP Technical Conference.

David J. Russell

Registration

Engineer-In-Training in the State of Pennsylvania

Fields of Competence

Wastewater treatability studies; municipal and industrial wastewater sampling; wastewater treatment plant operations; monitor and control analyses for plant performance and operations; biodegradation studies.

Experience Summary

Bench-scale modeling of industrial wastewater treatment systems; execution of static aquatic bioassays; RCRA testing to include EP toxicity and ignitability testing; establishment and operation of standardized bench-scale tests for biodegradability and anaerobic digestion inhibition; water quality sampling of rivers and streams.

Credentials

B.S., Environmental Engineering—Temple University (1980)

National Society of Professional Engineers

American Red Cross Certification in Cardiopulmonary Resuscitation (CPR)

Basic life support course in Self-Contained Breathing Apparatus (SCBA)

Safety planning training

Employment History

1981-Present	WESTON
1980-1981	Hatfield Township Municipal Authority
1979	Environmental Protection Agency

Key Projects

Team Leader on a project at Brunner Island Unit 3, responsible for conducting particulate and SO_x tests at one of four sites sampled concurrently for Pennsylvania Power and Light Company, Hazleton, PA.

Team Leader responsible for conducting particulate, SO_x, and scrubber liquor entrainment tests during programs at Eddystone Units 1 and 2 for Philadelphia Electric Company, Philadelphia, PA.

Assistant Project Scientist for a bench-scale modeling study of an industrial treatment system being evaluated for upgrading of cyanide and chromium removal.

Assistant Project Scientist for establishment, certification, and operation of a standardized test for screening the anaerobic digestion inhibition potential of materials prior to introduction to commerce.

Assistant Project Scientist for execution of static bioassays for a pharmaceutical firm as part of NPDES compliance testing.

Participant in large-scale review of NPDES permit and compliance information for a West Virginia coal mine.

Project Scientist for preparation and execution of RCRA testing for a variety of clients.

Participant in large-scale water quality sampling project along 35 miles of a Pennsylvania river for three Pennsylvania power utilities.

Professional Profile

APPENDIX B

LIST OF INTERVIEWEES AND
OUTSIDE AGENCIES

Table B-1

List of Interviewees
U.S. Air Force Reserve

	Area of Knowledge	Approximate Service (years)
1.	Aircraft Maintenance	5
2.	Corrosion Shop	5-1/2
3.	Fuel Cell	16-1/2
4.	Aircraft Maintenance	29
5.	Aircraft Maintenance	20+
6.	Flight Line	27
7.	Aircraft Maintenance	20+
8.	Material Control	24
9.	Material Control	24
10.	Ground Maintenance	5
11.	Operations Shop	14
12.	Foreman, POL Area	13
13.	Base Fire Department	17
14.	Contract Office	2/3
15.	Aircraft Maintenance	8
16.	Photo Lab	12
17.	Public Affairs	7
18.	Liquid Fuel Maintenance	5+
19.	Contract Office	12
20.	Occupational Health Permits	4
21.	County Fire Department	25+
22.	Supply/Disposal of Material	27
23.	Wing History	3

Table B-2

List of Interviewees
Wisconsin Air National Guard

	Area of Knowledge	Approximate Service (years)
1.	Motor Pool	35
2.	Motor Pool	35
3.	Building and Grounds (11 years in buildings)	30
4.	Medical Clinic	27
5.	Personnel and Supply	31
6.	Support Equipment (nonpowered)	5
7.	AGE Shop	30
8.	Foreman, Engine Shop	30
9.	Fuel Cell Repair	20
10.	Corrosion Control	7
11.	Sheet Metal/Welding	
12.	Maintenance	7
13.	Maintenance	7
14.	POL Area	19
15.	Commercial Flight	15+
16.	Fire Department	10
17.	Base Engineering	10

Table B-3

List of Outside Agencies

Jim Beyers
National Archives and National Records Center
Research Assistance and Information
Washington, DC
202-523-3218

Steve Bern
Records Officer
Washington National Records Center
Suitland, Maryland
301-763-1710

Bill Lewis
Washington National Records Center
Suitland, Maryland
301-763-1710

Mr. Eldridge
Army Records Office
703-325-6179

Ed Reese
Records Officer
Military Archives Division
Modern Military Headquarters Branch
Washington, DC
202-523-3340

Grace Rowe
Air Force Records Management
Air Force Records
Washington, DC
202-694-3527

John Brabacker
Soil Scientist
Wisconsin Soil Conservation Service
Madison, Wisconsin
608-264-5334

Table B-3
(continued)

William Crowlute
Wisconsin Department of Transportation
Special Services
Madison, Wisconsin
608-266-7809

Kevin Kessler
Groundwater Coordinator
Wisconsin Department of Natural Resources
Madison, Wisconsin
608-267-9350

Frank Schultz
Wastewater Supervisor
Wisconsin Department of Natural Resources
Southeastern District
Milwaukee, Wisconsin
414-562-9653

Will Wawrzyn
Water Resources Management Unit
Wisconsin Department of Natural Resources
Milwaukee, Wisconsin
414-562-9668

Publications Clerk
Wisconsin Geological Survey
Madison, Wisconsin
608-262-1705

Richard Bantel
Branch Manager
EPA Region V Remedial Response Group
Chicago, Illinois
312-353-9773

Table B-3
(continued)

Sally Swansin EPA Region V Wastewater Management Branch Chicago, Illinois 312-886-0497
Donald Reed Biologist Southeastern Wisconsin Regional Planning Commission Waukesha, Wisconsin 414-547-6721
Don Martinson Transportation Planner Southeastern Wisconsin Regional Planning Commission Waukesha, Wisconsin 414-547-6721
Bruce Rubin Chief Land Use Planner Southeastern Wisconsin Regional Planning Commission Waukesha, Wisconsin 414-547-6721

APPENDIX C

MASTER LIST OF SHOPS

Table C-1

U.S. Air Force Reserve Operation

Shop	Location	Handles Hazardous Material	Generates Hazardous Waste	Handling Procedures Past	Handling Procedures Present
Aircraft Maintenance					
AGE	219	Yes	Yes	Base contractor or fire pit	DPDO, service contractor
Avionics	217	Yes	No		
Environmental Shop	217	Yes	Yes	Pit drains with separators	Pit drains with separators
Flight Line	217	Yes	Yes	Contractor or fire pit	DPDO, service contractor
Fuel Cell	217	Yes	Yes	Fire pit for training	Recycled
Machine Shop	217	Yes	No		
Phase Dock	217	Yes	No		
Pneudraulic	217	Yes	Yes	Base contractor or fire pit	DPDO, service contractor
Propulsion and Engine	208	Yes	No		
Repair and Reclamation	217	Yes	Yes	Base contractor or fire pit	DPDO, service contractor
Sheet Metal	217	Yes	No		
Welding	217	Yes	No		
Corrosion Control	219	Yes	Yes	Base contractor or fire pit	DPDO, service contractor
Battery	108	Yes	Yes	Neutralized to sanitary sewer	Neutralized to sanitary sewer

Table C-1
(continued)

Shop	Loca-tion	Handles Hazardous Material	Generates Hazardous Waste	Typical TSD Past	Typical TSD Present
NDI	218	Yes	Yes	Sanitary sewer	Sanitary sewer
Life Support	112	Yes	No		
Survival	112	Yes	Yes	Dumpster (small quantity)	
Civil Engineering					
Heating System	215	Yes	Yes	Sanitary sewer	Sanitary sewer
Paint	106	Yes	Yes	Base contractor or fire pit	DPDO, service contractor
Roads and Ground	106	Yes	Yes	Base contractor or fire pit	DPDO, service contractor
Plumbing	106	Yes	No		
Carpentry	106	Yes	No		
Support					
Vehicle Maintenance	104	Yes	Yes	Base contractor or fire pit	DPDO, service contractor
Supply	205	Yes	Yes	Base contractor or fire pit	DPDO, service contractor
POL	303	Yes	Yes	Fire pit for training	Recycling

Table C-2

Wisconsin Air National Guard Operation

Shop	Location	Handles Hazardous Material	Generates Hazardous Waste	Typical Past	TSD Present
AGE	108	Yes	Yes	Solvent waste tank	Solvent waste tank/oil waste tank
Corrosion Control	105	Yes	Yes	Solvent waste tank	Solvent waste tank
Engine Repair	107	Yes	Yes	Solvent waste tank	Waste solvent tank/oil waste tank
Fire Department	103	Yes	No		
Fuel Cell Repair	106	Yes	No		
Aircraft Maintenance	104	Yes	Yes	Solvent waste tank	Solvent waste tank
Medical Center	113	Yes	Yes	Silver recovery	Silver recovery and DPDO
Motor Pool	114	Yes	Yes	Waste solvent tank	Waste oil tank DPDO Neutralization
Nonpowered	106	Yes	Yes	Waste solvent tank	Waste solvent tank/waste oil tank Drains/separator DPDO
Sheet Metal/Welding	106	Yes	No		

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Table C-3

U.S. Air Force Reserve
Aircraft Maintenance

Shop	Location	Handles Hazardous Material	Generates Hazardous Waste	Typical Past	TSD Present
Avionics	217	Yes	No		
Environmental	217	Yes	Yes	Pit drains with separators	Pit drains with separators
Flight Line	217	Yes	Yes	55-gallon drum	DPDO
				Storm sewer	Drain to sanitary sewer
Fuel Cell	302	Yes	No		
Machine	217	Yes	No		
Phase Dock	217	Yes	No		
Pneudraulic	217	Yes	Yes	Base contractor	DPDO
Propulsion and Engine	208	Yes	Yes	55-gallon drum	DPDO
Repair and Reclamation	217	Yes	Yes	Base contractor	DPDO
Sheet Metal	217	Yes	No		
Welding	217	yes	No		
<u>Maintenance</u>					
Carpentry	106	Yes	No		
Electrical	106	Yes	No		
Paint	106	Yes	Yes	Fire pit	DPDO
Plumbing	106	Yes	No		
Roads and Grounds	106	Yes	Yes	Base contractor	DPDO

Table C-3
(continued)

Shop	Location	Handles Hazardous Material	Generates Hazardous Waste	Typical Past	TSD Present
Support					
AGE	219	Yes	Yes	55-gallon drum	DPDO
Corrosion Control	219	Yes	Yes	55-gallon drum/ Base contractor	DPDO
Life Support	112	Yes	No		
Survival	112	Yes	Yes		DPDO
Vehicle Maintenance	104	Yes	Yes	Pit drain	DPDO
Battery	108	Yes	Yes	Neutralization	Neutralization
NDI	218	Yes	Yes	Silver recovery	Silver recovery
				Dilution to sanitary sewer	Dilution to sanitary sewer
				55 gallon drum	55-gallon drum
Supply	205	Yes	Yes	55-gallon drum	DPDO
Liquid Fuel Maintenance	215	Yes	No		
Heating System	215	Yes	No		
POL	303	Yes	Yes	Waste fuel tank to fire pit Dilution to sanitary sewer	

APPENDIX D

HAZARD ASSESSMENT RATING METHODOLOGY

APPENDIX D

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.

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.

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.

FIGURE 1

HAZARD ASSESSMENT RATING METHODOLOGY FLOW CHART

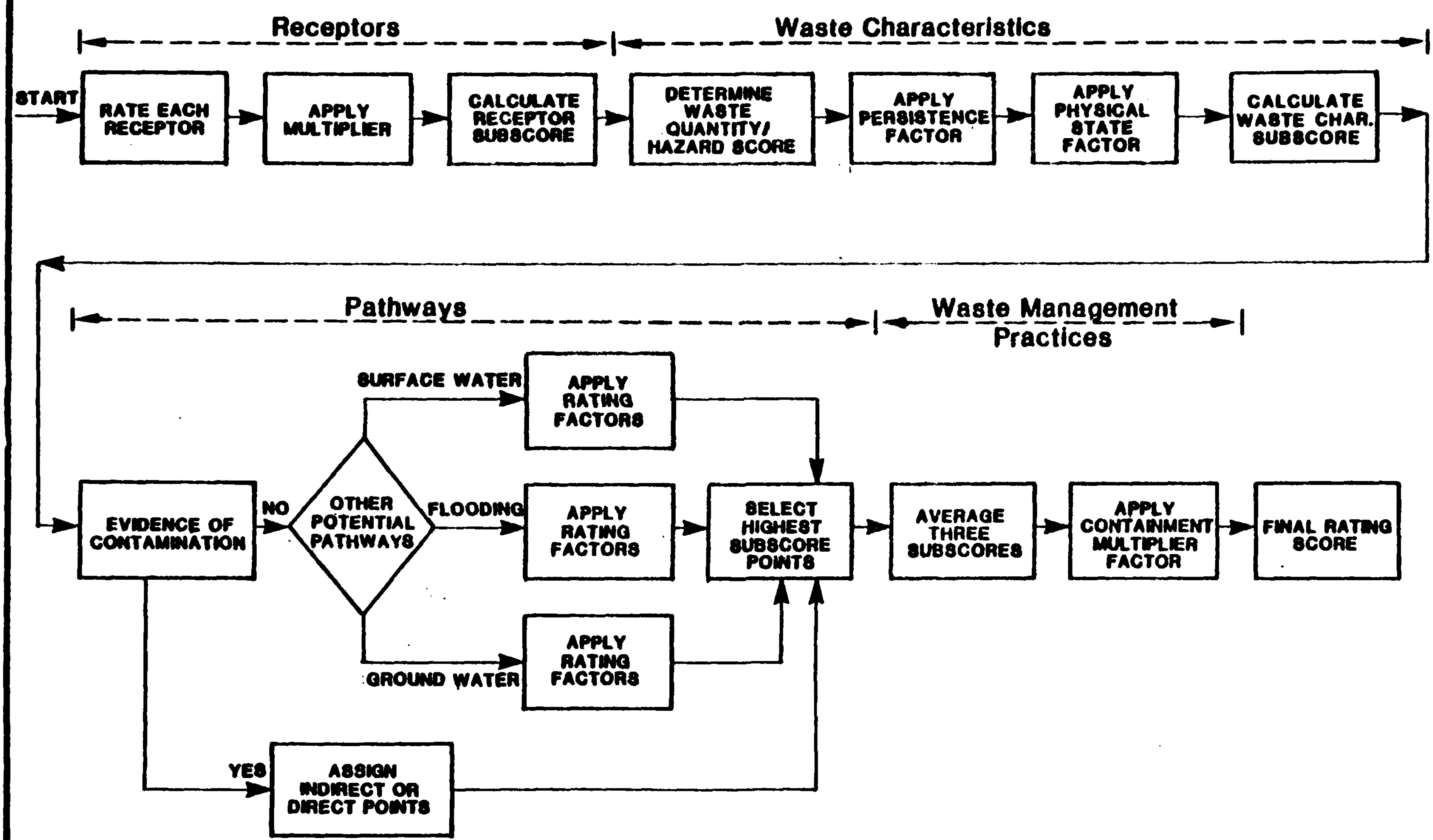

FIGURE 2

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 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 ______ = [   ]

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

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 (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 + SCH = 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

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 0	1	2	3	Multiplier
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

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:

<u>Landfills:</u>

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

<u>Spills:</u>

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

<u>Surface Impoundments:</u>

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

<u>Fire Proection Training Areas:</u>

- 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.

APPENDIX E

Site HARM Score Calculations

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE POL Area -

LOCATION Southeast Corner of Base

DATE OF OPERATION OR OCCURRENCE 1950's to Present

OWNER/OPERATOR U.S. Air Force Reserve

COMMENTS/DESCRIPTION numerous small leaks, and tank cleaning waste in previously unlined berm.

SITE RATED BY K. Sheedy

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	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	2	10	20	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	3	6	18	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			126	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 70

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) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) 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 .8 = 64

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

64 x 1 = 64

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 80

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	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108

Subscore (100 X factor score subtotal/maximum score subtotal) 59

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

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	2	8	16	24
Direct access to ground water	3	8	24	24
		Subtotals	84	114

Subscore (100 x factor score subtotal/maximum score subtotal) 74

C. Highest pathway subscore.

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

Pathways Subscore 80

IV. WASTE MANAGEMENT PRACTICES

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

Receptors 72
Waste Characteristics 64
Pathways 80

Total 214 divided by 3 = 71
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

71 x 1 = 71

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Fire Training Area - 440th TAW
LOCATION Beneath present Fire Training Area (8906)
DATE OF OPERATION OR OCCURRENCE 1956 (?) - 1981
OWNER/OPERATOR U.S. Air Force Reserve
COMMENTS/DESCRIPTION Pit was replaced by updated design with containment at the same location.
SITE RATED BY Sheedy

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	2	10	20	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	3	6	18	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			130	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 72

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) L
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) M

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 .90 = 72

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

72 x 1 = 72

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 0

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	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108

Subscore (100 X factor score subtotal/maximum score subtotal) 59

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

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
		Subtotals	44	114

Subscore (100 x factor score subtotal/maximum score subtotal) 39

C. Highest pathway subscore.

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

Pathways Subscore 59

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	72
Waste Characteristics	72
Pathways	59

Total 203 divided by 3 = 68
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

68 x 1 = 68

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Storage Area #1 - 440th TAW

LOCATION Behind 7201 - adjacent to present Fire Training Pit

DATE OF OPERATION OR OCCURRENCE 1956 - 1981

OWNER/OPERATOR U.S. Air Force Reserve

COMMENTS/DESCRIPTION Used for storage for Hazardous Waste prior to removal by contractor or to Fire Pit.

SITE RATED BY K. Sheedy

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	2	10	20	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	3	6	18	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			130	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 72

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) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

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

60 x .9 = 54

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

54 x 1 = 54

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 0

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	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
		Subtotals	64	108

Subscore (100 x factor score subtotal/maximum score subtotal) 59

2. Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
		Subtotals	44	114

Subscore (100 x factor score subtotal/maximum score subtotal) 39

C. Highest pathway subscore.

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

Pathways Subscore 59

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	72
Waste Characteristics	54
Pathways	59

Total 185 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 .95 = 59

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Storage Area #2

LOCATION West Boundary of POL Area

DATE OF OPERATION OR OCCURRENCE Mid 1970's to present

OWNER/OPERATOR U.S. Air Force Reserve

COMMENTS/DESCRIPTION Used for storage of drummed waste - visual evidence of drips and spillage.

SITE RATED BY K. Sheedy

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	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	2	10	20	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	3	6	18	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			126	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 70

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) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) 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

60 x .9 = 45

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

45 x 1 = 45

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	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
		Subtotals	72	108

Subscore (100 X factor score subtotal/maximum score subtotal) 67

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

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	1	8	8	24
		Subtotals	44	114

Subscore (100 x factor score subtotal/maximum score subtotal) 39

C. Highest pathway subscore.

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

Pathways Subscore 67

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	70
Waste Characteristics	45
Pathways	67

Total 182 divided by 3 = 61 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

61 x .95 = 58

APPENDIX F

References

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APPENDIX F

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APPENDIX G

Glossary of Terms and Abbreviations

APPENDIX G

GLOSSARY OF TERMS AND ABBREVIATIONS

ACCUMULATION POINT	A designated location for the accumulation of wastes prior to removal from the installation.
ACFT MAINT	Aircraft Maintenance
AF	Air Force
AFB	Air Force Base
AFESC	Air Force Engineering and Services Center
AFFF	Aqueous Film Forming Foam (a fire extinquishing agent).
AFR	Air Force Regulation
AFRES	Air Force Reserve
Ag	Chemical symbol for silver.
AGE	Aerospace Ground Equipment
Al	Chemical symbol for aluminum.
ALLUVIUM	Materials eroded, transported, and deposited by surface water.
ANG	Air National Guard
ARTESIAN	Groundwater contained under hydrostatic pressure.
AQUIFER	A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.

AROMATIC	Organic chemial compounds in which the carbon atoms are arranged into a ring with special electron stability associated. Aromatic compounds are often more reactive than nonaromatics.
AVGAS	Aviation Gasoline (contains lead).
Ba	Chemical symbol for barium.
BIOACCUMULATE	Tendency of elements or compounds to accummulate or buildup in the tissues of living organisms when they are exposed to elements in their environments, e.g., heavy metals.
BIODEGRADABLE	The characteristic of a substance to be broken down from complex to simple compounds by microorganisms.
BOWSER	A mobile tank, usually 1,000 gallons or less in capacity.
BX	Base Exchange
$CaCO_3$	Chemical symbol for calcium carbonate.
Cd	Chemical symbol for cadmium.
CE	Civil Engineering
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIRCA	About, used to indicate an approximate date.
Cn	Chemical symbol for cyanide.
COD	Chemical Oxygen Demand, a measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water.
COE	Corps of Engineers

CONFINED AQUIFER	An aquifer bounded above and below by geologic units of distinctly lower permeability than that of the aquifer itself.
CONFINING UNIT	A geologic unit with low permeability which restricts the vertical movement of groundwater.
Cr	Chemical symbol for chromium.
Cu	Chemical symbol for copper.
2,4-D	Abbreviation for 2,4-dichlorophenoxyacetic acid, a common weed killer and defoliant.
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DIP	The angle at which a geologic structural surface is inclined from the horizontal.
DoD	Department of Defense
DOT	Department of Transportation
DOWNGRADIENT	In the direction of decreasing hydraulic static head; the direction in which groundwater flows.
DPDO	Defense Property Disposal Office - responsible disposal or reuse/recycling of hazardous materials from DoD installations.
DUMP	An uncontrolled land disposal site where solid and/or liquid wastes are deposited.
EFFLUENT	A liquid waste, untreated or treated, that discharges into the environment.
EP	Extraction Procedure - the EPA standard laboratory procedure for simulation of leachate generation.
EPA	U.S. Environmental Protection Agency

EROSION	The wearing away of land surface by wind, water, or chemical processes.
FAA	Federal Aviation Administration
FAULT	A fracture in rock along the adjacent rock surfaces which are differentially displaced.
Fe	Chemical symbol for iron.
FLOW PLAIN	The low land and relatively flat areas adjoining inland and coastal areas of the mainland and off-shore islands, including, at a minimum, areas subject to 1 percent or greater chance of flooding in any given year.
FLOOD PATH	The direction of movement of groundwater as governed principally by the hydraulic gradient.
FMS	Field Maintenance Squadron
FPTA	Fire Protection Training Area
FY	Fiscal Year
GC/MS	Gas chromatograph/mass spectrophotometer, an analytical instrument for qualitative and quantitative measurement of organic compounds having a maximum molecular weight of 800.
GROUNDWATER	Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure.
GROUNDWATER RESERVOIR	The earth materials and the intervening open spaces that contain groundwater.
HALON	A fluorocarbon fire extinguishing compound.
HALOGEN	The class of chemical elements including fluorine, chlorine, bromine, and iodine.

HARM	Hazard Assessment Rating Methodology
HAZARDOUS SUBSTANCE	Under CERCLA, the definition of hazardous substance includes: o All substances regulated under Paragraphs 311 and 307 of the Clean Water Act (except oil). o All substances regulated under Paragraph 3001 of the Solid Waste Disposal Act. o All substances regulated under Paragraph 112 of the Clean Air Act. o All substances which the Administrator of EPA has acted against under Paragraph 7 of the Toxic Substance Control Act. o Additional substances designated under Paragraph 102 of the Superfund Bill.
HAZARDOUS WASTE	As defined in RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical/chemical, or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.
HAZARDOUS WASTE GENERATION	The act or process of producing a hazardous waste.
HEAVY METALS	Metallic elements, including the transition series, which include many elements required for plant and animal nutrition in trace concentrations but which become toxic at higher concentrations.

Hg	Chemical symbol for mercury
HQ	Headquarters
HYDROCARBONS	Organic chemical compounds composed of hydrogen and carbon atoms chemically bonded. Hydrocarbons may be straight chain, cylic, branched chain, aromatic, or polycyclic, depending upon arrangement of carbon atoms. Halogenated hydrocarbons are hydrocarbons in which one or more hydrogen atoms has been replaced by a halogen atom.
INFILTRATION	The movement of water across the atmosphere-soil interface.
IRP	Installation Restoration Program
ISOPACH	Graphic presentation of geologic data, including lines of equal unit thickness that may be based on confirmed (drill hole) data or indirect geophysical measurement.
JP-4	Jet Propulsion Fuel (unleaded) No. 4, military jet fuel.
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.
LITHOLOGY	The description of the physical character of a rock.
LOESS	An essentially unconsolidated unstratified calcareous silt; commonly homogeneous, permeable, and buff to gray in color.
LYSIMETER	A vacuum operated sampling device used for extracting pore waters at various depths within the unsaturated zone.

MEK	Methyl Ethyl Ketone
METALS	See "Heavy Metals".
MGD	Million gallons per day.
MOA	Military Operating Area
MIK	Methyl Isobutyl Ketone
MOGAS	Motor Gasoline
Mn	Chemical symbol for manganese.
MONITORING WELL	A well used to obtain groundwater samples and to measure groundwater elevation
MSL	Mean Sea Level
NDI	Nondestructive inspection.
NET PRECIPITATION	The amount of annual precipitation minus annual evaporation.
Ni	Chemical symbol for nickel.
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OEHL	Occupational and Environmental Health Laboratory
OIC	Officer-In-Charge
ORGANIC	Being, containing, or relating to carbon compounds, especially in which hydrocarbon is attached to carbon.
OSI	Office of Special Investigations

O&G	Symbols for oil and grease.
Pb	Chemical symbol for lead.
PCB	Polychlorinated Biphenyl - liquids used as a dielectrics in electrical equipment.
PERCOLATION	Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.
PERMEABILITY	The capacity of a porous rock, soil, or sediment for transmitting a fluid.
PERSISTENCE	As applied to chemicals, those which are very stable and remain in the environment in their original form for an extended period of time.
PD-680	Kerosene-based cleaning solvent
pH	Negative logarithm of hydrogen ion concentration.
PL	Public Law
POL	Petroleum, Oils, and Lubricants
POLLUTANT	Any introduced gas, liquid, or solid that makes a resource unit for a specific purpose.
POLYCYCLIC COMPOUND	All compounds in which carbon atoms are arranged into two or more rings, usually in nature.
POTENTIOMETRIC SURFACE	The surface to which water in an aquifer would rise in tightly cased wells open to the aquifer.
PPB	Parts per billion by weight.
PPM	Parts per million by weight.

PRECIPITATION	Rainfall.
QUATERNARY MATERIALS	The second period of the Cenozoic geologic era, following the Tertiary, and including the last 2 to 3 million years.
RCRA	Resource Conservation and Recovery Act of 1976
RECEPTORS	The potential impact group or resource for a waste contamination source.
RECHARGE AREA	A surface area in which surface water or precipitation percolates through the unsaturated zone and eventually reaches the zone of saturation.
RECHARGE	The addition of water to the groundwater system by natural or artificial processes.
RIPARIAN	Living or located on a riverbank.
SANITARY LANDFILL	A site using an engineered method of disposing solid wastes on land.
SATURATED ZONE	Soil or geologic materials in which all voids are filled with water.
SAX's TOXICITY	A rating method for evaluating the toxicity of chemical materials.
SCS	U.S. Department of Agriculture Soil Conservation Service
SOLID WASTE	Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility, and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic

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	sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).
SPILL	Any unplanned release or discharge of a material onto or into the air, land, or water.
STORAGE OF HAZARDOUS WASTE	Containment, either on a temporary basis or for a longer period, in such manner as not to constitute permanent disposal of such hazardous waste.
STP	Sewage Treatment Plant
2,4,5-T	Abbreviation for 2,4,5-trichlorophenoxyacetic acid, a common herbicide.
TAW	Tactical Airlift Wing
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TOXICITY	The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism.
TRANSMISSIVITY	The rate at which water is transmitted through a unit width of aquifer under a hydraulic gradient.

TREATMENT OF HAZARDOUS WASTE	Any method, technique, or process including neutralization designed to change the phsyical, chemical, or biological character or composition of any hazardous waste so as to neutralize the waste or so as to render the waste non-hazardous.
TSD	Treatment, storage, or disposal.
TSDF	Treatment, storage, or disposal facility.
UPGRADIENT	In the direction of increasing hydraulic static head; the direction from which groundwater flows.
USAF	United States Air Force
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WANG	Wisconsin Air National Guard
WATER TABLE	Surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.
WWTP	Wastewater Treatment Plant
Zn	Chemical symbol for zinc

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