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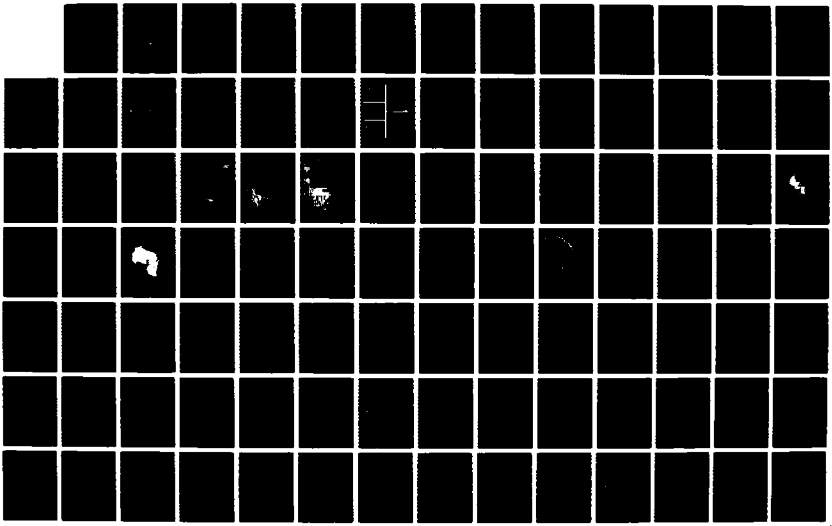

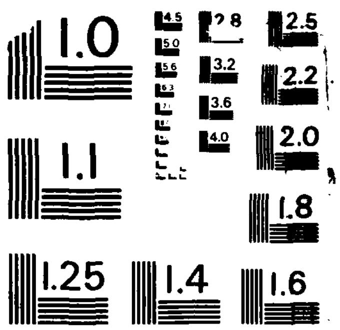

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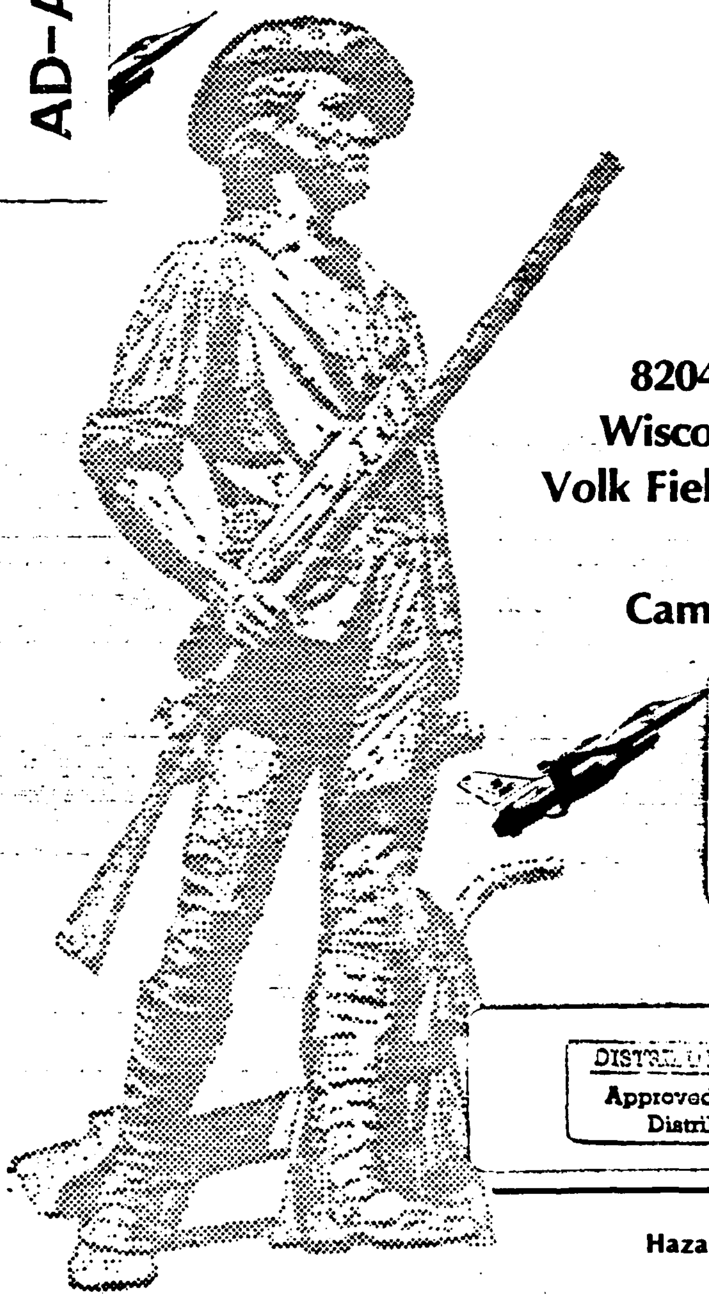

Records Search

8204th Field Training Site
Wisconsin Air National Guard
Volk Field Air National Guard Base

Camp Douglas, Wisconsin

Hazardous Materials Technical Center

August 1984

NOTICE

This report has been prepared for the United States Air National Guard by the Hazardous Materials Technical Center for the purpose of aiding in the implementation of the Air Force Installation Restoration Program. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the official views of the publishing agency, the United States Air Force, the Air National Guard, or the Department of Defense.

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INSTALLATION RESTORATION PROGRAM
RECORDS SEARCH

Prepared for

8204th FIELD TRAINING SITE
WISCONSIN AIR NATIONAL GUARD
VOLK FIELD AIR NATIONAL GUARD BASE
CAMP DOUGLAS, WISCONSIN

Prepared by

THE HAZARDOUS MATERIALS TECHNICAL CENTER
P.O. BOX 8168
ROCKVILLE, MD 20856-8168

August 1984

Contract No. DLA900-82-C-4426

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TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS

(Continued)

LIST OF FIGURES

LIST OF FIGURES
(Continued)

LIST OF TABLES

EXECUTIVE SUMMARY

A. Introduction

1. The Hazardous Materials Technical Center (HMTC) was retained on March 6, 1984, to conduct the Volk Field Air National Guard (ANG) Base Records Search under Contract No. DLA900-82-C-4426, with funds provided by the ANG.

2. Department of Defense (DOD) policy, directed by Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites on DOD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations.

3. To implement the DOD policy, a four-phase Installation Restoration Program (IRP) has been directed. Phase I, the Records Search, is the identification of potential problems. Phase II (not part of this contract) consists of follow-on field work to determine the extent and magnitude of contaminant migration. Phase III (not part of this contract) consists of development of any required new technology to abate unique contamination problems. Phase IV (not part of this contract) includes those efforts to evaluate alternatives for remedial actions and any efforts required to control identified hazardous conditions.

4. The Volk Field ANG Base Records Search included a detailed review of pertinent installation records, contacts with eight government organizations for documents relevant to the Records Search effort, and an onsite base visit conducted by HMTC during April 23-27, 1984. Activities conducted during the onsite base visit included interviews with 18 past and present base employees, ground tours and

helicopter overflight of base facilities at Volk Field and Hardwood Range, detailed search of base records, and meetings with personnel from several Wisconsin State agencies in Madison, Wisconsin.

B. Major Findings

1. The major industrial operations of Volk Field ANG Base and Hardwood Range which have produced hazardous wastes include Aircraft Maintenance and Nondestructive Inspection, Ground Vehicle Maintenance, Fuels Management, Ordnance Disposal, Painting and Plumbing. These operations generate varying quantities of waste oils, recovered fuels, and spent solvents and cleaners. The Ordnance Disposal operations at Hardwood Range primarily deal with BDU-33 practice bombs, 2.75 rocket heads, MK-106 projectiles, and 20- or 30-mm shells.

2. Various mechanisms for disposal of the waste materials generated by these shops have existed in the past. These include disposal via the Defense Property Disposal Office (DPDO), neutralization of the wastes and discharge to the sanitary sewer, burning and burial in the on-base landfill, burning at the various Fire Department Training Areas and at Hardwood Range, and discharge onto the ground. Since 1980, the majority of the hydrocarbon wastes have been disposed of via DPDO or at Hardwood Range during ordnance disposal operations.

3. Interviews with 18 previous and present base employees and a field survey resulted in the identification of 15 past disposal and/or spill sites at Volk Field ANG Base and Hardwood Range. Of these 15 sites, 8 have been further evaluated using the Air Force's Hazard Assessment Rating Methodology (HARM). Seven of the 8 sites are at Volk Field. The last site is at Hardwood Range. The following table presents a priority listing of these waste disposal and spill sites and their associated hazard assessment scores.

Priority	Site No.	Site Description	Subscores: Receptors	Subscores: Waste Characteristics	Subscores: Pathway	Subscores: Waste Mgmt. Practices	Overall Score
1	1	Fire Dept. Training Area	64	100	100	1.00	88
2	2	Current Landfill	66	54	86	1.00	69
3	3	Chronic Fuel Spill Site	68	54	72	1.00	65
4	4	Transformer Fluid Disposal Site	64	60	72	1.00	65
5	5	KC-97 Crash Site	64	54	72	1.00	63
6	6	JP-4 spill Site	68	54	72	0.95	62
7	7	Former Landfill	64	30	72	1.00	55
8	8	Munitions Burial Site	58	45	72	0.95	55

C. Conclusions

1. The groundwater environment downgradient of the Fire Department Training Area (Site No. 1) has been contaminated by various organic chemicals which are likely to have originated from the training area. The contaminants observed to date include chloroform, 1,1,1-trichloroethane, trichloroethylene, benzene, toluene, and ethyl benzene. Toluene is present at a concentration of 36 mg/l, which was the maximum observed contaminant concentration. It is unlikely that any of the contamination related to the Fire Department training area extends beyond the boundaries of Volk Field ANG Base, therefore, there does not appear to be an imminent health hazard.

2. The overall groundwater environment at Volk Field ANG Base is highly susceptible to contamination from surface contaminants. Factors contributing to this susceptibility are the highly permeable nature of the soils and underlying unconsolidated sediments, the lack of impermeable confining layers overlying the primary aquifers, and the shallow depth (generally less than 10 feet) to the water table.

3. No evidence of off-base environmental stress resulting from past disposal of waste materials was observed in the immediate vicinity of Volk Field ANG Base. However, the close proximity of several of the sites to the base boundaries increases the likelihood of off-base contaminant migration via the groundwater pathway. This is particularly true for the current landfill (Site No. 2) because it is within 200 feet of a boundary line, and this boundary is down-gradient from this site. The next closest sites to a base boundary are Site Nos. 3 and 6, but fortunately, the groundwater flow is away from the boundary at these sites.

D. RECOMMENDATIONS

The potential for contaminant migration at Volk Field ANG Base is high; therefore, it is strongly recommended that Phase II monitoring be conducted. This monitoring should consist of analysis of soil and groundwater samples for selected organic and inorganic parameters. The primary purposes for monitoring each of the proposed locations are to:

- Determine the depth within the unsaturated zone to which contaminants have migrated. If only the shallow subsurface has been contaminated at a particular site, it may be possible to remedy the problem by excavating the contaminated material.
- Determine whether groundwater at each monitoring site has been contaminated.
- Determine the extent of contamination and the rate and direction of contaminant migration, if groundwater contamination is observed.

All of the rated sites are recommended for monitoring. This includes the seven sites at Volk Field and the one site at Hardwood Range. These sites have been grouped into monitoring areas on the basis of their proximity to each other. Figure ES-1 illustrates the five general areas at Volk Field that are recommended for monitoring, and the locations of the spill/disposal sites within these areas. Two of the proposed monitoring areas encompass more than one spill/disposal site due to the close proximity

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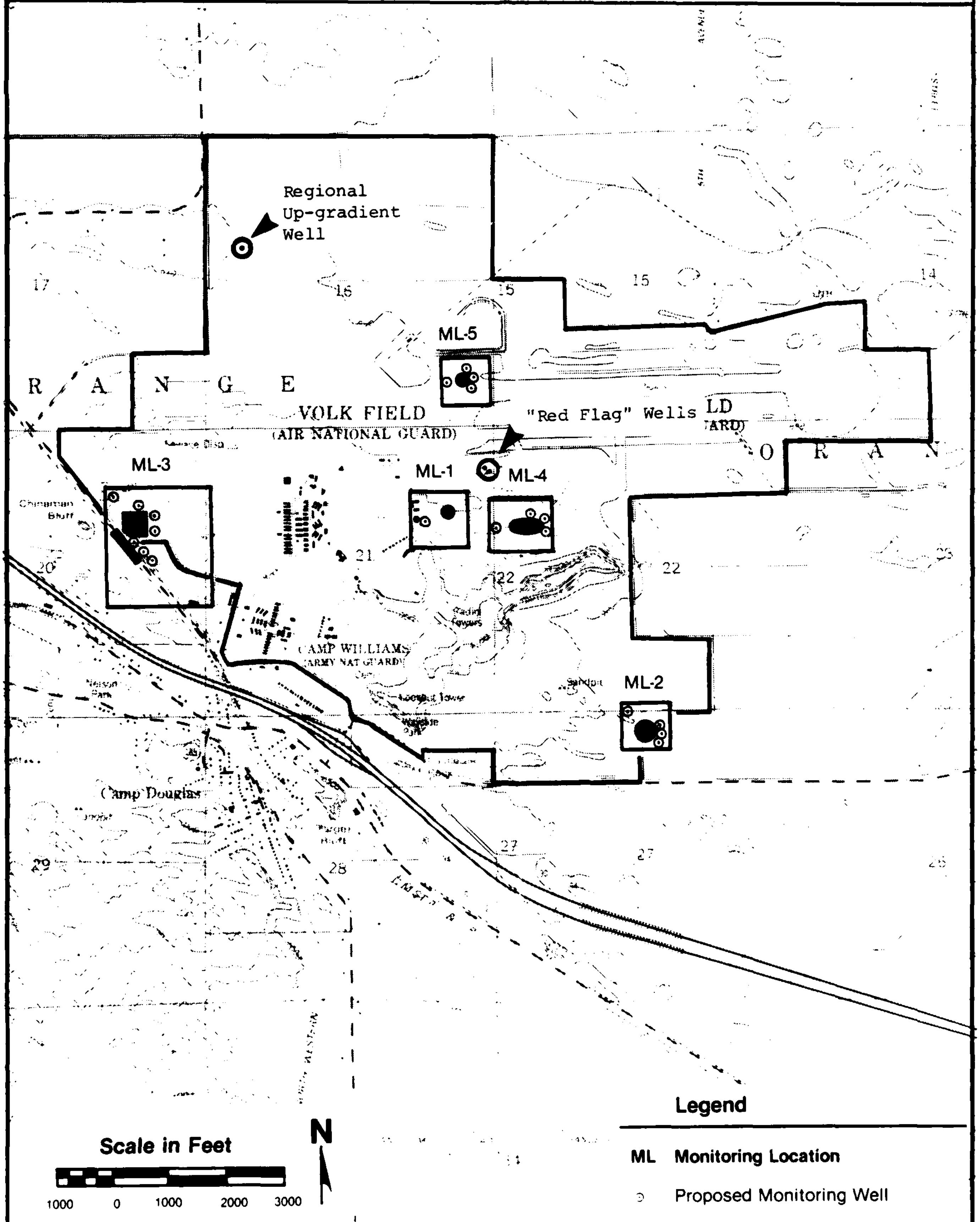
Figure ES-1.

Locations of the Proposed Areas at Volk Field to be Investigated During Phase II of the IR Program.



Source: U.S.G.S.

of the sites. The first monitoring area encompasses the Fire Department Training Area (Site No. 1) and the transformer fluid disposal site (Site No. 4). The second monitoring area encompasses the current landfill (Site No. 2). The third monitoring area encompasses the chronic fuel spill site (Site No. 3) and the JP-4 spill site (Site No. 6). The fourth monitoring area encompasses the former landfill (Site No. 7). The fifth monitoring area encompasses the KC-97 crash site (Site No. 5). Figure ES-2 illustrates the location of the sixth monitoring area, the only area recommended for monitoring at Hardwood Range. This monitoring area encompasses the Munitions Burial Site (Site No. 8). Table ES-1 summarizes the monitoring locations within which all of the above spill/disposal sites are located.

Enlargements of the proposed areas to be monitored at Volk Field are illustrated in Figure ES-3. For monitoring locations 4, and 5 it is initially recommended that monitoring wells be installed at the approximate locations indicated in Figure ES-3. This arrangement assures that three wells are located downgradient of each site and one is upgradient. Only one well is initially recommended for monitoring location No. 1, despite the presence of two disposal sites at this location, because numerous groundwater monitoring wells are already present at the Fire Department Training Area. For monitoring location No. 3, it is recommended that seven monitoring wells initially be installed. One of these wells will be upgradient of both sites at this location, three will be downgradient of the JP-4 spill site, and three will be downgradient of the chronic fuel spill site. For monitoring location No. 2, five down-gradient wells and one up-gradient well are recommended at the indicated locations.

The bottom portion of Figure ES-2 is an enlargement of the proposed area to be monitored at Hardwood Range. This monitoring location encompasses the only site at Hardwood Range which has been recommended for additional monitoring. Initially 3 down-gradient wells and one up-gradient well are recommended for this site.

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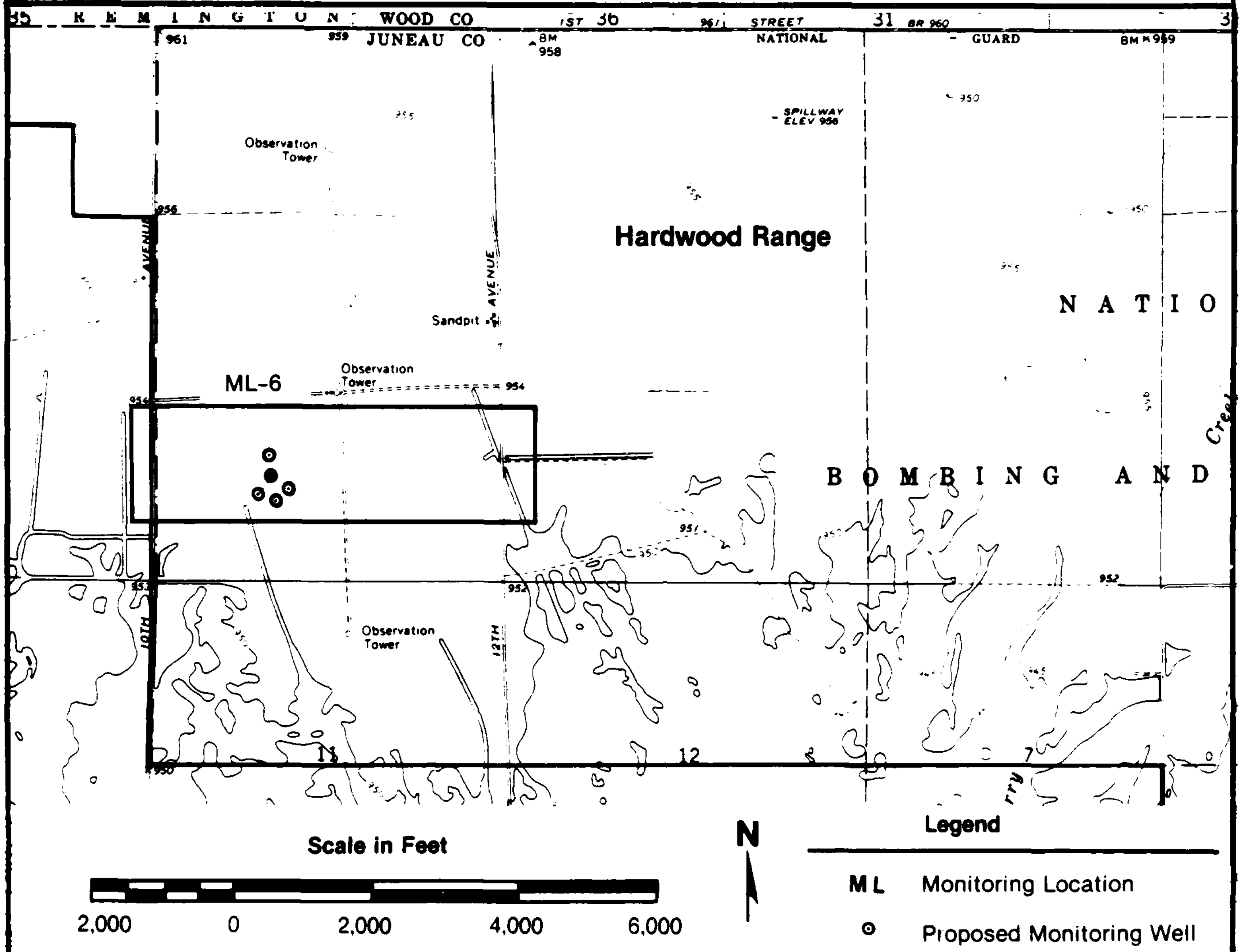
Figure ES-2.

Location of the Proposed Area at Hardwood Range to be Investigated During Phase II of the IR Program, and the Location of the Proposed Monitoring Wells Within this Area.



Monitoring Location No. 6

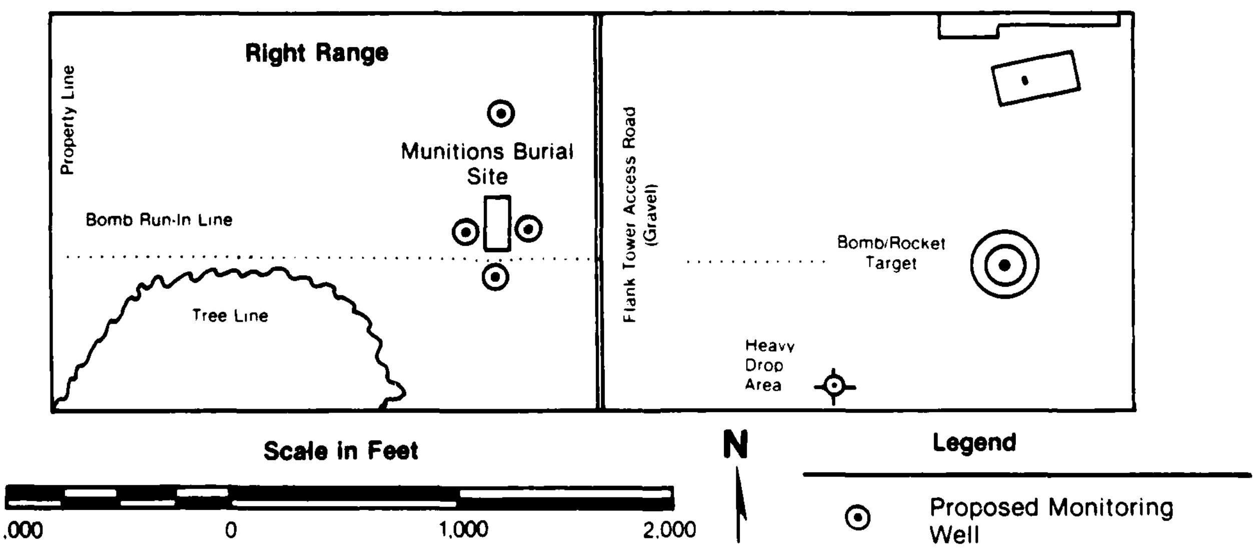
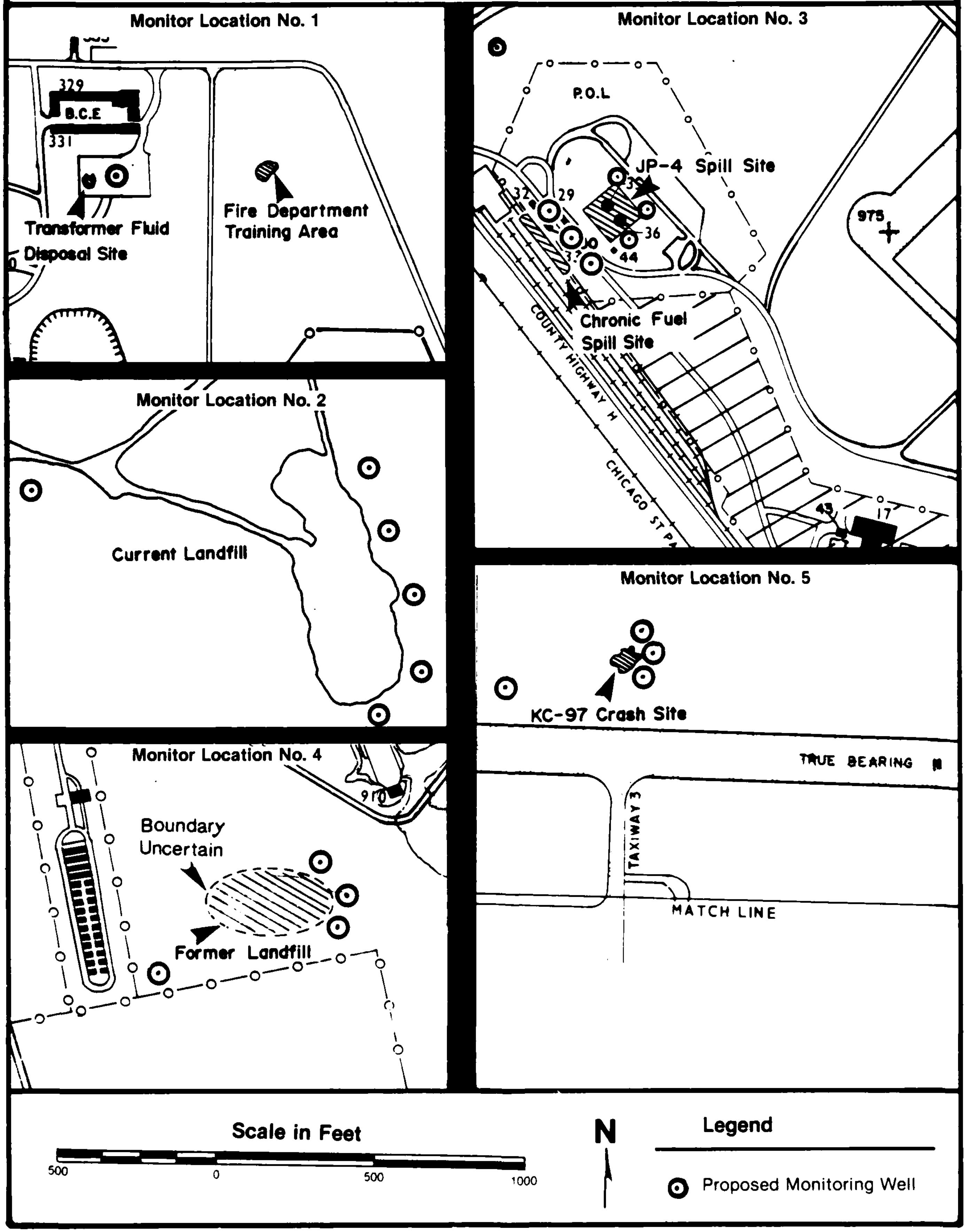


Table ES-1.

Summary of the Spill/Disposal Sites Recommended for Phase II Investigation, and the Monitoring Location Within Which Each is Located.

Site	Description	Monitoring Location
Site 1	Fire Dept. Training Area	ML-1
Site 2	Current Landfill	ML-2
Site 3	Chronic Fuel Spill Site	ML-3
Site 4	Transformer Fluid Disposal Site	ML-1
Site 5	KC-97 Crash Site	ML-5
Site 6	JP-4 Spill Site	ML-3
Site 7	Former Landfill	ML-4
Site 8	Munitions Burial Site	ML-6

Figure ES-3.
Locations of the Proposed Groundwater Monitoring Wells Within the Proposed Areas to be Investigated at Volk Field.



In addition to the above recommendations for the spill/disposal sites which were rated by the HARM procedure, other miscellaneous recommendations are offered for various non-rated sites and locations. The sanitary wastewater treatment system was not rated; however, the nature of the shops which discharge to this system is such that accidental hazardous waste discharges to this system may have occurred in the past. Therefore, it is recommended that limited monitoring be conducted at the stabilization pond. Initially, this monitoring should consist of analysis of five different sludge and sediment samples from within the pond for pH, total organic carbon and total organic halogens. These five samples should be collected from varied lateral locations throughout the pond, but from the same depth within the sediment at each location. If the results are positive, then a minimum of three down-gradient and three up-gradient groundwater monitoring wells should be installed; however, these wells are not presently recommended. Additionally, if the results of the first set of sediment samples are positive, further sediment sampling and analysis should be conducted to determine changes in contaminant concentration with depth in the sediment.

A single up-gradient well which is far removed from all known sources of contamination is recommended at the north end of the north-south runway, as illustrated in Figure ES-1. The purpose of this well is to provide reliable and alternative background groundwater quality data in the event that the previously recommended up-gradient monitoring wells at the individual monitoring locations are impacted by unanticipated groundwater contamination up-gradient from them. Such interference with the up-gradient wells is unlikely, but is possible due to the historically high level of operational activity throughout the area of the monitoring locations.

It is recommended that a set of nested down-gradient monitoring wells be installed at the location indicated in Figure ES-1. This nest should consist of two monitoring wells. The first should be a relatively shallow monitoring well designed to monitor groundwater within the unconsolidated sediments. The second should be a deep well which extends into the sandstone bedrock underlying the sediments, and which is constructed so as to preclude hydraulic communication between the deep sandstone-associated groundwater system and the groundwater system associated with the unconsolidated sediments.

All monitoring wells should be designed and constructed so that they facilitate:

- Determination of vertical variations in parameters such as aquifer permeability, pressure head, and contaminant concentrations. Whether such data are acquired using, for example, nested piezometers or fully screened wells fitted with packers, is at the discretion of the IRP Phase II Contractor. Such information is important for determining the three-dimensional orientation and movement of the contaminant plume and for designing any required Phase IV Remedial Actions.

- At a minimum, the well construction protocol should include:

  Tremie grouting of the annular space for each well to a depth of 5 feet below ground surface.

  Recording of detailed well logs which include daily static water levels, type of geologic materials encountered, depths to water-producing zones, and samples of cuttings from each well that are collected from 5-foot intervals.

  Proper identification and surveying of all wells.

Groundwater from each screened interval for all wells should be collected and analyzed for volatile organic carbon species, oil and grease, and total organic halogens. This includes the existing monitoring wells at the Fire Department Training Area. The results of analysis of water from these wells should be compared to the 1981 results summarized in Table 4 of this report to determine the need for installation of additional monitoring wells. All groundwater quality data should be statistically analyzed by methods approved by the U.S. Environmental Protection Agency and Wisconsin Department of Natural Resources, in order to identify significant differences in groundwater quality.

I. INTRODUCTION

A. Background

The 8204th Field Training Site (FTS), Volk Field Air National Guard (ANG) Base, fulfills a vital role of defense by providing an effective, realistic environment for military units to accomplish combat training and enhance their capability to perform their assigned mission. The nearby Hardwood Range, operated by Volk Field PFTS, serves to train military air crews to perform varied weapons deliveries in a controlled environment. The Wisconsin ANG assumes the responsibility of Base Manager for the operation and maintenance of the airfield, the range, personnel, and facilities; and assists units conducting training operations. Full-time preparedness to discharge these responsibilities necessitates that Volk Field PFTS be engaged in a variety of operations, some of which involve the use of toxic and hazardous materials.

In 1975, DOD began its Installation Restoration Program (IRP) to assess past activities on DOD installations related to storage and disposal of toxic and hazardous materials. DOD policy is to identify and fully evaluate suspected problems associated with sites of former hazardous materials disposal, and to control hazards to health and welfare that may have resulted from these past activities.

After the initiation of DOD's IRP, Congress created the Resource Conservation and Recovery Act (RCRA) of 1976 as the primary means for governing disposal of hazardous wastes. Under Sections 3012 and 6003 of this act, Federal agencies, such as DOD, are directed to assist the U.S. Environmental Protection Agency (EPA) and state agencies to inventory past disposal sites and to make the information available to the requesting agencies. Similarly, Congress created the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 to assess and alleviate potential adverse public health and environmental impacts resulting from past hazardous waste management practices. On August 14, 1981, in Executive Order 12316, the President delegated certain authority specified in CERCLA to the Secretary of Defense. The current DOD IRP policy is contained in DEQPPM 81-5 dated 11 December 1981. DEQPPM 81-5 reissued and amplified all previous directives and memoranda regarding the IRP.

To conduct the IRP Hazardous Materials Disposal Sites Records Search for Volk Field ANG Base, HMTC was retained on March 6, 1984, under Contract DLA900-82-C-4426, with funds provided by the ANG.

The Records Search, comprising Phase I of the DOD IRP, is intended to review installation records to identify possible hazardous waste contaminated sites and to assess the potential for contaminant migration from the installation. Phase II (not part of this contract) consists of follow-on field work recommended in Phase I. Phase II consists of a preliminary survey to confirm or rule out the presence and/or migration of contaminants and, if necessary, additional field work to determine the extent and magnitude of the contaminant migration. Phase III (not part of the contract) consists of development of any required new technology to abate unique contamination problems. Phase IV (not part of this contract) includes those efforts to evaluate alternatives for remedial actions, and any efforts required to control identified hazardous conditions.

B. Authority

The identification of hazardous material disposal sites at Air Force installations was directed by DEQPPM 81-5 dated 11 December 1981, and implemented by an Air Force message dated 21 January 1982, as a positive action to ensure compliance of Air Force installations with existing environmental regulations. The identification of hazardous material disposal sites at selected ANG bases/installations was directed by the Civil Engineering Division in a letter from the Air Directorate NGB/DE dated 18 March 1981.

p. I-3

C. Purpose

The purpose of the Phase I Records Search is to identify and evaluate suspected problems associated with past hazardous materials handling procedures, disposal sites, and spill sites on DOD facilities. The existence and potential for migration of hazardous material contaminants was evaluated at Volk Field ANG Base by reviewing existing environmental information, analyzing installation records, and conducting interviews with past and present employees at Volk Field ANG Base. Pertinent information includes the history of operations, with special emphasis on past hazardous materials management procedures; the geological and hydrogeological conditions that may facilitate migration of the suspected contaminants; and the ecological settings that indicate environmentally sensitive habitats or evidence of environmental stress.

D. Scope

The scope of this Records Search phase of the Volk Field IRP included:

- Preperformance meeting
- Onsite base visit and helicopter overflight
- Meeting with personnel from various agencies of the state of Wisconsin
- Review and analysis of all information obtained
- Preparation of report to include recommendations for further action.

The preperformance meeting was held at HMTC's office in Rockville, Maryland, on March 6, 1984. Present at this meeting were representatives of the Air National Guard Support Center (ANGSC), Volk Field ANG Base, and HMTC. The purpose of this preperformance meeting was to review the intent and requirements of the Records Search phase of the IRP, to clarify the responsibilities of the involved parties, and to exchange preliminary background data pertinent to Volk Field ANG Base.

The onsite visit and meetings with Wisconsin State Agency personnel were conducted during the period April 23-27, 1984. The titles of the government agencies are listed in Appendix A . The HMTC Records Search Team consisted of the individuals listed below. Appendix B contains the resumes of these team members:

1. Mr. Torsten Rothman, P.E., Project Manager (M.S. Environmental Health Engineering, 1969)

2. Mr. William Eaton, Hydrogeologist (M.S. Environmental Sciences, 1983)

3. Mr. Marcus Peterson, Ecologist (M.S. Water Resources Management, 1983)

Individuals from the ANG who assisted in the Volk Field ANG Base Records Search included:

1. Mr. Harold E. Lindenhofen, ANGSC, ANG Program Manager, IRP (M.S. Chemistry, 1970)

2. Major Doug Green, Volk Field ANG Base, Base Civil Engineer

E. Methodology

Figure 1 is a flow chart of the Records Search methodology utilized in the present study. Such a guideline helped to ensure a thorough and objective evaluation. The evaluation began by identifying all sites or locations on Volk Field ANG Base where hazardous materials were used. Subsequently, an evaluation of past and present operating procedures at the identified sites/locations was made to determine whether or not environmental contamination may have occurred.

Identification of hazardous materials sites/locations and evaluation of the contamination potential were facilitated by extensive interviews with past and present base employees familiar with the various operating areas of the base. Appendix C lists the identification numbers of the 18 people interviewed, their principal areas of knowledge, and their years of

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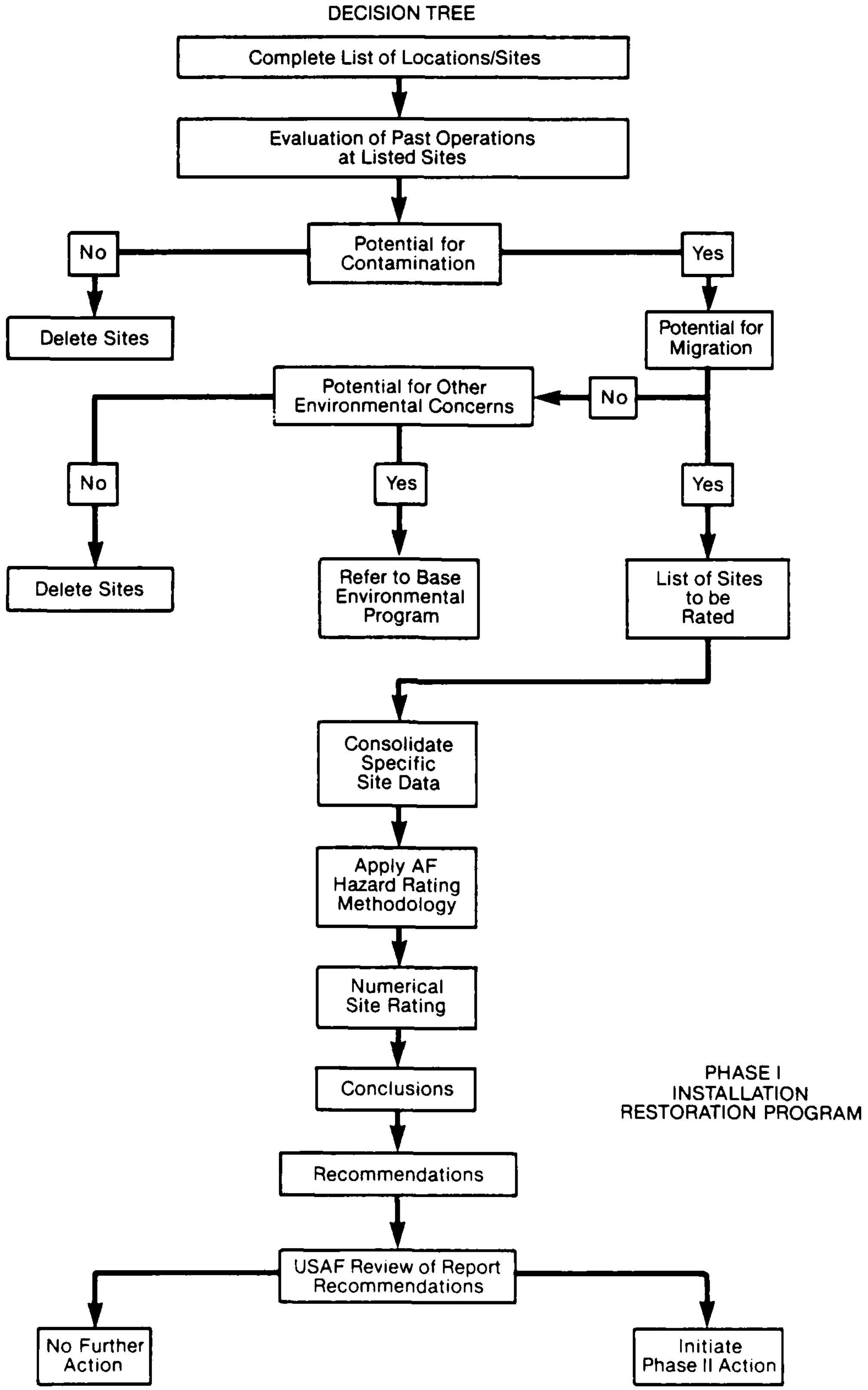
FIGURE 1.
Records Search Methodology Flow Chart.



experience at the installation. Additionally, historic blueprints of the base and available records contained in shop files and real property files were reviewed as a means to supplement information obtained from the interviews. A helicopter overflight followed by a general ground tour of identified sites was made by the Records Search Team to gather site-specific information helpful for determining the potential for contamination and contaminant migration. Such information included presence of nearby drainage ditches or surface-water bodies, and contamination or leachate migration.

If an activity was identified that indicated a potential to have contaminated the environment, then the site/location where this activity took place was evaluated to determine the potential for migration of the contaminant(s). Following the first 3 steps in Figure 1, 7 of the original 15 sites were eliminated from further consideration because, in the judgement of the investigators, these 7 sites have little or no potential for contamination, contaminant migration, or adverse environmental impacts. Those sites characterized as having the potential for contaminant(s) migration were assessed in detail, using the USAF Hazard Assessment Rating Methodology, as described in Appendix D. The site rating indicates the relative potential for environmental impact at each site. For those sites showing a significant potential, recommendations were made to confirm and quantify the potential contaminant migration problem under Phase II of the IRP.

II. INSTALLATION DESCRIPTION

A. Location

Volk Field ANG Base is located approximately 90 miles northwest of Madison, WI, in Juneau County. The village of Camp Douglas, WI, with a population of around 580, is located immediately southwest of the base. Volk Field consists of approximately 2,500 acres at a mean elevation of 905 feet above sea level, with the airfield at approximately 43° 56' N latitude and 90° 16' W longitude.

Hardwood Range is located approximately 25 miles northeast of Volk Field near the town of Finley in northeastern Juneau County. Hardwood Range consists of 7,680 acres at an elevation of 960 feet, and is situated at approximately 44° 14' N latitude and 90° 1' W longitude.

A regional locator map that indicates the location of Volk Field ANG Base and Hardwood Range within Juneau County is presented in Figure 2. Figure 3 is a vicinity map for both installations. Figures 4 and 5 respectively, are site maps of Volk Field and Hardwood Range. Figure 5 illustrates only the western portion of Hardwood Range because this is where the operations associated with hazardous materials utilization/disposal take place.

B. Organization and History

The origins of Volk Field ANG Base date back to 1886 when a site north of Camp Douglas was purchased by the Adjutant General of Wisconsin to train units of the Wisconsin National Guard. The land was officially purchased by the state in 1889, and a rifle range was built there in 1896 shortly after incorporation of the village of Camp Douglas. The state expanded its land holdings at the site over the next few decades as the size of the annual guard encampments grew. The base, then called Camp Douglas, was formally named Camp Williams in 1926.

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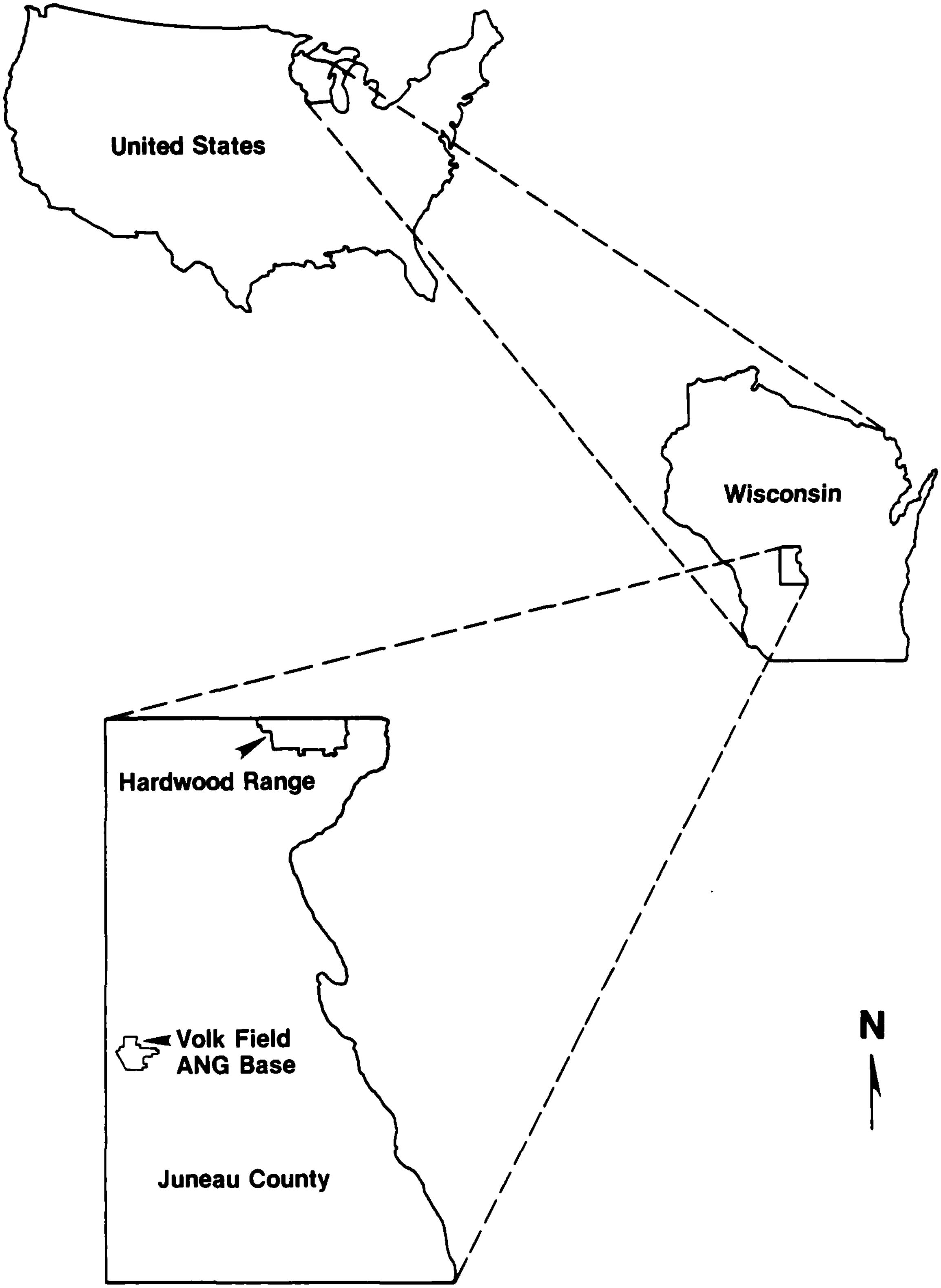
Figure 2.

Location of Volk Field ANG Base and Hardwood Range Within Juneau County, Wisconsin.



Not to Scale

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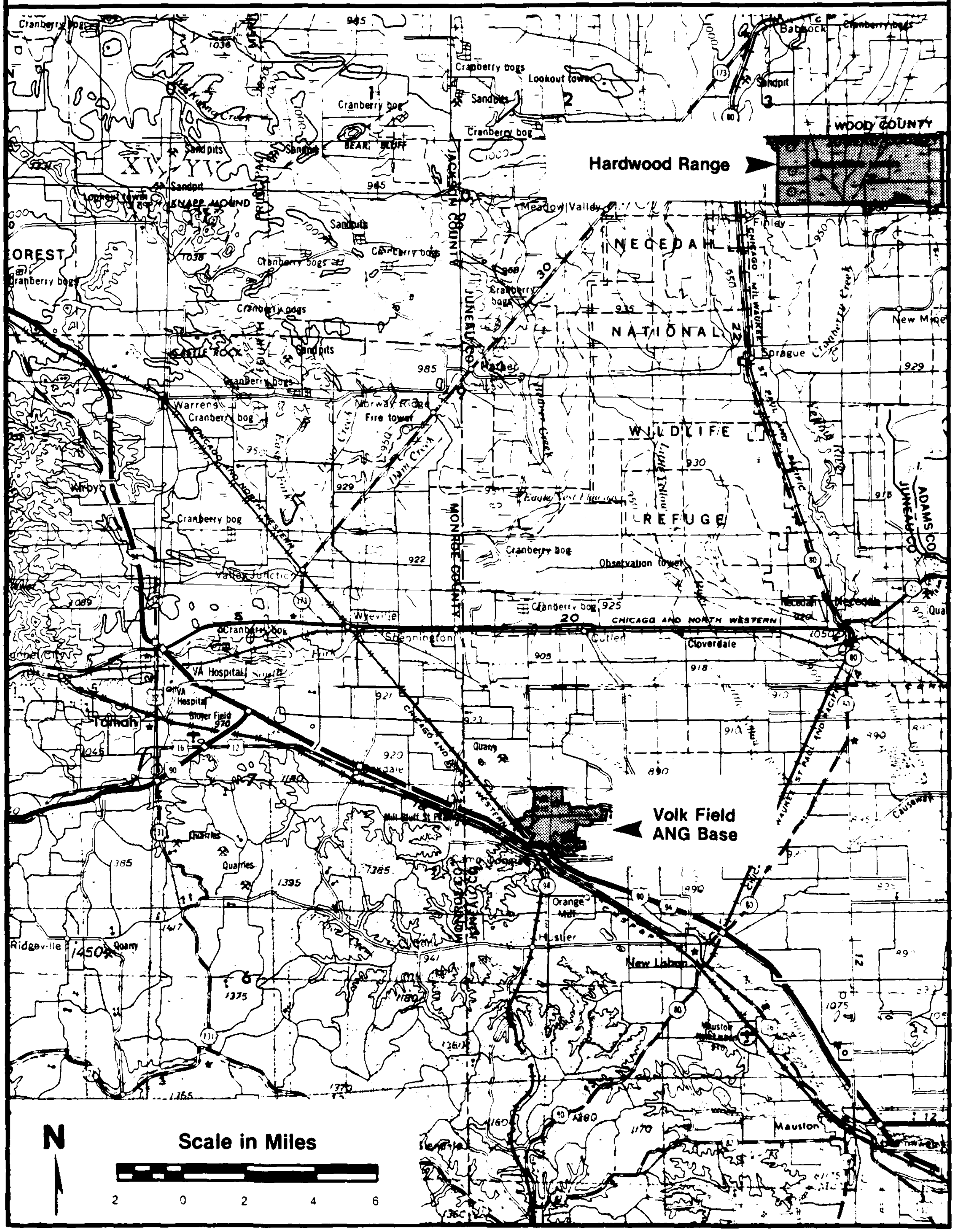
Figure 3.
Vicinity Map of Volk Field ANG Base and Hardwood Range.



Source: United States Geological Survey (U.S.G.S.)

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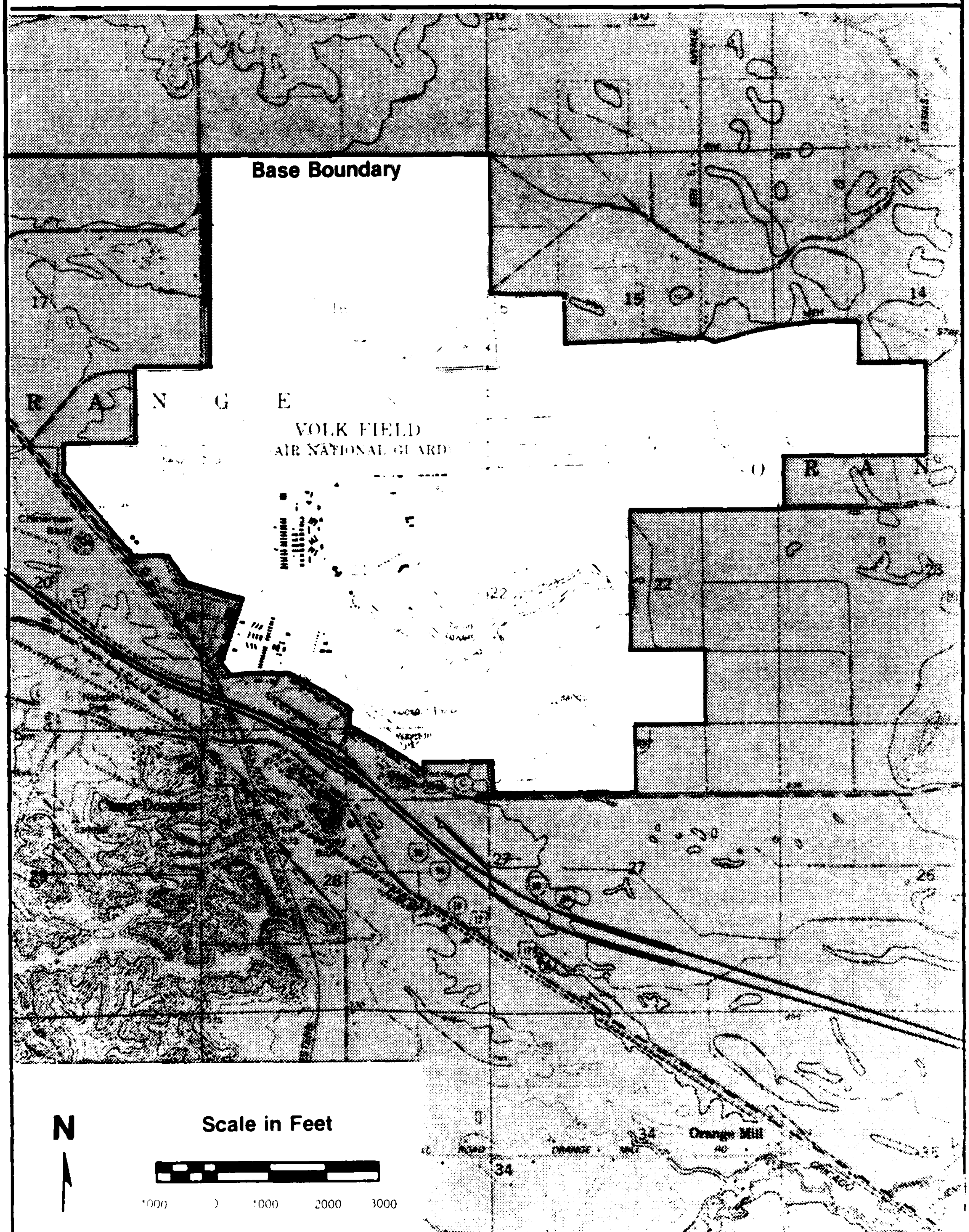
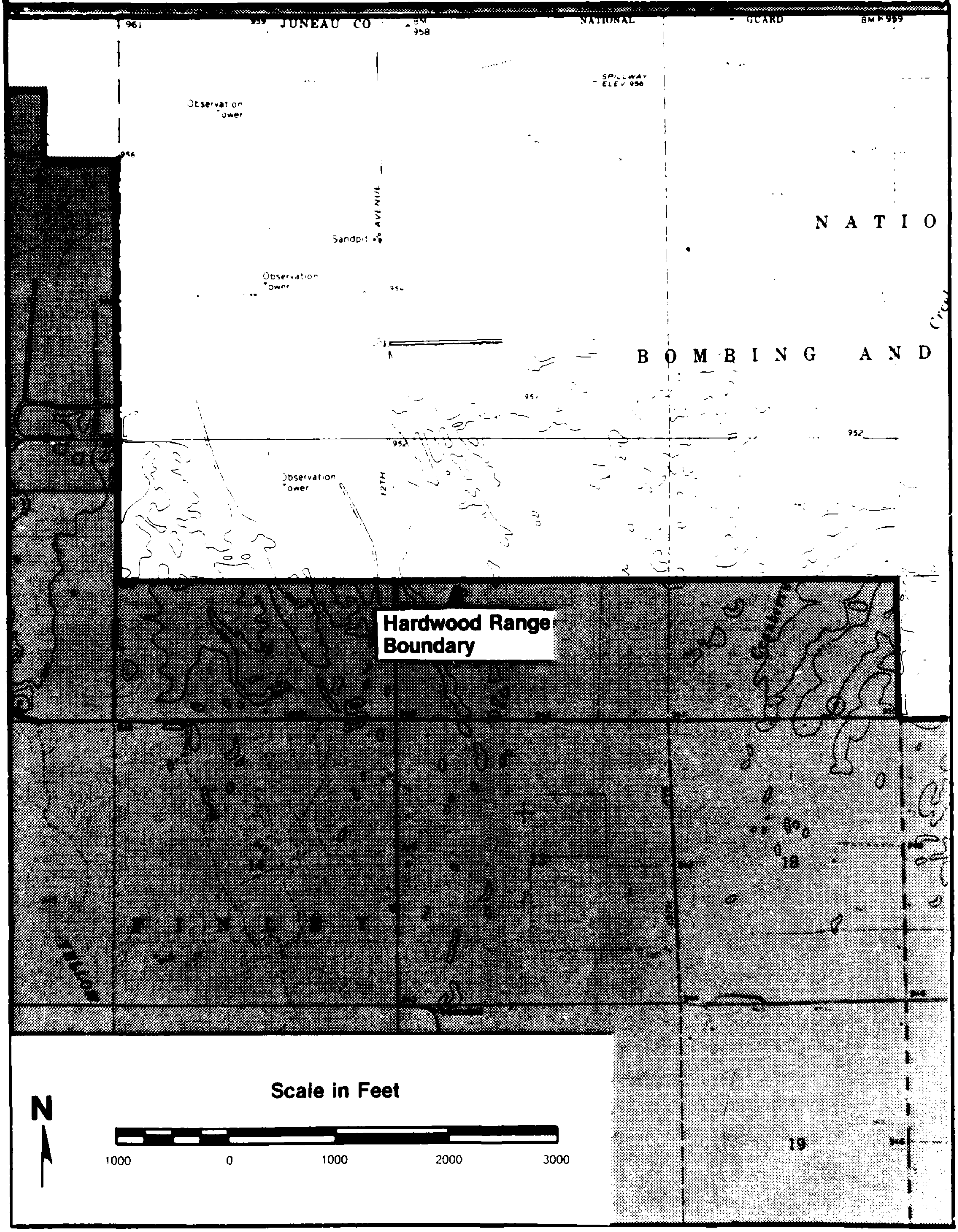
Figure 4.
Site Map of Volk Field ANG Base.



Source: U.S.G.S.

Figure 5.
Site Map of Hardwood Range.



Source: U.S.G.S.

Activities at Camp Williams continued to expand during the 1930s when surfaced runways and maintenance facilities were built to accommodate passenger and military aircraft. Immediately before WW II, the runways, aprons and shops were improved extensively. Structures for housing and training were constructed through the Works Progress Administration (WPA). Camp Williams was leased to the Federal government in June 1943 and returned to the state in December 1944. Army Air Corps personnel trained with B-26s and C-47s during this period.

The Wisconsin National Guard was reorganized following WW II, and in 1947 the Army Guard units began training at nearby Camp McCoy (now Fort McCoy) while Air Guard units from Madison and Milwaukee began training at Camp Williams. An air-to-air gunnery range was designated over Lake Michigan and first used by training units in 1949. Air Guard units from other states began summer training at Camp Williams in 1950. Aircraft employed from WW II to the mid-1950's were typically P-51s and B-27s.

Activities at Camp Williams decreased substantially during the Korean conflict. Following a general Air National Guard reorganization in 1953, Camp Williams was designated one of eight permanent training sites and the airfield complex was leased by the Federal government in 1954. Facilities at Camp Williams were further upgraded and the air-to-ground gunnery range, now known as Hardwood Range, was acquired. In 1955, flying training was first conducted with jet aircraft, including F-84s, F-89s and F-94Cs. In 1957, the Wisconsin Legislature officially changed the name of the Field Training Site to Volk Field in honor of 1st Lt. Jerome Volk, the first Wisconsin pilot shot down in the Korean conflict.

Volk Field was used extensively during the 1960s by jet fighter units for annual field training and weekend deployments. Jet aircraft of this period included the earlier types as well as F-86Hs, F-100s, F-102s, C-123s and C-124s. Major improvements during this period included the installation of ILS, TACAN, and VOR navigational aids. DOD has since reduced the number of ANG Field Training Sites from eight to four, and utilization for tactical air-to-ground training has significantly increased at Volk Field. In 1965, the base supported an Air Defense Command Dispersal Operating Base Mission. This mission was terminated in 1974. Typical aircraft used for training during these years at Volk Field included the KC-97 aerial tanker, A-7s, F-4s, and C-130s. Visiting aircraft since that time include the KC-135 tanker, C-141s, A-10s, OA-37s, A-4s, F-111s, F-14s, F-15s, and F-16s.

Volk Field has since operated as the 8204th FTS of the ANG. Hardwood Range continues to be used extensively by units operating from Volk Field. In 1981, a new lease between the Federal government and the state of Wisconsin was accomplished with a 50-year renewable term.

Today, the airfield complex at Volk Field consists of one active and two inactive runways. The active main runway, with full navigational aids and arresting gear systems, measures 9,000 feet in length; the inactive runways are 4,483 feet, and 1,960 feet in length. There is no operational airfield at Hardwood Range. The existing structures at Volk Field and Hardwood Range used for operations and maintenance are fully occupied and in use. Volk Field also has a base exchange, limited base housing, and messing and billeting facilities for up to 1433 people.

Located adjacent to the southwest boundary of Volk Field FTS is the present Camp Williams. This is the site of the Wisconsin ARNG State Maintenance Office, which provides equipment and vehicle maintenance for 11 battalion-sized units and 98 company/battery/detachment-sized units. Camp Williams also houses the United States Property and Fiscal Office of the Wisconsin National Guard. The nearest major military installation to Volk Field is Fort McCoy, a U.S. Army base located approximately 25 miles to the west. Active units of the Wisconsin ANG are based at nearby Truax Field in Madison, WI, and at General Mitchell Field in Milwaukee, WI.

C. Mission

Volk Field ANG Base is one of four Field Training Sites operated by the ANG in the continental U.S. Open 12 months a year, the mission of the Volk Field ANG Base is to provide an effective, realistic environment for military units to accomplish combat training and enhance their capability toperform their assigned mission. The 8204th Field Training Site Detachment is responsible for operating and maintaining the airfield, personnel, and facilities, and for providing assistance to units conducting training operations.

Training facilities at Volk Field include a high, heavily wooded bluff for tactical radar control operations, map reading exercises, and survival training. There is a personnel training complex which includes an obstacle course and a quarter-mile cinder track; this area is also used as a helicopter medivac site. The north side of the base is a low, flat semi-marshy area used for airlift operations from personnel airlifts to heavy drop exercises. There is also a fenced, limited-access area with eight aircraft alert barns located off the south side of the taxiway, which is segregated from the main operations area and used as a dispersal area for combat scenarios.

Nearby Hardwood Range is a "Class A" Air-to-Surface Scorable Range operated by the Volk Field FTS. The purpose of the range is to provide for the air-to-ground training and skip bombing, and the testing of airborne operational weapons systems. Other training areas available for visiting units at Volk Field include:

- Air-to-Air Restricted Firing Area over Lake Michigan, which provides subsonic and supersonic air-to-air training from the surface to 45,000 feet;
- Air-to-Ground Tactical Range at Fort McCoy, which features air-to-ground training on tactical targets, as well as low-altitude/high-speed military training routes;

- Air-to-Air Refueling Anchor Area, which allows air-to-air refueling training; and

- Fort McCoy, which provides close air support and joint exercise training and readiness for Army and Air Active Reserve and National Guard units

Several Wisconsin ANG units train at Volk Field on a routine basis. The 128th TAC Fighter Wing from Madison flies A-10 aircraft in close air support mission. The 128th Air Refueling Group from Milwaukee conducts air-to-air refueling training with KC-135 aircraft, while the 128th TAC Control Flight Group from Milwaukee is a forward air control unit capable of providing radar control for air-to-air refueling, air-to-air intercept, and close air support. The 440th TAC Airlift Wing of the Air Force Reserve at General Mitchell Field, Milwaukee, provides airlift support training using C-130 aircraft. Units from other states visiting Volk Field typically train with A-7, A-10, and F-4 aircraft.

A new mission was brought to Volk Field ANG Base in 1983 when it hosted and sponsored a Composite Force Training exercise with units from Active Guard and Reserve Air, Army, and Marine organizations. The exercise provided realistic training based on a European co-located operating base concept. Participating aircraft types included A-4, A-7, A-10, C-130, F-4, F-15, F-16, KC-135, and OA-37s.

III. ENVIRONMENTAL SETTINGS

A. Meteorology

The climate in the area of Volk Field ANG Base is generally classified as having wide and frequent variations in temperature. The data in Table 1 (National Oceanic and Atmospheric Administration, 1979) are the official records from the La Crosse Municipal Airport, located approximately 50 miles west of Volk Field ANG Base. Although this data summary is only through the year 1975, more recent data is expected to follow the indicated trends. The data in this table indicate that winters are cold and humid, and summers are warm with moderate humidities. Occasionally during summer there are periods of hot and humid weather which last from a few days to a week in length. The maximum and minimum daily temperatures, averaged for all days on record (1941 to 1970), are 55.9° and 36.9°, respectively. The first occurrence of a freezing temperature (32°) occurs on October 16, on the average. The last occurrence of 32° averages April 25. The highest temperature ever recorded was 103°F in August, 1955. The lowest recorded temperature was -37°F in January, 1951.

Precipitation averages 29.08 inches per year. Sixty percent of this precipitation occurs as rain during the period from May through September. The annual precipitation is ample, since 60 percent of it falls during the main growing season extending from May through September. Most of the summer rainfall comes during thunderstorms, which are spaced erratically. Some damage from heavy rains, high winds, and hail occurs each year, but tornadoes are infrequent and cover very small areas. Tornado frequency is highest in June and July. Snow is frequent and is the predominant form of precipitation in winter. Heavy snow sometimes falls with larger amounts over the ridges. Glaze storms are not numerous since this area is north of the main path of freezing rain.

The prevailing winds in the area of Volk Field ANG Base are from the northwest during February, March, and April, and are from the south at most other times. Monthly average wind speeds normally exceed 7 mph but rarely exceed 10 mph.

Table 1.
Summary of the Meteorological Data For West Central Wisconsin.

Table 1.

	Temperature °F Normal: Daily Maximum	Temperature °F Normal: Daily Minimum	Temperature °F Normal: Monthly Average	Precipitation (inches) Water equivalent: Normal	Maximum monthly	Year of occurence	Minimum Monthly	Year of occurence	Maximum in 24 hrs.	Year of occurence (b)	Snow, Ice pellets: Maximum monthly	Year of occurence	Maximum in 24 hrs. (b)	Year of occurence	Relative humidity (pct): Hour of occurence	Hour of occurence	Hour of occurence	Hour of occurence	Wind: Mean Speed (m.p.h.)	Prevailing direction	Fastest observed (b): Speed (m.p.h.)	Direction (bearing)	Year	Mean number of days: Precipitation: .01 inch or more	Snow, Ice pellets: 1.0 inch or more	Thunderstorms	Heavy fog, visibility 1/4 mile or less	Temperature °F Max.: 90° and above	Max.: 32° and below	Min.: 32° and below	Min.: 0° and below
(a)					29		29		18		29		18		20	27	27	27	29	13	18	18		29	29	29	29	29	29	29	29
J	25.0	7.1	16.1	0.96	2.86	1967	0.19	1962	1.31	1967	29.7	1979	8.7	1963	75	76	66	70	8.6	S	45	32	1962	8	3	*	1	0	23	31	13
F	29.1	10.3	20.0	0.87	2.58	1959	0.05	1969	1.06	1969	31.0	1959	10.9	1959	77	78	64	67	3.5	NW	37	34	1963	7	2	*	2	0	16	28	7
M	40.0	22.1	31.1	2.02	3.82	1951	0.30	1978	1.64	1966	33.5	1959	15.7	1959	78	81	62	64	9.2	NW	40	34	1960	10	3	1	2	0	7	26	1
A	57.8	37.4	47.6	2.63	7.31	1973	0.60	1966	3.84	1954	17.0	1973	7.3	1952	75	79	53	54	0.4	NW	53	25	1964	10	*	3	1	*	*	10	0
M	69.3	48.7	59.0	3.70	8.83	1960	1.07	1958	2.72	1960	0.8	1960	0.8	1960	76	80	53	54	9.6	S	58	09	1952	12	0	6	1	1	0	1	0
J	78.4	58.5	68.5	4.44	9.53	1968	1.58	1979	3.94	1967	0.0		0.0		83	45	56	57	8.3	S	63	34	1963	11	0	6	1	3	0	0	0
J	83.0	63.5	72.8	3.52	9.57	1978	0.16	1967	3.72	1952	0.0		0.0		80	87	57	57	7.6	S	52	27	1961	10	0	7	2	6	0	0	0
A	81.7	61.0	71.4	2.02	8.63	1973	0.54	1976	3.92	1962	0.0		0.0		88	90	59	60	7.4	S	63	12	1963	9	0	7	4	4	0	0	0
S	71.8	51.8	61.8	3.38	10.52	1965	0.42	1952	2.25	1968	T	1974	T	1965	87	90	61	65	8.2	S	40	27	1961	9	0	4	4	1	0	*	0
O	61.8	41.7	51.8	2.05	4.47	1954	0.02	1952	2.17	1966	1.4	1959	1.2	1959	78	84	58	63	9.2	S	39	34	1964	8	*	2	2	*	0	6	0
N	43.0	27.8	35.4	1.05	3.07	1975	T	1976	2.38	1958	13.0	1957	11.0	1957	80	82	66	71	9.7	S	46	18	1958	8	1	1	1	0	5	21	*
D	29.6	14.0	21.8	1.04	2.55	1971	0.30	1962	0.93	1965	26.6	1968	9.1	1966	79	81	71	75	8.7	S	43	34	1957	9	3	*	1	0	18	29	6
YR	55.9	36.9	46.4	29.08	10.52	SEP 1965	T	NOV 1976	3.94	JUN 1967	33.5	MAR 1959	15.7	MAR 1959	80	83	60	[illegible]	8.8	S	63	32	AUG 1963	111	13	40	21	16	71		27

Source : Local Climatological Data, LaCrosse Municipal Airport Meteorology Office, Wisconsin, Revised Data Through 1975.
Means and extremes From existing and comparable exposures.
Normals Based on the record for the interval 1941 1970.

(a) Length of record, years, through the current year unless otherwise noted, base on January data
(b) Through September 1968
* Less than one half
T Trace

B. Geology

1. Regional Geology

Volk Field ANG Base and Hardwood Range are situated within the Central Lowlands Physiographic Province of the United States. The geologic processes responsible for the formation of the rock units which comprise the Central Lowlands began during the Cambrian Period (600 million years ago). During the Cambrian Period differential uplift and subsidence occurred throughout Wisconsin and much of the North American Continent, thus causing the areas which subsided to become inundated by encroaching seas and the uplifted portions to undergo erosion. The uplifted areas were primarily composed of granite and undifferentiated igneous and metamorphic rocks, the geologic histories of which are uncertain due to the fact that many of these rocks were formed over 2.4 billion years ago.

Northcentral Wisconsin was part of the uplifted area which has since been termed the Wisconsin Arch. Along the flanks of this arch, ancient seas deposited sediments such as are currently being deposited along the continental margins of the United States. Subsequent lithofication (process of turning sediment into rock) created sandstone out of the ancient beach and shallow offshore sand deposits. Some of these sandstone units are called the Wonewoc Formation and are presently exposed in the bluffs at Volk Field ANG Base and in the incised valleys south of Volk Field ANG Base called the Wisconsin Dells.

The process which exposed the Wonewoc Formation was a final period of uplift along the Wisconsin Arch which occurred during the Permian Period (250 million years ago), thus initiating a long period of erosion which continues today. Beginning approximately 50 miles north of Volk Field ANG Base, this erosion has exposed the Precambrian-aged core of the Wisconsin Arch. Figure 6 is a generalized geologic map of Wisconsin which illustrates the location of the Precambrian rocks relative to the younger sedimentary rocks which overly this Precambrian material. Also in Figure 6 is a diagram

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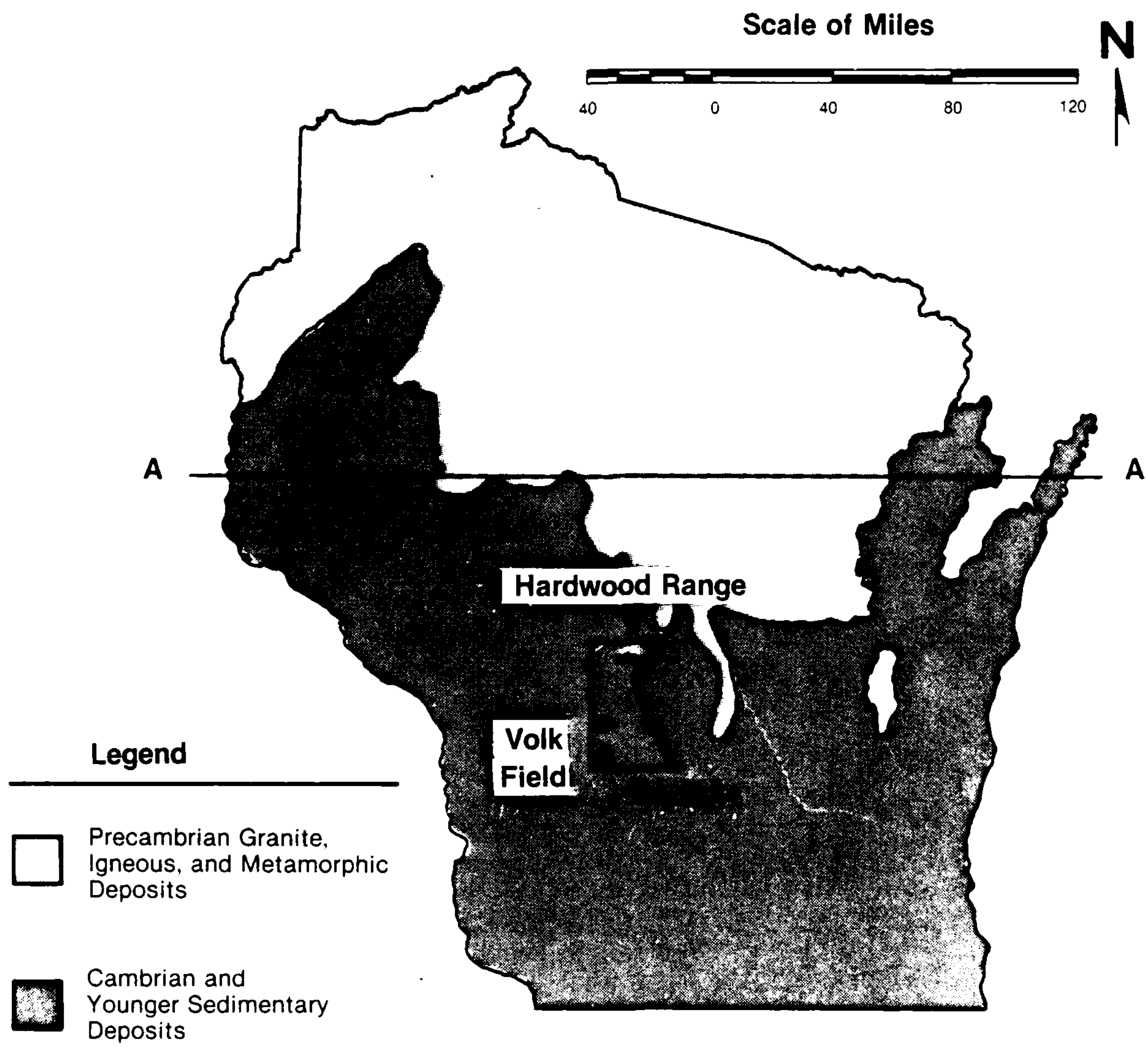
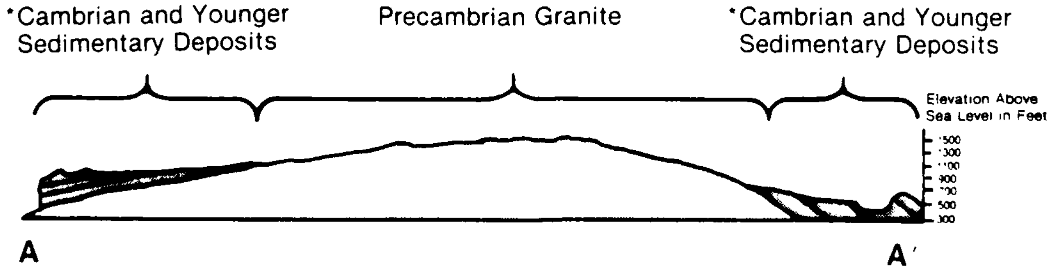
Figure 6.
Generalized Geologic Map and Geologic Cross-section of Wisconsin.





*Subdivisions denote orientations of bedding planes, only.

After Bean, 1949

of an east-west oriented geologic cross-section which illustrates the domed structure of the Wisconsin Arch and the position of the younger sedimentary rocks (including the Wonewoc) along the flanks of the Precambrian dome structure.

2. Local Geology

The geologic formations that directly underlie Volk Field ANG Base and Hardwood Range are predominately fine to coarse-grained sandstone with interbedded shale and overlying unconsolidated sand, silt, and minor amounts of clay, as described in Table 2. The unconsolidated deposits vary in thickness from less than 40 feet in the vicinity of Volk Field ANG Base, up to 100 to 150 feet in the vicinity of Hardwood Range. These deposits resulted from glaciers which developed during the Pleistocene Epoch (two million years ago). Although neither Volk Field ANG Base nor Hardwood Range were directly covered by glaciers, they were located close enough to ice masses situated to the north and east so that their landscapes were significantly affected by ice-related geologic deposits. When the glaciers began to retreat due to melting, large inland lakes were formed near the perimeters of the receding glaciers. Within these lakes sand, silt, and clay were deposited from streams and rivers carrying melt water and sediment. Figure 7 illustrates the boundaries of the major glaciers relative to the present study areas, and the locations of glacial lake sediments. The glacial lake sediments at Volk Field ANG Base and Hardwood Range were deposited within a 1,800 square mile Pleistocene lake presently referred to as Lake Wisconsin. Because Volk Field ANG Base is near the western boundary of this ancient lake, the unconsolidated sediments here are not as thick as at Hardwood Range, whose position is more centrally located within the ancient Lake Wisconsin.

According to the only available soil survey for Juneau County (Geib, et.al., 1913), the soil types of Juneau County can generally be classified into two main types. They are the heavier, loamy soils indicative of the hilly lower third of Juneau County, and those of the level upper two-thirds

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Table 2.
Descriptions of the Geological Formations in the Immediate Vicinity of Volk Field ANG Base and Hardwood Range.

SYSTEMS	FORMATION	AGE (Millions of Years)	THICKNESS (Feet)	DESCRIPTION
Quaternary	Pleistocene Deposits	2	8-150	- Unconsolidated sand and gravel deposits with interbedded silt and clay layers. - Peat and muck are commonly present at the surface in areas of poor drainage. - Yields small to large volumes of groundwater from the sand and gravel zones.
Cambrian	Wonewoc Sandstone	580	100-400	- Relatively thick, well-sorted quartz sandstone. Resistent to erosion and, therefore, forms the cap rock to bluffs in the vicinity of Volk Field ANG Base.
	Eau Claire and Mt. Simon Sandstone	600	290	- Fine to coarse grained sandstone with interbedded shale. - Both formations are below the groundwater table in the vicinity of Volk Field ANG Base and, therefore yield small to large volumes of water depending on the secondary porosity.

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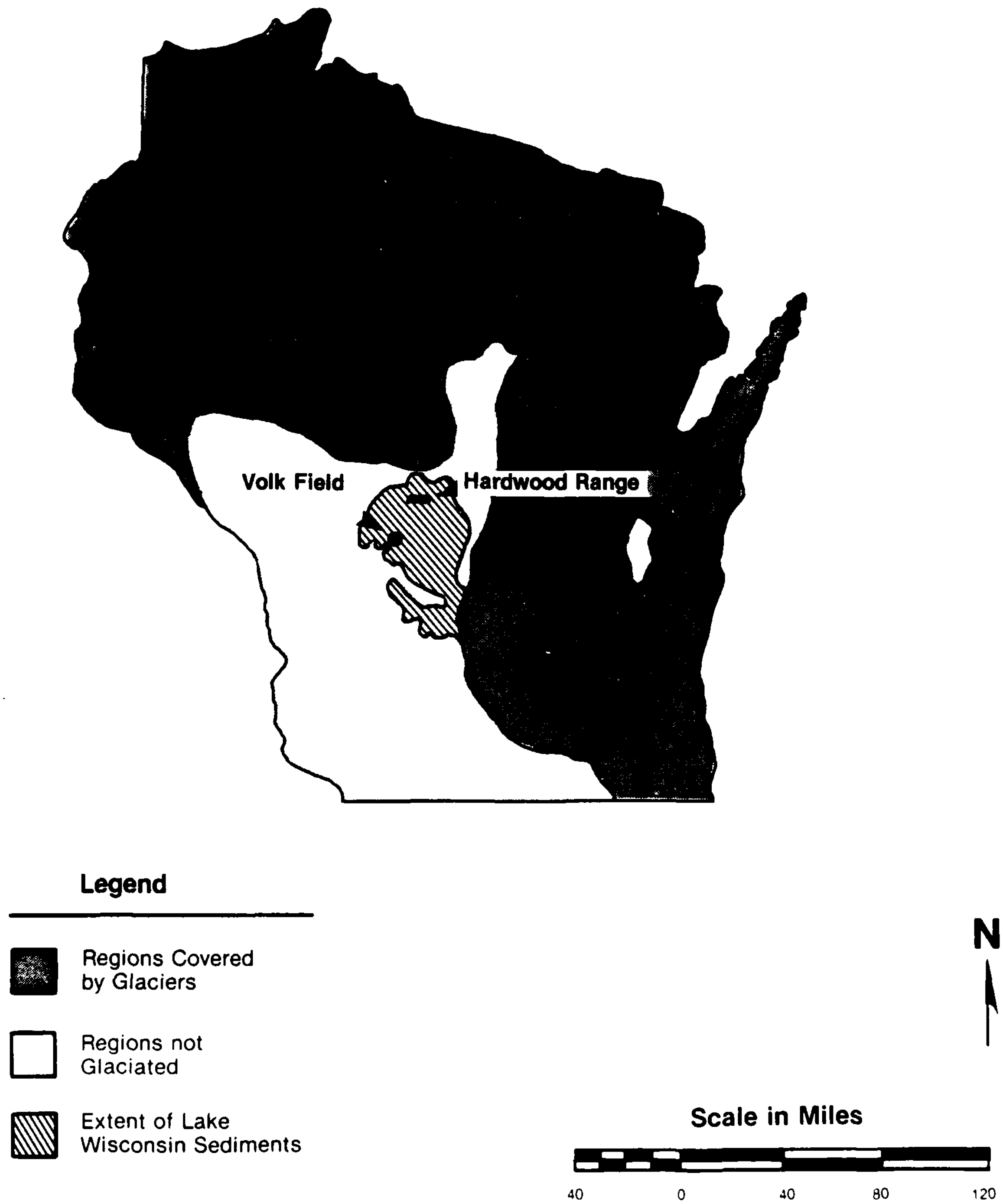
Figure 7.

Limits of Glacial Ice and Lake Wisconsin Sediments.



From Paull, 1977

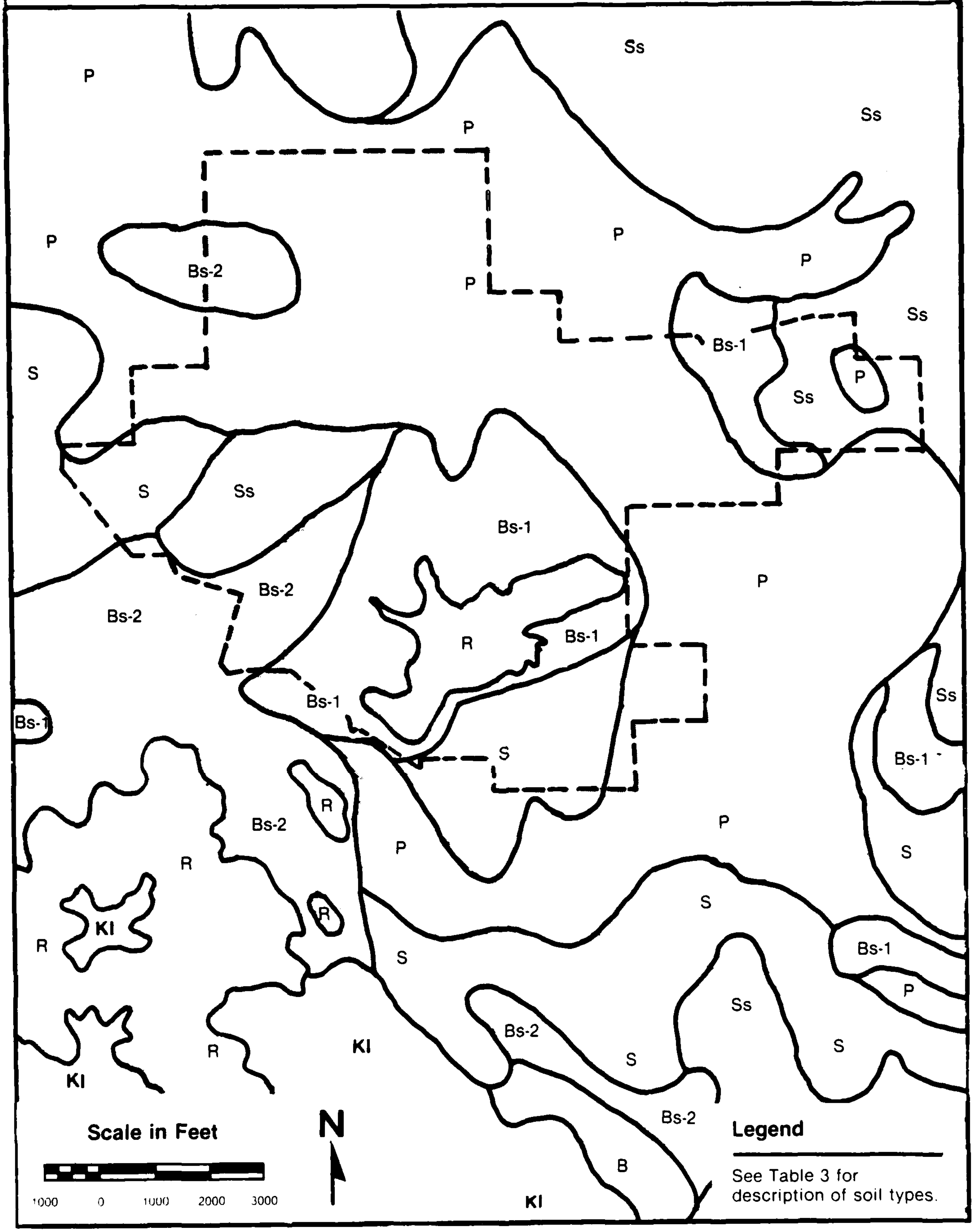
of the county which are generally characterized as marshy, sandy soils. Specifically, the primary soils at Volk Field ANG Base and Hardwood Range belong to the second major soil type. At these locations, Geib has further subdivided this broad soil type into six more specific soil types. These are rough stony land, loamy phase of the Boone fine sand, low phase of the Boone fine sand, superior sand, undifferentiated sands and peat, and undifferentiated peat and "muck."

Figure 8 illustrates the locations of these soil types at Volk Field ANG Base. A similar illustration for Hardwood Range is not presented because over 95 percent of the soils at this location are undifferentiated sands and peat. From the aforementioned six specific soil types, four are most significant with regard to the total areas they encompass at Volk Field ANG Base and Hardwood Range. The descriptions of these are from Geib, and are presented below.

The loamy and low phases of the Boone fine sand encompass the major portion of Volk Field ANG Base. The surface soil of the Boone fine sand, loamy phase, to an average depth of 8 inches, consists of a gray or light-brown fine sand, which contains sufficient finer material and organic matter to make it slightly loamy. It is loose and open in structure and is blown by the wind, though to a somewhat lesser extent than is the low phase of this type. The subsoil to a depth of over 3 feet consists of a loose and incoherent yellow fine sand. There is no gravel in the subsoil and the amount of material finer than fine and very fine sand is extremely small. Where the sand is blown into ridges the soil is almost entirely lacking in organic matter and the type is very similar to the fine sand. Along the Lemonweir River there are level areas, slightly above the flood plain, in need of drainage and having a higher organic content than usual. The subsoil in such places is sometimes a white fine sand.

The surface soil of the Boone fine sand, low phase, consists of a yellowish-brown or gray, loose, incoherent fine sand, with an average depth of 6 inches, and containing a small amount of organic matter in the first

Figure 8.
Map of Soils at Volk Field ANG Base.



Source: U.S.D.A. Soil Conservation Service and U.S.G.S.

inch of virgin soil. In cultivated fields the organic matter has usually disappeared. Being fine and loose, the surface soil is frequently blown into low dunes by the wind. The subsoil consists of a yellow, loose, incoherent fine sand, extending to a depth of over 3 feet and seldom containing any trace of silt or clay. The soils on and at the base of the sandstone buttes at Volk Field ANG Base are classified as rough stony land. Commonly this soil type is thin, low in organic matter, and contains medium to large rock fragments derived from the nearby buttes.

As previously indicated, the soils at Hardwood Range are predominately undifferentiated sands and peat. The material mapped as undifferentiated sands and peat is subject to wide variation, but generally consists of shallow peat and black sand in a low, marshy condition, with numerous small islands of light colored sand occurring throughout its entire extent. At the time of the Geib publication, none of these variations were considered to be of sufficient extent to be mapped as separate soil types. Peat consists of vegetable matter in various stages of decomposition, with which there is incorporated varying amounts of mineral matter. It extends to a depth of 1 to 20 inches and in a few instances to 30 inches. The underlying material consists of fine or medium sand, usually white, though it is frequently stained with iron or slightly mottled. The sand on the islands is usually identical with the low phase of the Boone fine sand, though in some sections it is coarser. The islands range in size from a fraction of an acre to about 5 acres, and in elevation from 1 to 2 feet above the level of the marsh. In a few places, where ridges occur, an elevation of 20 feet is attained. Black sand is often found surrounding the islands, usually as a narrow belt, while the peat occupies the larger spaces between the islands. Where the islands are close together there may be no peat between them. The islands occupy from 25 to 75 per cent of the total area, but taken as a whole the type will average about 50 percent sand islands and 50 percent marsh.

Table 3 summarizes important physical and chemical properties such as permeability, potential for erosion, and hydrologic classifications of the

Table 3.
Properties of The Soils Present at Volk Field ANG Base.

Soil Classification	Map Symbol	Erosion Factor	Hydrologic Group	Permeability (cm/sec)
Boone Low Phase	BS-1	Moderate	A	4.23×10^{-3} to 1.41×10^{-2}
Boone Loamy Phase	BS-2	Moderate	A	4.23×10^{-3} to 1.41×10^{-2}
Undifferentiated Sands & Peat	S	Slight	C	1.41×10^{-3} to 4.23×10^{-3}
Undifferentiated Peat and Muck	P	*-------	---	-------------------------
Superior Sand	Ss	--------	---	-------------------------
Rough Stony Land	R	--------	---	-------------------------
Boone Fine Sandy Loam	B	--------	---	-------------------------
Knox Silt Loam	Kl	--------	---	-------------------------

* Not determinable by cross-reference with the Soil Survey for Adams County Wisconsin.

soil types which represent a majority of the present study areas. It must be noted, however, that values for these parameters have been inferred for the present soil types on the basis of recent soil data for Adams County, which is immediately east of Juneau County. This inference was necessary because at the time of publication of the Juneau County Soil Survey, these parameters were not considered for any of the mapped soil types and, therefore, are not discussed in the Juneau County Soil Survey dated 1913. This inference is possible because two soil surveys for Adams County have been published, the first dated 1924 and the most recent dated 1980. The first uses soil mapping terminology (i.e., rough stony land) comparable to the Juneau County Soil Survey. The most recent Adams County Soil Survey updates much of the older terminology and applies the physical and chemical parameters mentioned above. Therefore, cross-reference of the old parameterless soil names for Juneau County with the new soil names and parameter values described for Adams County is possible.

With regard to Table 3, permeability is estimated on the basis of known relationships among the soil characteristics observed in the field -- particularly soil structure, porosity, and gradation or texture -- that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor is a measure of the susceptibility of the soil to erosion by water. Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms. The four hydrologic soil groups are:

- Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

- <u>Group B</u>. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

- <u>Group C</u>. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

- <u>Group D</u>. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a permanent high-water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

C. Hydrology

1. Surface Water

Volk Field ANG Base is located within the drainage basins of the Lemonweir and Little Lemonweir Rivers. As illustrated in Figure 9 the Lemonweir River generally flows from northwest to southeast and, at it closest location, is approximately 3,700 feet northeast of the base boundary. The Little Lemonweir River is approximately 1.5 miles south of the base boundary and flows from west to east. It joins the Lemonweir River 4.5 miles southeast of Volk Field ANG Base, at the town of New Lisbon. Both New Lisbon and Mauston are the only major communities on the Lemonweir River and downstream of the base. However, neither of these towns utilizes surface water for municipal drinking water supplies. The only communities in Wisconsin which do utilize surface water for this purpose are the large industrial cities along the Great Lakes. Figure 10 illustrates the directions of surface runoff at Volk Field. Runoff is facilitated by a system of drainage ditches and is generally toward the south and east, away from the adjacent town of Camp Douglas.

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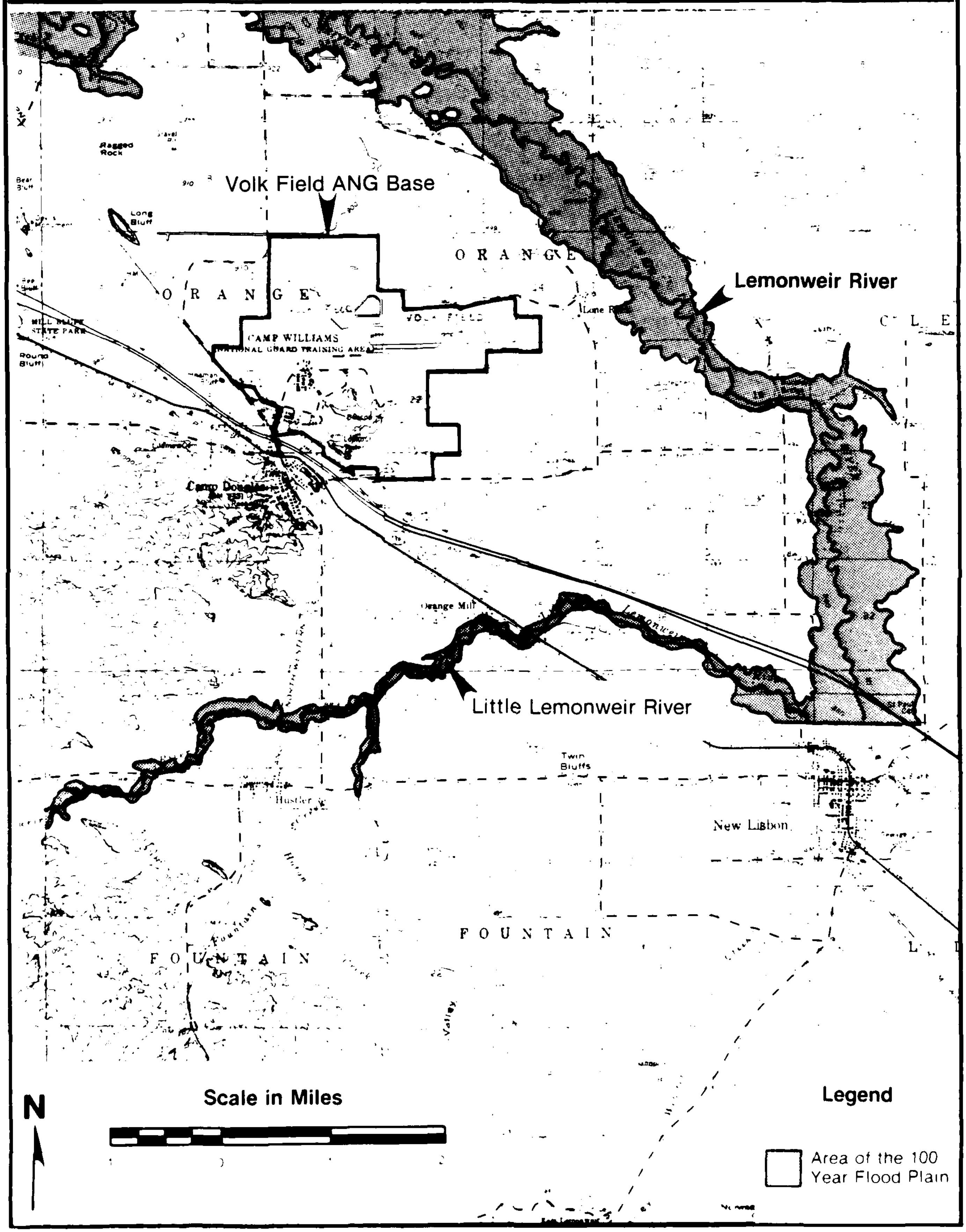
Figure 9.
Position of the Lemonweir and Little Lemonweir Rivers and Extent of the 100-Year Flood Plain.



Source: U.S.G.S., Federal Emergency Management Agency

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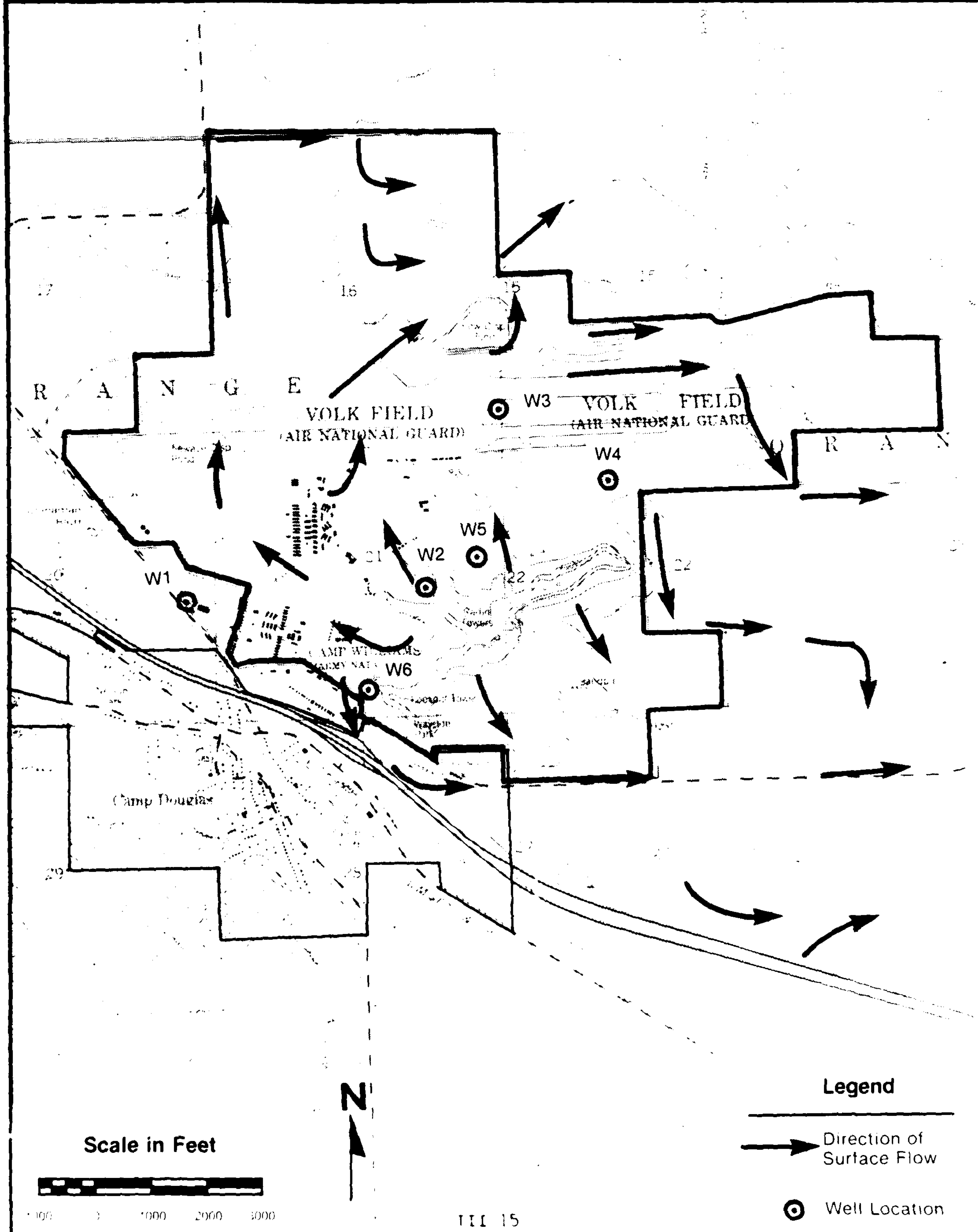
Figure 10.
Directions of Surface Drainage at Volk Field ANG Base and Locations of Groundwater Wells.



Hardwood Range is within the drainage basin of the Yellow River which joins the Wisconsin River approximately 25 miles south of Hardwood Range. Locally, Cranberry Creek carries surface runoff from the range. Necedah is the only town downstream from Hardwood Range, 13 miles south and along the Yellow River. Figure 11 illustrates the directions of surface drainage at Hardwood Range, as determined by field reconnaissance of the range and interpretation of topographic maps.

Much of the land at Hardwood Range and the land north and east of Volk Field ANG Base is poorly drained, thus resulting in natural wetlands. The drainage is poor because the unconsolidated sediments associated with past glaciation are very young, geologically, so that adequate surface drainage systems have not developed. The wetlands which result are classified into two main types (Novitzki, 1982). They are those which result from intersection of the groundwater table with the earth's surface, and those which result from ponding of surface water on top of relatively impermeable silt and clay lenses. Without detailed investigation of individual wetland areas, it is difficult to ascertain which of the above origins apply.

2. Groundwater

Groundwater is a very important resource throughout Wisconsin. As previously indicated, all domestic and industrial water demand is supplied by groundwater, except for the large industrial cities along the Great Lakes. In the vicinity of Volk Field ANG Base the major aquifers are the unconsolidated Pleistocene-aged sand and gravel deposits and the underlying Cambrian-aged sandstones. At Hardwood Range, almost all groundwater is derived from the unconsolidated sands and gravels because they have a large total thickness from 100 to 150 feet. The locations of the groundwater wells at Hardwood Range are illustrated in Figure 11. Both wells at Hardwood Range are immediately adjacent to each other. Well W1 is used for drinking water and well W2 is an emergency water supply for fighting fires. A portion of the groundwater used at Volk Field is also supplied by these

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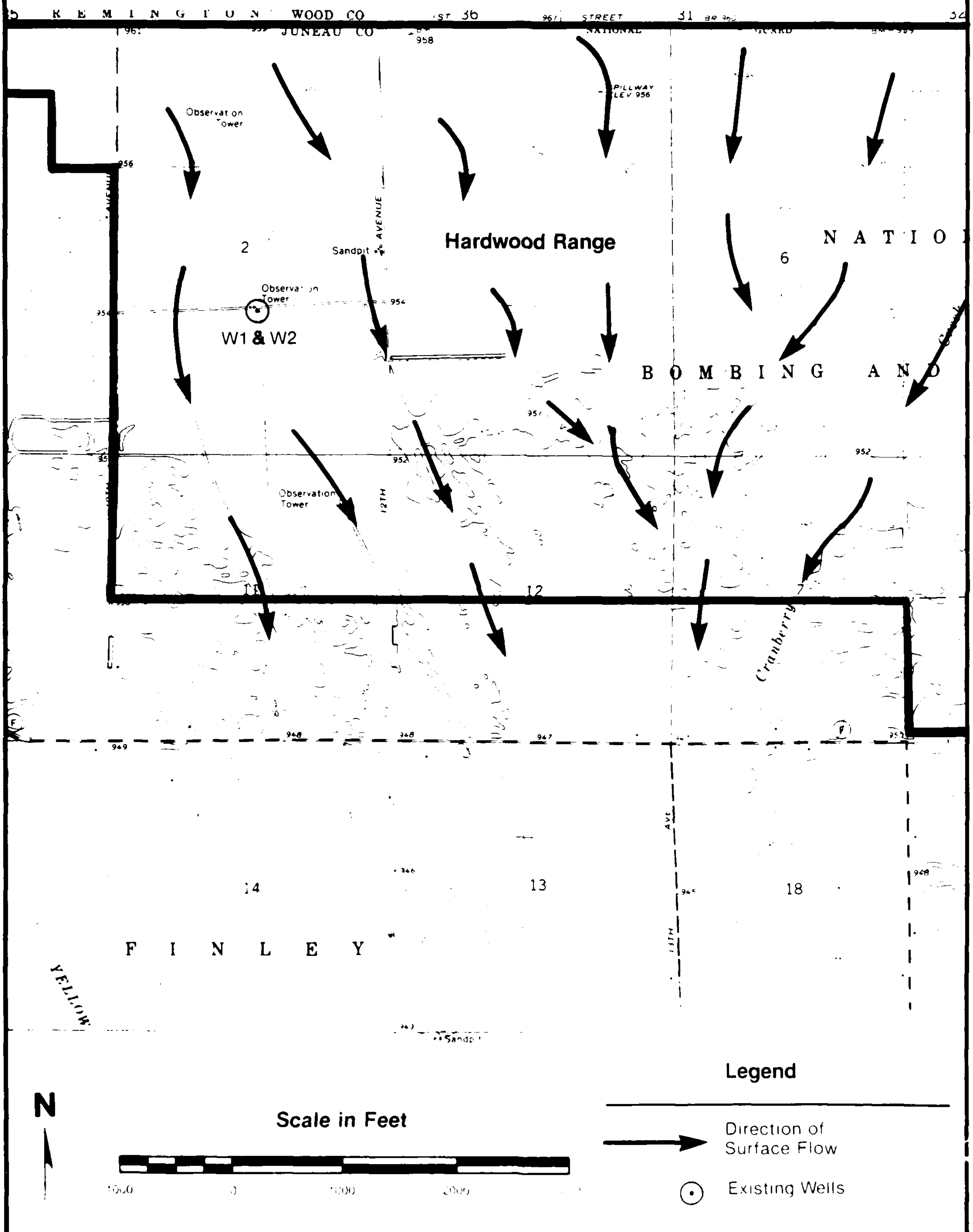
Figure 11

Directions of Surface Drainage at Hardwood Range and Locations of Groundwater Wells.



Source: U.S.G.S.

gravels, although their total thickness here is much less. The portion of the groundwater utilized at Volk Field which is not derived from the shallow unconsolidated deposits is derived from the deeper Cambrian-aged sandstone. The locations of the groundwater wells at Volk Field are illustrated in Figure 10. Of these wells, only well W6 is not in use. Wells W1 and W2 are the main drinking water wells for Volk Field. Wells W3, W4, and W5 are suplimental drinking water wells which are utilized during the summer months. Groundwater associated with the sands and gravels at both locations is contained within the pore spaces between sand and gravel particles. Groundwater associated with the Cambrian sandstones underlying the unconsolidated deposits is contained within secondary fractures which developed after the sandstone rock was formed.

Figure 12 illustrates the water-table elevation contours at Volk Field ANG Base and Hardwood Range. In both cases the direction of groundwater flow is toward contour lines with lower elevations. At Hardwood Range this is toward the south. At Volk Field ANG Base the groundwater flow direction is toward the east-northeast, away from the town of Camp Douglas. At both locations the depth to the groundwater table is frequently less than 10 feet. These groundwater elevation contours are based on regional groundwater elevation data and, therefore, are subject to local perturbations. Such perturbations may be caused by localized groundwater discharge points (wells) or climatic variations.

The records of wells throughout the present study areas do not indicate the presence of extensive confining layers of low permeability materials such as clay or fine silts; therefore, both the sandstone and unconsolidated aquifers may be classified as water-table aquifers rather than confined aquifers. The significance of this with regard to contaminant migration is two-fold. First, upward vertical components of the hydraulic gradient away from the zones from which drinking water is withdrawn are not likely; therefore, hindrance of downward migration of contaminants to the drinking water zones is not provided. Second, clay zones with low permeabilities are not available to protect against downward migration of contaminants. Other

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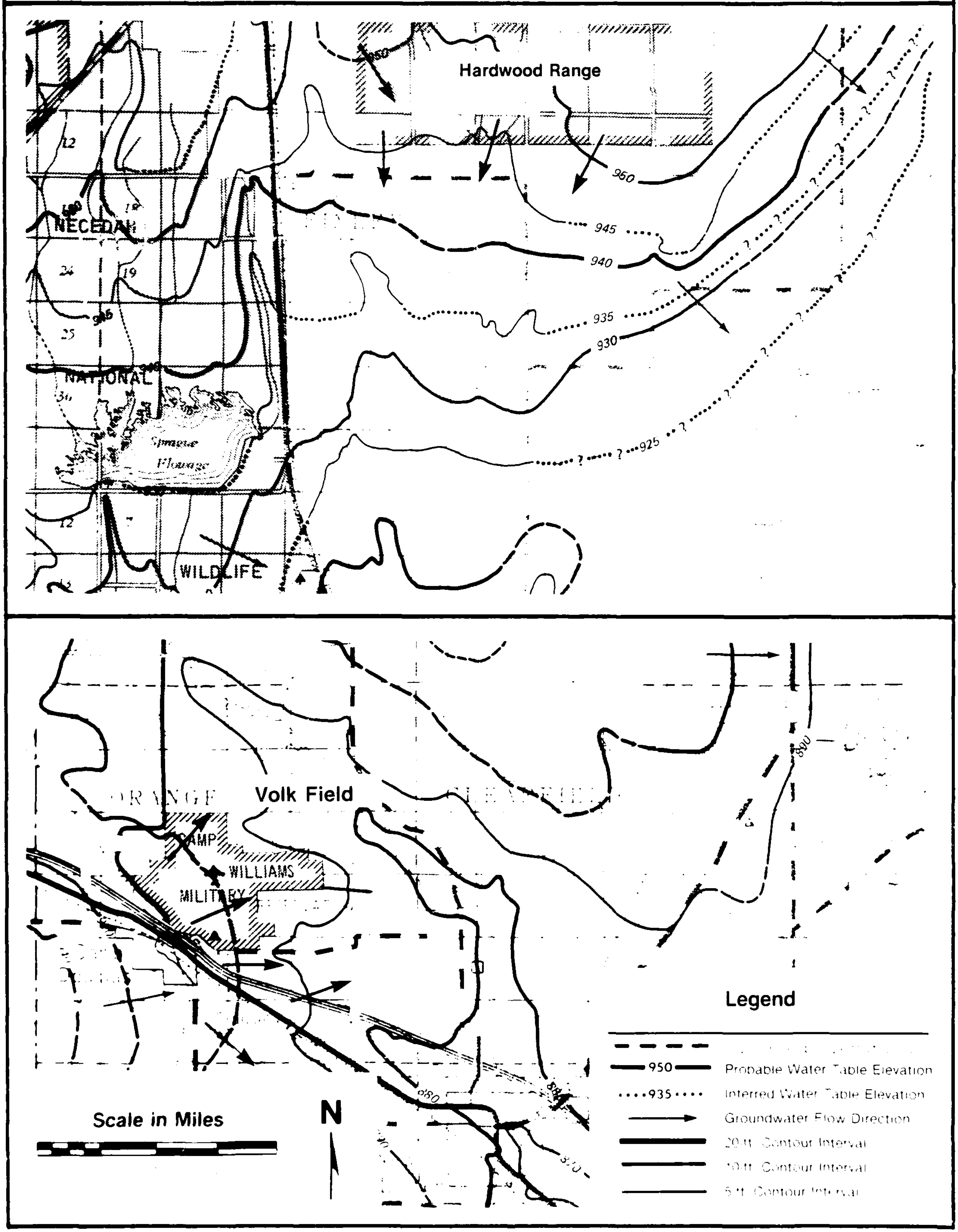
Figure 12.
Water Table Elevation Contour Maps for Volk Field ANG Base and Hardwood Range.



factors which suggest that the groundwater is particulary susceptible to contamination by surface contaminants is the large number of groundwater withdrawal wells and the large amount of precipitation, both of which would tend to induce a downward groundwater flow component. The exact locations and number of wells outside the boundaries of Volk Field ANG Base and Hardwood Range are not presented in the present report. This is because it can be assumed that every household, and other structures containing running water, have groundwater wells on the associated property because no surface water supplies are used and no municipal groundwater distribution systems are present. Additionally, concern for groundwater contamination may be warranted because the town of Camp Douglas is immediately adjacent to Volk Field ANG Base, to the southwest, so that little or no distance buffer is available to guard against contamination of off-base wells. However, this concern is only warranted if the pumping of domestic wells at Camp Douglas is sufficient to reverse the natural groundwater flow direction which is away from the town of Camp Douglas.

Figure 13 indicates that, in response to climatic variations, the depth to the groundwater table at Volk Field ANG Base has undergone historic fluctuations (Devaul, 1967). This figure presents the record of the depth to the surface of the water table observed in well W6, the location of which is illustrated in Figure 11. Figure 13 illustrates that during the period of record from 1950 to 1966, the depth to the water table varied from a maximum of 10.3 feet to a minimum of 3.5 feet below land surface. It also illustrates that the depth to the water table has fluctuated seasonally, as well as over the long term. Two obvious long-term trends include an increase in the depth to the water table during the period 1954 to 1959 and another water-table decline during the period 1960 to 1965.

The seasonal fluctuations are the result of depletion of the groundwater reservoir by evapotranspiration. This is indicated in Figure 13 by the consistent rise of the groundwater table during early spring through June, as a result of snow melt and a lack of vegetative activity, and then decrease during the summer months when vegetative activity is maximum. The two long-term decreases in the groundwater elevation previously noted are a result of the extended periods of abnormally low precipitation.

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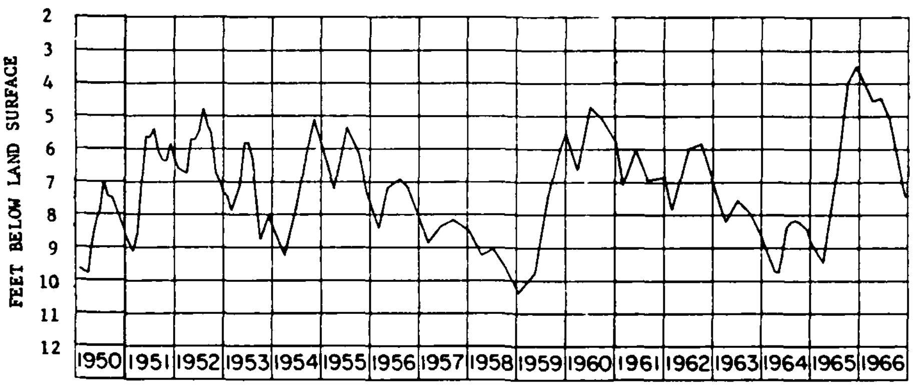
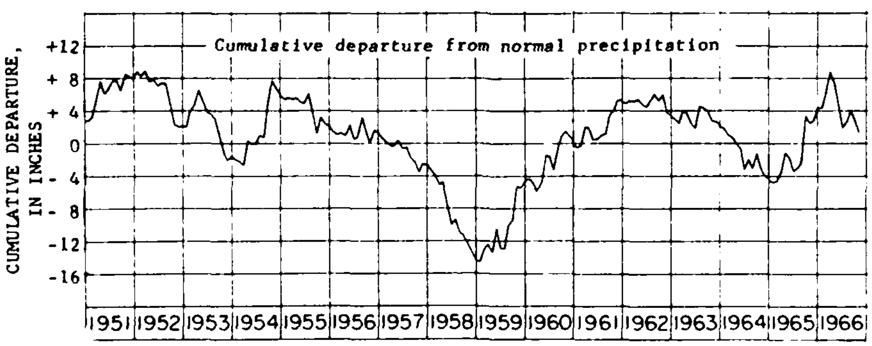
Figure 13.

Historic Fluctuations in the Water Table Elevation at Volk Field ANG Base, and Departures from Normal Monthly Precipitation.



Graph of monthly measurements of the depth to the groundwater table, observed in well W6 at Volk Field ANG Base from 1950 to 1966.



Graph of the cumulative departure from normal monthly precipitation, measured in Waushara County during the period 1951 to 1966.

Groundwater quality at Volk Field ANG Base has been impacted as a result of the Fire Department training exercises conducted at the Fire Department Training Area. A description of this area (Disposal Site No. 1) and the history of its operation are presented in Chapter 4 (Findings) of this report. Presently, this site is described in terms of observed groundwater quality, the analytical parameters that were measured, and the locations of the groundwater monitoring boreholes used to collect groundwater samples.

Figure 14 is a plat of the Fire Department Training Area which illustrates the locations of the existing groundwater monitoring boreholes. The method of installation of these monitoring wells was to drill down to the depth of the water table and then install 4-inch diameter PVC casing equipped with 2-foot long screens at the bottom of the casing. The casing and attached screens were installed so that the top of the screened interval was at the same elevation as the water table observed during drilling. The average observed depth to the water table was approximately 13 feet. From these boreholes, a total of 15 water samples were collected and then submitted for analysis on July 20, 1981. Of these 15 samples, 12 were analyzed for purgeables by EPA Methods 601 and 602. EPA Method 601 analyzes for 28 different analytes and Method 602 analyzes for 3 different analytes. From the total of 31 different analytes for which analyses were performed, 6 analytes were detected. The concentrations of the detected analytes and the boreholes from which the corresponding water samples were collected are summarized in Table 4. These 6 detected analytes are chloroform, 1,1,1-trichloroethane, trichloroethylene, benzene, toluene, and ethyl benzene. The remaining 3 water samples, from the original total of 15, were screened for purgeables by EPA Method 624. None of the analytes specified in EPA Method 624 were detected in these three water samples, as indicated in Table 4.

The laboratory reports for the above analyses indicated that the results reported for laboratory samples AF 00019, AF 00021, AF 00022, AF 00023, AF 00024, and AF 00029 should be considered as qualitative data

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Figure 14.
Locations of Existing Groundwater Monitoring Bore Holes at the Fire Department Training Area.

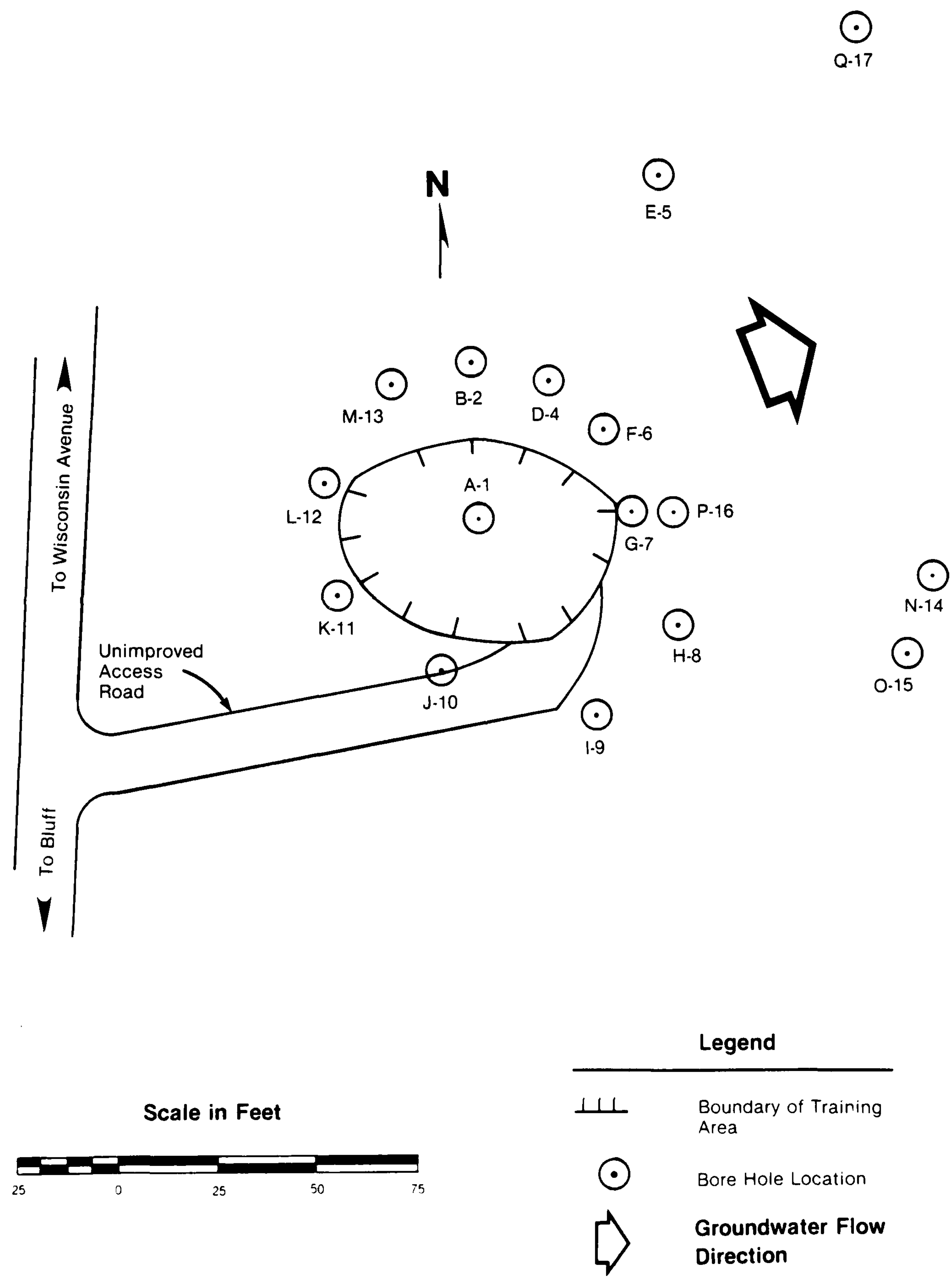

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Table 4.

Summary of the Organics Detected in the Groundwater Monitoring Wells at the Fire Department Training Area.

TABLE 4

Borehole I.D. Number	Laboratory I.D. Number	EPA Method 601 Chloroform (ug/l)	[a]TCA	[b]TCE	EPA Method 602 Benzene (ug/l)	Toluene	Ethyl benzene	EPA Method 624
A-1	AF 00019	2.3	<1.0	<1.0	4500.	2700.	270.	---
B-2	AF 00020	2.3	<1.0	<1.0	<10.	100.	<10.	---
D-4	AF 00021	1.5	7.8	22.	570.	2100.	190.	---
F-6	AF 00022	1.1	39.	100.	14000.	8000.	950.	---
G-7	AF 00023	59.	36.	42.	31000.	36000.	6800.	---
H-8	AF 00024	130.	<1.0	<1.0	1900.	5700.	200.	---
J-10	AF 00030	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---
K-11	AF 00025	1.3	<1.0	<1.0	<1.0	4.6	<1.0	---
L-12	AF 00026	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---
N-14	AF 00027	50.	<1.0	<1.0	8.5	<1.0	2.9	---
O-15	AF 00028	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---
P-16	AF 00029	120.	<10.	<10.	4000.	<50.	1000.	---
E-5	Unknown	---	---	---	---	---	---	[c]ND
M-13	Unknown	---	---	---	---	---	---	ND
Q-17	Unknown	---	---	---	---	---	---	ND

a 1,1,1-Trichloroethane
b Trichloroethylene
c None of the parameters specified in EPA Method 624 were detected

only, due to the presence of unknown interferences within the samples. Additionally, some of the samples analyzed by EPA Methods 601 and 602 were observed to be biphasic, thus suggesting the presence of free hydrocarbons within the subsurface of the Fire Department Training Area.

D. Environmentally Sensitive Conditions

1. Vegetation and Wildlife

Of the 2,500 acres comprising Volk Field ANG Base, 600 are classified as semi-improved, 650 as unimproved, and the remainder are improved. A 200-acre area on the southwest boundary of the base features steep wooded and rocky bluffs rising 200 feet above the surrounding terrain. These sandstone bluffs are valuable examples of geologic history and the areas adjacent to them are protected from excessive erosion by the maintenance of ground cover. There is currently no acreage under grazing cover or under grazing or agricultural outlease; however, forested portions of Hardwood Range are harvested during annual summer logging operations conducted by Wood County.

There are three major types of terrestrial wildlife habitat located at Volk Field ANG Base. The open field/brush habitat ranges from cropland and grassy areas to meadows and overgrown pastures, and features legume crops and wild herbaceous plants. This habitat supports populations of deer, red fox, and cottontails as well as bobwhite quail, meadowlark, and pheasant. The woodland habitat features jack pine, black oak, and white oak interspersed with stands of red and white pine. Red maple, paper birch, and northern pin oak are also common trees. Wildlife of the woodland habitat includes deer, grey fox, raccoon, and squirrels, along with ruffed grouse, woodpeckers, woodcock, and thrushes. The wet bottomland habitat generally consists of tamarack bogs and supports populations of muskrat, raccoon, and beaver as well as ducks, geese, cranes, and heron. The two sanitary wastewater treatment ponds contain small fish, snapping turtles, and other pond wildlife, including occasional ducks and other migratory waterfowl.

With the exception of the village of Camp Douglas, areas surrounding Volk Field and Hardwood Range are sparsely settled. The small farms scattered throughout the area are separated by large expanses of woodland and marshy areas. Volk Field ANG Base is recognized as a Wisconsin Wildlife Refuge; and the Necedah National Wildlife Refuge, an expansive feeding ground for waterfowl, is located five miles northeast of the base. Portions of Little Lemonweir River and Fountain Creek to the south of Volk Field are classified as Class II and III trout streams by the Wisconsin Department of National Resources.

2. Threatened and Endangered Species

The following species are present or are likely to be present within a 50-mile radius of Volk Field ANG Base, and have been listed as being threatened or endangered by the U.S. Fish and Wildlife Service or the Wisconsin Department of Natural Resources:

- o Massasauga Snake
- o Great Sandhill Crane
- o Double-crested Cormorant
- o Bald Eagle
- o Osprey

No observations of these species have been reported at Volk Field ANG Base; however, the bald eagle has been spotted from the main control tower at Hardwood Range, and a confirmed eagle nest is located in the northwestern corner of Juneau County.

There is also a possibility that the American peregrine falcon, listed as an endangered species by the U.S. Fish and Wildlife Service and the Wisconsin Department of Natural Resources, may appear on base as an occasional visitor. Bird strikes involving threatened or endangered species have not been reported at Volk Field ANG Base.

IV. FINDINGS

A. Activity Review

Table 5 summarizes the activities at Volk Field ANG Base that have required the use of industrial chemicals and management of the resultant waste materials. A review of base records and interviews with past and present base employees resulted in the identification of specific operations within each activity in which the majority of industrial chemicals are handled and hazardous wastes are generated. A brief description of these operations and best estimates of the quantities of wastes generated by each are provided below. Where available, information on specific past operations and industrial chemicals used is included. However, sufficient information in these areas was lacking in many cases. Table 6 summarizes the major operations associated with each activity, provides estimates of the quantities of waste currently being generated by these operations, and describes the past and current disposal routes for the wastes. If an operation is not listed in Table 6, then on a best-estimate basis that operation produces negligible quantities of wastes requiring ultimate disposal. For example, extremely small volumes of methyl ethyl ketone are used on occasion; however, it commonly evaporates after use and, therefore, does not present a disposal problem in these instances. Conversely, if a particularly volatile compound is listed, then the quantity represents an estimate of the amount actually disposed of according to the method shown. Appendix H contains additional operations information in the form of a detailed list of base operations, their locations, and whether they generate hazardous waste.

Previously it was indicated that 1,1,1-trichloroethane was detected in water samples from the monitoring wells at the Fire Department Training Area. However, Table 6 makes no reference to this solvent because none of the individuals interviewed were able to recall having used 1,1,1-trichloroethane.

Table 5.
Summary of Activities at Volk Field ANG Base Which Use Hazardous Materials.

Activity	Performing Organization
Aircraft Maintenance	8204th Permanent Field Training Site
Ground Vehicle Maintenance	8204th Permanent Field Training Site
Fuels Management	POL Motor Pool
Facilities Maintenance Utilities Operation	Civil Engineering

Table 6.
Shops Which Generate Hazardous Waste/Used Hazardous Materials.

Shop Name	Bldg. No.	Hazardous Waste/ Used Hazardous Material	Estimated Quantity	Method of Treatment/Storage/Disposal 1950-----1960-----1970-----1980---------Present
Aircraft Maintenance/ NDI	503	Methyl ethyl ketone	2 gal/yr	FIRE TR → '76 HRDWD →
		Methyl isobutyl ketone	2 gal/yr	
		Xylene	2 gal/yr	
		Hydraulic Fluid	15 gal/yr	FIRE TR → '73 DPDO →
		Cutting Fluid w/ sweeping compound	400 lbs/yr	LAND FL →
		Synthetic thinner w/rags	10 lbs/yr	
Aerospace Ground Equipment	509	Battery acid	12 gal/yr	NEUTR →
		Cleaning compound (Gunk)	12 gal/yr	DILUT →
		Cleaning Fluid (detergent)	40 gal/yr	
		Waste lube oil	50 gal/yr	FIRE TR → '73 DPDO →
Hangar	504	PD-680	30 gal/yr	FIRE TR → '76 HRDWD →
		Methyl isobutyl ketone	2 gal/yr	
		Paint thinner	2 gal/yr	
Motor Pool/ Vehicle Maintenance Shop	324	Battery acid	10 gal/yr	GROUND → '75 NEUTRL →
		Waste lube oil	1000 gal/yr	FIRE TR → '73 DPDO →
		Ethylene glycol	550 gal/yr	GROUND →
		Paint thinner	25 gal/yr	RDOIL → '76 HRDWD →
		Brake fluid	30 gal/yr	
		Hydraulic fluid	30 gal/yr	
		Transmission fluid	25 gal/yr	
Paint Shop	329	Paint thinner	4 gal/yr	LAND FL → '82 DPDO →
		Methanol	2 gal/yr	
		Paint containers w/rags	100 gal/yr	LAND FL →
Plumbing shop	329	Cutting oil	2 gal/yr	FIRE TR → '73 DPDO →
POL	44	JP-4	900 gal/yr	RDOIL → '76 HRDWD →
		AV-GAS	10 gal/yr	

DPOD - Defense Property Disposal Office (formally known as Redistribution and Marketing)
DILUT - Dilution and discharge to drainfield
NEUTR - Neutralization and discharge to sanitary sewer
LANDFL - On-base landfill
FIRE TR - Fire Dept. training exercises.
GROUND - Dumped on ground or drained to level field
HRDWD - Drummed and sent to Hardwood Range for burning spent munitions
RDOIL - Spread on roadways and parking lots to suppress dust

1. Aircraft Maintenance

Aircraft maintenance and parts repairs, including nondestructive testing, are performed in Building 503 and in the hangar, Building 504. Since the Volk Field FTS operates no aircraft of its own, these facilities are maintained in a state of preparedness for use by transient aircraft and by visiting ANG units during training exercises. A variety of hazardous wastes is generated during routine facility upkeep and transient aircraft maintenance activities.

Liquid wastes generated from these areas include PD-680 (30 gal/yr), hydraulic fluid (15 gal/yr), methyl ethyl ketone (2 gal/yr), methyl isobutyl ketone (4 gal/yr), xylene (2 gal/yr), and paint thinner (2 gal/yr). The solid hazardous wastes generated are rags soaked in synthetic thinner (10 lbs/yr), and sweeping compound containing waste-cutting oils (400 lbs/yr). Additionally, empty containers of paint, coating resin, varnish, wood preservative, and walkway compound are routinely disposed of in the base landfill at a rate of approximately 20 containers per year.

Similar types of fluids and solvents were employed in the past by aircraft maintenance activities. However, both the maintenance activity and the volume of wastes generated have steadily declined in recent years, and the volume of generated waste requiring disposal today may represent as little as 15 percent of the amounts generated annually during the 1950s and 1960s. As indicated in Table 6, such amounts would still be comparatively small for an average aircraft maintenance operation.

2. Ground Vehicle Maintenance

Vehicle maintenance is performed in the Motor Pool (Building 324) and in the Aerospace Ground Equipment (AGE) Shop (Building 509). Ground vehicles employed at Hardwood Range are maintained at the Volk Field Motor Pool. Wastes generated in the Motor Pool include waste lube oil (1,000 gal/yr), ethylene glycol (550 gal/yr), paint thinner (25 gal/yr), brake fluid (30 gal/yr), hydraulic fluid (30 gal/yr), transmission fluid (25 gal/yr), and battery acid (10 gal/yr). The AGE Shop is responsible for repair, maintenance, and periodic inspection of all aerospace ground equipment. Wastes generated from this activity include waste lube oil (50 gal/yr), caustic detergent (40 gal/yr), Gunk degreasing compound (12 gal/yr), and battery acid (12 gal/yr). Past activities at these shops have not changed significantly over the past few decades. Therefore, the waste types and generation rates given in Table 6 are representative of the past annual contribution of these shops generated hazardous wastes at Volk Field.

3. Fuels Management

Fuels stored and dispensed at Volk Field ANG Base are JP-4 jet fuel, AVGAS, MOGAS (regular and unleaded), No. 1 and No. 2 fuel oil, and No. 1 diesel fuel. JP-4 is stored in two 190,000 gallon aboveground tanks located at the POL Facility (Buildings 35 and 36). Ten refuelers with a capacity of 5,000 gallons each are used to transfer fuel to aircraft. AVGAS is stored underground in a 15,000-gallon tank located adjacent to the aviation fuel dispensing area (Building 29), and is supplied to aircraft in a single 1,000-gallon refueling truck. Four underground tanks with a combined capacity of 38,800 gallons are located in the POL area and are used to store supplies of No. 2 fuel oil. Fuel oil and liquid fuel pumping stations (Buildings 32 and 33) are located near the POL railcar staging area.

Regular MOGAS is stored underground at the Motor Pool (Building 324) and the AGE fueling station (Building 509) in amounts of 15,300 and 1,200 gallons, respectively. One 550-gallon tank of unleaded MOGAS is located at Hardwood Range. Appendix F contains an inventory of all fuel storage tanks in place at Volk Field and Hardwood Range.

4. Civil Engineering

a. Water Utilities

The main water supply system consists of two deep wells (Buildings 28 and 319), a pumping station (Building 319), and a concrete reservoir (Building 320). Chemicals on hand at the reservoir are chlorine and a commercial scale-prevention compound. Three auxiliary groundwater wells are utilized during summer months and are located near Buildings 905, 934, and 950.

b. Electrical Utilities and Heating

The electrical distribution system consists of overhead transmission lines and transformers. Several of the transformers have been replaced in recent years and the used ones were disposed of through DPDO. Those which remain will be analyzed for PCB content as part of a base utilities study to be initiated in 1984 and completed in 1985. There is a spare transformer in storage in Building 507.

The buildings at Volk Field are heated with No. 2 fuel oil, liquid propane, or electricity. Structures where liquid fuels are consumed generally each have their own heating plant and fuel supply tank. Efforts are underway to convert the oil-heated facilities to electricity or liquid propane.

c. Pest Management

Pesticides are used infrequently at Volk Field ANG Base for nuisance control. Insecticides are applied only to the interior of buildings. Herbicides are used on runway racks, around runway lights and security fences, and in the clear zones at each end of the runways. No major spill of herbicides or insecticides was recalled during interviews with base personnel. In 1974, the FTS was forced to store 1,550 gallons of the banned insecticide DDT, which was used prior to that date for mosquito control. After a few years, the containers showed signs of visible deterioration, but all containers were safely overpacked with no reported spills. The floor drain leading to the sanitary sewer was covered in the storage building as a precautionary measure. The containers were removed in 1982 by a disposal contractor through DPDO.

5. Wastewater Treatment

a. Sanitary Wastewater Treatment Plant

The sanitary wastewater treatment facilities at Volk Field consist of a lift station (Building 528) located near the East Parking Apron, an 8.5-acre wastewater stabilization pond (West Pond) at the west end of the main runway, and a 16.6-acre pond (East Pond) due north of the main runway. This system has afforded partial secondary wastewater treatment on a continuous basis since the West Pond was built around 1976. Previously, the domestic wastes passed directly from the lift station to the East Pond, which served as a sewage lagoon. Currently, effluents from Volk Field FTS, Camp Williams, and the town of Camp Douglas all feed via the underground sewer system to the lift station where they are pumped to the West Pond. Following stabilization, the effluent flows by gravity to the East Pond where it evaporates or infiltrates into the ground.

Due to the excessive infiltration of snowmelt water into the sewer lines, the capacity of the treatment system is generally exceeded each spring. Under these conditions, two overflow manholes in the East Pond are opened and the excess water is routed through a series of drainage ditches leading to the Lemonweir River. Because of the periodic discharges, the East Pond has been designated Outfall 001 under National Pollutant Discharge Elimination System (NPDES) Permit No. WI-0023078-3, which expires at the end of 1988. Issued by the Wisconsin Department of National Resources, this permit authorizes two annual discharges from the outfall: one in April-May and one in October-November. Influent monitoring is required at the lift station, and the permit stipulates that effluent five-day biochemical oxygen demand (BOD_5) and total suspended solid (TSS) concentrations must not exceed 15 percent of average influent concentrations. Effluent parameters which must be monitored during discharges include flow, BOD_5, TSS, pH, ammonia nitrogen, and dissolved oxygen.

Interviews conducted with past and present personnel brought forth the recollection that in 1957 approximately 250 gallons of JP-4 entered the sewer system from the maintenance hangar. This material was routed to the sewage lagoon. Undiluted sulfuric acid reportedly entered the sewer system from an activity at Camp Williams around 1979. Also, minor amounts of degreasing and cleaning compound may enter the sewer on a routine basis from wash racks located at the Motor Pool and Camp Williams. However, no signs of visible contamination in the ponds were recalled by the personnel interviewed.

b. Oil/Water Separators

Two oil/water separators are currently in use at Volk Field. An inventory and description of each separator is provided in Appendix G. One of the separators is located at the vehicle wash rack in the Motor Pool (Building 324). Water from this separator is discharged to the sanitary sewer. The second separator is located in the JP-4 storage area of the POL facility (Buildings 35 and 36), and discharges the water fraction to a level drain field. The oil fraction of all separators is drummed and disposed of through DPDO. Although recently installed, the separator at the POL area has design deficiencies that must be resolved before an acceptable level of performance can be achieved.

6. Fire Department Training

Fire Department training activities were conducted from around WW II until 1980 in a sand pit located east of Building 331. Table 6, however, indicates that use of the fire training area as a disposal site was terminated in 1973. This is because from the period 1973 to 1980 only fresh, new JP-4 was utilized in the fire training pit, as opposed to waste oils and solvents. Therefore, within the context of Table 6, the fire training pit is not considered to be a waste disposal site subsequent to 1973. The burn pit was used by personnel at Volk Field PFTS on an average of once weekly between May and September from 1970 to 1980. Approximately 250 gallons of fuel per exercise was employed, or a total of about 50,000 gallons. Fuels used were approximately 95 percent JP-4 and 5 percent mineral solvents and trichloroethylene. The burn pit was also used by the U.S. Air Force from 1963 to 1970. An estimated 25,000 gallons of waste fuels was employed for these exercises.

As a standard procedure, the training area was filled with water prior to an exercise in order to float the ignited fuels over the entire surface. Firefighting agents used include halon, protein foam, bromochloromethane, and aqueous film-forming foam (AFFF). Some transformers were reportedly emptied in the burn pit prior to disposal through DPDO, and the transformer fluid released may have contained PCBs. Also, JP-4 and AVGAS refueling equipment was routinely serviced at the burn pit from 1955 until about 1977. The required filter changes in this equipment caused a fuel release of 100-200 gallons each time, which was left unburned in the pit. From 1955 to 1968, 20 trucks were serviced quarterly, and from 1968 to 1977 about 10 trucks were serviced twice yearly. This fuel, totalling about 180,000 gallons, partially evaporated, but most probably seeped into the burn pit.

7. Ordnance Disposal

Currently, there are no ordnance disposal operations conducted at Volk Field ANG Base. However, several of the interviewees indicated that it is likely that small munitions were disposed at the current and former landfills. Spent ordnance generated at Hardwood Range is currently disposed of at two burial sites.

Munitions Burial Site No. 2 at Hardwood Range is located on the Right Range between the central control tower and the south spotting tower. It consists of a long, partially covered trench dug from the sand and fenced along the perimeter. Ordnance routinely buried at the site includes spent BDU-33 practice bombs, 2.75 rocket heads, MK-106 projectiles, and 20- or 30-mm shells. Since 1976, the used ordnance has been burned on an average of four times a year using 500 gallons of liquid wastes from Volk Field on each occasion. Generally, the waste fuel employed was approximately 95 percent JP-4 and 5 percent solvents and thinners.

Munitions Burial Site No. 1 was used briefly for the disposal of similar ordnance prior to closure in 1975. At that time, the contents of Site No. 1 were dug up and transferred to Munitions Burial Site No. 2. Only inert, cement-filled MK-82 bombs are placed in Munitions Burial Site No. 3; waste fuels are not burned at this site.

8. Hazardous Waste Storage

A total of four temporary hazardous waste/materials storage sites have been employed at Volk Field to contain waste oils, solvents, contaminated fuels, and miscellaneous liquid wastes prior to disposal.

a. Outside Drum Storage (AGE Shops)

Waste lube oils, hydraulic fluid, solvents, and thinner generated at the AGE Shop, the maintenance hangar, and the aircraft maintenance shop (Building 503) are placed in 55-gallon drums located next to the wash rack of the AGE Shop (Building 509). The lube oils are segregated and shipped via the Motor Pool to DPDO; prior to 1973, the waste oils were used for Fire Department training exercises. The solvents are stored prior to delivery to Hardwood Range for the burning of spent munitions. This storage area is not diked, but is located near the oil/water separator in the AGE Shop wash rack.

b. Underground Tank (POL Facility)

A 2,000-gallon underground waste fuel tank is located near Building 33 of the POL area. Approximately 800 to 1,000 gallons of contaminated JP-4 and AVGAS is collected in this tank. Periodically, the contents are drummed and delivered to Hardwood Range for spent munitions destruction.

c. Underground Tank (Motor Pool)

Another 2,000-gallon underground tank located near Building 324 is used for the disposal of waste lube oils and automotive fluids. The contents are removed periodically and shipped to DPDO. Prior to 1973, the waste oils were used for Fire Department training exercises.

d. Underground Tank (Paint Shop)

An underground tank of undetermined size has been located next to the Base Civil Engineering Paint Shop (Building 329) since 1970. In 1982, the tank was connected to a special sink in the paint shop in which waste paint thinner is placed. The disposal method for this liquid waste has not been determined because the tank has yet to be completely filled and emptied.

B. Disposal/Spill Site Identification, Evaluation, and Hazard Assessment

The interviews with the 18 base personnel (Appendix C) and subsequent site surveys resulted in the identification of 15 past disposal/spill sites. Of these 15 sites, 8 have been determined to have the potential for contaminant migration (as determined in step 3 of Figure 1) and, therefore, have been further evaluated using the Air Force's Hazard Assessment Rating Methodology (HARM). Of the eight rated sites, five represent hazardous materials disposal sites and three represent hazardous materials spill sites. The rated disposal sites at Volk Field are the Fire Department training area, the current landfill, the transformer fluid disposal site, and the former landfill. The rated spill sites at Volk Field are the chronic fuel spill site, the KC-97 crash site, and the JP-4 spill site. The only rated site at Hardwood Range is the munitions burial site. The locations of the sites at Volk Field are illustrated in Figure 15a. The location of the site at Hardwood Range is illustrated in Figure 15b. All sites were evaluated using the USAF HARM System (Appendix D).

A preliminary screening was performed on the 15 identified past disposal and spill sites based on the information obtained from the interviews and available records from the base and outside agencies. Using the decision tree process described in the Methodology Section of this report, a determination was made as to whether a potential exists for contaminant migration from these sites. Of the 15 identified sites, 8 were identified as having contaminant migration potential. The remaining seven sites were considered not to have significant potential for contaminant migration and, therefore, were eliminated from further evaluation. Reasons for why contaminant migration is considered minimal at the seven eliminated sites include facts such as very small volumes of disposed material(s) and the inability to confirm the existence of a site via the interviews. The seven sites with the potential for contaminant migration were then rated using the HARM system, which was developed for specific application to the Air Force Installation Restoration Program. The HARM system considers four aspects of the hazard posed by a specific site: the waste and its characteristics, the potential pathways for waste contaminant migration, the potential receptors of the contamination, 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. Copies of the completed rating forms are included in Appendix E. A summary of the overall hazard ratings for all rated sites is given in Table 7.

The seven sites that were not rated were eliminated for reasons such as potential contamination being of a non-point source nature (i.e., oiling of installation roadways), exception- ally small volumes of associated hazardous waste, or the relatively non-hazardous nature of the spilled or disposed material. For such reasons, these sites are considered to pose little or no environmental threat, however, limited monitoring and sampling at two of these unrated sites will be recommended (see RECOMMENDATIONS chapter of this document). The locations and descriptions of the seven

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Figure 15a.

Location of the Rated Waste Disposal and Spill Sites at Volk Field.

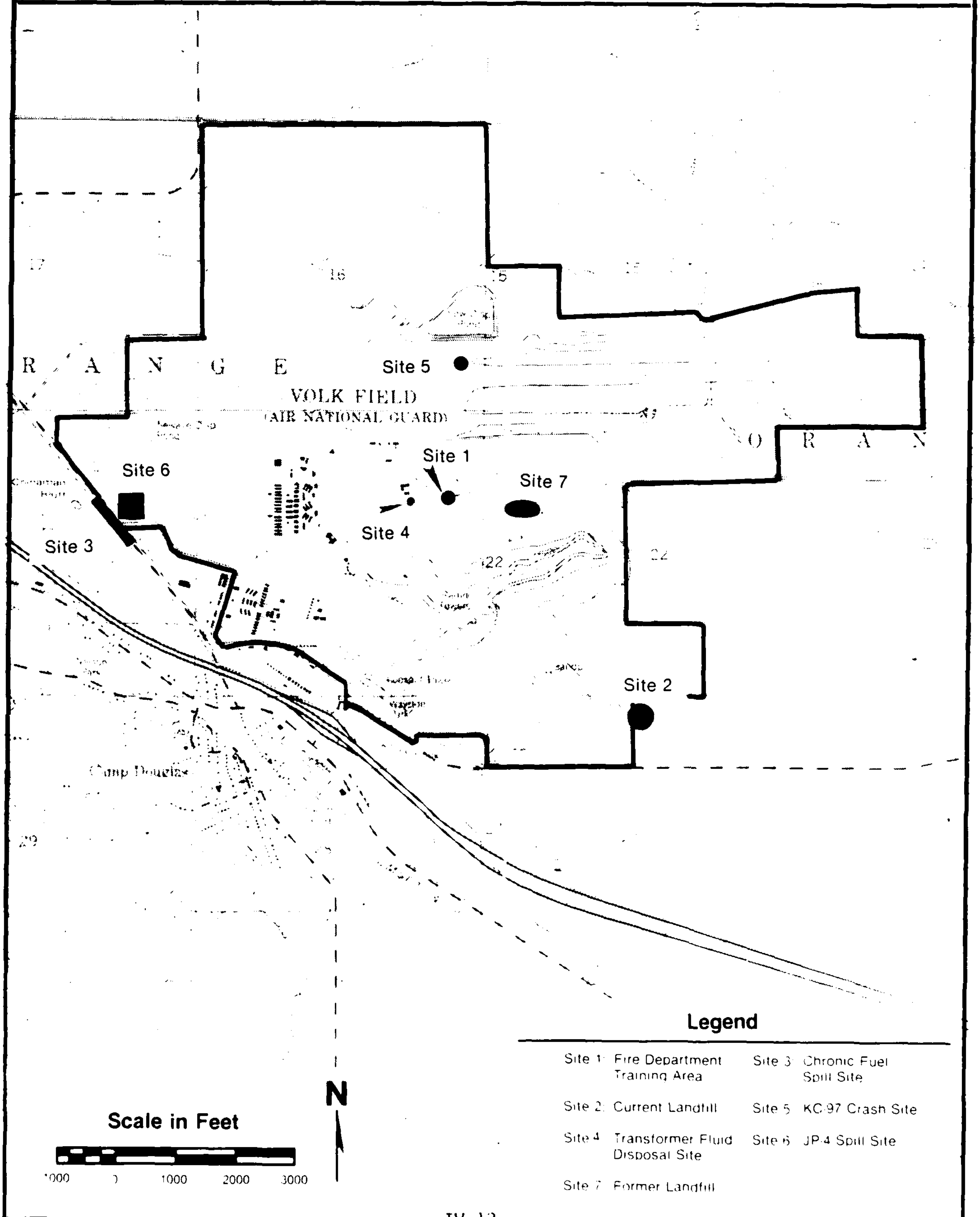

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Figure 15b.

Location of the Rated Waste Disposal Site at Hardwood Range.

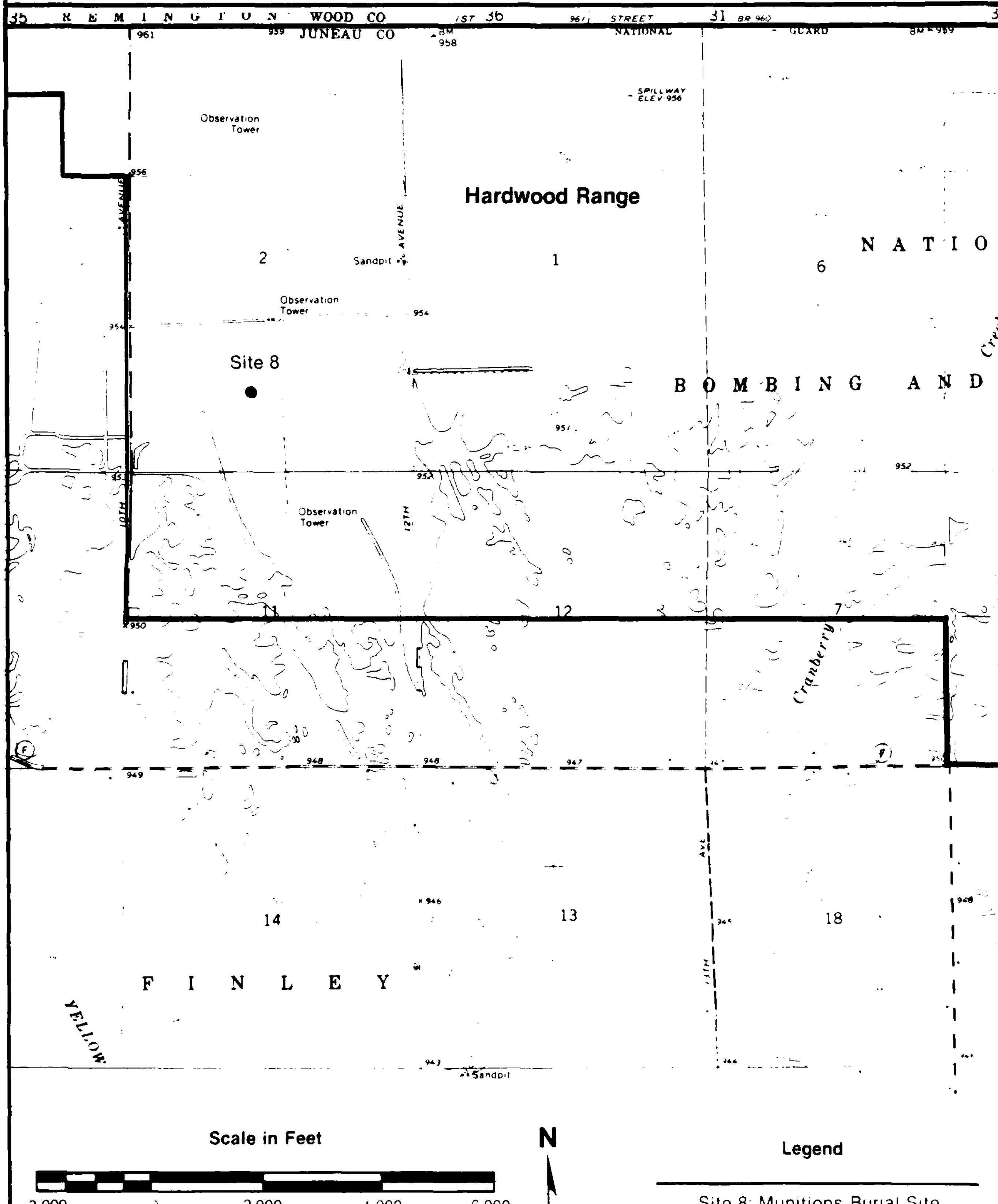


Table 7.
Summary of the Results of the Site Ratings.

Priority	Site No.	Site Description	Subscores: Receptors	Subscores: Waste Characteristics	Subscores: Pathway	Subscores: Waste Mgmt. Practices	Overall Score
1	1	Fire Dept. Training Area	64	100	100	1.00	88
2	2	Current Landfill	66	54	86	1.00	69
3	3	Chronic Fuel Spill Site	68	54	72	1.00	65
4	4	Transformer Fluid Disposal Site	64	60	72	1.00	65
5	5	KC-97 Crash Site	64	54	72	1.00	63
6	6	JP-4 spill Site	68	54	72	0.95	62
7	7	Former Landfill	64	30	72	1.00	55
8	8	Munitions Burial Site	58	45	72	0.95	55

unrated sites are discussed under subsection 2d, "Miscellaneous Unrated Sites," in this chapter. The unrated sites are (1) the electron tube disposal site, (2) the oiled roads and parking lots, (3) the ethylene glycol release site, (4) the site of the three ruptured 15-kilowatt transformers, (5) the firefighting agent (bromochloromethane) spill site, (6) the sanitary wastewater treatment system, and (7) the sanitary landfill at Hardwood Range.

Below are descriptions of each rated site, including a brief description of the rating results. For each site, the factors that most significantly influenced its HARM score are discussed. For all sites, certain factors were common that contributed to all scores. These factors are not repeated below, but include the nearby residentially zoned land, use of the uppermost aquifer for drinking water, a generally shallow groundwater table and direct access of contaminants to it via the highly pervious soils and subsoils, and a relatively high amount of precipitation throughout the area.

1. Rated Disposal Sites

a. Site No. 1: Fire Department Training Area (HARM Score: 88)

This site is identified as Site No. 1 in Figure 15 and is located approximately 400 feet southeast of the intersection of Camp Road and Wisconsin Avenue. The receptors, waste characteristics, pathways, and waste management subscores for this site are 64, 100, 100, and 1.00, respectively. The waste characteristics and pathways subscores both received maximum values because of the large amount of high-hazard material known to have been disposed of at the pit, and the fact that there is direct evidence of migration of contaminants. Another significant factor related to the scoring of this site is its close proximity to two base wells, both of which are used for drinking water.

The history of this site was previously discussed in Section IV A(6) of this report. This historical review indicates that a total of approximately 260,000 gallons of liquid waste was placed into the burn pit between 1955 and 1980. Of this total, 183,000 gallons was waste oil, 72,000 gallons was JP-4, and 2,500 gallons was mineral solvents and trichloroethylene. The firefighting agents which were used included aqueous film forming foam, protection, halon, and bromochloromethane. Of the total of 260,000 gallons placed into the burn pit, 80 percent (208,000 gallons) is assumed to have been consumed by fire.

An estimate of whether or not groundwater contamination resulting from the Fire Department Training Area is likely to have migrated across the eastern boundary of the installation can be made by utilizing Darcy's Law and conservative estimates of important hydrogeological parameters. The basic assumptions are that the porous media is homogeneous and isotropic and that vertical components of flow are negligable. Darcy's Law defines the relationship between discharge, hydraulic gradient, and hydraulic conductivity (permeability) for movement of liquids through porous media. In its steady-state form it is given as:

$$Q = K\,(\Delta h/\Delta l)\,A \qquad (1)$$

Where

Q = discharge (Volume/Time)

K = hydraulic conductivity (Length/Time)

h = change in hydraulic head (Length)

l = distance over which the change in hydraulic head is observed (Length)

A = cross-sectional area of porous media normal to flow (Area)

By dividing both sides by the cross-sectional area and considering the effects of porosity, the following form of Darcy's Equation is obtained:

$$V = K\ (\Delta h/\Delta l)(1/n) \qquad (2)$$

Where

V = average linear velocity (Length/Time)

n = porosity (dimensionless)

For the present situation, K is estimated to be 1×10^{-2} cm/s and n is estimated to be 0.35. Both of these approximations are appropriate (Freeze and Cherry, 1979) for silty to clean sand, of which the subsurface at Volk Field ANG Base largely consists. The hydraulic gradient (h/ l) is estimated to be 0.002 according to the data provided in Figure 12. Therefore, the average linear groundwater flow velocity at the Fire Department Training area is:

$$V = 1 \times 10^{-2}\ \text{cm/s}\ (0.002)(1/0.35)$$

$$V = 5.72 \times 10^{-5}\ \text{cm/s}$$

To convert to feet per year:

$$V = 5.72 \times 10^{-5}\ \frac{\text{cm}}{\text{s}} \times \frac{1\ \text{ft}}{30.48\ \text{cm}} \times \frac{3.15 \times 10^{7}\text{s}}{1\ \text{yr}}$$

$$V = 59.1\ \text{ft/yr}$$

According to the interviewees, the Fire Department Training area went into service in 1968. Therefore, assuming a groundwater flow rate of 60 ft/yr and ignoring the effects of longitudinal dispersion, the contaminants may have traveled a distance of 960 feet east of the Fire Department Training Area. The distance from the training area to the eastern installation boundary is approximately 3,600 feet.

It must be emphasized that the above method is only a conservative estimate for determining the position of the front of the contaminant plume. A precise determination requires site-specific values for hydraulic conductivity and porosity, and estimates of the effects of dispersion and aquifer heterogeneity and anisotropy. The data in Table 4 and Figure 14 suggest that, as of 1981, the furthest advance of the plume was to a position between monitoring wells N-14 and O-15 because the concentration of all analytes observed in well O-15 were less than 1.0 micrograms per liter. This suggests a flow velocity of only 14.2 feet per year. The flow velocities estimated using Darcy's Law and the empirical data suggest that contaminants associated with the Fire Department Training will reach the eastern installation boundary sometime between the years 2029 and 2222, if no action is taken during the interim. The natural flow direction is away from the town of Camp Douglas.

b. Site No. 2: Current Landfill (HARM Score: 69)

This site is identified as Site No. 2 in Figure 15 and is located approximately 600 feet southeast of the southeastern limit of Camp Road. The receptors, waste characteristics, pathways, and waste management subscores for this site are 66, 54, 86, and 1.00, respectively. Significant factors related to its scoring include its close proximity to the southeastern installation boundary and surface water, and the very shallow groundwater table which probably submerses a portion of the site during the wet season.

This site had been in use since 1954. It is reported that the north side received only wood waste and construction rubble while the south side received domestic and military wastes. The southern portion of the landfill consisted of a series of long trenches which were routinely filled, burned, and gradually covered over with sand. The wastes placed in the landfill by the Air Guard included paint thinners, brushes and rags, empty paint and thinner containers, lab chemicals, and sweeping compound contaminated with oils or solvents. Empty containers of herbicides and pesticides, including DDT, were also discarded by the Volk Field FTS in the landfill.

The landfill was used for a lengthy period by the Army Guard at Camp Williams as well as by the local population of Camp Douglas and adjacent areas. Items placed in the landfill from Camp Williams prior to 1977 reportedly included degreasing solvents, paint thinner, ethylene glycol, waste lube oils, and other automotive fluids, most of which were containerized. Batteries, empty paint cans, and contaminated sweeping compound were also received from activities at Camp Williams. Partial or whole burned aircraft may have found their way to the landfill on rare occasions. In the past, full cases of live small-arms ammunition and other munitions, including possibly napalm, were routinely discarded in the landfill following unit training. Several trucks and ammunition, some from before WW II, were reportedly buried at various other sites at Volk Field. The locations of these sites, other than those of the current and former landfill, are not presently known.

Until the mid-1970s, the landfill was routinely burned without use of supplemental fuels. After this time, sand from a borrow pit located at the foot of Target Bluff was used to cover materials placed in the landfill trenches. The water table at the landfill is very close to ground level and the older portions may be partially submerged, particularly during wet seasons. The landfill is slated for closure on July 1, 1984, and the refuse formerly placed there will be removed from Volk Field and Camp Williams by a commercial handler.

c. Site No. 4: Transformer Fluid Disposal Site (HARM Score: 65)

This site is identified as Site No. 4 in Figure 15 and is located under the asphalt parking lot approximately 100 feet south of Building 331. The receptors, waste characteristics, pathways, and waste management subscores for this site are 64, 60, 72, and 1.00, respectively. Significant factors related to its scoring include its close proximity to a base well, and the exceptionally hazardous nature of a potential constituent (PCB) of the transformer fluid.

This disposal site resulted when fluid from approximately ten retired transformers was emptied onto a patch of ground south of Building 331 around 1967 or 1968. The transformers were emptied as a requirement for disposal through DPDO. While the discarded material was never analyzed for PCBs, transformers of the period presumably contained some. No visible evidence of the discharge remains, as the area has since been paved to provide parking. Most of the pavement at this site was installed in 1977. Therefore this site was exposed to precipitation for a period of approximately 10 years prior to capping, during which leaching of possible contaminants may have occured.

d. Site No. 7: Former Landfill (HARM Score: 55)

This site is identified as Site No. 7 in Figure 15 and is located approximately 560 feet south of the firing-in butt structure 910. The receptors, waste characteristics, pathways, and waste management subscores for this site are 64, 30, 72, and 1.00, respectively. This disposal site received a low overall score primarily because the total amount of waste disposed at this site is thought to be low and the hazardous nature of this waste has not been confirmed, although it is suspected. An important factor that was partially responsible for causing the score to be as high as it is is the close proximity of this site to a base well.

The former landfill was used for domestic waste disposal from the early 1900s until 1954. In addition to municipal-type refuse from the base and surrounding community, hazardous wastes such as fuels, solvents, paint, and small munitions were likely placed there, particularly during the period around WW II. The area has since grown over with grass and no visible evidence of the landfill remains.

e. Site No. 8: Munitions Burial Site (HARM Score: 55)

This site is identified as Site No. 8 in Figure 15b and is located approximately 1500 feet south-southwest of the gunnery range control tower. The receptors, wast characteristics, pathways, and waste management subscores for this site are 58, 45, 72, and 0.95, respectively. This disposal site also recieved a low overall score, primarily because of its remote setting and because the disposal method encourages destruction of as much of the flammable waste organics by intentional burning.

Munitions from Hardwood Range are deactivated by burning and burial of the unoxidized residue within Burial Site No. 2 at Hardwood Range. The types of munitions disposed of here were described in Section IV A(7) of this report. The range burn pit is located in close proximately to the target area and measures approximately 12 feet wide, 40 feet long, and 8 feet deep.

2. Rated Spill Sites

a. Site No. 3: Chronic Fuel Spill Site (HARM Score: 65)

This site is identified as Site No. 3 in Figure 15 and is located along the railroad tracks adjacent to the POL storage area. The receptors, waste characteristics, pathways, and waste management subscores for this site are 68, 54, 72, and 1.00, respectively. Significant factors related to its scoring include its close proximity to a base well, the western boundary of the installation, and a surface-water drainage ditch.

Routine two-gallon spills of JP-4 and AVGAS occurred at this site during fuel unloading at the railcar staging area of the POL facility. These discharges occurred at a rate of approximately 50 per year for at least the past 30 years, resulting in a total estimated discharge of about 3,000 gallons. The frequency of the spills may have been even greater during the period from 1950 to 1960. During the site inspection, the soil in the immediate vicinity of the railcar staging area appeared to contain hydrocarbons and chronic vegetative stress was observed.

b. Site No. 5: KC-97 Crash Site (HARM Score: 63)

This site is identified as Site No. 5 in Figure 15 and is located 400 feet north of taxiway 3. The receptors, waste characteristics, pathways, and waste management subscores for this site are 64, 54, 72, and 1.00, respectively. The fact that this site is located within 3,000 feet of an existing base well resulted in a higher score than would otherwise have been assigned.

This spill resulted in 1978 when a KC-97 refueler aircraft ran off the runway and burned as the result of an engine malfunction. An estimated 2,000 to 5,000 gallons of JP-4 and AVGAS was released to a grassy area north of the main runway across from taxiway 3. Approximately half of the spill was consumed in the fire, but the other half seeped into the ground. No visible evidence of a fuel spill remains at this site.

c. Site No. 6: JP-4 Spill Site (HARM Score: 62)

This site is identified as Site No. 6 in Figure 15 and is located within the diked portion of the POL storage area, which is 1,200 feet south of the stabilization pond for the sanitary sewage system. The receptors, waste characteristics, pathways, and waste management practices are 68, 54, 72, and 0.95, respectively. The waste management practices subscore was lower than that of any of the other sites because efforts were made at the time of the spill to contain migration and to recover spilled JP-4. Despite this fact, the overall score is similar to the total scores for the other sites because this spill site is located within 1,000 feet of the western boundary of the installation and within 3,000 feet of an active base well.

This JP-4 spill occurred at the POL area in 1980 when a valve was inadvertently left open. Approximately 3,500 gallons of JP-4 accumulated in the dike area surrounding the tanks, but the location of the material hampered cleanup efforts. A large pit was dug in a field adjacent to the diked area, the dike was breached, and the JP-4 was routed into the pit.

Approximately 1,000 gallons was immediately salvaged while the remainder, around 2,500 gallons, seeped into the ground. The site was regraded, and has since been paved over with concrete.

C. Miscellaneous Unrated Sites

As previously indicated, there are seven disposal/spill sites which were not rated, primarily because the potential for contaminant migration from these sites was considered to be very low or nonexistent. Six of these eight sites are disposal sites and the remainder are spill sites. Brief descriptions of the unrated disposal sites and of the unrated spill sites follow.

1. Unrated Disposal Sites

a. Election Tube Disposal Site (Unrated)

A large, 15-foot-deep cement cylinder buried at the northeast corner of the igloo compound (Buildings 901-904) was once used for the disposal of electron tubes generated at nearby Air Force installations. These tubes each contained minute amounts of radioactivity. The pit was partially filled with the tubes at a rate of approximately 150 per year for a period of about 10 years starting around 1960. The cylinder was capped with concrete until recently, when the cap was removed and the area was monitored for residual radioactivity. Since none was found, the pit was filled in with gravel and the entire site was graded and seeded. Because these waste items are contained within a cement cylinder, the probability of migration is minimal. To initiate sampling or monitoring could damage the container and create problems where they do not presently exist.

b. Oiled Roads and Parking Lot (Unrated)

During the late 1950s and throughout the 1960s waste oil was applied for dust control to a gravel parking lot near Building No. 414, as well as to the gravel roads leading to the base landfill. In addition to crankcase oil, the waste reportedly contained brake fluid, differential fluid, transmission fluid, Gunk, and water. A group of oak trees around the perimeter of the parking lot was observed to die over the past years. This occurrence was variously attributed to the dust control activities, herbicide used to prevent vegetative encroachment on the lot, and an oak wilt transmitted by root borers.

c. Ethylene Glycol Release Site (Unrated)

Coolant from ground vehicles has routinely been released from the Motor Pool over the past four decades. The material is released during vehicle servicing in the paved lot of the Motor Pool, and drains to a level field situated due north across Wisconsin Avenue. No visible vegetation damage has been reported as a result of this practice, and no ground disturbance was observed in the field during the site visit.

d. Landfill - Hardwood Range (Unrated)

A small landfill (approximately 500 square feet) has been dug into the Left Range that is used for disposing of the small amounts of domestic trashgenerated by range activities. There are no hazardous wastes generated by these activities, as the vehicles used onsite or maintained in secure storage are all serviced at the Motor Pool at Volk Field. The waste fuels used to burn spent munitions are all received from activities at Volk Field. During the site visit, the landfill was partially filled with water and contained fluorescent light tubes and a lacquer thinner container. There was no visible evidence of any hydrocarbon contamination on the surface of the water.

e. Sanitary Wastewater Treatment System (Unrated)

This site is not rated because, on the basis of the interviews, it is neither a confirmed site of disposal or spillage of listed hazardous wastes. However, do to the nature of several of the shops that are equipped with floor drains that enter the sanitary wastewater treatment system, it is probable that various hazardous wastes entered this system on occassion in the past. Therefore, recommendations will be made (see RECOMMENDATIONS chapter of this document) for limited sampling and monitoring of this unrated site.

The sanitary wastewater treatment system at Volk Field ANG Base handles the combined Camp Douglas, Volk Field, and Camp Williams wastewaters. The wastewaters are conveyed by gravity sewers to the Volk Field lift station where wastewater is pumped through an 8-inch force main to an 8.5-acre wastewater stabilization pond (West Pond). Effluent from this West Pond is conveyed by gravity through 6-inch and 8-inch transfer pipes in series to a 16.6-acre combined stabilization and seepage pond (East Pond). Most of the treated wastewater seeps into the ground at the East Pond; intermittent pond overflow occurs through two overflow manholes.

Although a vast majority of the wastewater treated by this system does not contain hazardous wastes, it was reported that in the past, small quantities of hazardous waste may accidentally have been disposed into drain systems which are connected to this water treatment system. These drains include the one which services the vehicle wash rack at the Camp Williams Motor Pool, and the drains located at the engine wash rack located at the AGE Shop at Volk Field ANG Base. Although Camp Williams is not part of the present study, it is mentioned here because it is a source for a Volk Field facility. Types of hazardous waste introduced to the wastewater treatment by the above drains include straight-chain and aromatic hydrocarbons, and halogenated solvents.

2. Unrated Spill Sites

a. Transformer Fluid Spill (Unrated)

A utility pole located near Buildings 311 and 312 was overturned by high winds in 1978. One of three 15-kilovolt transformers attached to the pole was ruptured, and an unknown amount of transformer fluid was discharged to the ground. The spill material was not sampled or analyzed for PCB content. No visible evidence of this spill was observed during the site visit.

b. Bromochloromethane Spill (Unrated)

In 1977, a 55-gallon drum of bromochloromethane firefighting agent was accidentally spilled on the ground at the northeast corner of Building 531. Most of the material reportedly evaporated, but a small portion may have seeped into the ground. No visible evidence of this spill was observed during the site visit.

V. CONCLUSIONS

- o Information obtained through interviews with 18 past and present base personnel, review of base records, and field observations have resulted in the identification of a total of 15 past disposal and/or spill sites at Volk Field ANG Base.

- o Of these 15 sites, 8 have been further evaluated using the Air Forces's Hazard Assessment Rating Methodology. Seven of the rated sites are located at Volk Field ANG Base and one is located at Hardwood Range. A priority listing of these waste disposal and spill sites and their associated hazard assessment scores has been presented in Table 7. Site Nos. 1 (Fire Department Training Area) and 3 (Chronic Fuel Spill Site) presently exhibit varying degrees of environmental stress. No other sites exibit visible environmental stress.

- o The groundwater environment downgradient of the Fire Department Training Area (Site No. 1) has been contaminated by various organic chemicals which are likely to have originated from the training area. The contaminants observed to date include chloroform, 1,1,1-trichloroethane, trichloroethylene, benzene, toluene, and ethyl benzene. Toluene is present at a concentration of 36,000 ug/l, which was the maximum observed contaminant concentration. It is unlikely that any of the contamination related to the Fire Department training area extends beyond the boundaries of Volk Field ANG Base.

- o The overall groundwater environment at Volk Field ANG Base is highly susceptible to contamination from surface contaminants. Factors contributing to this susceptibility are the highly permeable nature of the soils and underlying unconsolidated sediments, the lack of impermeable confining layers overlying the primary aquifers, and the shallow depth (generally less than 10 feet) to the water table.

- No evidence of off-base environmental stress resulting from past disposal of waste materials was observed in the immediate vicinity of Volk Field ANG Base. However, the close proximity of several of the sites to the base boundaries increases the likelihood of off-base contaminant migration via the groundwater pathway. This is particularly true for the current landfill (Site No. 2) because it is within 200 feet of a boundary line, and because this boundary is down-gradient from the landfill. The next closest sites to a base boundary are Site Nos. 3 and 6, but fortunately the groundwater flow direction at these sites is toward the interior of Volk Field, rather than off-base.

- There is no imminent health hazard associated with any of the identified disposal/spill sites, including the Fire Department Training Area.

VI. RECOMMENDATIONS

The potential for contaminant migration at Volk Field ANG Base is high; therefore, it is strongly recommended that Phase II monitoring be conducted. This monitoring should consist of analysis of soil and groundwater samples for selected organic and inorganic parameters. The primary purposes for monitoring each of the proposed locations are to:

- Determine the depth within the unsaturated zone to which contaminants have migrated. If only the shallow subsurface has been contaminated at a particular site, it may be possible to remedy the problem by excavating the contaminated material, if concentration levels warrant excavation.

- Determine whether groundwater at each monitoring site has been contaminated.

- Determine the extent of contamination and the rate and direction of contaminant migration, if groundwater contamination is observed.

A. Locations to be Monitored

All of the rated sites are recommended for monitoring. This includes the seven sites at Volk Field and the one site at Hardwood Range. These sites have been grouped into monitoring areas on the basis of their proximity to each other. Figure 16 illustrates the five general areas at Volk Field that are recommended for monitoring, and the locations of the spill/disposal sites within these areas. Two of the proposed monitoring areas encompass more than one spill/disposal site due to the close proximity of the sites. The first monitoring area encompasses the Fire Department Training Area (Site No. 1) and the transformer fluid disposal site (Site No. 4). The second monitoring area encompasses the current landfill (Site No. 2). The third monitoring area encompasses the chronic fuel spill site (Site No. 3) and the JP-4 spill site (Site No. 6). The fourth monitoring area encompasses the former landfill (Site No. 7). The fifth monitoring area encompasses the KC-97 crash site (Site No. 5). Figure 17 illustrates the location of the sixth monitoring area, the only area recommended for

Figure 16.

Locations of the Proposed Areas at Volk Field to be Investigated During Phase II of the IR Program.

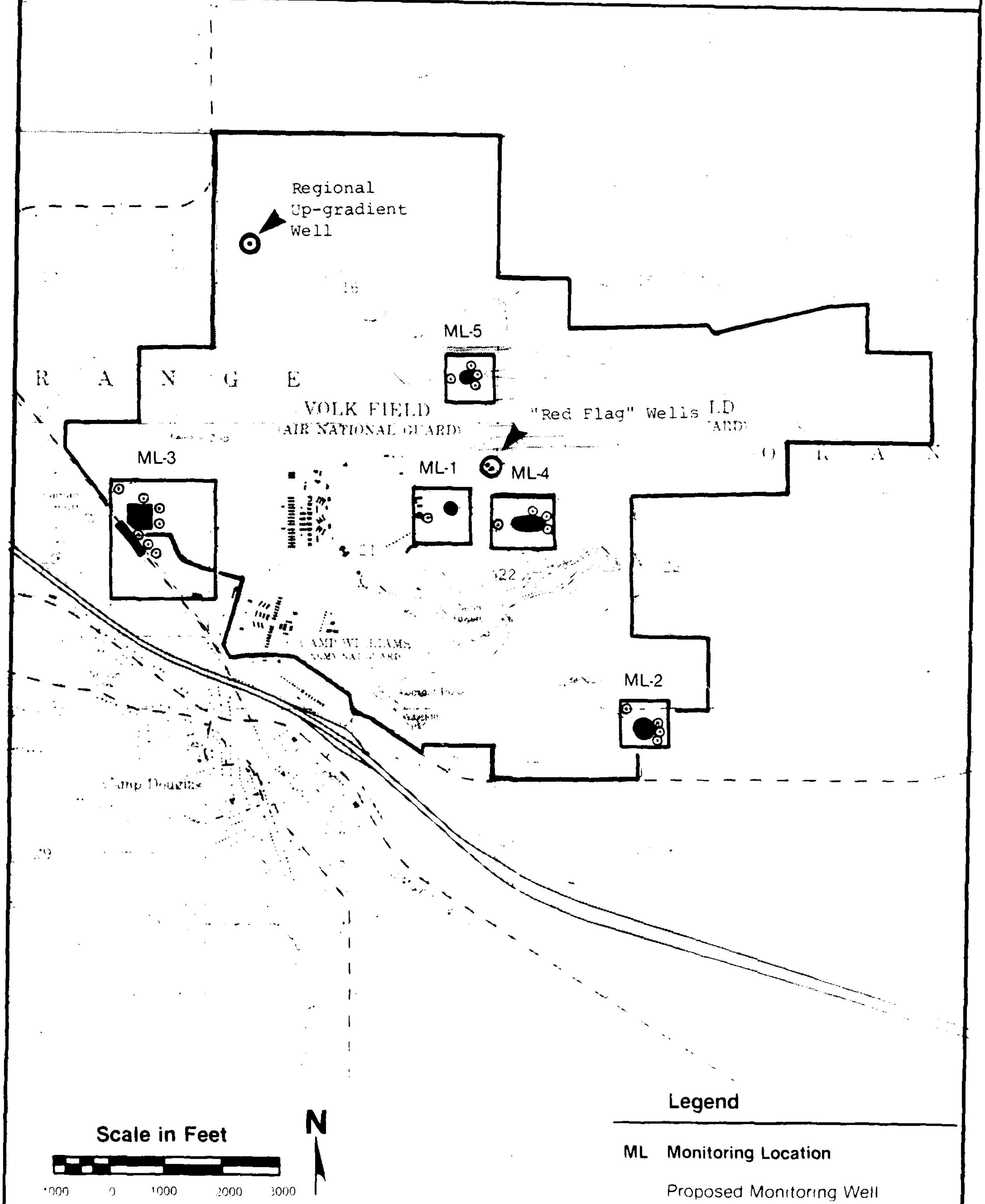
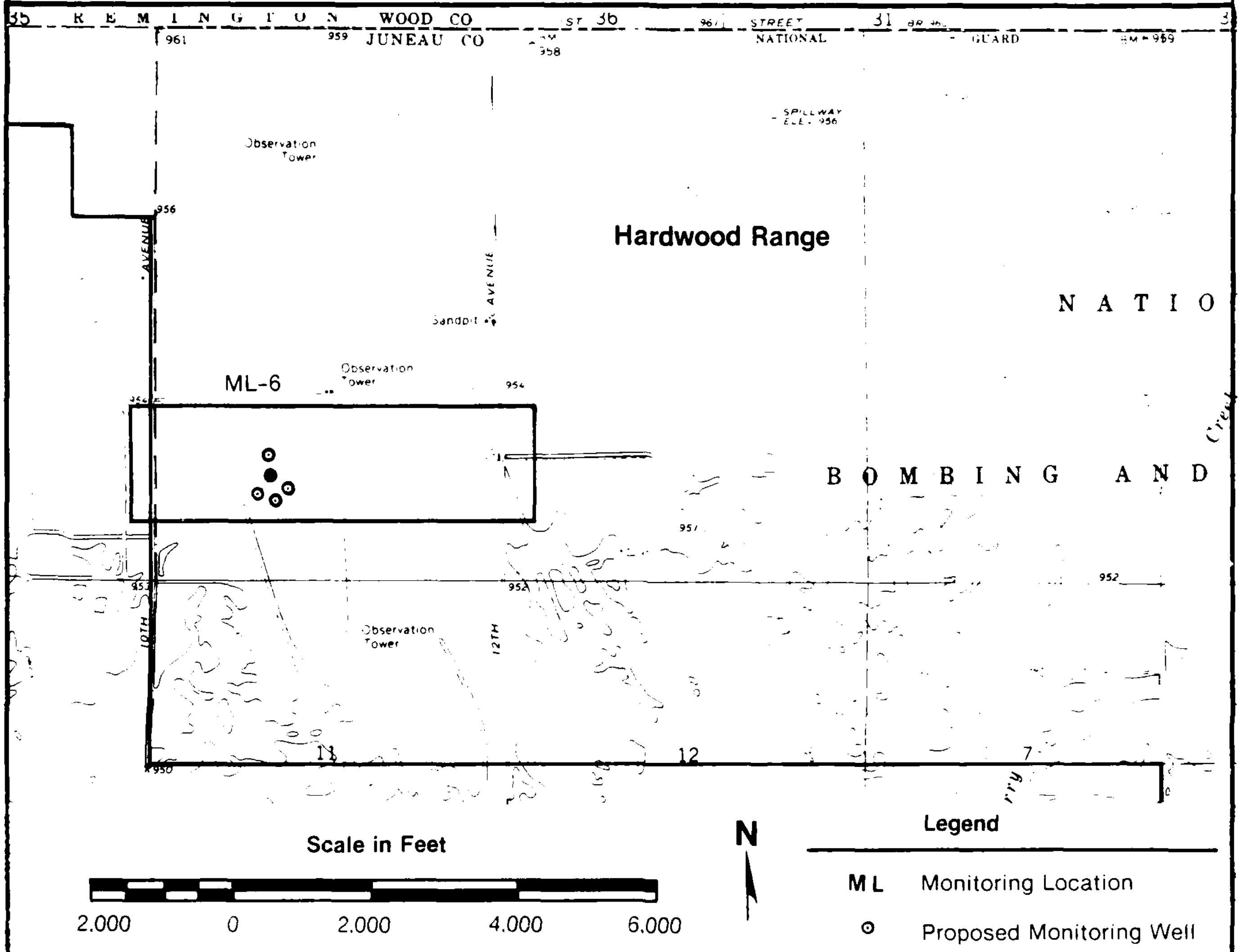
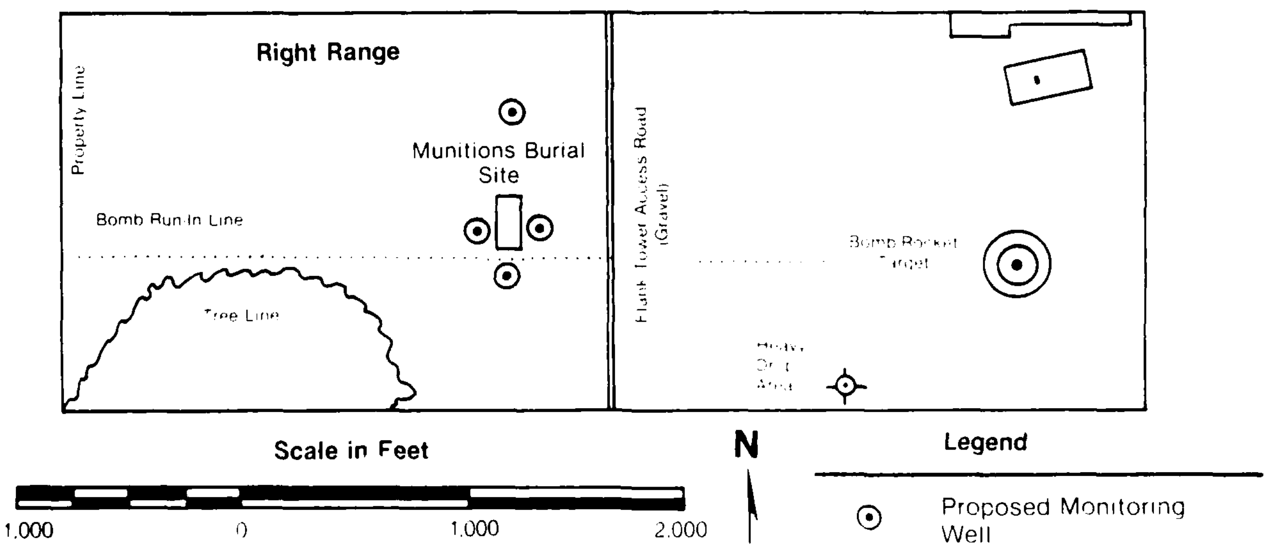


Figure 17.
Location of the Proposed Area at Hardwood Range to be Investigated During Phase II of the IR Program, and the Location of the Proposed Monitoring Wells Within this Area.



Monitoring Location No. 6



monitoring at Hardwood Range. This monitoring area encompasses the Munitions Burial Site (Site No. 8). Table 8 summarizes the monitoring locations within which all of the above spill/disposal sites are located.

B. Site-specific Recommendations for the Monitoring Locations

While reading the following site-specific recommendations, the reader should refer to the illustrated enlargements of each of the proposed sites to be monitored. For Volk Field these enlargements are illustrated in Figure 18. For Hardwood Range the enlargement is illustrated in the bottom portion of Figure 15b. Additionally, for all monitoring wells where analysis of soil samples is recommended, these soil samples should be collected from the surface and at depth intervals thereafter of no greater than 3 feet, down to the groundwater table.

Monitoring Location No. 1 (Fire Department Training Area and the Transformer Fluid Disposal Site)

Due to the large number of monitoring wells currently in place at the Fire Department training area, no additional wells at this immediate location are presently recommended. However, it is recommended that all existing monitoring wells at this site be sampled and analyzed for the parameters specified as Group I in Table 9a. If the results are positive for the furthest down-gradient monitoring wells (Wells Q17 and N-14) at this location, then additional down-gradient monitoring wells should be installed to facilitate determination of the extent of down-gradient contaminant migration. At Site No. 4, it is recommended that one monitoring well be installed as closely as possible to the site where the transformers are believed to have been emptied. Groundwater samples should be collected and analyzed for PCB and the Group II parameters listed in Table 9a. Soil samples should be analyzed for the parameters in Table 9b. Consideration should be given to the interfering effects that the chemical constituents (primarily heavy-end aliphatics) of the asphalt may have, and to the soil and groundwater chemistry at this location. If the results from this well

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Table 8.

Summary of the Spill/Disposal Sites Recommended for Phase II Investigation, and the Monitoring Location Within Which Each is Located.

Site	Description	Monitoring Location
Site 1	Fire Dept. Training Area	ML-1
Site 2	Current Landfill	ML-2
Site 3	Chronic Fuel Spill Site	ML-3
Site 4	Transformer Fluid Disposal Site	ML-1
Site 5	KC-97 Crash Site	ML-5
Site 6	JP-4 Spill Site	ML-3
Site 7	Former Landfill	ML-4
Site 8	Munitions Burial Site	ML-6

AD-A109 011 INSTALLATION RESTORATION PROGRAM RECORDS SEARCH 8204TH FIELD TRAINING SIT..(U) HAZARDOUS MATERIALS TECHNICAL CENTER ROCKVILLE MD AUG 84 DLA900-82-C-4426 2/2

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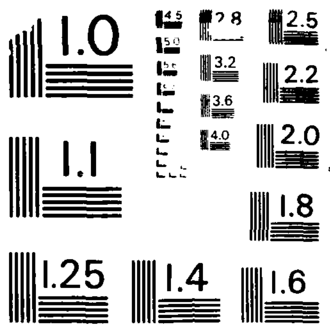

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963

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Figure 18.
Locations of the Proposed Groundwater Monitoring Wells Within the Proposed Areas to be Investigated at Volk Field.

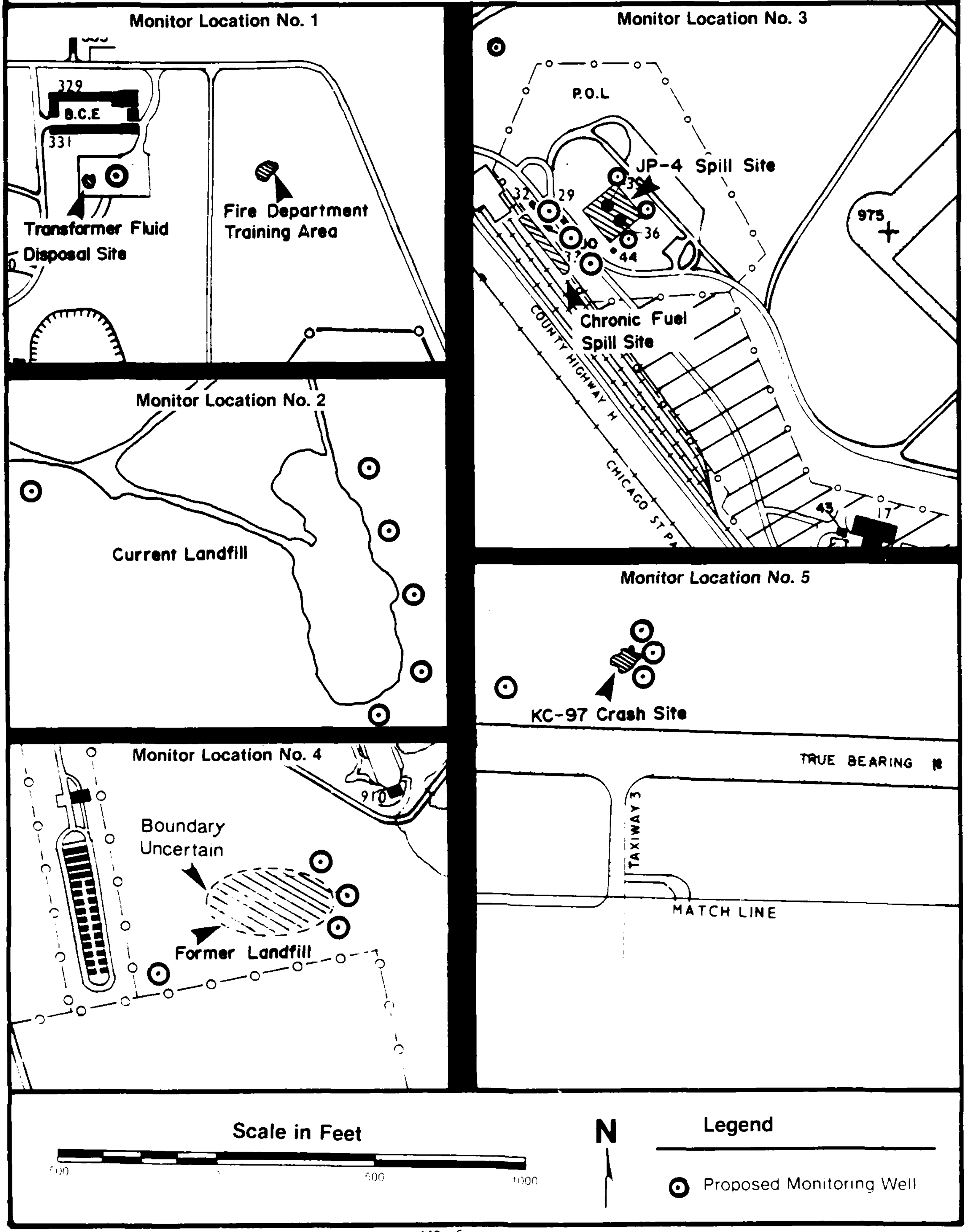

Table 9a

Recommended Parameters For Which Groundwater Samples Should be Analyzed.

WATER

Group I Parameters

Chloroform	Total Organic Carbon
1,1,1-Trichloroethane	Total Organic Halogens
Trichloroethylene	pH
Benzene	Specific Conductivity
Toluene	Oil and Grease
Ethyl benzene	Phenols

Group II Parameters

Total Organic Carbon
Total Organic Halogens
pH
Specific Conductivity
Oil and Grease

Table 9b

Recommended Parameters For Which Soil Samples Should be Analyzed.

SOIL

Volatile Organics
Oil and Grease
GC Scan

are positive, three down-gradient and one up-gradient well should be installed, and the corresponding water samples should be analyzed for PCB and the Group II parameters presented in Table 9a. Soil samples should be analyzed for PCB and the parameters presented in Table 9b.

Monitoring Location No. 2 (Current Landfill)

Five down-gradient monitoring wells and one up-gradient monitoring well should be installed at the approximate locations illustrated in Figure 18. Five down-gradient wells are recommended due to the relatively large extent of this site and the inherent uncertainty regarding the locations of hazardous wastes which may be present. Additionally, it is recommended that surface water samples adjacent and down-gradient of the site be collected. Both the surface water and groundwater samples should initially be analyzed for the Group II parameters listed in Table 9a. Soil samples from these monitoring wells should be analyzed for the parameters listed in Table 9b.

Monitoring Location No. 3 (JP-4 Spill Site and Chronic Fuel Spill Site)

Initially, one up-gradient monitoring well and six down-gradient wells are recommended (Figure 18). Three of the down-gradient wells should be associated with the JP-4 spill site and three should be associated with the chronic fuel spill site. All soil samples obtained during drilling should be analyzed for the parameters in Table 9b. Monitoring well-water samples should be analyzed for the Group II parameters in Table 9a. Because of the close proximity of subsurface utilities, extreme care should be exercised when staking the exact locations for the monitoring wells.

Monitoring Location No. 4 (Former Landfill)

The boundary of the former landfill is uncertain, as indicated by the dashed boundary line in Figure 18. Therefore, the indicated locations for the three down-gradient wells are only approximate. The location indicated for the up-gradient well is considered reliable. If the Phase II IR Program field team is not able to accurately locate this site to their satisfaction, then a geophysical survey of this area may be necessary; however, such a survey is not presently recommended. In the event that it becomes necessary, ground-penetrating radar may be an effective method due to the low water content and porous nature of the sandy subsurface. Soil samples should be analyzed for the parameters in Table 9b. Monitoring well water samples should be analyzed for the Group II parameters in Table 9a.

Monitoring Location No. 5 (KC-97 Crash Site)

Three down-gradient wells and one up-gradient well are recommended for this site at the approximate locations indicated in Figure 18. Soil samples from these wells should be analyzed for the parameters in Table 9b. Water samples should be analyzed for the Group II parameters in Table 9a.

Monitoring Location No. 6 (Munitions Burial Site)

Three down-gradient wells and one up-gradient well are recommended for this site, at the approximate locations illustrated in Figure 17. Water samples should be analyzed for Group II parameters in Table 9a. Soil samples should be analyzed for the parameters in Table 9b. If the results of this sampling and analysis are positive, it will be necessary to alter the procedures presently followed when disposing of unwanted munitions.

C. Miscellaneous Recommendations

Stabilization Pond

Although the sanitary wastewater treatment system was not rated, the nature of the shops which discharge to this system is such that accidental hazardous waste discharges to this system may have occurred in the past. Therefore, it is recommended that limited monitoring be conducted at the stabilization pond. Initially, this monitoring should consist of analysis of five different sludge and sediment samples from within the pond for the parameters in Table 9b. These five samples should be collected from varied lateral locations throughout the pond, but from the same depth within the sediment at each location. If the results are positive, then a minimum of three down-gradient and three up-gradient groundwater monitoring wells should be installed; however, these wells are not presently recommended. Additionally, if the results of the first set of sediment samples are positive, further sediment sampling and analysis should be conducted to determine changes in contaminant concentration with depth in the sediment.

Regional Up-gradient Well

A single up-gradient well which is far removed from all known sources of contamination is recommended at the north end of the north-south runway, as illustrated in Figure 16. The purpose of this well is to provide reliable and alternative background groundwater quality data in the event that the previously recommended up-gradient monitoring wells at the individual monitoring locations are impacted by unanticipated groundwater contamination up-gradient from them. Such interference with the up-gradient wells is unlikely, but is possible due to the high level of historic operations activity throughout the area of the monitoring locations. This well should be sampled and analyzed for the Group II parameters in Table 9a.

"Red Flag" Well

It is recommended that a set of nested down-gradient monitoring wells be installed at the location indicated in Figure 16. This nest should consist of two monitoring wells. The first should be a relatively shallow monitoring well designed to monitor groundwater within the unconsolidated sediments. The second should be a deep well which extends into the sandstone bedrock underlying the sediments, and which is constructed so as to preclude hydraulic communication between the deep sandstone-associated groundwater system and the groundwater system associated with the unconsolidated sediments. The purpose of these nested wells is twofold: First, to provide a warning in the event that contamination begins to bypass the down-gradient monitoring well systems at the Fire Department training area and the former landfill, and second, to facilitate acquisition of hydraulic head measurements for the sandstone- and sediment-associated aquifers. This head data will either substantiate or contradict the presumption that groundwater moves upward from the sandstone to the unconsolidated sediments. If the groundwater gradient is observed to be downward toward the sandstone aquifer (this is not anticipated), then deep monitoring wells at each of the previous monitoring locations will be necessary.

Oiled Parking Lot

The parking lot near building No. 414 was not rated primarily because there were no confirmed reports of disposal or spillage of listed hazardous wastes at the parking lot. However, the circumstantial evidence for contamination at this location is sufficient to induce limited soil sampling. This evidence consists of reports that the parking lot had been oiled, and also that nearby trees died due to unknown causes. It is recommended that five shallow subsurface soil samples be collected from the parking area and that they be analyzed for the parameters listed in Table 9b.

Base Drinking Water Wells

Because of the overall hazard related to groundwater contamination, all existing wells at Volk Field and Hardwood Range which are used for drinking water should be sampled and analyzed for the Group II parameters listed in Table 9a.

Table 10 summarizes the Phase II recommendations for Volk Field and Hardwood Range.

Table 10.

Summary of Phase II IR Program Recommendations.

	Site Name	HARM Score	Recommended Monitoring
1.	Fire Dept. Training Area	88	Sample existing 15 wells for Group I parameters, Table 9a. If the results are positive for wells Q-17 or N-14, then install additional wells down-gradient from Q-17 and N-14; analyze associated water samples for Group I parameters, Table 9a, and associated soil samples for the parameters in Table 9b.
2.	Current Landfill	69	Install 5 down-gradient and one up-gradient well. Analyze water samples from these wells for Group II parameters, Table 9a. Analyze surface water samples for the same parameters. Analyze soil samples from the monitoring wells for the parameters in Table 9b.
3.	Chronic Fuel Spill Site	65	Install 3 down-gradient monitoring wells and one up-gradient monitoring well. Analyze water samples from these well for Group II parameters, Table 9a. Analyze soil samples for the parameters in Table 9b. This up-gradient well also serves as up-gradient well for Site 6.
4.	Transformer Fluid Disposal Site	65	Install one monitoring well at the suspected area of disposal. Analyze water samples for PCB and Group II parameters, Table 9a. Analyze soil samples for the parameters in Table 9b. If results are positive, install one up-gradient and three down-gradient wells and analyze corresponding soil and water samples for the above parameters.
5.	KC-97 Crash Site	63	Install 3 down-gradient and one up-gradient well and analyze corresponding soil and water samples for Group II parameters, Table 9a. Analyze soil samples for the parameters in Table 9b.
6.	JP-4 Spill Site	62	Install 3 down-gradient wells and analyze associated water samples for Group II parameters, Table 9a. Analyze soil samples for the parameters in Table 9b. Up-gradient water quality is determined from the up-gradient well for site No. 3.
7.	Former Landfill	55	Install one up-gradient and 3 down-gradient wells and analyze associated water samples for Group II parameters, Table 9a. Analyze soil samples for the parameters in Table 9b. If the location of the site is not sufficiently well known, conduct geophysical survey.
8.	Munitions Burial Site	55	Install one up-gradient and 3 down-gradient wells and analyze associated water samples for Group II parameters, Table 9a. Analyze soil samples for parameters in Table 9b.
<u>Miscellaneous Unrated Sites</u>			
a.)	Stabilization Pond	Unrated	Collect and analyze five sediment/sludge samples for the parameters in Table 9b. If positive results, install 3 down-gradient and 3 up-gradient wells and analyze corresponding water samples for Group II parameters, Table 9a. Analyze associated soil samples for parameters in Table 9b. Also if positive initial sediment samples, collect and analyze sediment samples from various depths.
b.)	Oiled Parking Lot	Unrated	Collect 5 shallow sub-surface soil samples and analyze for the parameters in Table 9b.

D. General Monitoring-Well Construction Criteria

Selection of appropriate monitoring-well designs is the responsibility of the contractor for the Confirmation/Quantification Phase of the IR Program. Designs selected by the contractor should facilitate determination of vertical variations in parameters such as aquifer permeability, pressure head, and contaminant concentrations. Whether such data are acquired using, for example, nested piezometers or fully screened wells fitted with packers, is at the discretion of the contractor. Such information is important for determining the three-dimensional orientation and movement of the contaminant plume and for designing Phase III Remedial Actions.

At a minimum, the well construction protocol should include:

- o Tremie grouting of the annular space for each well to a depth of 5 feet below ground surface.
- o Recording of detailed well logs which include daily static water levels, type of geologic materials encountered, depths to water-producing zones, and samples of cuttings from each well that are collected from 5-foot intervals.
- o Proper identification and surveying of all wells.

E. Sampling Criteria

Groundwater from each screened interval for all wells should be collected and analyzed for volatile organic carbon species, oil and grease, total organic halogens, phenols, and heavy metals. This includes the existing monitoring wells at the Fire Department training area. The results of analysis of water from these wells should be compared to the 1981 results summarized in Table 4 of this report to determine the need for installation of additional monitoring wells. The sampling protocol for all monitoring wells should include:

- o Removal of a volume of water equal to at least three times the volume of the well below the saturated zone, prior to water sample collection.

- Use of stainless steel/teflon bailers and/or pumps for withdrawal of water.

- Acidification of samples to be analyzed for total metals.

- Use of glass containers for samples to be analyzed for oil and grease.

- Immediate refrigeration and transporting of the samples to the analytical laboratory subsequent to sample collection.

- Appropriate chain-of-custody records.

All groundwater quality data should be statistically analyzed by methods approved by the U.S. Environmental Protection Agency and the Wisconsin Department of Natural Resources in order to illustrate significant differences in groundwater quality.

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS USED IN THE TEXT

AFB	Air Force Base
AGE	Aerospace Ground Equipment
ANG	Air National Guard
ANGSC	Air National Guard Support Center
ARNG	Army National Guard
AVGAS	Aviation Gasoline
BOD	Biochemical Oxygen Demand
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DLA	Defense Logistics Agency
DOD	Department of Defense
DPDO	Defense Property Disposal Office
EPA	Environmental Protection Agency
FTS	Field Training Site
°F	Degrees Fahrenheit
gal/mo	gallons per month
gal/yr	gallons per year
HARM	Hazard Assessment Rating Methodology
HMTC	Hazardous Materials Technical Center
IRP	Installation Restoration Program
JP	Jet Petroleum
MEK	Methyl ethyl ketone

MOGAS	Motor Gasoline
MSL	Mean Sea Level
NDI	Nondestructive Inspection
No.	Number
NPDES	National Pollution Discharge Elimination System
OWS	Oil/Water Separator
PCB	Polychlorinated Biphenyl
PD	Petroleum Distillate
FTS	Field Training Site
POL	Petroleum, Oils, and Lubricants
ppm	Parts per Million
PVC	Polyvinyl Chloride
RCRA	Resource Conservation and Recovery Act
TACAN	Tactical Air Navigation
TCA	1,1,1-Trichloroethane
TCE	Trichloroethylene
TSS	Total Suspended Solids
USAF	United States Air Force
VOR	VHF Omni Directional Range
WPA	Works Progress Administration
WW	World War

GLOSSARY OF TERMS

1. ALLUVIUM - A general term for clay, silt, sand, gravel, or similar unconsolidated detrital material deposited during comparatively recent geologic time by a stream or other body of running water as a sorted or semisorted sediment in the bed of the stream or on its flood plain or delta.

2. AQUIFER - A geologic formation, or group of formations, that contains sufficient saturated permeable material to conduct groundwater and to yield economically significant quantities of groundwater to wells and springs.

3. CONFINING STRATA - A strata of impermeable or distinctly less permeable material stratigraphically adjacent to one or more aquifers.

4. CONTAMINANT - As defined by section 104(a)(2) of CERCLA, shall include, but not be limited to, any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformation, in such organisms or their offspring.

5. DISCHARGE - The process involved in the draining or seepage of water out of a groundwater aquifer.

6. DOWNGRADIENT - A direction that is hydraulically downslope; the direction in which groundwater flows.

7. EVAPOTRANSPIRATION - Evaporation of water from the ground surface and transpiration through vegetation.

8. HAZARDOUS WASTE - A solid or liquid waste that, because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

   (a) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or

   (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed.

9. MIGRATION (Contaminant) - The movement of contaminants through pathways (groundwater, surface water, soil, and air).

10. ORDNANCE - Any form of artillery, weapons, or ammunition used in warfare.

11. PCB (Polychlorinated Biphenyl) - A chemically and thermally stable toxic organic compound. Characteristically, it persists for long periods of time, is not readily biodegradable, and is biologically accumulative.

12. PD-680 - A petroleum distillate used as a safety cleaning solvent. Two types of PD-680 solvent have been used: Type I, having a flash point of 100° F; and Type II, having a flashpoint of 140° F.

13. PERMEABILITY - The capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.

14. POTENTIOMETRIC SURFACE - An imaginary surface that is coincident with the elevation to which water from a pumped or nonpumped aquifer would rise in a well hydraulically connected to that aquifer.

15. STATIC WATER ELEVATION - The elevation to which water from a nonpumped aquifer would rise in a well hydraulically connected to that aquifer.

16. STRATA - Distinguishable horizontal layers separated vertically from other layers.

17. SURFACE WATER - All water exposed at the ground surface, including streams, rivers, ponds, and lakes.

18. UPGRADIENT - A direction that is hydraulically upslope.

19. WATER TABLE - The upper limit of the portion of the ground wholly saturated with water.

20. WETLAND - An area subject to permanent or prolonged inundation or saturation that exhibits plant communities adapted to this environment.

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APPENDIX A.

OUTSIDE AGENCY CONTACT LIST

OUTSIDE AGENCY CONTACT LIST

1. Wisconsin Department of Natural Resources
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2. Wisconsin Department of Natural Resources
   Private Water Supply Division
   Madison, Wisconsin
   Thomas Riewe (Geologist)
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3. Wisconsin Department of Natural Resources
   Public Water Supply Division
   Madison, Wisconsin
   Eric Syftestad (Natural Resource Assistant)
   (608) 266-2621

4. Wisconsin Department of Natural Resources
   Endangered Resources Division
   Madison, Wisconsin
   Irene Schmidt (Biologist)
   (608) 266-7012

5. United States Geological Survey
   Library
   Reston, Virginia
   (703) 860-6673

6. United States Geological Survey
   Mid-Continent Mapping Center
   Rolla, Missouri
   Claude Summers (Reproduction Manager)
   (314) 341-0854

7. Juneau County Administration Office
   Office of the Zoning Administrator
   Mauston, Wisconsin
   Bob Turner (Zoning Administrator)
   (608) 847-4690

8. Wisconsin Geological and Natural History Survey
   Map and Publications Sales Office
   Madison, Wisconsin
   (608) 263-7789

APPENDIX B.

RESUMES OF SEARCH TEAM MEMBERS

RESUMES OF SEARCH TEAM MEMBERS

TORSTEN ROTHMAN

Senior Environmental Engineer

EDUCATION

M.S., environmental health engineering, University of Texas
B.Ch.E., Rensselaer Polytechnic Institute

EXPERIENCE

Mr. Rothman has 24 years of experience in all aspects of environmental health engineering, hazardous wastes and solid wastes management, environmental impact analysis, wastewater treatment, and air pollution evaluation and control. This includes 20 years as an Air Force bioenvironmental engineer with service at base level, major command, research and consulting laboratories, and USAF headquarters. He has in-depth knowledge and understanding of Air Force operations, organization, and occupational safety and health programs.

Mr. Rothman managed the implementation of the National Environmental Policy Act for the U.S. Air Force, and directed and managed the preparation and filing of over 15 Environmental Impact Statements. The subjects of these impact statements covered a broad spectrum of biophysical and socioeconomic issues. Mr. Rothman was responsible for technical adequacy, accuracy and completeness, as well as for procedural compliance of all documents. He also served on the staff of the Air Force Surgeon General as an advisor on all aspects of environmental health engineering, and directed the development of Air Force policy for compliance with Federal regulations in areas of wastewater, solid waste, air pollution, and drinking water.

Mr. Rothman's bioenvironmental engineering experience includes the provision of a full range of occupational and environmental health services to various Air Force installations. These services include conducting numerous industrial hygiene, medical and industrial ionizing radiation, wastewater, and environmental protection studies; and membership in a Disaster Response Force responsible for medical surveillance of nuclear, biological and chemical decontamination procedures, and personnel protection and monitoring.

Mr. Rothman's municipal wastewater experience includes in-depth studies on trickling filter and activated sludge municipal wastewater treatment plants. Most of these studies were performed while he was a consultant to the Pacific-area Air Force Installations regarding all aspects of environmental health engineering. Related studies include research on solid waste management practices, and combustion products of plastics commonly found in municipal refuse.

Presently Mr. Rothman serves as Director of the Hazardous Materials Technical Center, a center of expertise for information on all aspects of hazardous materials/hazardous wastes management including safety and health, transportation, storage, handling, and disposal. The types of projects that Mr. Rothman routinely manages include those involved with environmental engineering, hazardous waste management, sanitary engineering and waste treatment.

CERTIFICATION

Diplomate, American Academy of Environmental Engineers
Professional Engineer (environmental health), Texas

HONORS

Sigma Xi, Research Society of America
Chi Epsilon, Civil Engineering Honorary Society
Phi Kappa Phi, Scholastic Honorary Society
Registry of International Consultants, American Public Health Association
Member Emeritus of American Conference of Governmental Industrial Hygienists

WILLIAM EATON

Hydrogeologist

EDUCATION

M.S., environmental sciences, University of Virginia
B.A., geology, Susquehanna University

EXPERIENCE

Mr. Eaton's primary experience is in the areas of geologic and groundwater investigation of sites that were contaminated by hazardous or toxic organic and inorganic chemical substances. These investigations have included emergency response to ruptured surface petroleum storage tanks and subsurface pipelines. In such instances, Mr. Eaton directed onsite remedial actions including the proper location and installation of subsurface containment barriers, and nested piezometers designed to sample various confined aquifers. Similar studies involved the investigation of hazardous waste dump sites, and the development of contract design specifications for excavation of the buried waste and sealing of the contaminated area.

Investigation of nonpoint sources of chemical contamination have also been conducted by Mr. Eaton. Typically, these studies have involved implementation of a regional scale physical and chemical groundwater monitoring scheme, and subsequent analysis of the data to pinpoint the probable sources of contamination and contaminant migration directions and rates. Where applicable, consultations were held with the interested parties in order to advise them of alternatives for minimizing the impact of the contamination.

Mr. Eaton has been the primary investigator and author of several reports dealing with the development of groundwater resources for municipal, industrial, and domestic purposes. These studies included the design and analysis of pump-test data to determine the hydrogeologic characteristics of the tested aquifers. Such investigations have been performed in bedrock aquifers and unconsolidated, confined, and unconfined aquifers.

HONORS

Sigma Xi, Research Society of America

PUBLICATIONS

"Microbial Mineralization of ^{14}C-Labeled Bromobenzene," presented at the National Meeting of the American Society of Microbiology, New Orleans, Louisiana, March, 1983.

MARCUS A. PETERSON

Environmental Scientist

EDUCATION

M.S., water resource management, University of Quebec, 1983
B.A., biology, University of New Brunswick, 1976

EXPERIENCE

Mr. Peterson's responsibilities at Dynamac Corporation involve feasibility studies dealing with the thermal destruction of hazardous waste. He has participated in site surveys of hazardous waste management practices and incineration facilities at U.S. Navy bases, evaluated current incineration technologies, documented emerging trends in thermal destruction R&D, and defined the regulatory environment for waste co-firing and incineration applications by the U.S. Navy.

Mr. Peterson's past experience includes the direction of a contract to analyze and evaluate U.S. Department of Energy environmental information systems and compliance overview efforts. He developed options and recommendations for improving the environmental and radiological surveillance practiced at DOE nuclear weapons facilities. He also recommended changes to internal DOE orders to support improvements in monitoring and reporting, and data reporting procedures.

Previously, Mr. Peterson was assigned the technical coordination of a U.S. Fish and Wildlife Service contract to prepare a bibliography and eight ecosystem-specific reports dealing with the effects of air pollution and acid rain on fish, wildlife, and habitat. As part of this project, he compiled the bibliography of more than 2,000 references and authored both the introductory volume of the series and reports concerning ecological impacts on grasslands, urban ecosystems, and critical habitats of endangered species.

Prior to his employment at Dynamac, Mr. Peterson analyzed Flood Insurance Studies for technical accuracy under a contract with the Federal Insurance Administration. He compiled a bibliography on social impact assessment for the Ministry of Natural Resources of the Government of Quebec, and analyzed various impact assessment methodologies for application to specific scientific and technical articles from French to English for water science researchers in Quebec.

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

International Association for Impact Assessment

PETERSON (Continued)
Page 2

PUBLICATIONS

Peterson, M.A., 1982. The effects of air pollution and acid rain on fish, wildlife, and their habitats - introduction. U.S. Fish and Wildlife Service, Biological Services Program, Eastern Energy and Land Use Team, FWS/OBS-80/40.3. 181 pp.

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APPENDIX C.

LIST OF INTERVIEWEE IDENTIFICATION NUMBERS

LIST OF INTERVIEWEE IDENTIFICATION NUMBERS

Interviewee Number	Primary Duty Assignment	Years Associated with Volk ANG Base
1	Resource Manager	8
2	Base Engineer	2
3	Production Control	7
4	Engineering Technician	15
5	Buildings and Grounds Sup't.	15
6	Plumber	26
7	Resource Manager	6
8	Motor Vehicles Sup't.	28
9	Fuels Supervisor	15
10	Buildings and Grounds Supervisor	24
11	Resource Manager	22
12	Munitions Storage	32
13	Administrative Sup't.	22
14	Fire Chief	7
15	Mechanical Supervisor	12
16	Hardwood Range	1
17	Hardwood Range	7
18	Aircraft Maintenance	34

APPENDIX D.

USAF HAZARD ASSESSMENT RATING METHODOLOGY

USAF HAZARD ASSESSMENT RATING METHODOLOGY

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

"develop and maintain a priority listing of contaminated installations and facilites 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 the USAF Occupational and Environmental Health Laboratory (OEHL), the Air Force Engineering and Services Center (AFESC), Engineering-Science (ES) and CH_2M Hill.

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.

Site scores are developed using the appropriate ranking factors according to the method presented in the flow chart (Figure 1 of this report). The site rating form and the rating factor guideline are provided at the end of this appendix.

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, the potential pathways for contamination migration, and any efforts that were made to contain the wastes resulting from a spill.

The receptors 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. Scores for sites at which there is no containment are not reduced. 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 management practices category factor to the sum of the scores for the other three categories.

HAZARDOUS ASSESSMENT RATING 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 installation 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 ______ = ______

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) ________

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
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
HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES

1. 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	1-15	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

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

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

Rating Factors	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

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

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 Factors	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 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	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-hour rainfall (Thunderstorms)	<1.0 inch 0-5 0	1.0 to 2.0 inches 6-35 30	2.1 to 3.0 inches 36-49 60	>3.0 inches >50 100	8

B-2 Potential for Flooding

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

B-3 Potential for Ground-Water Contamination

Rating Factors	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to + 20 inches	Greater than +20 inches	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

Table 1--Continued

B-3 Potential for Ground-Water Contamination--Continued

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
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 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

IV. WASTE MANAGEMENT PRACTICES CATEGORY

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

B. Waste Management Practices Factor

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

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

Guidelines for fully contained:

Landfills:

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

Surface Impoundments:

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

Spills:

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

Fire Protection Training Areas:

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

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1, or III-6-3, then leave blank for calculation of factor score and maximum possible score.

GNR122

APPENDIX E.

SITE RATING FORMS

SITE RATING FORMS

NAME OF SITE Site No. 1 - Fire Department Training Area

LOCATION Volk Field ANG Base, 680 feet west of Building 907

DATE OF OPERATION OR OCCURRENCE 1955 to 1980

OWNER/OPERATOR Volk Field ANG Base Fire Department

COMMENTS/DESCRIPTION

SITE RATED BY Hazardous Materials Technical Center

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	116	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 64

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) H

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

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

100 x 1.0 = 100

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

100 x 1.0 = 100

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 100

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) ______

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
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 100

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	64
Waste Characteristics	100
Pathways	100
Total 264 divided by 3 =	88
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

88 X 1.0 = $\boxed{88}$

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 2 - Current Landfill

LOCATION Volk Field ANG Base, 600 feet southeast of southeastern limit of Camp Road

DATE OF OPERATION OR OCCURRENCE 1954 to July 1984

OWNER/OPERATOR Civil Engineering

COMMENTS/DESCRIPTION Possibly contains small munitions

SITE RATED BY Hazardous Materials Technical Center

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation 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	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	6	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	118	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 66

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) H

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 0.9 = 54

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

54 x 1.0 = 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	3	6	18	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	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	3	8	24	24
Net precipitation	3	6	18	18
Soil permeability	2	8	16	24
Subsurface flows	2	8	16	24
Direct access to ground water	3	8	24	24
		Subtotals	98	114

Subscore (100 X factor score subtotal/maximum score subtotal) 86

C. Highest pathway subscore.

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

Pathways Subscore 86

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	[illegible]
Waste Characteristics	54
Pathways	86
Total 206 divided by [illegible] =	[illegible]

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

69 X [illegible] = [illegible]

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 3 - Chronic Fuel Spill Site

LOCATION Volk Field ANG Base, Railroad tracks adjacent to POL storage area

DATE OF OPERATION OR OCCURRENCE 1950-1984

OWNER/OPERATOR Civil Engineering/Aircraft Maintenance Shop

COMMENTS/DESCRIPTION Buried petroleum pipelines present

SITE RATED BY Hazardous Materials Technical Center

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation 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	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	122	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 68

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 0.9 = 54

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

54 x 1.0 = 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	9	24
Net precipitation	3	6	18	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
		Subtotals	57	108

Subscore (100 X factor score subtotal/maximum score subtotal) 53

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	3	8	24	24
Net precipitation	3	6	18	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	3	8	24	24
		Subtotals	82	114

Subscore (100 X factor score subtotal/maximum score subtotal) 72

C. Highest pathway subscore.

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

Pathways Subscore 72

IV. WASTE MANAGEMENT PRACTICES

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

Receptors 68
Waste Characteristics 54
Pathways 72

Total 194 divided by 3 = 65
(Gross Total Score)

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

65 X 1.0 = 65

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 4 - Transformer Fluid Disposal Site

LOCATION: Volk Field ANG Base, 200 feet south of Building 331

DATE OF OPERATION OR OCCURRENCE: 1967 or 1968

OWNER/OPERATOR: Electrical Shop

COMMENTS/DESCRIPTION: Not known whether the transformer fluid contained PCB's

SITE RATED BY: Hazardous Materials Technical Center

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	116	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 64

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) H

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 1.0 = 60

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

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	2	8	16	24
Net precipitation	3	6	18	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
		Subtotals	64	108

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

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
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	3	8	24	24
Net precipitation	3	6	18	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	3	8	24	24
		Subtotals	82	114

Subscore (100 X factor score subtotal/maximum score subtotal) 72

C. Highest pathway subscore.

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

Pathways Subscore 72

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	64
Waste Characteristics	60
Pathways	72
Total 196 divided by 3 =	65 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

65 X 1.0 = 65

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 5-- KC-97 Crash Site

LOCATION Volk Field ANG Base, 400 feet north of taxiway 3

DATE OF OPERATION OR OCCURRENCE 1978

OWNER/OPERATOR Aerospace Ground Engineering

COMMENTS/DESCRIPTION No hazardous cargo other than fuel

SITE RATED BY Hazardous Materials Technical Center

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	116	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 64

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 0.9 = 54

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

54 x 1.0 = 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	3	6	18	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
		Subtotals	72	108

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

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
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	3	8	24	24
Net precipitation	3	6	18	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	3	8	24	24
		Subtotals	82	114

Subscore (100 X factor score subtotal/maximum score subtotal) 72

C. Highest pathway subscore.

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

Pathways Subscore 72

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	64
Waste Characteristics	54
Pathways	72
Total 190 divided by 3 =	63 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

63 X 1.0 = $\boxed{63}$

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 6 -- JP-4 Spill Site

LOCATION Volk Field ANG Base, POL storage area, 1200 feet south of Stabilization Pond

DATE OF OPERATION OR OCCURRENCE 1980

OWNER/OPERATOR Civil Engineering

COMMENTS/DESCRIPTION Spill occurred within diked area

SITE RATED BY Hazardous Materials Technical Center

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation 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	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	122	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 68

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 0.9 = 54

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

54 x 1.0 = 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	3	6	18	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	24
Rainfall intensity	1	8	8	24
		Subtotals	72	114

Subscore (100 X factor score subtotal/maximum score subtotal) 63

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	3	8	24	24
Net precipitation	3	6	18	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	3	8	24	24
		Subtotals	82	114

Subscore (100 X factor score subtotal/maximum score subtotal) 72

C. Highest pathway subscore.

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

Pathways Subscore 72

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	68
Waste Characteristics	54
Pathways	72
Total 194 divided by 3 =	65
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

65 X 0.95 = 62

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site No. 7 - Former Landfill

LOCATION Volk Field ANG Base, 560 feet south of Firing-in Butt (Structure 910)

DATE OF OPERATION OR OCCURRENCE Early 1900's until 1954

OWNER/OPERATOR Civil Engineering

COMMENTS/DESCRIPTION Possibly contains small munitions

SITE RATED BY Hazardous Materials Technical Center

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	116	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 64

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) S
3. Hazard rating (H - high, M - medium, L - low) M

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

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

30 x 1.0 = 30

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

27 x 1.0 = 30

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	3	6	18	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	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	3	8	24	24
Net precipitation	3	6	18	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	3	8	24	24
Subtotals			82	114

Subscore (100 X factor score subtotal/maximum score subtotal) 72

C. Highest pathway subscore.

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

Pathways Subscore 72

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	64
Waste Characteristics	30
Pathways	72
Total 166 divided by 3 =	55
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

56 x 1.0 = 55

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Site 8 - Munitions Burial Site

LOCATION 1500 feet SSW of the range control tower

DATE OF OPERATION OR OCCURRENCE 1976 to present

OWNER/OPERATOR Gunnery Range

COMMENTS/DESCRIPTION This site is referred to as Site No. 2 in Volk Field, Base Civil Engineering drawings

SITE RATED BY Hazardous Materials Technical Center

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
		Subtotals	104	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 58

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

50 x 0.9 = 45

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

45 x 1.0 = 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 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	2	8	16	24
Net precipitation	3	6	18	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	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	3	8	24	24
Net precipitation	3	6	18	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	3	8	24	24
		Subtotals	82	114

Subscore (100 X factor score subtotal/maximum score subtotal) 72

C. Highest pathway subscore.

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

Pathways Subscore 72

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	58
Waste Characteristics	45
Pathways	72

Total 175 divided by 3 = 58
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

58 x 0.95 = 55

APPENDIX F.

INVENTORY OF POL STORAGE TANKS

INVENTORY OF POL STORAGE TANKS

FUEL	LOCATION, FUNCTION	TANK CAPACITY (gal)	NUMBER, TYPE OF TANKS	PHYSICAL CONDITION (3/83)
JP-4	POL Area	194,471	1-Aboveground	Good
JP-4	POL Area	186,351	1-Aboveground	Good
AVGAS	POL Area	25,000	1-Underground	Good
MOGAS	Bldg 28	30	1-Aboveground	Good
MOGAS/regular	Motor Pool	10,036	1-Underground	Good
MOGAS/regular	Motor Pool	5,264	1-Underground	Good
MOGAS/regular	AGE Fueling Station	1,200	1-Underground	Good
MOGAS/unleaded	Hardwood Gunnery Range	550	1-Underground	Good
Waste Fuel	POL Area	2,000	1-Underground	Unknown
Waste Oil	Motor Pool	2,000	1-Underground	Unknown
#1 Diesel Fuel	Hardwood Gunnery Range	550	2-Underground	Unknown
#1 Diesel Fuel	Bldg 507	500	1-Aboveground	Unknown
#1 Diesel Fuel	Bldg 601	500	1-Underground	Unknown
#1 Diesel Fuel	Bldg 530	500	1-Underground	Unknown
#1 Diesel Fuel	Bldg 2013	300	1-Underground	Unknown
#1 Diesel Fuel	Bldg 2016	300	1-Underground	Unknown
#1 Diesel Fuel	Bldg 933	500	1-Underground	Unknown
#1 Diesel Fuel	Bldg 950	500	1-Underground	Unknown
#1 Diesel Fuel	Bldg 908	500	1-Underground	Unknown
#1 Diesel Fuel	Bldg 526	500	1-Underground	Unknown
#1 Fuel Oil	Motor Pool	1,500	1-Underground	Unknown
#2 Fuel Oil	POL Area	17,062	1-Underground	Good
#2 Fuel Oil	POL Area	9,994	1-Underground	Good
#2 Fuel Oil	POL Area	11,750	1-Underground	Good
#2 Fuel Oil	Bldg 950	6,000	1-Underground	Unknown
#2 Fuel Oil	Bldg 932	6,000	1-Underground	Unknown
#2 Fuel Oil	Bldg 449	6,000	1-Underground	Unknown
#2 Fuel Oil	Bldg 329	6,000	1-Underground	Unknown
#2 Fuel Oil	Bldg 504	6,000	1-Underground	Unknown
#2 Fuel Oil	Bldg 17	6,000	1-Underground	Unknown
#2 Fuel Oil	Bldg 503	4,000	1-Underground	Unknown
#2 Fuel Oil	Bldg 324	10,000	1-Underground	Unknown
#2 Fuel Oil	Bldg 115	2,000	1-Underground	Unknown
#2 Fuel Oil	Bldg 316	500	1-Underground	Good
#2 Fuel Oil	Bldg 325	1,000	1-Underground	Unknown
#2 Fuel Oil	Bldg 313	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 400	1,000	1-Underground	Unknown
#2 Fuel Oil	Bldg 508	1,000	1-Underground	Unknown
#2 Fuel Oil	Bldg 520	1,000	1-Underground	Unknown
#2 Fuel Oil	Bldgs 522 & 523	1,000	1-Underground	Unknown
#2 Fuel Oil	Bldgs 127 & 128	560	1-Underground	Unknown
#2 Fuel Oil	Bldgs 129 & 130	560	1-Underground	Unknown
#2 Fuel Oil	Bldgs 131 & 132	560	1-Underground	Unknown

INVENTORY OF POL STORAGE TANKS (Continued)

FUEL	LOCATION, FUNCTION	TANK CAPACITY (gal)	NUMBER, TYPE OF TANKS	PHYSICAL CONDITION (3/83)
#2 Fuel Oil	Bldg 137	560	1-Underground	Unknown
#2 Fuel Oil	Bldg 138	560	1-Underground	Unknown
#2 Fuel Oil	Bldg 531	560	1-Underground	Unknown
#2 Fuel Oil	Bldg 908	560	1-Underground	Unknown
#2 Fuel Oil	Bldg 331	550	1-Underground	Unknown
#2 Fuel Oil	Bldg 517	550	1-Underground	Unknown
#2 Fuel Oil	Bldg 2020	550	1-Underground	Unknown
#2 Fuel Oil	Bldg 102	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 113	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 116	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 117	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 125	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 134	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 135	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 136	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 300	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 302	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 309	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 401	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 403	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 414	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 415	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 428	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 433	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 525	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 526	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 916	500	1-Underground	Unknown
#2 Fuel Oil	Bldg 907	450	1-Underground	Unknown
#2 Fuel Oil	Bldg 126	300	1-Underground	Unknown
#2 Fuel Oil	Bldg 133	300	1-Underground	Unknown
#2 Fuel Oil	Bldg 613	300	1-Underground	Unknown
#2 Fuel Oil	Bldg 616	300	1-Underground	Unknown
#2 Fuel Oil	Bldg 2000	300	1-Underground	Unknown
Liquid Propane	Bldg 4	500	1-Aboveground	Unknown
Liquid Propane	Bldgs 146 & 147	1,000	1-Aboveground	Unknown
Liquid Propane	Bldg 329	1,000	1-Aboveground	Unknown
Liquid Propane	Bldgs 417 & 419	500	1-Aboveground	Unknown
Liquid Propane	Bldg 418	1,000	1-Aboveground	Unknown
Liquid Propane	Bldg 420	1,000	1-Aboveground	Unknown
Liquid Propane	Bldg 421	1,000	1-Aboveground	Unknown
Liquid Propane	Bldg 422	1,000	1-Aboveground	Unknown
Liquid Propane	Bldg 449	1,000	1-Aboveground	Unknown
Liquid Propane	Bldg 508A	1,000	1 Aboveground	Unknown

INVENTORY OF POL STORAGE TANKS (Continued)

FUEL	LOCATION, FUNCTION	TANK CAPACITY (gal)	NUMBER, TYPE OF TANKS	PHYSICAL CONDITION (3/83)
Liquid Propane	Bldg 519	1,000	1-Aboveground	Unknown
Liquid Propane	Bldg 521	1,000	1-Aboveground	Unknown
Liquid Propane	Bldg 933	500	1-Aboveground	Unknown
Liquid Propane	Bldg 2021	500	1-Aboveground	Unknown
Liquid Propane	Bldg 2014	500	1-Aboveground	Unknown
Liquid Propane	Bldg 2011	500	1-Aboveground	Unknown
Liquid Propane	Bldg 329	---	12 - 100 lb. cylinders	Unknown
PD-680 Solvent	Bldg 504	250	1-Aboveground	Unknown
Trichloroethylene	Bldg 509	32	1-Aboveground	Unknown
JP-4	POL Area	5,000	4-R-9 Refueler	Good
JP-4	POL Area	5,000	1-R-2 Refueler	Good
JP-4	POL Area	5,000	5-R-5 Refueler	Good
AVGAS	POL Area	5,000	1-R-5 Refueler	Good

APPENDIX G.

INVENTORY OF OIL/WATER SEPARATORS

INVENTORY OF OIL/WATER SEPARATORS

LOCATION	FACILITY IDENTIFICATION	SEPARATOR TYPE	OIL WATER DISPOSAL/DISCHARGE
Buildings 35 and 36	POL Storage	Baffled Chambers	DPDO/Drain Field
Building 324	Motor Pool	Baffled Chamber	DPDO/Sanitary Sewer

APPENDIX H

DETAILED LISTING OF BASE OPERATIONS

DETAILED LISTING OF BASE OPERATIONS

Operation/Shop Name	Building Number	Handles Hazardous Materials	Generates Hazardous Waste	Current Waste Management Method
Aircraft Maintenance/NDI	503	x	x	Munitions Burning/ DPDO/Landfill
Maintenance Hangar	504	x	x	Munitions Burning
Aerospace Ground Equipment	509	x	x	DPDO/Drain Field
Fuels Management (POL)	44	x	x	Munitions Burning
Fuels Storage	29-36	x		
LOX Storage	532	x		
Munitions Storage	901-917	x		
Supply	20/139/505			
Fire Protection	517	x		
Dispensary	316			
Motor Pool	324	x	x	DPDO/Munitions Burning/Sanitary
Civil Engineering Warehouse	43/506	x		Sewer/Drain Field
Paint Shop	329	x	x	DPDO/Landfill
Plumbing Shop	329	x	x	DPDO
Electrical Shop	329			
Heating/Ventilation Shop	329			
Wood Shop	329			
Sanitary Sewer Lift Station	528			

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