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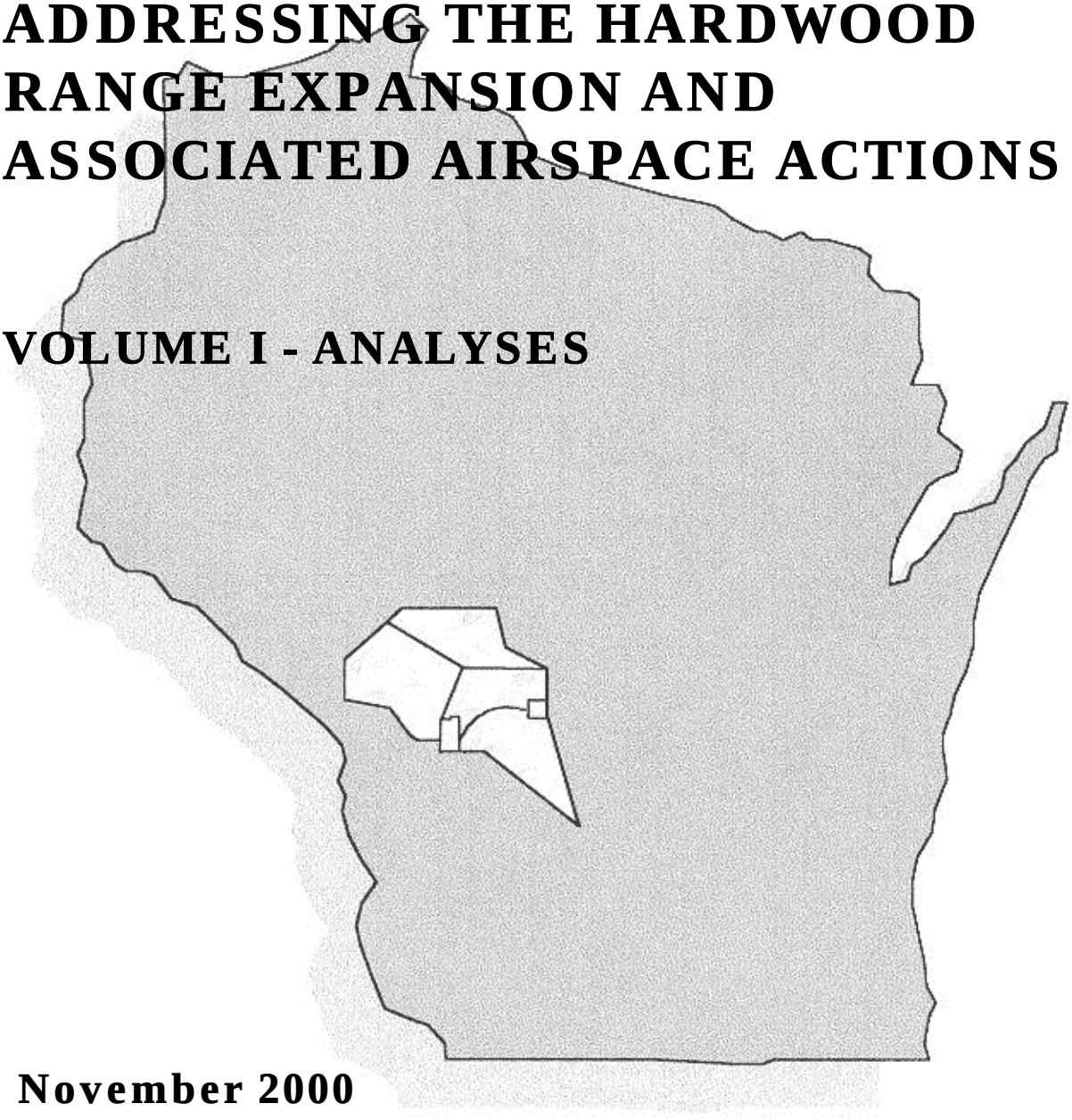
FINAL ENVIRONMENTAL IMPACT STATEMENT ADDRESSING THE HARDWOOD RANGE EXPANSION AND ASSOCIATED AIRSPACE ACTIONS



VOLUME I - ANALYSES

November 2000

ABBREVIATIONS AND ACRONYMS LIST

$\mu g/m^3$	micrograms per cubic meter
ACHP	Advisory Council on Historic Preservation
ACMI	Air Combat Maneuvering Instrumentation
AFB	Air Force Base
AFI	Air Force Instruction
AGL	above ground level
AMRAAM	Advanced Medium Range Air-to-Air Missile
ANG	Air National Guard
ANGRC	Air National Guard Readiness Center
AST	above ground storage tank
AW	Airlift Wing
BA	biological assessment
BAM	Bird Avoidance Model
BASH	bird-aircraft strike hazard
BDU	bomb dummy unit
BLM	Bureau of Land Management
BW	Bomb Wing
CAA	Clean Air Act
$CaCO_3$	calcium carbonate
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensations, and Liability Act
CFL	County Forest Land
CFR	Code of Federal Regulations
CHCN	Committee on the Health Council of the Netherlands
CO	carbon monoxide
CRTC	Combat Readiness Training Center
CWA	Clean Water Act
cwt	hundred weight
dB	decibel
dB(A)	A-weighted sound level
DEIS	Draft Environmental Impact Statement
DOD	Department of Defense
DOI	U.S. Department of Interior
DOPAA	Description of the Proposed Action and Alternatives
DOT	Department of Transportation
DRMO	Defense Reutilization and Marketing Organization
DZ	Drop Zone
E.O.	Executive Order
EBS	Environmental Baseline Survey
ECG	electrocardiogram
EIS	Environmental Impact Statement
EOD	explosive ordnance disposal
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAC	Forward Air Controller
FAR	Federal Aviation Regulation
FEIS	Final Environmental Impact Statement
FICON	Federal Interagency Committee on Noise
FICUN	Federal Interagency Committee on Urban Noise
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FL	flight level
FW	Fighter Wing
FY	Fiscal Year
HAP	high accident potential
HQTAC	Headquarters Tactical Air Command
IFR	instrument flight rules
IICEP	Interagency and Intergovernmental Coordination for Environmental Planning
IR	Instrument Route
KIAS	knots indicated airspeed
KTAS	knots true airspeed
LATN	low-altitude tactical navigation
lbs	pounds
L_{dn}	day-night average sound level
L_{dnmr}	onset rate-adjusted monthly day-night average sound level
L_{max}	maximum sound level
LOWAT	low-altitude air-to-air training
MAILS	Multiple-Aircraft Instantaneous Line Source
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mm	millimeter
MOA	Military Operations Area
mph	miles per hour
MR_NMAP	MOA Range NOISEMAP
MSL	mean sea level
MTR	Military Training Route
NAAQS	National Ambient Air Quality Standards
National	
NEPA	National Environmental Policy Act
NGB	National Guard Bureau
NHI	Natural Heritage Inventory
NHPA	National Historic Preservation Act
NM	nautical miles (approximately 1.15 statute miles)
NO	nitric oxide
NO_2	nitrogen dioxide
NOA	Notice of Availability
NOI	Notice of Intent
NO_x	nitrogen oxides
NPS	National Park System
NWR	National Wildlife Refuge
O_3	ozone
OSHA	Occupational Safety and Health Administration
PILT	payment in lieu of taxes
PM_{10}	particulate matter equal to or less than 10 microns in diameter
ppm	parts per million
PSA	Pacific Southwest Airlines
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
Register	National Register of Historic Places
ROD	Record of Decision
ROI	region of influence
SAIC	Science Applications International Corporation
SAM	surface-to-air missile
SCAQMD	South Coast Air Quality Management District
SEL	sound exposure level
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	sulfur dioxide
SOP	Special Operating Procedure
SR	state roads
SWA	State Wildlife Area
SWDA	Solid Waste Disposal Act
T&E	threatened and endangered
TSCA	Toxic Substance Control Act
TSP	total suspended particulates

TTS	temporary threshold shifts
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAF	United States Air Force
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
VFR	visual flight rules
VHF	very high frequency
VOC	volatile organic compound
VR	visual route
WCFA	Wisconsin County Forests Association
WCFL	Wood County Forest Land
WCWA	Wood County Wildlife Area
WDNR	Wisconsin Department of Natural Resources
WDT	Wisconsin Division of Tourism
WIANG	Wisconsin Air National Guard
WPA	Works Progress Administration

FINAL ENVIRONMENTAL IMPACT STATEMENT ADDRESSING THE HARDWOOD RANGE EXPANSION AND ASSOCIATED AIRSPACE ACTIONS

VOLUME I -- ANALYSES

Air National Guard
National Guard Bureau
Andrews Air Force Base, Maryland

November 2000

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COVER SHEET

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TITLE OF PROPOSED ACTION: Hardwood Range Expansion and Associated Airspace Actions

AFFECTED JURISDICTIONS: Wisconsin

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DOCUMENTATION DESIGNATION: Final Environmental Impact Statement

ABSTRACT: This document provides an evaluation of the environmental consequences associated with the proposed action to expand the Hardwood Air-to-Surface Gunnery Range and Associated Airspace Actions. If implemented, this action would increase the land area of the Hardwood Range; add a new area for potential target locations, a drop zone, and a landing zone; modify its associated restricted airspace (R-6904); and reassess the annual sortie utilizations of three Military Operations Areas (MOAs). Evaluation factors address range expansion and airspace utilization issues. Alternatives addressed include the Proposed Action and the No-Action Alternative.

COMMENTS SHOULD BE ADDRESSED TO:

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This Environmental Impact Statement (EIS) was prepared by the National Guard Bureau (NGB) in accordance with the National Environmental Policy Act (NEPA) to support decision-making relevant to a proposal referred to as the *Hardwood Range Expansion and Associated Airspace Actions*. The action would take place exclusively in Wisconsin. This document provides background information on the Proposed Action and alternatives considered, a description of the affected environment associated with each part of the action, and an analysis of the potential environmental consequences of implementing this proposal.

The Proposed Action has been updated since the public scoping period and no longer includes proposed new southern and southwestern low-level aircraft training corridors leading to the Hardwood Range. These proposed corridors were dropped from consideration when operational limitations for fighter aircraft surfaced during preliminary environmental studies in the areas where the low-level corridors were proposed. The southern and southwestern corridors will not be carried forward for further study.

The airspace and range addressed in this EIS have been historically used by the Air National Guard (ANG) and other military flying units. The Federal mission of these units is to provide the Department of Defense (DoD) with combat-ready pilots and support personnel for worldwide deployment, should the need arise. During peacetime, units must maintain combat readiness by conducting proficiency training. To serve its Federal mission, many aircrews of the ANG fly the recently acquired F-16 aircraft, which is a compact, highly maneuverable, multi-role, single-seat jet fighter that has proven to be highly effective in air-to-air combat and air-to-surface attack roles. A cost-effective fighter, the F-16 combines a high performance capability with low procurement and operational costs. In addition, transport planes, such as the C-130, must train using various techniques to deliver personnel and materials to locations without developed airports. Drop zones (DZs) and landing zones are required to provide the training arena necessary to ensure pilots and crews develop the skills for such deliveries. Other DoD aircraft would also use the proposed airspace and range facilities on an infrequent basis.

Proficiency training requires the use of military airspace approved by the Federal Aviation Administration (FAA) known as Military Operations Areas (MOAs), Military Training Routes (MTRs), and Restricted Airspace, such as that associated with the Hardwood Range. Training scenarios include such activities as aircraft intercept and air combat maneuvers in the MOAs and low-altitude tactical navigation (LATN) in the MTRs. Training in evasive tactics will incorporate the use of flares at appropriate altitudes. Training will require subsonic flying only at speeds between 250 and 550 knots indicated airspeed (KIAS) (285 to 625 miles per hour [MPH]). Ranges are used to practice ordnance delivery. Various United States Air Force (USAF) directives and instructions require this proficiency training to occur.

ADDITIONS MADE FOR THE FINAL ENVIRONMENTAL IMPACT STATEMENT

Improvements have been made to this Final Environmental Impact Statement (FEIS) in response to public comments on the Draft Environmental Impact Statement (DEIS). These efforts have addressed many areas; however, particular attention has been focused on adding new information in response to requests from regulatory agencies and the public. Such changes have included modifying or clarifying the EIS text, adding new maps, and completing the draft studies presented as appendices to the document.

This FEIS also includes (see Volume II, separate document) the results of public comments on the DEIS and provides the ANG responses to these comments, including comments submitted during the public hearings on the Draft conducted in September 1997. Volume III (also a separate document) presents other related correspondence.

PURPOSE OF AND NEED FOR THE ACTION

The DoD has assigned the ANG an ongoing commitment to deploy worldwide in support of major and lessor regional contingencies. United States military forces, including the ANG, must continually train to maintain the highest level of combat readiness to meet this commitment. Midwest ANG units, as well as several other Total Force units, would continue to deploy regularly in support of current and other contingencies for the foreseeable future. This serves to indicate the ANG's continuing need to support the National Security Strategy by demanding these units maintain their readiness, or "train the way we fight."

A key element to this readiness is a realistic wartime training environment conducted at air-to-ground gunnery ranges. However, the current training environment is inadequate to maintain the necessary level of combat readiness to meet global commitments. The ranges available to ANG units in the Midwest region are minimally adequate to practice combat weapons deliveries utilizing combat oriented tactics. This includes Hardwood Range in its present day configuration. Currently, Hardwood Range only provides the capability for pilots to hone their basic weapon delivery skills. However, tactics and weapons have changed drastically in the decades since this range was designed. The ANG needs improvements to Hardwood Range to ensure weapons deliveries fulfill wartime training commitments and to practice tactically sound combat oriented scenarios. This supports the National Security Strategy by providing a balance to deliver weapons with accuracy while maintaining survivability of the pilot and the aircraft.

Tactics currently conducted at Hardwood Range are extremely limited. Significant attack axis restrictions exist for all deliveries. Specifically, the current attack direction to any target is restricted to a specific magnetic heading. This limited attack direction restricts the extent which any level of tactics can be sufficiently performed. While this may result in pilots obtaining proficiency on the particular attack axis to a specific target in peacetime, the convenience to attack an enemy's target from the same direction results in predictability of flight path. This permits the enemy to easily destroy a predictable attacking aircraft, resulting in unacceptable combat losses.

Also, the Hardwood Range target array is relatively small and pilots are intimately familiar with all the targets. This results in the pilot's inability to obtain adequate training on unfamiliar first-look attack targets. Target acquisition is paramount to destroying the target the first time every time. The pilot's bombing skills are simply not challenged due to this familiarity. The pilot's skills sets are diminished and, subsequently, sound employment tactics suffer.

Further, inert heavy weight ordnance can only be delivered on two target groups with only one attack axis. This causes a very severe limitation to overall fighter tactics training. These restrictions affect over 50 percent of annual bombing training requirements. This equates to 25 percent of yearly-allocated sorties per year. The net result of Hardwood Range's restrictions is an overall decrease in combat capability due to the mismatch of a 1950s designed range that is inadequate to meet the needs of the 21st Century tactics and technology.

Fighter units are able to occasionally deliver weapons without restrictions at exercises such as Red Flag (Nellis Air Force Base [AFB]), Maple Flag (Canada), and Cope Thunder (Alaska). But units can only deploy to these exercises once every two years due to budgetary and scheduling constraints. This is hardly enough to attain, much less maintain, combat weapons delivery proficiency. If ANG units are to maintain the highest state of readiness demanded by the DoD, improvements to the current bombing range must occur.

In light of recent military technological applications, ANG F-16s are being modified to deliver precision guided munitions providing pinpoint accuracy to destroy enemy targets. This munition provides the pilot with the greatest degree of survivability. To successfully deliver this weapon, pilots must practice deliveries on a recurring basis to obtain the highest degree of combat proficiency. There are only three ANG air-to-ground ranges in the United States where pilots can practice these deliveries. The closest one to Midwest ANG units is at Smoky Hill range near Salina, Kansas. However, it is cost prohibitive for units to deploy to Smoky Hill to attain and maintain currency in precision guided munition weapons delivery tactics. The Midwest units need a range that is close to their home bases on which to practice these deliveries. The Hardwood Range expansion is needed to fill training in this new technology.

With the advent of precision guided munitions due to military technological applications, the Hardwood Range expansion imparts an even greater importance to combat readiness. Current doctrine dictates delivery of certain precision guided munitions at altitudes up to 25,000 feet with an extended distance greater than 3 miles from the target to successfully employ these weapons, while simultaneously utilizing sound tactics. This requires the weapons impact area to be increased for safety implications. Hardwood Range is currently not large enough to support fighter training in these deliveries. The proposed range expansion would provide an excellent opportunity to perform such deliveries. Increasing the impact area would also support attacks from multiple directions at various altitudes, and provide a greater array of target attacks to challenge pilot skills and increase proficiency.

Lastly, the ANG and Total Force units which utilize Volk Field Combat Readiness Training Center (CRTC) and Hardwood Range needs a cost-efficient location to develop and maintain pilot's skill sets needed. These improvements would ensure the ANG could continue to "train as we fight." This will ensure success on the first attack, as well as survival of forces, thus allowing forces to support the National Security Strategy on a continuing basis.

The Proposed Action would expand the land area of the existing Hardwood Range and allow for modifications to the airspace and certain operations associated with the Range. The need for this expansion is based on the ANG's current and future air-to-ground training requirements. The EIS analyzes impacts from both the acquisition of the necessary real estate interest as well as the impacts with regard to flying and operations related to the flying, such as a possible new tactical target range, a landing zone and a DZ. While data is available on the new property in general, some of the specific decisions and impacts related to air-to-ground operations cannot be completely assessed until the real estate interest is acquired and a thorough on-site investigation regarding such projects is possible. Following possible acquisition of the real estate interest, such site-specific decisions and impacts can then be assessed and made. Therefore, supplementing the current EIS may be necessary. It is quite possible that the decisions resulting from this EIS will come about in phases, with the decision dealing with acquisition/airspace modification coming prior to final decisions on the construction to support flying projects.

The airspace portion of the proposal would expand the upper, lower, and lateral boundaries of the restricted airspace directly associated with the Hardwood

Range [i.e., Restricted Area 6904B (R-6904B)], and increase the ceiling of R-6904A. The configuration of the five Military Operations Areas (MOAs) adjacent to the range (Falls 1, Falls 2, Volk East, Volk West, and Volk South) would remain unchanged, but three of the MOAs (Falls 1, Falls 2, and Volk South) would have increased utilization from currently assessed levels. The additional land acreage associated with the range would facilitate use of the training capabilities at the range. The maximum currently assessed utilization of 4,992 annual sorties for the range would not change under the proposal.

The Proposed Action responds to the requirements of, and has been prepared in accordance with, Air Force Instruction (AFI) 13-201, Airspace Management (19 July 1994), AFI 13-212 Volume I - Weapons Ranges (28 July 1994), Volume II - Weapons Range Management (26 August 1994), and Volume III - Hazard Methodology and Weapons Safety Footprints (16 December 1994).

Operational requirements generate the need for this action. One is military readiness. The declining DOD budget is causing the active duty military force to reduce its aircraft inventory, personnel force, and number of bases. The Air Reserve Components, such as the ANG, are also reducing in size but at a slower rate. As a result, the ANG's percentage of the total force (i.e., active duty, ANG, and Air Force Reserve) is increasing. Because of this, ANG units are being tasked for increasingly prominent responses to wartime and contingency situations as these units assume roles and missions formerly assigned to active duty units. Based on current and projected Congressional funding, global military force projection will increasingly rely on the ANG. To rapidly and effectively respond when called upon, ANG units must continue training to the same high standards established by the United States Air Force (USAF) for active duty units.

Developments in military weapons systems, such as advanced long range air-to-surface weapons, along with reductions in force structure, have altered USAF doctrine and tactics. These changes often necessitate modifying training ranges and/or modifying existing airspace and creating new airspace for training purposes.

Technological improvements at the Volk Field CRTC, such as the Air Combat Maneuvering Instrumentation (ACMI) system, make it possible for military flying units to accomplish a broad range of training that they are unable to accomplish at their home fields. A DZ and landing zone are required to provide airlift aircraft, such as the C-130, with an area to practice insertions/extractions of airlift cargo. DZs are areas designated to airdrop cargo. Landing zones are designed to develop proficiency through realistic short field landings. The actions included in this proposal would increase the military's training efficiency by offering consolidated training opportunities at a central location. Appendix E presents the current operational training requirements relevant to the Proposed Action.

Another operational requirement is safety. The proposed expansion would ensure that many flights would remain over land owned or controlled by the government to further increase safety for the civilian population near the range. In addition, the increased acreage would ensure that the safety footprint (i.e., an area beyond which no training ordnance would be predicted to fall) would remain on government land. Live ordnance would not be used at Hardwood Range.

Equally important is responsible stewardship of unit funding. Distances to some of the existing military airspace that support use of the Hardwood Range and associated airspace components used for training in air-to-air tactics are not within the criteria suggested in the *USAF Airspace Master Plan*. The Proposed Action would reassess airspace utilization and allow military units using the airspace to accomplish air-to-surface training and air-to-air training at the same location. This would allow

each unit to accomplish more of the required training on each flight, which would help reduce training expenses.

ALTERNATIVES CONSIDERED

As part of the EIS process, a number of alternatives were considered for inclusion in this analysis. The alternative considered feasible and able to meet the ANG training requirements included only the Proposed Action. The No-Action Alternative was also evaluated. The Proposed Action is the preferred alternative. The airspace actions associated with the No-Action and Proposed Action Alternatives are summarized in Table S-1. In addition, it is important to note that, should any of the changes associated with the *Hardwood Range Expansion and Related Airspace Actions* ultimately be excluded from the Proposed Action by decision-makers, adoption of the No-Action Alternative can be done individually and separately for any component of the alternatives.

Table S-1. Summary Overview of Alternatives Studied in Detail

RANGE OR AIRSPACE COMPONENT	*ALTERNATIVES*	
	NO-ACTION (BASELINE)	*PROPOSED ACTION*
Hardwood Air-to-Surface Gunnery Range	*Continued use as prior to the proposal.*	*Expand land area by 7,137 acres; add new area for target locations, a landing zone, and a DZ.*
R-6904	*Continued use as prior to the proposal.*	*Lower minimum altitude to surface and expand lateral confines of R-6904B to coincide with land expansion; increase maximum altitude of R-6904A/B to Flight Level (FL) 250 and higher to FL 500, as needed. Assessed utilization would remain unchanged at 4,992 annual sorties.*
Falls 1 MOA	*Continued use as prior to the proposal.*	*Airspace configuration would remain unchanged; increase the assessed number of sorties flown annually from to 2,789.*
Falls 2 MOA	*Continued use as prior to the proposal.*	*Airspace configuration would remain unchanged; increase the assessed number of annual sorties flown annually from to 1,617.*
Volk South MOA	*Continued use as prior to the proposal.*	*Airspace configuration would remain unchanged; increase the assessed number of sorties flown annually from to 1,340.*

The Proposed Action

The ANG proposes to obtain the use of 7,137 acres of land contiguous to the Hardwood Range located in Wood County, Wisconsin. The proposed expansion area is composed of a mix of county forest land and private land devoted to agriculture. The ANG considers this property desirable due to its potential for a number of possible tactical training uses. Such uses include airspace modifications and possible construction of a tactical target range, landing zone and a DZ. To some extent, the configuration of these projects is dependent on unrestricted access to the relevant property. In that regard, all significant real estate transactions/matters would be handled by the army Corps of Engineers, who would make recommendations as to the appropriate real estate interest necessary to accomplish the ANG goals. The process of acquiring any real estate interest, following any Record of Decision (ROD) on the merits of the proposal, may take up to three to four years. Following that process, (which would provide ANG with complete access to the property and allow the acquisition of

detailed site-specific information), a determination would be made as to whether the information in the EIS regarding certain possible actions is adequate or in need of being supplemented.

The proposal would also expand the vertical and lateral limits of R-6904B, increase the upper limit of R-6904A, and reassess the annual sortie utilization of three MOAs. The airspace components that comprise the Proposed Action are shown in Figure S-1 and summarized below:

- **Modify Hardwood Air-to-Surface Gunnery Range.** This action would expand the land area to the north of the current boundaries by a total of 7,137 acres. This area would include potential target locations, a DZ, and a landing zone. The new target area would provide opportunities for varied and more realistic air-to-ground training. Figure S-2 illustrates these elements. The Range is centered approximately 20 statute miles north-northeast of Volk Field and 80 statute miles north-northwest of Madison, Wisconsin. This action is a stand-alone initiative and is independent of the airspace actions.

- **Modify the Restricted Airspace Associated with the Hardwood Range.** This action would lower the bottom altitude and expand the lateral confines of Restricted Airspace 6904B (R-6904B) to coincide with the proposed land expansion (see Figure S-3). It would also increase the maximum altitude of R-6904A and R-6904B continuously to FL 250 and higher up to FL 500, on an as needed basis. Restricted airspace must be contiguous with any new range boundaries and extend vertically from ground level to ensure the safety of non-participating aircraft. The increase in the maximum altitude of R-6904A and B is a stand-alone initiative and is independent of the range expansion.

- **Reassess Falls 1 MOA Utilization**. This action would increase the currently assessed number of sorties flown annually to 2,789. The lateral and vertical boundaries would remain unchanged. The Falls 1 MOA is shown in Figure S-4. This action is a stand-alone initiative and is independent of the range expansion.

- **Reassess Falls 2 MOA Utilization**. This action would increase the currently assessed number of sorties flown annually to 1,617. The lateral and vertical boundaries would remain unchanged. The Falls 2 MOA is shown in Figure S-4. This action is a stand-alone initiative and is independent of the range expansion.

- **Reassess Volk South MOA Utilization**. This action would increase the currently assessed number of sorties flown annually to 1,340. The lateral and vertical boundaries would remain unchanged. The Volk South MOA is shown in Figure S-4. This action is a stand-alone initiative and is independent of the range expansion.

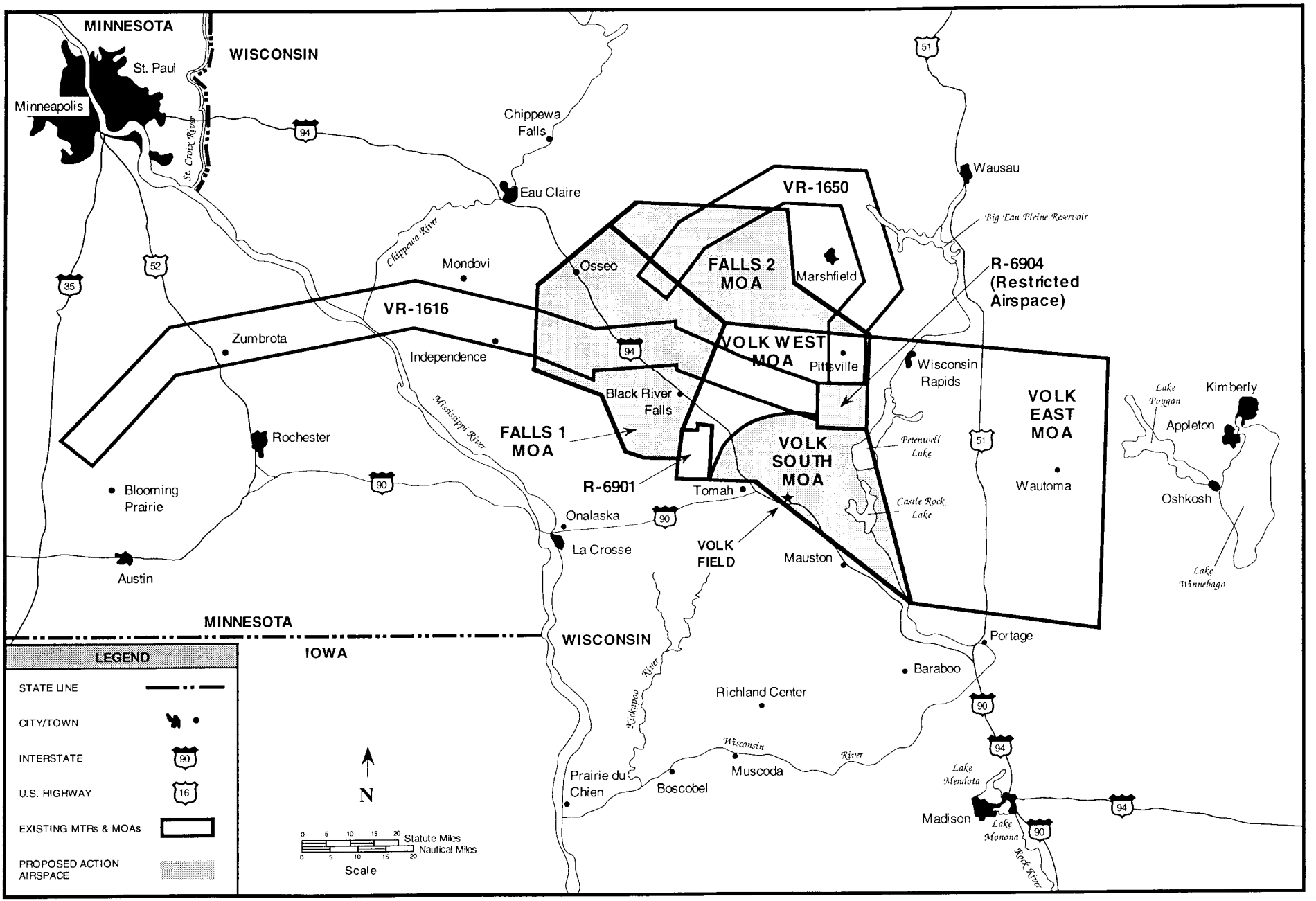

Figure S-1. Airspace Associated with the Proposed Action

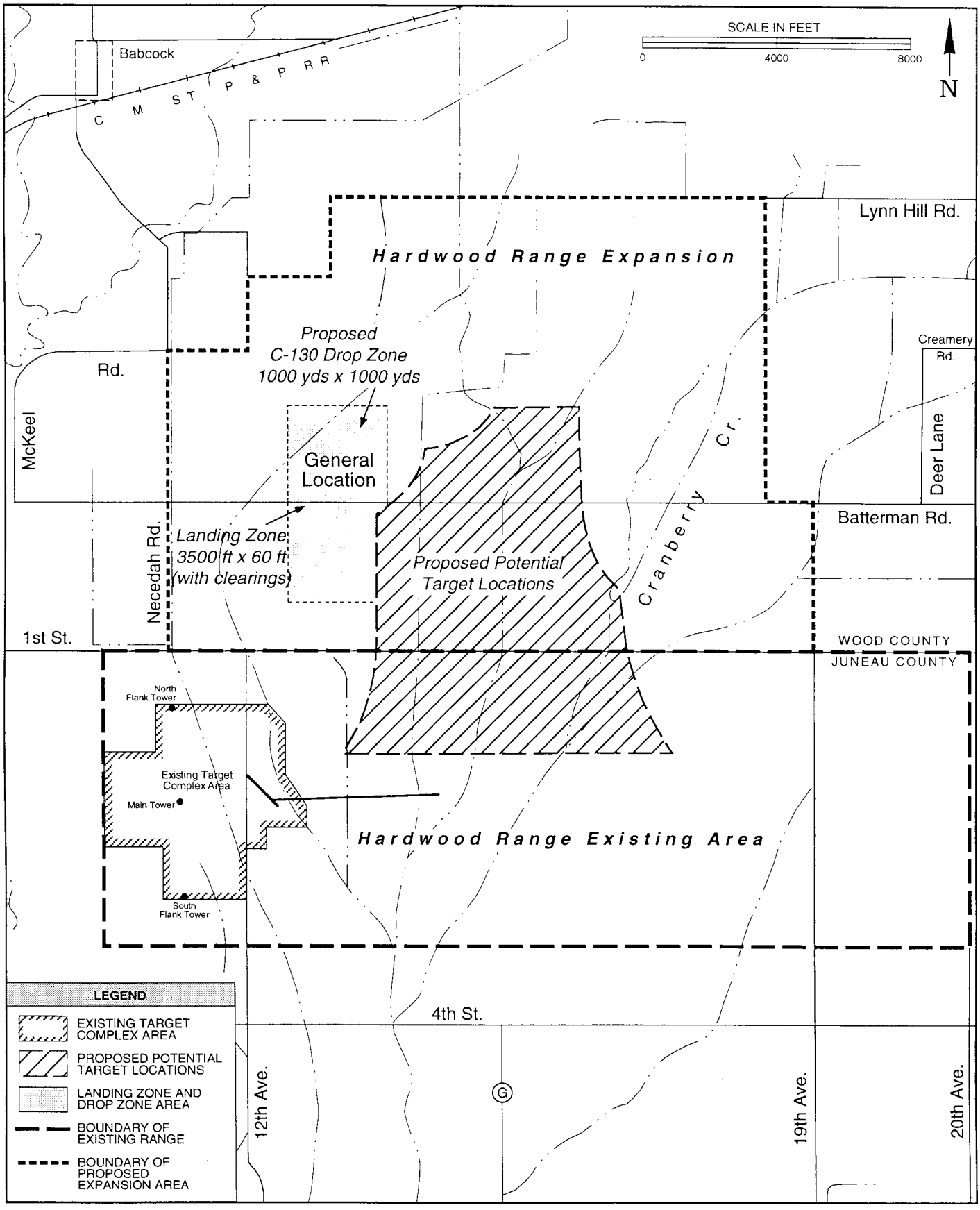

Figure S-2. Configuration of Existing Hardwood Range and Proposed Range Expansion

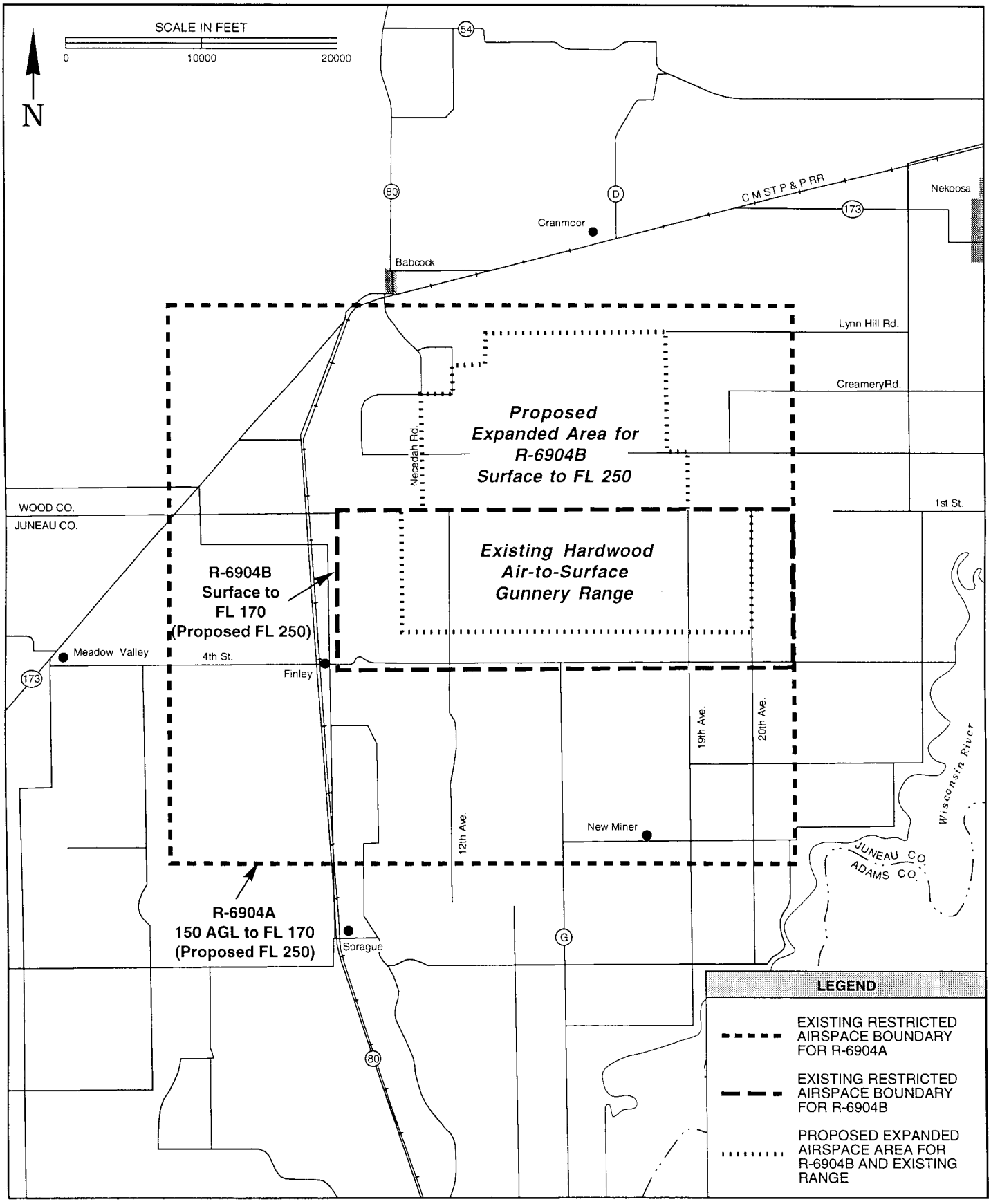

Figure S-3. Existing and Proposed Airspace R-6904A/B

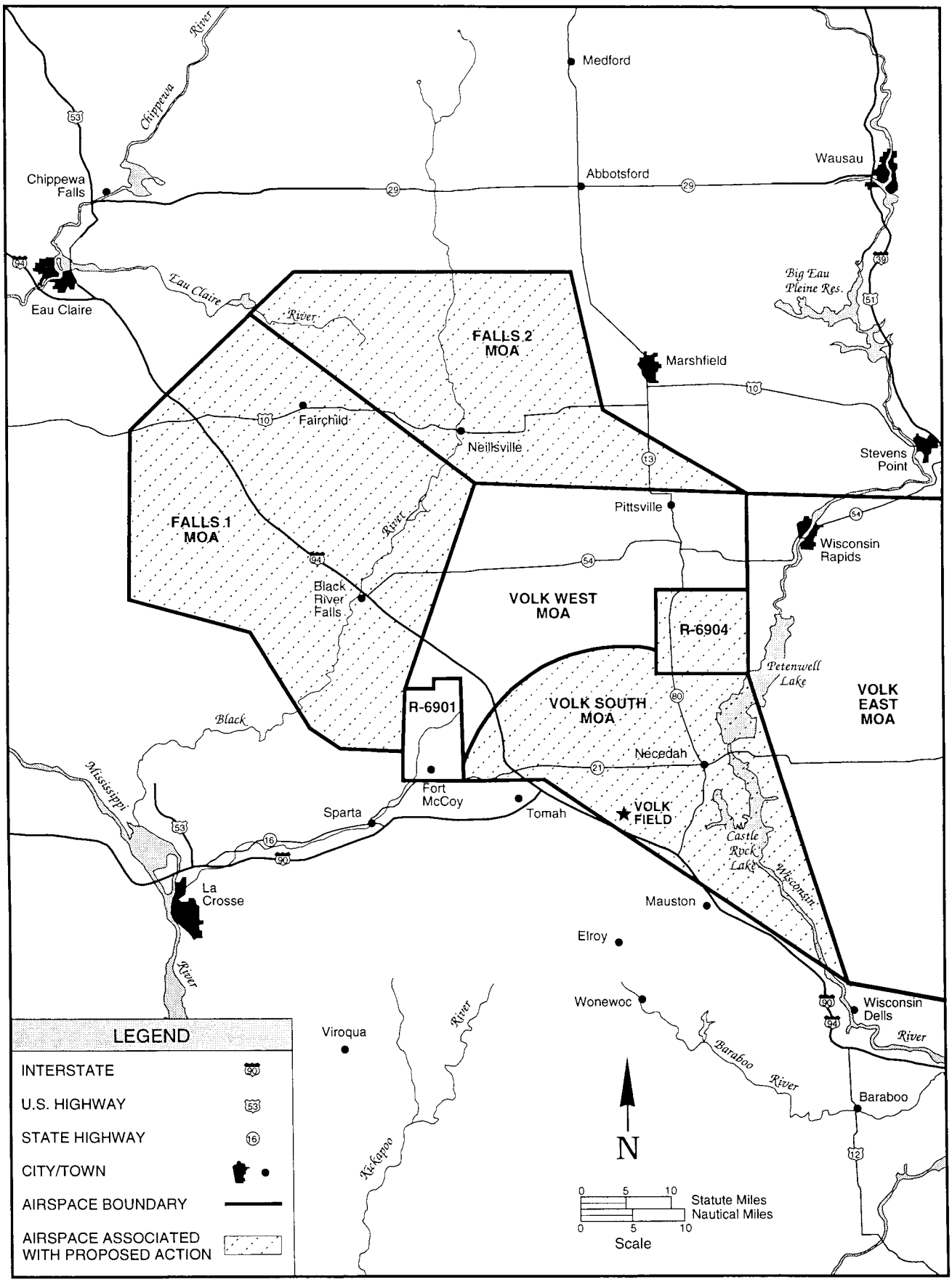

Figure S-4. Locations of Existing MOAs and Restricted Airspace Associated with the Proposed Action

The No-Action Alternative

The No-Action alternative would mean military units would continue to train using the current range and existing airspace. The configuration of the Hardwood Range and Restricted Airspace R-6904 would remain as they currently exist. The DZ and landing zone would not be developed. Assessment of annual utilization would continue to need to be updated.

Should any of the range changes or airspace additions or modifications considered under the Proposed Action ultimately be excluded from adoption by decision-makers, adoption of the No-Action alternative can be done individually and separately for any component of the No-Action alternative.

This alternative would limit any potential increase in operating efficiency of the range. For example, the small size and orientation of the current Hardwood Range and R-6904B limits the variety and realism of tactical training scenarios due to repeated identical missions from West to East. USAF doctrine requires pilots to train under conditions which are as realistic as possible. In addition, the current vertical limit of R-6904 does not permit high-altitude release bomb training, which is required for altitudes between FL 180 (18,000 feet) and FL 310. Consequently, training capabilities at Hardwood Range would provide more realistic combat scenarios if the range was expanded laterally and vertically. Training for landing zone use and DZ proficiency would not exist at this facility.

Other Alternatives Not Carried Forward for Detailed Study

Several other alternatives were studied for consideration in this EIS but were eliminated from further detailed study. These alternatives included the following:

- Establish a Range at Another Location. The establishment at another location of a new air-to-surface gunnery range as an alternative was eliminated from further study because of the associated costs of obtaining a new range in years and dollars.

- Use the Range at Fort McCoy. Continued and projected demands for utilization and facility upgrades at the United States Army range at Fort McCoy would likely preclude a transfer of Hardwood Range activity to Fort McCoy as an alternative. Additionally, the target area would need to be expanded to meet fighter aircraft training requirements.

- Close Hardwood Range. The closure of Hardwood Range and redirection of units to other ranges was eliminated from further study because this alternative would make training for affected units too costly. If the Hardwood Range were unavailable, units that currently rely on these range facilities would be required to incur additional costs for extra flying time, air refueling, or deployments to an alternative range facility.

- Use Other MOAs and MTRs. Using existing MOAs and MTRs other than those contained in the proposal as an alternative was eliminated from further study because none of the operational deficiencies associated with present conditions would be alleviated or corrected; this alternative would not improve conditions for meeting aircrew proficiency requirements.

- Use Electronic Scoring. The use of electronic scoring of simulated weapons delivery was eliminated because the ACMI system at Volk Field

does not yet possess the capability to score ordnance release skills to the accuracy parameters required by current USAF directives. In addition, AFI 11-F16 requires the actual release of practice ordnance to ensure the release mechanism is working properly and exact scoring can be achieved.

- Use Aircraft Flight Simulators. The use of aircraft flight simulators as a substitute for all flight training of aircrews was eliminated because simulator training does not provide the most important aspect of aircrew proficiency training--the requirement to conduct actual military training flights.

- Alternatives to the Northern Expansion of the Existing Hardwood Range

  – Expand Existing Range to the east. Past attempts to lower the floor of Volk East below 8,000 mean sea level (MSL) have been turned down by FAA due to the amount of civilian air traffic. A similar response was given to expansion of the Hardwood Range to the east. Therefore, it was eliminated as a viable alternative.

  – Expand Existing Range to the south. Several full-time residences and cranberry bogs exist south of the range. Run-in headings would impact a large recreational area around Petenwell Lake. Therefore, it was eliminated as a viable alternative.

  – Expand Existing Range to the west. Immediately west and south of the existing range is the Necedeh National Wildlife Refuge (NWR). There are currently seasonal altitude restrictions to flights over the refuge during migration of waterfowl. Therefore, it was eliminated as a viable alternative.

ENVIRONMENTAL IMPACT ANALYSIS PROCESS

The National Environmental Policy Act (NEPA) requires Federal agencies to take the environmental consequences of proposed actions into consideration in their decision-making process. When a proposed action may result in potentially significant impacts, NEPA requires the sponsoring Federal agency to prepare an EIS, the most comprehensive NEPA-compliance document. The analyses of potential impacts presented in this EIS responds to the requirements of NEPA and supports that decision-making process. This document has been prepared in accordance with NEPA and Council on Environmental Quality (CEQ) Regulations (40 Code of Federal Regulations [CFR] 1500-1508) and AFIs (32-7061 and 32-7060) implementing NEPA and intergovernmental and interagency coordination procedures.

Public Scoping Process and Interagency Coordination

In scoping for the preparation of the DEIS, the National Guard Bureau (NGB) actively solicited comments from a wide group of interested parties. The NGB published a Notice of Intent (NOI) (see Appendix A) in the *Federal Register* (see 60 F.R., No. 14, p. 4403, January 23, 1995) announcing its intent to prepare a DEIS. In addition, this NOI announced a series of six scoping meetings to be held in February 1995 in communities adjacent to the Hardwood Range and in areas associated with the related airspace components. At that time, the ANG published advertisements in local newspapers and issued news releases to inform the public of the on-going EIS process.

To further facilitate the coordination and scoping process between intergovernmental points-of-contact, the ANG developed an Interagency and Intergovernmental Coordination for Environmental Planning (IICEP) list and subsequently contacted those parties. Local, state, and Federal agencies and interested members of the public including the Native American Nations, were sent a letter and a Description of the Proposed Action and Alternatives (DOPAA) to solicit comments and obtain pertinent information for the EIS. Subsequently, scoping meetings and public information meetings have been conducted, and all interested parties have been kept informed through periodic information sources, such as the Hardwood Range Project Update Newsletter.

Evolution of the Alternatives Considered

As a result of the scoping process and the issues identified, the Proposed Action addressed in this EIS has evolved from the proposal originally presented during the scoping period. The Proposed Action no longer includes proposed new southern and southwestern low-level training corridors leading to the Hardwood Range. These proposed corridors were dropped from consideration when operational limitations for fighter aircraft surfaced during preliminary environmental studies in the areas where the low-level corridors were proposed. The southern and southwestern corridors will not be carried forward for further study.

Scope of this EIS

In accordance with CEQ Guidelines, this EIS provides analyses of a broad range of resource areas relevant to the assessed airspace utilization and construction of the expanded Hardwood Range facilities, including: airspace management, noise, safety, hazardous materials and solid waste, earth resources, water resources, air quality, biological resources, cultural resources, land use, visual and aesthetic resources, socioeconomic resources, and human health effects.

The NGB published a Notice of Availability (NOA) (see Appendix A) in the *Federal Register* on August 22, 1997 (see 62 FR, No. 163, p. 44685) announcing the availability of the DEIS. At the same time, the NGB mailed over 475 copies of the Draft EIS to Federal, state, and local organizations and members of the general public that had expressed an interest in the proposal. In addition, a series of three public hearings on the Draft EIS were held in Wisconsin the week of September 16, 1997 to further solicit public input on the document. The comment period was also extended to November 21, 1997, which allowed double the required period of time for preparation and submittal of comments on the DEIS.

SUMMARY COMPARISON OF ALTERNATIVES AND POTENTIAL IMPACTS

The Proposed Action and No-Action Alternative were evaluated as a part of the analysis associated with this EIS. In general, potential impacts can be viewed as either resulting from aircraft operations in the airspace associated with this proposal or from construction-related impacts on ground-based resources in and around the Hardwood Range expansion area. An overview of potential impacts in selected areas of concern is summarized below.

Several options are being evaluated that address how the land would be acquired for the range expansion; however, this determination will not be available prior to the completion of the EIS. To some degree, the option selected will influence the level of potential impacts. Detailed engineering plans for the range expansion are not

available and the ANG cannot justify development of such plans for the range expansion without knowing how the land acquisition will occur.

Sorties

Environmental impacts associated with use of the airspace are assessed based primarily on the level of utilization. Airspace utilization is quantified by determining the total military training flights (sorties) obligated to each airspace. A *sortie* consists of the take-off, all the training events performed while in flight, and landing of a single aircraft. Table S-2 illustrates historical use of the airspace, the existing conditions (No-Action Alternative), and the Proposed Action assessment levels of utilization evaluated in this EIS. Construction related impacts associated with development of the expanded range facilities are evaluated through assessment approaches unrelated to sorties.

Table S-2. Summary of Utilization for All Identified Aircraft for Each Airspace

YEAR	NUMBER OF SORTIES BY AIRSPACE COMPONENT [1]			
	FALLS 1	FALLS 2	VOLK SOUTH	R-6904
Historic Usage				
1990	1,613	335	N/A [3]	4,670
1991	1,430	330	N/A [3]	4,909
1992	225	55	N/A [3]	3,763
1993	625	71	236	2,887
1994	1,112	495	540	2,891
1995	2,080	1,733	722	2,696
Existing Conditions				
1996 [2]	2,173	1,347	368	2,672
Proposed Action Assessment	2,789	1,617	1,340	N/A [4]

NOTES:
1. *Types of aircraft flown include fighter aircraft such as the F-16 and F-15; bomber aircraft such as the B-1, B-2, and B-52; and other aircraft such as the A-6, A-10, AH-1, C-26, C-130, F-18, F-117, Tornado, LR-36, and UH-1.*
2. *Current use information is for the period October 1, 1995 through September 30, 1996.*
3. *N/A = Not Applicable, airspace not in use.*
4. *N/A = Not Applicable, existing assessment of 4,992 sorties covers all planned operations (Air National Guard Readiness Center [ANGRC] 1993).*

Cumulative Impact Analysis

Sorties were identified as the key component of cumulative impacts analysis because they form the basis from which essentially all other airspace-related analyses were derived, and in particular all those producing quantitative results, including noise level computations, air quality analyses, and safety evaluations. Analyses of cumulative impacts based on sorties were determined by using the numbers produced by adding together sorties from coincidental airspace (i.e., airspace overlapping the same geographic space).

In order to evaluate the alternatives considered, quantitative data on the potential impacts associated with the alternatives were generated using a reasonable maximum situation analysis. Under this scenario, the maximum number of training

sorties possible for each airspace is assumed to occur. This constitutes a reasonable maximum situation analysis because no other scenarios are possible that would obligate more utilization of the airspace, and therefore potential impacts are quantified and assessed at the highest possible level. Each airspace is individually addressed in this manner. In addition, the results are added together with coincidental military airspace use, thus producing a cumulative total of all military aircraft operations in these military airspaces and providing a basis to determine impacts. This reasonable maximum situation analysis approach is used as the basis for all impact assessments developed in this EIS. Because of the assumptions associated with this approach, this scenario is likely to represent more than the actual utilization of the airspace under typical conditions; however, this approach allows a basis for comparison of each of the alternatives studied in detail.

Noise Analysis And Potential Impacts from Airspace Utilization

Impacts associated with aircraft operations in military airspace are based primarily on predictions of noise levels. Computer-based simulation programs are normally used to determine the noise impacts and to model the expected noise environment. These programs have been developed for this purpose by the DoD. The impacts are quantified by calculating the current noise environment before a proposed action (i.e., the baseline level) and the noise environment expected after a proposed action. Noise from the action is evaluated by comparing it with baseline levels and with objective criteria that assess the acceptability of various levels of noise.

Noise calculations accomplished for this EIS used the Air Force's approved computer program designed for this purpose. This model accounts for the actual aircraft involved (usually several aircraft at a given time), their speeds, their power settings, and the types of missions flown. It accounts for the random distribution of flights in MOAs and the clustering of flights along MTRs and other concentration areas.

Noise levels produced by the modeling results that are used to support the analyses in this EIS are quantified by two noise measuring techniques (or metrics) (see Appendix F for more details). The first is the Onset Rate Adjusted Monthly Day-Night Average Sound Level, L_{dnmr}. This is a cumulative metric that accounts for the total sound energy over a 24-hour period. It accounts for the sound level of individual events, the duration of each event, and the number of events each day. It also includes a 10 decibel (dB) penalty for events at night (10:00 PM to 7:00 AM) and a penalty for up to 11 dB to account for the surprise, or "startle effect," factor of high-speed low-altitude military aircraft.

A L_{dnmr} value of 65 dB was assessed by the Federal Interagency Committee on Noise (FICON) and is considered the "FICON standard" as the threshold for acceptable levels of public annoyance. Potential impact is evaluated based on the noise in each affected area. Values of L_{dnmr}, other than 65 dB, which are of interest are 55 dB, a level identified by the U.S. Environmental Protection Agency (EPA) as a level "requisite to protect the public health and welfare with an adequate margin of safety" (usually interpreted as a level below which there is no adverse impact), 45 dB (10 dB below the EPA's guideline), and 75 dB (threshold above which effects other than annoyance may occur).

While L_{dnmr} represents the best available technology for assessing noise impact, it does not represent the sound that is heard at any one time. Therefore, the analysis for this EIS also presents individual sounds. The metric used to represent an individual sound is the Sound Exposure Level (SEL). This measurement technique combines the actual sound level of an individual event with its duration. SEL is a better predictor of the intrusiveness of a noise event than is the maximum level alone, since it measures the total sound from a given event. SEL values of interest are 45 dB (at

which noise events might be heard), 65 dB (at which noise might be intrusive), and 90 dB (intrusive events from overhead or near-overhead flyovers). Individual event analysis was performed to predict how often these levels would occur at any given location (i.e., how often an individual spending all of his/her time in the airspace would hear those noise levels).

To interpret daily noise event information given in this EIS, it is important to understand that individual aircraft noise events are typically heard for a period of only 30 to 90 seconds. The instantaneous noise level is very low at the beginning and end of this period. As the aircraft approaches, the sound level increases to some maximum level depending on how close the aircraft comes to the receiver. After the maximum, it decreases until it fades into the background. If an aircraft at low altitude passes directly overhead, the maximum instantaneous noise level can be in excess of 100 dB. Noise would be near that maximum for only a few seconds, with most of the event being at a lower level. An aircraft passing off to the side of a receiver would have a lower maximum level (e.g., half a mile to the side would be about 20 to 30 dB lower than directly overhead) but the levels would be near that maximum for a somewhat longer period of time, perhaps 10 to 15 seconds, with the net result of SEL for a flight half a mile to the side being 15 to 25 dB lower than that for a flight directly overhead. An aircraft 2 to 3 miles or more from a receiver may not be heard at all.

Based upon the analyses conducted for the EIS, assessed airspace use for the Proposed Action and the No-Action Alternatives does not appear to result in significant environmental impacts. The results of the modeling of each airspace under each of the alternatives indicate that noise will not be high enough to cause significant impact. Maximum cumulative noise levels for the Proposed Action will fall within guidelines identified by the EPA as protective of public health and welfare, with the primary consideration being annoyance. Noise levels will also be well below the threshold of any risk to hearing or human health. Individual noise events will be audible infrequently. However, aircraft noise, under both the Proposed Action and No-Action Alternatives, will be present and will represent an adverse environmental effect that cannot be avoided.

Noise levels under the Proposed Action, in general, will increase over baseline conditions. In some areas these increases will not be noticeable to the human ear; in other areas the increase will be noticeable. However, except for the central target location on the existing Hardwood Range, noise levels will remain well below the 65 dB threshold. Noise events will remain very infrequent. Consequently, impacts associated with assessed levels of utilization under the Proposed Action would be considered negligible.

Potential Impacts from the Hardwood Range Expansion

Construction and land-acquisition impacts would occur, primarily in Wood County, as a result of the proposed expansion of the Hardwood Range under the Proposed Action. These impacts would not occur under the No-Action Alternative.

Potential impacts to surface water would exist as a result of the clearing and grading associated with the construction of the DZ and Landing Zone. There would be no impacts to wetland resources as a result of the proposed action. All construction or target placing activities would avoid wetlands and surface water runoff areas to wetlands. Best management techniques would be necessary to ensure mitigations are in place to minimize impacts to surface water. Coordination with State and Federal agencies, including the Native American Nations, addressing potential impacts to threatened and endangered (T&E) species is ongoing; however, current assessments do not indicate any significant impact would occur. In fact, land clearing may be beneficial to one federally-endangered species present in the existing range area, the Karner blue

butterfly, by providing additional habitat for the wild lupine plant it needs to survive. The range expansion would result in some unavoidable loss of vegetation and habitat; however, this loss should not have a significant impact on any ecosystem or species.

Socioeconomic impacts to Wood County would involve relocation of approximately seven year-round residences currently occupied in the proposed range expansion area and the acquisition of 975 acres of privately-owned lands. In addition, 6,162 acres of land would be withdrawn from the Wood County Forest program and associated county revenues would be lost. This impact to Wood County may be significant; however, the degree of impact for some of these issues may be affected by the land acquisition approach selected, and at this time, the specific land-acquisition process has not been identified.

Consultations and coordination with the Ho-Chunk Nation will continue. Impacts have not been identified by discussions held with tribal leaders during the EIS process.

Access to land areas acquired for the range expansion would continue for some recreational use, such as hunting, based on appropriate operational and safety parameters. Other current recreational uses of the land, such as snowmobile trail access, would be modified. Approximately 12 miles of public roads through the range expansion area would be closed, the most significant of which would be the west end of Batterman Road. These impacts would be relatively insignificant, with alternate routes available throughout the area.

Mitigation Measures

Mitigations associated with the use of military airspace are primarily operational in nature. However, the ANG routinely employs a variety of special operating procedures (SOPs) to decrease impacts on communities and other sensitive noise receptors that exist under or near MTRs or MOAs. These would apply to any alternative chosen for implementation.

The ANG has developed mitigation measures for individual airspace components to lessen noise impacts on specifically identified noise sensitive locations on the ground. Such mitigations can significantly lessen potential impacts to sensitive biological species and reduce impacts to human activities on the ground.

Mitigation of impacts associated with the construction of the proposed expanded range facilities would be coordinated with the appropriate State and Federal agencies, including the Native American Nations, as specific construction design documents are developed.

The ANG will develop a range cleanup program that will support any potential for closure or transfer when the range is decommissioned.

COMPLETION OF THE ENVIRONMENTAL IMPACT STATEMENT PROCESS

The ROD in this matter will quite possibly follow a two-step process, with an initial ROD addressing the acquisition of the necessary property interest and modification of the airspace, and a later ROD addressing the impacts related to the flying operation decisions that can be more fully discussed and determined following the ANG's access to the property. If certain site-specific decisions to be made at that time are not adequately analyzed in this EIS, the EIS will be supplemented as required before those decisions are made.

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SECTION 1

PURPOSE OF AND NEED FOR THE ACTION

1. PURPOSE OF AND NEED FOR THE ACTION

1.1 INTRODUCTION

The National Guard Bureau (NGB) proposes to expand the land acreage of the Hardwood Air-to-Surface Gunnery Range (hereafter referred to as the Hardwood Range) and its training capabilities, and reassess the annual utilization of the existing airspace associated with the Hardwood Range. This Environmental Impact Statement (EIS) has been prepared in accordance with the National Environmental Policy Act (NEPA) to support decision-making and provides background information on the Proposed Action, alternatives considered, a description of the affected environment, and an analysis of the potential environmental consequences. This EIS also describes the military's training requirements and the aircraft that would operate within the airspace, the types of training missions typically flown within the airspace, and the operational requirements for airspace (see Appendix E).

The Proposed Action has been updated since the public scoping period and no longer includes proposed new southern and southwestern low-level training corridors leading to the Hardwood Range. These proposed corridors were dropped from consideration when operational limitations for fighter aircraft surfaced during preliminary environmental studies in the areas where the low-level corridors were proposed. The southern and southwestern corridors will not be carried forward for further study.

The Final Environmental Impact Statement (FEIS) has been modified and improved in response to comments from regulatory agencies and the public. Additional information, new figures, and revisions to the text have been accomplished to improve the document's coverage of specific subject matter. Draft appendices have all been finalized, including the socioeconomic study.

This FEIS includes (under separate cover in Volume II) the results of public comments on the Draft Environmental Impact Statement (DEIS) and provides the Air National Guard (ANG) responses to these comments. The ANG has provided responses to comments received by mail and to comments submitted during the public hearings on the DEIS conducted in September 1997. Volume III (also under separate cover) presents other correspondence related to the proposal.

1.2 PURPOSE OF THE ACTION

The Department of Defense (DoD) has assigned the ANG an ongoing commitment to deploy forces worldwide in support of major and lessor regional contingencies. U.S. military forces, including the ANG, must continually train to maintain the highest level of combat readiness to meet this commitment. Midwest ANG units, as well as several other Total Force units, would continue to deploy regularly in support of current and other contingencies for the foreseeable future. This serves to indicate the ANG's continuing need to support the National Security Strategy by demanding these units maintain their readiness, or "train the way we fight."

A key element to this readiness is a realistic wartime training environment conducted at air-to-ground gunnery ranges. However, the current training environment is inadequate to maintain the necessary level of combat readiness to meet global commitments. The ranges available to ANG units in the Midwest region are minimally adequate to practice combat weapons deliveries utilizing combat oriented tactics. This

includes Hardwood Range in its present day configuration. Currently, Hardwood Range only provides the capability for pilots to hone their basic weapon delivery skills. However, tactics and weapons have changed drastically in the decades since this range was designed. The ANG needs improvements to Hardwood Range to ensure weapons deliveries fulfill wartime training commitments and to practice tactically sound combat oriented scenarios. This supports the National Security Strategy by providing a balance to deliver weapons with accuracy while maintaining survivability of the pilot and the aircraft.

The Proposed Action would expand the land area of the existing Hardwood Range and allow for modifications to the airspace and certain operations associated with the Range. The need for this expansion is based on the ANG's current and future air-to-ground training requirements. The EIS analyzes impacts from both the acquisition of the necessary real estate interest as well as the impacts with regard to flying and operations related to the flying, such as a possible new tactical target range, a landing zone and a drop zone (DZ). While data is available on the new property in general, some of the specific decisions and impacts related to air-to-ground operations cannot be completely assessed until the real estate interest is acquired and a thorough on-site investigation regarding such projects is possible. Following possible acquisition of the real estate interest, such site-specific decisions and impacts can then be assessed and made. Therefore, supplementing the current EIS may be necessary. It is quite possible that the decisions resulting from this EIS will come about in phases, with the decision dealing with acquisition/airspace modification coming prior to final decisions on the construction to support flying projects.

The proposal would expand the upper, lower, and lateral boundaries of the restricted airspace directly associated with the Hardwood Range [i.e., Restricted Area 6904B (R-6904B)], and increase the ceiling of R-6904A. The configuration of the five Military Operations Areas (MOAs) adjacent to the range (Falls 1, Falls 2, Volk East, Volk West, and Volk South) would remain unchanged, but three of the MOAs (Falls 1, Falls 2, and Volk South) would be assessed based upon current utilization. The additional land acreage associated with the range would facilitate use of the training capabilities at the range. The maximum currently assessed utilization of 4,992 sorties for the range would not change under the proposal (Air National Guard Readiness Center [ANGRC] 1993).

This alternative would expand the land area for the Hardwood Range under what would be considered a real estate action. Should this current analysis determine that expansion of Hardwood Range would not have significant environmental impacts, and should it also be determined that the land acquisition meets the needs of the ANG, then the ANG would propose some construction projects within the area of expansion that would be analyzed in subsequent NEPA documentation. These construction projects could include: a new area for potential target locations; a drop-zone area for C-130 transport aircraft to practice drops of combat supplies (not munitions); and a 3,500-foot by 60-foot tactical landing zone for C-130 aircraft to practice landings simulating real world conditions.

The Proposed Action responds to the requirements of, and has been prepared in accordance with, Air Force Instruction (AFI) 13-201, Airspace Management (19 July 1994), AFI 13-212 Volume I - Weapons Ranges (28 July 1994), Volume II - Weapons Range Management (26 August 1994), and Volume III - Hazard Methodology and Weapons Safety Footprints (16 December 1994).

1.3 NEED FOR THE ACTION

Operational requirements generate the need for this action. One is military readiness. The declining DoD budget is causing the active duty military force to reduce its aircraft inventory, personnel force, and number of bases. The Air Reserve Components, such as the ANG, are also reducing in size but at a slower rate. As a result, the ANG's percentage of the total force (i.e., active duty, ANG, and Air Force Reserve) is increasing. Because of this, ANG units are being tasked for increased wartime and contingency situations as these units assume roles and missions formerly assigned to active duty units. Based on current and projected Congressional funding, global military force projection will increasingly rely on the ANG. To rapidly and effectively respond when called upon, ANG units must continue training to the same high standards established by the United States Air Force (USAF) for active duty units.

Developments in military weapons systems, such as advanced long range air-to-surface weapons, along with reductions in force structure, have altered USAF doctrine and tactics. These changes often necessitate modifying training ranges and/or modifying existing airspace and creating new airspace for training purposes.

Technological improvements at the Volk Field Combat Readiness Training Center (CRTC), such as the Air Combat Maneuvering Instrumentation (ACMI) system, make it possible for military flying units to accomplish a broad range of training that they are unable to accomplish at their home fields. A DZ and landing zone are required to provide airlift aircraft, such as the C-130, with an area to practice insertions/extractions of airlift cargo. DZs are areas designated to airdrop cargo. Landing zones are designed to develop proficiency through realistic short field landings. The actions included in this proposal would increase the military's training efficiency by offering consolidated training opportunities at a central location. Appendix E presents the current operational training requirements relevant to the Proposed Action.

Another operational requirement is safety. The proposed expansion would ensure that many flights would remain over land owned or controlled by the government to further increase safety for the civilian population near the range. In addition, the increased acreage would ensure that the safety footprint (i.e., an area beyond which no training ordnance would be predicted to fall) would remain on government land. Live ordnance would not be used at Hardwood Range.

Equally important is responsible stewardship of unit funding. Distances to some of the existing military airspace that support use of the Hardwood Range and associated airspace components used for training in air-to-air tactics are not within the criteria suggested in the *USAF Airspace Master Plan*. The Proposed Action would reassess airspace utilization and allow military units using the airspace to accomplish air-to-surface training and air-to-air training at the same location. This would allow each unit to accomplish more of the required training on each flight, which would help reduce training expenses.

Tactics currently conducted at Hardwood Range are extremely limited. Significant attack axis restrictions exist for all deliveries. Specifically, the current attack direction to any target is restricted to a specific magnetic heading. This limited attack direction restricts the extent which any level of tactics can be sufficiently performed. While this may result in pilots obtaining proficiency on the particular attack axis to a specific target in peacetime, the convenience to attack an enemy's target from the same direction results in predictability of flight path. This permits the enemy to easily destroy a predictable attacking aircraft, resulting in unacceptable combat losses.

Also, the Hardwood Range target array is relatively small and pilots are intimately familiar with all the targets. This results in the pilot's inability to obtain adequate training on unfamiliar first-look attack targets. Target acquisition is paramount to destroying the target the first time every time. The pilot's bombing skills are simply not challenged due to this familiarity. The pilot's skills sets are diminished and, subsequently, sound employment tactics suffer.

Further, inert heavy weight ordnance can only be delivered on two target groups with only one attack axis. This causes a very severe limitation to overall fighter tactics training. These restrictions affect over 50 percent of annual bombing training requirements. This equates to 25 percent of yearly-allocated sorties per year. The net result of Hardwood Range's restrictions is an overall decrease in combat capability due to the mismatch of a 1950s designed range that is inadequate to meet the needs of the 21st Century tactics and technology.

Fighter units are able to occasionally deliver weapons without restrictions at exercises such as Red Flag (Nellis Air Force Base [AFB]), Maple Flag (Canada), and Cope Thunder (Alaska). But units can only deploy to these exercises once every two years due to budgetary and scheduling constraints. This is hardly enough to attain, much less maintain, combat weapons delivery proficiency. If ANG units are to maintain the highest state of readiness demanded by the DoD, improvements to the current bombing range must occur.

In light of recent military technological applications, ANG F-16s are being modified to deliver precision guided munitions providing pinpoint accuracy to destroy enemy targets. This munition provides the pilot with the greatest degree of survivability. To successfully deliver this weapon, pilots must practice deliveries on a recurring basis to obtain the highest degree of combat proficiency. There are only three ANG air-to-ground ranges in the United States where pilots can practice these deliveries. The closest one to Midwest ANG units is at Smoky Hill, Kansas, near Salina. However, it is cost prohibitive for units to deploy to Smoky Hill to attain and maintain currency in precision guided munition weapons delivery tactics. The Midwest units need a range that is close to their home bases on which to practice these deliveries. The Hardwood Range expansion is needed to fill training in this new technology.

With the advent of precision guided munitions due to military technological applications, the Hardwood Range expansion imparts an even greater importance to combat readiness. Current doctrine dictates delivery of certain precision guided munitions at altitudes up to 25,000 feet with an extended distance greater than 3 miles from the target to successfully employ these weapons, while simultaneously utilizing sound tactics. This requires the weapons impact area to be increased for safety implications. Hardwood Range is currently not large enough to support fighter training in these deliveries. The proposed range expansion would provide an excellent opportunity to perform such deliveries. Increasing the impact area would also support attacks from multiple directions at various altitudes, and provide a greater array of target attacks to challenge pilot skills and increase proficiency.

Lastly, the ANG and Total Force units which utilize Volk Field CRTC and Hardwood Range needs a cost-efficient location to develop and maintain pilot's skill sets needed. These improvements would ensure the ANG could continue to "train as we fight." This will ensure success on the first attack, as well as survival of forces, thus allowing forces to support the National Security Strategy on a continuing basis.

1.4 BACKGROUND ON USE OF MILITARY AIRSPACE AND RANGES

Training requirements for active duty and reserve components of the military are specified in regulations written by their host commands (e.g., Air Combat Command, Air Mobility Command, Air Education and Training Command, etc.). These regulations specify the type, quality, and frequency of training that aircrews are required to develop and maintain flight proficiency to meet expected wartime tasking and contingency operations.

The Federal Aviation Administration (FAA) designates airspace for certain military training activities. One such type airspace is designated restricted airspace. A Restricted Area is airspace designated in Federal Aviation Regulation (FAR) Part 73 within which the flight of non-participating aircraft, while not wholly prohibited, is subject to restriction. Restricted Areas shall be designated when necessary to confine or segregate activities considered to be hazardous to non-participating aircraft. The airspace directly associated with the range is designated Restricted Area R-6904 A/B.

Another type of airspace is termed a MOA. A MOA consists of an airspace of defined vertical and lateral boundaries in which aircraft can perform military training activities separated from instrument flight rules (IFR) traffic, including such practice activities as aircraft intercepts, turning and evasive maneuvers, and air combat training. MOAs are designated by the FAA and serve to warn visual flight rules (VFR) traffic that military activities may be taking place in the airspace. The floor of a MOA may be near ground level and the ceiling up to but not including 18,000 feet above mean sea level (MSL).

A Military Training Route (MTR) is a military air traffic corridor designated by the FAA for low-altitude military operations at airspeeds in excess of 250 knots (287 miles per hour [MPH]). MTRs are typically 100 to 350 nautical miles (NM) long, three to 20 NM wide, and extend vertically from near ground level to as high as 15,000 feet above ground level (AGL). A nautical mile is 1.15 statute miles. MTRs provide airspace to practice navigational skills over a variety of terrain and provide the military with access to MOAs, ranges, and other destinations. Separation of MTRs from commercial air routes enhances general aviation safety. MTRs include two types and are identified as either an Instrument Route (IR) or Visual Route (VR) followed by a numerical designation. IR denotes IFR apply along the route, whereas VR denotes VFRs apply.

The use of an air-to-surface gunnery range, such as the Hardwood Range, is typically part of a larger set of training objectives included in a single training flight (or sortie). The use of a range is part of a series of training activities linked together and accomplished while a sortie is flown through several MTRs and MOAs on the way to the range. Certain types of aircrew training missions involve the simulated release of practice ordnance or the actual firing of weapons associated with the aircraft. This is only done in restricted airspace under controlled conditions to eliminate hazards to non-participating aircraft and to ensure the safety of persons and property on the ground.

Civilian and general aviation aircraft can traverse MOAs and MTRs unrestricted while on a VFR flight plan. To enhance safety, schedules of military training activities on MOAs and MTRs are available through the local flight service station to any pilots desiring to traverse military airspace. In addition, at Volk Field the flight schedules can be received by calling 1-800-972-8673 and/or monitoring the Very High Frequency (VHF) radio channel 120.0. MOAs and MTRs are only activated when needed and are returned to the FAA for general aviation and commercial aircraft use when not needed by the military.

1.4.1 Training Associated with the Hardwood Range

Military units located within operating distance (i.e., unrefueled) of Volk Field, Wisconsin use the Hardwood Range to accomplish air-to-surface training. Air-to-air and air-to-surface tactics training is accomplished in the Falls 1, Falls 2, Volk West, Volk East, and Volk South MOAs. Low-altitude training to support air-to-surface requirements is currently accomplished on VR-1616 and VR-1650. The existing airspace is shown in Figure 1-1.

The Volk Field CRTC is responsible for scheduling and managing the restricted area, and the MOAs and MTRs associated with the Proposed Action. The 114th Fighter Wing (FW) (Sioux Falls, SD), 115 FW (Madison, Wisconsin), 132 FW (Des Moines, Iowa), 183 FW (Springfield, Illinois), and the 185 FW (Sioux City, Iowa) would use the airspace regularly. These units fly F-16 C/D aircraft. In addition, A-6, A-10, AH-1, B-1, B-2, B-52, C-26, C-130, F-15, F-18, F-117, Tornado, LR-36, and UH-1 aircraft are representative of the type aircraft from numerous military units that would conduct periodic training in the airspaces. The 440th Airlift Wing (AW) in Milwaukee, Wisconsin; the 934th AW and the 133 AW in Minneapolis, Minnesota; would use the DZ and landing zone. These units fly the C-130 aircraft.

Aircraft generally enter the Hardwood Range from high-, medium-, or low-altitudes by way of MOAs and/or MTRs. To achieve realistic tactical weapons delivery training on the range, pilots need to approach the target area and release the ordnance from multiple directions and altitudes. This training can be accomplished by entering the range from a low altitude using an MTR or from a MOA whose altitude structure allows for medium-, high-, and low-altitude entry into the range.

Most air-to-surface gunnery ranges are configured with conventional and tactical target arrays. Each has different training purposes and size requirements. Conventional ranges are designed and used to develop and/or maintain basic weapons delivery skills. These ranges typically include one or more targets with concentric circles emanating from the target, two sighting towers to score ordnance deliveries, and a main control tower. Aircraft fly predetermined patterns to help develop basic gunnery proficiency. Tactical ranges, which are typically located immediately adjacent to conventional ranges, offer conditions that closely approximate the wartime conditions to which the pilot may be tasked. Tactical targets typically are obsolete military equipment, such as aircraft frames, armored tanks, and jeeps, that have been acquired through the Defense Reutilization and Marketing Office. Other targets include replica simulated Surface-to-Air Missile (SAM) sites and fuel storage facilities that have been constructed from empty 55-gallon drums and similar scrap material. Such targets are small in size and transportable and require a small clear area for placement within the range. Targets would be placed in existing upland open areas along the existing "roadway network." In placing these mobile targets, wetlands areas will be avoided. No improvements would be required for placement of the targets. Targets may be partially concealed to train aircrews for target acquisition while at low-altitude.

Because of the small size and orientation of R-6904B, aircraft primarily release ordnance on a west-to-east orientation (see Figure 1-2). This limitation reduces tactical training because it contributes to problems associated with memorized pilot

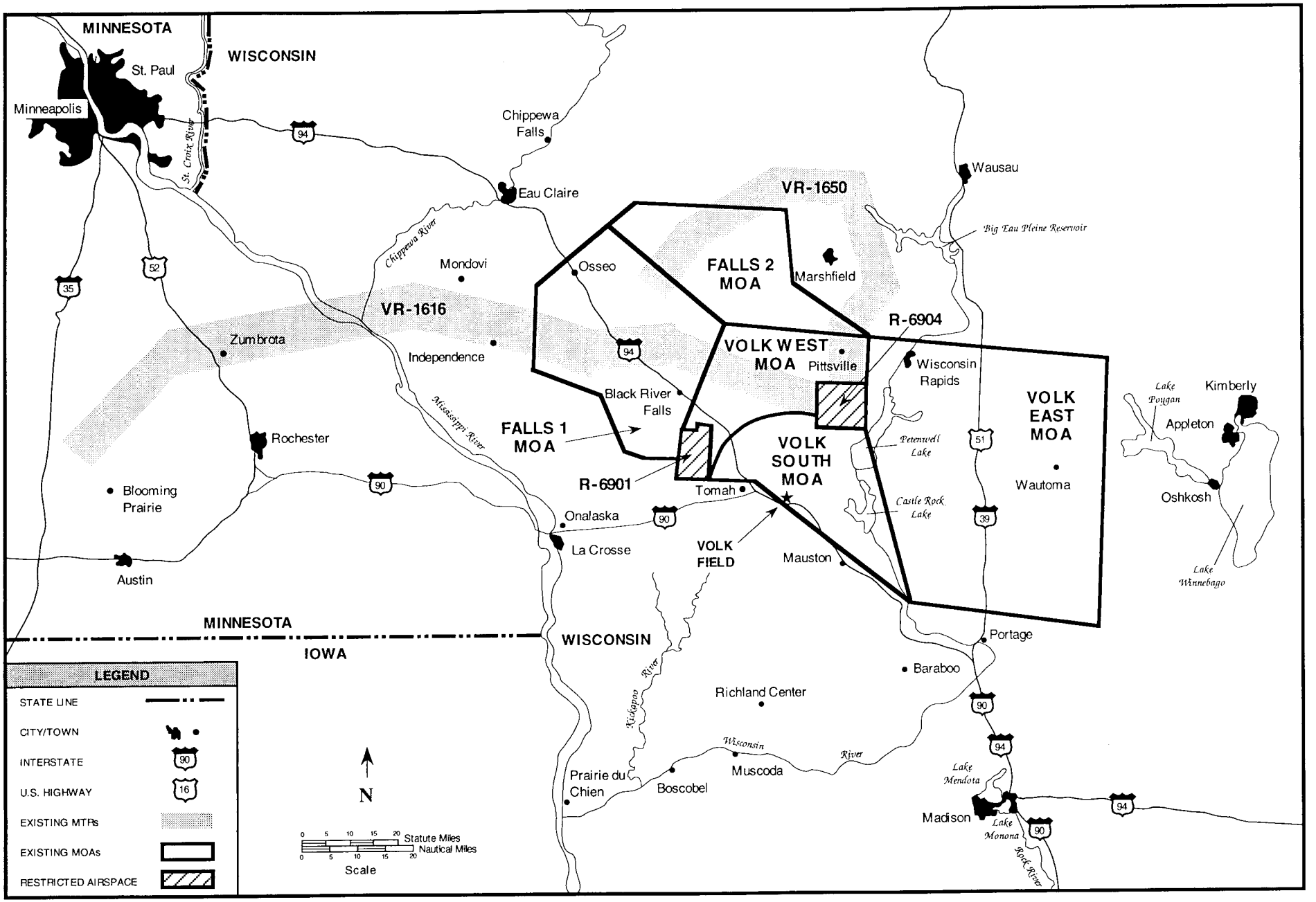


Figure 1-1. Existing Airspace Associated with the Hardwood Range

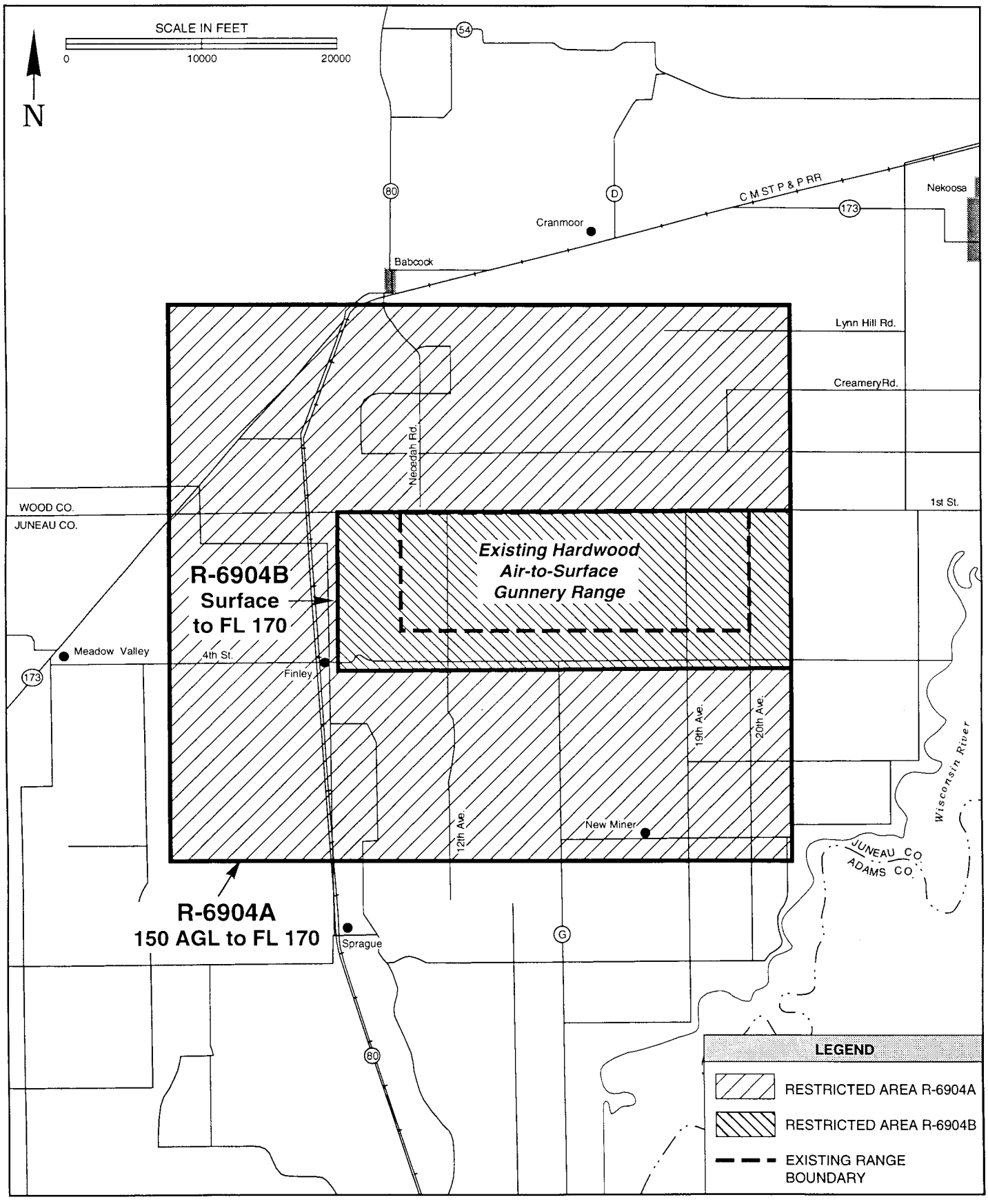


Figure 1-2. Location of Restricted Airspace R-6904 Associated with the Hardwood Range

responses from repeated identical missions. USAF doctrine requires pilots to train to conditions as realistic as possible. In combat, pilots would approach targets from multiple directions, whenever possible, to defeat and confuse enemy threats. In addition, the current vertical limit of R-6904 does not permit high-altitude release bomb training which Air Combat Command requires for altitudes between flight level (FL) 180 (i.e., approximately 18,000 feet MSL) and FL 310 (i.e., approximately 31,000 feet MSL). Consequently, training capabilities at the Hardwood Range would provide more realistic training if the range and its associated airspace were expanded.

To achieve multiple attack axis training from low- and high-altitudes, aircraft need to enter the range from airspace designated for military use, such as a MOA or MTR. Because of their distance from the start point at the entry to VR-1616, and their average sortie duration of 1.33 hours, the 132 FW and the 183 FW are unable to use MTR entries very often. VR-1650 is not normally used by units from the south because the start point is too far away from their point of origination. Consequently, units are using VR-1616, but the route's start point is of such distance that it reduces the amount of training events many units can normally accomplish on each mission. The Volk South and Volk West MOAs can be used without modifying the current vertical or lateral configurations to accommodate north/south headings while using the proposed expanded range.

1.4.2 Drop Zone and Landing Zone Requirements

DZs are designated areas that are used by military aircrews to conduct cargo and personnel airdrop operations. The *USAF Airspace Master Plan* calls for DZs and/or landing zones to be located along low-altitude training routes for use by cargo and troop carrying aircraft. Landing zones are often associated with DZs and are designed to develop aircrew proficiency through realistic short field landings. A DZ is required to provide airlift aircraft, such as the C-130, a designated area to practice insertions/extractions of cargo and deployment of personnel. DZ size and selection criteria are the joint responsibility of the Director of Mobility Forces and/or the Commander of Air Force Special Operations Forces. Depending on mission requirements and wartime contingencies, DZs may vary in their size and purpose.

1.4.3 Airspace Requirements

Military flying units require airspace for pilots to attain and maintain proficiency standards established by the USAF to support the National Command Authority (President of the United States and the Secretary of Defense). This basic requirement includes airspace for low-, medium-, and high-altitude air-to-air training and airspace for air-to-surface weapons or ordnance delivery training. Hardwood Range provides air-to-surface training for the CRTC based at nearby Volk Field. ANG units deployed to Volk Field CRTC, as well as ANG, USAF, Navy, Marine Corps, and Army units from throughout the United States, use Hardwood Range daily and periodically for special training exercises. Use of the airspace by foreign aircraft occurs occasionally.

The *USAF Airspace Master Plan* suggests standards for airspace requirements. It addresses USAF airspace requirements in every area of the country, and for every mission that has airspace needs. The plan provides a reference for intercommand and interservice cooperation and coordination of airspace acquisition, usage, modification, and retention. This plan establishes the basis for a comprehensive analysis of total DoD requirements and assists airspace managers in pursuing a coherent airspace acquisition, retention, or deletion plan.

Criteria for airspace to meet these requirements are found in several military and FAA documents (e.g., Air Force Policy Directive 13-2 *Air Traffic Control, Airspace and Range Management,* AFI 13-201 *Air Force Airspace Management,* and FAA Order 7610.4 *Special Military Operations*). These criteria are designed and selected to minimize the impact of military training airspace on the overall National Airspace System and other airspace users. The criteria are applied in the following order of priority: existing airspace, modifications to existing airspace, and new airspace.

The ANG reviewed the capabilities and locations of all air-to-surface gunnery ranges and airspace within a 200 NM radius of Volk Field. The review concluded that the Hardwood Range would need to be expanded, and modifications to existing military restricted airspaces also would be required.

The potential options and issues associated with each criteria are summarized below:

- *Existing Low/Medium Altitude Airspace*. Existing MOAs contiguous with the Hardwood Range are large enough laterally and vertically to satisfy training requirements. The Volk South MOA would help satisfy the requirement to vary range entry headings to accomplish realistic training. However, multiple axis attacks would require additional land to accommodate the weapons safety foot print (safety margin to minimize the probability of military ordnance coming to rest on private property). The 8,000-foot MSL floor of the Volk East MOA precludes low-altitude entries into the Hardwood Range from the east.

- *Modify Existing Airspace*. The ANG reviewed the possibility of modifying the vertical and lateral boundaries of R-6904B. The ANG determined the modifications could be accomplished if additional land was acquired.

- *Create New Airspace*. The ANG reviewed the feasibility of modifying existing airspace to meet training requirements before assessing the necessity for new airspace. The ANG determined that relocating Hardwood Range was neither economically nor environmentally feasible.

1.4.4 Narrowing Criteria for Military Training Airspace

Military units need airspace to accomplish advanced medium range air-to-air missile (AMRAAM), high-altitude, medium-altitude, low-altitude, and weapon delivery training. The criteria for each airspace as suggested in the *USAF Airspace Master Plan* and other applicable documents, are summarized below:

- AMRAAM—The airspace should be within 100 NM of Volk Field or a unit's home field, be at least 70 NM long and 60 NM wide, and extend vertically from 500 feet AGL to a FL of 50,000 feet (FL 500).

- High-altitude release bomb—The restricted airspace associated with the Hardwood Range must extend vertically and laterally to completely contain the flight path of any ordnance. The ANG Range Master Plan recommends a minimum upper altitude of FL 250 for ANG ranges.

- High-altitude training airspace—The airspace should be within 100 NM of Volk Field or a unit's home field, be 70 NM long and 60 NM wide, and extend vertically from FL 250 to FL 450.

- Medium-altitude training airspace—The airspace should be within 100 NM of Volk Field or a unit's home field, be 70 NM long and 60 NM wide, and extend vertically from 5,000 feet AGL to FL 250.

- Low-altitude training airspace—The airspace should be within 100 NM of Volk Field or a unit's home field, be 70 NM long and 60 NM wide, and extend vertically up to 5,000 feet AGL.

- Low-altitude navigation training airspace—MTRs should start within 50 NM and end within 100 NM of Volk Field or a unit's home field and be oriented to offer maximum utility to prospective users, such as ending at an air-to-surface gunnery range.

- Air-to-surface gunnery ranges—MOAs should adjoin the range airspace and be oriented such that aircraft could fly multiple entries to a target from a point approximately 15 NM away and remain within training airspace.

Airspace that satisfies the above training requirements must also address FAA aeronautical regulations while still addressing fiscal constraints, operational criteria, and environmental and public interest considerations. The mandatory and desired criteria for these considerations are summarized in the following paragraphs.

Mandatory Criteria

The proposed airspace must comply with the criteria contained in the FAA Order for Special Military Operations for management, control, design, and safe separation procedures. The airspace must be as free as possible of airways, jet routes and Class B and C airspace.

- The proposed restricted airspace for the Hardwood Range and the adjoining MOAs must be available for use at least eight hours per day.

Desired Criteria

- Airspace adjacent to the Hardwood Range should permit multiple entries into R-6904A/B from multiple attack axes from a point 15 to 25 NM from the target area while remaining within the lateral and vertical boundaries of training airspace.

- MOAs should provide low, medium, and high-altitude entry to the Hardwood Range.

Airspace should be located and management controls established such that a sufficient amount of time can be spent in the area to accomplish the objectives of the assigned mission.

1.4.5 Summary of Special Operating Procedures and Flying Restrictions

The ANG routinely employs a variety of special operating procedures to decrease impacts on communities and other sensitive noise receptors (i.e., hospitals, schools, churches, etc.) that lie under or near MTRs or MOAs. These would apply to any alternative chosen for implementation. These procedures include:

- Avoidance of sensitive areas along an MTR laterally or by increasing altitude. (Not applicable for the proposal.)

- Avoidance of sensitive areas under a MOA by increasing altitude or through other measures.

The ANG maintains a minimum altitude over areas sensitive to low-altitude flight. For example:

- Identified active nest sites for threatened and endangered (T&E) species.

- Known areas populated by other potentially sensitive species are avoided by increasing separation distances/altitudes determined through discussions with appropriate Federal and state agencies.

The following are examples of FAA and military flying restrictions.

- Avoid structures or persons in sparsely populated areas by 500 feet, maintaining a minimum altitude of 1,000 feet over populated areas.

- Avoid public-use airports displayed on aeronautical maps by at least 1,500 feet vertically when within 3 NM.

- Only activate airspace when required and return airspace to the public when not in use.

1.5 ENVIRONMENTAL IMPACT ANALYSIS

1.5.1 The NEPA Process

NEPA requires Federal agencies to take the environmental consequences of proposed actions into consideration in their decision-making process. The intent of NEPA is to protect, restore, or enhance the environment through well-informed Federal decisions. The Council on Environmental Quality (CEQ) was established under NEPA to implement and oversee Federal policy in this process. To this end, the CEQ issued the Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act [40 Code of Federal Regulations (CFR) 1500-1508].

Whenever Federal agencies propose major actions, such as the action described in Subsection 1.2, NEPA requires the sponsoring agency to undertake the systematic examination of possible and probable environmental consequences of the proposed action and alternatives to the action. The formal NEPA process used by the ANG is described in AFI 32-7061, *Environmental Planning-Environmental Impact Analysis Process*. When the potential impacts may be significant or controversial, the sponsoring

agency officially begins the NEPA process by announcing in the *Federal Register* a Notice of Intent (NOI) to prepare an EIS. Comments on potential issues to be addressed in the EIS are solicited from Federal and state agencies, and the public, and used in scoping the subjects to be addressed in a DEIS. The DEIS is then prepared and made available to the public for review and comment through an announcement of a NOA in the *Federal Register*. The agency then considers and responds to the public's comments on the DEIS in preparing a FEIS and announces its completion with a NOA. The agency decision-maker then issues its Record of Decision (ROD) concerning the proposed action, taking into consideration the findings of the EIS.

In conjunction with the preparation of this DEIS, and to comply with NEPA, correspondence has been sent to Federal, state, and local agencies with jurisdictions that could possibly be affected by the proposals. This coordination fulfills requirements under Executive Order (E.O.) 12372, which requires Federal agencies to cooperate with and consider state and local views in implementing a Federal proposal, and AFI 32-7061, which requires the ANG to implement an Interagency and Intergovernmental Coordination for Environmental Planning (IICEP) process.

This document also considers the relevant sections of the Clean Air Act (CAA), Clean Water Act (CWA), Wilderness Act, Forest Management Act, Threatened and Endangered Species Act, National Historic Preservation Act (NHPA), and the Wild and Scenic Rivers Act, as well as other applicable Federal laws and regulations. A detailed list of regulatory requirements is contained in Appendix D of this EIS.

1.5.2 Scoping Process, Issues Identified, and Alternatives Considered

1.5.2.1 Scoping

Pursuant to the CEQ regulations implementing NEPA, "*There shall be an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. This process shall be termed scoping.*"

Scoping is intended to "*determine the scope and the significant issues to be analyzed in depth in the EIS.*" The scoping process facilitates the participation of all affected parties by providing public notice of NEPA-related hearings, public meetings, and the availability of environmental documents so as to inform those persons and agencies who may be interested or affected.

The January 23, 1995 NOI to prepare the EIS also provided notice of a series of six meetings in two states during the period of February 14 to 25, 1995. Press releases were provided to the media regarding each scoping meeting. These meetings were held in the parts of Wisconsin and Iowa that would be potentially affected by specific aspects of the proposal. A stenographer was available at all meetings to record public comments. While each meeting presented all of the airspaces, public comments received at each meeting tended to be regionally focused.

Scoping meeting were held as follows:

- The Mauston Scoping Meeting was held on February 14, 1995, at the Mauston Expo Center in Mauston, Wisconsin. The meeting began at 7:00 PM and concluded at 10:00 PM. Twenty persons attended the

scoping meeting. Three individuals provided verbal comments regarding the Proposed Action. In addition, 5 written comments were provided.

- The second scoping meeting was held on February 15, 1995, at Independence High School in Independence, Wisconsin. The Independence Scoping Meeting convened at 7:00 PM and concluded at 9:00 PM. Attendance at the meeting totaled one person. One individual provided a verbal comment at the meeting. No written comments were provided.

- The Pittsville Scoping Meeting was held on February 16, 1995, at the Pittsville Community Center in Pittsville, Wisconsin. The Pittsville Scoping Meeting convened at 7:00 PM and concluded at 10:00 PM. Attendees began to arrive at 6:30 PM. Attendance at the meeting totaled 171 persons. Thirty-three individuals provided verbal comments at the meeting. Twenty-seven written comments were received.

- The Vinton Scoping Meeting was held on February 21, 1995, at the Tilford Middle School in Vinton, Iowa. The Vinton Scoping Meeting convened at 7:00 PM and concluded at 10:00 PM. Attendees began to arrive at 6:15 PM. Attendance at the meeting totaled 39 persons. Seven individuals provided verbal comments at the meeting. Two written comments were submitted.

- The Boscobel Scoping Meeting was held on February 22, 1995, at the Boscobel Community Center in Boscobel, Wisconsin. The Boscobel Scoping Meeting convened at 7:00 PM and concluded at 10:00 PM. Attendees began to arrive at 6:30 PM. Attendance at the meeting totaled 146 persons. Thirty individuals provided verbal comments at the meeting. Forty-one written comments were provided.

- The Elkader Scoping Meeting was held on February 23, 1995, at the Elkader Community School in Elkader, Iowa. The Elkader Scoping Meeting convened at 7:00 PM and concluded at 10:00 PM. Attendees began to arrive at 6:20 PM. Attendance at the meeting totaled 160 persons. Thirty individuals provided verbal comments at the meeting. Twenty-seven written comments were submitted.

The total period of time devoted to the scoping meeting was approximately 17 hours. Of the 537 persons who attended one or more meetings, 107 verbal comments were recorded and 102 written comments were received.

An additional scoping meeting was held on August 19, 1996, at the Black River Falls Armory in Black River Falls, Wisconsin. This meeting convened at 7:00 PM and concluded at 9:45 PM. Attendance at the meeting totaled 36 persons. Eighteen individuals provided verbal comments at the meeting. One written comment was submitted.

In addition to the comments received as a result of the scoping meetings, several hundred additional comment letters from the general public were received by mail, many after the official comment period had expired. All comments were considered by the ANG in scoping the DEIS.

1.5.2.2 Summary of Major Issues Identified

A variety of issues and concerns were raised at the scoping meetings. Although the meetings were conducted at many locations throughout the study area, several key issues were raised repeatedly and appeared to be generally of common interest across the public scoping process. These primary issues concerned noise generated by aircraft overflights, wildlife and animal reactions, and socioeconomic impacts. Other subsets of these primary issues include, but are not limited to, the following:

- Impacts from the proposed new southern and southwestern MTR corridors leading to the Hardwood Range
- Noise impacts on human health, wildlife, land use, and solitude
- Biological impacts on wildlife and domestic animals, including startle effects, stress, and behavioral reactions
- Bird impacts, particularly along the Mississippi River flyway
- Land use impacts regarding the loss of forest and wetlands
- Recreational land use impacts, including the Kickapoo River valley area
- Socioeconomic impacts regarding the tax base of counties near the range and property values
- Requirement and need for additional activity at Hardwood Range versus the availability of other locations
- Suitability of the potentially affected land areas for the proposed military activities and operations.
- Specific impacts from the Ho-Chunk Nation, if any, have not been identified during the coordination process; however, coordination will continue.

1.5.2.3 Evolution of the Alternatives Considered

As a result of the scoping process and the issues identified, the Proposed Action addressed in this EIS has evolved from the proposal originally presented during the scoping period. The Proposed Action no longer includes proposed new southern and southwestern low-level training corridors leading to the Hardwood Range. These proposed corridors were dropped from consideration when operational limitations for fighter aircraft surfaced during preliminary environmental studies in the areas where the low-level corridors were proposed. The southern and southwestern corridors will not be carried forward for further study.

The revised and updated Proposed Action that is now the subject of this EIS is considered by the ANG to be the Preferred Alternative.

1.5.3 Public Comment on the DEIS

A NOA for the DEIS was published in the *Federal Register* on August 22, 1997 (see 62 F.R. No. 163, p. 44685). The CEQ provides guidelines for the review of EISs by the public and various government agencies. These guidelines direct agencies

to "allow not less than 45 days for comments on draft statements" (Section 1506.10 of these guidelines). The comment period for the Hardwood Range DEIS officially opened August 22, 1997 with the NOA published in the *Federal Register*. The initial mailing of the statement to over 475 addressees was accomplished by August 21, 1997 prior to the NOA. The close of the comment period was extended to November 21, 1997 (91 days).

1.5.3.1 Public Hearings Process

A series of three public meetings were scheduled for the period of September 16, 1997 to September 18, 1997. The hearing locations were selected to ensure the inclusion of a wide geographic representation of potentially interested parties within the affected areas to ensure maximum participation. The availability of meeting rooms with the requisite facilities, that could be reserved on the dates required, also was a factor in the selection process.

Public comments, both oral and written, were solicited at all of the hearings. All meeting sites provided an open house area with information displays. In addition, a separate hearing room was set up to provide a public forum for individuals to provide oral comments. In order to allow everyone an opportunity to comment at the public hearings, a time limit of 5 minutes was established for each individual oral comment. After everyone had spoken once, individuals were given an opportunity to speak again in additional rounds in case the initial 5 minute period had not been adequate for an individual to complete their comments. This was repeated until everyone had given all their comments. No oral comment sessions ended with commentors indicating they wished to give further comments. Public hearings were held as follows:

- The Mauston meeting was held on September 16, 1997, at the Mauston High School in Mauston, Wisconsin. The meeting officially began at 5:00 PM and concluded at approximately 9:00 PM. Thirty-four persons attended the public meeting. Eleven individuals provided verbal comments during the oral hearing room session regarding the DEIS. Three individuals provided written comments. No verbal in-private comments were received via the stenographer.

- The Black River Falls meeting was held on September 17, 1997, at Black River Falls Middle School in Black River Falls, Wisconsin. The meeting officially began at 5:00 PM and concluded at approximately 9:30 PM. Twenty-nine persons attended the public meeting. Eleven individuals provided verbal comments during the oral comment session regarding the DEIS. No verbal in-private comments were submitted via the stenographer. In addition, one written comment was received.

- The Wisconsin Rapids meeting was held on September 18, 1997, at West Junior High School in Wisconsin Rapids, Wisconsin. The meeting convened at 5:00 PM and concluded at approximately 9:45 PM. The hearing room session was extended from the announced 9:00 PM ending to 9:30 PM to accommodate all those that wanted to speak. Attendance at the meeting totaled 145 persons. Twenty-four verbal comments were given during the oral comment session, and thirteen in-private comments were submitted via the stenographer. Nine written comments were received.

1.5.3.2 Summary of Issues Identified

The Hardwood Range expansion proposal has had organized and vocal opposition, especially from potentially affected citizens in Wood County, Wisconsin. Various advertisements by citizens groups to encourage citizens to oppose the range expansion are reflected in the attendance at the public hearings and the amount of written comments in opposition from geographic locations north of the existing range, such as Wisconsin Rapids, Wisconsin (see Volumes II and III).

In addition to the 65 oral comments on the DEIS received at the public hearings, the ANG received 175 written comments by the close of the comment period on November 21, 1997. These comments are presented in their entirety in Volume II of this FEIS, along with responses prepared by the ANG.

A broad range of issues were raised concerning both general opposition to the range expansion and the specific findings of the DEIS. The most common comment was disapproval of any acquisition of Wood County forest lands (WCFLs) and related concerns about such acquisition having a negative effect on socioeconomic resources in the County.

Several commentors addressed opposition to losing any lands suitable for cranberry farming. Numerous other comments were directed at concerns for potential impacts to wetlands in the expansion area, domestic animals and wildlife, access to recreational activities (e.g., hunting), and noise from training operations at the range.

Several commentors expressed concerns associated with potential conflicts with cultural activities among the Ho-Chunk Nation. Several comments also expressed mistrust over the possibility that in the future the now cancelled proposals for new MTR routes to the range from the south would be reintroduced.

1.6 STRUCTURE OF THIS EIS DOCUMENT

The primary presentation of the issues of concern and potential impacts associated with the alternatives is presented in the sections listed below:

- Section 1: Purpose and Need for the Action
- Section 2: Description of the Proposed Action and Alternatives
- Section 3: Affected Environment
- Section 4: Environmental Consequences.

Other shorter sections address the EIS preparers (Section 5), agency coordination (Section 6), references (Section 7), an index (Section 8), and acronyms and abbreviations (Section 9). Numerous appendices support the technical analyses and are presented at the end of this document. All reference materials used in the preparation of this FEIS are on reserve and available for public review in the Mauston, Wisconsin, public library.

SECTION 2

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 OVERVIEW OF ALTERNATIVES

This Environmental Impact Statement (EIS) for the proposed Hardwood Range expansion and related airspace actions considers the following alternatives.

Proposed Action: This action would expand the land area for the Hardwood Range by a total of 7,137 acres and include a new area for potential target locations, a drop zone (DZ), and a landing zone. It would also expand the vertical and lateral limits of the R-6904B airspace, increase the upper limit of R-6904A, and reassess the annual sortie utilization of three Military Operations Areas (MOAs).

Alternatives to the Proposed Action: The following alternatives to the Proposed Action were considered for this analysis and evaluated in light of the narrowing criteria for airspace presented in Subsection 1.4.4:

- Use existing U.S. Army Range at Fort McCoy
- Establish a new air-to-surface gunnery range
- Close Hardwood Range and redirect units to other ranges
- Use existing MOAs other than those contained in the Proposed Action
- Utilize electronic scoring of simulated weapons delivery
- Increase flight simulator training
- Alternatives to the Northern Expansion of the Existing Hardwood Range
- The No-Action alternative.

2.2 DESCRIPTION OF THE PROPOSED ACTION

The ANG proposes to obtain the use of 7,137 acres of land contiguous to the Hardwood Range located in Wood County, Wisconsin. The proposed expansion area is composed of a mix of county forest land and private land devoted to agriculture. The ANG considers this property desirable due to its potential for a number of possible tactical training uses. Such uses include airspace modifications and possible construction of a tactical target range, landing zone and a DZ. To some extent, the configuration of these projects is dependent on unrestricted access to the relevant property. In that regard, all significant real estate transactions/matters would be handled by the Army Corps of Engineers, who would make recommendations as to the appropriate real estate interest necessary to accomplish the ANG goals. The process of acquiring any real estate interest, following any ROD on the merits of the proposal, may take up to three to four years. Following that process, (which would provide ANG with complete access to the property and allow the acquisition of detailed site-specific information), a determination would be made as to whether the information in the EIS regarding certain possible actions is adequate or in need of being supplemented.

The Proposed Action would expand the Hardwood Range and its associated restricted airspace, and reassess the utilization of three MOAs. Figure 2-1 illustrates the airspace associated with the Proposed Action. The Proposed Action is summarized on the following pages.

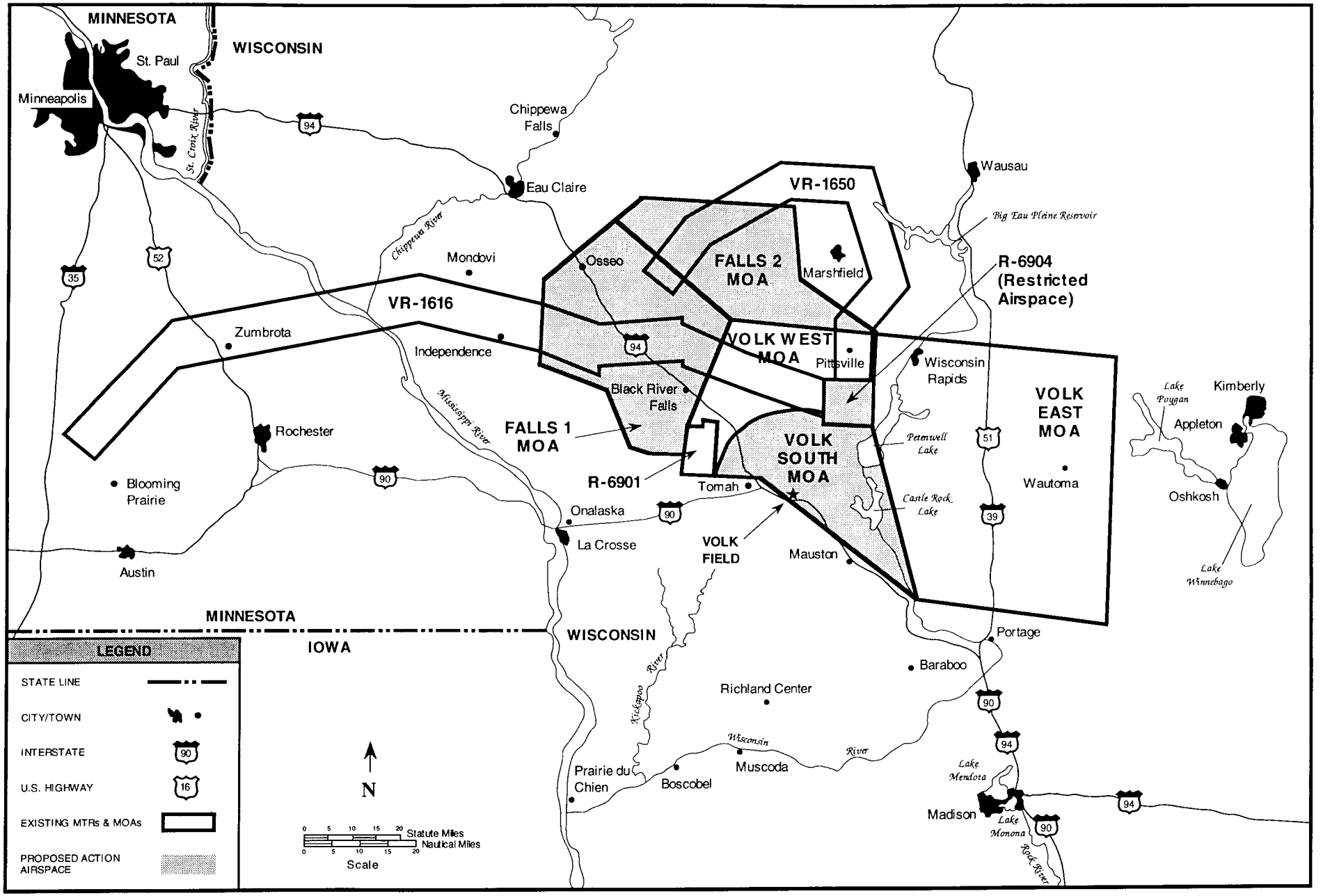


Figure 2-1. Airspace Associated with the Proposed Action

- **Modify Hardwood Air-to-Surface Gunnery Range.** This action would expand the land area to the north of the current boundaries by a total of 7,137 acres. This area would include potential target locations, a DZ, and a landing zone. The new target area would provide opportunities for varied and more realistic air-to-ground training. Figure 2-2 illustrates these elements. The Range is centered approximately 20 statute miles north-northeast of Volk Field and 80 statute miles northwest of Madison, Wisconsin. This action is a stand-alone initiative and is independent of the airspace actions

  Modify the Restricted Airspace Associated with the Hardwood Range. This action would lower the bottom altitude and expand the lateral confines of Restricted Airspace 6904B (R-6904B) to coincide with the proposed land expansion (see Figure 2-3). It would also increase the maximum altitude of R-6904A and R-6904B continuously to flight level (FL) 250 and higher up to FL 500, on an as needed basis. Restricted airspace must be contiguous with any new range boundaries and extend vertically from ground level to ensure the safety of non-participating aircraft. The increase in the maximum altitude of R-6904A and B is a stand-alone initiative and is independent of the range expansion.

- **Reassess Falls 1 MOA Utilization**. This action would increase the currently assessed number of sorties flown annually to 2,789. The lateral and vertical boundaries would remain unchanged. The Falls 1 MOA is shown in Figure 2-4. This action is a stand-alone initiative and is independent of the range expansion.

- **Reassess Falls 2 MOA Utilization**. This action would increase the currently assessed number of sorties flown annually to 1,617. The lateral and vertical boundaries would remain unchanged. The Falls 2 MOA is shown in Figure 2-4. This action is a stand-alone initiative and is independent of the range expansion.

- **Reassess Volk South MOA Utilization**. This action would increase the currently assessed number of sorties flown annually to 1,340. The lateral and vertical boundaries would remain unchanged. The Volk South MOA is shown in Figure 2-4. This action is a stand-alone initiative and is independent of the range expansion.

2.2.1 Proposed Range and Airspace Modifications

Specific details of each element of the Proposed Action are presented in the following subsections.

2.2.1.1 Modification of Hardwood Air-to-Surface Gunnery Range and Its Associated Restricted Airspace

The Hardwood Range expansion includes an expansion of the land area dedicated to the range, a new area for potential target locations, and the addition of a DZ and landing zone. These elements were illustrated in Figure 2-2. The Proposed Action would expand the land area of the range to the north by a total of approximately 7,137 acres, of which 6,162 acres are currently county-owned and 975 acres are privately-owned. Much of the land north of the existing range is sparsely inhabited.

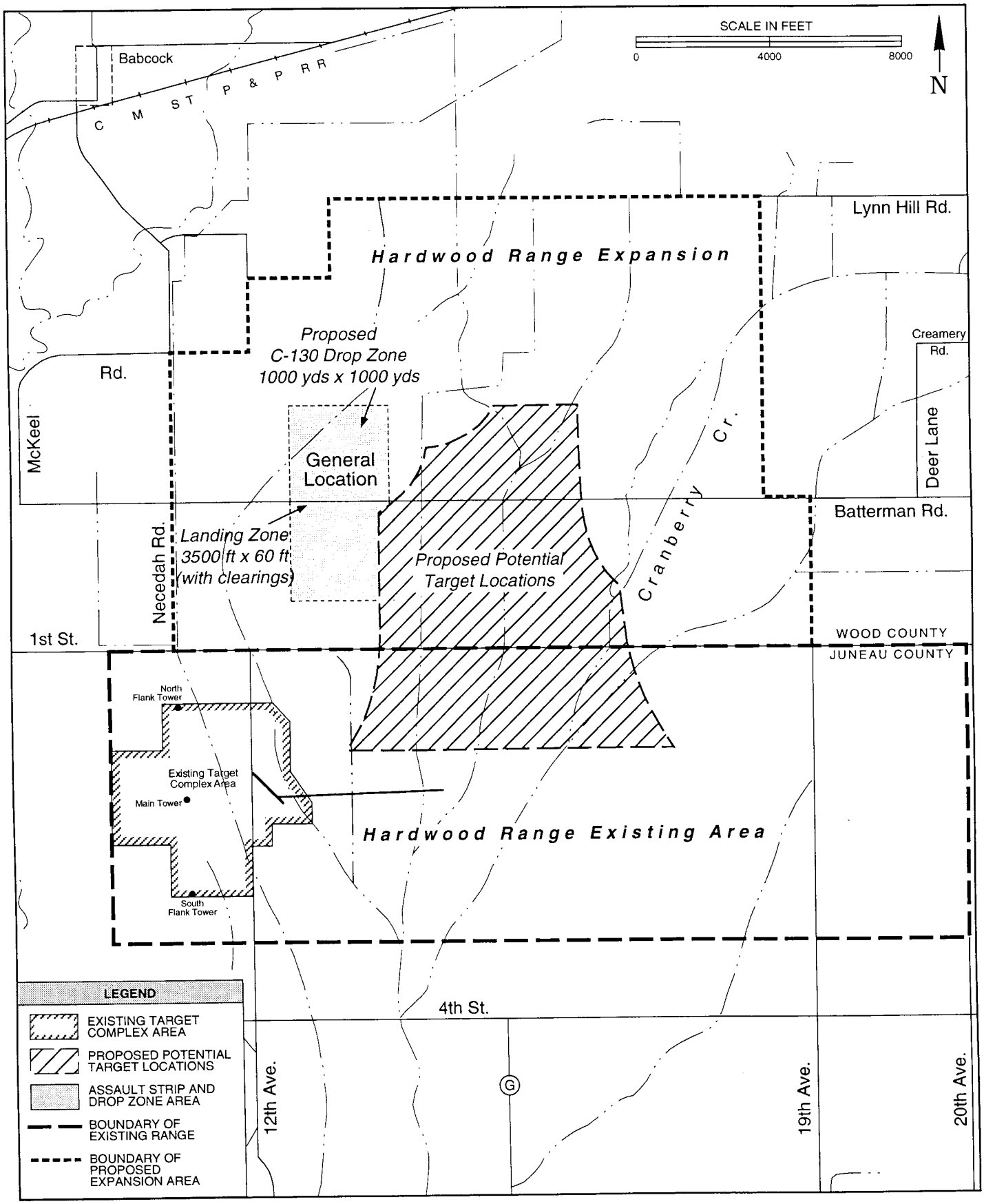


Figure 2-2. Configuration of the Hardwood Range Showing Details of Proposed Expansion

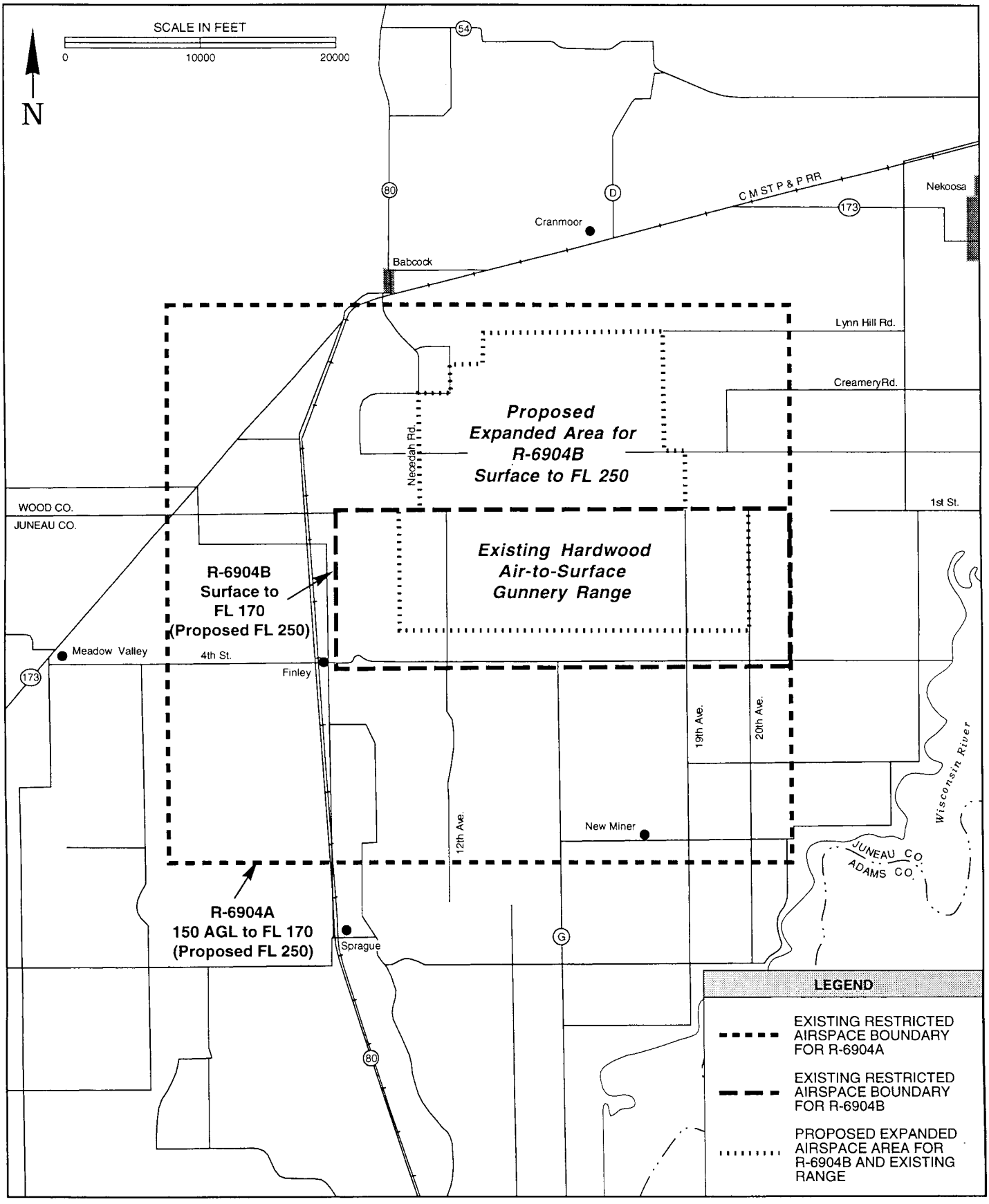


Figure 2-3. Existing and Proposed Airspace R-6904A/B

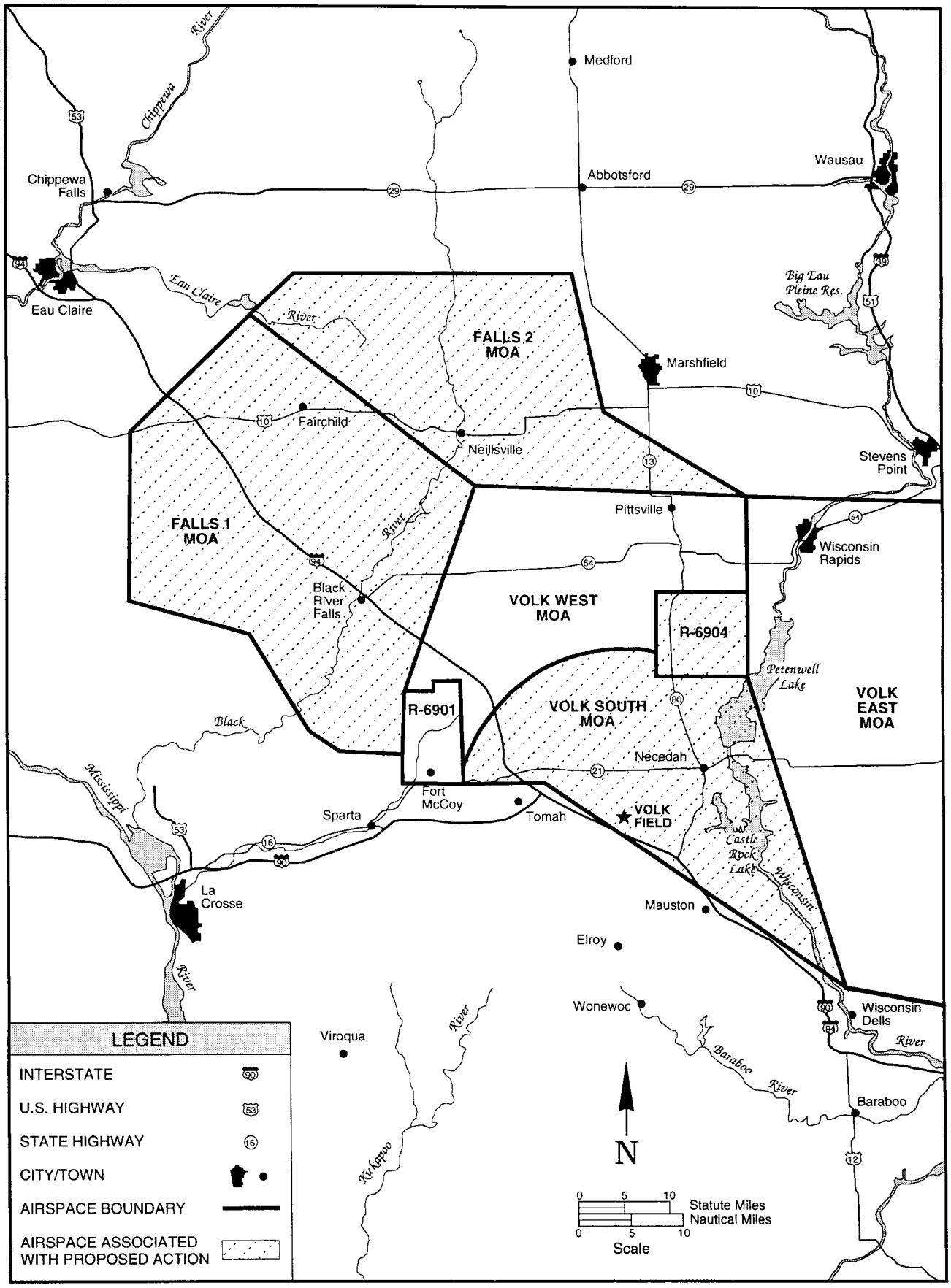


Figure 2-4. Locations of Existing MOAs and Restricted Airspace Associated with the Proposed Action

Within the area of expansion, the Air National Guard (ANG) would construct a new area for potential target locations, a drop-zone area for C-130 transport aircraft to practice drops of combat supplies (not munitions), and a 3,500-foot by 60-foot tactical landing zone for C-130 aircraft to practice landings simulating real world conditions. The landing zone and associated 1,000-yard by 1,000-yard DZ area would be located in the northwest area of the expanded portion of the range, 2 miles north of the existing range boundary. The landing zone and areas of the DZ must be cleared of obstacles. Although specific site development plans have not been developed for facilities in the range expansion area, some estimates can be made for land and tree clearing requirements. To reduce potential costs, the landing zone would most likely be located on an existing roadway with an additional area (approximately 100 total acres) added on either side for wing clearance. The landing zone area would be used as the DZ in most cases. There are currently no plans to remove trees and alter large areas in the proposed expansion area for new target locations, because enough clearings and dirt roads currently exist to meet most requirements. Tactical targets typically are obsolete military equipment, such as aircraft frames, armored tanks, and jeeps, that have been acquired through the Defense Reutilization and Marketing Office. Other targets include replica simulated Surface-to-Air Missile (SAM) sites and fuel storage facilities that have been constructed from empty 55-gallon drums and similar scrap material. Such targets are small in size and transportable and require a small clear area for placement within the range. Targets would be placed in existing upland open areas along the existing "roadway network." In placing these mobile targets, wetlands areas will be avoided. No improvements would be required for placement of the targets. Targets may be partially concealed to train aircrews for target acquisition while at low-altitude. The targets will be relatively small and, using the existing range as a model, the disturbance for the actual targets will probably be limited to less than 100 acres. This would bring the total area disturbed under the proposal for land and tree clearing to approximately 200 acres. Currently, the site is generally unimproved with the exception of Batterman Road, which crosses the area east to west.

Potential locations for facility development at the site may be subject to a high water table during various times of the year and would therefore either need to be filled or drained to protect the landing zone pavement section from loss of subbase strength or stability due to changes in the water table or frost conditions. Consideration will be given to the application of flexible pavement sections using a two-inch asphalt surface course with a 15-inch high-quality aggregate base course.

The proposed new area for potential target locations would be situated on land from both the existing and expanded range areas. Some limited tree removal, local soil disturbance, and grading would be required for target areas, fire breaks, and service roads to access the targets within the new target area. Whenever possible, wetlands in the areas of potential ground disturbance would be avoided.

The approximate proposed geographic coordinates of the Hardwood Range area are identified in Table 2-1.

As a result of the range expansion, the floor of Restricted Airspace R-6904B needs to encompass the proposed land expansion and would be lowered to the surface. In addition, the Proposed Action would increase the maximum altitude of R-6904A and R-6904B to FL 250 continuously and higher, as needed. The orientation of the target area would allow unrestricted run-in headings for most weapons deliveries. In addition to fighter and bomber flights, the 440th Airlift Wing (AW) in Milwaukee, Wisconsin; the 934th AW and the 133 AW in Minneapolis, Minnesota; collectively, would fly an estimated 228 sorties per year utilizing the drop/landing zone.

Table 2-1. Proposed Geographic Coordinates for the Hardwood Range

KEY POINTS OF REFERENCE	*LATITUDE*	*LONGITUDE*
Beginning at 90°04.8' W on Range Line Road	*44°17.6' N*	*90°04.8' W*
Then east to 90°01.4' W	*44°17.6' N*	*90°01.4' W*
Then south to Batterman Road	*44°15.8' N*	*90°01.4' W*
Then east along Batterman Road to 90°01.0' W	*44°15.8' N*	*90°01.0' W*
Then south to the Wood/Juneau County boundaries (First Street)	*44°14.9' N*	*90°01.0' W*
Then east along First Street to 89°59.8' W	*44°14.9' N*	*89°59.8' W*
Then south to 44°13.2' N	*44°13.2' N*	*89°59.8' W*
Then west to Tenth Avenue	*44°13.2' N*	*90°06.7' W*
Then west to 90°07.3' W	*44°14.8' N*	*90°07.3' W*
Then north to First Street	*44°14.9' N*	*89°59.8' W*
Then east to Necedah Road	*44°14.9' N*	*90°06.1' W*
Then north along Necedah Road to McKeel Road	*44°16.7' N*	*90°06.1' W*
Then east to Hines Road	*44°16.7' N*	*90°05.4' W*
Then north along Hines Road to 44°17.2' N	*44°17.2' N*	*90°05.4' W*
Then east to Range Line Road	*44°17.2' N*	*90°04.8' W*
Then north to the point of beginning		

The restricted airspace (R-6904A/B) and range would continue to be used between 7:00 AM and 10:00 PM. Approximately 10 percent of flights would be between 10:00 PM and 7:00 AM, the majority of which would occur between 6:00 AM and 7:00 AM and 10:00 PM to 11:00 PM. The range (outside of the impact area) is open to the public during periods of non use. People wanting to enter the range can call (800) 972-8673 to determine if the range is scheduled for use. If it is not scheduled for use, the ANG will provide access to the public for recreational purposes.

2.2.1.2 Reassessment of Falls 1 MOA Utilization

No modifications to the lateral and vertical dimensions of the MOA would be made. However, this action would increase the assessed number of sorties flown annually to 2,789. Specific utilization data are presented in Subsection 2.2.2.1. All missions would be flown at subsonic airspeeds between 250 and 550 knots indicated airspeed (KIAS) (285 to 625 miles per hour [MPH]). The area would be used predominantly between the hours of sunrise to sunset.

2.2.1.3 Reassessment of Falls 2 MOA Utilization

No modifications to the lateral and vertical dimensions of the MOA would be made. However, this action would increase the assessed number of sorties flown annually to 1,617. Specific utilization data are presented in Subsection 2.2.2.2. All missions would be flown at subsonic airspeeds between 250 and 550 KIAS (285 to 625 MPH). The area would be used predominantly between the hours of sunrise to sunset.

2.2.1.4 Reassessment of Volk South MOA Utilization

No modifications to the lateral and vertical dimensions of the MOA would be made. However, this action would increase the assessed number of sorties flown annually to 1,340. Specific utilization data are presented in Subsection 2.2.2.3. All

missions would be flown at subsonic airspeeds between 250 and 550 KIAS (285 to 625 MPH). The area would be used predominantly between the hours of sunrise to sunset.

2.2.2 Airspace Utilization

The following subsections briefly describe the utilization of each airspace component of the Proposed Action. Tables in each subsection depict current and proposed annual military training flights (sorties) for each airspace component. This utilization, displayed in the tables and shown as sorties, represents the number and type of aircraft anticipated in each airspace. An aircraft typically uses several MOAs and/or Military Training Routes (MTRs) on a single training flight. For example, a single aircraft may fly a single training flight through VR-1616, the Hardwood Range airspace (R-6904), and the Volk South MOA. This one sortie would be counted in each of the sortie totals for each of these airspaces. Therefore, the totals shown in the tables for each airspace component cannot be added together to produce a total sortie count for the overall Proposed Action, as this would over-count the sortie totals. Sorties are compiled in this manner, by airspace, because analyses are quantified by each individual piece of airspace based upon the total number of sorties conducted within that airspace.

2.2.2.1 Falls 1 MOA

This action would increase the currently assessed number of sorties in the airspace annually in the Falls 1 MOA. The lateral and vertical boundaries would remain unchanged. Table 2-2 depicts the current and projected number of sorties in the airspace by type aircraft in the Falls 1 MOA.

Table 2-2. Current and Proposed Annual Utilization in the Falls 1 MOA

UNIT	AIRCRAFT TYPE	SORTIES/YEAR (CURRENT [1])	SORTIES/YEAR (PROPOSED [2])
114 Fighter Wing (FW)	F-16	214	208
115 FW	F-16	1,262	1,137
119 FW	F-16	20	A
132 FW	F-16	437	600
148 FW	F-16	32	A
183 FW	F-16	28	64
185 FW	F-16	50	30
2 Bomb Wing (BW)	B-52	2	A
5 BW	B-52	0	A
28 BW	B-1	2	A
Multiple	F-15	16	A
Multiple	F-16	72	A
Multiple	Other [3]	38	750
TOTAL		2,173	2,789

NOTE:
1. Current use information is for the period October 1, 1995 through September 30, 1996.
2. Approximately 10 percent would be flown at night (i.e., between 10:00 pm and 7:00 am).
3. "Other" includes A-6, A-10, AH-1, B-2, C-26, C-130 , F-18, F-117, Tornado, LR-36, and UH-1 aircraft.

A. Included in total shown for "Other."

2.2.2.2 Falls 2 MOA

This action would increase the currently assessed number of sorties in the airspace annually in the Falls 2 MOA. The lateral and vertical boundaries would remain unchanged. Table 2-3 depicts the current and projected number of sorties in the airspace by type aircraft in the Falls 2 MOA.

Table 2-3. Current and Proposed Annual Utilization in the Falls 2 MOA

UNIT	AIRCRAFT TYPE	SORTIES/YEAR (CURRENT [1])	SORTIES/YEAR (PROPOSED[2])
114 FW	F-16	130	208
115 FW	F-16	785	1,137
119 FW	F-16	13	A
132 FW	F-16	268	100
148 FW	F-16	20	A
183 FW	F-16	18	64
185 FW	F-16	32	8
2 BW	B-52	2	A
5 BW	B-52	0	A
28 BW	B-1	2	A
Multiple	F-15	10	A
Multiple	F-16	44	A
Multiple	Other[3]	23	100
TOTAL		1,347	1,617

NOTE:
1. *Current use information is for the period October 1, 1995 through September 30, 1996.*
2. *Approximately 10 percent would be flown at night (i.e., between 10:00 pm and 7:00 am).*
3. *"Other" includes A-6, A-10, AH-1, B-2, C-26, C-130 , F-18, F-117, Tornado, LR-36, and UH-1 aircraft.*

A. *Included in total shown for "Other."*

2.2.2.3 Volk South MOA

This action would increase the currently assessed number of sorties in the airspace annually in the Volk South MOA. The lateral and vertical boundaries would remain unchanged. Table 2-4 depicts the current and projected number of sorties in the airspace by type aircraft in the Volk South MOA.

Table 2-4. Current and Proposed Annual Utilization in the Volk South MOA

UNIT	AIRCRAFT TYPE	SORTIES/YEAR (CURRENT [1])	SORTIES/YEAR (PROPOSED[2])
114 FW	F-16	70	100
115 FW	F-16	86	682
119 FW	F-16	21	A
132 FW	F-16	72	100
148 FW	F-16	16	A
183 FW	F-16	38	258
185 FW	F-16	16	100
2 BW	B-52	0	A
5 BW	B-52	0	A
28 BW	B-1	0	A
Multiple	F-15	18	A
Multiple	F-16	13	A
Multiple	Other[3]	18	100
TOTAL		368	1,340

NOTE:
1. Current use information is for the period October 1, 1995 through September 30, 1996.
2. Approximately 10 percent would be flown at night (i.e., between 10:00 pm and 7:00 am).
3. "Other" includes A-6, A-10, AH-1, B-2, C-26, C-130 , F-18, F-117, Tornado, LR-36, and UH-1 aircraft.

A. Included in total shown for "Other."

2.3 ALTERNATIVES TO THE PROPOSED ACTION

The following subsections present alternatives to the Proposed Action that were considered in light of the narrowing criteria described in Subsection 1.4.4. Current operations are represented by the No-Action Alternative and it is presented here as an alternative to the Proposed Action. Section 2.3.2 addresses those alternatives considered but eliminated from detailed study in this EIS.

2.3.1 No-Action Alternative

The No-Action alternative would mean military units would continue to train using the current range and existing airspace. The configuration of the Hardwood Range and restricted airspace R-6904 would remain as they currently exist. The DZ and Landing Zone would not be developed. Assessment of annual utilization would continue to need to be updated.

Should any of the range changes or airspace utilization assessments considered under the Proposed Action ultimately be excluded from adoption by decision-makers, adoption of the No-Action alternative can be done individually and separately for any component of the No-Action alternative.

2.3.1.1 Hardwood Air-to-Surface Gunnery Range

Hardwood Range is located in Juneau County in west-central Wisconsin approximately 20 statute miles north-northeast of Volk Field ANG Base (approximately 80 statute miles northwest of Madison). The range encompasses 7,929 acres of land, is

generally flat and surrounded by heavily wooded areas, and is approximately two miles wide by six miles long. The State of Wisconsin leases the land to the Federal government, which licenses the land to the ANG to conduct aircrew training. The ownership of the land comprising the existing range area is a checkerboard of State-owned and County-owned land. The airspace directly above the range is R-6904B. R-6904B extends vertically from the surface to 17,000 feet mean sea level (MSL). A second restricted area, R-6904A, surrounds R-6904B and incorporates an area approximately 8 by 9 nautical miles (NM) (see Figure 1-2). R-6904A surrounds R-6904B on the north, west, and south and extends from 150 feet above ground level (AGL) to 17,000 feet MSL. The Volk Field Combat Readiness Training Center (CRTC) schedules the range.

Approximate geographic coordinates of existing R-6904A are as follows:

Beginning at	44°18.0'N 89°59.0'W
to	44°10.0'N 89°59.0'W
to	44°10.0'N 90°11.0'W
to	44°18.0'N 90°11.0'W
to	point of beginning, excluding R-6904B.

Approximate geographic coordinates of existing R-6904B are as follows:

Beginning at	44°15.0'N 89°59.0'W
to	44°13.5'N 89°59.0'W
to	44°13.5'N 90°07.6'W
to	44°15.0'N 90°07.6'W
to	point of beginning.

2.3.1.2 Falls 1 MOA

This MOA is centered approximately 47 NM northwest of Volk Field and 112 NM northwest of Madison. The MOA adjoins the Volk West MOA to the east, the Falls 2 MOA to the northeast, and R-6901 to the southeast. Falls 1 extends from 500 feet AGL up to, but not including, FL 180 (approximately 18,000 feet MSL). The Falls 1 MOA is used primarily for low-altitude air-to-air training (LOWAT) and air combat training.

Approximate geographic coordinates of the existing Falls 1 MOA are as follows:

Beginning at	44°28.0'N 90°35.0'W
to	44°08.7'N 90°44.3'W
to	44°02.8'N 90°44.5'W
to	44°03.0'N 90°53.0'W
to	44°05.0'N 90°57.0'W
to	44°14.0'N 91°05.0'W
to	44°17.0'N 91°21.0'W
to	44°33.0'N 91°21.0'W
to	44°44.0'N 91°05.0'W
to	point of beginning.

2.3.1.3 Falls 2 MOA

This MOA is centered approximately 45 NM north-northwest of Volk Field and 110 NM northwest of Madison. The MOA adjoins the Volk West MOA to the south and the Falls 1 MOA to the southwest. Falls 2 extends from 500 feet AGL up to, but not including, FL 180 (approximately 18,000 feet MSL). The Falls 2 MOA is used primarily for LOWAT and air combat training.

Approximate geographic coordinates of the existing Falls 2 MOA are as follows:

Beginning at	44°44.0'N 91°05.0'W
to	44°48.0'N 90°59.0'W
to	44°48.0'N 90°22.0'W
to	44°35.0'N 90°18.0'W
to	44°27.0'N 89°59.0'W
to	44°28.0'N 90°35.0'W
to	point of beginning.

2.3.1.4 Volk South MOA

This MOA is centered approximately 5 NM northeast of Volk Field and 68 NM northwest of Madison. The MOA adjoins and is south of Volk West MOA. The Volk South MOA extends vertically from 500 feet AGL up to, but not including, FL 180 (approximately 18,000 feet MSL). The Volk South MOA is used primarily for LOWAT, air combat training, and access to Hardwood Range.

Approximate geographic coordinates of the existing Volk South MOA are as follows:

Beginning at	44°10.0'N 89°59.0'W
to	43°40.0'N 89°46.3'W
to	44°00.0'N 90°26.0'W
to	44°00.0'N 90°35.3'W
to	44°00.0'N 90°35.3'W
to	44°00.2'N 90°36.6'W
to	44°00.2'N 90°36.7'W
to	44°01.3'N 90°36.7'W
clockwise	along an arc with a 16 NM radius centered
at	43°56.6'N 90°15.5'W
to	44°12.3'N 90°11.0'W
to	44°10.0'N 90°11.0'W
to	point of beginning.

2.3.2 Alternatives Considered But Eliminated From Detailed Study

This subsection provides information concerning the reasons some alternatives to the Proposed Action were eliminated from further detailed study in this EIS. The ANG utilized a specific set of narrowing criteria, discussed in Subsection 1.4.4 to make determinations as to the suitability of each alternative.

2.3.2.1 Use Existing U.S. Army Range at Fort McCoy

The Fort McCoy range complex consists of the Fort McCoy Army Airfield, the Young Landing Zone, and an artillery range. The complex is located approximately 20 miles west of Volk Field and approximately 32 miles southwest of the Hardwood Range. The restricted airspace associated with the Fort McCoy Range is R-6901.

The Fort McCoy Army Airfield has two runways. One runway is 4,200 feet long, of which 2,800 feet is 100 feet wide and the remainder is 50 feet wide. The second runway is 4,700 feet long and 100 feet wide for its entire length.

The Young Landing Zone is unlit, 3,500 feet long and 60 feet wide with 300-feet overruns at each end. The surface is compressed gravel. Designed and constructed to replicate an unimproved air landing field at a third world country, it is capable of handling C-130 aircraft. The landing zone can also be used as part of a DZ for airborne operations. However, the landing zone is inaccessible during periods when training is occurring using live ammunition. U.S. Army units have priority over all other units requesting to use the range. According to U.S. Army use schedules, the landing zone would not be available for ANG use at sufficient levels to meet projected ANG and other unit requirements. Therefore, a landing zone would still be needed on the Hardwood Range.

The artillery range is used primarily for ground-to-ground artillery training; however, some air-to-surface training is conducted. The range is 3.5 miles by 4 miles on the northern end and tapers to 1.5 miles on the southern end. The U.S. Army schedules and manages the airspace and range. The U.S. Army is the primary user and obligates the range for day and night armor, artillery, and armed helicopter training to the extent that unobligated availability cannot meet ANG requirements.

While the range complex is well suited for U.S. Army artillery training, it has several limitations that preclude conducting viable tactical aircraft training. Experience has shown that realistic tactical aircraft training is most effectively accomplished in an area that is at least 7 miles by 5 miles. If an area with those dimensions is not available, the military adjusts the flight profiles to accomplish as much training as possible within the available training configuration. In addition to the size limitation, the Fort McCoy range operating procedures require a Forward Air Controller (FAC) to direct all tactical aircraft training. Approximately 80 percent of the tactical training that would be conducted on Hardwood Range does not require a FAC. Only 20 percent of the required tactical training could be conducted on the Fort McCoy range even if the range were large enough to conduct viable training. A third limitation is the absence of equipment such as control towers and ordnance spotting/scoring devices to score weapons delivery accuracy. Future range improvements do not include any of this equipment. If the existing U.S. Army range at Fort McCoy were transferred to ANG control, new targets developed, and towers and support facilities constructed, then the range could be used for some of the training planned for the Hardwood Range. However, future U.S. Army plans for utilization and facility upgrades make a transfer very unlikely. Therefore, this is not a viable alternative.

2.3.2.2 Establish a New Air-to-Surface Gunnery Range

The ANG considered the possibility of establishing a new range at some other location within an unrefueled radius for each unit currently using the Hardwood Range. This examination concluded that establishing a new range would be cost prohibitive and potentially undesirable from an environmental standpoint. Such a project could also

take up to 10 years to get into place for use to conduct training exercises. Therefore, this is not a viable alternative.

2.3.2.3 Close Hardwood Range and Redirect Units to Other Ranges

The ANG considered the possibility of having current and projected military air-to-surface gunnery training accomplished on air-to-surface ranges other than the Hardwood Range. Although some other ANG ranges are closer to Hardwood Range for some using units (see Table 2-5 and Figure 2-5), Volk Field and the Hardwood Range offer a unique opportunity for air-to-surface and instrumented air-to-air training to be accomplished at one location. Combined air-to-air and air-to-surface training is available only at a select few locations throughout the United States, each of which is well outside a usable operational distance. The closest available ACMI range is in Gulfport, Mississippi. Requiring units to undertake air-to-surface training and air-to-air training at different locations would substantially increase the cost of training for some units. Increased costs are incurred because of additional fuel requirements and flying time necessary to reach more distant training ranges. Closing Hardwood Range also would involve costs associated with decommissioning the range. This alternative did not satisfy any of the desired or mandatory operational criteria specified in Subsection 1.4.4. Therefore, this is not a viable alternative.

Table 2-5. ANG Air-to-Surface Gunnery Ranges Within 300 NM of Primary Using Unit Locations

UNIT/LOCATION	RANGE	DISTANCE	APPROXIMATE TRAVEL TIME [1]	APPROXIMATE TRAVEL COSTS [2]
114 FW/Sioux Falls, SD	Hardwood	290 NM	0.64 hr	$1,116
	Smoky Hill	297 NM	0.66 hr	$1,151
115 FW/Madison, Wisconsin	Atterbury	274 NM	0.60 hr	$1,046
	Grayling	230 NM	0.51 hr	$889
	Hardwood	67 NM	0.15 hr	$262
132 FW/Des Moines, Iowa	Cannon	242 NM	0.54 hr	$942
	Hardwood	225 NM	0.50 hr	$872
	Smoky Hill	256 NM	0.57 hr	$994
183 FW/Springfield, Illinois	Atterbury	170 NM	0.38 hr	$663
	Cannon	178 NM	0.40 hr	$698
	Hardwood	264 NM	0.59 hr	$1,029
	Jefferson Proving Ground	204 NM	0.45 hr	$785
185 FW/Sioux City, Iowa	Hardwood	296 NM	0.68 hr	$1,186
	Smoky Hill	220 NM	0.49 hr	$855
Hardwood Range	Grayling	245 NM	0.54 hr	$942

NOTES: 1. Travel time based on an F-16 aircraft traveling at 450 NM/hr.
2. Travel cost based on DOD FY97 estimate to operate an F-16 aircraft at $1,744/flying hour.

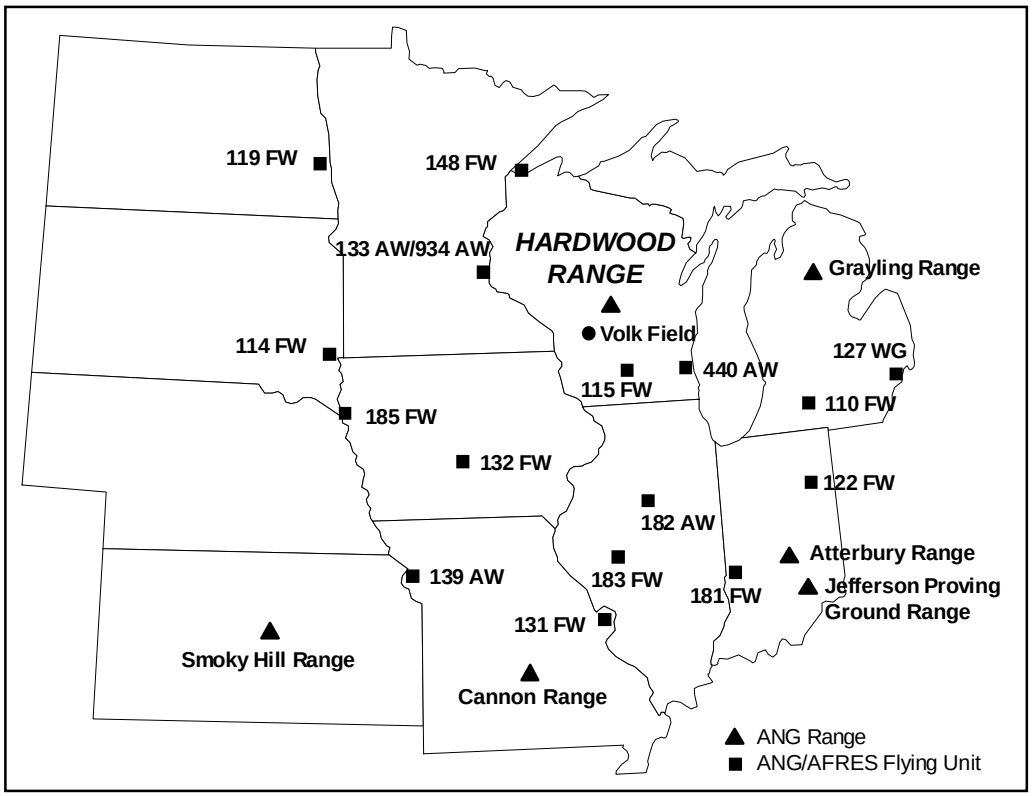


Figure 2-5. Primary Using Units of the Hardwood Range and Other Range Options

2.3.2.4 Use or Modify Existing MOAs and MTRs Other Than Those Contained in the Proposed Action

The use of other existing airspace associated with the Volk Field/Hardwood Range complex as alternatives to the Proposed Action was reviewed to determine the adequacy to meet training requirements. However, for the reasons indicated below, these airspace components were not utilized.

- **Lower Volk East MOA.** The Volk East MOA adjoins R-6904A/B airspace to the east. The floor of the MOA is 8,000 feet MSL. The FAA will not lower the floor of the MOA because of underlying airways. A low-altitude entry to the Hardwood Range could not be accomplished from this MOA. Therefore, because the floor of the MOA could not be lowered, it was eliminated as a viable alternative.

- **Use VR-1650.** The start point for VR-1650 is approximately 40 NM northwest of the Hardwood Range. The route proceeds northeast before turning south and terminating on the Hardwood Range. For units from the east or south, VR-1650 would increase traveling distances to the range by this additional forty miles. It should also be noted that VR-1650 does not presently access the range complex.

2.3.2.5 Utilize Electronic Scoring of Simulated Weapons Delivery

The Air Combat Maneuvering Instrumentation (ACMI) system at Volk Field can provide the ability to electronically score a simulated ordnance release (referred to as No-Drop Weapons Scoring). To use this system, an aircraft equipped with a special transmitting pod maneuvers toward selected targets on Hardwood Range in much the same way as it would during actual ordnance drops. The aircraft simulates ordnance release by using the same armament switches as if actually releasing ordnance. The transmitter pod sends a signal to a processing location which then electronically scores the accuracy of the simulated ordnance release. This system is currently used by some units deployed to Volk Field. While the ACMI system is good for developing basic proficiency skills, it does not yet possess the capability to score ordnance release skills to the accuracy parameters required by current United States Air Force (USAF) directives. Therefore, this system was eliminated from further consideration.

2.3.2.6 Increase Flight Simulator Training

Flight simulators are already included in the aircrew's proficiency training program, such as instrument procedures training, emergency procedures training, and limited intercept training as described in Air Force Instruction (AFI) 11-F16. However, the complete substitution of simulator training for all flight training is not a viable alternative to the airspace proposals in this document. Actual military training sorties are the most important part of a pilot's training and are necessary to accomplish those portions of the training which cannot be accomplished through the use of a simulator. When the technology becomes available, no-drop scoring of training flights will be used as a substitute for actual drops of bombs for some training. The ANG continuously studies ways to incorporate emerging simulator technology into aircrew training programs to reduce the cost of actual sorties where that substitution will contribute to readiness requirements. Therefore, this alternative was eliminated from further consideration.

2.3.2.7 Alternatives to the Northern Expansion of the Existing Hardwood Range

Expand Existing Range to the east. Past attempts to lower the floor of Volk East below 8,000 MSL have been turned down by Federal Aviation Administration (FAA) due to the amount of civilian air traffic. A similar response was given to expansion of the Hardwood Range to the east. Therefore, it was eliminated as a viable alternative.

Expand Existing Range to the south. Several full-time residences and cranberry bogs exist south of the range. Run-in headings would impact a large recreational area around Petenwell Lake. Therefore, it was eliminated as a viable alternative.

Expand Existing Range to the west. Immediately west and south of the existing range is the Necedeh National Wildlife Refuge (NWR). There are currently seasonal altitude restrictions to flights over the refuge during migration of waterfowl. Therefore, it was eliminated as a viable alternative.

2.4 SUMMARY OF SPECIAL OPERATING PROCEDURES AND FLYING RESTRICTIONS

The ANG routinely employs a variety of special operating procedures to decrease impacts on communities and other sensitive noise receptors (i.e., hospitals, churches, schools, etc.) that exist under or near MOAs or MTRs. These would apply to any alternative chosen for implementation. These procedures include:

- Avoidance of sensitive areas under a MOA by increasing altitude or through other measures

- Avoidance of sensitive areas along an MTR by flying to the side or by increasing altitude over the sensitive area. (Not applicable for this proposal.)

The ANG maintains a minimum altitude over areas sensitive to low-altitude flight. For example:

- Maintain certain minimum altitudes over identified federally-designated threatened and endangered (T&E) species nest sites.

- Known areas populated by other potentially sensitive species are avoided by increasing separation distances determined through discussions with appropriate Federal and state agencies.

The following are examples of FAA and military flying restrictions.

- Avoid flying lower than 1,000 feet above the highest obstacle within a 2,000 feet horizontal radius when over a congested area, such as a city, town, or settlement, or over any open air assembly of people.

- Avoid flying lower than 500 feet above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure.

- Avoid public-use airports displayed on aeronautical maps by at least 1,500 feet vertically when within 3 NM.

In addition to these procedures, which are routinely applied, specific mitigations are sometimes required to deal with impacts at a specific location. Subsection 4.17 provides additional details on the types of specific mitigations that are relevant to the MOAs and restricted airspace addressed in this EIS.

2.5 SORTIE TOTALS AND CALCULATING CUMULATIVE IMPACTS

Airspace utilization is quantified by determining the total military training flights (sorties) obligated to each airspace. Cumulative impacts are based on sorties determined by using the numbers produced by adding together sorties from coincidental airspace (airspace overlapping the same geographic space). Considerable effort has been put into developing the sortie profile for each airspace that can provide information to determine cumulative totals.

Table 2-6 summarizes historical airspace utilization. The table also displays the sortie totals used to develop Appendix F and shows the number of sorties that will be assessed in each airspace component under the proposal for the Hardwood Range expansion. The numbers in Table 2-6 do not represent the cumulative sortie totals. Subsection 4.14 displays the cumulative sortie totals for each airspace component under each of the alternatives studied in detail in this EIS.

The airspace utilization shown in Table 2-6 represents the number of sorties anticipated in each airspace. An aircraft typically uses several MOAs and/or MTRs on a single training flight. For example, a single aircraft may fly a single training flight through VR-1616, the Hardwood Range airspace (R-6904) and the Volk South MOA. This one sortie would be counted in each of the sortie totals for each of these airspace components. Therefore, the totals shown in Table 2-6 for each airspace component cannot be simply added together to produce a total sorties count for the overall proposal, as this would over-count the sortie totals. Special care must be used to properly quantify coincidental airspace use to provide the data necessary for the analyses in this EIS.

Cumulative impact analysis based on a maximum expected sortie rate that adds together all coexisting sorties, at the highest possible level of utilization, provides the basis for the impact assessments for each individual airspace and resources affected underneath. Sorties were identified as the key component of cumulative impact analysis because they form the basis from which essentially all other analyses were derived, and in particular all those producing quantitative results, including noise level computations, air quality analyses, and safety evaluations. Other non-qualitative resources, such as visual resources, land use, and cultural resources are indirectly affected by these results through the subsequent changes in the noise and visual environment. These resources are also analyzed in this document.

In preparing this EIS, the ANG began its consideration of cumulative impacts by viewing the impacts of the Hardwood Range expansion in the broadest sense. Also, through the IICEP process, information from all affected state, Federal, Native American Nations and other interests were solicited (see Appendices B, C, H and O). In looking at the applicable airspace with this broad view, there exists a potentially infinite combination of insignificant cumulative environmental impacts in a variety of resource areas. NEPA does not require a proponent to analyze the most remote or attenuated consequences of a Proposed Action. Therefore, the maximum sortie rates analysis was developed and used to quantify and assess cumulative impacts. The results of this analysis are addressed in Section 4.0.

Table 2-6. Summary of Utilization for All Identified Aircraft for Each Airspace

YEAR	NUMBER OF SORTIES BY AIRSPACE COMPONENT [1]			
	FALLS 1	FALLS 2	VOLK SOUTH	R-6904
Historic Usage				
1990	*1,613*	*335*	*N/A [3]*	*4,670*
1991	*1,430*	*330*	*N/A [3]*	*4,909*
1992	*225*	*55*	*N/A [3]*	*3,763*
1993	*625*	*71*	*236*	*2,887*
1994	*1,112*	*495*	*540*	*2,891*
1995	*2,080*	*1,733*	*722*	*2,696*
Existing Conditions				
1996 [2]	*2,173*	*1,347*	*368*	*2,672*
Proposed Action Assessment	*2,789*	*1,617*	*1,340*	*N/A [4]*

NOTES:
1. *Types of aircraft flown include fighter aircraft such as the F-16 and F-15; bomber aircraft such as the B-1, B-2, and B-52; and other aircraft such as the A-6, A-10, AH-1, C-26, C-130, F-18, F-117, Tornado, LR-36, and UH-1.*
2. *Current use information is for the period October 1, 1995 through September 30, 1996.*
3. *N/A = Not Applicable, airspace not in use.*
4. *N/A = Not Applicable, existing assessment of 4,992 sorties covers all planned operations (ANGRC 1993).*

2.6 SUMMARY OF FINDINGS AND COMPARISON OF REASONABLE ALTERNATIVES

In accordance with National Environmental Policy Act (NEPA) requirements, this subsection provides a comparison of the environmental impacts associated with the Proposed Action and the reasonable alternatives to the Proposed Action. Previously in this section of the Final Environmental Impact Statement (FEIS), a Description of the Proposed Action (Subsection 2.2) and each of the reasonable alternatives (Subsection 2.3) were presented. In Subsection 2.3.2 of this FEIS, an evaluation of several other alternatives to the Proposed Action was performed that identified that these alternatives should be eliminated from further consideration and detailed study in the FEIS because they were technically unfeasible or could not meet the ANG's narrowing criteria. Consequently, the environmental impacts of these alternatives are not analyzed in this EIS. This subsection provides a comparison and evaluation of the environmental impacts for only the Proposed Action and the No-Action Alternative. The No-Action Alternative would continue the current operations and is provided in this EIS as a baseline and provides a framework to help understand the relative importance of various evaluation factors associated with the analysis.

2.6.1 Summary of Anticipated Environmental Effects

A characterization of the affected environment relevant to the Hardwood Range expansion is presented in Section 3. The anticipated environmental impacts associated with selection of the Proposed Action or the No-Action Alternative are evaluated in detail in Section 4 and summarized below by topical area. For the airspace

utilization assessments, noise issues are addressed in greater detail because of their relatively higher importance indicated by public comments and because they form a component of the basis for determining potential effects in some of the other topical resource areas.

In order to evaluate the alternatives considered, quantitative data on the potential impacts associated with the alternatives were generated using a reasonable maximum situation analysis. Under this scenario, the maximum number of training sorties possible for each airspace is assumed to occur. Each airspace is individually addressed in this manner. In addition, the results are added together with coincidental airspace use not a part of the Hardwood Range Expansion proposal (e.g., overlap with VR-1616 and VR-1650), thus producing a cumulative total of all military aircraft operations in these military airspaces and providing a basis to determine impacts. This analysis approach is used as the basis for all impact assessments developed in Section 4 and the supporting appendices. Because of the assumptions associated with this approach, the maximum situation scenario is likely to represent more than the actual utilization of the airspace under typical conditions; however, this approach allows for a basis for comparison of each of the alternatives studied in detail.

Many citizens have expressed concern that their quality of life, which is based directly on the kind of lifestyle that they can enjoy while residing in or visiting the State of Wisconsin, will be changed by the training associated with the Hardwood Range. The ANG has been conducting military aircraft operations and training at the Hardwood Range since 1955. All of the military airspace assessed under this EIS is currently in use. Commercial aircraft overflights of the study area have also been taking place and will continue to do so. Citizens may notice changes in military aircraft overflights in certain areas associated with the proposal. The number of assessed sorties are proposed to increase over the 1995-1996 baseline, but for the most part are not a significant variation from historical utilization. No changes in the configuration of any of the MOAs or their altitude limitations is proposed. Therefore, existing quality of life should not be changed.

The following subsections present summaries of potential environmental consequences, organized by specific resource area, associated with the proposed adoption of the Proposed Action. These summaries are drawn from the more detailed analyses presented in Section 4. NEPA requires that such analyses need only address those areas with a reasonable potential to be affected by the action rather than attempting to provide analyses that are encyclopedic. Consequently analysts preparing this EIS evaluated the relative potential of impacts from either the Hardwood Range expansion or utilization of the MOA airspace to directly or indirectly affect a resource area. This evaluation resulted in a focused analyses that is illustrated in Table 2-7.

2.6.1.1 Airspace Management/Air Traffic

This subsection summarizes more detailed analyses presented in Subsection 4.1. No changes in any airspace configuration or operational parameters will occur for any of the MOAs considered in this EIS. R-6904B will be increased in size. The change in R-6904B will improve pilot awareness in conjunction with ground-based modification associated with the range expansion. Training scenarios include standard military training activities such as aircraft intercept and air combat maneuvers in the MOAs and low-altitude training in the airspace associated with the range.

Table 2-7. Analyses of Importance Addressed in this EIS

RESOURCE	*HARDWOOD RANGE EXPANSION AND RESTRICTED AIRSPACE*	*MOA UTILIZATION*
Airspace	*X*	*X*
Noise	*X*	*X*
Safety		
Ground	*X*	
Ordnance	*X*	
Flight	*X*	*X*
Hazardous Materials	*X*	
Earth Resources		
Geology	*X*	
Soils	*X*	
Water Resources		
Surface Water	*X*	
Groundwater	*X*	
Water Availability	*X*	
Floodplains	*X*	
Air Quality	*X*	*X*
Biological Resources		
Flora	*X*	
Fauna	*X*	
Threatened and Endangered Wildlife Species	*X*	*X*
Sensitive Habitats	*X*	*X*
Cultural Resources		
Prehistoric and Historic Archaeological	*X*	*X*
Historic Architectural	*X*	*X*
Traditional Resources	*X*	*X*
Land Use		
Ownership/Management	*X*	*X*
Special Use Areas	*X*	*X*
Transportation	*X*	
Recreation	*X*	*X*
Visual and Aesthetics	*X*	*X*
Socioeconomics	*X*	*X*

Existing MOA boundaries would not be modified under the Proposed Action. Under both alternatives, conflicts between defense-related flight activities in the MOAs would be resolved by the military through scheduling of flight activities. Military pilots would be responsible for deconflicting each other's flight path through mutual timing arrangements and/or applying "see-and-avoid" principles. Military pilots would also be responsible for avoiding aircraft flying under visual flight rule (VFR) along low-altitude airways.

Although the MOA airspace intersects with federal airways or airport-related air traffic operations, the proposed changes in MOA utilization would not result in conflicts with or significant impacts to existing operations. The FAA manages all airspace and has established rules of flight and air traffic control procedures to govern safe aircraft operations near and between airports, and within defense-related airspace. Military operations are conducted within designated airspace and follow specific procedures to minimize the hazard of high-speed flight training to non-participating civil or military aircraft.

The FAA and each military service have very strict rules to ensure that pilots stay within defined training airspace. The rules govern minimum altitudes, maximum speed, and type of maneuvers that can be performed inside and outside designated training airspace. The military closely manages the airspace they use to ensure that they do not exceed planned parameters.

For the airspace addressed in the Proposed Action, assessed levels of utilization are consistent with historical usage, except for Volk South MOA. Assessed utilization in the Volk South MOA, which was first used in 1993, would increase significantly but would be less than the projected utilization for the Falls 1 and Falls 2 MOAs as part of the Proposed Action.

2.6.1.2 Noise

Noise generated by aircraft overflights is considered to be one of the most important factors addressed in the analyses associated with this EIS. This subsection summarizes more detailed analyses presented in Subsection 4.2.

Computer-based simulation programs are normally used to determine the noise impacts associated with changes in aircraft operations and to model the expected noise environment. Noise levels for the alternatives addressed in this EIS were computed using the Air Force's MR_NMAP computer program. That model is based on the Air Force's NOISEMAP program. These programs have been developed for this purpose by the Department of Defense (DoD). The impacts are quantified by calculating the current noise environment before a proposed action (i.e., the baseline level) and the noise environment expected after a proposed action. Noise from the action is evaluated by comparing it with baseline levels and with objective criteria. Appendix F presents an overview of noise and noise effects. Appendix F may be referred to should definitions of basic acoustic concepts be needed.

In this EIS, sound levels are quantified by two basic noise measuring techniques (metrics). Both metrics (and, unless otherwise noted, all sound levels given in this EIS) are based on A-weighted sound levels (dB[A]). A-weighting is a filter which approximates the response of the human ear. A-weighted levels therefore represent how loud a sound is perceived by a person.

The first metric used is the Onset Rate-Adjusted Monthly Day-Night Average Sound Level, L_{dnmr}. This is a modification, developed for military airspaces, of the Day-Night Average Sound Level, L_{dn}. L_{dn} (alternatively denoted DNL) is a cumulative metric which accounts for the total sound energy over a 24-hour period. Although L_{dn} is called an "average", it is often described as a "cumulative" measure of impact. It accounts for the sound level of individual events, the duration of each event, and the number of events occurring each day. L_{dnmr} has two modifications. One is the application of an onset rate penalty of up to 11 decibel (dB) to account for the surprise factor of high speed, low altitude military aircraft, sometimes referred to as "startle effect". The other is the specification that L_{dnmr} is based on average operations during the busiest month of the year. This is in contrast to standard practice around civil airports, where annual averages are used. A monthly average prevents predictions from being diluted downward by seasonal periods of low activity.

The second metric is the Sound Exposure Level (SEL). This is a quantity which combines the sound level of an individual event with its duration. SEL is usually higher (by up to 15 dB for the sounds involved in this action) than the maximum level of an event. SEL is a more reliable predictor of intrusiveness than is the maximum level alone, since it measures the total sound associated with a given event.

Quantitative assessment of noise impact is done in terms of L_{dnmr}, since that metric has been demonstrated to correlate with community reaction to noise. L_{dnmr} does not convey a description of what would be heard at any given time, particularly during an aircraft overflight. SEL analysis was performed for this EIS to provide such a description. This analysis presents the number of times per day individual aircraft events occur at a location that would exceed 45 dB (representing events which might be heard), 65 dB (representing events which might be intrusive) and 90 dB (overhead or near-overhead low-altitude events which would be intrusive).

The positioning of aircraft operations within an individual airspace, by its nature, occurs in a random manner, so the exact individual noise events at a given location cannot be predicted with absolute accuracy. The noise models available do, however, allow prediction of the average numbers of events of various sound levels which will occur. That capability has been used in this EIS to provide a measure of how often aircraft might be heard and might be intrusive, and to allow a prediction of the percentage of time in a day that could be adversely affected.

To interpret daily noise event information given in this EIS, it is important to understand that individual aircraft noise events are typically heard for a period of only 30 to 90 seconds. The instantaneous noise level is very low at the beginning and end of this period. As the aircraft approaches, the sound level increases to some maximum level depending on how close the aircraft comes to the receiver. After the maximum, it decreases until it fades into the background. If an aircraft at low altitude passes directly overhead, the maximum instantaneous noise level can be in excess of 100 dB. Noise would be near that maximum for only a few seconds, with most of the event being at a lower level. An aircraft passing off to the side of a receiver would have a lower maximum level (e.g., half a mile to the side would be about 20 to 30 dB lower than directly overhead) but the levels would be near that maximum for a somewhat longer period of time, perhaps 10 to 15 seconds, with the net result of SEL for a flight half a mile to the side being 15 to 25 dB lower than that for a flight directly overhead. An aircraft 2 to 3 miles or more from a receiver may not be heard at all. Noise impacts in this EIS are evaluated based on the differences between the noise levels predicted for the alternatives, on changes from baseline, and on other objective measures of noise effects.

The computer programs and modeling functions were calibrated using direct measurements of the noise environment for typical aircraft operations. The results of the noise modeling of each of the MOAs under each of the alternatives indicate that noise will not be high enough to cause significant impact. Maximum cumulative noise levels for both the Proposed Action and No-Action Alternative will fall within guidelines identified by the U.S. Environmental Protection Agency (EPA) as protective of public health and welfare, with the primary consideration being annoyance. Noise levels will also be well below the threshold of any risk to hearing or human health. Individual noise events will be audible at times. Indirect overflights, such as events just over 45 dB or just over 65 dB, would be audible for shorter times. Taking an average duration of 30 seconds for events above 45 dB and 60 seconds for events above 65 dB, aircraft noise will be heard in the Falls 1 MOA along the centerline of certain segments of VR-1616 (the maximum situation) for an average of less than seven and one-half minutes per day. The portion of the audible period that would actually be above 45 or 65 dB is less, since the maximum level for a given overflight lasts only a few seconds.

For this EIS, noise levels at 27 ground locations (points) were modeled in order to provide a profile of potential cumulative noise impacts under baseline conditions (the No-Action Alternative) and under the Proposed Action (see maps in Section 3.2). The results of these analyses, showing L_{dnmr} and SEL levels, are summarized in Tables 2-8 and 2-9, respectively, and indicate that projected changes in noise impacts from the implementation of the Proposed Action would vary depending on location but would be expected to be minimal in most areas. Table 2-8 illustrates that relative changes in L_{dnmr} noise levels will be fairly insignificant except at Points 1, 4, 8, and 9 where the increase in noise level would be significant. In each of these locations, noise levels remain well below 65 dB. The effect of expanding the range and spreading out the potential target locations actually reduces anticipated noise level for uniformly distributed noise in R-6904B from 63 dB to 61 dB. Only at a gravel pit at the northeast corner of R-6904A (66 dB) and at the location of the bomb target circle on the existing range complex (69 dB) will noise levels exceed 65 dB. For the range complex area, this result is consistent with expectations for military land set aside for this purpose.

Changes in individual events are summarized in Table 2-9. Table 2-9 shows the maximum number of daily events exceeding an SEL of 45, 65, and 90 dB. As described in more detail in Section 4, these represent (respectively) levels which might be heard, levels which might interfere with speech communication, and intrusive levels which would result from an aircraft flying within one-half to one mile from directly overhead. Fractions less than one denote events not occurring on a daily basis; 0.1 indicates that the event would occur, on average, once every 10 flying days.

The relative rarity of individual noise events supports the conclusion that there would be no significant noise impact from aircraft operations either in the MOAs or at the Hardwood Range. However, existing noise from current operations, or the increased noise levels associated with the Proposed Action, are adverse impacts that would occur and that cannot be mitigated.

Under the Proposed Action, the Hardwood Range would be expanded geographically, and new targets would be located and constructed to provide an increased tactical range capability that would augment the capability that currently exists. During this construction period, construction equipment, handling equipment, and increased human activity would be sources of additional noise. However, this would be very localized, and of relatively short duration. Noise created by these activities would not be significant, and it is reasonable to assume that aircraft noise associated with on-going operations on the conventional range would continue to dominate the regional acoustic environment.

Table 2-8. Summary of Maximum Cumulative Noise Levels (L_{dnmr}, dB) at Selected Locations in the Study Area

POINT DESIGNATOR	LOCATION	BASELINE NOISE LEVELS (IN L_{dnmr})	PROPOSED ACTION NOISE LEVELS (IN L_{dnmr})	CHANGE IN dB
SPECIFIC POINT [3]				
1	Pittsville	35	46	+11
2	Cranmoor	57	59	+2
3	Gravel Pit at NE Corner of R-6904A	64	66	+2
4	Armenia	47	56	+9
5	Finley	50	55	+5
6	Babcock	61	60	-1
7	Remington	54	55	+1
8	Dexterville	36	54	+18
9	Beneath VR-1650 within 12 Miles of Hardwood Range	44	56	+12
10	Beneath VR-1616 within 12 Miles of Hardwood Range	38	37	-1
11	Beneath VR-1650 within Falls 2 MOA	51	51	---
12	Beneath VR-1650 within Falls 1 MOA	50	52	+2
13	Beneath VR-1616 within Falls 1 MOA	51	53	+2
14	Specific Point within Falls 1 MOA (Lake Arbutus)	56	56	---
15	Specific Point within Falls 2 MOA (Coon Fork County Park)	49	52	+3
16	Specific Point within Volk South MOA (Castle Rock Lake)	47	49	+2
UNIFORMLY DISTRIBUTED NOISE AREAS				
17	Uniformly Distributed Noise in Falls 1 MOA	49	52	+3
18	Uniformly Distributed Noise in Falls 2 MOA	49	50	+1
19	Uniformly Distributed Noise in Volk South MOA	46	50	+4
20	Range of Maximum Noise Levels Along Centerline of VR-1616	55 - 58	55 - 58 [1]	---
21	Range of Maximum Noise Levels Along Centerline of VR-1650	45 - 47	45 - 47 [1]	---
22	Uniformly Distributed Noise in R-6904A	56	53	-3
23	Uniformly Distributed Noise in R-6904B (Existing)	63	---	N/A
24	Maximum Noise at Bomb Circle on Existing Conventional Range	72	69	-3
25	Uniformly Distributed Noise in Expanded R-6904B	N/A [2]	61	N/A
26	Uniformly Distributed Noise within 12 Mile Radius Circle Around Range	N/A [2]	55	N/A
27	Maximum Noise at Proposed C-130 DZ / Landing Zone	N/A [2]	49	N/A

Notes:
1. *Range of maximum noise levels along MTR centerlines.*
2. *N/A - Not Applicable. Point associated with Proposed Action.*
3. *See Figures 3-4 and 3-5, in Section 3.2.*

Table 2-9. Summary of Average Daily Noise Events Above SEL 45 dB, 65 dB, and 90 dB, by Analysis Location

LOCATION	EVENTS ABOVE 45 dB			EVENTS ABOVE 65 dB			EVENTS ABOVE 90 dB		
	BASE-LINE	PROP.	CHANGE	BASE-LINE	PROP.	CHANGE	BASE-LINE	PROP.	CHANGE
Falls 1 MOA	1.7	2.4	+0.7	0.5	0.6	+0.1	0.0	0.0	—
Falls 2 MOA	1.7	2.0	+0.3	0.4	0.5	+0.1	0.0	0.0	—
Volk South MOA	0.6	1.9	+1.3	0.2	0.5	+0.3	0.0	0.0	—
Falls 1+ VR-1650 (A-B)	2.6	3.3	+0.7	0.7	0.8	+0.1	0.0	0.0	—
Falls 1+ VR-1616 (D-E)	7.7	8.4	+0.7	2.3	2.4	+0.1	0.1	0.1	—
Falls 1+ VR-1616 (E-G)	8.3	9.0	+0.7	2.7	2.8	+0.1	0.1	0.1	—
Falls 2+ VR-1650 (A-C)	2.6	2.9	+0.3	0.6	0.7	+0.1	0.0	0.0	—

2.6.1.3 Safety

The safety analysis, presented in detail in Subsection 4.3, does not reveal any significant impacts that would result from the Proposed Action or the No-Action Alternative. The probability of an aircraft mishap is a calculated number using historical data collected by the USAF (by aircraft type) and applied to each airspace studied. Risks of Class A mishaps are not significantly altered by any element of the Proposed Action. Although some minor reductions in the statistically predicted time interval between mishaps are noted as a result of increased utilization of some airspace elements, all continue to indicate very low risk levels. For all of the aircraft using all of the airspace, the minimum projected time between Class A mishaps is 20.9 years in the Falls 1 MOA.

Because of the potential for loss of a pilot's life and the high cost of modern military aircraft, avoidance of collisions with birds is extremely important to the ANG. The potential for a bird-aircraft strike would not change significantly under any of the alternatives. Airspace use would not be significantly affected by the proposal. These actions, therefore, would encompass the same seasonally adjusted bird avoidance procedures associated with known bird migration corridors as are utilized currently with existing operations in the airspace. The U.S. Air Force provides Volk Field and units using the airspaces with bird avoidance precautions specific to each airspace. The probability of a bird aircraft strike is very low.

Potential increases to fire risk resulting from new and expanded operations are minimal. Risks to persons and property underlying the training airspace associated with the proposals from objects dropped from aircraft using the airspace is minuscule. Flares would be used only at appropriate altitudes. Consequently, impacts from the use of flares would be remote.

Development of the tactical range will require ongoing weapon safety footprint analysis and control by range managers to ensure that all ordnance delivered remains within range boundaries and avoids range facilities. Additionally, all unexploded ordnance (spotting charges in training bombs) and ordnance debris must be cleared from the proposed landing zone and DZ prior to tactical airlift training operations at those facilities. Capability exists to meet these requirements.

2.6.1.4 Hazardous Materials and Solid Waste

This subsection summarizes the more detailed analyses presented in Subsection 4.4. Only a small increase in use, handling, and generation of hazardous and solid waste materials is expected with the Proposed Action. Since 1995, hazardous waste generation has decreased and this trend is expected to continue even with the Proposed Action. Since hazardous waste generation levels fall well below the range's EPA generator status, no adverse impact is expected from the Proposed Action. Range expansion is not expected to affect the use of hazardous materials. Some increases in gasoline and diesel consumption may occur as a result of an expanded area. However, this increase is expected to be very minimal.

In the event of an aircraft crash of sufficient force to rupture hazardous material containers, it is highly probable that a fire would result. All the hazardous materials aboard the aircraft, including hydrazine, are flammable and would most likely be consumed by the fire. Nonetheless, there is a very small chance that a crash would occur in which the hazardous materials would not be consumed by fire. If a crash occurs on land, then the hazardous materials would contaminate the soil in the immediate vicinity. The movement of fuel, oil, and hydrazine through the soils is slow and limited due to absorption and decomposition. There would not be sufficient amounts of hazardous materials released to pose a threat to groundwater sources. Contaminated soil would have to be removed or cleaned by the ANG or its designated agent. If a crash occurs adjacent to or in surface water, then the hazardous materials could contaminate the surface water. The fuels and hydraulic oils could be removed from the water if they had not been greatly dispersed. The hydrazine could be diluted in the water to safe concentrations, or could be neutralized by bleach or calcium hypochlorite. However, if hazardous materials were released into a small stream or confined surface water, potential impacts to aquatic organisms could result.

The ANG will develop a range cleanup and decontamination program that will promote cleanup in the event of any future land transfer or closure.

2.6.1.5 Earth Resources

This subsection summarizes more detailed analyses presented in Subsection 4.5. The assessment of potential impacts that might result from the Proposed Action or the No-Action Alternative indicates that no potential impacts would occur to earth resources from training flights in the MOAs. There would be no impact on soil, topography, or geological formations from these training flights.

Minor impacts are expected to occur to earth resources as a result of the range expansion. Construction activities and bombing are expected to create local disturbances of soil which will increase the potential for erosion. However, best management practices would be employed to control soil erosion (i.e., vegetated buffer zones along streams and other sensitive features, use of silt fencing around construction sites, etc.). As no significant geological features are located on the proposed range expansion area, no impacts are expected.

2.6.1.6 Water Resources

This subsection summarizes more detailed analyses presented in Subsection 4.6. The assessment of potential impacts on water resources indicated no impacts would occur to water quality from training flights in the MOAs or R-6904, as the training flights would not affect surface runoff, groundwater conditions, or water quality. In addition, water recreation resources would not be significantly impacted. No impacts to groundwater resources are expected to occur.

Construction of the tactical target complex, roads, landing zone, and DZ and bombing at the target complex may cause soil erosion. Erosion could adversely affect surface water drainage and surface water quality at the Hardwood Range and proposed expansion area. However, best management practices would be employed to control soil erosion (i.e., vegetated buffer zones along streams and other sensitive features, use of silt fencing around construction sites, etc.) so erosion should be minimal. Construction could also change the site topography, which could negatively impact surface water drainage patterns and floodplain configuration and storage.

As wetlands would be avoided for target placement, impacts associated with the use of targets would result from surrounding construction or the use of the targets. In regards to construction, wetlands would be identified and avoided prior to construction and best management practices used to avoid unnecessary destruction of vegetation. A very small percentage of ordnance may fall outside of the target areas. If these ordnance fall into a wetland, however, very limited or no EOD clean up would occur to prevent damage to wetland vegetation. Although the ordnance may contain a small spotting charge (which may or may not have ignited on impact), the amount of residue from the spotting charge would not be of a sufficient quantity to affect local water resources. The practice bomb, consisting of ferrous metals, could produce some rust, however, again it would be at an insufficient quantity to cause a concern.

2.6.1.7 Air Quality

The EIS evaluated aircraft air pollution resulting from each of the alternatives studied in the EIS using scientifically validated emissions modeling tools designed to predict ground-level pollutant concentrations. The detailed analyses are presented in Subsection 4.7.

The cumulative air pollution concentrations, as determined through computer modeling for each of the airspace segments, could increase or decrease depending upon a variety of factors. These factors include the type of aircraft using the airspace, their altitude, frequency, power setting and meteorological conditions rather than a strict proportional relationship to the number of sorties flown. Nonetheless, under the maximum sortie rate modeled for each airspace segment under each of the alternatives, no air pollution concentrations resulting from aircraft operations would cause any local area to be out of compliance with Federal or state standards or make

any significant impact on air quality in any area. Also, when comparing these air pollution concentrations with Federal and state limits for the Prevention of Significant Deterioration (PSD) in air quality, all levels were far below minimums.

There are no PSD Class I areas within the region of influence (ROI). For the Hardwood Range, air quality impacts from the Proposed Action would consist of increased emissions from land-clearing and construction activities. Aircraft emissions would be the primary source of operational impacts. The Proposed Action would lead to an incremental increase of emissions in areas which are already in use; however, these increased emissions are expected to be insignificant.

As neither the Proposed Action nor the No-Action Alternative would cause violations of any National Ambient Air Quality Standards (NAAQS) or Wisconsin AAWS criteria, there are no unavoidable adverse impacts associated with either alternative.

2.6.1.8 Biological Resources

The assessment of potential impacts resulting from the proposed alternatives on biological resources, presented in detail in Subsection 4.8, indicates that there would be no adverse impacts on wildlife, livestock, or vegetation. For aircraft operations, mitigation measures specifically targeted to reduce or avoid noise impacts on selected ground locations would enhance protection of potentially sensitive species.

It is possible that aircraft noise could startle domestic animals, especially young or penned animals, and cause them to injure themselves. However, studies have shown that animals generally adapt and habituate to various sound sources, including jet aircraft noise. Because the airspaces associated with the Hardwood Range expansion are existing airspace that have been utilized for many years, this adaptation and habituation to jet aircraft noise has likely already occurred for a majority of the animals in the study area.

Studies conducted on wildlife have shown that numerous wildlife species have the ability to adapt to the presence of man and various man-made sound sources, including jet aircraft noise. While the noise generated from low-altitude military overflights may be initially startling, habituation to jet aircraft noise occurs with most wildlife species. Species-specific responses to low-altitude overflights vary considerably, and responses from individual animals may have the potential to cause injury. However, wildlife populations are usually affected only when a variety of factors work in combination to impact them, including declines or fluctuations in the availability of a food source, habitat destruction or alteration, predation, hunting, trapping, poaching, disease, or inclement weather, rather than noise alone. Normally, it would be unrealistic to predict or attribute any wildlife population declines to a single factor, such as noise. In addition, no published scientific evidence was identified that indicated long-term harm may occur to wildlife as a result of exposure to the levels of noise generated by military aircraft that would utilize the airspace associated with the Hardwood Range expansion.

The Range expansion would result in the unavoidable loss of some types of vegetation and habitat. However, this loss should not have a significant impact on any ecosystem or species.

The Wisconsin Department of Natural Resources (WDNR) has compiled a listing of threatened, endangered, and special concern species potentially occurring on the Hardwood Range and proposed expansion area. It is estimated that several of these

species are very likely to occur on the site. A biological survey (Wisconsin Air National Guard [WIANG] 1998) of the study area was conducted by the ANG to provide additional information. Disruption of habitat of these species, through construction activities or use of the tactical target range, may adversely affect localized populations of these species. However, additional similar habitats would exist around the target complex. These buffer areas would remain relatively undisturbed and would be managed to maintain biological diversity.

Changes in plant community composition and physiognomy may have some benefit. One of the species of concern is the federally-endangered Karner blue butterfly. Because activities proposed for the landing zone, DZ and tactical target complex are likely to open the forest canopy and possibly allow grasslands or savanna-like conditions to develop, suitable habitat for this species may increase over that available under the existing land use. This has shown to be the case at the existing target complex where both wild lupine and Karner blue butterflies are present.

Coordination with the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA) is ongoing. The Service has informed the ANG that "if the decision is made to proceed with the proposals contained in the DEIS, the USFWS will need a determination from the ANG whether the proposed activity may affect any federally listed species. The determination would form the conclusions of a biological assessment prepared by the ANG" (U.S. Department of Interior [DOI] 1997). The ANG has also coordinated with the USFWS Green Bay Field Office pursuant to this proposal and discussed the proposal in detail and concurrence was reached on the part of the USFWS and the ANG on the procedures taking place. The USFWS provided the ANG with a letter in April 1998 (DOI 1998) (see Appendix G) concurring with the approach the ANG is pursuing, and has agreed the dialog will continue as the plans for the proposal become more firm. Additionally, in a letter dated November 1999 (DOI 1999), the USFWS stated that "it is premature to prepare a biological assessment (BA) at this time to determine whether a federally-listed threatened or endangered species may be adversely affected by the proposed project... When detailed plans are available regarding specific impacts on the property, we may recommend preparation of a BA. If a BA concludes that a federally-listed threatened or endangered species may be adversely affected, formal consultation should be initiated with the Service pursuant to section 7 of the ESA of 1973, as amended." See Appendix G for USFWS correspondence.

2.6.1.9 Cultural Resources

The subsection summarizes more detailed analyses presented in Subsection 4.9. Modifications to airspace use have a low potential to adversely affect existing National Register-listed and National Register-eligible properties beneath the airspace in Volk South, Falls 1, and Falls 2 MOAs. The area proposed for expansion of the Hardwood Range has been partially inventoried for cultural resources. Based on the results of previous investigations and known land-use patterns for the project area, use of the expansion area has a moderate potential to affect previously undocumented cultural resources. Additionally, many of the listed or eligible National Register sites are present in populated areas such as towns and cities. The ANG avoids population centers in accordance with FAA regulations (i.e., avoidance of congested areas by 1,000 feet).

Maps provided by the Ho-Chunk Nation show a tribal village under R-6904A airspace. Although no traditional cultural resources have been formally recorded within the boundaries of R-6904, petroglyphs and mound sites are likely objects of traditional

Native American values. Both site types are found beneath R-6904A. Efforts to identify traditional cultural resources through consultation with Native American groups are ongoing, and the series of meetings to date are illustrated in Appendix O.

For the MOAs, the presence of mound sites, the Ho-Chunk Nation reservation, and the large number of Native American inhabitants of the area in general, indicate the likely presence of objects of traditional Native American values. Efforts to identify traditional cultural resources through consultation with Native American groups are ongoing (see Appendix O). Potential effects of aircraft noise to significant traditional cultural resources can only be determined in consultation with the concerned traditional group, in this case, the Ho-Chunk Nation.

2.6.1.10 Land Uses and Transportation Resources

The range expansion would affect current land use in Wood County. More detailed analyses are presented in Subsections 4.10 (Land Use Resources) and 4.12 (Socioeconomics).

For the range expansion area, proposed construction activities involve a new target complex area, DZ, and landing zone. Limited tree removal, grading, and construction of fire breaks and service roads would be required in the new target complex area. Much of the land in the new target complex area consists of undeveloped forest and forested and meadow wetlands. Implementation of the Proposed Action would result in the unavoidable loss of some vegetation and habitat. In addition, access to some ground-based resources, such as forest areas and hunting areas, and recreational trail routes, now currently available, would be affected, as safety concerns would prohibit access during training periods.

For the airspace addressed in this EIS, a number of potentially sensitive land use receptors were identified in the study area. Generally, the predicted noise levels for aircraft operations are well below the FICON guidelines of noise levels less than 65 dB in the ROI. Therefore, the general potential impacts on sensitive land use receptors from the noise associated with the use of the military airspace would be negligible. Noise levels associated with aircraft operations would be highest in the immediate area of target locations on the range; however, this would be consistent with expectations for military training areas set aside for this type of use. Modeled noise levels at a gravel pit under the northeast corner of R-6904A would increase 2 dB and be slightly adverse at 66 dB.

For areas under the MOAs, existing land use patterns would not be precluded or substantially disrupted. The analysis of land uses and resources does not reveal any significant impacts to sensitive land use receptors, with noise events existing for a short period of time and then disappearing.

Recreational and forestry uses of the land proposed for inclusion in the range expansion and of the lands underneath the proposed expanded R-6904B airspace would continue to occur within operational and safety parameters; therefore, significant adverse impacts on land uses of this area are not expected to occur. Demolition of some buildings and other structures would be required for construction of the DZ and landing zone. Impacts to major transportation routes would be negligible since major roads and railroad systems would be unaffected by the proposed actions. Some impact to local automobile traffic would occur. Because predicted noise levels fall well within Federal guidelines, the proposed changes in MOA utilization are expected to be compatible with

existing land use patterns; consequently, no impacts to land use resources are expected.

2.6.1.11 Visual Resources and Aesthetics

Ground activities associated with the proposed Hardwood Range Expansion are expected to have low or no impacts on the visual environment. All structures and facilities constructed at the range would be low to the ground and well-screened by the forest vegetation present in the area. No structures are expected to dominate the viewshed. In the overlying restricted airspace, minimum flight altitude restrictions would minimize the visual impacts of aircraft overflights, especially with regard to the Necedah NWR and Wood County State Wildlife Area (SWA). With these restrictions, and because aircraft overflights are already a feature of the visual environment, no impacts from expansion of R-6904B are expected.

In the Falls 1 and 2 and the Volk South MOAs, aircraft overflights have been a daily feature of the visual environment for many years. Flight activity over visually sensitive areas, such as parks and wildlife areas, is restricted so as not to alter the visual environment of these areas. Impacts on visual resources as a result of the proposed changes in MOA utilization are expected to be low to none.

2.6.1.12 Socioeconomic Resources

This subsection summarizes more detailed analyses presented in Subsection 4.12. Direct impacts to socioeconomic resources from training operations in the MOAs are very unlikely. Under the No-Action Alternative, current conditions would continue, and there would be no changes to socioeconomic resources as a result of this alternative. Under the Proposed Action, some impacts to existing socioeconomic conditions in Wood County would be expected as a result of implementing this alternative.

For the range expansion, potential impacts were assessed under three potential scenarios associated with the manner in which the land for the expansion of the Hardwood Range might be acquired. The scenarios evaluated included: (1) Federal land acquisition through fee simple purchase, (2) Federal lease from existing owners, and (3) Federal lease from the State of Wisconsin. The approach used to characterize socioeconomic effects under each of the three acquisition options includes the following: (1) analysis of resulting changes in management or use of lands currently in forestry, recreation, farming, and transportation (i.e., public roads) uses; (2) identification of relocation requirements; (3) description of changes in employment and the local economy, especially forestry, recreation, and agriculture; and (4) estimation of changes in public revenues and expenditures of local jurisdictions resulting from each acquisition option.

Potential socioeconomic effects common to all three options include the following:

- Acquisition of public lands (Wood County land) and withdrawal of a minimum of 1,570 acres and up to 6,162 acres of public lands from the County Forest Land program.

- Acquisition of 975 acres of private lands.

- Relocation of seven year-round residences (three single family residences and four mobile homes) and six seasonal residents.

- Loss of agricultural use and timber revenues on private lands, including relocation of a cranberry farm.

- Withdrawal of over 280 acres of private lands entered in forest tax contracts and payments to offset past tax reductions.

- Reduction in the value of County Forest Land timber sales (i.e., stumpage value) in the expansion area, and potential reduction in wages and earnings from paper and timber products manufacturing and related transportation.

- Reduction of public recreation access and use of the expansion area for hunting, trapping, hiking, wildlife viewing, and other forms of recreation; closure or relocation of six miles of state snowmobile trails.

- Closure of approximately 12 miles of public roads through the expansion area.

- Other potential fiscal effects involving the Wood County tax base.

2.6.1.13 Human Health Effects

Based on the results of an extensive review of existing research on the effects of low-altitude aircraft noise on humans, health effects from military training operations in any of the airspace associated with the Hardwood Range expansion are highly unlikely. This review is presented in detail in Subsection 4.13. Researchers have concluded that the risk of hearing damage from the noise levels that would be associated with the use of the MOAs and restricted airspace can generally be ruled out, even in small children. Other health risks, such as adverse cardiovascular effects or mental health problems, have not been demonstrated to be associated with the noise levels and exposure rates associated with the airspace under study in this EIS. In general, no scientific basis was found to support claims that potential health effects exist for time-averaged aircraft sound levels below 75 dB.

2.6.2 Comparison of Reasonable Alternatives and Conclusions

Based upon public and agency input and the subsequent analyses conducted to date for this EIS using industry accepted criteria, aircraft operations associated with the Proposed Action and the No-Action Alternative do not represent environmental impacts that are significant or cannot be mitigated through routinely used operational procedures or through a specifically applied mitigation action designed to reduce potential impacts. This is based upon all information received, knowing that further coordination with the USFWS and Ho-Chunk Nation may produce some effects. When mitigation actions are considered, all remaining potential impacts to specific environmental resources from activities associated with aircraft operations that are likely to occur are either insignificant or exist for a short period of time and then disappear. None represents any irreversible or irretrievable commitment of environmental resources or degradation of environmental quality.

Noise levels associated with aircraft operations in the MOAs are quite low overall when compared to generally accepted standards. Specific areas identified as having the highest L_{dnmr} levels are associated with the range and R-6904 and are consistent with expectations for military lands designated for such purpose. In general, implementation of the Proposed Action would be associated with modest increases in noise levels from aircraft operations. Aircraft noise, however brief, may be considered by some individuals to be highly annoying, particularly those living in areas with extended periods of solitude. Most of the area associated with airspace addressed in the proposal is located over relatively uncongested areas.

Impacts from the range expansion activity is more significant than noise from aircraft operations in any of the airspace. Construction activities related to the Hardwood Range expansion under the Proposed Action will require a variety of standard mitigation measures and best management techniques to ensure potential impacts to water and biological resources are minimized. The ANG will work with State and Federal agencies to ensure such measures are incorporated into the site development plan and sensitive species are provided appropriate protection. Socioeconomic impacts would involve some negative impacts to Wood County fiscal resources and impacts to individual land owners who would lose their ownership of land in the range expansion area.

2.7 STRUCTURE OF THIS EIS DOCUMENT

The primary presentation of the issues of concern and potential impacts associated with the alternatives is presented in the sections listed below:

- Section 1: Purpose and Need for the Action
- Section 2: Description of the Proposed Action and Alternatives
- Section 3: Affected Environment
- Section 4: Environmental Consequences.

Other shorter sections address the EIS preparers (Section 5), agency coordination (Section 6), references (Section 7), an index (Section 8), and acronyms and abbreviations (Section 9). Numerous appendices support the technical analyses and are presented at the end of this document.

SECTION 3

AFFECTED ENVIRONMENT

3. AFFECTED ENVIRONMENT

Under the National Environmental Policy Act (NEPA), the analysis of environmental baseline conditions is directly related to the expected environmental consequences of the proposed alternatives. NEPA requires that the analysis only address those areas and the components of the environment with the potential to be affected by the Proposed Action; locations and resources with no potential to be affected need not be analyzed. The environment includes all areas and lands that might be affected, as well as the natural, cultural, and socioeconomic resources they contain or support. Thus, in the environmental analysis process, analysts first identify the resources to be analyzed and then select the level of analysis, both in spatial extent and intensity that the resources will be examined. This section examines the existing environmental conditions of 12 resource categories.

The scope of the descriptions for the environmental baseline conditions is guided by the region of influence (ROI) for each resource category. An ROI for any given resource category consists of the geographical area (including airspace) in which the Proposed Action and Alternatives might reasonably be expected to directly or indirectly affect the resource. While ROIs can vary among the resource categories, for the majority of the resource areas, two primary ROIs can be used. The first ROI focuses on the activities associated with the expansion of the Hardwood Range and restricted airspace. These activities include ground disturbance from facility construction, ordnance delivery, target and road construction. The second ROI focuses on those activities associated with airspace utilization. This area includes the Falls 1 and 2 MOAs, and Volk South MOA. Potential impacts associated with MOA utilization focus primarily on the change in the noise environment and view or visual setting due to an increase in military aircraft training. Table 3-1 provides a graphic depiction of each resource's ROI to be analyzed in this document.

Table 3-1. Resource Area Analyses Addressed in this EIS

RESOURCE	*HARDWOOD RANGE EXPANSION AND RESTRICTED AIRSPACE*	*MOA UTILIZATION*
Airspace	*X*	*X*
Noise	*X*	*X*
Safety		
Ground	*X*	
Ordnance	*X*	
Flight	*X*	*X*
Hazardous Materials	*X*	
Earth Resources		
Geology	*X*	
Soils	*X*	
Water Resources		
Surface Water	*X*	
Groundwater	*X*	
Water Availability	*X*	
Floodplains	*X*	
Air Quality	*X*	*X*
Biological Resources		
Flora	*X*	
Fauna	*X*	
Threatened and Endangered Wildlife Species	*X*	*X*
Sensitive Habitats	*X*	*X*
Cultural Resources		
Prehistoric and Historic Archaeological	*X*	*X*
Historic Architectural	*X*	*X*
Traditional Resources	*X*	*X*
Land Use		
Ownership/Management	*X*	*X*
Special Use Areas	*X*	*X*
Transportation	*X*	
Recreation	*X*	*X*
Visual and Aesthetics	*X*	*X*
Socioeconomics	*X*	*X*

3.1 AIRSPACE MANAGEMENT/AIR TRAFFIC

The Federal Aviation Administration (FAA) manages airspace within the U.S. and U.S. territories. Federal legislation, and Federal and military regulations and procedures govern how the airspace is used. The ultimate authority in assigning and managing airspace is the FAA, which has acknowledged the need of the military to conduct certain training operations within airspace that is separated from other aircraft, such as civilian and commercial, and sets aside such airspace for military operations.

Airspace is defined in physical terms vertically and horizontally, and also by duration of use. Because airspace is a finite resource, it must be managed and used to equitably serve commercial, general, and military aviation needs. The FAA manages all airspace and has established various airspace designations to protect aircraft while operating near and between airports, or operating within airspace identified for defense-related purposes. The FAA establishes rules of flight and air traffic control procedures to govern safe operations within each type of designated airspace. Military operations are conducted within designated airspace and follow specific procedures to maximize flight safety for non-participating civil or military aircraft. This section presents airspace associated with the proposed Hardwood Range expansion and associated airspace.

For purposes of describing existing conditions in the context of a particular airspace, the ROI includes those areas where military airspace (i.e., military operations areas [MOAs], military training routes [MTRs], and Restricted Areas) interact with controlled, uncontrolled, or other designated airspace. Airspace management also includes air traffic from airports, Jet (J) routes, and Victor (V) airways.

3.1.1 General Aviation

Airspace use in the ROI is shown in Figure 3-1. Civilian and general aviation aircraft can traverse MOAs and MTRs unrestricted while on a visual flight rules (VFR) flight plan. To enhance safety, schedules of military training activities on MOAs and MTRs are available through the local flight service station to any pilot desiring to traverse military airspace. In addition, at Volk Field the flight schedules can be received by calling 1-800-972-8673 and/or monitoring the Very High Frequency (VHF) radio channel 120.0. MOAs and MTRs are activated only when needed and are returned to the FAA for general aviation and commercial aircraft use when not needed by the military.

Although located outside of the MOAs, Marshfield Municipal Airport has occasional medical emergency flights. These flights may lead into the MOAs. If an emergency flight through MOA airspace should be necessary while training operations are taking place, the pilot can notify Volk Field to ensure that training activities in the vicinity are halted or redirected.

3.1.2 Hardwood Range Expansion and Associated Restricted Airspace

The Hardwood Range is located in Juneau County in west-central Wisconsin approximately 20 statute miles north-northeast of Volk Field Air National Guard (ANG) Base (approximately 80 statute miles northwest of Madison). The range encompasses 7,403 acres of land, is generally flat and surrounded by heavily wooded areas, and is approximately 2 miles wide by 6 miles long. The State of Wisconsin leases the land to

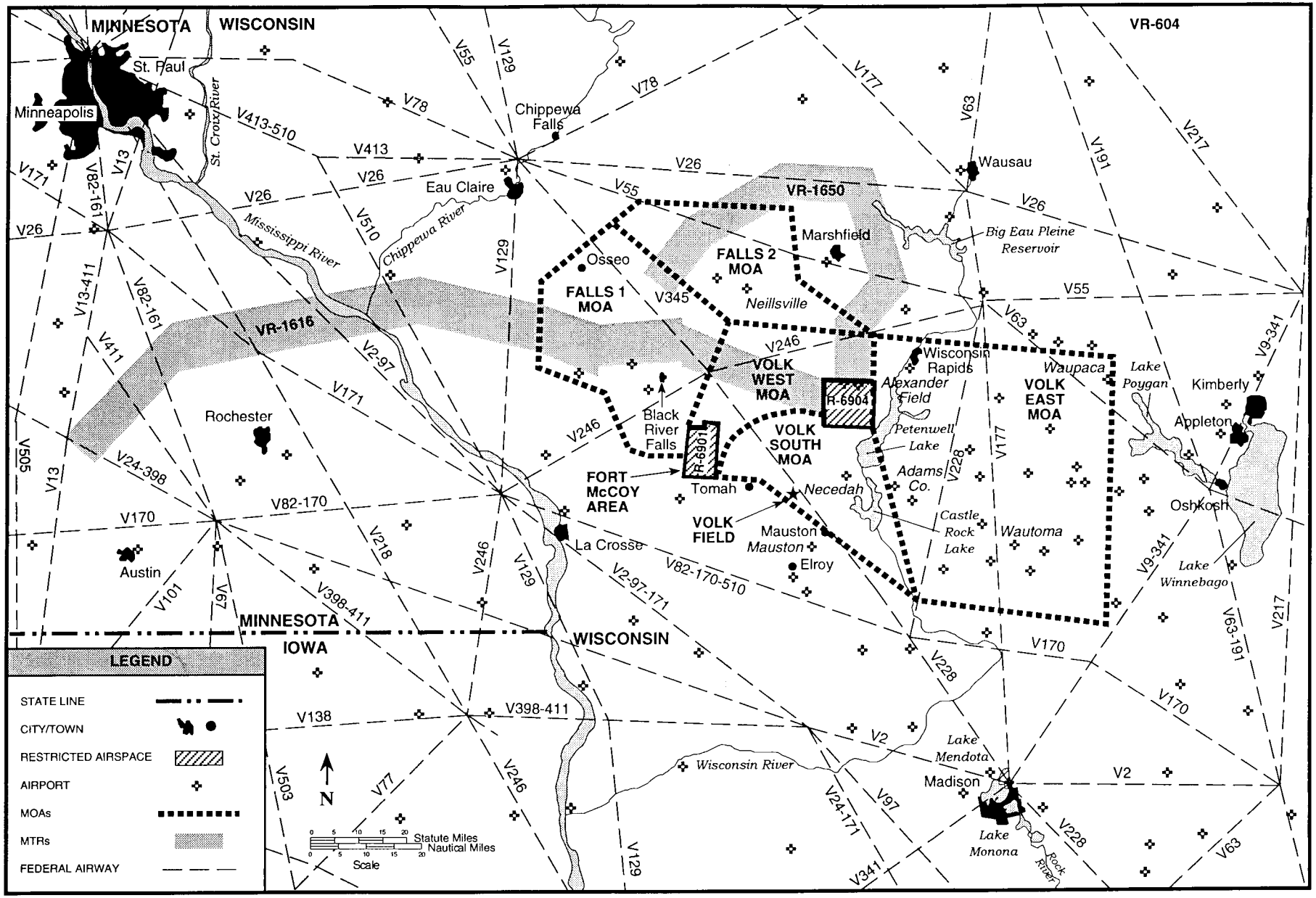


Figure 3-1. Airspace Use in the Region of Influence for Airspace Associated with the Hardwood Range

the Federal government, which licenses the land to the ANG to conduct aircrew training. Ownership of the existing range land is a checkerboard of State-owned land and County-owned land.

The FAA designates airspace away from congested areas for certain military training activities. One such type airspace is designated a Restricted Area. A Restricted Area is airspace within which the flight of non-participating aircraft, while not wholly prohibited, is subject to restriction (Federal Aviation Regulation [FAR] Part 73). Restricted Areas are designated when necessary to confine or segregate activities considered to be hazardous to non-participating aircraft. The airspace directly associated with the Hardwood Range is designated Restricted Area 6904 A and B (R-6904 A and B). The airspace directly above the range is R-6904B. R-6904B extends vertically from the surface to 17,000 feet mean sea level (MSL). A second restricted area, R-6904A, surrounds R-6904B and incorporates an area approximately 8 by 9 nautical miles (NM) (Figure 3-2). R-6904A surrounds R-6904B on the north, west, and south and extends from 150 feet above ground level (AGL) to 17,000 feet MSL. The Volk Field Combat Readiness Training Center (CRTC) schedules the range.

Approximate geographic coordinates of existing R-6904A are as follows:

Beginning at	44°18.0'N 89°59.0'W
to	44°10.0'N 89°59.0'W
to	44°10.0'N 90°11.0'W
to	44°18.0'N 90°11.0'W
to	point of beginning, excluding R-6904B.

Approximate geographic coordinates of existing R-6904B are as follows:

Beginning at	44°15.0'N 89°59.0'W
to	44°13.0'N 89°59.0'W
to	44°13.0'N 90°07.0'W
to	44°15.0'N 90°07.0'W
to	point of beginning.

The ROI for the airspace associated with the Hardwood Range includes the vertical and lateral confines of the R-6904 A/B. No airports underlie this airspace nor do commercial airways traverse the area. The Speed Wing and Gottschalk private airports border the northern limits of R-6904A.

The Hardwood Range expansion includes an expansion of the land area dedicated to the range, a new area for potential target locations, and the addition of a drop zone (DZ) and landing zone. The Proposed Action would expand the land area of the range to the north by a total of approximately 7,137 acres. Within the area of expansion, the ANG would construct a new area for potential target locations, a drop-zone area for C-130 transport aircraft to practice drops of combat supplies (not munitions), and a 3,500-foot by 60-foot tactical landing zone for C-130 aircraft to practice landings simulating real world conditions. Tactical targets typically are obsolete military equipment, such as aircraft frames, armored tanks, and jeeps, that have been acquired through the Defense Reutilization and Marketing Office (DRMO). Other targets include replica simulated Surface-to-Air Missile (SAM) sites and fuel storage facilities that have been constructed from empty 55-gallon drums and similar scrap material. Such targets are small in size and transportable and require a small clear area for placement within the range. Targets would be placed in existing upland open areas along the existing "roadway network." In placing these mobile targets, wetlands areas will be avoided. No improvements would be required for placement of

the targets. Targets may be partially concealed to train aircrews for target acquisition while at low-altitude.

As a result of the range expansion, R-6904B would also need to be expanded to coincide with the proposed land expansion and be lowered to the surface. In addition, the Proposed Action would increase the maximum altitude of R-6904A and R-6904B to FL 250 or FL 500, as needed. The orientation of the target area would allow unrestricted run-in headings for most weapons deliveries. Figure 3-2 illustrates the proposed expanded area. Coordinates for the proposed expansion of the Hardwood Range are shown in Table 3-2.

3.1.3 MOA Airspace

Falls 1 MOA

This existing MOA is centered approximately 47 NM northwest of Volk Field and 112 NM northwest of Madison. The MOA adjoins the Volk West MOA to the east, the Falls 2 MOA to the northeast, and R-6901 to the southeast (refer to Figure 3-1). Falls 1 extends from 500 feet AGL up to, but not including, flight level (FL) 180 (approximately 18,000 feet MSL). The Falls 1 MOA is used primarily for low-altitude surface attack tactics and air combat training.

Approximate geographic coordinates of the existing Falls 1 MOA are as follows:

Beginning at	44°28.0'N 90°35.0'W
to	44°08.7'N 90°44.3'W
to	44°02.8'N 90°44.5'W
to	44°03.0'N 90°53.0'W
to	44°05.0'N 90°57.0'W
to	44°14.0'N 91°05.0'W
to	44°17.0'N 91°21.0'W
to	44°33.0'N 91°21.0'W
to	44°44.0'N 91°05.0'W
to	point of beginning.

The ROI for the Falls 1 MOA includes the MOA's vertical and horizontal confines. Figure 3-1 depicts the airspace in the ROI and the surrounding area for the airspace associated with the MOA. The Blair, Lewis (private), and Black River Falls (public use) airports underlie the MOA. The Blair and Lewis airports do not have hard surface runways. Victor Airways 246 and 345, and Visual Routes (VR) 1616 and 1650 traverse the MOA.

No modifications to the lateral and vertical dimensions of the MOA would be made. However, this action would increase the assessed number of sorties flown annually to 2,789. Specific utilization data are presented in Subsection 2.2.2.1. All missions would be flown at subsonic airspeeds between 250 and 550 knots indicated airspeed (KIAS) (285 to 625 miles per hour [MPH]). The area would be used predominantly between the hours of sunrise to sunset.

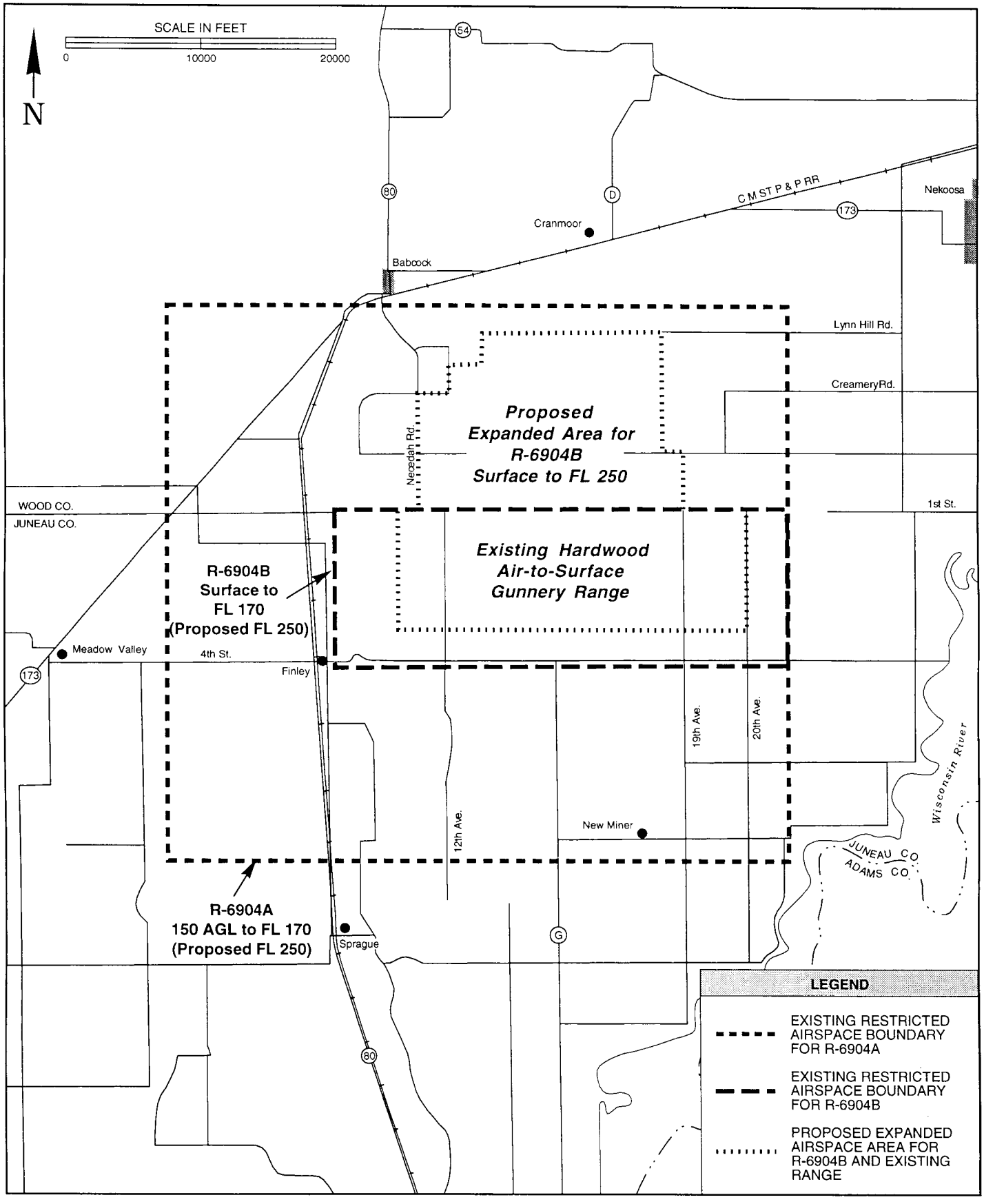


Figure 3-2. Existing and Proposed Airspace R-6904A/B

Table 3-2. Proposed Geographic Coordinates for the Hardwood Range

KEY POINTS OF REFERENCE	*LATITUDE*	*LONGITUDE*
Beginning at 90°04.8' W on Range Line Road	*44°17.6' N*	*90°04.8' W*
Then east to 90°01.4' W	*44°17.6' N*	*90°01.4' W*
Then south to Batterman Road	*44°15.8' N*	*90°01.4' W*
Then east along Batterman Road to 90°01.0' W	*44°15.8' N*	*90°01.0' W*
Then south to the Wood/Juneau County boundaries (First Street)	*44°14.9' N*	*90°01.0' W*
Then east along First Street to 89°59.8' W	*44°14.9' N*	*89°59.8' W*
Then south to 44°13.2' N	*44°13.2' N*	*89°59.8' W*
Then west to Tenth Avenue	*44°13.2' N*	*90°06.7' W*
Then west to 90°07.3' W	*44°14.8' N*	*90°07.3' W*
Then north to First Street	*44°14.9' N*	*89°59.8' W*
Then east to Necedah Road	*44°14.9' N*	*90°06.1' W*
Then north along Necedah Road to McKeel Road	*44°16.7' N*	*90°06.1' W*
Then east to Hines Road	*44°16.7' N*	*90°05.4' W*
Then north along Hines Road to 44°17.2' N	*44°17.2' N*	*90°05.4' W*
Then east to Range Line Road	*44°17.2' N*	*90°04.8' W*
Then north to the point of beginning		

Falls 2 MOA

This existing MOA is centered approximately 45 NM north-northwest of Volk Field and 110 NM northwest of Madison. The MOA adjoins the Volk West MOA to the south and the Falls 1 MOA to the southwest. Falls 2 extends from 500 feet AGL up to, but not including, FL 180 (approximately 18,000 feet MSL). The Falls 2 MOA is used primarily for low-altitude air-to-air training (LOWAT) and air combat training.

Approximate geographic coordinates of the existing Falls 2 MOA are as follows:

Beginning at	44°44.0'N 91°05.0'W
to	44°48.0'N 90°59.0'W
to	44°48.0'N 90°22.0'W
to	44°35.0'N 90°18.0'W
to	44°27.0'N 89°59.0'W
to	44°28.0'N 90°35.0'W
to	point of beginning.

The ROI for the Falls 2 MOA includes the MOA's vertical and horizontal confines. Figure 3-1 depicts the airspace in the ROI and the surrounding area for the airspace associated with the MOA. The Neillsville (public use) and Cunningham (private) airports underlie the MOA. Victor Airways 55 and 246 and VR-1650 traverse the airspace.

No modifications to the lateral and vertical dimensions of the MOA would be made. However, this action would increase the assessed number of sorties flown annually to 1,617. Specific utilization data are presented in Subsection 2.2.2.2. All missions would be flown at subsonic airspeeds between 250 and 550 KIAS (285 to 625 MPH). The area would be used predominantly between the hours of sunrise to sunset.

Volk South MOA

This existing MOA is centered approximately 5 NM northeast of Volk Field and 68 NM northwest of Madison. The MOA adjoins and is south of Volk West MOA. The Volk South MOA extends vertically from 500 feet AGL up to, but not including, FL 180 (approximately 18,000 feet MSL). The Volk South MOA is used primarily for LOWAT, air combat training, and access to Hardwood Range.

Approximate geographic coordinates of the existing Volk South MOA are as follows:

Beginning at	44°10.0'N 89°59.0'W
to	43°40.0'N 89°46.3'W
to	44°00.0'N 90°26.0'W
to	44°00.0'N 90°35.3'W
to	44°00.0'N 90°35.3'W
to	44°00.2'N 90°36.6'W
to	44°00.2'N 90°36.7'W
to	44°01.3'N 90°36.7'W
clockwise	along an arc with a 16 NM radius centered
at	43°56.6'N 90°15.5'W
to	44°12.3'N 90°11.0'W
to	44°10.0'N 90°11.0'W
to	point of beginning.

The ROI for the Volk South MOA includes the MOA's vertical and horizontal confines. Figure 3-1 depicts the airspace in the ROI and the surrounding area for the airspace associated with the MOA. Volk Field, the Necedah (public use), and Accurate (private) airports underlie the MOA. Victor Airway 345 traverses the airspace.

No modifications to the lateral and vertical dimensions of the MOA would be made. However, this action would increase the assessed number of sorties flown annually to 1,340. Specific utilization data are presented in Subsection 2.2.2.3. All missions would be flown at subsonic airspeeds between 250 and 550 KIAS (285 to 625 MPH). The area would be used predominantly between the hours of sunrise to sunset.

3.1.4 Associated Military Training Routes

Two existing MTRs service the Hardwood Range. These MTRs would be unaffected by the Proposed Action as type of aircraft and use would not change. Figure 3-3 illustrates the locations of VR-1650 and VR-1616.

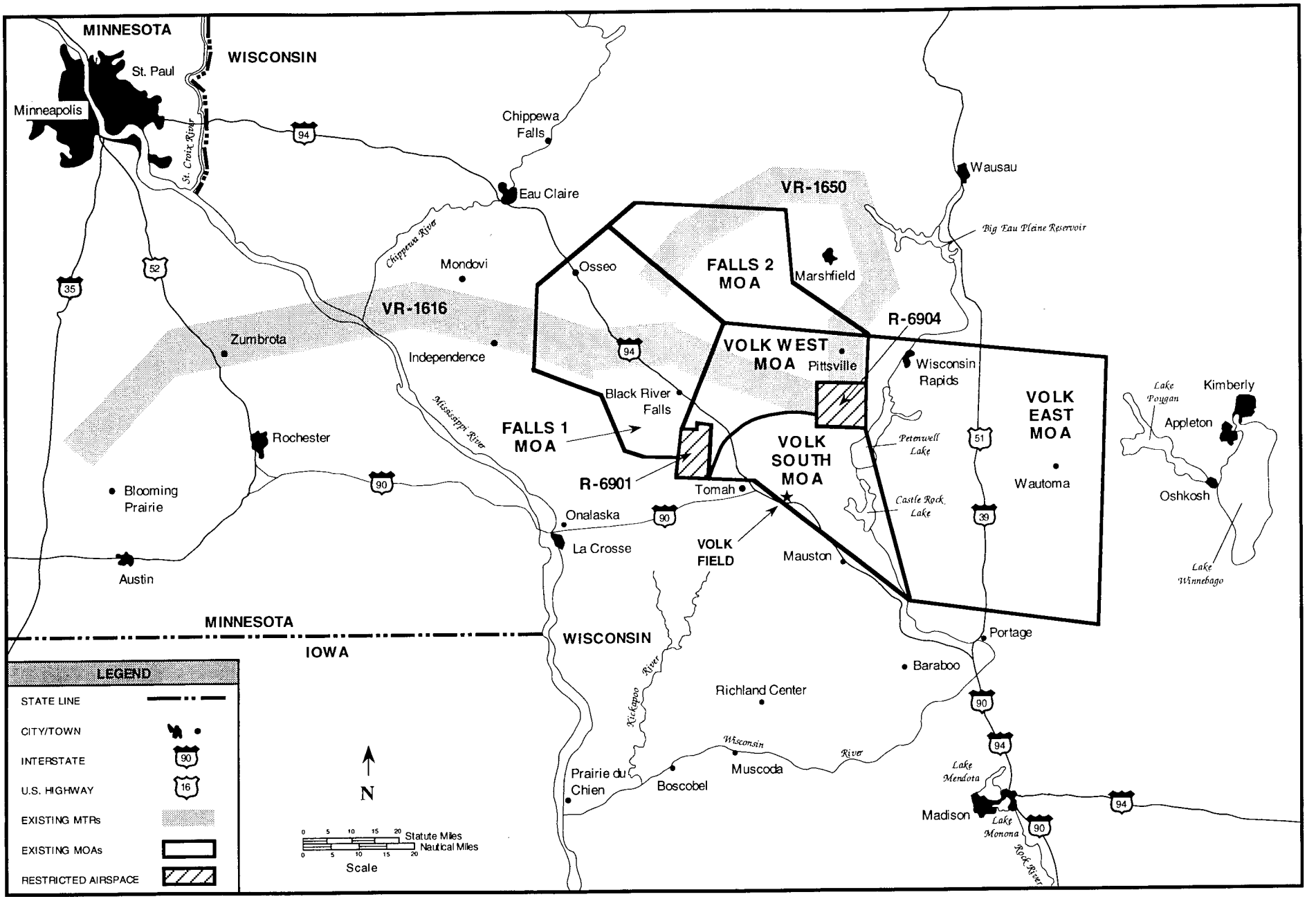


Figure 3-3. Existing Airspace Associated with the Hardwood Range

3.1.5 Other Associated Military Operations Areas

Two other existing MOAs associated with the Hardwood Range, Volk East and Volk West, as depicted in Figure 3-1, will not be affected by the Proposed Action.

3.2 NOISE

Noise is perhaps the most identifiable concern associated with aircraft operations. Although many other sources of noise are present in today's communities, aircraft noise is often singled out for special attention and/or criticism. An assessment of aircraft noise requires a general understanding of sound measurement and the effects of noise on humans, animals, and structures. Appendix F provides a description of the characteristics and metrics used to describe sound, as well as a discussion of noise and its effects on the environment and land use compatibility. The description of the existing noise environment presented below assumes a working knowledge of the metrics and compatibility guidelines discussed in this appendix.

Noise levels for the subsonic aircraft operations conducted in the Restricted Areas, MOAs, and along MTRs associated with existing and proposed conditions were calculated using the Air Force's MOA Range NOISEMAP (MR_NMAP) noise modeling computer program. Noise levels are presented in terms of the Onset Rate-Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}) metric in units of decibels (dB).

The term "metric" is used to describe a standard of measurement. As used in environmental noise analysis, there are many different types of noise metrics. Each metric has a different physical meaning or interpretation and each metric was developed by researchers in an attempt to represent the effects of environmental noise. The noise metrics used in this EIS are the maximum sound level (L_{max}), the Sound Exposure Level (SEL), and L_{dnmr}. Each of these metrics represents a "tier" for quantifying the noise environment. In this EIS, all noise level metrics are "A-weighted." A-weighting is an adjustment of the frequency content of a noise event to represent the way in which the average human ear responds to the noise.

Maximum Sound Level

L_{max} represents the first tier in quantifying the noise environment. It is the highest sound level measured during a single aircraft overflight. For an observer, the noise level will start at the ambient noise level, rise up to the maximum level as the aircraft flies closest to the observer, and returns to the ambient level as the aircraft recedes into the distance. L_{max} is important in judging the interference caused by an aircraft noise event with conversation, sleep, or other common activities.

Sound Exposure Level

SEL, the second tier, combines the L_{max} associated with the noise event and the duration of the event. L_{max} alone may not represent how intrusive an aircraft noise event is because it does not consider the length of time that the noise persists. SEL combines both of these characteristics into a single metric. It is important to note, however, that SEL does not directly represent the sound level heard at any given time, but rather provides a measure of the total exposure of the entire event.

Cumulative Noise Metrics

The first and second tiers (L_{max} and SEL) provide a description of a single aircraft overflight, but neither of these metrics describes in a single measure the overall noise impact from multiple aircraft noise events. The third tier, which does assess the overall noise impact, is referred to as the L_{dnmr}. This metric represents the sum of the

individual noise events, and the average of the resulting level over a specified length of time. Thus, it is a composite metric representing the maximum noise levels, the duration of the events, and the number of events that occur. This cumulative metric does not represent the variations in the sound level heard. Nevertheless, it does provide an excellent measure for comparing environmental noise exposures when there are multiple aircraft noise events to be considered.

MR_NMAP also accounts for the surprise or startle effect that results from a high-speed aircraft overflight by adding from 0 to 11 dB to the SEL for the event, depending on the rate at which noise from the approaching aircraft increases. Finally, the model adds an additional 10 dB penalty to sound levels from nighttime aircraft operations (occurring from 10:00 P.M. to 7:00 A.M.), to take into account reduced background noise levels and increased sensitivity to noise at night.

3.2.1 Aircraft Noise

Flight operations within Restricted Areas, MOAs, and MTRs occur over a range of altitudes, depending on the type of aircraft, training missions, and airspace dimensions. For noise modeling purposes, the range of representative flight and altitude profiles, engine thrust settings, and airspeeds for each type aircraft performing various operations were used to calculate the L_{dnmr} for each airspace component.

The Restricted Areas R-6904A/B support a conventional air-to-ground gunnery range. While a small portion of flight within this airspace is somewhat random, the majority follows one or more of several relatively defined bombing tracks. The Falls 1, Falls 2, and Volk South MOAs addressed in this EIS support training that is generally characterized by random flight patterns. Two MTRs, VR-1616 and VR-1650, interact with the MOAs and Restricted Areas addressed in this EIS. MTRs are corridors, defined by a centerline and specific widths on either side of that centerline. Research has shown that aircraft flight on MTRs is distributed on either side of the centerline in a pattern that follows a normal, or gaussian, distribution.

MR_NMAP is capable of handling both types of flight activity. When random flight occurs, MR_NMAP is adapted to simulate a uniform horizontal distribution throughout the airspace. Along specific tracks, MR_NMAP distributes operations around the centerline of the track.

Noise levels reported for those types of airspace supporting random flight represent a uniformly distributed noise level throughout the airspace. Noise levels reported for flight operations along tracks represent the maximum noise level calculated along the centerline of the track. In those areas where random and track noise data interact, the noise levels reported represent the cumulative noise levels resulting from all operations.

Twenty-seven reference locations were chosen to provide a detailed spatial representation of the noise environment and to denote the range of noise levels throughout the ROI encompassed by all of the military training airspace associated with this proposal. These locations are identified in Table 3-3, illustrated in Figures 3-4 and 3-5, and the noise levels calculated for each location under current conditions are shown in Table 3-4.

Table 3-3. Noise Assessment Locations

POINT DESIGNATOR	*LOCATION*
1	*Pittsville*
2	*Cranmoor*
3	*Gravel Pit*
4	*Armenia*
5	*Finley*
6	*Babcock*
7	*Remington*
8	*Dexterville*
9	*Beneath VR-1650 within 12 Miles of Hardwood Range*
10	*Beneath VR-1616 within 12 Miles of Hardwood Range*
11	*Beneath VR-1650 within Falls 2 MOA*
12	*Beneath VR-1650 within Falls 1 MOA*
13	*Beneath VR-1616 within Falls 1 MOA*
14	*Specific Point within Falls 1 MOA (Lake Arbutus)*
15	*Specific Point within Falls 2 MOA (Coon Fork County Park)*
16	*Specific Point within Volk South MOA (Castle Rock Lake)*
17	*Uniformly Distributed Noise in Falls 1 MOA*
18	*Uniformly Distributed Noise in Falls 2 MOA*
19	*Uniformly Distributed Noise in Volk South MOA*
20	*Range of Maximum Noise Levels Along Centerline of VR-1616*
21	*Range of Maximum Noise Levels Along Centerline of VR-1650*
22	*Uniformly Distributed Noise in R-6904A*
23	*Uniformly Distributed Noise in R-6904B (Existing)*
24	*Maximum Noise at Bomb Circle on Existing Conventional Range*
25	*Uniformly Distributed Noise in Expanded R-6904B*
26	*Uniformly Distributed Noise within 12 Mile Radius Circle Around Range*
27	*Maximum Noise at Proposed C-130 DZ / Landing Zone*

Points 1 through 16 represent specific points under military airspace.
Points 17 through 27 are uniformly distributed noise levels in regional airspace.
Points 20 and 21 represent maximum noise levels along MTRs.

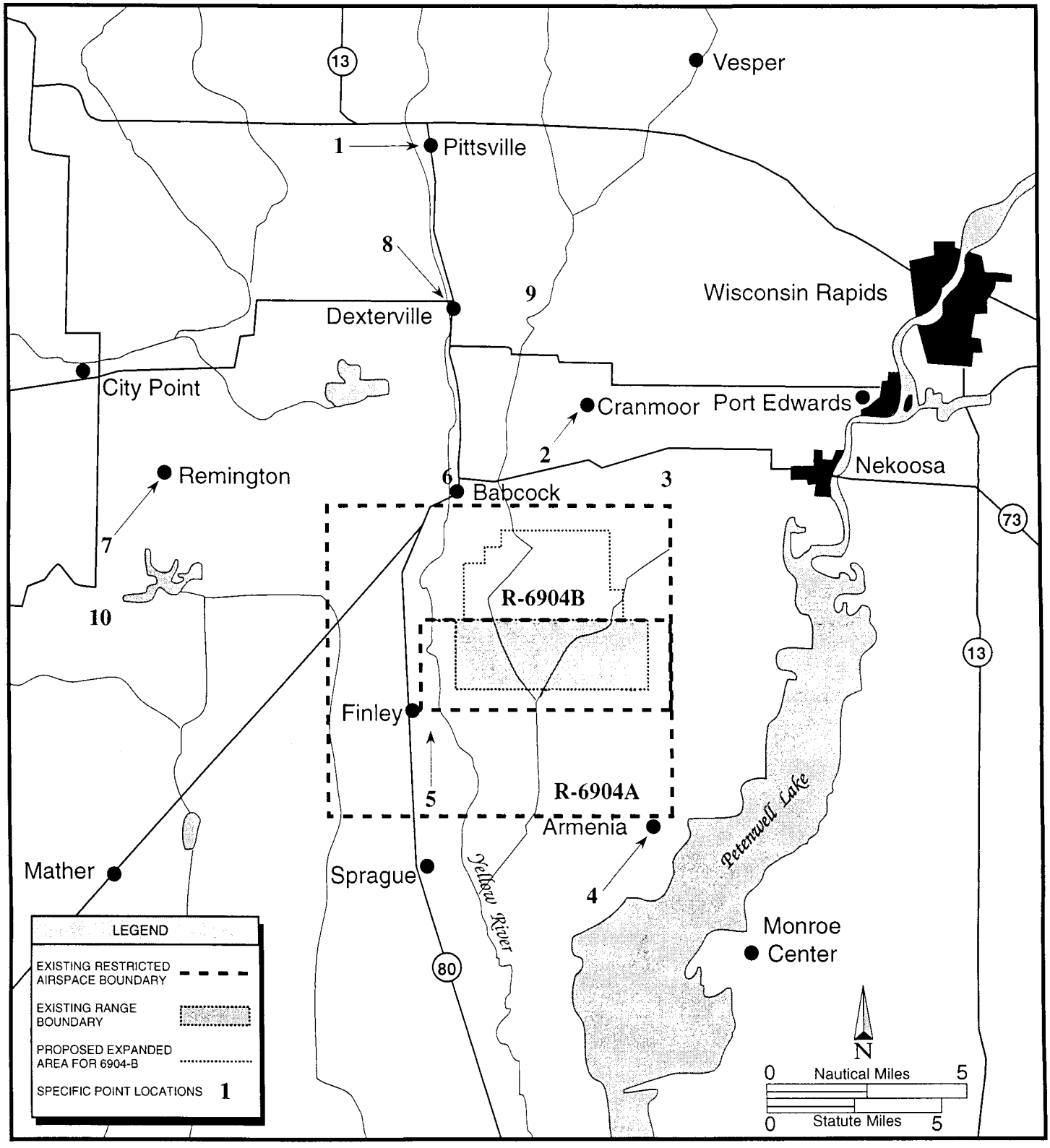


Figure 3-4. Noise Assessment Locations in Vicinity of Hardwood Range

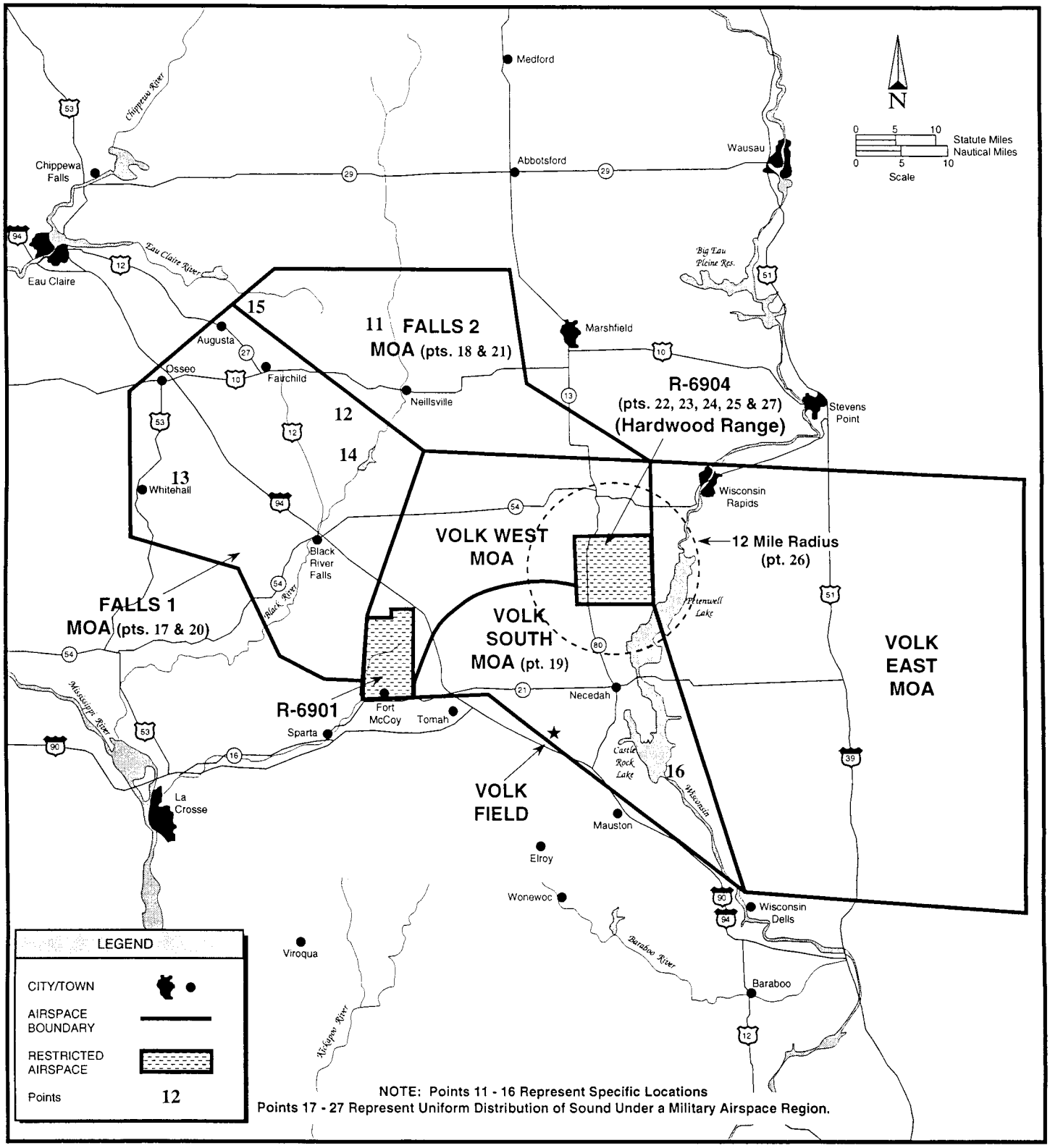


Figure 3-5. Noise Assessment Locations Underlying MOAs

Table 3-4. Current Noise Levels

SPECIFIC POINT	NOISE LEVEL (IN L_{dnmr})	SPECIFIC POINT	NOISE LEVEL (IN L_{dnmr})
1	35	17	49
2	57	18	49
3	64	19	46
4	47	20	55 - 58[2]
5	50	21	45 - 47[2]
6	61	22	56
7	54	23	63
8	36	24	72
9	44	25	N/A [1]
10	38	26	N/A
11	51	27	N/A
12	50		
13	51		
14	56		
15	49		
16	47		

Notes: 1. N/A = Not Applicable. Point associated with Proposed Action
2. Range of maximum noise levels along MTR centerlines.

Within the Falls 1 and Falls 2 MOAs, previous environmental documentation had projected noise levels of 53 L_{dnmr} and 49 L_{dnmr}, respectively (Air National Guard Readiness Center [ANGRC] 1992). In the environmental documentation prepared to support the creation of the Volk South MOA, the maximum noise level projected to occur was 64 L_{dnmr} (National Guard Bureau [NGB] 1990). Under current conditions, the uniformly distributed noise levels in the Falls 1, Falls 2, and Volk South MOAs are 49, 49, and 46 L_{dnmr}, respectively (Points 17-19).

Specific points (1) through (16) refer to population centers, potentially noise sensitive areas, or overlapping military airspace. The remaining points, 17 through 27, provide uniformly distributed noise levels throughout various airspace elements, representative noise levels within airspace elements, or cumulative noise levels when two or more airspace elements interact. Under baseline conditions, the noise levels at points specifically associated with the Proposed Action are shown as not applicable.

As shown for the population centers around the range, current noise levels range from a low of 35 L_{dnmr} at Pittsville to a high of 61 L_{dnmr} at Babcock, which borders the northern edge of the Restricted Area.

Within the Restricted Areas, the uniformly distributed sound level in R-6904B is 63 L_{dnmr} (Point 23). However, at the bomb circle (Point 24), where bombing tracks on the conventional range converge, noise levels rise to 72 L_{dnmr}.

Within the Falls 1, Falls 2, and Volk South MOAs, the uniformly distributed sound levels are 49, 49, and 46 L_{dnmr}, respectively (Points 17 - 19). However, at specific points within the MOAs, and in those areas where MTRs exist coincidentally with MOA airspace, noise levels are higher (Points 11 - 16). Along the centerlines of the two MTRs that interact with other military training airspace in the region, maximum noise levels associated with VR-1616 range from 55 to 58 L_{dnmr}, and those associated with VR-1650 range from 45 to 47 L_{dnmr} (Points 20 and 21).

3.3 SAFETY

This section addresses ground, flight, and explosive safety associated with the operation of the ANG's Hardwood Air-to-Ground Gunnery Range, operations conducted in the associated Restricted Airspace, R-6904, and operations conducted in adjacent MOAs. The ROI for this resource is, therefore, the Hardwood range and proposed expansion, R-6904 A/B, and the Falls 1, Falls 2 and Volk South MOAs. Ground safety considers issues associated with operations and maintenance that support range activities, and includes considerations of fire safety and objects dropped from aircraft potentially injuring persons or damaging property on the ground. Flight safety considers aircraft flight risks such as aircraft accidents and bird-aircraft strikes. Explosive safety discusses the use of ordnance or munitions associated with the operation of the range.

3.3.1 Hardwood Range Expansion

3.3.1.1 Fire Risks

The greatest fire risk on the range arises from the possibility of a heat source igniting vegetation. There are two major potential sources of heat associated with range operations: flares and heat generated from the spotting charges contained in training ordnance. A third possible source of heat is tracer ammunition.

Flares are ejected by military aircraft as a means of misleading enemy guidance systems of heat-seeking weapons. Flares are primarily composed of a magnesium and Teflon flare pellet wrapped in aluminum foil, a small ignition device, a plastic piston, and a plastic endcap. The flare is ignited immediately upon exiting the aircraft and reaches its highest temperature by the time it passes the tail of the aircraft. The flare failure (i.e., dud) rate has been assessed at zero by the United States Air Force (USAF). Data show that if the flare exits the dispenser, it ignites. Flares are designed to be consumed completely within 4.0 to 4.5 seconds after deployment from the aircraft. In those 4.0 to 4.5 seconds, the flare falls approximately 500 feet. The main byproducts of flare use are magnesium oxide (gaseous) and flare ejection mechanism fragments. Produced by combustion, magnesium oxide occurs in very small amounts in the immediate vicinity of a burning flare. It is dispersed rapidly into the air. Other flare debris may consist of small (up to 1.8 ounces) metal initiator mechanisms and primer pins, which may or may not survive the combustion process as debris (ANGRC 1992; Headquarters Tactical Air Command [HQ TAC] 1989).

Flares are authorized for use on Hardwood Range when the fire risk is low. If used, flares are released no lower than 2,000 feet AGL (Wisconsin Air National Guard [WIANG] 1992). This provides a safety margin of approximately 1,500 feet for a "slow burning" flare. When fire risks on the range increase due to extremely dry and windy conditions, flare use is discontinued on the range (WIANG 1992).

A second potential source of fire risk is the spotting charge used in the training ordnance. This spotting charge is a visual aid to scoring accuracy of ordnance delivery. When the training munition impacts the ground, the gunpowder in the spotting charge detonates. The flame and heat associated with the combustion of the gunpowder are almost completely contained by the casing of the munition, and pose no more fire risk than would be associated with a hunter discharging a firearm. However, the gunpowder also ignites a small amount (approximately one ounce) of red phosphorous, which is expelled from the training munition, producing a brilliant flash

of light and dense white smoke. The red phosphorous, although producing extremely high temperatures, is completely consumed in approximately 0.1 seconds. Infrequently, small amounts of tracer ammunition may be used on the range. Tracer rounds are normally used by helicopters. Use of this ammunition must be pre-coordinated with the Range Control Officer, and during periods of high fire risk, it is never allowed.

The probability of a significant fire occurring from ordnance use is low for the following reasons. First, when fire risk is high, ordnance containing these high-heat source spotting charges is prohibited from use on the range. Second, most of the ordnance delivered would be expected to impact in areas near the targets that would be characterized by significant surface disturbance and a relative lack of vegetation. Furthermore, all of the target areas are surrounded by firebreaks, and the range is staffed with personnel trained in fire suppression and equipped with an immediate fire suppression response capability. This includes an on-site water source, a pumper truck, and other person-portable fire suppression equipment. There is no history of significant fire risk associated with the operation of the Hardwood Range.

In addition to fire suppression equipment and trained personnel, the range also has a fire safety agreement with the Wisconsin DNR. This agreement provides each entity to support the other in case of fire. For example, all fires started on the range will use range personnel, however, if a fire becomes out of control or if it appears that it could leave the range premises, the Wisconsin DNR are called to respond. The Wisconsin DNR also uses the WIANG to help fight fires off the range. The Wisconsin DNR also supports fire fighting training of the unit. Two similar agreements exist between the range and the townships of Armenia and Remington.

3.3.1.2 Ground Safety/Dropped Objects

Day-to-day operations and maintenance activities associated with maintaining the range are conducted by range staff in accordance with standard industrial safety standards and procedures. Aside from those tasks associated with ordnance use on the range, no activities are especially unique or significantly hazardous. Activities concerning handling and maintenance of ordnance items are discussed in greater depth in Section 3.3.4.

There are three potential situations associated with range operations that could create safety concerns regarding dropped objects. One involves the possibility of part of the aircraft (e.g., a bolt) separating from the aircraft during flight. A second concerns the inadvertent release of ordnance from the aircraft. A third considers ordnance that does not release when commanded, but remains with the aircraft in an unknown condition, but potentially susceptible to unanticipated release.

The probability of an aircraft component separating from the aircraft while on the range is no greater than during any other time of flight. This probability is extremely low. However, should this event occur during range operations, since personnel would not be on the range impact area during such operations, the already minute possibility that someone would be injured by the falling object would be even further lessened.

Safeguards designed into weapons systems and standard range procedures limit the risk of inadvertent release of ordnance. Weapons release is only effected through a positive signal sent by the pilot and only upon clearance from the Range Control Officer. During air-to-ground training, aircrews avoid population centers. Therefore, even if a malfunction should occur that resulted in an inadvertent release, the probability of the ordnance impacting a person or structure on the ground would be remote.

Standard procedures also exist to deal with the third safety concern, which results when ordnance does not release when commanded, or becomes "hung ordnance." In this situation, attempts are made to release the hung ordnance. If these attempts are unsuccessful, the aircrew will depart the range, and follow their hung ordnance procedures. This normally involves immediate and direct routing to a military installation, with flight paths over uncongested areas to the maximum extent possible. After landing, the aircraft is normally parked in a remote location, and trained maintenance personnel "safe" all ordnance, and recover the munitions. Every unit using Hardwood Range has developed specific and detailed hung ordnance procedures, and all aircrews are thoroughly familiar with required actions.

3.3.2 MOA Airspace

The Falls 1, Falls 2, and Volk South MOAs currently support military flight training activity.

3.3.2.1 Fire Risks

Aircraft overflight, in itself, poses no fire risk. Fire risks associated with aircraft flight training activities normally arise from three associated elements of risk. These are (1) the risk of an aircraft mishap and crash; (2) the risk of the heat generated by the small spotting charge contained in training ordnance igniting a fuel source; and, (3) the risk of a still-burning or malfunctioning flare reaching the ground and igniting a fuel source.

As will be shown in Section 3.3.3, the risk of an aircraft mishap is extremely low. Furthermore, no ordnance of any type is authorized for use in the MOAs. Although the possibilities of system malfunctions resulting in inadvertent releases cannot be totally discounted, the probabilities of such occurrences are remote. Therefore, fire risk from aircraft training activities in these MOAs is minimal.

3.3.2.2 Dropped Objects

As discussed above, there are three potential causes for an object being dropped from an aircraft while in flight, posing a safety risk to persons and property on the ground. Two of these causes involve ordnance. Since ordnance is not authorized for use in MOAs, ordnance releasing circuits would never be armed during MOA operations. Therefore, the probabilities of either an inadvertent release of ordnance, or a malfunction allowing ordnance to remain hung on the aircraft after an attempted release, are considered extremely minimal. The possibility of an aircraft component becoming separated from the aircraft and falling to the ground still exists. However, as discussed in the detail that follows, the probabilities of such an event having significant consequences are extremely low.

To evaluate this probability, a hypothetical scenario was developed based on the following conservative assumptions.

- A four ounce bolt separates from an aircraft flying at 450 knots, 750 feet AGL.
- This occurs once every 1,000 sorties (a probability of occurrence of 0.001).

- The potential ground impact zone is 50 feet wide and 1,300 feet long (65,000 square feet).

- To injure a person, impact would have to be within 1.5 square feet of the person.

- A structure susceptible to impact would cover a ground area of 1,500 square feet.

- Given the propensity for military training airspace to be located over rural and remote areas, population density considered is 100 persons per square mile, and structure density is one structure per acre.

Using these assumptions, the potential for a person being injured may be assessed as follows:

- The probability of an object separating from an aircraft is 0.001.

- The probability of impact within any 1.5 square foot area of the 65,000 square foot impact zone is 2.3×10^{-5}, or one chance in more than 43,000.

- The probability of a person being in any 1.5 square foot area is 5.4×10^{-6}, or one in 185,000.

- Overall, the joint probability of an object separating from an aircraft, impacting in any specific 1.5 square foot area of the impact zone, and a person being in that area when it impacts is estimated to be 1.242×10^{-13}, or only one chance in more than 8 trillion.

Currently, 2,173 sorties are flown in the Falls 1 MOA; 1,347 sorties are flown in the Falls 2 MOA; and 368 sorties are flown in the Volk South MOA annually. Based on these sortie levels, probability data indicate that a ground injury could be expected once every 3.7×10^{9} years under the Falls 1 MOA, once every 5.9×10^{9} years under the Falls 2 MOA, and once every 2.2×10^{10} years under the Volk South MOA.

Similarly, the probability of structure damage may be assessed as follows:

- The probability of an object separating from an aircraft is 0.001.

- The probability of impact within any 1,500 square foot area of the 65,000 square foot impact zone is 0.023.

- The probability of a structure being present in that area is 0.034.

- Overall, the joint probability of an object separating from an aircraft, impacting in any specific 1,500 square foot area of the impact zone, and a structure being present in that area is estimated to be 7.82×10^{-7}, or only one chance in more than 1,250,000.

Based on the annual sorties flown in the Falls 1, Falls 2, and Volk South MOAs, a dropped object impacting a structure could be expected to occur once every 588, 949, and 3,475 years in these airspace elements, respectively.

Dropped objects create very little safety risk to persons or structures occupying the land under these MOAs.

3.3.3 Flight Risks

The public's primary concern with regard to flight safety is the potential for aircraft accidents. Such mishaps may occur as a result of mid-air collisions, collisions with manmade structures or terrain, weather-related accidents, mechanical failure, pilot error, or bird-aircraft collisions. Flight risks apply to all aircraft; they are not limited to the military. Flight safety considerations addressed include aircraft mishaps, and the hazard potential associated with bird-aircraft strikes.

3.3.3.1 Aircraft Mishaps

The Air Force defines four categories of aircraft mishaps: Classes A, B, C, and High Accident Potential (HAP). Class A mishaps result in a loss of life, permanent total disability, a total cost in excess of $1 million, destruction of an aircraft, or damage to an aircraft beyond economical repair. Class B mishaps result in total costs of more than $200,000, but less than $1 million, or result in permanent partial disability, but do not result in fatalities. Class C mishaps involve costs of more than $10,000, but less than $200,000, or a loss of worker productivity of more than eight hours. HAP represents minor incidents not meeting any of the criteria for Class A, B, or C. Class C mishaps and HAP, the most common types of accidents, represent relatively unimportant incidents because they generally involve minor damage and injuries, and rarely affect property or the public. This analysis focuses on Class A mishaps because of their potentially catastrophic results.

It is impossible to predict the precise location of an aircraft accident, should one occur. Major considerations in any accident are loss of life and damage to property. The aircrew's ability to exit from a malfunctioning aircraft is dependent on the type of malfunction encountered. The probability of an aircraft crashing into a populated area is relatively low; however it cannot be totally discounted. Several factors are relevant: the ROI and areas beneath military training airspace have relatively low population densities; pilots of aircraft are instructed to avoid low altitude overflight of population centers; and, finally, the limited amount of time the aircraft is over any specific geographic area limits the probability that impact of a disabled aircraft in a populated area would occur.

Secondary effects of an aircraft crash include the potential for fire and environmental contamination. Again, because the extent of these secondary effects is situationally dependent, they are difficult to quantify. The terrain overflown in the ROI is diverse. For example, should a mishap occur, highly vegetated areas during a hot, dry summer would have a higher risk of experiencing extensive fires than would more barren and rocky areas during the winter. When an aircraft crashes, hydrocarbons may be released. However, most petroleums, oil and lubricants are often consumed in the subsequent fire.

F-16 aircraft carry a small quantity of hydrazine in a sealed canister that is designed to withstand crash impact damage. The hydrazine is part of the aircraft's emergency engine restart system, and is completely consumed if used for this purpose. In any crash that is severe enough to rupture the canister, it is most likely that fire will also be involved. In this case, the hydrazine will also burn and be completely decomposed. In the unlikely event that the hydrazine should be released, but not consumed by fire, impacts on soils and groundwater are likely to be of minor consequence. Hydrazine absorbs water at room temperature. It is incombustible in solution with water at concentrations of 40 percent or less, and it evaporates at any given temperature at a rate slightly slower than water. Movement of hydrazine through natural soils has been shown to be slow and limited. The nearest Department of

Defense (DoD) emergency team responding to an accident would immediately neutralize any residue present, rendering it harmless. Due to its absorption and natural decomposition processes, the probability of significant groundwater contamination is considered extremely low.

Based on historical data on mishaps at all installations, and under all conditions of flight, the military services calculate Class A mishap rates per 100,000 flying hours for each type of aircraft in the inventory. It should be noted that these mishap rates do not consider combat losses due to enemy action. Hardwood Range, and its associated R-6904, currently supports air-to-ground training activities. The data presented in Table 3-5 reflect statistical predictions of Class A mishaps for the types of aircraft currently using this airspace, and the level of activity occurring in the airspace. These predictions are based on the estimated flying time for specific aircraft types, the statistical Class A mishap rate per 100,000 flying hours for that aircraft, and the total estimated annual flight time for that specific aircraft in the airspace. Data presented reflect only statistical projections; aircraft mishaps result from many factors, not simply the amount of flying time of the aircraft.

It should be noted that the German Air Force calculates annual mishap rates per 10,000 flying hours without regard to the severity of the mishap. Five years of safety statistics were collected for the PA-200 (Tornado) aircraft. In order to use data as analogous to U.S. data as possible, these statistics were normalized to 100,000 flying hours, averaged, and then weighted for mishap severity (Class A) using the mishap severity ratios of the F-15, a similar twin-engine aircraft with a multi-role mission. The resultant mishap rate of 1.12 Class A mishaps per 100,000 flying hours is used as a conservative estimate for the flight safety assessments.

Table 3-5. Baseline Hardwood Range (R-6904) Projected Class A Mishaps

AIRCRAFT	*CLASS A MISHAP RATE*	*SORTIES/YEAR*	*FLIGHT HRS/YR*	*PROJECTED YRS BETWEEN MISHAPS*
F-16	*4.57*	*4,093*	*1,365*	*16.0*
F-15	*2.62*	*100*	*34*	*1,122.6*
B-52	*1.29*	*50*	*17*	*4,560.0*
B-1B	*4.02*	*50*	*17*	*1,463.3*
A-6	*3.33*	*50*	*17*	*1,766.5*
A-10	*2.56*	*50*	*17*	*2,297.8*
AH-1	*3.43*	*50*	*17*	*1,715.0*
B-2	*0.00*	*50*	*17*	*N/A*
C-26	*N/A*	*50*	*17*	*N/A*
C-130	*0.99*	*200*	*67*	*5,941.8*
F-18	*2.07*	*50*	*17*	*2,841.7*
F-117	*1.69*	*50*	*17*	*3,480.7*
PA-200	*1.12*	*50*	*17*	*5,252.1*
UH-1	*3.43*	*50*	*17*	*1,715.0*
Lear Jet	*N/A*	*49*	*17*	*N/A*

Note: 1. N/A = Not Available

Source: Mishap Rates: Naval Flight Safety Center 1996; USAF Flying Safety Center 1996. Flight Hours: ANGRC 1992.

As shown, there is relatively low risk associated with these operations. When all aircraft are considered, a minimum of 16 years is predicted between mishaps. This reflects the high utilization of the range by F-16 aircraft. To place this factor into context, if it were assumed that sortie levels would remain constant for those 16 years, this equates to one chance in almost 65,500 of a mishap occurring, a probability of 0.000015. All other predictions indicate thousands of years between mishaps.

During the 42 years of operation, the range has experienced four Class A mishaps. During the 1950s, one F-84 and one F-86 crashed. In 1983 there was a mishap involving a Marine Corps Reserve A-4 aircraft. The most recent mishap occurred in 1991 when a Wisconsin ANG A-10 aircraft experienced a fire in the aircraft's hydraulic system and crashed after the pilot directed the aircraft to a remote area and safely ejected (Olson 1995).

Mishap projections for the Falls 1, Falls 2, and Volk South MOAs under current conditions are presented in Tables 3-6 through 3-8 below.

As shown, there is minimal flight risk associated with the levels of use of these three MOAs. The minimum projected time between Class A mishaps occurs in the Falls 1 MOA, with more than 20 years projected. All other projections are significantly higher.

Table 3-6. Baseline Falls 1 MOA Projected Class A Mishaps

AIRCRAFT	CLASS A MISHAP RATE	SORTIES/YEAR	FLIGHT HRS/YR	PROJECTED YRS BETWEEN MISHAPS
F-16	4.57	2,115	1,058	20.7
F-15	2.62	16	8	4,771.0
B-52	1.29	2	1	77,519.4
B-1B	4.02	2	1	24,875.6
A-6	3.33	4	2	15,015.0
A-10	2.56	4	2	19,531.2
AH-1	3.43	3	2	14,577.3
B-2	0.00	3	2	N/A
C-26	N/A	3	2	N/A
C-130	0.99	4	2	50,505.0
F-18	2.07	4	2	24,154.6
F-117	1.69	4	2	29,585.8
PA-200	1.12	3	2	44,642.8
UH-1	3.43	3	2	14,577.3
Lear Jet	N/A	3	2	N/A

Note: N/A = Not Available

Source: Mishap Rates: Naval Flight Safety Center 1996; USAF Flying Safety Center 1996. Flight Hours: ANGRC 1992.

Table 3-7. Baseline Falls 2 MOA Projected Class A Mishaps

AIRCRAFT	CLASS A MISHAP RATE	SORTIES/YEAR	FLIGHT HRS/YR	PROJECTED YRS BETWEEN MISHAPS
F-16	4.57	1,310	655	33.4
F-15	2.62	10	5	7,633.6
B-52	1.29	2	1	77,519.4
B-1B	4.02	2	1	24,875.6
A-6	3.33	2	1	30,030.0
A-10	2.56	2	1	39,062.5
AH-1	3.43	2	1	29,154.5
B-2	0.00	2	1	N/A
C-26	N/A	2	1	N/A
C-130	0.99	3	2	50,505.0
F-18	2.07	2	1	48,309.2
F-117	1.69	2	1	59,171.6
PA-200	1.12	2	1	89,285.7
UH-1	3.43	2	1	29,154.5
Lear Jet	N/A	2	1	N/A

Note: N/A = Not Available

Source: Mishap Rates: Naval Flight Safety Center 1996; USAF Flying Safety Center 1996. Flight Hours: ANGRC 1992.

Table 3-8. Baseline Volk South MOA Projected Class A Mishaps

AIRCRAFT	CLASS A MISHAP RATE	SORTIES/YEAR	FLIGHT HRS/YR	PROJECTED YRS BETWEEN MISHAPS
F-16	4.57	332	166	131.8
F-15	2.62	18	9	4,240.9
A-6	3.33	2	1	30,030.0
A-10	2.56	2	1	39,062.5
AH-1	3.43	1	1	29,154.5
B-2	0.00	1	1	N/A
C-26	N/A	1	1	N/A
C-130	0.99	2	1	101,010.1
F-18	2.07	2	1	48,309.2
F-117	1.69	2	1	59,171.6
PA-200	1.12	2	1	89,285.7
UH-1	3.43	1	1	29,154.5
Lear Jet	N/A	2	1	N/A

Note: N/A = Not Available

Source: Mishap Rates: Naval Flight Safety Center 1996; USAF Flying Safety Center 1996. Flight Hours: ANGRC 1992.

3.3.3.2 Bird-Aircraft Strike Hazard

Bird-aircraft strikes constitute a safety concern because of the potential for damage to aircraft or injury to aircrews or local populations if an aircraft crash should occur. Aircraft may encounter birds at altitudes of 30,000 feet MSL or higher. However, most birds fly close to the ground. Over 95 percent of reported bird strikes occur below 3,000 feet AGL. Approximately 50 percent of bird strikes happen in the airport environment, and 25 percent occur during low-altitude flight training (Worldwide Bird-Aircraft Strike Hazard [BASH] Conference 1990).

Migratory waterfowl (e.g., ducks, geese, and swans) are the most hazardous birds to low-flying aircraft because of their size and their propensity for migrating in large flocks at a variety of elevations and times of day. Waterfowl vary considerably in size, from one to two pounds for ducks, five to eight pounds for geese, and up to 20 pounds for most swans. There are two normal migratory seasons, fall and spring. In the region of the Hardwood Range, the fall migratory period is normally from September 15 to November 15, and the spring period is from March 15 to June 1. Waterfowl pose the greatest hazard during these periods. Typically, waterfowl migrate at night, and generally fly between 1,500 to 3,000 feet AGL during the fall migration, and between 1,000 to 3,000 feet AGL during the spring migration. However, the area around the range contains significant waterfowl staging areas, and there are several wetland sites that provide critical habitat for migrating birds. Birds using these staging areas tend to fly during diurnal periods, and at lower altitudes as they move to nearby feeding areas.

The potential for bird-aircraft strikes is greatest in areas used as migration corridors (flyways) or where birds congregate for foraging or resting (e.g., open water bodies, rivers, and wetlands).

Although waterfowl are the greatest threat, raptors, shorebirds, gulls, herons, and songbirds also pose a hazard. Peak migration periods for raptors, especially eagles, are from October to mid-December and from mid-January to the beginning of March. In general, flights above 3,000 feet AGL would be above most migrating and wintering raptors.

Songbirds are small birds, usually less than one pound. During nocturnal migration periods, they navigate along major rivers, typically between 500 to 3,000 feet AGL.

Any bird-aircraft strike has the potential to be serious. However, many result in little or no damage to the aircraft, and only a minute portion result in a Class A mishap. For example, during the years 1987 to 1989, 9,334 bird strikes to Air Force aircraft were reported world-wide. Four resulted in loss of the aircraft, and one additional occurrence resulted in damage to the aircraft in excess of $1 million. These five occurrences constitute approximately one-half of one percent of all reported bird-aircraft strikes to Air Force aircraft (Worldwide BASH Conference 1990).

Records maintained by the USAF BASH Team indicate that during the last five years there have been no birdstrikes experienced in R-6904, or in the Falls 1, Falls 2, or Volk South MOAs.

3.3.4 Munitions Use and Handling

3.3.4.1 Hardwood Range Expansion

Only training or inert ordnance is authorized for use on Hardwood Range. Self protection flares are authorized for use when the risk of fire is low. If used, they must be released at greater than 2,000 feet AGL (WIANG 1992). All ordnance is handled and maintained by specifically trained personnel. Furthermore, Air Force Instruction (AFI) 91-201 requires safeguards on weapons systems and ordnance to ensure against inadvertent releases. All munitions mounted on aircraft, as well as the guns carried in the aircraft, are equipped with mechanisms that preclude release or firing without activation of an electronic arming circuit. On Hardwood Range, the most prevalent munition carried is the bomb dummy unit [BDU]-33. This is a small training bomb (weighing approximately 25 pounds) composed of ferrous metals and a small spotting charge. This charge, which is approximately equivalent to two 12 gauge shotgun shells, contains gunpowder that expels about one ounce of red phosphorous that aids in visual scoring of bombing accuracy on the range. All gun ammunition is training ammunition; no high explosive or incendiary rounds are used.

In accordance with procedures prescribed by AFI 13-212, the range is cleared of ordnance debris. The areas of the range with the greatest concentrations of debris are cleared annually, and a complete boundary to boundary clearance is accomplished every five years (WIANG 1992).

All ordnance debris is inspected by trained explosive ordnance disposal (EOD) personnel. Occasionally, the small spotting charge in the training ordnance does not detonate on impact. If necessary, EOD personnel render the debris safe, and then supervise the collection and ultimate disposal of the debris.

Air-to-ground training range activities using training munitions do raise one specific issue. That issue involves what happens to the munition after it impacts the ground. Training ordnance often remains relatively intact after impact, and can bounce, skid, and tumble along the ground for some distance beyond the ground point-of-impact. Based on historical data, “footprints” have been developed that describe a geographic area within which a training munition may ultimately be expected to come to rest on the ground. These zones have a long (i.e., beyond the target), short (i.e., in front of the target), and cross-range dimension. Based on data developed from varied aircraft flying varied attack profiles, and the type of ordnance delivered, frequency distributions describing the dispersion of these munitions around the target have been developed. With these specific statistical data, footprints can be developed around targets within which, at a 95 percent confidence level, 99.99 percent of the delivered munitions will be contained. These footprints are unique for each weapon system, aircraft, ordnance type, and delivery profile. These weapons footprints stay within range boundaries.

On the Hardwood Range, these data have been applied, and are reflected in published range operating procedures. These procedures provide detailed guidance to aircrews on authorized attack headings, approved ordnance use on specific targets, and other operational constraints that are designed to ensure that all ordnance remains within the range area.

3.3.4.2 MOA Airspace

Safeguards on all ordnance systems are required to ensure against accidental or inadvertent releases (Air Force Manual 91-201). Any release of any type ordnance requires positive activation of electronic arming circuits, followed by a

separate positive action to affect release. While arming and releasing system malfunctions cannot be totally discounted, the probability of such an occurrence is infinitesimal.

All munitions carried are either small training bombs or inert bombs, and training ammunition for the aircraft's guns. No live, high explosive, or incendiary munitions are carried during training. If any of this ordnance should inadvertently jettison from the aircraft, its location would be marked, and the nearest DoD recovery team would be immediately dispatched to render the ordnance safe and remove it for disposal.

3.4 HAZARDOUS MATERIALS AND SOLID WASTE

Hazardous materials are those substances defined as hazardous by the Comprehensive Environmental Response, Compensations, and Liability Act (CERCLA) as amended, and the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA). In general, hazardous materials include substances that, because of their quantity, concentration, physical, chemical, or infectious characteristics, may present substantial danger to public health or welfare or the environment when released. Hazardous waste management is outlined in the Wisconsin Administrative Code Chapter NR 600. Transportation of hazardous materials is regulated by Department of Transportation (DOT) regulations within Title 49 of the Code of Federal Regulations (CFR).

Hazardous materials and wastes are federally regulated by the U.S. Environmental Protection Agency (EPA), in accordance with the Federal Water Pollution Control Act; the Clean Water Act (CWA); the Solid Waste Disposal Act (SWDA); the Toxic Substance Control Act (TSCA); RCRA; CERCLA; and the Clean Air Act (CAA). Pesticide application, storage, and use is regulated by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The Federal government is also required to comply with the intent of the acts and with all applicable state laws and regulations under Executive Order (E.O.) 12088 and DoD 4150.7.

The ROI for hazardous materials consists of the existing and proposed Hardwood Range area. Because it is highly unlikely that a hazardous waste release would occur in the MOA airspace, the focus of this resource analysis is on the Hardwood Range and proposed expansion area. Only a very small possibility exists that an aircraft mishap would occur within the MOA airspace. The analysis for aircraft safety is discussed in sections 3.3 and 4.3, Safety.

3.4.1 Hardwood Range Expansion

The Hardwood Range requires the use of heavy equipment and vehicles on site for range maintenance and fire protection. As a result, small quantities of hazardous and non-hazardous substances are used and generated. These substances consist primarily of fuels, oils, and lubricants. These substances are stored in bulk (typically in 55-gallon or smaller drums) on a drum rack within the maintenance facility. Maintenance activities on the range include oil and antifreeze changes. These substances are not considered hazardous wastes in the State of Wisconsin.

The range also recycles and demilitarizes vehicles to be used as targets. All liquids from these vehicles (i.e., oil, antifreeze, and gasoline) are drained and disposed of in accordance with applicable laws and regulations by Volk Field personnel. In 1995, approximately 200 gallons of hazardous waste consisting of waste gasoline were generated from this procedure. However, since then, very few vehicles have been demilitarized. The only hazardous waste generated on the range are lithium batteries. Approximately 100 pounds of batteries were disposed of in 1996 (Neumann 1997). Non-hazardous waste produced on an annual basis by range activities includes approximately 200 gallons of oil (Neumann 1997). Personnel from Volk Field manage manifesting and disposal of hazardous waste and the non-hazardous oil, antifreeze, and batteries generated at the Hardwood Range. The Hardwood Range is listed by the EPA as a conditionally exempt small quantity generator (Neumann 1997).

The spill plan for the Hardwood Range is included in the Volk Field Spill Plan because Volk Field manages and operates the range. The spill plan was updated in

April, 1999 (Neumann 1999). A spill kit is kept on site near the hazardous waste storage area. No spills of reportable quantities have occurred on the range, nor has a Notice of Violation been issued to the range from state or Federal authorities.

Prior range activity included the use of pesticides and herbicides for insect and weed control. However, pesticides or herbicides are no longer used on the range. Weeds and other unwanted vegetation are burned annually.

Two above ground storage tanks (ASTs), providing fuel for maintenance vehicles, are located in the compound area of the range. These tanks consist of one 2,000-gallon AST containing unleaded gasoline and one 2,000-gallon AST containing diesel fuel. The unleaded gasoline AST is filled about twice a year and the diesel fuel tank three to four times per year. In 1996, 3,700 gallons of diesel fuel and 1,040 gallons of unleaded gasoline were dispensed (Neumann 1997). Both tanks are double-walled, monitored, and regularly checked for damage and leakage in compliance with all regulations pertaining to ASTs. No underground storage tanks (USTs) are located on the range, as all were removed in 1992. The sites were closed by the Wisconsin DNR in 1996.

One Defense Installation Restoration Project is located on the Hardwood Range. This site was used from 1976 to 1988 for annual burning and burial of spent munitions. A small plume of contaminated groundwater was identified in that area (Montgomery Watson 1995). Volatile organic compounds (VOCs) and semi-volatile organic compounds were detected in some samples. The contaminated area is located approximately 1.5 miles south of the southern property boundary line of the proposed expansion area. Figure 3-6 shows the location of this IRP site. The direction of groundwater flow from the impacted area is generally to the south away from the expansion area (Montgomery Watson 1995). An IRP Feasibility Study was produced in March 1998 and distributed for comment. The study includes a 10-year study and monitoring plan for this IRP site.

Solid waste products on the range are limited to scrap metals, spent bomb casings, concrete filler and parachute nylon material from the inert bombs, and used targets. This debris does not include any hazardous materials. EOD clean-up of the range occurs once a year. Used ordnance and targets are sorted and stored for recycling. Once a year, the scrap metals and other materials are sold through the DRMO to private recyclers and dealers. None of the ordnance or used targets are taken to a landfill. A private refuse hauler picks up the small amounts of household wastes (paper, aluminum cans, etc.) generated by personnel on range.

Ordnance consisting of firework-type aerial charges (e.g., Smoky Sams) are stored in a small shed on the range. In addition to practice ordnance, aircraft using the range also strafe with 20 millimeter (mm) and 30 mm ammunition. Aircrews use training ammunition only; no high-explosive or incendiary rounds are allowed. Each projectile is steel or steel capped aluminum; gunpowder used in the round is consumed when fired from the aircraft. Dud rounds are retained on the aircraft. The strafing pits are cleared every seven use days.

Signal cartridges in the training ordnance (particularly the BDU-33) contain small quantities of gunpowder. Two types of gunpowder are used: nitroglycerin and nitrocellulose. These materials are ignited and consumed upon impact. Gunpowder combustion products include carbon monoxide (CO), carbon dioxide, and nitrogen oxides (NO_x) (Hercules 1989). Two types of signal cartridges are used in the training ordnance: the Mark 4 Mod 3 (referred to as a hot spot), and the CXU-3A/B (referred to as a cold spot). The hot spot signal cartridges contain a small amount of red phosphorous. When the bomb impacts the ground, the red phosphorous ignites and is

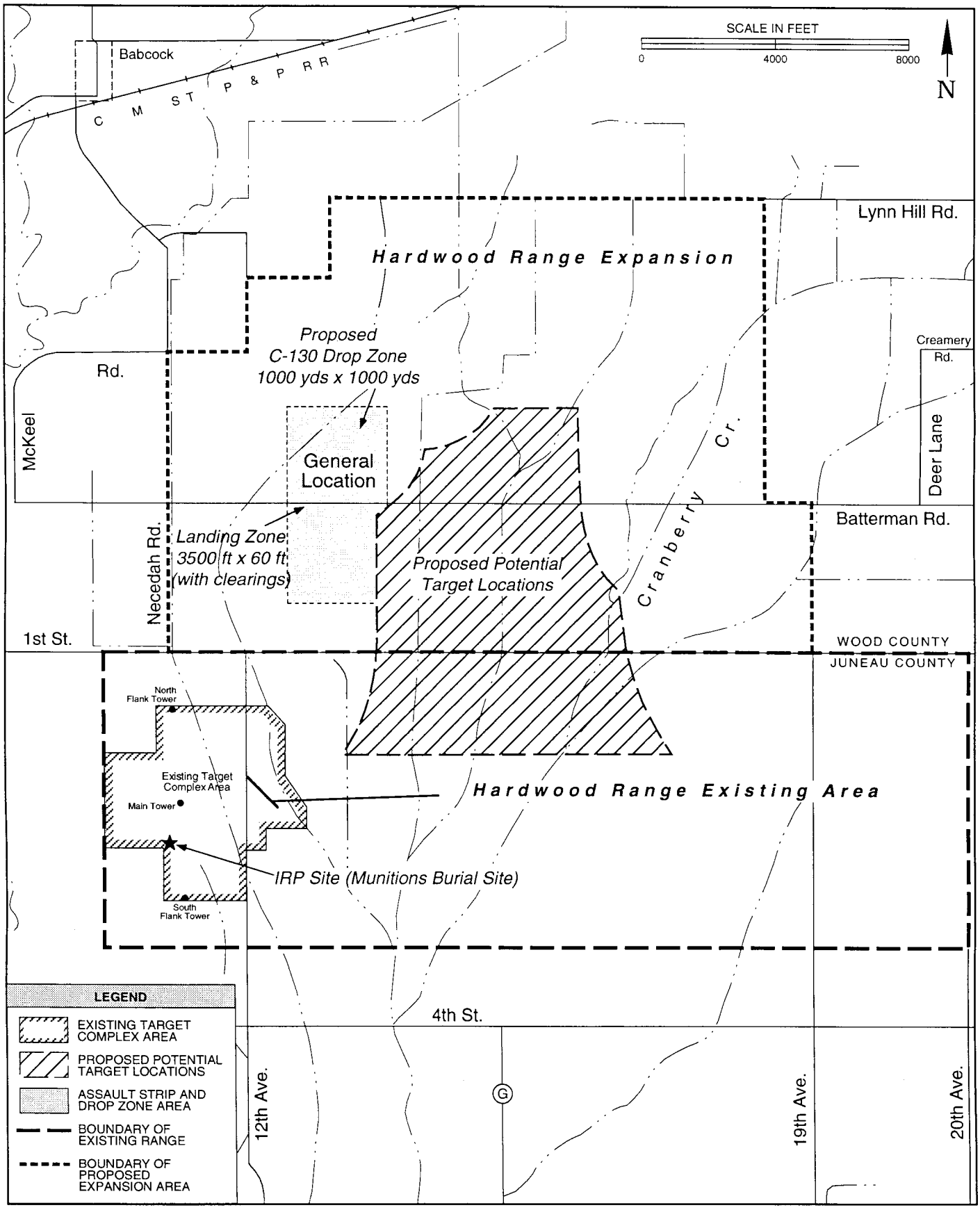


Figure 3-6. Location of IRP Site at Hardwood Range

rapidly consumed, leaving no residue. Cold spots are typically used during the fire season. The cold spots contain approximately 17 cubic centimeters of titanium tetrachloride. Titanium tetrachloride reacts with available moisture in the air to produce "smoke" for scoring. Titanium tetrachloride is an irritant to the skin, eyes, and mucous membranes, but is not classified as toxic. The compound is neutralized with water. A small number of ordnance containing spotting charges and gunpowder fail to ignite on impact. Compounds within these charges either decompose with time or are rendered harmless by EOD personnel.

Two plane crashes have occurred under R-6904A that resulted in a minor release of hazardous material. An A-10 crashed into the Necedah Wildlife Refuge. While most of the jet fuel was consumed in the subsequent fire, initial testing of the crash site for contamination was performed. Only one test was positive for contamination. The other plane crash occurred on the Hardwood Range over 10 years ago. No records are available regarding potential contamination of the site. Due to the nature of the crash, however, most contaminates were probably consumed in the subsequent fire.

The proposed area for the range expansion is presently being used for primarily forestry and cranberry cultivation. An Environmental Baseline Survey (EBS) (Montgomery Watson 1995) was performed on the proposed expanded area. This survey included a review of 17 state and Federal lists that identify properties of known or potential environmental concern. These lists include Superfund and state listed sites, old landfills, sites with historical spills, leaking USTs, etc. The site and surrounding areas were also aerially surveyed for facilities that generate hazardous wastes and properties which contain USTs (Montgomery Watson 1995). Results of the survey showed that the proposed land expansion area did not appear on any list nor was it likely that it was exposed to contamination in the past.

3.5 EARTH RESOURCES

This section discusses the land resources of the Hardwood Range and proposed expansion area, including the geological setting and soil types of the site area.

The ROI for Earth Resources consists of the Hardwood Range and proposed range expansion area. Since it is highly unlikely that a change in the use of the MOA airspace would affect earth resources, the area underlying the MOAs was not analyzed. The analysis focuses on those activities that have a possibility of affecting earth resources. These activities include construction of target areas, land zone, service roads, fire breaks, and ordnance delivery.

3.5.1 Hardwood Range Expansion

3.5.1.1 Physiography and Geology

The Hardwood Range, proposed expansion area, and Restricted Area R-6904A lie in the Central Sands physiographic province of Wisconsin (Martin 1965). This portion of Central Wisconsin is topographically flat, with surface elevations of 970 to 975 feet MSL in the northern part, grading to between 950 and 955 feet above MSL in the southern part. Much of the site, except the far eastern portion, is occupied by wetlands. Primary physiographic features of the Hardwood Range and proposed expansion area include Cranberry Creek, which drains most of the site, and Cranberry Rock Lookout, a rock outcrop of 1,036 feet MSL, near the eastern side of the site.

Bedrock beneath the site area consists of Cambrian sandstone of the Mount Simon Formation. During the Cambrian Period (570 to 505 million years ago), a shallow sea covered the area of present-day Wisconsin. Sandstones were eroded back to sand and these sands were compacted and re-lithified to sandstone. Because of this long cycle of reworking, only the most resistant minerals were left and, when final burial occurred, the sands were quartz-rich. These sands were compressed and lithified into the present day sandstone bluffs of the area.

Subsurface soils lying on the bedrock are glacial lakebed sands. During the most recent ice advance (Wisconsin Age), the Hardwood Range and proposed expansion area were part of the Driftless Area, an area not covered by the continental ice sheet. The area, however, was heavily influenced by the ice sheet. The Green Bay lobe of the glacier covered the eastern third of the state, creating a massive ice dam to the east of the site area and causing a large glacial lake to form. This lake, glacial Lake Wisconsin, covered parts of Adams, Juneau, Monroe, and Wood counties and existed for thousands of years. Density currents (moving slurries of mud and water) deposited thick layers of sand in the lake. Rock fragments in the glacier were either carried out by glacial meltwater or blown from the glacier by strong winds from the interior of the ice sheet. All these sediments came to rest on the bottom of this ancient lake, forming a layer that was several hundred feet thick in areas. The Central Sands of Wisconsin currently found in the area are a relict feature of this prehistoric lake. Present-day soils lie on sediments that were deposited in the basin of glacial Lake Wisconsin (Martin 1965).

The climate of the area during the Wisconsin Age resembled the arctic conditions of portions of present-day Alaska and northern Canada. Under these climatic conditions, the sandstone formations from earlier times were shattered by ice and reduced to sand by yearly freeze-thaw cycles. As the climate warmed, the glacier began to melt, and its margins retreated. With this warming, the ice dam that formed

glacial Lake Wisconsin was breached. Current theory holds that the ice dam failed catastrophically, and the entire lake changed its drainage from the northeastern outlet of the East Fork of the Black River, to the southeast. Drainage of the entire lake is hypothesized to have occurred in two to four days. The slurry of water and sand acted as a sand-blaster, carving the lower part of the cliffs in the present day Wisconsin Dells. The dominant south-southeast drainage of today's rivers in this area is the result of the channels cut during the rapid draining of this prehistoric lake (Martin 1965).

Recent changes to the area's physiography have been human-induced. These changes include excavation of drainage ditches and creation of impoundments by damming of some of the natural and artificial drainageways. These include seasonal impoundments for cranberry production and permanent impoundments for drainage and recreation. Exploitation of mineral resources in the area is limited to sandpits and quarries.

3.5.1.2 Soils

The soils of the Hardwood Range, proposed expansion area, and R-6904A are derived from coarse-to-fine sands, silts, and clays deposited by glacial meltwaters along the Wisconsin River and in glacial Lake Wisconsin (Martin 1965; U.S. Soil Conservation Service 1991). Soil particles were derived from both the erosion of the Cambrian sandstone formations and rock fragments carried in the glacier. Materials from both of these sources were deposited by wind and water into the basin of the prehistoric lake. As discussed above, the quartz-rich sands were derived from the Cambrian sandstone and re-worked several times as the sea rose and fell during that era, eventually compacting and lithifying into the present-day sandstone bluffs.

Most of Hardwood Range, proposed expansion area, and R-6904A lie within a larger area with soils classified as the Newson-Meehan or Newson-Meehan-Dawson association. Soils of this association are in nearly level areas, are poorly drained or somewhat poorly drained, and have a sandy subsoil. These soils were formed as deep sandy outwash on sandy outwash plains and as glacial lake deposits.

Newson soils comprise approximately 46 percent of the predominant association, Meehan soils approximately 28 percent, Dawson soils approximately 13 percent, and other soils the remaining 13 percent. Newson mucky loamy sands typically occur in depressions on sand plains. Meehan sands occur on low rises on sand plains. Dawson muck occurs on low flats and in drainageways and depressions on sand plains, stream terraces, and in glacial lake beds.

If soils of this association are cultivated, the hazard of erosion is severe. Wetness is a moderate to severe limitation to land use. Most of the land with this soil association is in woodland cover. Most of the areas that were formerly cultivated have been planted to trees or have reverted to woodland. Only a few small areas remain cultivated due to the low productivity associated with these soils. The Newson soils are well suited to cranberry production. Most of the wetlands of the Hardwood Range and proposed expansion area formed on soils of this association.

The far eastern part of the Hardwood Range and proposed expansion area is characterized by soils of the Friendship-Plainfield association. This association is characterized by deep, excessively drained and moderately well drained sands on nearly level to moderately steep slopes, on stream terraces, and in basins of glacial lakes. Few of the site wetlands, and most of the agricultural lands, are on soils of this association.

3.6 WATER RESOURCES

3.6.1 Hardwood Range Expansion

3.6.1.1 Surface Water

The Hardwood Range, proposed expansion area, and Restricted Area R-6904A lie in the hydrologic basin of the central portion of the Wisconsin River. The site is on the flat, poorly drained expanse of glacial Lake Wisconsin. The Hardwood Range and proposed expansion area are in the subbasin of Cranberry Creek, a tributary of the Yellow River, which joins the Wisconsin River approximately 25 miles south of the Hardwood Range. Surface waters in the area consist of hard waters (120 to 180 milligrams per liter [mg/L] as calcium carbonate [$CaCO_3$]), with low velocities due to the low topographic relief in the area (U.S. Geological Survey [USGS] 1971). Cranberry Creek and its tributaries have been channelized throughout much of the area to promote drainage.

3.6.1.2 Groundwater

Major groundwater resources in the site area include the outwash aquifer and the underlying Cambrian sandstone aquifer. The outwash aquifer is formed in the sand deposits of glacial Lake Wisconsin, and is 30 to 100 feet thick. Water yield from this aquifer is estimated to be in the 50 to 500 gallons/minute range. The Cambrian Mount Simon Formation functions as a water supply aquifer more prominently to the south of the site. The Pre-Cambrian bedrock that lies under the other formations has a severely limited groundwater supply (USGS 1989).

Groundwater is recharged primarily by infiltration from precipitation and snowmelt. The water supply is also subject to depletion by evaporation (including evapotranspiration), surface drainage, and well pumping. The local soil types have a high water capacity, and soils are drained by open ditches. The soil along these ditches is easily eroded, resulting in subsidence. Such subsidence can cause blockage of water flow and reduced drainage capacity, reducing the effectiveness of the surface drains (USGS 1989).

Annual precipitation for the area is approximately 32.66 inches. Approximately 60 percent of the precipitation falls as rain during May through September, when heavy thunderstorms are likely. This intense rainfall raises the level of the groundwater to above the natural surface of the land and causes flooding of lower areas. The annual evaporation loss is approximately 19.7 inches. In the eastern part of the site, recharge through the coarse sands averages 11 to 12 inches/year. In the western part of the site, the tighter soils, with a greater silt content, limit recharge to 7 to 10 inches/year. Groundwater discharge is to the ground surface, and is aided by the numerous ditches and stream channelization projects in the Hardwood Range and proposed expansion area. Shallow groundwater flow through the area is generally from the north to the south (USGS 1971).

3.6.1.3 Water Quality

Groundwater quality is reflective of the chemical makeup of the soil and rock formations in which the groundwater occurs. Generally, the groundwater is soft to moderately hard. Major dissolved constituents of groundwater include calcium, magnesium, and bicarbonate ions. Lesser constituents include sodium, potassium,

chloride, and sulfate. These constituents comprise almost all of the dissolved solids in groundwater at the site. A summary of area groundwater quality data and relevant standards is provided in Table 3-9 below.

Table 3-9. Groundwater Quality Data and Standards

PARAMETER	UNITS	AREA AQUIFER (MEDIAN MEASURED VALUES)			GROUNDWATER QUALITY STANDARDS	
		PRECAMBRIAN AQUIFER	CAMBRIAN SANDSTONE AQUIFER	SAND & GRAVEL AQUIFER	NR 140 ENFORCEMENT STANDARD	NR 140 PREVENTIVE ACTION LIMIT
Specific conductance	US/cm	310	235	165	No standard	
pH	units	6.7	6.5	6.5	No standard	
Alkalinity as CaCO3	mg/L	102	41	47	No standard	
Hardness as CaCO3	mg/L	125	76	58	No standard	
Chloride	mg/L	13	3.9	4.2	250	125
Sulfate	mg/L	5.2	-	-	250	125
Fluoride	mg/L	0.2	-	<0.1	4	0.8
Nitrate as N	mg/L	<0.1	2.3	0.5	10	2
Iron, dissolved	µg/L	350	16	150	300	150
Manganese, dissolved	µg/L	155	No measurement		50	25
Barium	µg/L	51	No measurement		2000	400

Source: USGS 1989

Aquifers used for drinking water include the Cambrian sandstone and the outwash sands and gravels. These aquifers provide soft waters (generally less than 60 mg/L as $CaCO_3$) without problem concentrations of iron, manganese, nitrates, or chlorides. The Pre-Cambrian aquifer, little used for drinking water, has locally high concentrations of iron and manganese (USGS 1989).

Groundwater generally meets groundwater quality criteria included in NR 140, Wisconsin Administrative Code, administered by the Wisconsin Department of Natural Resources (WDNR) and the Juneau and Wood County health departments. Data compiled for the 1989 publication, *Hydrogeology of Wood County, Wisconsin* (USGS 1989) indicate few concerns with groundwater pollutants, especially nitrates, in drinking water aquifers. Groundwater quality monitoring results reflect the limited extent of agriculture in the site area.

3.6.1.4 Wetlands

Wetlands are defined as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that

under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (U.S. Army Corps of Engineers [USACE] 1987).

Extensive wetlands are located within the Hardwood Range, proposed expansion area, and Restricted Area R-6904A. These wetlands are primarily forested and scrub/shrub wetlands that occupy historic drainageways to Cranberry Creek and other tributaries of the Yellow River. Many of the wetlands contain smaller areas of emergent/wet meadow wetlands on the more poorly drained soils or exist as a complex of two or more wetland types. Wisconsin Wetland Inventory maps for the area are included in the Land Use Management Guidelines (Appendix K). Table 3-10 lists the wetland types located within the Hardwood Range and proposed expansion area, according to the Wisconsin Wetland Inventory.

3.6.1.5 Floodplains

The Hardwood Range, proposed expansion area, and R-6904A include extensive acreage in the 100-year floodplain. This designation is a result of the general flatness and the extent of artificial surface drainage of the site area. The lands adjacent to the Yellow River and Cranberry Creek function as floodways for those streams. Additional lands, especially in the northern and south central parts of the site, lie within the 500-year floodplain. The southeastern part of the site, with fewer wetlands and drainage features, lies outside of the 500-year floodplain. Other areas have mixed designations, with floodplains centered on drainage features, and upland islands where flood fringes do not meet or overlap. The Federal Emergency Management Agency floodplain maps for the area are included in the Land Use Management Guidelines (Appendix K).

Table 3-10. Classification of Wetlands Found within the Hardwood Range and Proposed Expansion Area

*WWI CLASSIFICATION**	*DESCRIPTION*	*PLANT COMMUNITY TYPE (CURTIS 1959)*
E1K	*Emergent / wet meadow, narrow or broad-leaved persistent, wet soil, palustrine*	*Wet prairie, wet meadow, sedge meadow*
E1Kv	*Emergent / wet meadow, narrow or broad-leaved persistent, wet soil, palustrine, vegetation recently removed*	*Wet prairie, wet meadow, sedge meadow*
E2K	*Emergent / wet meadow, narrow-leaved persistent, standing water, palustrine*	*Emergent aquatic*
E1H	*Emergent / wet meadow, narrow or broad-leaved persistent, standing water, palustrine*	*Emergent aquatic*
E2Ha	*Emergent / wet meadow, narrow or broad-leaved persistent, standing water, palustrine, abandoned farmland*	*Emergent aquatic*
S3H	*Shrub / scrub, broad-leaved deciduous, standing water, palustrine*	*Shrub-carr*
S3Hv	*Shrub / scrub, broad-leaved deciduous, standing water, palustrine, vegetation recently removed*	*Shrub-carr*
S3K	*Shrub / scrub, broad-leaved deciduous, wet soil, palustrine*	*Shrub-carr*
T3H	*Forested, broad-leaved deciduous, standing water, palustrine*	*Wet forest*
T3K	*Forested, broad-leaved deciduous, wet soil, palustrine*	*Wet forest*
T3Kv	*Forested, broad-leaved deciduous, wet soil, palustrine, vegetation recently removed*	*Wet forest*
T5K	*Forested, needle-leaved evergreen, wet soil, palustrine*	*Wet forest*
W∅H	*Open water, subclass unknown*	*None*

*Note: *Wetlands frequently occur in a complex of two or more types. For example, an area denoted as T3/E1K wetland consists of (WWI), 1988, 1992 forested and wet meadow areas intermixed.*

Source: WDNR 1988; WDNR 1992. From the Wisconsin Wetland Inventory. See Appendix K, page 28 to 31.

3.7 AIR QUALITY

3.7.1 Hardwood Range Expansion and Associated Restricted Airspace

Air quality in a given location is described by the concentration of various pollutants in the atmosphere, generally expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). Air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. The significance of a pollutant concentration is determined by comparing it to Federal and state ambient air quality standards. These standards represent the maximum allowable atmospheric concentrations that may occur and still protect public health and welfare, with a reasonable margin of safety. The Federal standards are established by the EPA and termed the National Ambient Air Quality Standards (NAAQS). The State of Wisconsin has adopted the NAAQS plus a state ambient air quality for total suspended particulates (TSP) (see Wisconsin Administrative Code, Chapter NR 404.04). The NAAQS and Wisconsin standards are presented in Table 3-11.

The main pollutants of concern are ozone (O_3), CO, NO_x, sulfur dioxide (SO_2) and particulate matter equal to or less than 10 microns in diameter (PM_{10}). NO_x include all oxides of nitrogen; primarily nitrogen dioxide (NO_2) and nitric oxide (NO). NO_x emissions are of concern because of their potential contribution to ozone formation. Only that portion of total NO_x which is measurable as NO_2 is subject to the NAAQS. Although there is no NAAQS for VOCs, emissions of VOC are of concern since they are considered to be ozone precursors. The previous NAAQS for particulate matter were based upon total suspended particulate (TSP) levels; they were replaced in 1987 by ambient standards based only on the PM_{10} fraction of TSP. Lead is not addressed in this EIS because the only sources of lead emissions are small arms (i.e., no lead from jet fuel, bombs, rockets, or 20-30 mm munitions). Lead concentrations are monitored in a number of high population density areas throughout the United States, and all areas currently meet the quarterly primary and secondary standard of 1.5 $\mu g/m^3$.

The Hardwood Range is located in the townships of Finley and Armenia in Juneau County in North Central Wisconsin. The Falls 1 and 2 MOAs and Volk South MOA also cover the following counties: Trempealeau, Monroe, Jackson, Wood, Adams, La Crosse, Eau Claire, and Clark. The North Central Wisconsin Air Region extends from the Northern Highland south through the Central Plain. The flat surface of the Northern Highland slopes from elevations of 1,700 feet in the north to 1,000 feet in the south and is interrupted by numerous hills in between. In the northern counties, most of the land area is forested. South of Marathon County, the land is mostly devoted to agricultural use. It is generally flat with less than 100 feet of relief. (Wood, Juneau, and Adams Counties are south of Marathon County.) Population and industry are concentrated along the Wisconsin River Valley in the Wausau, Stevens Point, and Wisconsin Rapids area. Major industrial activity consists of paper mills and electrical power generation.

Table 3-11. Ambient Air Quality Standards

AIR POLLUTANT	AVERAGING TIME	(FEDERAL) NAAQS		WISCONSIN AAQS	
		PRIMARY	SECONDARY	PRIMARY	SECONDARY
Carbon Monoxide	8-hour	9 ppm	9 ppm	9 ppm	9 ppm
	1-hour	35 ppm	35 ppm	35 ppm	35 ppm
Nitrogen Dioxide	Annual	0.053 ppm	0.053 ppm	0.05 ppm	0.05 ppm
Sulfur Dioxide	Annual	0.03 ppm	----	0.03 ppm	----
	24-hour	0.14 ppm	----	0.14 ppm	----
	3-hour	----	0.5 ppm	----	0.5 ppm
Total Suspended Particulate	AGM	----	----	----	----
	24-hour	----	----	----	150 $\mu g/m^3$
PM_{10}	AAM	50 $\mu g/m^3$	50 $\mu g/m^3$	50 $\mu g/m^3$	50 $\mu g/m^3$
	24-hour	150 $\mu g/m^3$	150 $\mu g/m^3$	150 $\mu g/m^3$	150 $\mu g/m^3$
Ozone	1-hour	0.12 ppm	0.12 ppm	0.12 ppm	0.12 ppm
Lead	Calendar Quarter	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$

NOTES: AGM = Annual Geometric Mean; AAM = Annual Arithmetic Mean; ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter.

3.7.1.1 Climatology

Climatological conditions are primary factors that influence air quality. Precipitation, wind direction and speed, and atmospheric temperature inversions are factors that determine the extent of the pollutant dispersion. Wisconsin has a typical continental climate with a large annual range of temperature. The coldest temperatures occur during the passage of frigid air masses transported into Wisconsin by a strong northwestern flow out of the Canadian Arctic. Warmest temperatures occur in the summer months, at the peak of south to southwestern flow from the desert southwest and the Gulf of Mexico. The Great Lakes have a buffering effect on temperature and result in increased cloudiness in winter. The lakes also increase atmospheric stability in late spring and early summer, leading to the trapping of air pollutants near the surface. In winter, when the lakes are warmer than the land, the atmosphere is less stable, and more likely to mix with cleaner air occurring higher in the atmosphere. In areas away from the influence of the Great Lakes, local climates reflect both the general continental climate of the upper Midwest and the distinctive topography of each site. Elevation and topography can affect local temperature, precipitation, stability, and wind patterns.

3.7.1.2 Regional Air Quality

According to EPA guidelines, an area with air quality better than the NAAQS is designated as being in attainment; areas with poorer air quality are classified as nonattainment areas. An area is considered to be in attainment of a NAAQS (except for

ozone and those based upon annual average or annual arithmetic means) if the standards for the pollutant are not exceeded more than once per year. An area is considered to be in attainment for ozone if maximum hourly concentration exceeds the standard on no more than one day per calendar year. Pollutants in an area may be designated as unclassified when there is a lack of data for the EPA to form a basis for establishing attainment status. For regulatory purposes, unclassified areas are treated as attainment areas. The attainment status of the different areas affected by the expansion of the Hardwood Range is given below.

The existing air quality of the affected environment is defined by air quality data and emissions information. Air quality data are obtained by examining air quality monitoring records collected by the State of Wisconsin from monitoring stations in the surrounding area. Information on pollutant concentrations measured for short-term (24 hours or less) and long-term (annual) averaging periods is extracted from the monitoring station data in order to characterize the existing air quality background of the area.

The closest ozone monitoring sites to the Hardwood Range are located in Vernon, Marathon, and Columbia Counties. The maximum 1-hour concentrations for ozone in 1995 were 0.091, 0.088 at the Vernon and Marathon stations, and 0.118 ppm at the Columbia station. The three stations did not register any exceedances of the Federal or state standards in 1995, the latest available monitoring data. Two NO_2 monitoring stations in Milwaukee showed annual arithmetic means of 0.0247 and 0.017 ppm in 1995, which were well below the primary national standard of 0.050 ppm. CO was monitored at 10 sites in Wisconsin during 1995. There were no exceedances of the Federal and state standards. The highest maxima were recorded in Dane County at 5.1 ppm (8-hour average) and in Milwaukee at 8.9 ppm (1-hour average), which are below the national standard.

3.7.1.3 Current Attainment Status

The Hardwood Range, R-6904, Falls 1 and 2 MOAs, and the Volk South MOA cover portions of Juneau, Trempealeau, Monroe, Jackson, Wood, Adams, La Crosse, Eau Claire, and Clark Counties, Wisconsin. According to Federal regulations (40 CFR 81) and the WDNR, Bureau of Air Management, the entire state of Wisconsin is in attainment of the NAAQS and the Wisconsin AAQS for CO, SO_2, NO_2, lead, and PM_{10}. While several Wisconsin counties on or near the Lake Michigan shoreline are designated as nonattainment of the NAAQS for ozone, all nine of the counties listed above that involve the Proposed Action are designated as attainment for ozone. There are two areas in the State located near industrial facilities which are designated nonattainment for SO_2 and are currently undergoing redesignation to attainment status, Rib Mountain and Weston/Rothschild in Marathon County. These areas will not be impacted by the Proposed Action.

Certain national parks and wilderness areas are designated as PSD Class I areas, where any appreciable deterioration in air quality or impairment of visibility is considered significant. There is one PSD Class I Area in Wisconsin. The closest PSD Class I Area to the Proposed Action is located in the Rainbow Lake area located in the Chequamegon National Forest, north of Drummon in Bayfield County, Wisconsin. The area is over 100 miles north of the VR-1616 and would not be affected by the Proposed Action.

3.7.1.4 Emission Calculations

The quantity of fuel required for each sortie was calculated based upon the amount of time required to complete each sortie and the engine requirements for the aircraft utilizing the airspace. Each aircraft was assumed to perform sorties in military mode. Emissions factors from "*Calculation Methods for Criteria Air Pollutant Emission Inventories*" (Jagielski and O'Brien 1994), from "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources" (EPA 1992), and from the Holloman Air Force Base (AFB) engine test cell (Holloman 1995) were used to estimate the annual emissions of regulated pollutants. Table 3-12 details the emission factors used for various aircraft.

Table 3-12. Aircraft Emission Factors

AIRCRAFT	AIRCRAFT EMISSIONS (LBS/HR)				
	CO	VOC	NO_X	SO_X	PM_{10}
F-16	9.3	1.0	278.6	5.6	3.5
F-15	18.6	2.1	557.3	11.1	7.0
B-52	101.2	35.7	595.2	32.1	103.0
B-1	303.4	16.0	91.8	21.6	0.8
A-6	10.5	13.7	192.4	8.0	14.7
A-10	11.9	0.5	58.0	2.9	5.4
AH-1	2.3	0.2	4.3	0.4	0.7
B-2	303.4	16.0	91.8	21.6	0.8
C-26	0.7	0.1	11.3	0.5	0.9
C-130	19.3	3.7	85.6	5.0	4.2
F-18	17.0	5.0	406.7	8.7	45.4
F-117	18.0	5.3	432.2	8.7	48.2
PA-200	34.5	1.0	151.4	4.5	7.7
UH-1	2.3	0.2	4.3	0.4	0.7
Lear Jet	4.5	0.4	49.6	1.8	3.3

Source: Jagielski and O'Brien 1994; EPA 1992

Current emissions at the Hardwood Range and associated R-6904A/B are primarily a result of aircraft flying operations. The aircraft emissions were calculated using the methods and assumptions outlined in Section 3.7.1.4. A sortie time of 20 minutes was used for all aircraft. Baseline emissions for the Hardwood Range and R-6904A/B are shown in Table 3-13.

Table 3-13. Baseline Emissions at the Hardwood Range and Restricted Area R-6904A/B

AIRCRAFT	ANNUAL SORTIES	AIRCRAFT EMISSIONS (LB/YR)				
		CO	VOC	NO_X	SO_X	PM_{10}
F-16	4,093	12,675	1,405	380,158	7,603	4,775
F-15	100	619	69	18,576	372	233
B-52	50	1,687	595	9,920	536	1,716
B-1	50	5,057	266	2,530	359	13
A-6	50	174	228	3,206	133	246
A-10	50	199	9	967	49	90
AH-1	50	38	3	72	6	11
B-2	50	5,057	266	1,530	359	13
C-26	50	12	2	189	8	15
C-130	200	1,288	245	5,704	331	277
F-18	50	283	84	6,779	145	757
F-117	50	301	89	7,203	145	803
PA-200	50	575	17	2,523	76	129
UH-1	50	38	3	72	6	11
Lear Jet	49	74	6	811	29	53
Total	**4,992**	**28,075**	**3,286**	**439,240**	**10,158**	**9,145**
Total Emissions (ton/yr)		**14.0**	**1.6**	**219.6**	**5.1**	**4.6**

3.7.2 MOA Utilization

Current emissions from aircraft operations within the Falls 1 and 2 MOAs and from the Volk South MOA were calculated using the methods and assumptions outlined in Section 3.7.1.4. A sortie time of 30 minutes was used for all aircraft. Baseline emissions for the Falls 1 and 2 MOA and the Volk South MOA are shown in Tables 3-14, 3-15, and 3-16, respectively.

Table 3-14. Baseline Emissions at the Falls 1 MOA

AIRCRAFT	ANNUAL SORTIES	AIRCRAFT EMISSIONS (LB/YR)				
		CO	VOC	NO_X	SO_X	PM_{10}
F-16	2,115	9,824	1,089	294,662	5,893	3,701
F-15	16	149	16	4,458	89	56
B-52	2	101	36	595	32	103
B-1	2	303	16	92	22	1
A-6	4	21	27	385	16	29
A-10	4	24	1	116	6	11
AH-1	3	3	0	7	1	1
B-2	3	455	24	138	32	1
C-26	3	1	0	17	1	1
C-130	4	39	7	171	10	8
F-18	4	34	10	813	17	91
F-117	4	36	11	864	17	96
PA-200	3	52	2	227	7	12
UH-1	3	3	0	7	1	1
Lear Jet	3	7	1	74	3	5
Total	**2,173**	**11,052**	**1,241**	**302,626**	**6,146**	**4,118**
Total Emissions (ton/yr)		**5.5**	**0.6**	**151.3**	**3.1**	**2.1**

Table 3-15. Baseline Emissions at the Falls 2 MOA

AIRCRAFT	ANNUAL SORTIES	AIRCRAFT EMISSIONS (LB/YR)				
		CO	VOC	NO_X	SO_X	PM_{10}
F-16	1,310	6,085	675	182,509	3,650	2,293
F-15	10	93	10	2,786	56	35
B-52	2	101	36	595	32	103
B-1	2	303	16	92	22	1
A-6	2	10	14	192	8	15
A-10	2	12	1	58	3	5
AH-1	2	2	0	4	0	1
B-2	2	303	16	92	22	1
C-26	2	1	0	11	0	1
C-130	3	29	6	128	7	6
F-18	2	17	5	407	9	45
F-117	2	18	5	432	9	48
PA-200	2	34	1	151	5	8
UH-1	2	2	0	4	0	1
Lear Jet	2	5	0	50	2	3
Total	**1,347**	**7,017**	**784**	**187,513**	**3,824**	**2,565**
Total Emissions (ton/yr)		**3.5**	**0.4**	**93.8**	**1.9**	**1.3**

Table 3-16. Baseline Emissions at the Volk South MOA

AIRCRAFT	ANNUAL SORTIES	AIRCRAFT EMISSIONS (LB/YR)				
		CO	VOC	NO_X	SO_X	PM_{10}
F-16	332	1,542	171	46,254	925	581
F-15	18	167	19	5,016	100	63
B-52	0	0	0	0	0	0
B-1	0	0	0	0	0	0
A-6	2	10	14	192	8	15
A-10	2	12	1	58	3	5
AH-1	1	1	0	2	0	0
B-2	1	152	8	46	11	0
C-26	1	0	0	6	0	0
C-130	2	19	4	86	5	4
F-18	2	17	5	407	9	45
F-117	2	18	5	432	9	48
PA-200	2	34	1	151	5	8
UH-1	1	1	0	2	0	0
Lear Jet	2	5	0	50	2	3
Total	**368**	**1,979**	**227**	**52,702**	**1,076**	**774**
Total Emissions (ton/yr)		**1.0**	**0.1**	**26.4**	**0.5**	**0.4**

3.7.3 Overlap with VR-1616 and VR-1650

In considering cumulative effects, two MTRs that interact with some of the airspace elements associated with the action alternatives will be addressed. VR-1616 passes through the area of the Falls 1 MOA and VR-1650 passes briefly through the area of the Falls 1 MOA, then through the area of the Falls 2 MOA. The baseline aircraft emissions from these MTRs were calculated (using the approach outlined in section 3.7.1.4) for only those portions of the two MTRs that overlap with the MOAs. These emissions are presented below in Tables 3-17 and 3-18 for VR-1616 and VR-1650, respectively. For this analysis, the flight times, shown in each of the following two tables, reflect only those portions of the MTR sorties that are flown through the MOAs considered above.

Table 3-17. Baseline Emissions from Aircraft Operations in VR-1616 that Overlap with the Falls 1 MOA

AIRCRAFT	ANNUAL SORTIES	DURATION (MIN)	AIRCRAFT EMISSIONS (LB/YR)				
			CO	VOC	NO_X	SO_X	PM_{10}
F-16	1,646	4.13	1,053	117	31,570	631	397
F-15	40	4.13	51	6	1,534	31	19
B-52	20	5.31	179	63	1,054	57	182
B-1	20	3.65	369	19	112	26	1
A-6	35	4.13	25	33	463	19	36
A-10	35	6.64	46	2	225	11	21
B-2	35	4.13	731	38	221	52	2
C-26	35	6.20	3	0	41	2	3
F-18	35	4.13	41	12	980	21	109
F-117	36	4.13	45	13	1,071	22	119
PA-200	35	4.13	83	2	365	11	19
Lear Jet	35	5.31	14	1	154	5	10
Total	**2,007**		**2,639**	**308**	**37,789**	**888**	**918**
Total Emissions (ton/yr)			**1.3**	**0.2**	**18.9**	**0.4**	**0.5**

Table 3-18. Baseline Emissions from Aircraft Operations in VR-1650 which Overlap with the Falls 1 and 2 MOAs

AIRCRAFT	ANNUAL SORTIES	DURATION (MIN)	AIRCRAFT EMISSIONS (LB/YR)				
			CO	VOC	NO_X	SO_X	PM_{10}
F-16	321	3.33	166	18	4,964	99	62
Total Emissions (ton/yr)			**0.1**	**0.0**	**2.5**	**0.0**	**0.0**

3.8 BIOLOGICAL RESOURCES

The biological resources included in the analysis for the proposed airspace actions include terrestrial wildlife (excluding livestock), and threatened, endangered, and sensitive species. The terrestrial and aquatic vegetation (including wetlands and riparian areas) are described to provide background information but are not included in the airspace analysis, since these resources would not be affected by changes in configuration or utilization of airspace. The ROI for biological resources includes the Hardwood Range and proposed expansion area, the airspace and underlying land area associated with Restricted Airspace R-6904A, Falls 1 MOA, Falls 2 MOA, and Volk South MOA. Additional information on biological resources of the area is included in the Land Use Management Guidelines (WIANG 1996; WIANG 1997 - see Appendix K) and the Biological Survey (NGB 1997; WIANG 1998 - see Appendix L).

3.8.1 Hardwood Range And Associated Restricted Airspace

The Hardwood Range and proposed expansion area are located within what is referred to as the *tension zone* — a vegetational transition area lying between the prairie-forest province in the southwest portion of the state and the northern hardwoods province in the northeast (Curtis 1959). This transition zone, or ecotone, contains a blending of plant species from both provinces with southern species approaching their northern range limits and northern species approaching their southern limits. Jackson (1961) and Robbins (1991) document similar transitional phenomena for mammal and bird species, respectively, in the area of the Hardwood Range. For mammal species, the Hardwood Range lies between the Canadian Life Zone to the north and the Upper Austral Life Zone to the south. For bird species, the Hardwood Range lies on the border between the Central Sand Plain to the south and the Tension Zone West and Central to the north. The transitional nature of the area creates a unique situation where northerly and southerly plant and animal species are intermingled.

Hardwood Range is north and east of a hilly area known as the Driftless Area. As evidenced by its buttes and mesas, the Driftless Area escaped glaciation during the Wisconsin Age although it very likely was glaciated in earlier, more extensive ages such as the Illinoian, Kansan, and Nebraskan (Martin 1965). This area is widely believed to have functioned as a refugium for many species during the Wisconsin Age, subsequently serving as a population source for recolonization of glaciated regions (Vogt 1981).

3.8.1.1 <u>Flora</u>

Plant communities within the Hardwood Range and the proposed expansion area were delineated from a combination of several sources including historic data and reports, the county soil surveys, and aerial photographs. Associations were named using the nomenclature of Curtis (1959) and the Wisconsin Natural Community Working List, developed by the Wisconsin Natural Heritage Inventory (NHI). Dominant plant species listed for each plant community are primarily those reported by Curtis, but also include field observations (Curtis 1959). The composition of these plant communities is frequently very different from the original reported by Curtis (1959) due to changes in land use, forestry management, and the hydrology of the area.

Three general categories (based on growth form and life histories of the dominants) of vegetation cover exist within the Hardwood Range and the proposed expansion area — herbaceous communities, tall shrub communities, and forest

communities. These general cover types are further divided into plant communities identified by Curtis (1959) based on species composition and moisture regime within the community. Major plant communities of the Hardwood Range and the proposed expansion are discussed below.

Herbaceous Communities

This category includes the wet-mesic prairies, which are dominated by grasses (Graminae) and forbs, and the sedge meadows, which are dominated by sedges (*Carex* spp.), grasses, and forbs. Together, these communities comprise 0.5 percent (37 acres) of the proposed expansion area and 5.3 percent (420 acres) of Hardwood Range (see Appendix L).

Wet-Mesic Prairie. Wet-mesic prairies are dominated by big bluestem (*Andropogon gerardi*), bluejoint reed grass (*Calamagrostis canadensis*), prairie cordgrass (*Spartina pectinata*), Canada wildrye (*Elymus canadensis*), and panic-grass (*Panicum leibergii*) (Curtis 1959). These communities are found on Newson and Meehan soils primarily within the existing target area at the Hardwood Range. Low prairies are located on lowlands subject to ponding and/or flooding for a significant portion of the growing season. The soils of wet-mesic prairies have drainage impeded by a high water table or the presence of an impermeable soil layer. In an undrained condition, these areas meet the USACE jurisdictional wetland criteria.

Sedge Meadow. Sedge meadows are dominated by: hummock sedge (*Carex stricta*) and other sedges; bluejoint reed grass; fowl meadow grass (*Poa palustris*); rattlesnake and fowl manna grasses (*Glyceria canadensis* and *G. striata*); and prairie cordgrass (Curtis 1959). These areas are found on the Newson and Dawson soils within the Hardwood Range and proposed expansion area. The soils of sedge meadows have drainage impeded by a high water table or the presence of an impermeable soil layer. In an undrained condition, these areas meet the USACE jurisdictional wetland criteria.

Tall Shrub Communities

The tall shrub communities are fairly stable intermediate stages in succession from wet prairie, fen, and sedge meadow to lowland forest or conifer swamp. They are widely distributed throughout the state wherever the moist herbaceous communities are present. Curtis (1959) identified two tall shrub communities in Wisconsin — the alder thicket and southern shrub-carr. The two communities have different ranges; the alder type is primarily north of the tension zone and the non-alder type is south of it. Within the Hardwood Range and the proposed expansion area, the tall shrub communities are composed of both northern and southern species. However, tag alder (*Alnus rugosa*, the dominant species in alder thicket) was never observed as the dominant species at the Hardwood Range, so these areas more closely resemble southern shrub-carr.

Southern Shrub-Carr. Shrub-carr is dominated by red osier dogwood (*Cornus stolonifera*), pussy willow (*Salix discolor*), Bebb's willow (*Salix bebbiana*), meadow willow (*Salix petiolaris*), and meadowsweet (*Spirea alba*) (Curtis 1959). These areas are found on the Newson and Dawson soils within the Hardwood Range and proposed expansion area. The soils of shrub-carr have drainage impeded by a high water table or the presence of

an impermeable soil layer. In an undrained condition, these areas meet the USACE jurisdictional wetland criteria. Shrub-carr communities are found on approximately 628 acres (8.8 percent) of the proposed expansion area and 293 acres (3.7 percent) of Hardwood Range (see Appendix L).

Forested Communities

The forested communities within the Hardwood Range and the proposed expansion area are composed of both northerly and southerly species. The forested communities tend to be quite stable, although they may gradually move toward a more mesic condition in the absence of disturbance. Species composition and/or physiognomy of the forests within the Hardwood Range and the proposed expansion area are very different from the original reported by Curtis (1959). This is probably caused by several factors, including, but not limited to the current absence of fire; current forestry management practices; and the historic attempts to drain and farm the area.

Mixed Deciduous Woodland. Mixed deciduous woodlands are the most prevalent habitat type at the proposed expansion area and Hardwood Range. This vegetation type is variable and includes characteristics of both early-successional southern hardwood forests and northern hardwoods. Communities tend to be dry to dry-mesic with a crown closure (more than 5 meters high) typically exceeding 50 percent (Curtis 1959). Communities are typically dominated by various oak species *(Quercus* sp.) including black *(Q. velutina)*, white *(Q. alba)*, pin *(Q. ellipsoidalis)*, and red *(Q. rubra)*. Pines *(Pinus* sp.) are also one of the major dominants including red *(P. resinosa)*, jack *(P. banksiana)*, and white pine *(P. strobus)*. Red maple *(Acer rubrum)*, quaking aspen *(Populus tremuloides)* and big tooth aspen *(P. grandidentata)* also tend to occur on the more moist sites. Herbaceous species noted during July and August include bracken fern *(Pteridium aquilinum)*, sedge *(Carex* sp.), false Solomon's seal *(Smalicina racemosa)*, twisted stalk *(Streptopus roseus)* and blueberry *(Vaccinium* sp.). These communities are widely distributed throughout the entire expansion area and along the northern and eastern half of the Hardwood Range. Mixed deciduous woodlands cover approximately 5,095 acres (71 percent) of the proposed expansion area and 6,327 acres (80 percent) of Hardwood Range (see Appendix L).

Pine Woodland. Pine woodlands occur as a remnant community type in the expansion area and eastern half of the Hardwood Range. The pines may occur in nearly pure stands of a single species or in mixtures of jack *(P. resinosa)*, red *(P. banksiana)*, and white pine *(P. strobus)*, and are generally the result of reforestation efforts that occurred during the 1940s and 1950s. The growth form of the pines is typically a predominating central trunk, great height, small taper, and small branches. In mature pine stands, hardwoods such as red maple *(A. rubrum)* and quaking aspen *(P. tremuloides)* are found. Aspen is usually a pioneer invader following forest fires, and is extremely intolerant of shade (Curtis 1959). The herbaceous layer can be fairly variable; in some of the stands it is practically non-existent, consisting of only a litter of needles. Other herbaceous species noted during July and August include sedge *(Carex* sp.), bracken fern *(P. aquilinum)*, and blueberry *(Vaccinium* sp.). Pine woodlands cover approximately 939 acres (13 percent) of the proposed expansion area and 349 acres (4 percent) of Hardwood Range (see Appendix L).

Dry Oak Woodland. In general, the dry oak woodland habitat is dominated by oaks including white *(Q. alba)*, black *(Q. velutina)*, red *(Q. rubra)*, and pin oak *(Q. ellipsoidalis)*, but while, red, and jack pine *(P. strobus, P. banksiana*, and *P. resinosa)* may be associated in some stands. Canopy closure exceeds 50 percent. Ground cover is typically bracken fern *(P. aquilinum)*, sweet fern *(Comptonia peregrina)*, big bluestem *(Andropogon gerardi)*, little bluestem *(Andropogon scoparius)*, sedge *(Carex* sp.), and blueberry *(Vaccinium* sp.). Oak stands within the expansion area and Hardwood Range occur in small, isolated pockets within the mixed deciduous woodland type (see Appendix L). Because of the difficulty of sampling this habitat, the area covered by dry oak woodlands within the proposed expansion area and Hardwood Range are included in the acreages of mixed deciduous woodlands, above.

Restricted Area R-6904A is above other relatively undeveloped areas such as Wood County Forest; Necedah National Wildlife Refuge (NWR); Sandhill, Meadow Valley, and Wood County State Wildlife Areas (SWAs). Therefore, the plant communities and flora within Restricted Area R-6904A are probably similar to those recorded at Hardwood Range. The only exception is the scattered agricultural lands that exist within R-6904A that are not present within the Hardwood Range or proposed expansion area.

3.8.1.2 Fauna

The fauna within the existing Hardwood Range has not been extensively documented. Lists of wildlife species compiled in 1994 for the Hardwood Range and Volk Field indicated the documented or likely presence of 55 species of mammals, 17 species of reptiles, 12 species of amphibians, and 246 species of resident or transient birds (WIANG 1994). In general, the various habitat types present on or near the range support different faunal components (NGB 1990). Species are present in the area when the basic resources of food, cover, water, nesting, and denning sites are present and they are adapted to the climate and competitors and predators of the area.

Mammal species with potential to occur within the bounds of Restricted Area R-6904A include the eastern mole (*Scalopus aquaticus*), little brown bat (*Myotis lucifugus*), white-footed deer mouse (*Peromyscus leucopus*), eastern chipmunk (*Tamias striatus*), gray squirrel (*Sciurus carolinensis*), mink (*Mustela vision*), coyote (*Canis latrans*), and white tailed deer (*Odocoileus virginianus*).

Bird species with potential to occur within the bounds of Restricted Area R-6904A include the pied-billed grebe (*Podilymbus podiceps*), great blue heron (*Ardea herodias*), wood duck (*Aix sponsa*), mallard (*Anas platyrhynchos*), red-tailed hawk (*Buteo jamaicensis*), kestrel (*Falco sparverius*), American woodcock (*Scolopax minor*), belted kingfisher (*Ceryle alcyon*), northern flicker (*Colaptes auratus*), blue jay (*Cyanocitta cristata*), American crow (*Corvus brachyrhynchos*), American robin (*Turdus migratorius*), red-eyed vireo (*Vireo olivaceus*), yellow warbler (*Dendroica petechia*), song sparrow (*Melospiza melodia*), common grackle (*Quiscalus quiscula*), and American goldfinch (*Carduelis tristis*).

Reptile and amphibian species with potential to occur within the bounds of Restricted Area R-6904A include the American toad (*Bufo americanus*), western chorus frog (*Pseudacris triseriata triseriata*), northern spring peeper (*Pseudacris [= Hyla] crucifer crucifer*), gray tree frog (*Hyla versicolor and Hyla chrysoscelis*), northern leopard frog (*Rana pipiens*), painted turtle (*Chrysemys picta*), snapping turtle (*Chelydra serpentina*),

eastern garter snake (*Thamnophis sirtalis sirtalis*), eastern hognose snake (*Heterodon platyrhinos*), and eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*).

Fish species with potential to occur within the bounds of Restricted Area R-6904A include the central mudminnow (*Umbra limi*), hornyhead chub (*Nocomis biguttatus*), common shiner (*Notropis cornutus*), northern redbelly dace (*Phoxinus eos*), fathead minnow (*Pimephales promelas*), white sucker (*Catostomus commersoni*), creek chub (*Semotilus atromaculatus*), pumpkinseed (*Lepomis gibbosus*), northern pike (*Esox lucius*), and walleye (*Stizostedion vitreum vitreum*).

3.8.1.3 Threatened and Endangered Species

Threatened, endangered, and other rare species recorded within and/or near the Restricted Area R-6904A were identified by WDNR Bureau of Endangered Resources from the NHI database and by the U.S. Fish and Wildlife Service (USFWS) (Table 3-19). Categories include Federal- and state-designated endangered and threatened species; those species proposed for Federal listing as endangered or threatened, Federal candidate species (under review for listing); and special concern (watch) species. Special concern species are WDNR-designated species about which some problem of abundance or distribution is suspected but not yet proved. The NHI database contains information on the documented occurrences of rare species statewide. Additionally, in a letter dated November 1999 (U.S. Department of Interior [DOI] 1999), the USFWS stated that it is premature to prepare a biological assessment (BA) at this time. (Also refer to Section 4.8.2.)

A review of the WDNR species list and discussions with U.S. Fish and Wildlife Service (USFWS) indicated that the Hardwood Range and the proposed expansion area had not been extensively inventoried. Based upon this finding, a Biological Survey (NGB 1997; WIANG 1998) was conducted on the existing range and the proposed expansion area to provide additional baseline information (see Appendix L). Only the Karner blue butterfly (*Lycaeides melissa samuelis*, state special concern, Federal endangered) has been reported on the existing Hardwood Range. Only the striped hairstreak (*Satyrium liparops strigosum*, state special concern) has been reported within the proposed expansion area. From surveys conducted by WIANG or Hardwood Range in 1995 and 1996, the Karner blue is known to exist within the southern portion of the target complex at the Hardwood Range. Additional surveys conducted in the proposed expansion area in 1996 identified four previously undocumented wild lupine sites, but Karner blue butterflies were not detected (NGB 1997; WIANG 1998). However, occurrence of Karner blue butterflies at these sites cannot be precluded.

Of the rare species identified by WDNR, habitat for only a subset of these species likely exists within the Hardwood Range and proposed expansion area. Additional state- and federally-listed threatened and endangered (T&E) species that are most likely present within the Hardwood Range and the proposed expansion area include the eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*, state endangered, Federal candidate), red-shouldered hawk (Buteo lineatus, state threatened), Blanding's turtle (state threatened, Federal candidate), and the frosted elfin (*Incisalia irus*, state threatened). In addition, several state special concern species are often associated with the Karner blue butterfly and their habitat, including: hoary elfin (*Incisalia polia*); striped hairstreak; and Persius dusky wing (Erynnis persius persius).

An additional category of rare species that should be identified is the federally-protected species for which currently unoccupied but suitable habitat exists within R-6904A. This category would include one species — the timber wolf (*Canis*

Table 3-19. Threatened, Endangered, and Other Rare Species Recorded Within and/or Near Restricted Air Space R-6904A

SPECIES	*COMMON NAME*	*WISCONSIN STATUS*[a]	*U.S. STATUS*[b]
Plants			
Arabis missouriensis var. deamii	*Missouri rock cress*	*Special concern*	*Under review for listing*
Arethusa bulbosa	*dragon's mouth*	*Special concern*	*None*
Asclepias lanuginosa	*wooly milkweed*	*Threatened*	*None*
Bartonia virginica	*screwstem*	*Special concern*	*None*
Calamagrostis stricta ssp. *inexpansa*	*bog reed grass*	*Special concern*	*None*
Carex cumulata	*clustered sedge*	*Special concern*	*None*
Carex livida var. radicaulis	*livid sedge*	*Special concern*	*None*
Didiplis diandra	*water purslane*	*Special concern*	*None*
Eleocharis engelmannii	*Engelmann spike-rush*	*Special concern*	*None*
Festuca paradoxa	*cluster fescue*	*Special concern*	*None*
Malaxis brachypoda	*white adder's-mouth*	*Special concern*	*Under review for listing*
Myriophyllum farwellii	*Farwell's water-milfoil*	*Special concern*	*None*
Ophioglossum vulgatum var. pseudopodum	*adder's-tongue*	*Special concern*	*None*
Opuntia fragilis	*brittle prickly-pear*	*Threatened*	*None*
Orobanche uniflora	*one-flowered broomrape*	*Special concern*	*None*
Platanthera flava var. herbiola	*tubercled orchid*	*Threatened*	*None*
Poa paludigena	*bog bluegrass*	*Threatened*	*Under review for listing*
Polygala cruciata	*cross milkwort*	*Special concern*	*None*
Potamogeton confervoides	*algal-leaved pondweed*	*Threatened*	*Under review for listing*
Potamogeton vaseyi	*vasey's pondweed*	*Special concern*	*None*
Utricularia geminiscapa	*twin-stemmed bladderwort*	*Special concern*	*None*
Rhexia virginica	*meadow beauty*	*Special concern*	*None*
Invertebrates			
Aeshna verticalis	*green-striped darner*	*Special concern*	*None*
Atrytonopsis hianna	*dusted skipper*	*Special concern*	*None*
Erynnis persius persius	*Persius dusky wing*	*Special concern*	*None*
Hemileuca maia	*buck moth*	*Special concern*	*None*

Table 3-19. Threatened, Endangered, and Other Rare Species Recorded Within and/or Near Restricted Air Space R-6904A (continued)

SPECIES	*COMMON NAME*	*WISCONSIN STATUS*[a]	*U.S. STATUS*[b]
Hesperia leonardus leonardus	*Leonard's skipper*	*Special concern*	*None*
Incisalia irus	*frosted elfin*	*Threatened*	*None*
Incisalia polia	*hoary elfin*	*Special concern*	*None*
Lycaeides melissa samuelis	*Karner blue butterfly*	*Special concern*	*Endangered*
Somatochlora incurvata	*warpaint emerald*	*Special concern*	*None*
Somatochlora tenebrosa	*clamp-tipped emerald*	*Special concern*	*None*
Fish			
Lythrurus umbratilis	*redfin shiner*	*Threatened*	*None*
Reptiles and Amphibians			
Clemmys insculpta	*wood turtle*	*Threatened*	*None*
Emydoidea blandingii	*Blanding's turtle*	*Threatened*	*Under review for listing*
Ophisaurus attenuatus	*western slender glass lizard*	*Endangered*	*None*
Sistrurus catenatus catenatus	*eastern massasauga rattlesnake*	*Endangered*	*Under review for listing*
Birds			
Buteo lineatus	*red-shouldered hawk*	*Threatened*	*None*
Casmerodius albus	*great egret*	*Threatened*	*None*
Dendroica cerulea	*cerulean warbler*	*Threatened*	*Under review for listing*
Empidonax virescens	*acadian flycatcher*	*Threatened*	*None*
Haliaeetus leucocephalus	*bald eagle*	*Delisted*	*Threatened*
Nyctanassa violacea	*yellow-crowned night-heron*	*Threatened*	*None*
Cyghus buccinator	*trumpeter swan*	*Special concern*	*None*
Pandion haliaetus	*osprey*	*Threatened*	*None*
Tympanuchus cupido	*greater prairie-chicken*	*Threatened*	*None*
Tympanuchus phasianellus	*sharp-tailed grouse*	*Special concern*	*None*
Tyto alba	*barn owl*	*Endangered*	*None*
Mammal			
Canis lupis	*timber wolf*	*Endangered*	*Endangered/ Threatened*

Notes: a. WDNR-designated status of the species in Wisconsin.
b. USFWS-designated status of the species in the United States.

Source: WDNR 1995b; WDNR 1997a

lupus, state and Federal endangered). WDNR live-captured a female timber wolf within five miles of R-6904A. The wolf was equipped with a radio-transmitting collar, released,

and is occasionally located from the air by fixed-wing aircraft. Recent locations indicate that this female may be using habitat within R-6904A. However, this has not yet been verified since R-6904A is restricted airspace. The capture and movements of this wolf indicate that the Hardwood Range, proposed expansion area, and R-6904A may contain suitable wolf habitat. According to Adrian Wydeven, Bureau of Endangered Resources Mammalian Ecologist, road densities within R-6904A are slightly above those areas in which a wolf would be expected to establish a territory. However, since most of R-6904A is forested and access to some roads is controlled by ANG, WDNR, and USFWS, the area likely contains suitable travel and dispersal habitat.

3.8.1.4 Sensitive Habitats

WDNR identified one state-designated natural area within the vicinity of the Hardwood Range, proposed expansion area, and R-6904A. The Cranberry Creek Mound Group State Park Natural Area lies along the southern boundary of R-6904A. Additionally, WDNR considers R-6904A and all of the MOAs to contain habitats sensitive for several plant and animal species, although these habitats lack official State designation.

3.8.2 MOA Utilization

3.8.2.1 Flora

Falls 1 and 2 MOAs

Falls 1 and Falls 2 MOAs lie primarily in Laurentian Mixed Forest Province as defined by Bailey (1980), with the western portion of Falls 1 MOA falling in the Eastern Deciduous Forest Province. The Laurentian Mixed Forest Province is transitional between the boreal forest further north and the deciduous zones to the south. It consists of either mixed stands of a few coniferous and deciduous species, or of a macromosaic with pure deciduous forest on areas with good soil, and pure coniferous forest on areas that have poorer soils. Several species of pine (*Pinus* spp.), spruce (*Picea* spp.), fir (*Abies* spp.), and hemlock (*Tsuga* spp.) represent the conifers in the mixed stands, depending on location. Pine trees are often the pioneer woody species following forest fires or on abandoned arable land. Conifers grow more rapidly than deciduous species on poor soils, and, therefore, constitute the upper tree stratum. Regeneration in such mixed stands is problematic, however, if the deciduous undergrowth is dense. For this reason, pine trees regenerate successfully where fire is recurrent. Wildfires occur commonly in such forests, particularly where soils are sandy and where there is a layer of dry litter in summer.

The Eastern Deciduous Forest Province is dominated by tall, broadleaf trees that provide a continuous and dense canopy in summer but shed their leaves completely in winter. The understory of small trees and shrubs is generally sparse. In spring, a luxuriant layer of herbs quickly develops, but this is greatly reduced after trees reach full foliage and shade the ground. The climax forest types in the area below Falls 1 MOA are Maple-Basswood Forest and Oak Savannah. Where forests have been cleared by logging, pines develop readily as second-growth vegetation. In poorly drained habitats, the deciduous forest consists of alder, willow, elm, and hydrophytic shrubs (Bailey 1980).

Extensive areas of red, white, and jack pine occur in the Black River State Forest in Jackson County. The forest also contains extensive areas of wetlands and

natural streams. Farmland underlying Falls 1 and 2 MOAs include cranberry bogs, corn and potato fields, and livestock ranges.

Volk South MOA

Volk South MOA lies primarily over the Laurentian Mixed Forest Province (Bailey 1980), described above.

Juneau County Forest, which is maintained for wildlife habitat, recreation, and sustainable forestry, is dominated by scrub oak, aspen, jack pine, and scrub willow. The ROI also contains large areas of wetlands and natural streams. Necedah NWR and Meadow Valley SWA contain areas of scrub oak-pine, early growth scrub oak-birch-aspen forests, sedge meadow, shrub-carr, and emergent and open-water wetlands. Tall-grass prairie in these wildlife areas is maintained only by intensive management practices such as burning and mowing. Lowland hardwood forests are limited to the flood plains of major streams, especially those of the Yellow, Black, and Wisconsin Rivers (NGB 1990).

3.8.2.2 Fauna

Falls 1 and 2 MOAs

In general, the various habitat types present within Falls 1 and 2 MOAs support different faunal components (NGB 1990). Croplands, when interspersed with brushland, woodland, or grassland, typically support white-tailed deer, red fox, quail, ring-necked pheasant, striped skunk, raccoon, coyote, eastern cottontail, woodchuck, and common passerines and raptors. Animals often associated with the tall grass prairie or woodland-prairie border include badger, Franklin's ground squirrel, western meadowlark, greater prairie chicken, and sharp-tail grouse. Wet meadows, shrub-carr, and marshes support beaver, muskrat, mink, various wading birds, and waterfowl such as Canada geese and dabbling ducks. Deciduous and mixed deciduous-coniferous forests provide habitat for numerous nesting species of passerines such as warblers, vireos, finches, thrushes, and woodpeckers; for game birds such as wild turkey and ruffed grouse; for raptors such as Cooper's hawks; and for mammals such as gray fox, eastern chipmunk, and red and gray squirrels.

Falls 1 and 2 MOAs include many managed wildlife areas of high biological value. These include five SWAs, five state fishery areas, and Black River State Forest. The wetland or aquatic wildlife areas are of particular importance for migratory waterfowl and other waterbirds. These MOAs are part of a major continental flyway for waterfowl, raptors, and passerines. Ducks and geese migrating along this flyway in the fall use the larger aquatic areas as stop-over habitat; many smaller areas are important for nesting.

The following areas of biological concern are located in or near Falls 1 and 2 MOAs:

- Black River State Forest includes nearly 65,000 acres on the edge of the glaciated central plain east of the Driftless Area. Important wildlife habitat, including wetlands and sedge meadows, is found in the Dike 17 area, which contains 12 flowages that provide a waterfowl staging area prior to migration in fall and spring. Canada geese, wood ducks, mallards, and blue-winged teal are among the waterfowl that use the area. Peak geese populations of up to 7,000 birds have been reported.

Other species present include double-crested cormorants, egrets, great blue herons, loons, bitterns, green herons, sandhill cranes, osprey, red-shouldered hawks, Cooper's hawks, sharp-tailed grouse, otters, beavers, muskrats, and mink. About 60 sandhill cranes migrate here in April to nest, and much larger flocks occur during fall migration.

- Tollefson Marsh, Lowe Creek, Vosse Coulee, Lakes Coulee, and West Taylor SWAs are all approximately 100-600 acres in size. These areas are owned and managed by the State of Wisconsin for preservation and management of native species such as wild turkey, fur-bearing mammals, and deer.

- Buffalo River, Northfield Lake, North Branch Trempealeau River, Trump Lake, and Big Creek State Fishery Areas are state-owned and were established to provide public access to these waterways and to manage native fish populations.

Volk South MOA

In general, the various habitat types present within Volk South MOA support faunal components similar to those in the Falls 1 and 2 MOAs (NGB 1990). Volk South MOA includes many managed wildlife areas of high biological value. These include the Wisconsin River and its flowages (especially the Petenwell and Castle Rock dam areas), Necedah NWR, Meadow Valley SWA, Juneau County Forest, and Buckhorn SWA. The wetland or aquatic wildlife areas are of particular importance for migratory waterfowl and other waterbirds. Volk South MOA is part of a major continental flyway for waterfowl, raptors, and songbirds. Ducks and geese migrating along this flyway in the fall use the larger aquatic areas as stop-over habitat; many smaller areas are important for nesting.

The following areas of biological concern are located in or near Volk South MOA:

- Necedah NWR covers a total area of approximately 65 square miles (41,720 acres) to the west and south of Hardwood Range. The refuge's primary purpose is to provide sanctuary for migrating waterfowl during fall stopover. Several managed waterbodies provide valuable resting and feeding grounds for these birds. Waterfowl are at highest density at the refuge during the primary migrating season, mid-September through early November. Although Necedah NWR also supports breeding populations of various waterfowl species, waterfowl are spread more evenly over the state during the rest of the year, including spring migration. Necedah NWR provides stopover habitat for approximately 19,000 to 25,000 dabbling ducks and 12,000 to 18,000 geese per year, and supports 1,000 roosting sandhill cranes (NGB 1990). The geese and cranes leave the refuge in the morning to feed in nearby fields and return at sundown. Sandhill crane nesting also occurs at the refuge.

- The Petenwell Flowage Dam is located 3 miles east of Necedah NWR on the Wisconsin River. The area below the dam provides wintering habitat for bald eagles. Fishing and hiking are also popular at the dam.

- The Meadow Valley SWA, adjacent to Necedah NWR to the west, is owned by USFWS but leased and managed by the State of Wisconsin for wildlife. Habitats in the 98-square-mile tract include extensive flowages, marshes,

and mixed forests. Wildlife species that occur here include ruffed grouse, woodcock, white-tailed deer, wild turkey, Canada goose, muskrat, mink, and beaver. Waterfowl and eagles concentrate in pools south of Hog Island and in other flowages. A bald eagle nesting territory occurs on at least one flowage in the area (USFWS 1995).

- Buckhorn State Park is located near Castle Rock Flowage on the Wisconsin River and contains marshes, sloughs, open areas, and scrub oak-jack pine-aspen forests within just over 3,000 acres. Mammal species known to be present include whitetail deer, red fox, coyote, red squirrel, fox squirrel, gray squirrel, skunk, raccoon, woodchuck, ground squirrel, chipmunk, cottontail rabbit, and porcupine. Bird species include ruffed grouse, pileated woodpecker, barred owl, woodcock, mallards, teal, wood ducks, red-winged blackbirds, kingfishers, sandpipers, and a variety of songbirds. It is suspected that the bobcat may be a resident or transient user of the area. Bald eagles winter below the dams, and at least two osprey territories have been established on transmission towers.

- Roche-a-Cri State Park contains 411 acres with similar natural communities and wildlife species to Buckhorn State Park. No federally Threatened or Endangered wildlife species are known to occur within the park.

3.8.2.3 Threatened and Endangered Species

USFWS and WDNR were contacted to identify T&E species that could be affected by the Proposed Action (see Appendix G correspondence). The USFWS and WDNR provided lists of federally and state threatened, endangered, and candidate wildlife species that may be present in the study area (Table 3-20) (USFWS 1995; USFWS 1997; WDNR 1995a; WDNR 1997b). Additionally, in a letter dated November 1999 (DOI 1999), the USFWS stated that it is premature to prepare a BA at this time. (Also refer to Section 4.8.2.)

Small numbers of bald eagle nesting pairs (estimated at fewer than six annually) are known to occur at times along flowages of the Wisconsin River and in the Meadow Valley and Necedah flowage areas near the Necedah NWR. Bald eagles are more common in the fall, when groups of 20 to 35 can be found at Necedah NWR where they scavenge crippled or dead waterfowl. Populations of bald eagles also winter at the Petenwell flowage dam on the Wisconsin River (NGB 1990).

Sightings of migrating peregrine falcons have been reported at Volk Field and at Necedah NWR (NGB 1990). No nesting has been observed in the area, but historically peregrines nested on cliffs along the Wisconsin River in lower Juneau, Wood, and Adams Counties, and this area is considered potential nesting habitat (USFWS 1995). Occasional nesting of ospreys has been reported in Necedah NWR.

A restoration effort for trumpeter swans, a State Endangered species, has released over 150 swans in Minnesota, Michigan, and Wisconsin. Trumpeter swans are currently or have recently been present on Necedah NWR, and plans have been developed for future reintroduction of trumpeter swans on the refuge's flowages (USFWS 1995). Restoration efforts for the trumpeter swan have also occurred on the Meadow River Wildlife Area.

Gray wolves are dispersing from northern Wisconsin and are reestablishing populations in Juneau, Jackson, and Wood Counties (USFWS 1995). The Black River is considered a potential travel corridor for wolves dispersing from northern Wisconsin through Taylor, Eau Claire, Jackson, Wood, and Juneau Counties.

The eastern massasauga rattlesnake is found on Necedah NWR.

Karner blue butterflies are present on Necedah NWR, Meadow Valley SWA, and in Adams County in association with wild blue lupine plants. A substantial population exists on the Fort McCoy Military Reservation in Monroe County. In addition, loggerhead shrikes, tawny crescent butterflies, red-veined leafhoppers, phlox flower moths, and Blanding's turtles are state-listed species that are associated with Karner blue butterfly habitat (USFWS 1995).

Potential Kirtland's warbler habitat (jack pine forests) occurs in Jackson County.

Red-shouldered hawks, a Wisconsin state-designated threatened species, nest in bottomland hardwoods along the Yellow and Wisconsin Rivers in Adams, Wood, and Juneau Counties, and along the Black River in Trempealeau and Jackson Counties (WDNR 1995b; WDNR 1997b).

Table 3-20. Federal and State Threatened, Endangered, and Rare Species Under the Volk South MOA

SPECIES	***COMMON NAME***	***WISCONSIN STATUS***	***U.S. STATUS***
Invertebrates			
Lycaeides melissa samuelis	*Karner Blue Butterfly*	*Special concern*	*Endangered*
Schenia indiona	*Phlox Flower Moth*	*Endangered*	
Phycoides batesii	*Tawny Crescent Butterfly*	*Special concern*	
Aflexia rubranura	*Red-veined Prairie Leafhopper*	*Special concern*	
Reptiles and Amphibians			
Clemmys insculpta	*Wood Turtle*	*Threatened*	
Emydoidea blandingii	*Blanding's Turtle*	*Threatened*	
Hemidactylium scutatum	*Four-Toed Salamander*	*Special concern*	
Sistrurus catenus catenus	*Eastern Massasauga Rattlesnake*	*Endangered*	
Fish			
Acipenser fulvescens	*Lake Sturgeon*	*Special concern*	
Coregonus artedi	*Lake Herring*	*Special concern*	
Notropis texanus	*Weed Shiner*	*Special concern*	
Moxostoma valenciennesi	*Greater Redhorse*	*Threatened*	
Fundulus diaphanus	*Banded Killifish*	*Special concern*	
Etheostoma microperca	*Least Darter*	*Special concern*	
Percina evides	*Gilt Darter*	*Threatened*	
Birds			
Botaurus lentiginosus	*American Bittern*	*Special concern*	
Ixobrychus exilis	*Least Bittern*	*Special concern*	
Anas americana	*American Wigeon*	*Special concern*	
Pandion haliaetus	*Osprey*	*Threatened*	
Haliaeetus leucocephalus	*Bald Eagle*	*Threatened*	*Threatened*
Circus cyaneus	*Northern Harrier*	*Special concern*	
Cygnus buccinator	*Trumpeter Swan*	*Special concern*	
Accipiter gentilis	*Northern Goshawk*	*Special concern*	
Falco columbarius	*Merlin*	*Special concern*	
Pedioecetes phasianellus	*Sharp-Tailed Grouse*	*Special concern*	
Charadrius melodus	*Piping Plover*	*Endangered*	*Endangered*
Bartramia longicauda	*Upland Sandpiper*	*Special concern*	
Sterna caspia	*Caspian Tern*	*Endangered*	

Table 3-20. Federal and State Threatened, Endangered, and Rare Species Under the Volk South MOA (continued)

SPECIES	***COMMON NAME***	***WISCONSIN STATUS***	***U.S. STATUS***
Sterna hirundo	*Common Tern*	*Endangered*	
Chlidonias niger	*Black Tern*	*Special concern*	
Empidonax flaviventris	*Yellow-Bellied Flycatcher*	*Special concern*	
Perisoreus canadensis	*Gray Jay*	*Special concern*	
Dendroica tigrina	*Cape May Warbler*	*Special concern*	
Dendroica caerulescens	*Black-Throated Blue Warble*	*Special concern*	
Dendroica kirtlandii	*Kirtland's Warbler*	*Special concern*	*Endangered*
Dendroica cerulea	*Cerulean Warbler*	*Threatened*	
Oporornis agilis	*Connecticut Warbler*	*Special concern*	
Ammodramus leconteii	*Le Conte's Sparrow*	*Special concern*	
Carduelis pinus	*Pine Siskin*	*Special concern*	
Buteo lineatus	*Red-Shouldered Hawk*	*Threatened*	
Casmerodius albus	*Great Egret*	*Threatened*	
Cygnus buccinator	*Trumpeter Swan*	*Endangered*	
Falco peregrinus	*Peregrine Falcon*	*Endangered*	*Endangered*
Lanius ludovicianus	*Loggerhead Shrike*	*Endangered*	
Nyctanassa violacea	*Yellow-Crowned Night-Heron*	*Threatened*	
Tympanuchus cupido	*Greater Prairie-Chicken*	*Threatened*	
Tyto alba	*Barn Owl*	*Endangered*	
Mammals			
Spermophilus franklinii	*Franklin's Ground Squirrel*	*Special concern*	
Lynx Canadensis	*Lynx*	*Endangered*	
Canis lupus	*Timber Wolf*	*Endangered*	*Endangered*

Source: USFWS 1995; USFWS 1997; WDNR 1995a; WDNR 1997b

3.9 CULTURAL RESOURCES

Cultural resources are defined as any prehistoric or historic district, site, building, structure or object considered important to a culture, subculture, or community for scientific, traditional, religious or any other reason. Cultural resources can be divided into three major categories: prehistoric and historic archaeological resources, architectural resources, and traditional cultural resources. Prehistoric and historic archaeological resources are locations where human activity has altered the earth or left deposits of physical remains (e.g., arrowheads, bottles). Prehistoric (or Pre-Columbian) archaeological resources predate the appearance of written records in the region. They range from a scatter of a few artifacts to village sites and rock art. Historic resources post-date the appearance of written records. They include campsites, roads, fences, farmsteads, refuse dumps, or other remains.

Architectural resources are standing buildings, dams, bridges and other structures of historic or aesthetic significance. Architectural resources generally must be more than 50 years old to be considered for protection under existing cultural resource laws. However, more recent structures, such as military buildings or facilities associated with the Cold War, may warrant protection if they have the potential to gain significance in the future.

Traditional cultural resources are associated with cultural practices or beliefs of a living community. The beliefs must be rooted in the community's history and important in maintaining the continuing cultural identity of the community. Traditional cultural resources can include archaeological resources, linear and effigy mounds, buildings, neighborhoods, prominent topographic features, habitats, plants, animals, and minerals that Native American or other groups consider essential for the persistence of their traditional culture. Intangible traditional cultural resources may include religious, ceremonial, or traditional values and concerns that are *not* tied to specific cultural properties. Protection of these resources may involve access to sites, the use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.

Only significant cultural resources are evaluated for adverse impacts resulting from a Proposed Action. To be considered significant, archaeological or architectural resources must meet one or more of the criteria for inclusion on the National Register of Historic Places (National Register) as defined in 36 CFR 60.4. Traditional cultural properties may also be evaluated for significance according to criteria defined in 36 CFR 60.4 and in consultation with concerned traditional groups. There are, however, no legally established criteria for evaluating the significance of intangible traditional cultural resources. The significance of intangible resources must be established primarily through consultation with the concerned traditional group, or with Native Americans according to the requirements of E.O. 13007. Subsection 4.9.1.2 details National Register criteria and the establishment of significance.

Table 3-21 summarizes the presently known National Register-listed archaeological and architectural sites within the ROI. The ANG is not aware of the existence of any traditional cultural resources within the proposed expansion area. The ANG has not completed a cultural resources survey for the expansion property. Several cultural resources lie underneath existing airspace associated with Volk Field not included in the proposed action. As additional resources are made available to the ANG, appropriate analysis will be determined and accomplished.

Table 3-21. National Register-Listed Properties Within the ROI

COUNTY (WISCONSIN)	PROPERTY	TYPE	NATIONAL REGISTER STATUS *	RANGE EXPANSION	R-6904	VOLK S. MOA	FALLS 1 MOA	FALLS 2 MOA
Clark	Clark County Jail	Architectural	Listed					X
Clark	Robert Schofield House	Architectural	Listed					X
Jackson	Gullickson's Glen	Archaeological	Listed				X	
Jackson	Silver Mound Archaeological District	Archaeological	Listed				X	
Jackson	Union High School	Architectural	Listed				X	
Juneau	Sprague Bridge	Architectural	Listed		X	X		
Juneau	Cranberry Creek Archaeological District	Archaeological	Listed		X	X		
Juneau	Gee's Slough Mound Group	Archaeological	Listed			X		
Juneau	Weston-Babcock House	Architectural	Listed			X		

*See Subsection 4.9.1.2 for National Register criteria.

Source: National Register of Historic Places 1997

The ANG currently has a coordination system in place with the Ho-Chunk Nation that provides for a 5 NM avoidance area during any of their special observances or ceremonies. This system is on an "as called for" basis and is implemented by NOTAM and direct communication with daily users.

3.9.1 Prehistoric and Historic Context

The central Wisconsin region probably has been occupied by humans for at least 12,000 years. The prehistoric era (before the presence of written records) can be divided into four periods: Paleo-Indian (9500 to 6500 B.C.); Archaic (6500 to 600 B.C.); Woodland (600 B.C. to A.D. 1200); and Mississippian (A.D. 1200 - 1634). Written history of the Winnebago people (now known as the Ho-Chunk) and other Native American groups began when Euroamericans entered the area around 1634. Euroamerican history is summarized for the period from 1634 to 1946.

3.9.1.1 Prehistoric Context

Paleo-Indian Period. This period is defined by the first inhabitants of Wisconsin who entered the area from the south or southwest during late glacial times (Mason 1986). They were well adapted to the forest-steppe environment and lived in small, mobile hunting societies using the animal and plant resources of the region. Artifacts of the Early Paleo-Indian period include large Clovis fluted projectile points, sometimes found in association with other lithic tools used for butchering. The Late Paleo-Indian period is characterized by a change in projectile point style: fluting is seen less often and lanceolate points are found. Settlement expanded northward into new lake and forest-margin environments as the water levels of Lake Michigan and Lake Huron dropped (Mason 1986). Evidence for Paleo-Indian use of the Hardwood Range vicinity is represented by several projectile point localities in Juneau County and Jackson County.

Archaic Period. This period represents a more diversified adaptation to the changing, post-glacial environment of North America. Flexible hunting-fishing-gathering subsistence strategies allowed for regional variation suitable to local resources. Sites dating to the Early Archaic (ca. 6500 - 3000 B.C.) are rare in Wisconsin (Stoltman 1986). Rising lake levels may have covered archaeological evidence from this period.

Middle Archaic (ca. 3000 - 1200 B.C.) sites are more common. Middle Archaic cultures in Wisconsin are characterized by the presence of large side-notched projectile points and knives (Stoltman 1986). Native copper was cold-hammered into a variety of tools, providing the basis for the archaeological definition of the "Old Copper" complex. A variety of burial and cremation methods were used. In the Hardwood area, "Old Copper" artifacts have been recovered from sites in Trempealeau, Jackson, La Crosse, Monroe, Wood, Juneau, and Adams counties (Stoltman 1986).

Late Archaic (ca. 1200 - 800 B.C.) sites show evidence of a decline in the use of copper for everyday tools. Most copper items were used for personal adornment. Projectile points changed from side-notched to stemmed forms (Stoltman 1986). Earlier hunting and gathering activities continued. The climate was slightly cooler and moister than previously. People in the Wisconsin and Great Lakes area utilized moose, elk, deer, migratory birds, fish and plant foods. Some burials from this period are characterized by the presence of powdered hematite (red ocher) and increased numbers of artifacts, apparently part of a larger regional network of interaction (Stoltman 1986). Ovate bifaces and turkey-tail points, copper artifacts, bead and shell necklaces, and

polished stone also appear in burials. Most burials with red ocher are found in the southeastern part of the state. Turkey-tail blades have been recovered in Juneau County, and Archaic sites are known throughout Juneau County, although none have been recorded in the immediate Hardwood Range vicinity.

Woodland Period. This period begins with the appearance of pottery in Wisconsin and is characterized by later burial mound construction, and plant cultivation. The Early Woodland (600 B.C. - A.D. 100) is defined by the presence of thick pottery and contracting-stem points in southern Wisconsin where inhabitants used the resources of the prairies and deciduous woodlands (Salzer 1986). The transition from Early to Middle Woodland has been studied at campsites in Monroe County. Thick, Early Woodland pottery, straight and contracting-stem projectile points, and pottery of early Middle Woodland style were recovered. Early Woodland ends with the appearance of Hopewell cultural influences from southern Ohio and Illinois (Salzer 1986).

Middle Woodland (A.D. 100 - 500) in Wisconsin is defined by the Hopewell interaction sphere (Salzer 1986). Population increased and people were heavily dependent on hunting and gathering. One Hopewell center is found just southwest of the project area in Trempealeau and La Crosse counties. Hopewell-style rectangular mounds with extended burials, pottery, obsidian blades, effigy pipes, copper ear spools, and elaborately worked bone or shell are found at these sites. Village and campsite locations reflect the distributions of resources such as deer, elk, small mammals, fish, and shellfish. Trade and exchange among Hopewell groups and Great Plains and Rocky Mountain people are also evident (Salzer 1986). Winter base settlements are found along river valleys; summer camps are located close to plant resources and regional exchange centers; and short-term camps are found near mound groups (mortuary sites). Middle Woodland sites are recorded in Trempealeau and Jackson counties.

The Effigy Mound culture, with its animal-shaped, conical, and linear mounds, is the defining feature of Wisconsin's **Late Woodland** period (A.D. 500 - 1200). Artifacts associated with this culture are not as elaborate as those of the preceding Hopewell culture. Cord-impressed pottery vessels, cord-wrapped sticks, clay pipes, bone tools, fish nets, fabrics, small stemmed, side-notched, and triangular points, axes, celts, and some copper items are represented. Site types include open campsites, caves and rockshelters, villages, and small to large mound sites (Hurley 1986). River valley locations were preferred, while high bluffs were often used for mound building. Hunting and gathering may have been accompanied by some cultivation of corn, but evidence for this is limited. Effigy Mound sites have been recorded southwest of the project area in Monroe County. Other Late Woodland sites are recorded in Trempealeau, Jackson and Monroe counties.

Mississippian (A.D. 1200 - 1634). Mississippian period Oneota Culture is identified by the presence of agriculturalists in southern Wisconsin who raised corn, beans, and squash. Their camp and village sites are found along waterways and near lakes (Gibbon 1986). Sites in La Crosse and Trempealeau counties, on the terraces and floodplains of the Mississippi River, are associated with the Orr and Blue Earth Oneota phases (A.D. 1400 - 1600). The climate was cool and dry. Extensive prairies with deciduous forests covered southern Wisconsin. Artifacts include line-decorated pottery, pottery discs, bone and antler tools and ornaments, ground and polished stone tools, small triangular projectile points, scrapers, ovate knives, and shell and copper tools and ornaments. Housing consisted of oval wigwams with hard-packed floors and large fireplaces. Burial took place in graves not covered by mounds. Village settlements are found in areas where the environment was amenable to plant cultivation (Gibbon 1986). Sites are also found near hunting and fishing resources. Oneota and Mississippian period sites are recorded in Jackson and Monroe counties.

3.9.1.2 Historic Context

Historical research indicates that at least two groups of Native Americans may have used lands within the ROI: Ho-Chunk (Wisconsin Winnebago), and Menominee (Lurie 1978; Spindler 1978). The ripple effect of European settlement and the expansion of Iroquoian groups from the east into the Great Lakes region makes it difficult to define the pre-contact configuration of these three groups. However, the Wisconsin Winnebago were the last group to control the lands in the area.

The first Euroamerican contact with the Winnebago people was in 1634 when Jean Nicollet visited a settlement near Green Bay at a time when the Winnebago, Ottawa, Fox, and Illinois people were at war. During the fur trade era (1665–1828), Winnebago settlements concentrated in the Lake Winnebago area where people cultivated plants and sometimes traveled great distances to hunt, including crossing the Mississippi to hunt buffalo on the plains (Lurie 1978). The marshy areas along the Mississippi were also sources of the fur-bearing animals that were valuable trade items. New settlements were established as hunting activities focused to the south and west of Lake Winnebago. Eight historic Winnebago village locations dating to the 18th and 19th centuries are known for the Hardwood region (Ho-Chunk Historic Preservation Department, no date).

Winnebago alliances switched back and forth between the French and British at various times during the 1700s. The British ended their ties with the Winnebago in 1815 and the peace chief Naw-Kaw, with Spoon Decorah, traveled to St. Louis to sign a peace treaty with the United States in 1816.

Euroamerican lead miners began incursions into Native American lands south of Prairie du Chien in 1821. The Treaty of Prairie du Chien (1825) established firm boundaries for area tribal lands, but did not settle territorial disputes between competing tribes in the area. The Treaty defined the western boundary of Menominee lands as the Black River. Later conflicts between lead miners and Native Americans resulted in an 1828 treaty that ceded half of the tribe's territory south of the Wisconsin River to the U.S. (Lurie 1978).

Other treaties in the following years resulted in the cession of much Winnebago land in Wisconsin. Disagreements about the details of treaty negotiations split the tribe into two factions, one of which believed it would be better to leave the area, and other that it would be better to stay. The group that remained, the Wisconsin Winnebago, hid out in central Wisconsin from where they were periodically removed by the Federal government (Lurie 1978). In 1881, special homesteading legislation permitted the Wisconsin Winnebago to take up 40-acre homesteads (Lurie 1978). More than 600 Winnebago homesteads, scattered throughout central Wisconsin, were registered under this Act. Many homesteads were lost to pay back taxes in 1906. Litigation on behalf of the Nebraska and Wisconsin Winnebago to regain properties began after the establishment of the Indian Claims Commission in 1946.

The Wisconsin Winnebago Tribal Constitution was written in 1962. In 1994, the tribe officially changed its name to the Ho-Chunk Sovereign Nation. Presently, the largest concentration of Ho-Chunk people is in west-central Wisconsin, particularly Jackson County (Ho-Chunk Nation 1996). The Ho-Chunk Nation has a reservation along the Black River north of the town of Black River Falls.

Euroamerican presence in Wisconsin began with transient occupations by trappers early in the late 18th and early 19th centuries. Trappers interacted extensively with Menominee people who participated in local fur trade (U.S. West Research 1992). Later the Menominees were pressured to move west of the Mississippi River and to cede

lands in Wisconsin to the United States. After the Treaty of Cedar Point in 1836, Menominee people established settlements along the Lemonweir River, including near present-day Mauston south of the project area (U.S. West Research 1992). The remaining Menominee lands were ceded at the Treaty of Lake Pygan (1848). Later the U.S. government granted them a reservation near the Wolf and Oconto Rivers (U.S. West Research 1992).

Logging operations began in Juneau County in the early 1840s when dams and sawmills were built at New Lisbon and Mauston along the Lemonweir River. White and red pine were taken along the Yellow River and Cranberry Creek. A sawmill was built in the Necedah area. The last log drive on the Yellow River took place in 1892 (U.S. West Research 1992).

After the pine forest had been logged (1870), attempts at agricultural development met with mixed results. Farmers found the marshland to be more suitable for cranberries and marsh hay than for traditional crops. Attempts to improve the poor agricultural potential of local land began after 1901 when drainage districts were formed and miles of ditches were built to drain the marshes (U.S. West Research 1992). Farmlands remained marginal, however, and the agricultural depression of the 1920s further affected local farming. By the 1930s, many property owners abandoned their land. A New Deal program, the Resettlement Administration, bought up much of the marginal farmland and settled farmers elsewhere. Works Progress Administration (WPA) funds were used to improve the drainage systems and build water-control structures along Cranberry Creek. Those farmers who remained generally grew feed corn for dairy livestock until after World War II.

Volk Field was leased in 1954 from the state of Wisconsin to establish an air training site. Work also began at the same time on the Hardwood Air-to-Ground Range, completed in 1955. The range, one of 14 ANG ranges, has experienced a number of modifications over the years, including the addition of structures, dating into the present.

3.9.2 Hardwood Range Expansion and Associated Restricted Airspace

3.9.2.1 Prehistoric and Historic Archaeological Resources

Cultural resource studies conducted in Juneau County early in the 20th century include a number of anecdotal accounts, unpublished notes, and non-systematic surveys that identified cultural resources in the vicinity of the range. Only one site was located on the Hardwood Range itself, a prehistoric site with incomplete documentation. It has not been relocated in recent times, and its provenience and continued existence are in doubt. No National Register-listed or eligible sites are known to be located within the range itself. Subsection 4.9.1.2 details National Register criteria. Both eligible and listed sites are protected.

No National Register-listed sites have been recorded beneath R-6904. However, at least 11 National Register eligible prehistoric sites have been reported beneath the restricted airspace, including prehistoric petroglyphs (Boszhardt 1992). To the west there are two eligible mound sites and eligible prehistoric village and camp sites. A number of archaeological properties beneath R-6904 are potentially eligible for the National Register but have not had formal determinations of eligibility (Dexter 1995; Wisconsin State Historic Preservation Office [SHPO] 1995).

A systematic cultural resources survey of Hardwood Range was conducted in 1992 by the Mississippi Valley Archaeology Center (Boszhardt 1992). The survey

covered approximately 50 percent, or 3,340 acres, of the range. No prehistoric sites were located. However, eight historic architectural features (dams) and the sites of seven farmsteads (with no standing structures) identified through a historical overview were relocated. All of these resources have been evaluated as potentially eligible to the National Register (Wisconsin SHPO 1992).

The low-lying lands of the Hardwood Range expansion area are similar to locations where Woodland sites have been recorded north, west, and south of the range. South of the range, a number of significant archaeological sites, including an archaeological district, are located on Cranberry Creek, which flows from north to south through the range. In addition, geologic features such as bedrock outcrops may contain prehistoric rock art.

Historical research has shown that the area may have been used as a resource collecting locale by the Menominee and Wisconsin Winnebago people (U.S. West Research 1992). One Winnebago family settled just outside the range boundaries in the middle 1920s and lived there until 1952 (U.S. West Research 1992). Use by groups such as the Menominee or Winnebago people may have resulted in temporary camps along streams or other areas with resource concentrations. However, subsequent historic use of the area, including development and channelizing of streams like Cranberry Creek, may have removed traces of these activities.

Historic logging activities may have left evidence in the form of 19th century camps along Cranberry Creek and Yellow River. Early agricultural activities may be represented by the remnants of farmsteads, dams, fencelines, outbuildings, drainage features and windbreaks. Later agricultural development in the region included major drainage works, such as the Cranberry Creek Drainage District. Historic farmsteads on the existing Hardwood Range have been researched, though not all have been relocated. It is likely that additional farmstead sites are located in the expansion area.

3.9.2.2 Historic Architectural Resources

A historic resources overview (U.S. West Research 1992) identified 12 historic farmsteads and a rural schoolhouse dating from 1870 to 1914 within Hardwood Range. The U.S. West overview refers to a 1954 inventory which located six groupings of standing buildings, including at least two of the 12 farmsteads noted above, that were razed for range construction. Other historic features documented in the U.S. West overview included drainage and logging features, such as the Yellow River Improvement Company Canal, the Yellow Pinery Road, Cranberry Creek Drainage District System, and WPA Water Control Dams from the 1930s.

A subsequent survey conducted in 1992 by the Mississippi Valley Archaeological Center (Boszhardt 1992) concentrated on areas known to have the potential for historic resources based on the 1992 overview. Although seven historic farmsteads were located, including five of the six noted in 1954, none of the associated structures remained standing. The farmstead sites are considered potentially eligible archaeological sites (refer to Section 3.9.2.1). Eight historic dams, considered to be potentially eligible for the National Register, were also documented (Boszhardt 1992).

The existing Hardwood Range includes 11 structures built for range operation: three towers; training, storage and equipment buildings; a helicopter pad; a well; a diesel storage tank; and a fence. The earliest of these was constructed in 1958 (U.S. West Research 1992). None have been evaluated for National Register eligibility. As discussed earlier, buildings must be at least 50 years old to be eligible to the

National Register unless they had an important role in a major modern historic event like the Cold War.

No National Register historic architectural properties are located on the existing range or within the proposed area of range expansion. The proposed expansion may contain additional farmsteads, farming-related features, or sites associated with drainage or logging activities, similar to those on the existing range. One National Register-listed architectural property lies beneath restricted airspace R-6904. Historic Sprague Bridge spans the Yellow River in Juneau County in the western portion of the restricted airspace.

3.9.2.3 Traditional Cultural Resources

Although no traditional cultural resources have been formally recorded within the range and associated airspace, maps provided by the Ho-Chunk Nation show a tribal village under R-6904A airspace. A letter from the Ho-Chunk Nation Legislator, Area IV, indicated that Native American Church activities may be held outdoors in Wood County (Garvin 1996).

Although the range is not known to include traditional resources, prehistoric petroglyph and mound sites are found nearby. These site types may be associated with traditional cultural practices. In addition, the historic presence of Menominee and Winnebago groups in the 19th and early to mid-20th centuries raises the possibility of traditional resources. Locations and significance of traditional cultural resources are determined in consultation with affected Native American groups.

The ANG is not aware of the existence of any traditional cultural resources within the proposed expansion area. The ANG has not completed a cultural resources survey for the expansion property. Several cultural resources lie underneath existing airspace associated with Volk Field not included in the proposed action. As additional resources are made available to the ANG, appropriate analysis will be determined and accomplished.

The ANG currently has a coordination system in place with the Ho-Chunk Nation that provides for a 5 NM avoidance area during any of their special observances or ceremonies. This system is on an “as called for” basis and is implemented by NOTAM and direct communication with daily users.

3.9.3 MOA Utilization

The Proposed Action would reassess airspace utilization in three MOAs: Volk South, Falls 1, and Falls 2.

3.9.3.1 Volk South MOA

Volk South MOA lies above terrain that includes the part of the Wisconsin River, the Lemonweir River, Decorah Lake, Castle Rock Lake, part of Petenwell Lake, and the Necedah National Wildlife Area. Volk South overlies parts of Juneau, Adams, Monroe, and Jackson counties. Four National Register-listed properties are located beneath the MOA: Cranberry Creek Archaeological District, Gee’s Slough Mound Group, Sprague Bridge, and the Weston-Babcock house (refer to Table 3-21). Cranberry Creek Archaeological District, a National Register Historic District, consists of a major concentration of more than 200 prehistoric conical, linear, and effigy mounds. Twenty-five potentially eligible or eligible prehistoric and historic archaeological sites have also

been documented in the central portion of the MOA. These include a mound group west of Yellow River near Finley, two Woodland sites, and petroglyphs (Boszhardt 1992). Numerous other unevaluated resources are located within the Volk South MOA ROI (Dexter 1995; Wisconsin SHPO 1995).

The presence of Cranberry Creek Archaeological District, Gee's Slough mound groups, other prehistoric sites, and documented historic activity suggests that Volk South MOA is likely to contain previously undocumented archaeological resources in certain locations. A number of towns that may have undocumented historic architectural resources also underlie the MOA. In contrast, disturbed areas, swamps, and other uninhabitable locales are less likely to contain archaeological or architectural resources.

Although no traditional cultural resources have been formally recorded within the boundaries of the Volk South MOA, petroglyphs and mound sites are likely objects of traditional Native American values. Both site types are found within Volk South MOA. Locations and significance of traditional cultural resources are determined in consultation with affected Native American groups.

3.9.3.2 Falls 1 MOA

Terrain beneath Falls 1 MOA is transected north to south by the Black River. It includes part of Black River State Forest, Arbutus Lake, a number of SWAs and fisheries, the Trempealeau River, the Ho-Chunk Nation Reservation, and six Mound groups: Silver, Wildcat, Bruce, Levis, Trow, and Stanley. Falls 1 overlies portions of Trempealeau, Jackson, Clark, Eau Claire and La Crosse counties. Three National Register-listed properties are located in the area of the Falls 1 MOA: Gullickson's Glen; the Silver Mound Archaeological District; and Union High School in Black River Falls. Gullickson's Glen is the largest group of petroglyphs in Wisconsin. It was listed on the National Register in 1978. The Silver Mound Archaeological District consists of numerous prehistoric campsites and workshops at the location of aboriginal quarrying operations (Hixton quartzite). Euroamerican digging occurred in the area in search of a supposed silver cache. Silver Mound was listed on the National Register in 1975.

The presence of the Silver Mound Archaeological District, Gullickson's Glen, the many prehistoric sites whose eligibility has not yet been evaluated, and the documented historic activity in the area indicates that land beneath the Falls 1 MOA is likely to contain undocumented archaeological resources in certain locations. The towns underlying the MOA are likely to have undocumented historic architectural resources as well. In contrast, disturbed areas, swamps, and other uninhabitable locales are less likely to have archaeological or architectural resources.

No traditional resources have been identified within the Falls 1 MOA. However, a map of tribal lands provided by the Ho-Chunk Nation indicates a number of areas of concern along the Black River in central Jackson County and southern Clark County. A letter from the Ho-Chunk Nation Legislator, Area IV, stated that sacred sites (as defined in E.O. 13007) exist under airspace in central Jackson County (Garvin 1996).

In general, the presence of petroglyph sites, the Ho-Chunk Nation reservation, and the large number of Native American inhabitants of the area indicate the likely presence of objects of traditional Native American values. Locations and significance of traditional cultural resources are determined in consultation with affected Native American groups.

The ANG is not aware of the existence of any traditional cultural resources within the proposed expansion area. The ANG has not completed a cultural resources survey for the expansion property. Several cultural resources lie underneath existing airspace associated with Volk Field not included in the proposed action. As additional resources are made available to the ANG, appropriate analysis will be determined and accomplished.

The ANG currently has a coordination system in place with the Ho-Chunk Nation that provides for a 5 NM avoidance area during any of their special observances or ceremonies. This system is on an "as called for" basis and is implemented by NOTAM and direct communication with daily users.

3.9.3.3 Falls 2 MOA

Falls 2 MOA overlies terrain that includes the Black River, Eau Claire River, the Yellow River, Mead Lake, and several mound groups: North, Middle, and South Mounds, Neillsville Mounds, Christie Mound, Burdock Mound, and Seven Points. It covers portions of Eau Claire, Clark, and Wood counties. Two National Register-listed properties lie within the Falls 2 MOA area. These architectural properties are the Clark County Jail in Neillsville and the Robert Schofield House in Greenwood.

The presence of prehistoric sites and the documented historic activity in the area indicate that portions of the Falls 2 MOA may have undocumented archaeological resources in certain locations. The towns underlying the MOA are likely to have undocumented historic architectural resources. In contrast, disturbed areas, swamps, and other uninhabitable locales are less likely to contain archaeological or architectural resources.

No traditional cultural properties have been formally recorded within the boundaries of the Falls 2 MOA. A map provided by the Ho-Chunk Nation shows some tribal lands located in Clark and Eau Claire counties. Locations and significance of traditional cultural resources are determined in consultation with affected Native American groups.

The ANG is not aware of the existence of any traditional cultural resources within the proposed expansion area. The ANG has not completed a cultural resources survey for the expansion property. Several cultural resources lie underneath existing airspace associated with Volk Field not included in the proposed action. As additional resources are made available to the ANG, appropriate analysis will be determined and accomplished.

The ANG currently has a coordination system in place with the Ho-Chunk Nation that provides for a 5 NM avoidance area during any of their special observances or ceremonies. This system is on an "as called for" basis and is implemented by NOTAM and direct communication with daily users.

3.10 LAND USE

This discussion of land uses includes potentially sensitive land use receptors in and adjacent to the ROIs defined for the Hardwood Range expansion and for the changes in MOA utilization. Potentially sensitive land use receptors include population centers, due to the presence of a relatively higher concentration of people engaged in residential, commercial, and industrial activities; institutional facilities, such as schools, hospitals, or churches; and recreational land units, such as parks and wildlife refuges. It is generally assumed that institutional facilities, such as schools, hospitals, and churches, are located in population centers. No further attempt is made to specifically identify and locate these centers in the following general description of land uses and resources.

3.10.1 Hardwood Range Expansion and Associated Restricted Airspace

The ROI described in this subsection for the Hardwood Range and associated restricted airspace R-6904 is defined as the land area underneath R-6904 A/B.

General Land Use and Ownership

The Hardwood Range and R-6904 A/B are located in central Wisconsin. Specifically, Hardwood Range is located in Finley Township (T20N R3E) Sections 1 and 2 and the northern halves of Sections 11 and 12 and Armenia Township (T20N R4E) Sections 3, 4, 5, 6, and the northern halves of Sections 7, 8, 9, and 10. The existing Hardwood Range covers about 7,403 acres. Approximately 5.2 percent (400 acres) of the Hardwood Range is maintained as open lands, as either pasture, roads, parking area, or structures, and the remaining acreage consists of forest or wetlands. Restricted Area R-6904 A/B covers the townships of Finley and Armenia in Juneau County and the townships of Remington and Port Edwards in Wood County. The geographic relationship of these areas and general land use and ownership are shown in Figure 3-7. Hardwood Range and R-6904 A/B are located approximately 30 miles north of Mauston and 20 miles southwest of Wisconsin Rapids. These counties are predominantly rural, consisting of forests and wetlands interspersed with farms and pasture land.

The proposed range expansion area would take place in Wood County, as shown in Figure 3-8. This area is mostly Wood County Forest Land (WCFL) with some privately-owned land used for residences, farming, cranberry growing, or recreational purposes. WCFL, comprising 37,536 acres, is owned by Wood County, Wisconsin. A portion of this forest land (16.4 percent) is located under R-6904A adjacent to the north side of the existing Hardwood Range. The forest is administered jointly by the County and the WDNR and managed for the purpose of timber production, wildlife habitat, soil and watershed protection, roads, aesthetics, and recreation.

Construction of proposed new potential target locations would take place in both Juneau and Wood Counties and the proposed new DZ and Landing Zone would be entirely within Wood County.

Historically, the forests in this region were logged and burned in the 1800's to create farms and open lands. However, due to high water tables, poor soil, and short growing season, the farms were not productive. In the 1900's, efforts began to drain the wetlands. For example, approximately 60 miles of drainage ditches were constructed in the Remington Township. The ditch network was somewhat successful in draining the

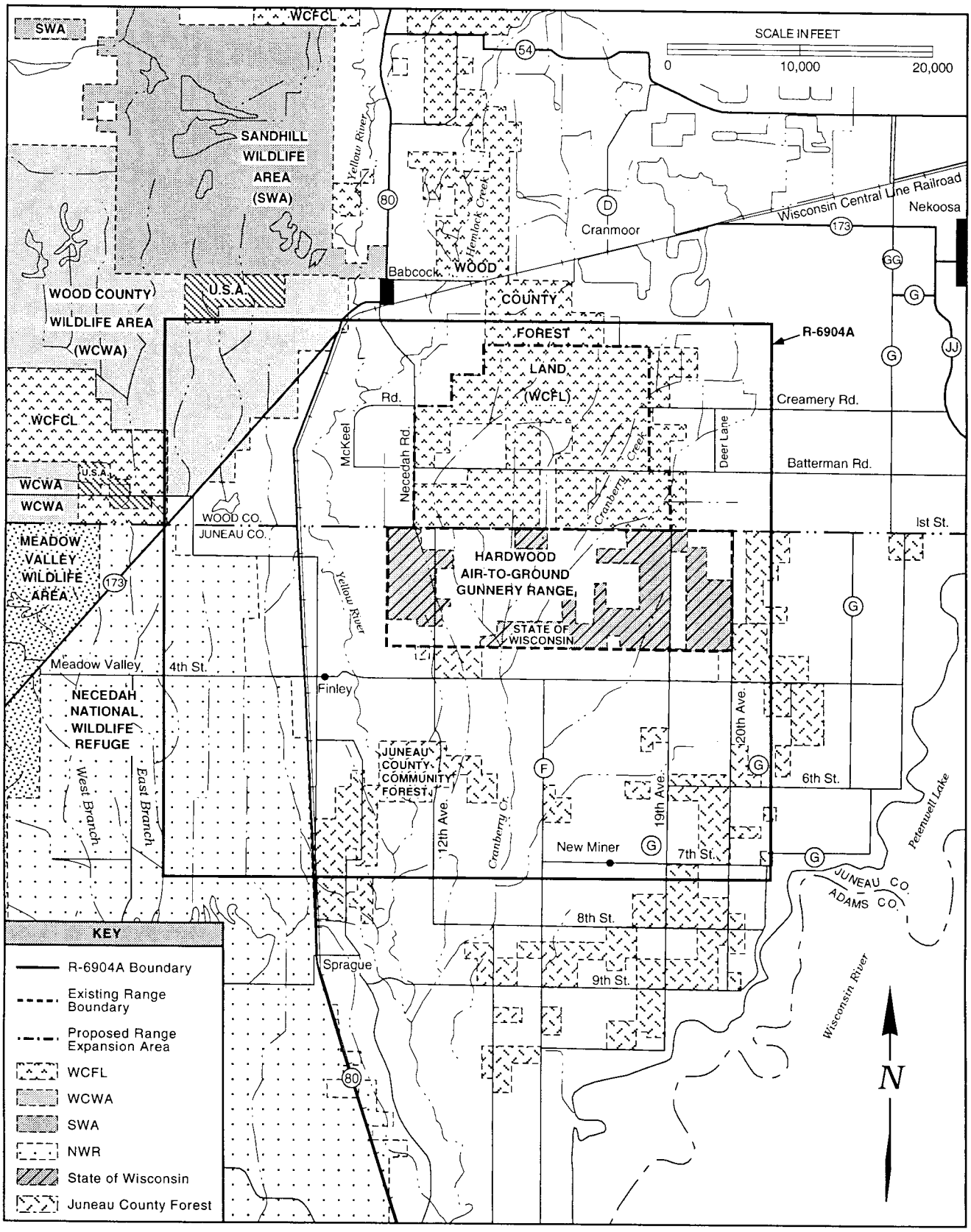


Figure 3-7. General Land Use and Ownership Identified Within and Surrounding the Existing and Proposed Hardwood Range and Restricted Airspace R-6904

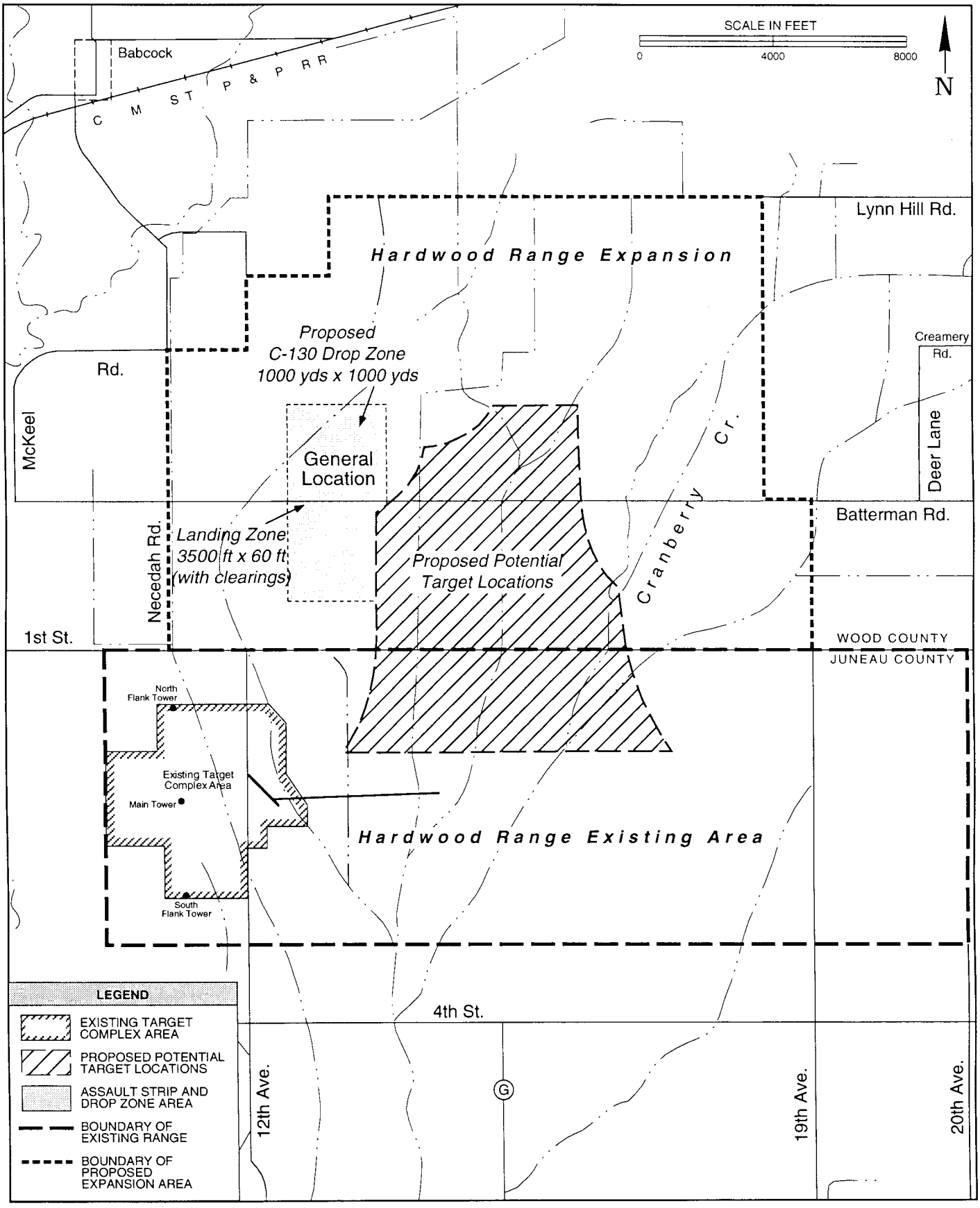


Figure 3-8. Configuration of Existing Hardwood Range and Proposed Range Expansion

wetlands and producing lands for agricultural use; however, due to the poor soils, excessive taxes, and the Great Depression, agricultural activities were not successful. In the 1930's, much of the land was deserted and reverted to government ownership. In the 1940's, the area was recognized as valuable wildlife production area, especially for the prairie chicken. At that time, efforts were underway at both the state and Federal government level to secure property to be managed for wildlife production and public recreation (WDNR 1986).

Privately-owned and government-owned lands are split relatively evenly within the ROI, as illustrated in Figure 3-7. A much higher portion of the land in the range expansion area consists of county-owned forest lands. Land use planning and zoning authority in Juneau and Wood Counties is delegated to the township level government. The Townships of Armenia, Finley, and Remington do not currently have zoning or land use plans for land in the ROI. The Township of Port Edwards has zoning but does not have a land use plan. Much of the land in the ROI in the Township of Port Edwards is zoned as agricultural.

Both primary and secondary residences are located under R-6904. Most houses are situated on several acres of land and are widely scattered throughout the ROI. Concentrations of houses are found in the communities of Finley, located about one and a quarter mile southwest of Hardwood Range, and New Miner, located about three and a half miles south of Hardwood Range. Communities located near R-6904 include Babcock, located less than a quarter mile north; Cranmoor, about one mile north; Nekoosa, about three and a quarter miles northeast; and Sprague, about one and a quarter mile southwest.

Forestry and agricultural activities are still prevalent in the ROI. The forest products, primarily from the county-owned forests, include pulp for paper mills, wood chips, and Christmas trees. Agricultural activities are related primarily to field crops, such as cranberries, corn, and potatoes. Dairy cattle, veal, and mink are also raised in the ROI.

3.10.1.1 Transportation

The ROI is accessed by a variety of paved, gravel, and dirt roads maintained by either the State of Wisconsin DOT, Juneau County, or Wood County. Vehicular access to Hardwood Range is restricted by gates at the boundaries of the property. State roads (SR) include SR-80, oriented north to south, and SR-173, oriented northeast to southwest. County roads are generally laid in a grid pattern oriented either east to west or north to south. Major county roads include Batterman, Sprague Mather Road, Finley Road, County Trunk F, County Trunk G, and County Trunk X. Corridor 23 of the State of Wisconsin Snowmobile Trail System as well as several public and club trails are located under R-6904 (Wisconsin Department of Development, Division of Tourism [WDT] 1993). The Wisconsin Central Line Railroad operates a segment of track that is located to the west of Hardwood Range under R-6904 and runs in a generally north to south direction along SR-80.

3.10.1.2 Recreational and Special Use Areas

Several recreation and special use areas are located within or adjacent to the Hardwood Range and R-6904 A/B. Special use areas are listed in Appendix J. Recreation lands can be owned, operated, or managed by Federal, state, or local agencies. Examples of Federal recreation land include units of the National Park System (NPS); National Wilderness Preservation System; National Wildlife System;

National Forest System; National Wild and Scenic River Systems; national recreation areas; and NWRs. The Federal agencies responsible for these recreational land units include the NPS, U.S. Forest Service (USFS), Bureau of Land Management (BLM), and the U.S. Fish and Wildlife Service. Examples of state recreational lands include state parks, state recreation areas, and SWAs. The state agencies responsible for these recreational land units include the WDNR. The county agencies responsible for these recreational land units include the Juneau County Forest and the Wood County Forest Department. Table 3-22 provides a summary of the attributes of recreational land units in the ROI. Although only county forest lands exist within the range boundaries, and a portion of Wood County Wildlife Area (WCWA) land exists under the northwest corner of R-6904A, several special land use areas exist under the MOAs (see Appendix J).

Table 3-22. Summary of General Attributes of Recreational Land Units

RECREATIONAL LAND UNIT	*RESPONSIBLE AGENCY*	*TYPICAL USES*
National Wildlife Refuge	*USFWS*	*Wildlife viewing, hiking*
State Park	*State*	*Camping, wildlife viewing, boating, fishing, picnicking*
State Wildlife Area	*WDNR*	*Hunting, wildlife viewing, fishing, boating, camping*
County Forest	*JCFPD, WCFL*	*Logging, hiking, hunting, wildlife viewing*

USFWS = U.S. Fish and Wildlife Service
WDNR = Wisconsin Department of Natural Resources
JCFPD = Juneau County Forestry and Parks Department
WCFL = Wood County Forest Land

Recreation activities in central Wisconsin include wildlife and bird watching, picnicking, biking, hiking, camping, hunting, trapping, boating, fishing, berry picking, all-terrain vehicle use, snowmobiling, and cross-country skiing. Recreation activities occur on both public and private lands. Public recreation lands located in the ROI include the Necedah NWR, WCWA, Juneau County Forest, WCFL, and most areas of the Hardwood Range.

Recreation activities available to the public on the Hardwood Range include hunting, snowmobiling and sight-seeing. Hunters are allowed access to the range during hunting season, however they must sign in at the control tower upon entering the range. Hunting and safety information is provided in nine locations around the range perimeter. Trespassing signs are posted on fenced access areas directing hunters to the tower for admission to the range and also areas to avoid. The Target Complex area on the western edge of the property is closed to all visitor access. For a two-week period each year during deer season, the entire range is closed to training activities and opened for use by hunters. Hunters are still directed to avoid impact areas and a briefing is provided and signs posted to direct hunters away from this area. The Range Control Officer also performs a visual scan of the range prior to range use. Hunters and other recreation users of the range can also call into a recorded message that provides the schedule of range use. The range is also used by visitors for viewing aircraft ordnance delivery. Benches have been provided for the public at a safe distance from the target area.

Necedah NWR, covering 65 square miles (41,720 acres), is owned and managed by the U.S. Fish and Wildlife Service and was established in 1939. Necedah NWR is located about one and a half miles west of the existing Hardwood Range and is under R-6904A. The primary purpose of the Necedah NWR is to provide a sanctuary for migratory waterfowl and other wildlife. Recreation activities include an observation tower, auto tour road, wildlife and bird watching, hiking, camping, fishing, and hunting, and winter sports such as cross-country skiing (USFWS 1994).

Portions of Juneau County land, comprising 14,304 acres, is located within the existing Hardwood Range. The area is administered by the County for the purpose of timber production, wildlife habitat, soil and watershed protection, roads, aesthetics, and recreation. Recreational activities include wildlife and bird watching, picnicking, hiking, camping, hunting, trapping, berry picking, cross-county skiing, and snowmobiling (Wisconsin County Forests Association [WCFA] 1987).

WCWA, covering 35 square miles, is located in Wood County, Wisconsin, approximately 20 miles north of Necedah and 18 miles west of Wisconsin Rapids. WCWA is located about two and a half miles northwest of the existing Hardwood Range and is under R-6904A. This area is not in the range expansion area. About 18,500 acres of the 21,000 acres of the WCWA is owned by Wood County and leased to the WDNR. Approximately 4,000 acres of WCFL, managed by the County, are located within the Wildlife Area. The WCWA is managed to provide habitat for waterfowl and upland wildlife, such as deer, as well as to provide recreational opportunities. Recreation activities include wildlife and bird watching, hiking, camping, hunting, trapping, and berry picking (WDNR 1986).

Recreation activities in the WCFL include wildlife and bird watching, picnicking, hiking, camping, hunting, trapping, berry picking, cross-county skiing, and snowmobiling (WCFA 1987).

Wood County Public Hunting Grounds is owned by Wood County, Wisconsin and is located about three miles from the existing Hardwood Range under R-6904A. Recreation activities include wildlife and bird watching, picnicking, hiking, camping, hunting, trapping, berry picking, cross-county skiing, and snowmobiling.

3.10.2 MOA Utilization

This section describes general land use patterns for the lands likely to be affected by the proposed changes in MOA utilization, with particular consideration given to designated recreation areas and other special use areas.

The ROI for the MOA utilization analysis of land use consists of all lands located under the existing Falls 1, Falls 2, and Volk South MOAs. This includes portions of Monroe, Jackson, Trempealeau, Eau Claire, Clark, Wood, Juneau, and Adams Counties, and a very small portion of La Crosse County, all of which lie in central Wisconsin. Under each of the land use attributes considered in this section, a description is provided first for lands underlying the Falls 1 and 2 MOAs, followed by a description for lands underlying the Volk South MOA.

3.10.2.1 General Land Use

Appendix J identifies sensitive land use areas that should be noted for purposes of the Noise, Safety, and Visual Resources and Aesthetics analyses (Sections 3.2, 3.3, and 3.11, respectively). These areas are considered sensitive for several reasons: some refer to population centers, others consist of recreational or ecological resources, and still others include notable private land uses such as airports or hospitals. Towns included in the list either have populations greater than 500 or are located near visitor areas or other special sites.

Falls 1 and 2 MOAs

The Falls 1 and 2 MOAs are located north and west of the Hardwood Range. Lands underlying the MOAs are generally rural in character – the largest town in the ROI is Black River Falls, with a population of 3,500. The landscape features a mix of deciduous and coniferous forests among scenic rolling hills and valleys. The Black River flows south through the area into Arbutus Lake, the largest water body underneath the MOAs, before reaching its final destination at its confluence with the Mississippi River southwest of the MOAs. Two smaller lakes, Mead Lake and Rock Dam Lake, are located under the northern portion of the MOAs.

The land in this region has provided for its inhabitants in many ways. Agriculture, quarrying, and recreational opportunities abound. Cranberry marshes, orchards, Christmas tree farms, and dairy farms dot the landscape, with shale pits, gravel pits, sand pits, and quarries scattered throughout. The area's abundant forests, rivers, and wildlife offer a multitude of recreational pursuits, such as hunting, hiking, snowmobiling, and boating.

Other than Black River Falls, the largest towns underlying the MOAs consist of Neillsville (population 2,700), Osseo (population 1,551), and Augusta (population 1,510). All of the other towns within the ROI are inhabited by less than 1,500 people; most are inhabited by less than 500 (Rand McNally 1997).

The ROI transects portions of the Black River State Forest on the east and covers large portions of designated county forest land in the center. Portions of Jackson, Clark, and Eau Claire County Forests also are located underlying the MOAs. In addition to being used for the forestry industry, these areas are used by recreationists for fishing, camping, nature walks, and many other activities, due to the remoteness of the area and its abundant fish and wildlife (Wisconsin County Forest Association n.d.). County parks, state wildlife and fishery areas, and numerous rivers and lakes in the ROI all provide opportunities for recreation as well.

Transportation resources available in the ROI consist mainly of roads and highways, with some major rail lines traversing across. No major commercial airports are located in the ROI. The largest highway through the ROI is Interstate 94, which bisects it in a northwest-southeast direction, connecting two of the state's major cities: Madison and Eau Claire. Two major U.S. Highways (10 and 53) travel underneath the MOAs. U.S. Highway 53 travels in a north-south direction under the western portion of the Falls 1 MOA. U.S. Highway 10 extends in an east-west direction, providing a connection between Interstate 94 (under the western portion of the MOAs) and U.S. Highway 51/Interstate 39 (located east of the MOA). U.S. Highway 12 is a smaller U.S. Highway, a small portion of which is located under the MOA and runs concurrently with State Highway 27. State Highway 27 bisects the lands underlying the MOAs in a north-south direction and provides an alternate route between the cities of Eau Claire and Black River Falls.

Other state highways underlying the Falls 1 and 2 MOAs include 54, 95, 73, and 121. State Highway 54 generally travels in an east-west direction and connects the city of Black River Falls underneath the MOAs with Wisconsin Rapids, which lies just past the eastern tip of the Falls 2 MOA. State Highway 95 travels in a general east-west direction and connects the city of Blair to State Highway 73, just south of Neillsville. State Highway 73 travels north and then east out of Neillsville, connecting the city to major roads in these directions. State Highway 121 travels between the cities of Merillan and Pigeon Falls, intersecting with Interstate 94 between.

Numerous county roads also serve the area. These roads provide access between towns and to recreational or other special use areas.

Volk South MOA

The Volk South MOA is located south of the Hardwood Range. As depicted in Figure 3-8, the MOA forms a triangle that, at its southernmost point, is just north of the town of Wisconsin Dells. The eastern boundary extends generally along the eastern banks of the Wisconsin River. The northern boundary forms an arc extending west approximately from the town of New Miner to the Fort McCoy Military Reservation.

The area underlying Volk South MOA is generally rural in character. The landscape in the northern and western portions is dominated by both private and publicly owned forest lands. The Wisconsin River and associated water bodies are situated under the eastern portion of the MOA. Located on the river are two dams (the Castle Rock and the Petenwell) that drain into two large reservoirs.

Although there is an abundance of agricultural activity, recreational and other activities associated with the abundant fish and wildlife found in the local forests and waterways dominate the area's land use. Agricultural uses throughout the area include dairies and cranberry farming.

The ROI contains numerous small towns; fewer than a dozen have populations greater than 500. The largest town is Mauston, the Juneau County seat, with a population of 3,439 (Rand McNally 1997). Only the northeast tip of the town is located under the MOA.

The largest highway underneath the MOA is Interstate 94, which underlies the western boundary of the MOA and also travels underneath the Falls 1 and 2 MOAs, as discussed above. Extending in a northwest-southeast direction, it connects two of the state's major cities: Madison and Eau Claire. Other major roadways include State Highways 21 and 13. State Highway 21 traverses across the MOA in an east-west direction, providing a connection between U.S. Highway 51/Interstate 39 on the east (outside of the ROI) and Interstate 94 on the west, accessing the town of Necedah in between. State Highway 13 extends north-south, underlying the eastern boundary of the MOA and providing access from Wisconsin Rapids to Interstate 94.

Several smaller state highways traverse underneath the MOA, including Highways 80, 82 and 173. State Highway 80 is located just west of the Wisconsin River and provides north-south access from the town of Finley to Interstate 94. State Highway 82 crosses the southern tip of the ROI, connecting U.S. Highway 51/Interstate 39 to the town of Mauston. State Highway 173 is located in the northwestern corner of the ROI, traversing the Necedah NWR.

Numerous County roads also serve the area. These roads provide access to specific towns and recreational areas.

3.10.2.2 Recreation and Special Use Areas

Falls 1 and 2 MOAs

Several recreation and special use areas are located under the boundaries of the Falls 1 and 2 MOAs. These include a state forest and several county forests, five

SWAs, five state fishery areas, three county parks, and several rivers and lakes (Figure 3-9).

Black River Falls State Forest, the area's only state forest, is available for a large variety of recreational activities, including swimming, fishing, boating, hiking, hunting, and winter sports. Over one hundred campsites (Smith 1992) have been developed in the forest, and nature trails, hiking trails, snowmobiling trails, and cross-country trails are all available. The forest is abundant with wildlife for viewing and hunting. County forest lands consist of portions of Eau Claire, Jackson, Juneau, and Clark County Forests. County forests offer parks and camp sites; hiking, snowmobile, and cross-country skiing trails; picnic shelters; and boat landings for recreational use (WCFA, no date).

Five SWAs are located underneath the Falls 1 and 2 MOAs, all of which are located in the western half of the airspace: Tollefson Marsh, Lowe Creek, Vosse Coulee, Lakes Coulee, and West Taylor SWAs. These SWAs are all approximately 100-120 acres in size, except for the Lakes Coulee SWA, which is 600 acres in size. All are owned and managed by the State of Wisconsin for preservation and management of native species such as wild turkey, pheasant, fur-bearing mammals, and deer (Matson 1997). Recreational activities in these areas include hunting, fishing, hiking, berry-picking, and nature walks. Winter sports include cross-country skiing and some snowmobiling on marked trails.

The Falls 1 and 2 MOAs cover three county parks: North Wood County Park, in the very eastern portion of the ROI; Coon Fork County Park, near the town of Augusta in the western portion of the ROI; and Wazee Lake County Park, just outside of Black River Falls in the southern portion of the ROI. These parks offer many recreational activities including fishing, canoeing, picnicking, hiking, and swimming. Amenities are available at all three parks. These include camping units, showers, dumping stations, fireplaces or grills, boat ramps, and enclosed shelters.

Lake Arbutus, located near the small town of Hatfield (population less than 200) on the Black River, offers boating, canoeing, and fishing opportunities. Three recreation areas surround the lake, offering facilities such as campsites with picnic tables and grills, boat ramps, and restrooms (Matson 1997). Mead Lake and Rock Dam Lake, located northwest of Lake Arbutus, also offer boating and fishing opportunities. Campsites are also available alongside these lakes (Matson 1997). Numerous rivers offering boating, fishing, and other recreational opportunities underlie the MOAs. These include the Black River, Trempealeau River, Eau Claire River, and Wedges Creek, among many others.

Six established state fishery areas are located underneath the MOAs: Buffalo River, Northfield Lake, North Branch Trempealeau River, Trump Lake, Big Creek and Evans Pond. These areas are all state-owned and were established to provide public access to these waterways and also to manage their native fish populations. All streams are designated as Class I or II trout streams, indicating that although some stocking occurs, most are already inhabited by adequate numbers of native species for sport-fishing (Matson 1997).

Snowmobiling is a popular winter activity throughout the ROI. The WDT prepared a map identifying snowmobile trails throughout the state (WDT 1993). Four major north-south corridors and one major east-west corridor travel across the ROI, while many other self-funded or club trails also traverse the ROI and connect the major corridors.

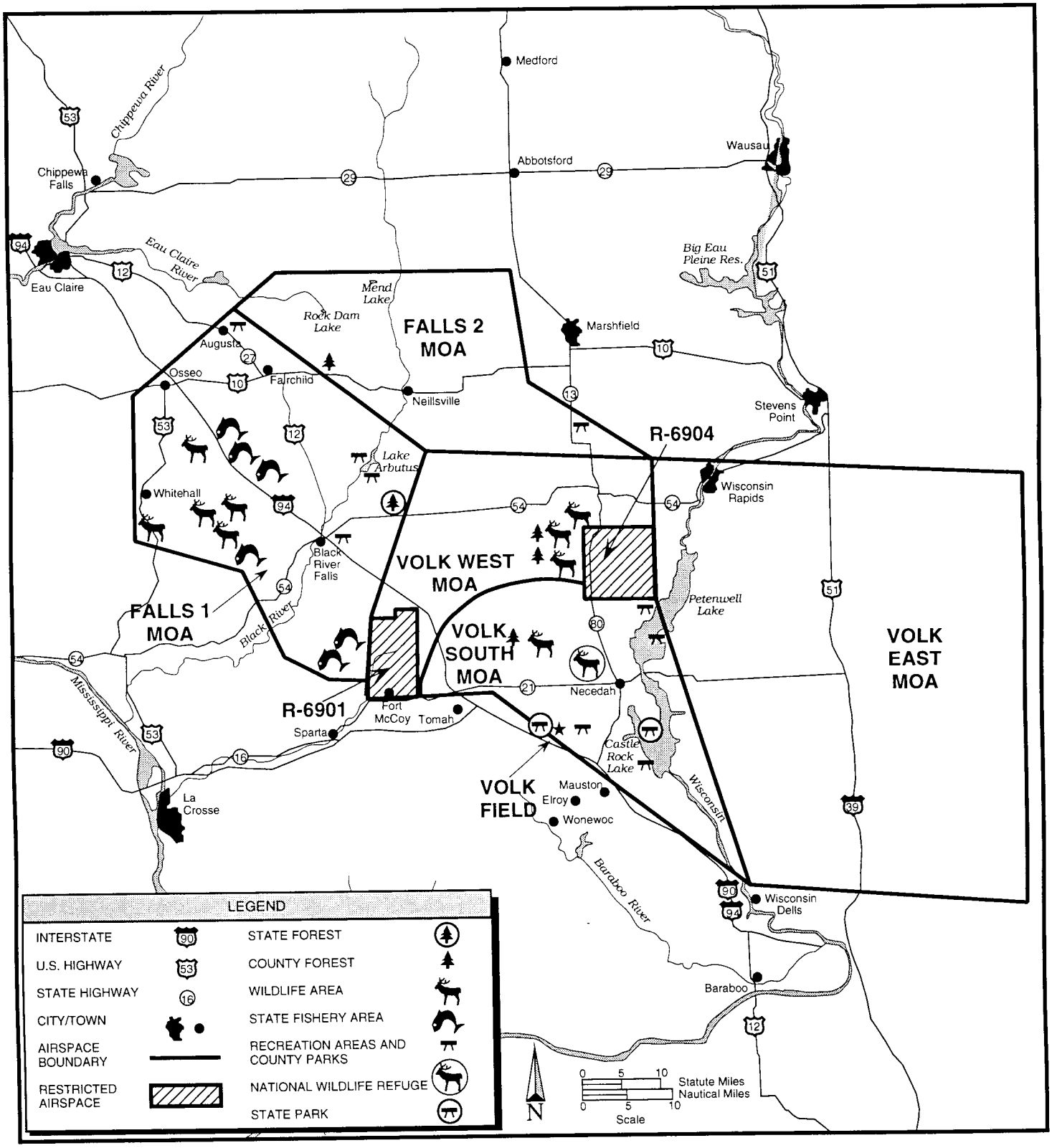


Figure 3-9. Recreation and Special Use Areas Underlying the Falls 1, Falls 2, and Volk South MOAs

Volk South MOA

Several recreation, wildlife and natural resource areas are located under the boundaries of the Volk South MOA. These consist of one national and one SWA, two state parks, three state fishery areas, one county forest, and one county park. These areas are identified in Figure 3-8 and further discussed in the following paragraphs.

The Necedah NWR is located in the northern portion of the ROI north of State Highway 21 and west of State Highway 80. The refuge serves as a 41,720-acre sanctuary for migratory waterfowl and other wildlife. The refuge is owned and managed by the U.S. Fish and Wildlife Service (USFWS). An observation tower and driving tour permit visitors to view the abundant wildlife. Other recreation activities include hiking, camping, hunting, and fishing in some areas. Winter sports include cross-country skiing.

The Meadow Valley SWA is located west of the Necedah NWR. The 90-square-mile area is leased to the State of Wisconsin and is administered under a cooperative agreement with the USFWS. The primary species managed on the property are forest wildlife and waterfowl. Recreational activities include berry picking, hiking, canoeing, and birdwatching. Fishing and hunting are permitted in some areas. In the fall primitive camping is permitted at designated sites. Winter sports include cross-country skiing and snowmobiling on marked trails.

The 1,258-acre Mill Bluff State Park underlies the western boundary of the MOA. The park is located 4 miles northwest of Camp Douglas off Interstate 94. Numerous recreational activities are provided, including camping, picnicking, hiking, and swimming.

Buckhorn State Park is located in the eastern portion of the ROI on a peninsula in the Castle Rock Flowage. The park is accessed by County Road G and State Highway 58. Encompassing 2,507 acres, the park provides opportunities for camping, picnicking, and hiking. Its proximity to water affords sports such as fishing, swimming, and boating. An interpretive canoe trail is situated in the flowage backwaters. Winter sports are also popular at this state park.

The river corridor formed by the Wisconsin River and associated water bodies, including Castle Rock and Petenwell Lakes, provides ample opportunities for fishing. Furthermore, many streams and creeks extend throughout the area. Three established state fishery areas are located underneath the MOA: Mill Creek, White Creek, and Gilmore Creek.

Snowmobiling is also popular underneath the Volk South MOA. The largest corridor identified by the WDT (WDT 1993), is a north-south corridor that roughly parallels State Highway 80 to the west. An east-west trail crosses the Necedah NWR between State Highway 173 and State Highway 21. County trails are also scattered throughout the area.

Local recreational opportunities exist throughout the region, including several county parks. Kennedy County Park is located in Juneau County east of Volk Field. The park is accessed by County Road M. Juneau County also maintains the 160-acre Castle Rock Park. Located on 16,000-acre Castle Rock Lake (south of Buckhorn State Park), the park is accessed by County Road G. Recreational opportunities include picnicking, swimming, boating, water-skiing, fishing, and canoeing. Playgrounds and 300 campsites are also available. The Juneau County Wilderness Park provides similar opportunities on Petenwell Lake near the town of New

Miner. The park offers 140 campsites on 80 acres. Petenwell County Park is located on the east side of Petenwell Lake under the eastern boundary of Volk South MOA. The 431-acre park is located 9 miles north of the town of Friendship on Highway 13 and is accessed from County Trunk C. Recreational amenities include a designated swimming area, boat launch, playground equipment, hiking and cross country ski trails, showers, and restrooms.

Juneau County Forest is located north of Highway 24 under the northwest corner of the Volk South MOA. The forest is administered jointly by the county and the WDNR. County forests offer park-like areas and camp sites and numerous recreational opportunities.

3.11 VISUAL RESOURCES AND AESTHETICS

Visual resources are the natural features (e.g., landforms, water bodies, vegetation) and man-made features (e.g., buildings, fences, signs) that give a particular environment its aesthetic qualities and contribute to its "quality of life." The quality of life of an area is made up of the values placed by individuals on the visual, cultural, socioeconomic, and natural elements in their environment. Because many of these values are subjective and vary from person to person, the environmental impact analysis presented here focuses on the visual element of quality of life as determined by designation or management standards set by public land agencies.

Attributes used to describe the visual resource value of an area include landscape character, perceived aesthetic value or quality, and uniqueness.

3.11.1 Hardwood Range Expansion and Associated Restricted Airspace

The ROI for the range expansion analysis for visual resources and aesthetics consists of the Hardwood Range, the proposed land expansion area, and lands underlying R-6904 A/B.

The Hardwood Range is surrounded by forests and agriculture. In the interior portion of the range, around the target impact area, most of the trees have been removed for safety purposes and improved visibility. The forest surrounding the impact area consists predominantly of oak, aspen, and pine trees. Adjacent to the range lie several cranberry bogs and other types of vegetated open space. The topography of the area is relatively flat; no prominent hills or vistas are located on the range.

The Hardwood Range is approximately six miles long and two miles wide. Hardwood Range includes 11 structures built for range operation: three towers; a maintenance shop; training, storage, and equipment buildings; a helicopter pad; a well; a diesel storage tank; and fences. The outer perimeter of the range is not completely fenced. Fences extend approximately 100 feet from each side of the entrance roads. Warning signs notifying the public of the range are posted on the fence and on nearby trees. Each sign is posted so that a person reading one sign can also see the adjacent sign. For safety purposes, a barbed-wire fence encompasses the range maintenance facilities and visitors viewing area. A sliding gate is used for access to the main entrance of the range. The range maintenance facilities are visible from this entrance. Of the structures listed above, there are two control towers used for scoring located on the north and south sides of the impact area. They are not visible from the main entrance. With the exception of the control towers, all buildings on the range are about one story high.

Visitors are allowed on the range throughout the year. The visitor's viewing area is located next to the main tower within the fenced area (for visitor safety). Visitors have a good view of many of the target arrays and aircraft. Approximately 13,000 people visit the Hardwood Range annually (Neumann 1997).

The target impact area consists of military targets and roads. Target arrays on the range vary from simple bulls-eyes to more complex command post and airfield target arrays. The command post was constructed to resemble a small industrial area. The airfield target array uses old aircraft for scoring. The moveable targets (e.g., airplanes, jeeps, barrels) are replaced as needed. A storage area for replacement targets is located next to the fenced facilities area.

The land character under restricted area R-6904 is similar to that described for the range, consisting of forested areas interspersed with agricultural areas. These agricultural areas consist predominantly of cranberry bogs and are located throughout the region. Areas underneath R-6904 that provide scenic views include the Necedah NWR, located in the southwestern portion of the restricted airspace, and the Wood County SWA under the northwest portion of the restricted area. Wisconsin State Highway 80, which runs along the western boundary of the range and the eastern boundary of the NWR is a popular route for driving tours of the refuge. An observation tower and driving tour offered by Necedah NWR allow visitors to view the abundant wildlife. The landscape of both these wildlife areas is characterized by wetlands of lush meadows and meandering streams. Figure 3-7 depicts land uses under the restricted area and in the vicinity of Hardwood Range that may also be scenic in nature.

3.11.2 MOA Utilization

The ROI for the MOA utilization analysis of visual resources and aesthetics consists of all lands located under the Falls 1, Falls 2, and Volk South MOAs. This includes portions of Monroe, Jackson, Trempealeau, Eau Claire, Clark, Wood, Juneau, and Adams Counties, and a very small portion of La Crosse County, all of which lie in central and western Wisconsin. This section first provides a description of visual resources underlying the Falls 1 and 2 MOAs, and follows with a description of visual resources located in lands underlying the Volk South MOA.

Appendix J identifies sensitive land use areas that should be noted for purposes of the Noise, Safety, and Visual Resource and Aesthetics analyses (Sections 3.2, 3.3, and 3.11, respectively). These areas are considered sensitive for several reasons: some refer to significant population centers, others consist of recreational or ecological resources, while still others include notable private land uses such as airports or hospitals. Towns included in the list have populations greater than 500 or are otherwise located near visitor areas or other special sites. Transportation corridors and facilities located under the MOAs are discussed in Section 3.10.2.1. Recreation areas include state or Federal parks, forests, or wildlife areas, as well as other amenities such as visitor centers, trails, and campgrounds. A discussion of recreation resource areas is provided in section 3.10.2.2.

<u>Falls 1 and 2 MOAs</u>

The landscape underlying Falls 1 and 2 MOAs varies from rural agricultural areas and communities to forested areas and rolling hills and valleys. The topography in the region is gently undulating with the most varied topography occurring to the west of the Black River after it flows out of Lake Arbutus near the town of Black River Falls. Without dramatic geologic features such as mountains or large rock outcroppings to draw the viewer's attention, the skyline is defined instead by features in the immediate vicinity. These generally include man-made structures and vegetation, especially in the forested areas that predominate in this region. Expansive views and scenic vistas are available in the areas of higher elevation, such as those to the west of Black River Falls, and on the various mounds scattered throughout the ROI, but views from the flat terrain or the forested areas, in particular, are limited to the immediate vicinity.

A portion of the 65,000-acre Black River State Forest is located underneath the MOAs. The forest offers scenic views of native vegetation, wildlife, riverine areas, and riparian habitats. A self-guided automobile tour allows visitors to view the park's resources from their cars. Three miles west of the city of Neillsville lies "The Highground," Wisconsin's Vietnam Veterans' Memorial Park. Various sculptures in the

park commemorate those who fought and served in America's wars. The Highground overlooks a 100-acre park that offers nature trails for viewing wildlife and native vegetation. County forest lands underneath the MOAs also offer scenic views of vegetation, wildlife, rivers, and water storage areas. Other areas that provide high quality of scenery and moderate to high visual sensitivity include the Tollefson Marsh, Lowe Creek, Vosse Coulee, Lakes Coulee, and West Taylor SWAs.

Large water bodies and rivers in the region provide highly scenic areas. The Black River flows south under the MOAs, forming Lake Arbutus just southwest of Neillsville, and continuing on southward until it reaches its final destination at the Mississippi River north of La Crosse. Mead Lake and Rock Dam Lake are two other large lakes located underneath the MOAs, providing scenic areas to campers, hikers, canoers, and other visitors. Other major rivers in the ROI include the Trempealeau, the Eau Claire Rivers, and Wedges Creek.

Approximately 100 Amish families have settled around the city of Augusta in Eau Claire County, offering scenic views of the Amish countryside. Other predominant visual features in the affected counties are related to the land uses in these regions, including agricultural vistas, forests, and water storage. Other land uses potentially offering scenic quality are shown on Figure 3-7 and can be found in Appendix J.

Volk South MOA

The landscape character under the Volk South MOA is similar in nature to that described for lands underlying the Falls 1 and 2 MOAs. It varies from rural agricultural areas and communities to forested areas and wetlands. The topography in the region is generally flat or gently undulating, except for an occasional sandstone ridge resulting from glaciation. Expansive views or scenic vistas are available on the sandstone ridges. The primary vegetation consists of jack pine and scrub oak mixtures on the uplands and aspen and scrub willow in the lowlands.

Under the Volk South MOA, designated areas that provide high quality of scenery and moderate to high visual sensitivity include the Necedah NWR, Meadow Valley SWA, Mill Bluff State Park, and Buckhorn State Park. Both Necedah NWR and Meadow Valley SWA support abundant waterfowl and are characterized by numerous ponds and marshy areas separated by sandy ridges and islands resulting from glaciation.

Large water bodies and rivers also provide highly scenic areas. Petenwell Lake and Castle Rock Lake are the largest water bodies under the Volk South MOA. Petenwell Rock, located on the west banks of the Wisconsin River, is the largest scenic rock formation in northern Juneau County. Castle Rock Lake is the fourth largest water body in Wisconsin. Both lakes are noted for their recreational opportunities in highly scenic areas. Other notable waterways include the Lemonweir, Little Yellow, and Yellow Rivers. Wetland areas under the MOA provide views of lush meadows and cranberry bogs.

Designated scenic highways dissect the Volk South MOA. Interstate Highway 90/94, which underlies the southwestern edge of the MOA, provides a scenic drive along forest and wetland areas. Cranberry farms also provide notable views along the highways. State Highway 82, another designated scenic road, crosses under the southern tip of the MOA.

Dairy and cranberry farming are common agricultural scenes under the MOAs, particularly in Monroe County. In Juneau, Adams, and Jackson counties, the

predominant visual features are related to the land uses in the region, including forestry, recreation, water storage, and uses related to fish and wildlife. Other land uses potentially offering scenic quality are shown on Figure 3-7 and can be found in Appendix J.

3.12 SOCIOECONOMICS

The geographical areas addressed in Subsection 3.12.1 include Juneau County (the site of the existing Range) and Wood County (the site of the proposed range expansion). Since the Proposed Action related to range expansion would occur in Wood County, the assessment presented is of a more detailed nature than for Juneau County. Other political entities within Wood County are also addressed: the towns of Port Edwards and Remington, the school districts of Pittsville and Nekoosa, and the Mid-State Technical College District.

The resource areas described are summarized from Appendix I (Science Applications International Corporation [SAIC] 1996; SAIC 1998) and are as follows: demographics, housing, employment and local economy, and public finance.

Subsection 3.12.2 addresses socioeconomic resources within the MOAs, which include the larger area affected by airspace utilized in connection with the range.

3.12.1 Hardwood Range Expansion

3.12.1.1 Demographics

Juneau County

According to the U. S. Census, Juneau County had a population of 23,192 people in 1997, compared to 21,650 people in 1990, a 7.1 percent increase. This level of population growth was significantly less than the national increase of 10 percent for the same period, but exceeded the 6.7 percent population growth for the State of Wisconsin. About 85 percent of the population is rural with population concentrations in the following communities: Mauston, the county seat, with a population of 3,609, Elroy (population of 1,598), New Lisbon (population of 1,500), and Necedah (population of 826). The population density of Juneau County is approximately 29 persons per square mile.

Wood County

Wood County had 77,215 residents in 1997, an increase of less than 5 percent from the 1990 population of 73,605. There are four cities in the county. The two largest are Marshfield, located in the northwestern part of the county, with a population of 19,491 and Wisconsin Rapids, the county seat, located in the southeastern part of the county with a population of 19,051. The other two cities are Nekoosa (population of 2,608) and Pittsville (population of 850). In addition, there are eight villages. The 1997 populations of the towns of Port Edwards and Remington were 1,420 and 323 persons, respectively.

3.12.1.2 Housing

Juneau County

There were 11,422 housing units in Juneau County in 1990. An estimated 8,265 of these units were occupied. Of the occupied units, 6,273 were owner-occupied,

with the remainder comprising rentals, recreation homes, and other housing classifications. The vacancy rate in Juneau County was 27.6 percent, which reflects a large number of seasonal units (approximately 2,400 units in 1990) that are vacant for most of the year.

Wood County

According to the 1990 Census, there were 28,829 housing units in Wood County. An estimated 27,473 of these units were occupied. Of the occupied units, approximately 73.3 percent were owner-occupied and the remaining 26.7 percent comprised rentals, recreation homes, and other housing classifications. The overall vacancy rate in Wood County was 4.7 percent in 1990.

3.12.1.3 Employment and Local Economy

The annual economic impact of Volk Field ANGB, located in Juneau County, exceeds $25 million per year, including more than $14.7 million in payrolls and expenditures and over $10 million in secondary economic effects. Volk Field ANGB payrolls totaled approximately $8.5 million in Fiscal Year (FY) 1995 and annual procurements and deployed personnel spending totaled $6.2 million. Approximately $10.2 million or 40 percent of construction contracts issued by Volk Field between 1990 and 1995 went to contractors in Wood County. In FY 1995 Volk Field ANGB contributed 197 jobs, including 111 military, 80 civilian, and 6 contract employees. Nine of these employees are assigned to Hardwood Range. Military members reside in Monroe, Juneau, Wood, Sauk, Jackson, Lacrosse, and Adams counties.

Juneau County

Employment in Juneau County totaled 11,637 in 1992, with the largest number of jobs in manufacturing (25.6 percent), followed by services (17.1 percent), retail trade (16.5 percent), and government (14.8 percent). There were 1,180 jobs in agriculture, forestry, and fisheries (10.1 percent). Average annual earnings per job amounted to $19,028 in Juneau County in 1993. According to the 1990 Census, median household income in the county was $22,073.

Forestry

There are 14,304 acres of County Forest Land (CFL) in Juneau County, which comprise 0.6 percent of the State total of CFL. The ownership of the existing range is a checkerboard of state-owned land and county-owned land. As of March 1, 1997, Juneau County withdrew 3,368 acres within the Hardwood Range from the CFL program while retaining ownership. Substantial acreage was added to the CFL program in the town of Finley southwest of the Range and other areas were added in the towns of Armenia, Cutler, and Necedah. This replacement land was already owned by Juneau County. Juneau County holds the timber rights to the entire existing range including the area owned by the state, and contracts timber cutting within this area. The most common timber type on the county-owned portion of the existing range is aspen (42 percent), followed by jack pine (29 percent), and pin oak (12 percent). Approximately 10 percent of this acreage is marsh and non-productive.

Over the period 1991-1996, aggregate Juneau County revenues from CFL timber sales, county forest administrator's grants, and payments in lieu of taxes on CFL

have totaled $608,867, averaging $121,773 per year. On the lands of the existing Hardwood Range, the sold value of timber was $63,166 on the CFL over this period.

Agriculture

According to the U.S. Census, there were 675 farms in Juneau County in 1992 with a total acreage of 195,287, or an average of 289 acres per farm. Harvested cropland comprised 103,139 acres on 622 of these farms. The average market value of land and buildings was $240,626 per farm, an average of $819 per acre and the market value of products sold was $55,708,000 or $82,530 per farm. Seven farms harvested cranberries on a total of 932 acres producing 115,398 hundred weight (cwt).

Wood County

The economy of Wood County is supported by a combination of manufacturing, services, and retail employment. In 1994, employment in the services industry accounted for 15,642 jobs, representing 30.4 percent of the total 51,532 workers employed in the county that year. Manufacturing industries employed 10,772 workers, or 20.9 percent of the county total. Retail trade accounted for 9,215 jobs, 17.9 percent of total county employment. Agriculture, forestry, and fisheries accounted for 1,971 jobs, together representing 3.8 percent of county workers.

The overall contribution of forestry to the economy of the county, however, is not clearly represented by these industry-specific employment figures. Significant portions of other industry sectors, such as manufacturing (which includes paper and lumber products) and transportation (which includes forest product trucking and warehousing), are dependent upon timber production. Therefore, the economic activity in these industries is generated by activity in the forestry industry. It is estimated that close to 30 percent of all jobs in the region are either directly or indirectly related to forestry and timber production.

Earnings in Wood County totaled approximately $1.4 billion in 1994. The distribution of earnings across industries is essentially the same as the distribution of employment, with services, manufacturing, and retail trade representing the largest income producers.

Forestry

Statewide, the county forest system contains 2,313,000 acres enrolled in the CFL program. Over the period 1990-1995 Wisconsin counties have entered approximately 1,900 acres annually under the county forest law for a total program acreage increase of 19,324. Wood County's 37,536 acres of CFL represents 1.62 percent of the CFL land state-wide.

The range expansion area contains 6,162 acres or 16.4 percent of the existing Wood CFL. Merchantable timber in the proposed Hardwood Range expansion area consists primarily of aspen, oak, and pines (red, white, and jack). According to a 1997 appraisal, there were approximately 3,838 acres of merchantable timber present comprising over 44,967 cords and almost 2.9 million board feet, with a value of $1,202,787. There were approximately 1,603 acres of immature timber. The remaining 779 acres of CFL are comprised of 696 acres of non-forested land and 83 acres of uplands. The appraisal acreage is 6,220 acres, slightly larger than the range expansion area.

To minimize annual fluctuations in the timber sale revenues passed on to the towns, each town's share is calculated according to its local percentage of the total state program acreage, not the amount of timber actually cut in the town in any one year. The expansion area contains 6,162 acres or 16.4 percent of the total Wood CFL. It therefore generated an average of $16,768 of gross timber sale revenues annually over the period 1992-1996. The towns receive 10 percent of these revenues from Wood County (i.e., approximately $1,677 per year, with $1,384 going to Port Edwards and $293 going to Remington).

Multiplying the average annual timber sales revenue by a factor of 20 provided by the Wisconsin DNR, results in an annual manufacturing value of $335,360. In addition, 32 manufacturing jobs and $599,640 of related wages would be produced, for a total of $935,000 in additional value beyond the timber stumpage value.

Agriculture

There were over 1,000 farms in Wood County in 1992, with a total acreage over 200,000 acres. Farms in Wood County account for about 1.5 percent of the total number of farms and land in farms in the state. The average farm size in the county is 215 acres, compared to the state average of 228 acres. Of the total land in farms, approximately 136,000 acres (or 61.8 percent) is cropland, while the remaining 38.2 percent is pasture and other land. The total market value of farm land and buildings in Wood County amounted to an average of $228,408 per farm, and an average of $1,040 per acre. These figures are comparable to the state level average values of $210,179 per farm and $925 per acre. The market value of products sold amounted to $82 million, with an average value per farm of $80,221.

Wood County is the largest cranberry-producing county in the United States and Wisconsin is the leading cranberry-producing state. In 1997 there were 4,031 acres of planted cranberries in Wood County before the spring growing season. This represents 26.5 percent of Wisconsin's 15,195 planted acres.

According to the 1992 Census of Agriculture, cranberry production in Wood County occurred on 40 farms with a total acreage of 3,065 acres. Wood County contained almost 30 percent of the cranberry-producing farms and acres in the State of Wisconsin in 1992 and cranberry production in the county amounted to 448,821 cwt, representing 31.8 percent of the total state cranberry production. While the number of farms increased by less than 10 percent from 1987 to 1992, cranberry production increased almost 30 percent during the same period.

One cranberry farm containing approximately 25 planted acres is currently operating on the proposed expansion area near the intersection of Range Line and Batterman roads. A typical cranberry farm may contain 10-12 acres of related non-producing natural wetlands, ditches, ponds, reservoirs, and uplands for each acre of cranberry producing wetlands.

There are approximately 200 companies growing cranberries in the State of Wisconsin and 15,195 planted acres of cranberries in Wisconsin with a crop value exceeding $143 million and crop size of over 2.2 million barrels. Based on 1997 prices, a farm containing 25 harvested acres could potentially generate approximately $276,000 annually, assuming 170 barrels of production (i.e., 100 pounds per barrel) per harvested acre and a $65.00 average price per barrel.

3.12.1.4 Public Finance

Juneau County

In FY 1996, Juneau County's revenues were $14,364,299 and expenditures were $13,839,079. Intergovernmental grants and aid comprised the largest revenue category, totaling $6,465,094 or 45.0 percent. This is followed by taxes, which comprise $2,218,990 or 34.5 percent of total county revenues. The largest expenditure categories include health and human services, totaling $6,010,707 or 43.4 percent, followed by public safety, totaling $4,952,175 or 16.0 percent.

Wood County

Services provided by Wood County are funded principally through the county's general fund, which contributed approximately 95 percent of revenues generated by all types of funds in FY 1996. In FY 1996, revenues and expenditures of the general fund were $26,918,507 and $26,957,042, respectively.

Principal revenue sources are intergovernmental transfers (56.5 percent of total FY 1996 general fund revenue collections) and property taxes (25.9 percent of total FY 1996 collections). Principal expenditures are for health and social services (44.9 percent of total FY 1996 expenditures), public safety (18.6 percent of total FY 1996 expenditures), and conservation and development (13.9 percent of total FY 1996 expenditures). The assessed valuation in Wood County was $2,644,117,600 in 1997. General obligation indebtedness is $4.7 million.

TOWN OF PORT EDWARDS

In FY 1996, estimated revenues and expenditures of the town of Port Edwards were $184,983. The principal revenue sources are intergovernmental revenues, primarily from state shared revenues and state highway aid (75.3 percent of total FY 1996 revenue collections), and property taxes (11.6 percent of the total FY 1996 revenue collections). Principal expenditures are for public works (63.7 percent of total FY 1996 expenditures), general government (22.9 percent of total FY 1996 expenditures), and public safety (12.8 percent of total FY 1996 expenditures). Assessed valuation in Port Edwards is approximately $32,932,750.

TOWN OF REMINGTON

In FY 1996, revenues and expenditures of Remington were $390,566 and $395,340 respectively. Excluding $200,871 of revenues that are collected by the town and passed through to either the state, county, or local school district, the principal revenue source for Remington is intergovernmental transfers, primarily state grants for highway aid and state shared revenues (54.8 percent of total FY 1996 revenue collections), followed by property taxes levied by the town (approximately 16.8 percent of FY 1996 revenue collections). Principal expenditures, excluding pass throughs from total expenditures, are for public works (76.9 percent of FY 1996 expenditures), general government (12.5 percent of FY 1996 expenditures), and public safety (4.3 percent of FY 1996 expenditures). Assessed valuation in Remington is approximately $14,006,800.

PITTSVILLE SCHOOL DISTRICT

The Pittsville School District serves areas within four counties: Wood, Juneau, Jackson, and Clark, including a portion of the range expansion area. Enrollment for the 1996/97 school year was 828 students in K-12 classes, compared to an enrollment of 824 in 1990/91.

Services provided by the Pittsville School District are funded principally through the district's general fund, which contributed approximately 90 percent of revenues generated by all types of funds in FY 1996. In that period, revenues and expenditures of the general fund were $4,793,738 and $4,819,187, respectively. The fund balance was $614,528, or 12.8 percent of operating expenditures. Principal revenue sources are state aid (66.3 percent of total FY 1996 general fund revenue collections) and local property taxes (30.8 percent of total FY 1996 collections). Principal expenditures are for instruction (60.0 percent of total FY 1996 expenditures) and support services (40.0 percent of total FY 1996 expenditures). The equalized valuation of the district is $123,163,714. Total general obligation debt was $1,678,724 as of June 30, 1994.

NEKOOSA SCHOOL DISTRICT

The Nekoosa School District serves areas within Wood, Juneau, and Adams counties, including a portion of the range expansion area. Enrollment for the 1996/97 school year was 1,538 students in K-12 classes, compared to an enrollment of 1,478 in 1990/91.

Services provided by the Nekoosa School District are funded principally through the district's general fund, which contributed approximately 76 percent of revenues generated by all types of funds in FY 1996. In that period, revenues and expenditures of the general fund were $8,615,696 and $8,770,833, respectively. The fund balance was $2,064,991, or 23.5 percent of operating expenditures. Principal revenue sources are local property taxes (52.0 percent of total FY 1996 general fund revenue collections) and state aid (46.1 percent of total FY 1996 collections). Principal expenditures are for instruction (62.6 percent of total FY 1996 expenditures) and support services (37.4 percent of total FY 1996 expenditures). The equalized valuation for 1996/97 was $390,074,392.

MID-STATE TECHNICAL COLLEGE DISTRICT

The Mid-State Technical College District is one of 15 vocational technical school districts in the State of Wisconsin. Its facilities serve 8 counties, including Wood County and Juneau County. Services provided by the district are funded primarily by property taxes.

3.12.2 MOA Utilization

Evaluation of potential socioeconomic impacts is generally accomplished within the context of the existing condition of a variety of factors, including population, housing, employment, and other social and economic parameters. The socioeconomic analysis for the three MOAs (Falls 1, Falls 2, and Volk South) is on a broader scale than that associated with the Hardwood Range analysis. The proposed activities and potential effects associated with the MOA utilization are dispersed over a greater geographic area and are less concentrated with regard to socioeconomic impacts. The baseline conditions for the MOA utilization analysis, therefore, is less detailed than that

prepared for the Hardwood Range analysis. Discussion of baseline conditions is limited to demographics, employment, and income. Particular attention is given to tourism and agriculture, because they are the industries most likely to be affected by aircraft overflight activity.

3.12.2.1 Falls 1 MOA

The ROI for the Falls 1 MOA socioeconomic analysis consists of the five counties under the existing MOA, including portions of Clark, Eau Claire, Jackson, Monroe, and Trempealeau counties in west central Wisconsin (see Figure 3-10). Socioeconomic data are available for these counties in their entirety.

Although a very small area in the northeast corner of La Crosse County underlies the Falls 1 MOA, the county was not included in the ROI. It was determined that including La Crosse County in the ROI would misrepresent potential impacts.

Demographics

In 1995, total population in the ROI was 201,002 persons, representing 3.9 percent of the State's total population of 5,122,871 (see Table 3-23). At the time of the 1990 Census, total population in the ROI was 195,314 persons, representing a 2.9 percent increase from the 1980 population of 189,778 persons. Population growth in the ROI between 1980 and 1990 has been somewhat less than the state-level population growth of 4.0 percent.

The most populous county in the ROI is Eau Claire County, which alone accounts for 44 percent of the five-county population. Eau Claire County is also the most densely populated with approximately 139 residents per square mile, compared to 17 to 42 residents per square mile in the remaining counties. With an average population density in the ROI of 45 persons per square mile, compared to the statewide density of 92 persons per square mile, the ROI is considered to be generally rural in nature. At the time of the 1990 Census, there were 71,383 households in the ROI, with an average household size of 2.7 persons.

Employment and Income

During 1992, total employment in the ROI amounted to 109,932 jobs, representing about 4 percent of all employment in the State (see Table 3-24). Total employment figures for 1980 and 1990 amount to 95,482 and 105,970, respectively. In 1991, the average unemployment rate in the ROI was 6 percent, compared to the state unemployment rate of 5.2 percent.

In 1992, total earnings for jobs located in the ROI amounted to $2.1 billion (see Table 3-25). Of this total, $70 million (3.4 percent) was related to the tourism industry and $106 million (5.1 percent) was related to agriculture.

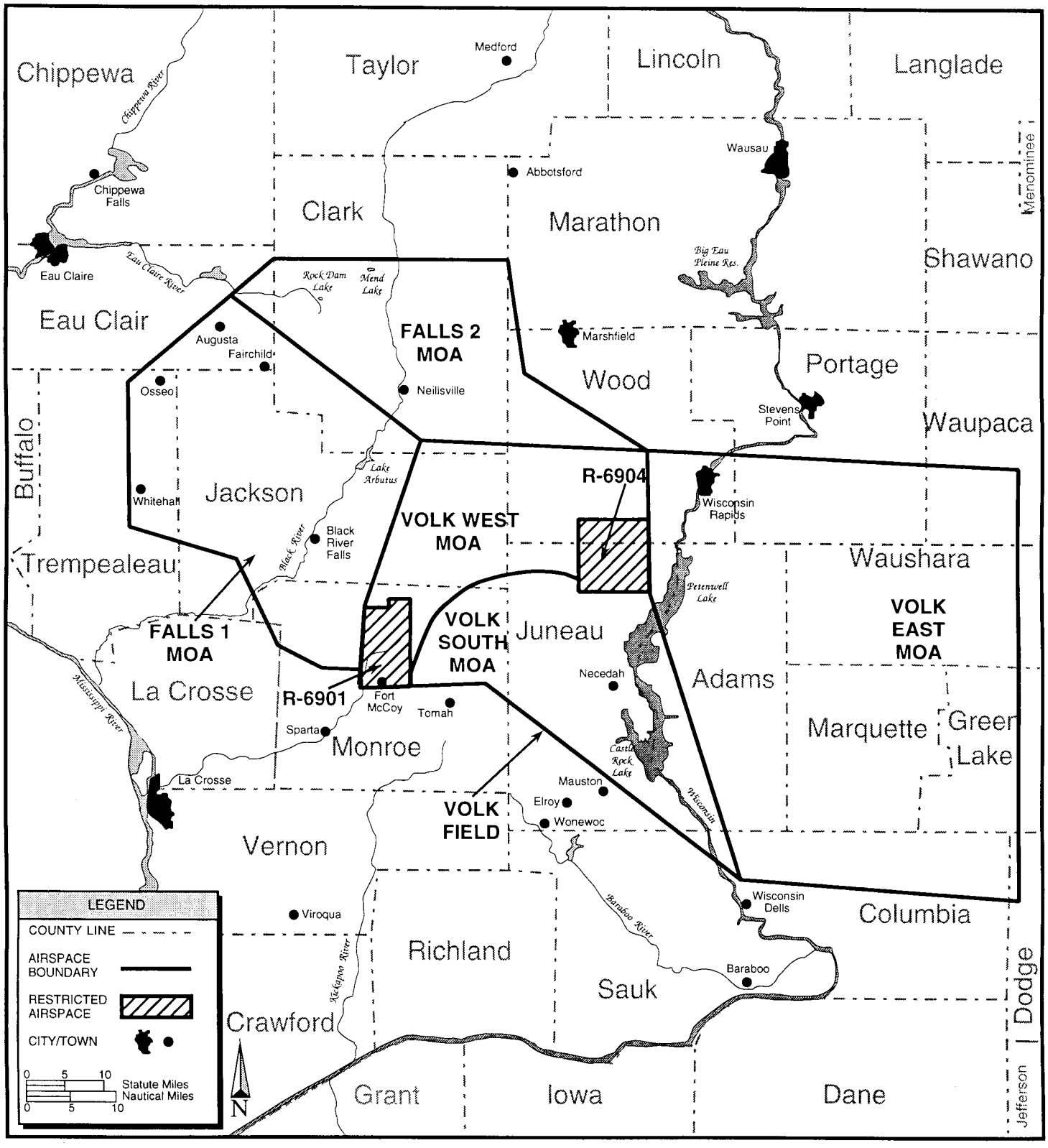


Figure 3-10. Counties Underlying Airspace Associated with the Hardwood Range

Table 3-23. County and Falls 1 ROI Demographics

	CLARK COUNTY	EAU CLAIRE COUNTY	JACKSON COUNTY	MONROE COUNTY	TREMPEALEAU COUNTY	ROI
1995 Population	32,660	88,488	16,725	37,694	25,435	201,002
1990 Population	31,647	85,183	16,588	36,633	25,263	195,314
1980 Population	32,910	78,805	16,831	35,074	26,158	189,778
1995 Persons per Square Mile	26.9	138.8	16.9	41.8	34.6	44.9
1990 Households	11,209	31,282	6,253	13,144	9,495	71,383
1990 Average Household Size	2.8	2.7	2.6	2.8	2.7	2.7

Source: U.S. Bureau of the Census 1994, 1996.

Table 3-24. Falls 1 MOA ROI Employment

	CLARK COUNTY	EAU CLAIRE COUNTY	JACKSON COUNTY	MONROE COUNTY	TREMPEALEAU COUNTY	ROI
1992 Employment	14,579	52,742	7,857	20,370	14,384	109,932
1990 Employment	14,297	50,412	7,305	19,731	14,225	105,970
1980 Employment	14,934	41,930	7,681	18,327	12,610	95,482
Unemployment Rate (1991)	8.3	4.6	7.7	7.0	6.6	6.0

Source: U.S. Bureau of Economic Analysis 1994.

Table 3-25. Tourism and Agriculture Earnings in Falls 1 MOA ROI (thousands of dollars)

	CLARK COUNTY	EAU CLAIRE COUNTY	JACKSON COUNTY	MONROE COUNTY	TREMPEALEAU COUNTY	ROI
Total Earnings	241,114	1,065,694	143,984	379,375	237,293	2,067,460
Tourism Earnings	4,327	40,609	6,344	12,407	6,236	69,923
Percent of Total	1.8	3.8	4.4	3.3	2.6	3.4
Agriculture Earnings	37,350	12,136	19,381	22,808	13,919	105,594
Percent of Total	15.5	1.1	13.5	6.0	5.9	5.1

Source: U.S. Bureau of Economic Analysis 1994.

3.12.2.2 Falls 2 MOA

The ROI for the Falls 2 MOA socioeconomic analysis consists of the three counties under the existing MOA, including portions of Clark, Eau Claire, and Wood counties in west central Wisconsin (see Figure 3-10). Socioeconomic data are available for these counties in their entirety.

Demographics

In 1995, total population in the ROI was 195,877 persons, representing 3.8 percent of the state's total population of 5,122,871 (see Table 3-26). At the time of the 1990 Census, total population in the ROI was 190,435 persons, representing a 3.2 percent increase from the 1980 population of 184,514 persons. Population growth in the ROI between 1980 and 1990 has been slightly slower than the state-level population growth of 4.0 percent.

The most populous county in the ROI is Eau Claire County, which alone accounts for 45 percent of the three-county population. Eau Claire County is also the most densely populated with approximately 139 residents per square mile, compared to 27 and 94 residents per square mile in the remaining counties. With an average population density in the ROI of 74 persons per square mile, compared to the statewide density of 92 persons per square mile, the ROI is considered to be somewhat urban in nature, but the population is concentrated in particular geographic areas within the ROI. At the time of the 1990 Census, there were 69,964 households in the ROI, with an average household size of 2.7 persons.

Table 3-26. County and Falls 2 ROI Demographics

	CLARK COUNTY	EAU CLAIRE COUNTY	WOOD COUNTY	ROI
1995 Population	32,660	88,488	74,729	195,877
1990 Population	31,647	85,183	73,605	190,435
1980 Population	32,910	78,805	72,799	184,514
1995 Persons per Square Mile	26.9	138.8	94.2	74.1
1990 Households	11,209	31,282	27,473	69,964
1990 Average Household Size	2.8	2.7	2.7	2.7

Source: U.S. Bureau of the Census 1994, 1996.

Employment and Income

During 1992, total employment in the ROI amounted to 116,106 jobs, representing less than 5 percent of all employment in the state (see Table 3-27). Total employment figures for 1980 and 1990 amount to 96,225 and 112,027, respectively. In 1991, the average unemployment rate in the ROI was 5.3 percent, compared to the state unemployment rate of 5.2 percent.

Table 3-27. Falls 2 ROI Employment

	CLARK COUNTY	EAU CLAIRE COUNTY	WOOD COUNTY	ROI
1992 Employment	*14,579*	*52,742*	*48,785*	*116,106*
1990 Employment	*14,297*	*50,412*	*47,318*	*112,027*
1980 Employment	*14,934*	*41,930*	*39,361*	*96,225*
Unemployment Rate (1991)	*8.3*	*4.6*	*5.2*	*5.3*

Source: U.S. Bureau of Economic Analysis 1994.

In 1992, total earnings for jobs located in the ROI amounted to $2.5 billion (see Table 3-28). Of this total, $72 million (2.9 percent) was related to the tourism industry and $64 million (2.6 percent) was related to agriculture.

Table 3-28. Tourism and Agriculture Earnings in Falls 2 MOA ROI (thousands of dollars)

	CLARK COUNTY	EAU CLAIRE COUNTY	WOOD COUNTY	ROI
Total Earnings	*241,114*	*1,065,694*	*1,179,785*	*2,486,593*
Tourism Earnings	*4,327*	*40,609*	*27,389*	*72,325*
Percent of Total	*1.8*	*3.8*	*2.3*	*2.9*
Agriculture Earnings	*37,350*	*12,136*	*14,682*	*64,168*
Percent of Total	*15.5*	*1.1*	*1.2*	*2.6*

Source: U.S. Bureau of Economic Analysis 1994.

3.12.2.3 Volk South MOA

The ROI for the Volk South MOA socioeconomic analysis consists of the three counties under the existing MOA, including portions of Adams, Juneau, and Monroe counties in west central Wisconsin (see Figure 3-10). Socioeconomic data are available for these counties in their entirety. Although a very small area in the SE corner of Jackson County is under the Volk South MOA, the County was not included in the ROI. It was determined that including Jackson County in the ROI would misrepresent potential impacts.

Demographics

In 1995, total population in the ROI was 94,034 persons, representing 1.8 percent of the state's total population of 5,122,871 (see Table 3-29). At the time of the 1990 Census, total population in the ROI was 90,253 persons, representing a 4.8 percent increase from the 1980 population of 86,399 persons. Population growth in the ROI between 1980 and 1990 has been relatively faster than the state-level population growth of 4.0 percent.

The most populous county in the ROI is Monroe County, which alone accounts for 40 percent of the four-county population. Monroe County is also the most

densely populated with approximately 42 residents per square mile, compared to 17 to 29 residents per square mile in the remaining counties. With an average population density in the ROI of only 28 persons per square mile, compared to the statewide density of 92 persons per square mile, the ROI is considered to be generally rural in nature. At the time of the 1990 Census, there were 33,634 households in the ROI, with an average household size of 2.7 persons.

Table 3-29. County and Volk South MOA ROI Demographics

	ADAMS COUNTY	JUNEAU COUNTY	MONROE COUNTY	ROI
1995 Population	17,422	22,193	37,694	77,309
1990 Population	15,682	21,650	36,633	73,965
1980 Population	13,457	21,037	25,074	69,568
1992 Persons per Square Mile	26.9	28.9	41.8	33.4
1990 Households	5,972	8,265	13,144	27,381
1990 Average Household Size	2.4	2.6	2.7	2.7

Source: U.S. Bureau of the Census 1994, 1996.

Employment and Income

During 1992, total employment in the ROI amounted to 36,601 jobs, representing less than 2 percent of all employment in the state (see Table 3-30). Total employment figures for 1980 and 1990 amount to 31,376 and 35,304, respectively. In 1991, the average unemployment rate in the ROI was 6.8 percent, compared to the state unemployment rate of 5.2 percent.

Table 3-30. Volk South MOA ROI Employment

	ADAMS COUNTY	JUNEAU COUNTY	MONROE COUNTY	ROI
1992 Employment	4,805	11,426	20,370	36,601
1990 Employment	4,589	10,984	19,731	35,304
1980 Employment	3,948	9,101	18,327	31,376
Unemployment Rate (1991)	6.5	6.7	7.0	6.8

Source: U.S. Bureau of Economic Analysis 1994.

In 1992, total earnings for jobs located in the ROI amounted to $677 million (see Table 3-31). Of this total, $22 million (3.2 percent) was related to the tourism industry and $39 million (5.8 percent) was related to agriculture.

Table 3-31. Tourism and Agriculture Earnings in Volk South MOA ROI (thousands of dollars)

	ADAMS COUNTY	JUNEAU COUNTY	MONROE COUNTY	ROI
Total Earnings	*87,097*	*210,519*	*379,375*	*676,991*
Tourism Earnings	*2,788*	*6,539*	*12,407*	*21,734*
Percent of Total	*3.2*	*3.1*	*3.3*	*3.2*
Agriculture Earnings	*7,236*	*8,886*	*22,808*	*38,930*
Percent of Total	*8.3*	*4.2*	*6.0*	*5.8*

Source: U.S. Bureau of Economic Analysis 1994.

3.13 STRUCTURE OF THIS EIS DOCUMENT

The primary presentation of the issues of concern and potential impacts associated with the alternatives is presented in the sections listed below:

- Section 1: Purpose and Need for the Action
- Section 2: Description of the Proposed Action and Alternatives
- Section 3: Affected Environment
- Section 4: Environmental Consequences.

Other shorter sections address the EIS preparers (Section 5), agency coordination (Section 6), references (Section 7), an index (Section 8), and acronyms and abbreviations (Section 9). Numerous appendices support the technical analyses and are presented at the end of this document.

SECTION 4

ENVIRONMENTAL CONSEQUENCES

4. ENVIRONMENTAL CONSEQUENCES

This section of the Environmental Impact Statement (EIS) assesses the potential environmental consequences associated with the Proposed Action and Alternatives that may occur as a result of the Hardwood Range expansion and associated airspace actions. Pursuant to the requirements of the National Environmental Policy Act (NEPA) and Air Force Instruction (AFI) 32-7061, the following sections assess direct, indirect, unavoidable, and cumulative effects. Potential environmental impacts are evaluated in the context of the scope of the Proposed Action using a conservative, maximum situation approach, as defined in Section 2, and in consideration of the potentially affected environment characterized in terms of the region of influence (ROI), as described in Section 3. Some of the assessments of the potential for range use and aircraft-related impacts discussed in this section draw from more detailed analyses presented in Appendices E and F of this EIS.

4.1 AIRSPACE MANAGEMENT/AIR TRAFFIC

4.1.1 Overview

4.1.1.1 Issues and Concerns

Primary issues and concerns pertaining to airspace management/air traffic resulting from the proposed airspace actions include the following:

- The effect of the establishment and/or modification of the military training airspace components upon adjacent controlled, uncontrolled, special use, or other designated airspace
- The effect of the proposed airspace actions upon non-participating civil and military aircraft operations
- The effect of the proposed airspace actions upon civil airports that underlie, are adjacent to, or are in the immediate vicinity of the military airspace being assessed as part of the Hardwood Range Expansion.

4.1.1.2 Methodology for Analyzing Impacts

Airspace impacts are predicated upon the extent to which the proposed airspace actions affect the navigable airspace in a terminal or en route airspace-related environment. Significant impacts would occur if an action had a major effect on (1) movement of other air traffic in the area; (2) air traffic control systems or facilities; or (3) airspace already designated and used for other purposes (i.e., military operations areas [MOAs], restricted areas, and military training routes [MTRs]).

Potential airspace impacts were assessed by a general evaluation to determine the extent to which the proposed airspace actions would change existing relationships with Federal airways, transition areas, and airport-related air traffic operations, and the effect of the airspace alternatives upon the movement of instrument flight rules (IFR) and visual flight rules (VFR) air traffic.

4.1.1.3 General Findings

MOAs are designated for military training, and use of these areas is controlled. MOA airspace must be scheduled; access, entry, and exit from the airspace is controlled by an air traffic control agency. Despite these restrictions, MOAs are still available for use by non-military air traffic. Because MOAs are not in continuous military use, they are available for use by non-military aircraft during these inactive times. In addition, compliance with FAA regulations to exclude airspace below 1,500 feet above ground level (AGL) within 3 nautical miles (NM) of public use airports (Federal Aviation Administration [FAA] Order 7400.2D, Procedures for Handling Airspace Matters, Chapter 11) precludes impacts on air traffic patterns at public use airports. Military pilots either avoid private airports or approach them with caution, using the "see-and-avoid" flight principle to ensure safe separation of aircraft. This is the current practice in existing airspaces. An aircraft's onboard radar also aids in identifying other aircraft and maintaining safe separation distances from these aircraft.

Although existing MOA boundaries would not be modified under the Proposed Action, the number of sorties flown within the MOAs would be reassessed. Under both alternatives, conflicts between defense-related flight activities in the MOAs would be resolved by the military through scheduling of flight activities. Military pilots would be responsible for deconflicting each other's flight path through mutual timing arrangements and/or applying "see-and-avoid" principles. In addition, military and civilian pilots would be responsible mutually for avoiding aircraft flying under VFR along low-altitude airways and in the MOAs. Non-military pilots, by consulting with the local Flight Service Station or Volk Field Operations (at 1-800-972-8673), could determine when flights are scheduled for the neighboring airspaces. In addition, MOA status is available on VHF 120.0 for any aircraft in flight. Air traffic controllers would also be available to provide information to radio-equipped aircraft regarding the position of other aircraft to help ensure safe separation distances. For airways and military training airspace that are in close proximity, the servicing air traffic control agency would provide safe separation for aircraft operating under IFR. In addition, the air traffic control agency would consider other areas where MOAs and MTRs interact with controlled, uncontrolled, special use, or other designated airspace.

The proposed range expansion is not anticipated to have an adverse impact on "Spirit of Marshfield" helicopter medevac operations through the restricted airspace. The Marshfield Base Manager has established an agreement with Volk Field personnel which includes procedures to ensure that military flight operations will be curtailed, if necessary, to ensure that "Spirit of Marshfield" flights with patients will have direct, unimpeded access to their destination. In addition, Minneapolis Air Route Traffic Control Center personnel assign the necessary priority to "Spirit of Marshfield" flights to ensure direct flight routing.

Although the MOA airspace intersects with Federal airways and airport-related air traffic operations, the proposed changes in MOA utilization would not result in conflicts with or significant impacts to existing operations. The FAA manages all airspace and has established rules of flight and air traffic control procedures to govern safe aircraft operations near and between airports, and within defense-related airspace. Military operations are conducted within designated airspace and follow specific procedures to minimize the hazard of high-speed flight training to non-participating civil or military aircraft.

4.1.2 Hardwood Range Expansion and Associated Restricted Airspace

4.1.2.1 Range Expansion

The area proposed for inclusion in the Hardwood Range consists of land north of the existing range that would be designated as a weapons impact area. No charted or uncharted, private or public-use airports, or navigation aids are located within the area proposed for expansion. The impact area would be clearly marked by posted signs and/or barricade type fencing to notify pedestrians and motorists of the impending danger of trespassing. Without any conflicts with Federal airways, transition areas, or airport-related air traffic operations, the range expansion would not pose any significant impact to air operations.

4.1.2.2 Use of Restricted Airspace R-6904

The airspace associated with the Hardwood Range includes the vertical and horizontal confines of Restricted Airspace 6904A and 6904B (R-6904A/B). R-6904B

would be wholly contained within R-6904A and would mirror the range land expansion area, while being lowered to the surface. Additionally, the maximum altitude of R-6904A and B would increase to flight level (FL) 250 or higher, as needed. Access into and through the airspace would be granted by the designated Air Route Traffic Control Center (Minneapolis Center). No charted or uncharted, private or public-use airports would be within the proposed area for expansion; therefore, expansion of R-6904 would not conflict with transition areas, or airport-related air traffic operations, and no significant impacts would be expected. High-altitude Federal airways could be impacted by the increased altitude of R-6904.

4.1.3 Falls 1 and 2 MOAs

Reassessing the utilization of Falls 1 and Falls 2 MOAs involves the MOAs' vertical and horizontal confines as currently charted. The MOAs overlie the Blair (public use), Lewis (private), Black River Falls (public use), Neillsville (public use) and Cunningham (private) airports. Military pilots would continue to be required to avoid public use airports by at least 3 NM laterally or 1,500 feet vertically as is the current practice. Victor airways 246, 345 and 55, along with visual routes (VRs) 1616 and 1650, traverse the airspace. Minneapolis Air Route Traffic Control Center would provide traffic separation for aircraft on an IFR flight plan. Pilots would be able to determine the utilization status of the Falls 1 or Falls 2 MOAs by contacting the Minneapolis Center, the servicing Flight Service Station, Volk Field Operations (at 1-800-972-8673) and/or by monitoring the Volk Airspace Information System on VHF 120.0.

4.1.4 Volk South MOA

The airspace area associated with the proposed Volk South MOA utilization reassessment includes the MOA's vertical and horizontal confines as currently charted. Volk Field along with one charted public-use airport and five private landing zones underlie the Volk South MOA. Pilots would be required to avoid these airports by at least 3 NM laterally or 1,500 feet vertically as is the current practice. In addition, one low altitude airway (V-345) traverses the MOA. Safe separation distance from aircraft flying in V-345 on an IFR flight plan would be provided by Chicago Center. Pilots would be able to determine the utilization status of the Volk South MOA by contacting Chicago Center, Volk Tower, Volk Approach Control, the servicing Flight Service Station, or using procedures identified in Subsection 4.1.3.

4.1.5 No-Action Alternative

Under the No-Action Alternative, the Hardwood Range real property, R-6904B, Falls 1 and 2 MOAs, and Volk South MOA would remain in their current configuration, and utilization would remain unchanged. There would continue to be no conflicts with Federal airways, transition areas, or airport-related air traffic operations. Accordingly, under the No-Action Alternative, there would be no impact upon airspace management/air traffic.

4.1.6 Unavoidable Adverse Impacts

Under both the Proposed Action and No-Action Alternatives, no adverse environmental impacts associated with airspace management would be expected to occur.

4.2 NOISE

4.2.1 Overview

4.2.1.1 Issues and Concerns

Noise, often defined as unwanted sound, is one of the most common environmental issues associated with aircraft operations. Although aircraft are not the only source of noise, they are readily identifiable to those affected by their noise emissions and are typically singled out for special attention and criticism. Consequently, aircraft noise problems often dominate analyses of environmental impacts on actions such as those proposed and analyzed in this document.

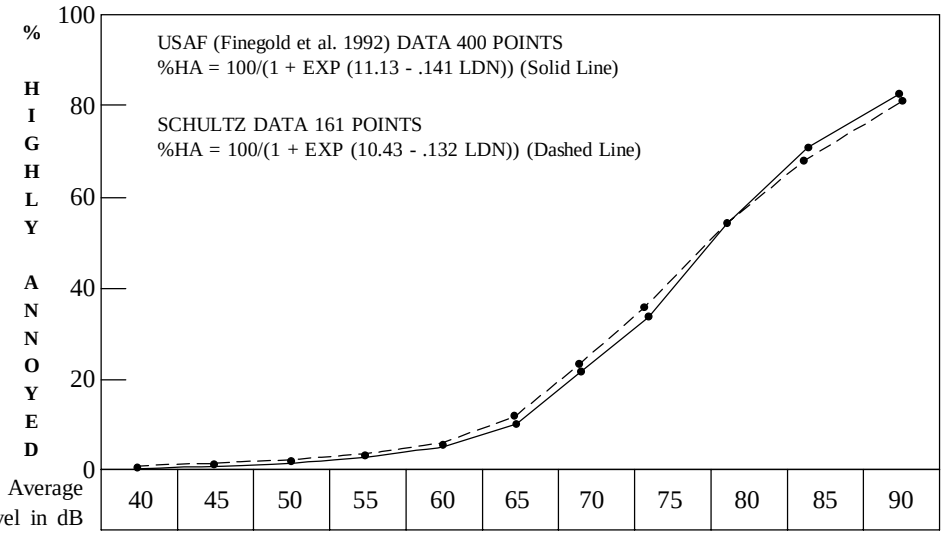
Concerns regarding aircraft noise relate to certain potential impacts such as hearing loss; non-auditory health effects; annoyance; speech interference; sleep interference; and effects on domestic animals and wildlife, structures, terrain, and historical and archaeological sites. A general discussion of noise and noise effects is presented in Appendix F of this EIS.

4.2.1.2 Methodology for Analyzing Impacts

In this EIS, the primary noise metric used to model aircraft noise levels is the Onset Rate-Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}). This is an enhanced version of the widely accepted Day-Night Average Sound Level, L_{dn} (also denoted DNL). L_{dn} is a cumulative metric which accounts for the sound level and duration of individual events, plus the number of events. It includes a 10 dB penalty for events at night (10:00 PM to 7:00 AM). L_{dnmr} includes two additional factors. First, it includes an onset rate penalty to account for increased annoyance associated with the surprise factor of high speed, low-altitude military aircraft noise. This is sometimes referred to as "startle effect." Second, it is based on operations during the busiest month of the year, so that predictions are not diluted by seasonal periods of low activity.

L_{dn} (and, by extension, L_{dnmr}) is based on decades of research on the effects of noise on communities. Dozens of metrics have been proposed, with each accounting for the magnitude, duration, and frequency of noise. L_{dn} has emerged as the most widely accepted metric. It correlates well with community response, and is consistent with controlled laboratory studies of people's perception of noise. It was the primary metric used in the U.S. Environmental Protection Agency's (EPA) "levels document" (EPA 1974), and was further endorsed for aviation noise analysis by the Federal Interagency Committee on Noise (FICON 1992). While originally developed for major noise sources such as highways and airports in populated areas, L_{dn} has been shown to be applicable to infrequent events (Fields and Powell 1985) and to rural populations exposed to sporadic military aircraft noise (Stusnick et al. 1992; Stusnick et al. 1993).

Interpretation of L_{dn} or L_{dnmr} is usually based on the "Schultz Curve." This curve predicts the average response of communities to various L_{dn} levels. It was first published in 1978 (Schultz 1978) and has been updated and validated several times (e.g., Fidell et al. 1991). The current version is as presented by FICON (FICON 1992), with a logistic curve fit (Finegold et al. 1994) (see Figure 4-1). The equation fit by Finegold et al. (1994) represents a good fit to the data and is also consistent with current theory of human annoyance reaction (Fidell et al. 1988). The model includes a



Calculated %HA Points												
	USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
	SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

Figure 4-1. Response of Communities to Noise; Comparison of Original (Schultz 1978) and Current USAF (Finegold et al. 1994) Curve Fits

single inflection point, and annoyance never equals zero even when there is no noise (because some people are always annoyed), and annoyance never equals 100 percent, no matter how noisy (because some people are never annoyed or never complain). Response to L_{dnmr} is obtained by applying L_{dnmr} to the L_{dn} axis of the Schultz curve. Since L_{dnmr} is always greater than or at least equal to L_{dn}, this automatically yields the increased annoyance associated with the added penalties used with L_{dnmr}.

The most common point referred to on the Schultz curve is 65 dB. This is a benchmark often applied to determine residential land use compatibility around airports or highways. By extension, it is often used as a criterion in planning of airspace. In this EIS for the proposed expansion of the Hardwood Range, it is recognized that affected areas are diverse and it is not appropriate to use a single criterion.

The L_{dn} 65 dB is useful to recognize as a level which, when exceeded, is normally not compatible with residential land use. Two other levels are also useful:

- L_{dn} of 55 dB was identified by the US EPA as a level "...requisite to protect the public health and welfare with an adequate margin of safety" (EPA 1974). Noise may be heard, but there is no risk to public health or welfare.

- L_{dn} 75 is a threshold above which effects other than annoyance may occur. It is 10 to 15 dB below levels at which hearing damage is a known risk (Occupational Safety and Health Administration [OSHA] 1983). It is also a level above which adverse health effects (as detailed in Subsection 4.13) cannot be categorically ruled out.

At levels below 55 dB the percentage of annoyance is correspondingly lower. Annoyance is never zero, but at 45 dB or less it is small enough to be negligible.

L_{dn} can be interpreted in two ways: as an average or as a summation. Its formal definition is an average, and this fits intuitive concepts when dealing with continuous noise such as a busy highway. The other interpretation is as a summation: an average represents a summation divided by a time period. Because L_{dn} is divided by a fixed 24 hour time period, it represents the total sound energy over that period. For that reason, L_{dn} is often referred to as a "cumulative" metric. For intermittent sounds, it does not represent the sound level at any given time, but represents the total sound being received - effectively the "noise dose" for a day.

The noise associated with flight activities on the Hardwood Range and in the regional military training airspace is intermittent, so that L_{dn} provides a valid measure of the total noise but does not provide an intuitive description of the noise at any given time. This EIS therefore contains information describing the number of noise events each day that would have a sound exposure level (SEL) at or above 65 dB. The primary measure for events heard is the SEL. Individual time-varying noise events (such as an aircraft overflight) have two main characteristics: a sound level that changes throughout the event and a period of time during which the event is heard. The SEL is a composite metric that represents both the intensity of a sound and its duration. It is important to note, however, that the SEL does not directly represent the sound level

heard at any given time, but rather provides a measure of the net impact of the entire event. Appendix F provides a detailed discussion of noise metrics. Conversational speech is in the 65 dB range; noises at this level are likely to interfere

with speech communication and are very likely to be heard. Aircraft sounds with SEL of 65 dB will typically have maximum sound levels in the 50 to 65 dB range.

In addition to numbers of events with SEL above 65 dB, the analysis presents the number of sounds with SEL above 45 dB and above 90 dB. SEL of 45 dB represents sounds which might be detected but would cause no objective interference. SEL of 90 dB represents sounds which are comparable to the noise of a heavy truck or equipment such as tractors. This is a sound which is intrusive, and which would result from aircraft flying within a half mile to one mile of overhead. The maximum instantaneous level during a noise event is typically 0 to 15 dB lower than the SEL.

4.2.1.3 Methodology for Predicting Noise

Noise levels for the alternatives addressed in this EIS were computed using the Air Force's MR_NMAP computer program (Lucas and Calamia 1994). That model is based on the Air Force's NOISEMAP program (Moulton 1992). Within MOAs with no preferred tracks, it computes noise based on a uniform distribution of sorties. For MTRs and similar tracks within MOAs, MR_NMAP incorporates the calculations used by the Air Force's ROUTEMAP program (Lucas and Plotkin 1988). NOISEMAP routines are also included for special conditions not represented by the MOA or route algorithms. MR_NMAP calculates noise levels on a regular grid within the ROI. Results are output via the NOISEMAP noise-contouring routine NMPLOT, either as contours of various noise levels or as levels at individual grid points.

MR_NMAP calculates noise levels as if the ground were flat. The study area includes hilly terrain. Studies have been conducted on the effect of terrain (Plotkin et al. 1993; NATO 1994). These studies show that topographic features can sometimes increase noise levels by up to 3 dB (reflections) and can sometimes decrease noise substantially (shielding, often in excess of 20 dB). The net result is lower cumulative noise levels than predicted from flat ground. Low-altitude flight altitudes are also expressed as AGL.

Results of noise analyses are presented in table form. The information given in this EIS accounts for cumulative and maximum situation analysis. In terms of cumulative impacts, other MOAs and/or MTRs that intersect, overlap, and/or coincide with an airspace component that is being assessed are considered cumulatively in the analysis. This approach results in cumulative L_{dnmr} levels that account for all flight activity occurring within the airspace boundaries for each ROI. In addition, the maximum number of aircraft operations that would occur have been accounted for in order to obtain a maximum situation analysis. Aircraft operational data used for calculating noise levels include aircraft types, hours of operation, power settings, speeds, durations, altitude profiles, and sorties. Thus, this approach results in the presentation of the highest L_{dnmr} values and number of SEL events within a 24-hour day.

4.2.1.4 General Findings

Cumulative noise levels for the Proposed Action are compared with current conditions and summarized in Table 4-1.

Table 4-1. Summary of Maximum Cumulative Noise Levels (L_{dnmr}, dB) at Selected Locations in the Study Area

SPECIFIC POINT	*BASELINE NOISE LEVELS (IN L_{dnmr})*	*PROPOSED ACTION NOISE LEVELS (IN L_{dnmr})*	*CHANGE IN dB*
1 (Pittsville)	*35*	*46*	*+11*
2 (Cranmoor)	*57*	*59*	*+2*
3 (Gravel Pit)	*64*	*66*	*+2*
4 (Armenia)	*47*	*56*	*+9*
5 (Finley)	*50*	*55*	*+5*
6 (Babcock)	*61*	*60*	*-1*
7 (Remington)	*54*	*55*	*+1*
8 (Dexterville)	*36*	*54*	*+18*
9 (Beneath VR-1650)	*44*	*56*	*+12*
10 (Beneath VR-1616)	*38*	*37*	*-1*
11 (Beneath VR-1650 & Falls 2 MOA)	*51*	*51*	*---*
12 (Beneath VR-1650 & Falls 1 MOA)	*50*	*52*	*+2*
13 (Beneath VR-1616 & Falls 1 MOA)	*51*	*53*	*+2*
14 (Lake Arbutus)	*56*	*56*	*---*
15 (Coon Fork County Park)	*49*	*52*	*+3*
16 (Castle Rock Lake)	*47*	*49*	*+2*
UNIFORMLY DISTRIBUTED NOISE	***BASELINE NOISE LEVELS (IN L_{dnmr})***	***PROPOSED ACTION NOISE LEVELS (IN L_{dnmr})***	***CHANGE IN dB***
17 (Falls 1 MOA)	*49*	*52*	*+3*
18 (Falls 2 MOA)	*49*	*50*	*+1*
19 (Volk South MOA)	*46*	*50*	*+4*
20[1] (VR-1616)	*55 - 58*	*55 - 58*	*---*
21[1] (VR-1650)	*45 - 47*	*45 - 47*	*---*
22 (R-6904A)	*56*	*53*	*-3*
23 (R-6904B, existing)	*63*	*---*	*N/A*
24 (Bomb Circle on Range, existing)	*72*	*69*	*-3*
25 (R-6904B, proposed)	*N/A*	*61*	*N/A*
26 (12-mile Circle Around Range, proposed)	*N/A*	*55*	*N/A*
27 (C-130 Drop Zone, (DZ) proposed)	*N/A*	*49*	*N/A*

Note: 1. Represents combined airspace (MTR with MOA).

Changes in individual events are summarized in Table 4-2. This table shows the maximum number of daily events exceeding SEL of 45, 65 and 90 dB. As described in Section 4.4.1.2, these represent (respectively) levels which might be heard, levels which might interfere with speech communication, and intrusive levels which would result from an aircraft flying within one-half to one mile from directly overhead. Fractions less than one denote events not occurring on a daily basis; 0.1 indicates that the event would occur, on average, once every 10 flying days.

Table 4-2. Summary of Average Daily Noise Events Above SEL 45 dB, 65 dB, and 90 dB, by Analysis Location

	EVENTS ABOVE 45 dB			*EVENTS ABOVE 65 dB*			*EVENTS ABOVE 90 dB*		
LOCATION	*BASE-LINE*	*PROP.*	*CHANGE*	*BASE-LINE*	*PROP.*	*CHANGE*	*BASE-LINE*	*PROP.*	*CHANGE*
Falls 1 MOA	*1.7*	*2.4*	*+0.7*	*0.5*	*0.6*	*+0.1*	*0.0*	*0.0*	—
Falls 2 MOA	*1.7*	*2.0*	*+0.3*	*0.4*	*0.5*	*+0.1*	*0.0*	*0.0*	—
Volk South MOA	*0.6*	*1.9*	*+1.3*	*0.2*	*0.5*	*+0.3*	*0.0*	*0.0*	—
Falls 1+ VR-1650 (A-B)	*2.6*	*3.3*	*+0.7*	*0.7*	*0.8*	*+0.1*	*0.0*	*0.0*	—
Falls 1+ VR-1616 (D-E)	*7.7*	*8.4*	*+0.7*	*2.3*	*2.4*	*+0.1*	*0.1*	*0.1*	—
Falls 1+ VR-1616 (E-G)	*8.3*	*9.0*	*+0.7*	*2.7*	*2.8*	*+0.1*	*0.1*	*0.1*	—
Falls 2+ VR-1650 (A-C)	*2.6*	*2.9*	*+0.3*	*0.6*	*0.7*	*+0.1*	*0.0*	*0.0*	—

An alternate perspective for individual events is the amount of time each day that an aircraft might be heard. In a Report to Congress (U.S. Department of Interior [DOI] 1995), the National Park Service evaluated the potential for wilderness experiences to be adversely affected by aircraft noise. One method of analysis was based on the percentage of time aircraft were audible, with charts presented covering the range from 1 percent to 100 percent of the time. Direct overflights of low-altitude high speed military aircraft are generally audible for 30 to 90 seconds (Plotkin et al. 1991). Indirect overflights, such as events just over 45 dB or just over 65 dB, would be audible for shorter times. Taking an average duration of 30 seconds for events above 45 dB and 60 seconds for events above 65 dB, aircraft noise will be heard in the Falls 1 MOA along the centerline of segments E-G of VR-1616 (the maximum situation) for an average of less than seven and one-half minutes per day. The portion of the audible period that would actually be above 45 or 65 dB is less, since the maximum level for a given overflight lasts only a few seconds. The brief time periods of potential exposure to noise levels of 65 dB or greater would not be expected to create significant impacts.

4.2.2 Hardwood Range Expansion

Under the Proposed Action, the Hardwood Range would be expanded geographically, and new targets would be emplaced and constructed to provide a tactical range capability that would augment the capability that currently exists. During this construction period, construction equipment, handling equipment, and increased human activity would be sources of additional noise. However, this would be very localized, and of relatively short duration. Noise created by these activities would not be significant, and it is reasonable to assume that aircraft noise associated with on-going operations on the conventional range would continue to dominate the regional acoustic environment.

4.2.3 Restricted Airspace R-6904

With the expansion of the range, and the development of a tactical training ordnance delivery capability, the current restricted airspace R-6904B would also be enlarged to support the new operations. Additionally, with the initiation of a tactical range capability, flight patterns around the immediate vicinity of the range would be modified. It is estimated that those conventional type operations that are currently centered around established conventional bombing tracks would be reduced by 50 percent. These operations would transition from the conventional range to the tactical. This not only means that operations will be more dispersed within R-6904A, but also within the abutting MOA airspace surrounding the range. It is estimated that the airspace contained within an approximate 12 mile radius circle around the range will provide support airspace for the conduct of tactical operations on the range. The noise analyses for the modification of the range reflect these changing flight patterns.

As shown in Table 4-1, the areas surrounding the range complex (Points 1-10, 25, and 26) generally reflect increases in noise levels as aircraft begin to use more of the available airspace for tactical range activities. Conversely, this more diffused aircraft activity reduces noise levels in R-6904A and on the conventional portion of the range (Points 22 and 24). Nevertheless, it should be noted that the noise increases associated with the expansion of the range, which range up to an 18 dB increase in total sound exposure at one location, would be noticeable and at the higher levels constitute a substantial change. Overall noise levels resulting from this action would indicate that approximately 1 to 13 percent of the people so exposed would be highly annoyed by the noise. The highest noise levels off of the range are expected to occur near a gravel pit northeast of the range expansion area, where noise levels would increase from 64 to 66 L_{dnmr} and at Cranmoor, where noise levels would increase from 57 to 59 L_{dnmr}.

4.2.4 MOA Utilization

Under the Proposed Action operations would be reassessed in the Falls 1, Falls 2, and Volk South MOAs. As shown for points 17 - 19, the uniformly distributed resultant noise levels would be 52, 50, and 50 L_{dnmr} in each of these airspaces, respectively. Although this represents a 1 to 4 dB increase, the resultant levels would be noticeable to a moderate degree. Since use of the MTRs remains constant, those cumulative noise levels associated with the interaction of the MTRs and MOAs reflect the same general trends as the MOAs (Points 11-16). Changes under these areas are slight.

Flight activities in the Volk West MOA are unaffected by these proposals. The environmental effects of these activities were previously assessed under other

environmental documentation (Air National Guard Readiness Center [ANGRC] 1992). However, the cumulative effects associated with two MTRs (VR-1616 and VR-1650) passing through the MOA airspace were considered. Resultant noise directly along the centerline of these two MTRs is not significant, and varies only slightly from the MTR-related contribution. The analysis indicates that cumulative noise levels are at L_{dnmr} 58 and 48 under VR-1616 and VR-1650, respectively.

4.2.5 No-Action Alternative

Under the No-Action Alternative, Hardwood Range would not be expanded, and a realistic tactical delivery capability for the range would not be developed. Range operations would continue as described under current operations.

4.2.6 Unavoidable Adverse Impacts

The increased noise levels associated with the modified use of all of the airspace elements associated with these proposals are unavoidable adverse impacts that would occur if the Proposed Action were implemented.

4.3 SAFETY

4.3.1 Overview

For the Proposed Action and each alternative, the elements of the proposal that have a potential to affect safety are evaluated relative to the degree to which the action increases or decreases safety risks to aircrews, the public, and property. A proposal's anticipated altered risks to ground, flight, and explosive safety are considered both individually and collectively.

4.3.1.1 Issues and Concerns

The proposals raise the following issues and concerns with regard to safety:

- Modifications to, and expansion of Hardwood Range may create safety hazards.
- Changes to range operations may increase hazards associated with munitions and explosive safety.
- Reassessing the utilization of some elements of military training airspace may increase flight safety risks.

4.3.1.2 Methodologies for Analyzing Impacts

Risks associated with ground, flight, and explosive safety, and their level of significance, are evaluated as follows.

In terms of ground safety, training-related activities are considered to determine if additional risk is associated with their undertaking. If additional risk is incurred, the ability to manage that risk is assessed.

Analysis of flight risks correlates Class A mishap rates and bird-aircraft strike hazards (BASH) with projected airspace utilization associated with the proposal. When compared to similar data for current use of the airspace, assessments can be made of the magnitude of the safety impacts resulting from the change. Since fire and crash risk are also a function of the risks associated with mishaps and bird-aircraft strikes, those statistical data are also considered in assessing that risk.

Explosive safety issues are evaluated to determine if any specific training activities would introduce major changes or alterations in the use and handling of ordnance, thereby increasing risk. If a unique situation is anticipated to develop as a result of any of the proposals, the capability of the range and its associated support personnel to manage that situation is assessed.

4.3.1.3 General Findings

The effects of the Proposed Action on safety include the following:

- Risks of Class A mishaps are not significantly altered by any element of the Proposed Action. Although some minor reductions in the statistically predicted time interval between mishaps are noted as a result of the

reassessed utilization of some airspace elements, all continue to indicate very low risk levels. For all of the aircraft using all of the airspace, the minimum projected time between Class A mishaps is 20.9 years in the Falls 1 MOA.

- Bird-aircraft strike risk is minimal.
- Potential increases to fire risk resulting from new and expanded operations are minimal.
- Development of the tactical range will require ongoing weapon safety footprint analysis and control by range managers to ensure that all ordnance delivered remains within range boundaries and avoids range facilities. Additionally, all unexploded ordnance (spotting charges in training bombs) and ordnance debris must be cleared from the proposed landing zone and DZ prior to tactical airlift training operations at those facilities. Capability exists to meet these requirements.
- Risks to persons and property underlying the training airspace associated with the proposals from objects dropped from aircraft using the airspace is minuscule.

4.3.2 Hardwood Range Expansion

Under the proposal, the overall numbers of operations on the range would be unchanged. However, operations would be modified and the range itself would be expanded. Nevertheless, increases to fire risk are considered minimal. The range's in-place fire suppression capability and trained personnel have proven effective in the past of minimizing fire spread. This capability will remain sufficient to manage expanded operations. Additionally, fire management techniques (e.g., firebreaks) are incorporated into the design of the existing range and will be included in the proposed expansion. During periods of high fire risk, procedures currently in effect to limit or completely curtail use of specific ordnance will continue to be enforced. This includes the use of flares, spotting charges in training ordnance that produce heat, and tracer ammunition.

During construction of the new range, standardized industrial safety practices will be used and enforced, thus minimizing any potential risk to workers.

Since the types and numbers of flight operations remain unchanged, the physical expansion of Hardwood Range does not increase risks associated with objects dropped from aircraft and has no effect on flight safety. However, the range expansion, both physically and operationally, does introduce some explosive and associated ground safety issues.

As previously discussed in Section 3.3, since training ordnance remains relatively intact after impact, and, occasionally a spotting charge fails to detonate, a prime safety consideration in range operations involves ensuring that the safety footprint associated with specific ordnance use is contained within range boundaries. Under current operations, aircraft attack headings, specific delivery profiles, and authorized ordnance have been identified and operational constraints have been developed and documented to ensure that all ordnance comes to rest on the range, and poses no risk to facilities on the range (Wisconsin Air National Guard [WIANG] 1992).

However, as part of the proposed range expansion, new target areas will be developed to be used as a tactical range. Under optimum conditions, this means that targets would be randomly placed, periodically moved, and would support attacks from

any direction (360 º axis of attack). Therefore, ongoing weapon safety footprint analysis is a critical aspect of safe operation of the range. Since analyses of these footprints involve unique considerations of specific target location, the aircraft attacking the target, the specific attack profile flown by that aircraft, and the ordnance delivered, a detailed assessment of all considerations is not possible at this time. As each factor varies, new assessments must be made by range operators, and necessary constraints developed to ensure continuation of safe operations. A brief discussion of these considerations will highlight the issues of potential concern.

In the broadest sense, there are two general classifications of weapon safety footprints. The first are those that are weapon system specific; the second are those that are not. As weapon systems (aircraft), and their associated bombing and navigation systems have improved both in accuracy and reliability, specific footprints have been developed that account for these improvements. The specific footprints associated with those aircraft for many events are relatively small in overall size. However, when aircraft for which specific footprints have not been developed are using the range, all that is available to assess their probable footprint are those identified as general, or "All." These footprints are based on historic data that often include older aircraft, that had less accurate and less reliable bombing systems. As such, these footprints are quite large, and create constraints on the flexibility available for both target placement and attack profiles, unless vast land areas are available. To illustrate the differences between the two general types of footprints, Table 4-3 presents comparative data for some typical attack profiles flown by specific aircraft, as well as data for an unspecified aircraft. All of the footprints shown are for the bomb dummy unit (BDU)-33, the most prevalent training munition to be used on the range. Shown is the aircraft applicability, the attack profile, target characteristics, and the long, short, and cross-range dimensions of the footprint.

Table 4-3. Weapon Safety Footprint Comparison

		FOOTPRINT DIMENSIONS (IN FEET)		
AIRCRAFT TYPE	***ATTACK PROFILE***	***LONG***	***SHORT***	***CROSS***
All	*Pop-Up*	*10,100*	*6,800*	*2,500*
All	*Low Altitude Level*	*11,042*	*5,900*	*2,000*
F-16	*Low Angle (Hard Target)*	*2,087*	*3,400*	*1,550*
F-16	*Dive Bomb (Soft Target)*	*3,300*	*2,125*	*1,600*
A-10	*Low Angle (Hard Target)*	*3,696*	*2,450*	*2,500*
A-10	*Dive Bomb (Soft Target*	*3,125*	*2,110*	*2,500*
F-15	*Low Angle (Hard Target)*	*2,300*	*3,400*	*1,900*
F-15	*Dive Bomb (Soft Target)*	*2,100*	*2,800*	*2,100*

Source: U.S. Air Force 1994

To continue the illustration, and assess the application of these footprint data, consider a target placed in the center of the proposed new target area. In this case, all of the weapon system specific footprints shown above would support an attack from any direction, and all ordnance would remain contained within the range area. However, if an aircraft for which no specific footprint were available would attempt a low altitude level delivery against the same target, attack heading constraints would have to be enforced to contain the ordnance. In this specific case, the aircraft would have to be prohibited from attacking on headings from 038° to 115° because the footprint extends off range to the east, and on headings from 237° to 342° because one of the range spotting towers is contained within the footprint, or it extends beyond the western border of the range. If the target location were changed, the constraints would also change. However, in the case of this particular footprint, it should be noted that there is no possible location within the proposed target area to place a target that would support a full 360° axis of attack.

During range operations, target placement and operational opportunities and constraints may be narrowed by considering distances from the target area boundaries and the range borders. These distances are approximately 6,300 feet to the north, 6,000 feet to the south, 5,300 feet to the east, and 6,300 feet to the west. As an added consideration, it should be noted that the range scoring towers are located approximately 5,200 feet from the southwest corner of the proposed target area.

Range managers must also consider these safety footprints in relation to the proposed C-130 landing zone and DZ. These areas are included as part of the land area available to contain the safety footprints. Therefore, there is a high probability that these areas would contain ordnance debris. Some of this debris could contain spotting charges which failed to detonate on impact, which would constitute unexploded ordnance. After air-to-ground training activities on the range, and before the landing zone or the DZ could be used for C-130 operations, the area would require explosive ordnance disposal (EOD) personnel to collect all unexploded ordnance, render it safe, and remove it for disposal. These requirements do not necessarily mean that the range would have to curtail all operations. However, range managers would have to ensure that any operations performed did not include any training events that would have the potential to recontaminate the areas being prepared for tactical airlift training activities.

Special activities to support tactical airlift training would have no specific effect on the requirement for regular, periodic range clearance. Sufficient EOD personnel are available to support this requirement. Processes, procedures, and schedules that exist, and have proven effective in the past, will continue to be employed. Hardwood Range is capable of supporting the proposed expansion in both size and activities.

4.3.3 Airspace Utilization

As previously stated, aircraft overflight, in and of itself, poses little risk to persons and property on the ground. Aside from an aircraft mishap, which is discussed in more detail below, the only other source of risk arises from objects being dropped from an aircraft in flight. The circumstances surrounding this possibility were discussed in detail in Section 3.3. Based on the potential for exposure to this risk, the risk associated with operations on the range remain unchanged. However, changes in operations in the three MOAs would cause some minor alterations to the existing very low risk associated with their use. Table 4-4, below, compares this changed condition. For each airspace element, the projected potential for injury to persons or damage to structures is compared with baseline conditions. These data are based on the same hypothetical scenario developed in Section 3.3, and reflect the probability of the event occurring once in the number of years shown for the condition. As indicated, risk remains slight.

Table 4-4. Comparison of Risk Associated With Objects Dropped From Aircraft.

AIRSPACE	INJURY TO PERSON (ONCE IN YEARS INDICATED)		DAMAGE TO STRUCTURE (ONCE IN YEARS INDICATED)	
	BASELINE	PROPOSED	BASELINE	PROPOSED
Falls 1 MOA	3.7×10^{9}	2.8×10^{9}	588	458
Falls 2 MOA	5.9×10^{9}	4.9×10^{9}	949	791
Volk South MOA	2.2×10^{10}	6.0×10^{9}	3,475	954

Under the Proposed Action, the Restricted Airspace (R-6904) which supports operations on Hardwood Range would be enlarged. The utilization of Falls 1, Falls 2, and Volk South MOAs would be reassessed. The data presented in Tables 4-5 through 4-7 identify the changes to flight risk associated with this reassessment. The table reflects the statistically predicted Class A mishaps for the proposed level of activity in the airspace. Shown are the aircraft types, their planned utilization of the airspace, and the predicted frequency of Class A mishaps. For comparative purposes, where applicable, baseline data are repeated in the table. In evaluating these data, it should be emphasized that it is only statistically predictive. Class A mishap rates reflect the life-time history of the aircraft, under all conditions of flight. The actual causes of mishaps are due to many factors, not simply the amount of flying time of the aircraft.

Projections for Class A mishaps throughout the military training airspace remain relatively unchanged for the Proposed Action. For all of the airspace elements, when all aircraft are considered, the minimum time projected between Class A mishaps is 20.9 years in the Falls 1 MOA. Overall, this indicates slightly less risk than under baseline conditions, where in the same MOA the minimum predicted time was 20.7 years. Overall, the proposed reassessed use of the airspace raises little safety risk.

The potential risk for bird-aircraft strikes is assessed as a function of flight miles flown in a given area of airspace. Based on extensive operational and biological data, the Air Force has developed a computer-generated Bird Avoidance Model (BAM) that indicates relative risk of experiencing bird strikes at different times of day, and at various times of the year in specific geographic areas. The BAM is based on population and distribution of North American waterfowl (viz. geese, ducks, and swan) and some species of raptors (birds of prey) that comprise approximately 60 percent of all damaging bird strikes.

Although no bird-aircraft strikes are recorded for Hardwood Range during the last five years, BAM data indicate moderate risk associated with this airspace. Raptors are present throughout the year, and waterfowl feeding flights during migration cause the risk to peak during the dawn and dusk periods while the fall and spring migrations are in progress. As with the range, during the last five years, no bird strikes have been documented in the Falls 1, Falls 2, or Volk South MOAs (two bird strikes have been documented along VR-1616, part of which transverses the Falls 1 MOA). The indicated low-risk situation is substantiated in BAM data. Although raptors are present throughout the year in these MOAs, and waterfowl use the area during migration periods, the BAM-indicated risk is low (United States Air Force [USAF] BASH Team 1997).

There are no major explosive and ground safety issues associated with the proposed increased airspace utilization.

Table 4-5. Falls 1 MOA Projected Class A Mishaps

AIRCRAFT	CLASS A MISHAP RATE	PROJECTED YEARS BETWEEN MISHAPS (BASELINE)	SORTIES PER YEAR (PROPOSED)	FLIGHT HOURS PER YEAR (PROPOSED)	PROJECTED YEARS BETWEEN MISHAPS (PROPOSED)
F-16	4.57	20.7	2,089	1,045	20.9
F-15	2.62	4,771.0	50	25	1,526.7
B-52	1.29	77,519.4	50	25	3,100.8
B-1B	4.02	24,875.6	50	25	995.0
A-6	3.33	15,015.0	50	25	1,201.2
A-10	2.56	19,531.2	50	25	1,562.5
AH-1	3.43	14,577.3	50	25	1,166.2
B-2	0.00	N/A	50	25	N/A
C-26	N/A	N/A	50	25	N/A
C-130	0.99	50,505.0	50	25	4,040.4
F-18	2.07	24,154.6	50	25	1,932.4
F-117	1.69	29,585.8	50	25	2,366.9
PA-200	1.12	44,642.8	50	25	3,571.4
UH-1	3.43	14,577.3	50	25	1,166.2
Lear Jet	N/A	N/A	50	25	N/A

NOTE: N/A = Not Available

Source: Mishap Rates: Naval Flight Safety Center 1996; USAF Flying Safety Center 1996.
Flight Hours: ANGRC 1992

Table 4-6. Falls 2 MOA Projected Class A Mishaps

AIRCRAFT	CLASS A MISHAP RATE	PROJECTED YEARS BETWEEN MISHAPS (BASELINE)	SORTIES PER YEAR (PROPOSED)	FLIGHT HOURS PER YEAR (PROPOSED)	PROJECTED YEARS BETWEEN MISHAPS (PROPOSED)
F-16	4.57	33.4	1,525	763	28.7
F-15	2.62	7,633.6	7	4	9,542.0
B-52	1.29	77,519.4	7	4	19,379.8
B-1B	4.02	24,875.6	7	4	6,218.9
A-6	3.33	30,030.0	7	4	7,507.5
A-10	2.56	39,062.5	7	4	9,765.6
AH-1	3.43	29,154.5	6	3	9,718.2
B-2	0.00	N/A	6	3	N/A
C-26	N/A	N/A	6	3	N/A
C-130	0.99	50,505.0	7	4	25,252.5
F-18	2.07	48,309.2	7	4	12,077.3
F-117	1.69	59,171.6	7	4	14,792.9
PA-200	1.12	89,285.7	6	3	29,761.9
UH-1	3.43	29,154.5	6	3	9,718.2
Lear Jet	N/A	N/A	6	3	N/A

NOTE: N/A = Not Available

Source: Mishap Rates: Naval Flight Safety Center 1996; USAF Flying Safety Center 1996.
Flight Hours: ANGRC 1992

Table 4-7. Volk South MOA Projected Class A Mishaps

AIRCRAFT	CLASS A MISHAP RATE	PROJECTED YEARS BETWEEN MISHAPS (BASELINE)	SORTIES PER YEAR (PROPOSED)	FLIGHT HOURS PER YEAR (PROPOSED)	PROJECTED YEARS BETWEEN MISHAPS (PROPOSED)
F-16	4.57	131.8	1,247	624	35.1
F-15	2.62	4,240.9	7	4	9,542.0
B-52	1.29	N/A	6	3	25,839.8
B-1B	4.02	N/A	7	4	6,218.9
A-6	3.33	30,030.0	7	4	7,507.5
A-10	2.56	39,062.5	7	4	9,765.6
AH-1	3.43	29,154.5	6	3	9,718.2
B-2	0.00	N/A	6	3	N/A
C-26	N/A	N/A	6	3	N/A
C-130	0.99	101,010.1	7	4	25,252.5
F-18	2.07	48,309.2	7	4	12,077.3
F-117	1.69	59,171.6	7	4	14,792.9
PA-200	1.12	89,285.7	7	4	22,321.4
UH-1	3.43	29,154.5	6	3	9,718.2
Lear Jet	N/A	N/A	7	4	N/A

NOTE: N/A = Not Available

Source: Mishap Rates: Naval Flight Safety Center 1996; USAF Flying Safety Center 1996
Flight Hours: ANGRC 1992.

4.3.4 No-Action Alternative

Under the No-Action Alternative, Hardwood Range and its associated Restricted airspace would not be expanded. Operations on the range would continue as under baseline conditions. Utilization of the military training airspace would remain unchanged. Flare use would also remain unchanged. The results of these modifications in use were discussed under the Proposed Action. No significant safety impacts are associated with these actions.

4.3.5 Unavoidable Adverse Impacts

There are no significant safety impacts that can not be managed. Therefore, there are no unavoidable adverse impacts.

4.4 HAZARDOUS MATERIALS AND SOLID WASTE

4.4.1 Overview

As military aircraft overflights and the proposed range expansion do not involve an increase in hazardous materials management, impacts related to hazardous materials are, therefore, minimal in scope.

4.4.1.1 Issues and Concerns

The primary issues and concerns regarding hazardous materials and solid waste associated with the Proposed Actions and Alternatives involve the following:

- The effects of hazardous materials spills.
- Increased hazardous and/or solid waste generation and the method of disposal of this waste.

4.4.1.2 Methodology for Analyzing Impacts

The assessment of impacts focuses on how and to what degree the Proposed Action or Alternatives affect hazardous materials use and management. The pertinent laws are Resource Conservation and Recover Act (RCRA) (1976); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (1980); Superfund Amendments and Reauthorization Act (1986); Hazardous Materials Transportation Act (1975); Solid Waste Disposal Act (SWDA) and Amendments (1980); Hazardous and Solid Waste Amendments (1984); Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (1988); and the Wisconsin Administrative Code NR600. The assessment involves qualitative and, where possible, quantitative considerations of hazardous materials management practices. No specific impacts or models are proposed or used in the analysis.

4.4.1.3 General Findings

Only a small increase in use, handling, and generation of hazardous and solid waste materials is expected with the Proposed Action. Since 1995, hazardous waste generation has decreased and this trend is expected to continue even with the Proposed Action. Since hazardous waste generation levels fall well below the range's EPA generator status, no adverse impact is expected from the Proposed Action.

4.4.2 Hardwood Range Expansion

Hazardous Materials

Range expansion is not expected to affect the use of hazardous materials. Some increases in gasoline and diesel consumption may occur as a result of the expanded area. However, this increase is expected to be very minimal. The increase in fuel consumption would depend on target location and configuration. Currently the range consumes approximately 3,700 gallons of diesel fuel and 1,040 gallons of

unleaded gasoline, annually. As above-ground storage tanks (ASTs) are in compliance and are checked regularly, a potential extra delivery is not expected to create an adverse impact. The Range's current spill plan would have to be updated to take into account the new area.

An aircraft crash and subsequent spill occurred under R-6904A in Necedah National Wildlife Refuge (NWR). Most of the fuel was consumed in the subsequent fire. Initial sampling taken of the crash site by the Corps of Engineers recorded that all samples except one recorded no contamination to the area (Bandt 1995). To demonstrate that no contamination has taken place, a draft work plan has been prepared by the ANGRC to conduct further groundwater and soil testing of the site.

An IRP site is located near the proposed expansion area. Since no disturbance is expected to this site as a result of the Proposed Action, no impact is expected to the IRP site.

Solid Waste

With an annual auction and recycling of scrap metals, a buildup of solid waste is not expected.

The Range currently has enough demilitarized vehicles to create new targets. Therefore, an increase of hazardous waste is not expected as a result of the Proposed Action.

4.4.3 No-Action Alternative

Under the No-Action Alternative, there would be no increase in use or generation of hazardous materials or solid waste, with the possible exception of a spill resulting from an aircraft crash. The probability of this occurrence is very low. Section 4.3, Safety, further addresses the probability and effects associated with such an event.

4.4.4 Unavoidable Adverse Impacts

There are no unavoidable adverse impacts associated with the Proposed Action that involve hazardous materials or solid waste.

4.5 EARTH RESOURCES

4.5.1 Overview

4.5.1.1 Issues and Concerns

The primary issues and concerns regarding effects of the Proposed Action on earth resources involve the effects of range construction activities on soil erosion potential and disruption of unique geological features.

4.5.1.2 Methodology for Analyzing Impacts

Analysis of the impacts to earth resources resulting from the Proposed Action involved identification of locations where the proposed activities may influence or affect earth resources and evaluation of the degree to which characteristics, abundance, or value of the resource would be altered, depleted, or degraded by the Proposed Action.

4.5.1.3 General Findings

Minor impacts are expected to occur to earth resources as a result of the range expansion. Construction activities and bombing are expected to create local disturbances of soil. However, best management practices would be employed to control soil erosion (i.e., vegetated buffer zones along streams, use of silt fencing around construction sites). As no significant geologic features are located on the proposed range expansion, no impact is expected.

4.5.2 Hardwood Range Expansion

4.5.2.1 Physiography and Geology

Site physiographic and geological features are not likely to be affected by the proposed expansion and use of the Hardwood Range. Construction activities are likely to involve localized disruption of soils, as discussed below, but no alteration of geologic features would occur.

4.5.2.2 Soils

Localized disruption of site soils would occur during construction of site facilities. Although specific site development plans have not been developed for facilities in the range expansion area, some estimates can be made for land and tree clearing requirements. To reduce potential costs, the landing zone will most likely be located on an existing roadway with an additional area (approximately 100 total acres) added on either side for wing clearance. The landing zone area will be used as the DZ in most cases. There are currently no plans to remove trees and alter large areas in the proposed expansion area for new target locations because enough clearings and dirt roads currently exist to meet most requirements. The targets will be relatively small and, using the existing range as a model, the disturbance for the actual tactical targets will probably be limited to less than 100 acres. This would bring the total area

disturbed under the proposal for land and tree clearing to approximately 200 acres. Any disruption to soils would be minimized by the use of best management practices for construction site erosion control.

Minor disruption of soils may occur during use of portions of the tactical target complex for bombing and during use of the DZ and landing zone areas. Because the soils are highly erosive when disturbed, bombing these areas with inert ordnance may result in localized erosion of the highly friable soils. The erosion concerns are localized because much of the proposed target area is forested, which would limit the potential for winds to carry loosened soil from the site. However, there may be some soil loss from the target area from flushing of soil particles into the numerous streams of the area.

4.5.3 No-Action Alternative

Under the No-Action Alternative, no impacts to earth resources would be expected since no construction activities would occur.

4.5.4 Unavoidable Adverse Impacts

No unavoidable adverse impacts to earth resources are expected as a result of the Proposed Action.

4.6 WATER RESOURCES

4.6.1 Overview

4.6.1.1 Issues and Concerns

The primary issues and concerns regarding water resources involve the following:

- The potential for construction activities and bombing to alter local drainage patterns
- Increased soil erosion from surface water runoff, causing blockage of water flow, and, ultimately, reduced effectiveness of drainage capacity
- The effects of bombing and construction on wetlands
- Changes in floodplains from bombing and construction activities.

4.6.1.2 Methodology for Analyzing Impacts

Analysis of the impacts to water resources resulting from the Proposed Action involved identification of locations where the proposed activities may influence or affect surface water, groundwater, water quality, or structure of floodplains, and evaluation of the degree to which characteristics, abundance, or value of that resource would be altered, depleted, or degraded by the Proposed Action.

4.6.1.3 General Findings

Construction, use, and maintenance of the tactical target complex, roads, landing zone, and DZ may cause soil erosion and vegetation loss and change the site topography, which could negatively impact surface water drainage and quality, and floodplain configuration and storage. No changes to wetland functions and values would occur. The Hardwood Range expansion will not impact wetlands.

4.6.2 Hardwood Range Expansion

Construction activities associated with the Proposed Action would likely impact wetlands. Adverse impacts to other surface water or groundwater resources in the area are not expected to occur. Although existing drainage patterns and soil erosion could increase with construction activity, proper construction practice along with the flat topography of the area would minimize the potential adverse effects.

4.6.2.1 Surface Water

Construction and use of the tactical target complex, landing zone, and DZ could impact surface water drainage patterns on the Hardwood Range Expansion Area. Modification of localized drainage might occur, unless culverts, bridges or other water equalization structures are installed as part of construction.

As described in Section 4.10.2.1, the tactical target complex could be subject to soil erosion due to bombing. Soils displaced by bombing or erosion of disturbed soils could collect in drainageways and alter drainage patterns. Throughout much of the area, soils are drained by open ditches. The soil along these ditches is easily erodible, resulting in subsidence. Such subsidence can cause blockage of water flow and reduced drainage capacity, reducing the effectiveness of the surface drains. But because the Hardwood Range and proposed expansion area are relatively flat, water-driven erosion would be minimal. Erosion can also be minimized through the use of best management practices around streams, ditches, and construction sites.

Chapter 30, Wisconsin State Statutes, administered by WDNR, requires permits for structures and deposits into navigable waterways of the state. Most, if not all, of the drainage ditches at the Hardwood Range and proposed expansion area meet the state criteria for navigability. Any proposed road crossings or other impacts to the drainage ditches will likely require consultation with WDNR and a Chapter 30 permit. In addition, local zoning agencies, and in some cases WDNR, require erosion control permits and stormwater management permits for some construction activities. Coordination with these agencies will be initiated prior to any construction.

4.6.2.2 Groundwater

None of the activities associated with the Proposed Action would have an impact on groundwater resources underlying the expanded Hardwood Range.

4.6.2.3 Water Quality

As described in Section 4.6.2.1, use of the tactical target complex and construction may cause soil erosion which could negatively impact surface water quality at the Hardwood Range and areas downstream. However, soils in the area are comprised primarily of sands and streams and ditches have low gradients and flows, so eroded soil should settle quickly.

Potential sources of pollutants to surface and groundwater in the Range Expansion Area are from aircraft mishaps and from munitions. These sources and the fate of potential pollutants are discussed in Subsection 3.3.3.1, *Aircraft Mishaps*; Subsection 3.3.4.1, *Munitions Use and Handling*, and Subsection 3.4.1, *Hazardous Materials and Solid Waste*. Based on this information, adverse impacts to surface and groundwater quality would not be expected.

4.6.2.4 Wetlands

Presidential Executive Order (E.O.) 11990, Protection of Wetlands, requires Federal agencies to avoid, to the extent possible, any long- and short-term impacts associated with the destruction or modification of wetlands. Federal agencies are directed to avoid new construction in wetlands unless there is no practicable alternative. Where wetlands cannot be avoided, the proposed action must include all practicable measures to minimize harm to wetlands.

The Hardwood Range expansion would not impact wetlands. Much of the Hardwood Range, proposed expansion area, and surrounding areas are comprised of similar wetlands that would continue to function unimpeded at the regional level. Use of best management practices to control construction site and bombing-induced erosion would be followed.

As wetlands would be avoided for target placement, impacts associated with the use of targets would result from surrounding construction or the use of the targets. In regards to construction, wetlands would be identified and avoided prior to construction and best management practices used to avoid unnecessary destruction of vegetation. A very small percentage of ordnance may fall outside of the target areas. If these ordnance fall into a wetland, however, very limited or no EOD clean up would occur to prevent damage to wetland vegetation. Although the ordnance may contain a small spotting charge (which may or may not have ignited on impact), the amount of residue from the spotting charge would not be of a sufficient quantity to affect local water resources. The practice bomb, consisting of ferrous metals, could produce some rust, however, again it would be at an insufficient quantity to cause a concern.

Stream and wetland alterations due to the Hardwood Range expansion are subject to individual permits under Section 404 of the Clean Water Act (CWA) (33 United States Code 1344). This permit program, administered by the U.S. Army Corps of Engineers (USACE), covers the discharge of fill material into waters of the United States, including wetlands. Issuance of individual permits is contingent upon receipt of water quality certification from WDNR, Section 401 of the CWA, and the Wisconsin Administrative Code Chapter NR 299.

4.6.2.5 Floodplains

Presidential E.O. 11988, Flood Plain Management, directs that "any federally undertaken, financed, or assisted construction project must provide leadership and take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains." This order requires each Federal agency to determine whether a project will occur in a floodplain and to consider alternatives. If no practicable alternative is found, it requires minimizing harm and notifying the public as to why the project must be located in the floodplain. It also provides for public review and comment.

The Hardwood Range expansion could have adverse impacts on floodways and floodfringe areas. Impacts could potentially result from construction activities such as roads, the landing zone, and the DZ. The amount of impact associated with future construction is difficult to predict at this time. However, it is anticipated that floodplain impacts will be minimal given the regulatory constraints that require alternatives analysis and mitigation and the large area in which alternatives can be developed and implemented. In addition, much of the Hardwood Range, proposed expansion area, and surrounding areas are comprised of floodway and floodfringe that will continue to function unimpeded at the regional level.

Use of the tactical target complex is not expected to impact floodplains.

Local zoning agencies have jurisdiction over floodplain use and would need to be consulted prior to any floodplain impacts. In addition, local zoning agencies can request the assistance of WDNR for evaluation of the effects of proposals for floodplain impacts under NR 116, Wisconsin Administrative Code.

4.6.3 No-Action Alternative

Under the No-Action Alternative, no impacts would be expected to water resources, since no construction activities would occur, and potential impacts are related to construction.

4.6.4 Unavoidable Adverse Impacts

Wetlands and other surface water resources are present at the Hardwood Range and in the proposed expansion area. Therefore, construction and use of the expanded Hardwood Range will likely have unavoidable impacts to water resources in these areas. These impacts could include soil erosion and changes in surface water drainage patterns, ground water discharge/recharge characteristics, and flood water attenuation and storage characteristics in localized areas. Mitigation measures based on the specific site development plan may minimize the local and regional consequence of these potential adverse impacts. Wetlands would not be impacted.

No unavoidable adverse impacts to water resources are anticipated to occur as a result of the Hardwood Range expansion.

4.7 AIR QUALITY

4.7.1 Overview

The Clean Air Act (CAA) Amendments of 1990 constitute a renewed commitment by the U.S. government to establish a workable framework to achieve attainment and maintenance of health protective National Ambient Air Quality Standards (NAAQS). Title I sets provisions for the attainment and maintenance of the NAAQS. The EPA recently reclassified various areas as to their attainment status for nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter equal to or less than 10 microns in diameter (PM_{10}), and ozone (O_3). As described in Section 3.7.1.3, the areas potentially impacted by the Proposed Action are considered in attainment of the NAAQS for all regulated pollutants. Under the General Conformity Rule of the CAA, Section 176(c), an action must not cause or contribute to any new violation, nor increase the frequency or severity of any existing violation or delay timely attainment of any NAAQS.

4.7.1.1 <u>Issues and Concerns</u>

The CAA, as amended in 1990, dictates that project emission sources must comply with the air quality standards and regulations that have been established by Federal, state and county regulatory agencies. These standards and regulations focus on (1) the maximum allowable ambient pollutant concentrations resulting from project emissions, both separately and combined with other surrounding sources, and (2) the maximum allowable emissions from the project.

New or modified major stationary sources in the area of Hardwood Range would be subject to Prevention of Significant Deterioration (PSD) review to ensure that these sources are constructed without significant adverse deterioration of the clean air in the area. Emissions from any new or modified source must be controlled using Best Available Control Technology. The air quality impacts in combination with other PSD sources in the area must not exceed the maximum allowable incremental increases identified in Table 4-8. Certain national parks and wilderness areas are designated as Class I areas, where any appreciable deterioration in air quality is considered significant. Class II areas are those where moderate, well-controlled industrial growth could be permitted. Class III areas allow for greater industrial development. There are no PSD Class I areas in Wisconsin.

In addition to the requirements for PSD review, Title V of the CAA now requires a permit for any of the following sources:

1. A source with the potential to emit 10 tons or more of a single hazardous air pollutant in a 1-year period.

2. A source with the potential to emit 25 tons or more of HAPs in a 1-year period.

3. A source with the potential to emit 100 tons or more of any criteria pollutant in a 1-year period.

4. A source that is required to meet New Source Performance Standards.

5. A "major" source located in a nonattainment area. (The threshold for a major source depends on the severity of nonattainment of the area.)

Table 4-8. Maximum Allowable Pollutant Concentration Increases under Federal PSD Regulations

POLLUTANT	AVERAGING PERIOD	MAXIMUM ALLOWABLE INCREMENT ($\mu g/m^3$)		
		CLASS I	CLASS II	CLASS III
Nitrogen dioxide	Annual	2.5	25	50
Sulfur dioxide	Annual	2	20	40
	24-hr	5	91	182
	3-hr	25	512	700
PM_{10}	Annual	4	17	34
	24-hr	8	30	60

Notes: Class I areas are regions in which the air quality is intended to be kept pristine, such as national parks and wilderness areas. All other areas are initially designated Class II. Individual states have the authority to redesignate Class II lands as Class III to allow maximum industrial use, although none have been redesignated to date.

Source: 40 CFR Parts 51 and 52, as revised 3 June 1993.

The permitting authority must notify an adjoining state if one of the above sources is within 50 miles of that state or could affect the air quality of that state. The affected states then have the opportunity to make recommendations concerning the terms and conditions of the permit that would be issued to the source.

4.7.1.2 Methodology for Analyzing Impacts

Criteria to determine the significance of air quality impacts are based on Federal, state and local air pollution standards and regulations. Impacts would be significant if the emissions from the Proposed Action (1) increase ambient air pollution concentrations from below to above any NAAQS, (2) contribute to an existing violation of any NAAQS, (3) interfere with or delay timely attainment of an NAAQS, or (4) impair visibility within federally mandated PSD Class I areas. As described above, the Proposed Action will not impact any PSD Class I areas. Therefore, impacts to PSD Class I areas is not an issue for this project.

To demonstrate compliance with the CAA, emission inventories were prepared for activities associated with the Proposed Action including those resulting from construction and aircraft operations. The emissions from the Proposed Action were then compared to the emissions under baseline conditions.

To determine whether the Proposed Action will result in significant air quality impacts, the Multiple-Aircraft Instantaneous Line Source (MAILS) Dispersion Model (Leibsch et al. 1992) was used to estimate air pollutant concentrations from the Proposed Action under a maximum situation scenario.

4.7.1.3 General Findings

There are no PSD Class I areas within the ROI. For the Hardwood Range, air quality impacts from the Proposed Action would consist of increased emissions from land-clearing and construction activities. Aircraft emissions would be the primary source of operational impacts. The Proposed Action would lead to an incremental increase of emissions in areas which are already in use. Based on the results of the MAILS modeling, which predicts maximum situation ground-level concentrations for criteria pollutants from aircraft emissions data, the air quality impacts of these increased emissions are expected to be insignificant.

4.7.2 Hardwood Range Expansion and Restricted Airspace

4.7.2.1 Construction

The Proposed Action would expand the land area for the Hardwood Range by 7,137 acres. The expansion would require some tree clearing and grading. Although specific site development plans have not been developed for facilities in the range expansion area, some estimates can be made for land and tree clearing requirements. To reduce potential costs, the landing zone will most likely be located on an existing roadway with an additional area (approximately 100 total acres) added on either side for wing clearance. The landing zone area will be used as the DZ in most cases. There are currently no plans to remove trees and alter large areas in the proposed expansion area for new target locations because enough clearings and dirt roads currently exist to meet most requirements. The targets will be relatively small and, using the existing range as a model, the disturbance for the actual tactical targets will probably be limited to less than 100 acres. This would bring the total area disturbed under the proposal for land and tree clearing to approximately 200 acres. The debris from tree and brush clearing will not be burned. Air quality impacts during construction activities related to the Proposed Action would occur from fugitive dust due to ground-disturbing activities, combustion products from the tree-clearing and grading equipment, and vehicle emissions from worker travel to and from the site.

Based on an emission factor of 55 pounds per day (lbs/day) per acre per day (acre/day) from the California Environmental Quality Act (CEQA) Handbook (South Coast Air Quality Management District [SCAQMD] 1993), the potential emissions of PM_{10} resulting from ground-disturbing and excavation of the 200 acres are estimated at 5.5 tons of PM_{10}. These emissions would be significantly less than this estimate due to the implementation of control measures in accordance with standard construction practices. For instance, frequent spraying of water on exposed soil during construction and prompt replacement of ground cover (grass and landscaping) are standard procedures that could be used to minimize the amount of dust generated during construction.

Tree-clearing activities over the area to be developed would involve the use of chain saws, tractors, and loaders. Potential impacts from fuel combustion equipment could be reduced through efficient use of the equipment, a phased construction schedule to reduce the number of units operating simultaneously, and the performance of regular engine maintenance programs. Although such construction-related impacts on air quality may be locally significant, they are short-term, temporary effects. Air pollution impacts associated with these emissions are expected to be temporary and insignificant.

Combustion emissions from construction equipment were estimated using exhaust emission factors for land graders from the CEQA Handbook (SCAQMD 1993). The emissions were calculated based on the assumption that ground clearing and grading activities would require the use of 4 diesel-powered motor graders for 20 days per month, 8 hours per day, over a 12-month period. Total combustion emissions from grading activities are estimated to be 4.8 tons of CO, 1.8 tons of volatile organic compound (VOC), 12.6 ton of nitrogen oxides (NO_x), 1.2 tons of sulfur dioxide (SO_2), and 0.5 tons of PM_{10}. Combustion emissions impacts could be reduced by efficient use of the equipment, a phased construction schedule to reduce the number of units operating simultaneously, and the performance of regular vehicle engine maintenance programs.

Emissions from construction worker travel were calculated assuming that each of the estimated 15 workers would drive an average round-trip of 30 miles each day, 20 days per month, over a 12-month period. Emission factors from "Calculation Methods for Criteria Air Pollutant Emission Inventories" (Jagielski and O'Brien 1994) have been used to estimate vehicle exhaust emissions. Total exhaust emissions from worker commutes are estimated to be 3.5 tons of CO, 0.5 tons of VOC, 0.3 tons of NO_x and 0.01 tons of PM_{10}.

A summary of proposed construction emissions for clearing and grading of land under the Proposed Action is presented in Table 4-9. Combustion emissions impacts could be reduced by efficient use of the equipment, a phased implementation schedule to reduce the number of units operating simultaneously, and the performance of regular vehicle engine maintenance programs. Although such construction-related impacts on air quality may be locally significant, they are short-term, temporary effects. Air pollution impacts associated with these emissions are expected to be temporary and insignificant.

Table 4-9. Construction Emissions under the Proposed Action

	EMISSIONS (TONS)				
ACTIVITY	***CO***	***VOC***	***NO_x***	***SO_x***	***PM***
Ground Disturbing	--	--	--	--	*5.5*
Fuel Combustion	*4.8*	*1.8*	*12.6*	*1.2*	*0.6*
Worker Travel	*3.5*	*0.5*	*0.3*	--	*0.01*
Total Emissions	***8.3***	***2.3***	***12.9***	***1.2***	***6.1***

4.7.2.2 Restricted Airspace R-6904A/B

Aircraft flying operations in Restricted Airspace R-6904A/B would not change as a result of the Proposed Action. Therefore, emissions from these operations will be the same as the baseline emissions presented in Section 3.7.2.

4.7.3 MOA Utilization

Aircraft flying operations in the Falls 1 and 2 MOAs and the Volk South MOA would be reassessed as a result of the Proposed Action. Flying time in each MOA is 30 minutes per sortie, which is identical to baseline conditions. Emissions under the Proposed Action from aircraft operations within the Falls 1 and 2 MOAs and from the Volk South MOA were calculated using the methods and assumptions outlined in Section 3.7.1.4.

Previous air quality environmental documentation has been performed on the use of Falls 1 and 2 MOAs (ANGRC 1992) and Volk South MOA (National Guard Bureau [NGB] 1990). In addressing these MOAs, the levels of some pollutant emissions would increase slightly in the affected military training airspace. However, these levels were determined insignificant given the likely dispersal of pollutants throughout a large volume of air and the fact that NAAQS would not be exceeded as a result of project-related emissions.

4.7.3.1 Falls 1 MOA

Table 4-10 provides estimates of the annual emissions due to the Proposed Action at Falls 1 MOA. Total emissions would be 15.4 tons of CO, 1.8 tons of VOC, 179.7 tons of NO_x, 4.5 tons of SO_x, and 4.9 tons of PM. These emissions represent increases of 180 percent CO, 188 percent VOC, 18.7 percent NO_x, 46.5 percent SO_x, and 136 percent PM. The potential impact of these emission increases on the ambient concentrations of criteria pollutants is presented in the MAILS modeling section below.

Table 4-10. Proposed Action Emissions at the Falls 1 MOA

AIRCRAFT	ANNUAL SORTIES	AIRCRAFT EMISSIONS (lb/yr)				
		CO	VOC	NO_x	SO_x	PM
F-16	2,089	9,703	1,076	291,039	5,821	3,656
F-15	50	465	52	13,932	279	175
B-52	50	2,530	892	14,880	804	2,574
B-1	50	7,585	399	2,295	539	20
A-6	50	262	343	4,809	199	368
A-10	50	298	14	1,450	73	136
AH-1	50	57	4	109	9	17
B-2	50	7,585	399	2,295	539	20
C-26	50	17	3	283	12	23
C-130	50	483	92	2,139	124	104
F-18	50	424	125	10,168	218	1,136
F-117	50	451	133	10,805	218	1,205
PA-200	50	862	26	3,785	114	194
UH-1	50	57	4	109	9	17
Lear Jet	50	113	9	1,241	44	81
Total	2,789	30,893	3,570	359,338	9,002	9,725
Total Emissions (ton/yr)		15.4	1.8	179.7	4.5	4.9

4.7.3.2 Falls 2 MOA

Table 4-11 provides estimates of the annual emissions due to the Proposed Action at Falls 2 MOA. Total emissions would be 4.9 tons of CO, 0.6 tons of VOC, 110.9 tons of NO_x, 2.3 tons of SO_x, and 1.8 tons of PM. These emissions represent increases of 40.8 percent CO, 43.5 percent VOC, 18.3 percent NO_x, 22.4 percent SO_x, and 36.9 percent PM. The potential impact of these emission increases on the ambient concentrations of criteria pollutants is presented in the MAILS modeling section below.

Table 4-11. Proposed Action Emissions at the Falls 2 MOA

AIRCRAFT	ANNUAL SORTIES	AIRCRAFT EMISSIONS (lb/yr)				
		CO	VOC	NO_x	SO_x	PM
F-16	1,525	7,084	785	212,463	4,249	2,669
F-15	7	65	7	1,950	39	25
B-52	7	354	125	2,083	112	360
B-1	7	1,062	56	321	75	3
A-6	7	37	48	673	28	52
A-10	7	42	2	203	10	19
AH-1	6	7	1	13	1	2
B-2	6	910	48	275	65	2
C-26	6	2	0	34	1	3
C-130	7	68	13	299	17	15
F-18	7	59	18	1,424	31	159
F-117	7	63	19	1,513	31	169
PA-200	6	103	3	454	14	23
UH-1	6	7	1	13	1	2
Lear Jet	6	14	1	149	5	10
Total	1,617	9,876	1,126	221,868	4,680	3,511
Total Emissions (ton/yr)		4.9	0.6	110.9	2.3	1.8

4.7.3.3 Volk South MOA

Table 4-12 provides estimates of the annual emissions due to the Proposed Action at Volk South MOA. Total emissions would be 4.3 tons of CO, 0.5 tons of VOC, 91.5 tons of NO_x, 1.9 tons of SO_x, and 1.5 tons of PM. These emissions represent increases of 332 percent CO, 325 percent VOC, 247 percent NO_x, 262 percent SO_x, and 285 percent PM. The potential impact of these emission increases on the ambient concentrations of criteria pollutants will be evaluated in the MAILS modeling section below.

Table 4-12. Proposed Action Emissions at the Volk South MOA

AIRCRAFT	ANNUAL SORTIES	AIRCRAFT EMISSIONS (lb/yr)				
		CO	VOC	NO_x	SO_x	PM
F-16	1,247	5,792	642	173,732	3,475	2,182
F-15	7	65	7	1,950	39	25
B-52	6	304	107	1,786	96	309
B-1	7	1,062	56	321	75	3
A-6	7	37	48	673	28	52
A-10	7	42	2	203	10	19
AH-1	6	7	1	13	1	2
B-2	6	910	48	275	65	2
C-26	6	2	0	34	1	3
C-130	7	68	13	299	17	15
F-18	7	59	18	1,424	31	159
F-117	7	63	19	1,513	31	169
PA-200	7	121	4	530	16	27
UH-1	6	7	1	13	1	2
Lear Jet	7	16	1	174	6	11
Total	1,340	8,554	965	182,940	3,893	2,979
Total Emissions (ton/yr)		4.3	0.5	91.5	1.9	1.5

4.7.3.4 Overlap with VR-1616 and VR-1650

VR-1616 passes through the area of the Falls 1 MOA and VR-1650 passes briefly through the area of the Falls 1 MOA, then through the area of the Falls 2 MOA. The baseline aircraft emissions from portions of these MTRs which overlap with the MOAs would not change as a result of the Proposed Action. Cumulative emissions under the Proposed Action were calculated as the sum of emissions in R-6904A/B, Falls 1 and 2 MOAs, and Volk South MOA plus emissions from aircraft flying MTR sorties within the airspace of the MOAs. The cumulative emissions are presented below in Tables 4-13.

Table 4-13. Cumulative Emissions within the Affected Airspace*

AIRSPACE	AIRCRAFT EMISSIONS (tons/yr)				
	CO	VOC	NO_x	SO_x	PM
Range+MOAs	38.7	4.5	601.7	13.9	12.7
MTRs**	1.4	0.2	21.4	0.5	0.5
Total Emissions	40.1	4.6	623.1	14.4	13.2

*Notes: * - Affected airspace includes Restricted Area R-6904 A/B, Falls 1 MOA, Falls 2 MOA, and Volk South MOA, plus their overlap with two MTRs (VR-1616 and VR-1650).*
*** - MTR emissions represent only that portion of the MTR that overlaps with the Falls 1 or Falls 2 MOA.*

4.7.3.5 MAILS Modeling Results

Air quality impacts could occur as a result of the Proposed Action due to low altitude operations. The approach was to assess the impacts of aircraft emissions using a maximum situation or the maximum expected sortie rate and utilize the results to identify potential exceedances from the Proposed Action. The MAILS Dispersion Model (Leibsch et al. 1992) was used to estimate air pollutant concentrations from a potential maximum impact scenario and to compare these concentrations with existing PSD and the NAAQS Class I increments for regulated pollutants. The MAILS model is an air quality screening model that provides conservative estimates of ground-level pollutant concentrations resulting from aircraft engine emissions along MTRs and is intended for low altitude flights (below 5,000 feet).

Sorties associated with activities at the Hardwood Range and surrounding airspace (including the Falls 1 MOA, Falls 2 MOA, Volk South MOA, and on MTRs VR-1616 and VR-1650) were selected for inclusion in the MAILS modeling analysis since they encompass a common area. Based on the projected annual passes for these airspaces, conservative maximum sortie operations estimates for the 1-hour, 3-hour, 8-hour, and 24-hour sortie numbers were developed. It was assumed that all sorties occur at 500 feet AGL. This is a conservative assumption since in some instances the sorties occur at altitudes significantly greater than 500 feet AGL. Thus, if this analysis did not result in significant impacts, using such a conservative assumption, it can be concluded that the Proposed Action would not result in significant air quality impacts. Due to limitations in the MAILS model, annual sorties for one of the aircraft (F-16s) were input into the model as one-tenth of the actual sorties and the model's output annual concentration results were corrected to account for the larger sortie numbers.

The aircraft emission database in the MAILS model was modified by adding revised emissions data for the aircraft engines operating in military mode. The MAILS model was used to predict 1-hour, 3-hour, 8-hour, 24-hour, and annual ground-level concentrations for four air pollutants: CO, PM, SO_2 and NO_2. The maximum situation concentrations predicted by the MAILS model were compared to the Federal PSD Class I increments and the NAAQS, as shown in Table 4-14. The modeling run verified that air impacts of the proposed action (as demonstrated by assessing impacts for the cumulative conditions under a maximum situation scenario) would fall well below the PSD Class I increments and NAAQS concentrations in Table 4-14. Consequently, it can be concluded that the impacts from the Proposed Action for all airspace are insignificant. Printouts of the MAILS model runs are provided in Appendix N.

Table 4-14. MAILS Modeling Results for Proposed Action

CRITERIA POLLUTANT	AVERAGING PERIOD	CONCENTRATION ($\mu g/m^3$)			IMPACT AS A PERCENTAGE OF THE PSD CLASS I INCREMENT (percent)	IMPACT AS A PERCENTAGE OF THE NAAQS (percent)
		NAAQS	PSD CLASS I INCREMENTS[a]	MODELLED RESULTS FOR THE AFFECTED AIRSPACE		
NO_2	Annual	100	2.5	0.0785	3.14	0.0785
Part [b]	24-hour	150 [c]	10 [c]	0.0064	0.079	0.0043
	Annual	50	5	0.0014	0.02	0.0028
SO_2	3-hour	1300 [c]	25 [c]	0.0982	0.3927	0.0076
	24-hour	365 [c]	5 [c]	0.0076	0.1516	0.0021
	Annual	80	2	0.0014	0.0700	0.0018
CO	1-hour	40,000 [c]	—	1.1424	0.0029 [d]	0.0029 [d]
	8-hour	10,000 [c]	—	0.0630	0.0006 [d]	0.0006 [d]

Notes: a. The PSD Class I increments for particulate are for TSP.
b. The NAAQS for particulates are for PM_{10}.
c. Not to be exceeded more than once per year.
d. As a percentage of the NAAQS.

4.7.3.6 Conformity Analysis

Any new major project that may lead to nonconformance or contribute to a violation of the NAAQS must conduct a conformity analysis before initiating any new action. As defined in the Final Rule (40 CFR Parts 6, 51, and 93), "Conformity to a State Implementation Plan (SIP) is defined in the Act as amended in 1990 as meaning conformity to a SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards." Consequently, the Conformity Rule applies to nonattainment areas. Since the affected airspace is designated as attainment for all criteria pollutants (CO, ozone, NO_2, SO_2, and PM_{10}), a conformity analysis is not necessary.

Therefore, based on this analysis, implementation of the Proposed Action would not be expected to result in any adverse change in air quality leading to nonconformance with the EPA's Conformity Rule or the CAA.

4.7.4 No-Action Alternative

Under the No-Action Alternative, the Proposed Action would not occur. As such, the baseline condition would continue, and the general air quality would be good with no exceedances of the NAAQS or Wisconsin AAQS.

4.7.5 Unavoidable Adverse Impacts

As neither the Proposed Action nor the No-Action Alternative would cause the violation of any NAAQS or Wisconsin AAQS, there are no unavoidable adverse impacts associated with either alternative.

4.8 BIOLOGICAL RESOURCES

4.8.1 Overview

4.8.1.1 Issues and Concerns

The primary issues concerning biological resources are the potential for adverse impacts from the noise of low-altitude military aircraft overflights, and ground disturbance resulting from construction and maintenance activities in the proposed range expansion area. The following further details the concerns associated with biological resources:

- Noise impacts on wildlife, especially threatened or endangered species
- Impacts on vegetation, including sensitive plant species and resulting effects to wildlife habitat.

Coordination with the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA) is ongoing. These activities are conducted pursuant to 50 CFR, Part 402. The Service has informed the Air National Guard (ANG) that "if the decision is made to proceed with the proposals contained in the Draft Environmental Impact Statement (DEIS), the USFWS will need a determination from the ANG whether the proposed activity may affect any federally listed species. The determination would form the conclusions of a biological assessment (BA) prepared by the ANG" (DOI 1997). The ANG has also coordinated with the USFWS Green Bay Field Office pursuant to this proposal and discussed the proposal in detail and concurrence was reached on the part of the USFWS and the ANG on the procedures taking place. The USFWS provided the ANG with a letter in April 1998 (DOI 1998) (see Appendix G) concurring with the approach the ANG is pursuing, and has agreed the dialog will continue as the plans for the proposal become more firm. Additionally, in a letter dated November 1999 (DOI 1999), the USFWS stated that "it is premature to prepare a BA at this time to determine whether a federally-listed threatened or endangered species may be adversely affected by the proposed project... When detailed plans are available regarding specific impacts on the property, we may recommend preparation of a BA. If a BA concludes that a federally-listed threatened or endangered species may be adversely affected, formal consultation should be initiated with the Service pursuant to section 7 of the ESA of 1973, as amended." See Appendix G for USFWS correspondence.

4.8.1.2 Methodology of Analyzing Impacts

Braid (1992) developed a definition framework for determining the level of impacts to wildlife from noise. This framework was modified for use in this document for noise and other types of disturbance (e.g., ground disturbance). The modified definitions of impacts are provided in Table 4-15.

Potential noise impacts on biological resources resulting from airspace modifications were analyzed by comparing baseline sound levels and sortie rates for R-6904A, Falls 1 MOA, Falls 2 MOA, and Volk South MOA to the sound levels and sortie rates that are projected to result from each proposal.

Table 4-15. Definition of Impacts to Wildlife Used in the Impact Analysis

NEGLIGIBLE	*LOW*	*MODERATE*	*HIGH*
Impact is unlikely to degrade habitat or affect individuals or local populations because it is infrequent, does not occur in same time or space as resource, or affect to resource is temporary or minimal.	*Impact may degrade small areas of habitat. On occasion, may result in temporary changes in habitat use. Local animal population declines would be unlikely. Direct animal mortality would be limited to a few individuals.*	*Impact would degrade or alter small areas of habitat or reduce habitat quality in large areas. Would result in temporary changes in habitat use. Local animal population decline may result from (1) short-term habitat abandonment by some individuals, (2) reduced short-term reproductive success or life span, or (3) higher mortality.*	*Impact would degrade or alter small and large areas of habitat. Would result in long-term changes in habitat use by majority of population. Local and regional population declines may result from (1) long-term habitat abandonment by many individuals, (2) reduced long-term reproductive success or life span, or (3) higher mortality.*

Source: Braid 1992

Sensitive species as shown in Table 3-19 were identified as being present or absent in the areas underlying the proposed airspace modification. The potential for disturbance was then evaluated based on the projected change in sound level and, where possible, the documented response of the species or species group to similar changes in sound level.

4.8.1.3 General Findings

The effects of noise and startle effects on wildlife and domestic animals have been examined in a variety of studies and reviews over the past 30 to 35 years (i.e., Manci et al. 1988). These studies show a wide variety of animal responses to aircraft overflight (or simulated aircraft noise) by different types of animals and even differing responses by the same species under similar conditions.

Research related to particular species or species groups of concern in the ROI is summarized below.

Raptors

Several studies have evaluated the effects of aircraft, military training, and blasting on raptors. Raptor responses to noise and disturbance in these studies have varied. Most impacts reported appeared to be minor and temporary (e.g., Lamp 1989) and, where evaluated, did not noticeably affect reproduction. The studies discussed below evaluated noise sources from ground-based activities and aircraft.

Sensitivity to noise and other disturbances varies among raptor species and among individuals within species, due in part to differences in hearing acuity and previous exposure to noise. Sensitivity to noise is also dependent upon timing; birds and other animals are typically most sensitive to disturbance during the breeding season.

Few studies have been conducted on the impacts of jet aircraft noise on raptors. An account of a single female northern harrier hunting within the target area

of a Navy bombing range reported no change in hunting behavior despite jet noise of 80 to 87 dB at a distance of approximately 1,500 feet (Jackson et al. 1977).

In a two-year study of the effects of low-level jet aircraft flights on cliff-nesting raptors (Ellis et al. 1991), nests of eight raptor species were subjected to almost 1,000 overflights by military jets. Mid- to high-altitude sonic booms were also simulated using explosive devices. Noise levels in the study ranged from 82 to 114 A-weighted decibel (dB[A]) for overflights and 111 to 151 dB(A) for sonic booms. Raptor nests studied were primarily prairie falcon and peregrine falcon nests, but red-tailed hawk, Cooper's hawk, and golden eagle nests were also included. Birds were often noticeably alarmed and sometimes temporarily left nests in response to overflights and simulated booms. All significant responses (i.e., cowering, calling, fleeing, interruption of incubation, or feeding young) were observed when jets passed within 150 meters of the nest; adults showed alarm when jets were within 300 meters, but generally ignored jets more than 500 meters distant. Twenty of 22 nests fledged young after being disturbed, and 21 of 22 nests disturbed in the first year of the study were reoccupied during the second year. The results of this study indicate that low-level jet overflights and mid- to high-altitude sonic booms do not have long-term adverse impacts to nesting raptors. The authors note, however, that the birds in the study were not naïve (i.e., except for nestlings, they had all previously been subjected to moderate levels of low-altitude overflights). In addition, nests were exposed to an average of 11 overflights during the first year of the study (with a maximum of 32) and an average of 38 overflights (maximum 229) during the second year. It is not known whether higher numbers of low-level overflights would cause more severe responses, particularly in naïve birds.

Flights at less than 150 m from nests and sonic booms of greater than 112 dB are most likely to exhibit biologically significant responses to stimuli (Ellis et al. 1991); long-term consequences of high-frequency exposure to these disturbances are unknown. According to Gladwin and McKechnie (1993), long-term reactivity to overflights may result in energy losses, which "could be a critical problem for animals that are somewhat energy-limited in the first place." While Ellis et al. (1991) did not demonstrate that elevated reactivity resulted in reductions in reproductive success, the overall effects of long-term disturbance are still uncertain because of the limited data available. Wintering or migrating birds, or nesting birds in drought or other low-prey situations, may be energy-limited, and may respond differently to overflight noise than the subject birds in the studies described above.

Noise from construction, maintenance, and use of range facilities would be greatest for the proposed range expansion area. Holthuijzen (1989) indicated that prairie falcons were not adversely affected by construction activities, similar activities with associated noise, and other disturbances. According to Holthuijzen (1989), there is evidence that birds in areas of greater activity were less sensitive to additional disturbances than birds inhabiting more remote areas.

Conversely, Andersen and others (1990) found that raptors temporarily avoided habitats during military training, which included ground traffic, bivouacs, and weapons firing, at a training site in southeastern Colorado. Army National Guard training within the Snake River Birds of Prey National Conservation Area has been associated with increased foraging distances and temporary training area avoidance in prairie falcons (Marzluff et al. 1994). Increases in foraging distances may cause stress to birds by affecting the energetic costs of foraging.

In a study at Bellingham International Airport in Whatcom County, Washington, the effect of jet aircraft flights on the behavior of resident bald eagles was undertaken when Pacific Southwest Airlines (PSA) began to fly jets into the airport (cited in Manci et al. 1988). During field observations, bald eagles reacted to the presence of

aircraft in the study area during 12 percent of the eagle-aircraft observations. A differential response to aircraft types was observed; helicopters and small jets had the greatest effect on bald eagles. Eagles reacted to PSA jets 11 percent of the time, to propeller airplanes 2 percent of the time, to helicopters 40 percent of the time, and to small jet aircraft 55 percent of the time. Observed reactions to PSA jets included turning of the head to look at the jet (5 percent of the observations) and flying from a perch site (5 percent). Eagle reactions to PSA jets were twice as frequent when the eagle-jet distance was 0.5 mile or less. The authors concluded that the existing level of jet flights appeared to have a minor effect on bald eagles within the airport project area, but that if overflights occurred more frequently, repeated flight from perches and interrupted eagle interactions due to aircraft disturbances could have a negative effect on bald eagles.

Another study (Grubb and King 1991) focusing on nesting bald eagles did note increased reaction to jet overflights as the distance from the nest to the aircraft decreased. However, pedestrians and helicopters elicited far greater responses than the aircraft.

Responses of nesting raptors to fixed wing aircraft have been investigated for several species. Poole (1981) reported that osprey rarely left the nest when exposed to fixed-wing aircraft. Similarly, White and Thurow (1985) reported that ferruginous hawks did not respond to fixed-wing aircraft within 100 feet of their nests.

While these studies suggest that aircraft noise and overflights would not generally or adversely affect raptor species, previous studies (Ellis 1981; Grubb and King 1991) include observations of temporary abandonment of a roost or nest by some individuals due to direct or near-direct overflights. For wintering bald eagles, repeatedly leaving a roost would increase energy expenditures during a season when the birds tend to conserve energy. For nesting raptors, events causing them to leave their nests temporarily would increase the potential for predation, egg chilling, or egg overheating, thus reducing reproductive success.

The critical potential disturbance period for nesting bald eagles and red-shouldered hawks would be February 15 to August 15 when the adults are incubating eggs and raising their young. The critical disturbance period for wintering bald eagles would be November 15 to March 15 (USFWS 1995). Avoidance or restriction of aircraft overflights near known nest sites during this time period would reduce disturbance to bald eagle and red-shouldered hawk nests. The USFWS typically recommends a distance of 0.25 mile for avoidance of impacts to bald eagle, osprey, red-shouldered hawk, and peregrine falcon nests; bald eagle wintering areas; wildlife in wilderness areas; and colonial birds' nesting sites (USFWS 1995).

Waterbirds

Many studies have focused on the impacts of aircraft noise on waterbirds (Manci et al. 1988). A majority of studies involved piston-engined fixed-wing aircraft or helicopters that may or may not elicit different behavioral responses than subsonic and supersonic jets due to differences in noise frequencies and levels, and different visual stimuli; therefore, their applicability to the proposed military activity is speculative.

Several studies report contradictory results on the effects of military overflights on time-activity budgets of waterbirds (Black et al. 1984; Lamp 1989; Fleming et al. 1996). Results from a comprehensive study indicated that the effects of military overflights on waterbirds in Florida did not adversely affect breeding success, colony establishment, or size (Black et al. 1984). Some of the birds in this study (e.g.,

great egrets, snowy egrets, cattle egrets) occur within the ROI for the Proposed Action as well. Fleming et al. (1996) found that the energy costs associated with response behaviors of wintering black ducks to military overflights in North Carolina were low. However, Ward and Stehn (1989) report that foraging activity of staging geese in Alaska was disrupted by helicopter and fixed-wing aircraft overflights. Schweinsburg (1974) found that duck populations on Canadian North Slope lakes showed short-term decreases, as much as 40 percent, when aircraft overflights occurred. Additionally, Lamp (1989) reported that some waterbird species were sensitive to both subsonic and supersonic military overflights, with snow geese exhibiting adverse responses (alert calling, alert posture, flight) 59 percent of the time. Other species that displayed sensitivity to military jet overflights in Lamp's study include several species (northern pintail, long-billed dowitcher, American widgeon, and green-winged teal) that might potentially occur in the ROI. Burger (1981) found that supersonic jet overflights caused herring gulls to fly from their nest and fight more when they returned, causing many eggs to break.

The USFWS (1995) reports that a great blue heron colony on the Winona District of the Upper Mississippi Wildlife and Fish Refuge was almost entirely abandoned shortly after low-level military flights were conducted at or below 1,000 feet AGL, indicating that rookeries of colonial waterbirds are extremely sensitive to any source of disturbance.

Noise disturbance from maintenance activities may impact waterbirds if they occur close to wetland habitat. A study on breeding trumpeter swans found that vehicular traffic caused behavioral responses (alert posture) at nests closest to roads where neither vegetation nor the landscape formed a visual barrier, or when vehicles stopped (Henson and Grant 1991). Noise impacts during migration may mask natural sounds in the environment. It is hypothesized that migrating birds use natural sounds to impart information on surfaces and landscapes below them and possibly gauge wind velocities (D'Arms and Griffin 1972; Griffin and Hopkins 1974).

Trumpeter swans, ducks, geese, and sandhill cranes at the Sandhill Wildlife Area north of Hardwood Range were personally observed by biologists and non-biologists during overflights of F-16 and B-52 military aircraft on September 10, 1992 (Dannenberg 1992; Zeckmeister 1992). Aircraft flew at altitudes of 1,300 to 1,800 feet AGL and at distances of 0.5 to 5 NM from a group of young, reintroduced trumpeter swans and other waterfowl. In seven of eight overflights, the swans exhibited either no response or a slight response (e.g., looking in the direction of the aircraft, slight grouping) to the stimulus. In the eighth overflight, a B-52 flew at 1500 feet AGL and 0.5 mile south of the swans, and the swans reacted with a noticeable startle response. A distinct startle effect was also noted when helicopters flew over the area later the same day. On subsequent days at the Sandhill Wildlife Area, waterfowl flushed from the area during several instances of low-level F-16 and B-52 overflights directly over the flowages.

As with raptors, little is known about the impact of high- or low-level jet aircraft flights on the migratory patterns or migration-related mortality of waterfowl. The Necedah NWR, the Wisconsin River, and many state wildlife areas (SWAs) are considered major migration staging areas for waterbirds, where they improve their physical condition prior to migrating to breeding or wintering areas. Hundreds of thousands of waterbirds are known to use aquatic areas in these regions as stop-over points during migration. Large numbers of wintering and nesting waterbirds are also found in the area. Waterbird densities are highest during October, at the peak of the fall migration. Frequent flushing due to overflights could increase stress-induced mortality during migration.

Upland Game Birds

Studies of noise effects on gallinaceous birds are rare for upland game birds but more common for poultry. At Naval Air Station Fallon, Nevada, chukar exhibited brief (average 57 seconds) changes in behavior as a response to aircraft disturbances (Lamp 1989). White leghorn chicks exposed to simulated sonic booms (156 dB peak flat) had significantly lighter weights than control chicks (Jehl and Cooper 1980). In contrast, Stadelman (1958) found that noise levels of 80-118 dB did not affect the growth of young chickens. Sonic boom noise had no effect on the hatchability of chicken eggs (Jehl and Cooper 1980; Heinemann 1969), however, aircraft flyovers (115 dB) interrupted hens brooding their young (Stadelman 1958). The effect of long-term exposure to overflights on game birds has not been investigated and is unknown.

Large Mammals

Effects of aircraft noise on canids are largely unknown. Wolves have been reported to exhibit a strong startle response to overflights by helicopters and fixed-wing aircraft (Manci et al. 1988; Krausman et al. 1986). Coyotes and wolves rely strongly on auditory stimuli for detecting prey (Manci et al. 1988).

Lamp (1989) found that responses of mule deer to overflights at Naval Air Station Fallon, Nevada were temporary behavioral changes and minor changes in winter habitat use. However, Lamp (1989) suggested that long-term cumulative impacts are unknown and need to be evaluated in future studies. Weisenberger et al. (1996) suggested that bighorn sheep and mule deer habituated to low-level aircraft noise with increased exposure. In support of this opinion, mule deer and bighorn sheep populations continue to exist under airspace where low-level aircraft sorties having been flown for years at such training areas as the Nellis Range, Nevada, and the Goldwater Range, Arizona.

Naïve, penned, heart-rate telemetered pronghorn antelope (Workman et al. 1992a) and Rocky Mountain elk (Workman et al. 1992b) were exposed to F-16 super- and sub-sonic overflights. Exposure duration varied from nine seconds to over one minute, AGLs varied from 5,000 to 9,000 feet, and the time interval between exposures was 30 minutes for pronghorn antelope and 15 minutes for elk. Both pronghorn antelope and elk experienced the highest elevated heart rates and behavioral responses (jumping, running) during their first exposures to super- and sub-sonic flyovers. Average heart rates during exposures were at least double pre-exposure rates in most cases. Subsequent exposures over two to four trials produced diminishing responses as animals appeared to habituate to the noise source. However, sample sizes and a lack of duplication precluded statistical analyses or an inference beyond the experimental animals used in the study.

Bats and Other Small Mammals

Few studies have been conducted on the effects of anthropogenic noise on free-ranging bats. Howell (1992) found that noise from unmanned aerial vehicles overlapped with lesser long-nosed bat's hearing at only one frequency (30 kilohertz), and flights at operational cruising altitude (3,000 feet AGL) were inaudible. Another study conducted on the same bat species found no apparent short-term effects of low-flying jet aircraft on bats in maternity roosts within a mine; however, the researchers warned that their results may not be adequate for extrapolation to other areas because of differences in roost site geometry and the outside terrain (Dalton and Dalton 1993). Dalton and Dalton (1993) remained concerned that long-term effects may have a

negative impact on the colony, but no study had been conducted yet to test that hypothesis. Griffin et al. (1963) found that echolocating Townsend's big-eared bats were able to resist jamming from a constant noise field by orienting to second harmonics. Jamming resistance and an ability to navigate and locate targets despite acoustical clutter and interference has been demonstrated for numerous other bat species (Simmons et al. 1974; McCarty and Jen 1983; Troest and Mohl 1986; and Schmidt and Joermann 1987). Many of these adaptations appear designed to allow for echolocation, in the presence of conspecifics. In terms of acoustical systems operation, resistance to jamming may indicate that bats are adaptable, within limits, and can use an array of frequencies for echolocation but the ecological implications of anthropogenic noise have not been addressed.

Studies on the effects of noise on wild small mammals have shown increased adrenal and body weights as well as temporary threshold shifts in hearing (Manci et al. 1988). Long-term exposure to aircraft noise has been shown to cause increased adrenal weights in mice, which generally corresponds to higher levels of stress. However, no adverse impacts on longevity, reproductive success, or health were detected or noted (Chesser et al. 1975).

Reptiles and Amphibians

Although few field studies have been conducted to evaluate the impacts of noise on wild populations of amphibians and reptiles, Manci et al. (1988) summarized the results of several laboratory studies that demonstrated the sensitivity of amphibians and reptiles to sound. Desert iguanas and Mojave fringe-toed sand lizards were shown to experience hearing losses or decreases in hearing sensitivity after exposure to simulated off-highway vehicle noise of 95 to 114 dB. Neotropical treefrogs redistributed their calls to fall within spaces between tone bursts of up to 41 dB. Spadefoots, which appear to use auditory cues (such as thunderstorms) to emerge from hibernation, emerged from burrows in a laboratory setting after exposure to motorcycle sounds of 95 dB. Emergence during a period when water is not available may negatively impact spadefoot populations in arid regions. These studies indicate that exposure to high noise levels at certain times of year may cause amphibians and reptiles to respond inappropriately or with reduced sensitivity to auditory stimuli.

4.8.2 Hardwood Range Expansion and Associated Restricted Airspace

4.8.2.1 Range Expansion

The Hardwood Range expansion would have direct and indirect impacts to biological resources at the Hardwood Range and within the proposed expansion area. These impacts are presented below under two main headings: (1) vegetation loss and associated impacts; and (2) noise. Noise impacts associated with the proposed range expansion are included in the noise discussion in section 3.2.1 and 4.2.3, Use of Restricted Airspace R-6904.

Vegetation Loss and Associated Impacts

Vegetation loss would result from construction of the landing zone and DZ and from bombing and road development within the tactical target complex. Use of the tactical target complex would also impact vegetation. As localized areas within the tactical target complex are bombed, existing vegetation would be impacted. The level of impact would depend on several factors, which include, but are not limited to, time of

year, type of ordnance, intensity of bombing, and the frequency of bombing. Bombing at the tactical target complex would result in damage to localized areas initially. Using the existing conventional target complex as an example, it is unlikely that large (i.e., greater than one acre) areas of vegetation would be completely destroyed if target locations are moved regularly and a fire suppression program is implemented. Instead, small areas (i.e., less than 1,000 square feet) of bare soil may be present at and near target locations. These areas should become revegetated within two growing seasons in most cases. One exception would be impacts to wetland areas that tend to have relatively low primary productivity and may take longer for vegetation re-establishment.

Indirect impacts would include changes in plant community species composition and physiognomy and changes in animal community species composition within the expansion area due to construction and bombing. Over time, species composition and plant community physiognomy would likely change within the tactical target complex due to continued bombing impacts and the disruption to localized succession. For example, the existing plant communities are composed primarily of early to mid-successional species with dominant species within of each of the major growth forms (i.e., herbs, shrubs, trees). However, continued disturbance would favor herbaceous early successional species over most others. As the plant communities change, their associated animal communities would likely change also. These changes would probably occur over the long-term (years) rather than short-term (weeks). The impacted species would not be lost, but rather displaced by species that have an affinity for the resulting plant communities and their spatial arrangement (i.e., fragmented and early seral stage plant communities). This level of impact seems minimal given that: (1) the tactical target complex is a relatively small portion of the larger Hardwood Range and proposed expansion area; (2) the Hardwood Range is surrounded by significant state and Federal undeveloped holdings that contain similar plant and animal communities; and (3) in general, the plant and animal communities common in the area are not locally or regionally scarce.

WDNR has compiled a listing of threatened, endangered, and special concern species potentially occurring on the Hardwood Range and Proposed Expansion Area. It is estimated that several of these species are very likely to occur on the site. Disruption of habitat of these species, through construction activities or use of the tactical target range, may adversely affect localized populations of these species. However as described above, additional similar habitats would exist around the target complex. These buffer areas would remain relatively undisturbed and would be managed to maintain biological diversity.

Coordination with the USFWS under the ESA is ongoing. The Service has informed the ANG that “if the decision is made to proceed with the proposals contained in the DEIS, the USFWS will need a determination from the ANG whether the proposed activity may affect any federally listed species. The determination would form the conclusions of a BA prepared by the ANG” (DOI 1997). The ANG has also coordinated with the USFWS Green Bay Field Office pursuant to this proposal and discussed the proposal in detail and concurrence was reached on the part of the USFWS and the ANG on the procedures taking place. The USFWS provided the ANG with a letter in April 1998 (DOI 1998) (see Appendix G) concurring with the approach the ANG is pursuing, and has agreed the dialog will continue as the plans for the proposal become more firm. Additionally, in a letter dated November 1999 (DOI 1999), the USFWS stated that “it is premature to prepare a BA at this time to determine whether a federally-listed threatened or endangered species may be adversely affected by the proposed project... When detailed plans are available regarding specific impacts on the property, we may recommend preparation of a BA. If a BA concludes that a federally-listed threatened or endangered species may be adversely affected, formal consultation should be initiated

with the Service pursuant to section 7 of the ESA of 1973, as amended." See Appendix G for USFWS correspondence.

Changes in plant community composition and physiognomy may have some benefit. One of the species of concern is the federally-endangered Karner blue butterfly (*Lycaeides melissa samuelis*). Because activities proposed for the landing zone, DZ and tactical target complex are likely to open the forest canopy and possibly allow grasslands or savanna-like conditions to develop, suitable habitat for this species may increase over that available under the existing land use. This has shown to be the case at the existing target complex where both wild lupine and Karner blue butterflies are present.

4.8.2.2 Restricted Airspace R-6904

The area underlying restricted airspace R-6904 supports several Federal- and state-listed threatened and endangered (T&E) species (USFWS 1995; WDNR 1995b). Vertebrate species known or with potential to occur include redfin shiner, wood turtle, Blanding's turtle, eastern massasauga rattlesnake, red-shouldered hawk, great egret, cerulean warbler, acadian flycatcher, bald eagle, yellow-crowned night-heron, osprey, greater prairie-chicken, and barn owl.

Maximum sound levels associated with use of R-6904 would have an L_{dnmr} value of 53 dB. This sound level represents a 3 dB decrease from existing conditions, as described in section 4.2, Noise. There are predicted to be 1.2 daily noise events that exceed the 65 dB SEL for R-6904A and 15.8 for R-6904B. These levels are not directly comparable to baseline conditions because of the proposed reconfiguration of the airspace. In general, noise levels would be reduced in R-6904A because of more diffused aircraft activity resulting from the spatial redistribution of aircraft activity over the range. However, noise levels in areas surrounding the range complex and in the range expansion area would increase.

Wildlife in R-6904 are currently exposed to 2,672 aircraft sorties annually; therefore, some degree of assimilation to aircraft noise can be expected. Several studies (see section 4.8.1.3) indicate that animals in areas of greater human activity are less sensitive to additional disturbances than animals inhabiting more remote areas. However, use of R-6904 by wildlife may be at least temporarily reduced during training activities, especially when ground-based actions occur in the Hardwood Range and proposed expansion area.

Based on the criteria described in section 4.8.1.2 and the information presented in section 4.8.1.3, increased noise resulting from ground-based noise combined with an increase in frequency of aircraft noise events would have a low impact to wildlife in the area.

4.8.3 Falls 1 and 2 MOAs

The area underlying Falls 1 and 2 MOAs supports several Federal- and state-listed T&E species (USFWS 1995; WDNR 1995b; WDNR 1997b). Vertebrate species known or with potential to occur include timber wolf, redfin shiner, wood turtle, Blanding's turtle, eastern massasauga rattlesnake, red-shouldered hawk, great egret, cerulean warbler, acadian flycatcher, bald eagle, yellow-crowned night-heron, osprey, greater prairie-chicken, and barn owl.

Sound levels associated with the proposed use of Falls 1 and 2 MOAs would have a maximum L_{dnmr} value of 52 and 50 dB, respectively. These values represent

increases of 3 and 1 dB over existing conditions in these MOAs. There are predicted to be 0.6 and 0.5 daily noise events that exceed the 65 dB SEL for most of the Falls 1 and 2 MOAs. In each area, this would represent a 0.1 daily event increase compared to existing conditions, or an increase of one event every 10 flying days. In areas where Falls 1 and 2 MOAs overlap VR-1616 and VR-1650, daily noise events exceeding the 65 dB SEL would range from 0.7 to 2.8.

4.8.4 Volk South MOA

The area underlying Volk South MOA supports several Federal- and state-listed T&E species (USFWS 1995; WDNR 1995b). Vertebrate species known or with potential to occur include timber wolf, redfin shiner, wood turtle, Blanding's turtle, eastern massasauga rattlesnake, red-shouldered hawk, great egret, cerulean warbler, acadian flycatcher, bald eagle, yellow-crowned night-heron, osprey, greater prairie-chicken, and barn owl.

Maximum sound levels associated with use of Volk South MOA would have an L_{dnmr} value of 50 dB. This sound level represents a 4 dB decrease from existing conditions, as described in section 4.2, Noise. There are predicted to be 0.5 daily noise events that exceed the 65 dB SEL for Volk South MOA. This would represent a 0.3 daily event increase compared to existing conditions, or an increase of one event every three to four days.

To minimize potential disturbances to the greatest extent possible, seasonal avoidance procedures such as those described for the Falls 1 and 2 MOAs could be implemented. Based on implementation of these avoidance measures, the criteria described in section 4.8.1.2, and the information presented in section 4.8.1.3, the impacts to wildlife resulting from noise in Volk South MOA would be low.

4.8.5 No-Action Alternative

Under the No-Action Alternative, utilization of the existing Hardwood Range, R-6904, and Falls 1, Falls 2, and Volk South MOAs would remain at current levels. No additional ground disturbance would occur in or near the Hardwood Range. Sortie rates and sound levels within these airspace components would remain unchanged from the present. Sound levels associated with flight activities would continue to have L_{dnmr} values ranging from 46 to 63 dB, with 0.2 to 2.7 daily noise events that would exceed the 65 dB SEL. Therefore, potential impacts to biological resources resulting from current activities would continue to be negligible.

4.8.6 Unavoidable Adverse Impacts

On the ground, unavoidable adverse impacts associated with the expansion of the Hardwood Range would include loss of small amounts of vegetation. There would be no impacts to wetlands aside from the small potential of practice ordnance landing in these areas. Localized populations of threatened, endangered, and special concern plant species may be disturbed in the proposed expansion area. Plant community species composition, physiognomy, and productivity may change in the proposed expansion area over the long-term. The ANG firmly commits to not impact wetlands in development of the proposed expansion area.

For the airspace, there would be no unavoidable adverse impacts to biological resources associated with use of R-6904 or the Falls 1, Falls 2, or Volk South MOAs.

4.9 CULTURAL RESOURCES

This section provides an overview of the general issues and concerns regarding cultural resources within the area of the Proposed Action. It also provides a specific analysis of the potential impacts of the Proposed Action in each area of proposed change. The overview describes the impact assessment process for archaeological, architectural, and traditional cultural resources and methods of determining significance both of cultural resources and of impacts. The specific analysis addresses potential impacts of the Proposed Action in the Hardwood Range Expansion area and in the Volk South, Falls 1 and Falls 2 MOAs. These sections also include concerns about traditional cultural resources raised by the Ho-Chunk Nation.

4.9.1 Overview

Cultural resource issues and concerns generally relate to the impacts of a Proposed Action on a physical component of the resources or on the setting in which the resources are located. In either case, a cultural resource must first be determined to be significant by law, regulation, or rule to be evaluated for impacts by a Proposed Action.

4.9.1.1 Issues and Concerns

The Proposed Action involves increasing the size of Hardwood Range and reassessing use of three areas of existing associated airspace. The primary issues and concerns resulting from the Proposed Action consist of the following:

- Potential direct impacts to prehistoric and historic archaeological resources as a result of ground-disturbance associated with construction and use of new targets and other facilities on the expanded Hardwood Range

- Potential degradation of the setting of prehistoric and historic archaeological sites and historic architectural resources, listed or eligible to be listed, on the National Register of Historic Places (National Register) resulting from increased noise associated with reassessed use of existing airspace

- Potential audible and visual intrusions on traditional or sacred properties resulting from changes in aircraft noise

- Access to traditional cultural resources by Native American groups.

4.9.1.2 Methodology for Analyzing Impacts

Impact analysis employed guidelines and standards set forth in the Section 106 process defined under the National Historic Preservation Act (NHPA) of 1966, as amended. This process specifies identification of significant cultural resources potentially affected by an action, determination of the effect of that action, and implementation, where appropriate, of measures to mitigate those effects. The preparation of an EIS does not require a 100 percent inventory of the area of potential ground disturbance prior to the selection of a course of action. The NEPA process is one of non-destructive planning that requires a Federal agency proposing an undertaking to collect enough information on the resources to make a decision regarding the

alternatives (*Council on Environmental Quality [CEQ]-Regulations for Implementing NEPA* Part 1500-1508). NEPA is silent on the matter of how much cultural resource survey is required. However, the NHPA (36 CFR 800.3[c]) allows nondestructive planning (cf. NEPA) prior to an undertaking, as well as phased compliance at different stages of planning. Once a course of action is selected, cultural resource inventory is performed in compliance with Section 106.

As part of the process, the ANG has initiated consultation with the State Historic Preservation Office (SHPO) of Wisconsin regarding the potential effects of the actions on cultural resources examined in this EIS. This initial consultation included identification of known historic properties (defined as significant archaeological and architectural resources) potentially affected by the Proposed Actions.

The ANG has discussed the proposed action with the Ho-Chunk Nation and has coordinated with the Menominee Indian Tribe of Wisconsin regarding traditional cultural resources and Native American concerns in a series of discussions, meetings, requests for meetings, and letters from 1996 through 1998. At a meeting with the Ho-Chunk Nation in February 1998, the potential effects of ANG activities on traditional practices and settlement areas were discussed. The discussion also addressed resource identification and avoidance procedures, and archaeological investigation and protection within the proposed expansion area. Coordination was planned to continue at a future meeting. A gap in the regular series of meetings occurred from June 1997 through January 1998 while tribal elections and reassignments took place. A chronological summary of coordination activities with Native American representatives includes the following:

- 8/19/96 – ANG receives letter from Ho-Chunk Nation (C.A. Lowe, President) regarding effects of airspace use on cultural resources.
- 8/19/96 – ANG receives letter from Ho-Chunk Nation Legislature (O.M. Garvin, Legislator) regarding VR-1616.
- 12/20/96 – ANG meets at Volk Field with Ho-Chunk Nation members, Citizens Opposed to Range Expansion, and other groups
- 3/31/97 – ANG letter to Ho-Chunk Nation (N.J. Kingsley, Director, Ho-Chunk Historic Preservation Department) addressing questions raised at meeting regarding airspace expansion and existing conditions.
- 5/2/97 – ANG receives fax from Ho-Chunk Nation (O.M. Garvin, Legislator) referencing 5/1/97 teleconference with General Wilkening (Commander, Wisconsin ANG) addressing flights over cemetery.
- 5/13/97 – ANG contacted by Ho-Chunk Nation (D. Makes Strong Move) to schedule meeting for 6/13/97 (phone call).
- 6/13/97 – Meeting cancelled by Ho-Chunk Nation (per D. Makes Strong Move). To be rescheduled after 7/2/97 elections (phone call).
- 7/7/97 – ANG inquires of Ho-Chunk Nation about rescheduling the meeting (phone call).
- 7/9/97 – ANG requests meeting with Ho-Chunk Nation (R. Owens) in early August. No date set because of recent elections (phone call).
- 11/20/97 – ANG receives letter from Ho-Chunk Nation Department of Justice (G.F. Brownell, Attorney General) with written comments on the DEIS.

- 12/18/97 – ANG attempts to arrange meeting with Ho-Chunk Legislative Affairs Office (voice mail message).
- 1/12/98 – ANG calls Ho-Chunk Nation (L. Garvin) to arrange meeting in February and Ho-Chunk Nation schedules meeting for 2/25/98.
- 2/25/98 – ANG meets with Ho-Chunk legislators and legal counsel to discuss issues raised in the Nation's response to the DEIS.
- 2/26/98 – ANG meets with representative of Menominee Tribe (D. Grignon, Director of Historic Preservation) to discuss range expansion proposal and the necessity for archaeological study.
- 7/27/99 – ANG sends letter to the Ho-Chunk Nation (J. Lonetree, President) requesting a meeting to further discuss ongoing issues.

Appendix O contains correspondence and minutes of meetings documenting ANG Native American coordination.

Resource Significance

The significance of prehistoric and historic archaeological resources and architectural resources is evaluated based on the criteria for inclusion in the National Register as defined in 36 CFR 60.4 and in consultation with the SHPO. To be eligible for the National Register, a cultural resource must retain integrity of location, design, setting, materials, workmanship, feeling, or association.

In addition to retaining integrity, cultural resources must meet one of the following criteria:

a) Are associated with events that have made a significant contribution to the broad patterns of history

b) Are associated with the lives of persons significant in the past

c) Embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction

d) Have yielded, or may be likely to yield, information important in prehistory or history.

Criterion (d) forms the basis for evaluating the significance of most prehistoric and historic archaeological sites. For some historic archaeological resources (e.g., battlegrounds, historic event sites, trails), criteria (a) or (b) apply. Architectural resources are commonly evaluated under criterion (c), although many are also associated with important historic events (criterion a) or people (criterion b).

Cultural resources determined to be significant according to National Register criteria are termed historic properties. To be listed in or determined eligible for listing in the National Register, a property must meet at least one of the above criteria and must possess integrity. Integrity is the authenticity of a property's historic identity as indicated by the survival of physical characteristics that existed during the property's historic or prehistoric occupation or use.

Evaluating the significance of traditional cultural resources requires consultation with affected groups to understand the relative importance of tangible and intangible traditional resources. Tangible cultural resources, such as ancestral Native

American settlements or petroglyph and pictograph sites, may be protected through their eligibility for the National Register as traditional cultural properties. However, natural features and spiritual locations are not addressed in historic preservation legislation unless their historic use can be documented. Intangible resources that contribute to the uniqueness and maintenance of traditional cultures and communities are protected under the specifications of E.O. 13007.

A letter from the President of the Ho-Chunk Nation to the ANG describes types of sites considered sacred to Ho-Chunk People (Lowe 1996). These include religious sites where ceremonies are held, sites where traditional medicines are harvested, and sites where pre-Columbian petroglyphs and pictographs are located. Such sites "are viewed as delicate in their environments and sensitive to low-flying aircraft" (Lowe 1996).

Impact Significance

An action results in impacts to a historic property when it alters the property's characteristics, such as environment or use, that qualify it for inclusion in the National Register. Impacts may include the following:

- Physical destruction, damage, or alteration of all or part of the property
- Alteration of the character of the property's surrounding environment that contributes to the property's qualification for the National Register
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting
- Neglect of a property resulting in its deterioration or destruction
- Transfer, lease, or sale of property.

Direct impacts to cultural resources include those resulting from ground disturbance directly associated with the construction, operation, and maintenance of new or modified facilities and infrastructure. These actions can potentially disturb or destroy cultural resources. Direct impacts may also result from audible or visual intrusions, including vibrations from aircraft overflight, that can alter the setting or affect the integrity of a historic property.

For this EIS, impacts to cultural resources were assessed by:

- Identifying the types and locations of all elements (e.g., construction, aircraft noise) of the Proposed Action
- Comparing these locations with known cultural resource locations, areas considered sensitive, and disturbed locales
- Determining the known or potential significance of cultural resources that may be affected
- Determining the extent, intensity, and context of the effects.

Aircraft noise and overflights represent the primary consequences of changes in the configuration and use of airspace. Therefore the impact analysis focuses on how

these effects might impact the setting of significant cultural resources. To be adversely affected, the setting of a resource must be an integral part of the characteristics that qualify that resource for listing on, or eligibility for, the National Register.

Because of modern development, setting is not often a determining element in the significance of cultural resources, especially in urban or semi-urban environments. Even in rural areas, noise intrusions from a variety of sources such as vehicles, farm machinery, chainsaws, and snowmobiles create a noise environment that is unlikely to be consistent with the original setting of the property. If, however, the audible and visible aspects of the setting are fundamental to the resource's significance, then the potential impact from audible or visual intrusions on that setting can be evaluated. Intrusions sufficient to alter the setting can adversely affect the resource. The nature and magnitude of the impacts depend on the characteristic of the affected cultural resource, the amount by which the sound level would exceed baseline noise levels, and other kinds of existing noise sources in the vicinity of the resource.

Although architectural resources may be impacted by ground disturbance and by activities that destroy or modify the structure itself, there is also concern that vibrations from low-flying aircraft can disturb them. Normally, windows and, infrequently, plastered walls and ceilings are the most sensitive components of a structure to airborne noise. An evaluation of the anticipated peak sound pressures in the area of the structure is usually sufficient to determine the possibility of damage.

Studies have established that subsonic noise-related vibration damage to structures, even historic buildings, requires high dB levels generated at close proximity to the structure and in a low frequency range (U.S. Forest Service [USFS] 1992; Battis 1983, 1988). Aircraft must generate at least 120 dB at a distance of no more than 150 feet to potentially result in structural damage (Battis 1988). A study by Wyle Laboratories (Sutherland 1990) indicated that a large, high-speed aircraft flying directly over a building had less than a 0.3 percent chance of damaging fragile structures such as wooden buildings. In other words, the probability of an aircraft operating at 200 feet AGL at 540 knots true airspeed (KTAS) directly over such a structure is extremely unlikely to cause damage. Operations at higher altitudes have a lower potential for causing damage.

Noise effects on buildings have been difficult to test and document in the field. However, thresholds for noise effects to architectural resources are generally agreed to "be specifically oriented to the frequency range below 30 Hz" (U.S. Forest Service 1992). A vibration study on a historic building at White Sands National Monument, New Mexico, determined that "medium level vibrations (1-20 millimeter [mm]/sec at 1-30 Hz) were the most dangerous" (King et al. 1988).

It is also possible for sonic booms to adversely affect some cultural resources. However, all sorties in the Volk South and Falls 1 and 2 MOAs would be flown at subsonic airspeeds, between 250 and 550 knots indicated airspeed (KIAS).

Adverse effects from noise and vibrations on archaeological sites, including rock art (petroglyphs, pictographs), have not been demonstrated. Presently, there are no known data concerning the effects of noise and vibrations from aircraft on rock art or documented cases of impacts to rock art from noise and vibrations.

Significant traditional cultural resources can be affected by noise and visual intrusions, limitations of access to sacred sites or traditional resources, and direct physical impacts. Noise and visual intrusions can affect the setting of a significant resource when that resource is dependent on quiet and solitude. Direct physical impacts to traditional cultural resources can potentially result from ground disturbing

activities like those that disturb archaeological sites. Access to sacred sites can be limited in areas that are restricted for safety or security reasons.

The potential impact of noise, visual, and physical intrusions on significant traditional cultural resources, and the need for access to the resources must be assessed through consultation with concerned Native American groups. Certain locations may be frequently used for traditional purposes, while others may be used less frequently and may be of less immediate concern.

The Section 106 Process

The NHPA and associated regulations (36 CFR 60.4, 36 CFR 800) require that effects to cultural resources from Federal undertakings be taken into consideration as part of the decision-making process. To comply with the NHPA, Federal undertakings go through the Section 106 review process. This process consists of the following:

1. *Survey*. Once a course of action is selected, a cultural resources survey of all lands that would be potentially affected by ground disturbance would be completed. Consultation with the Ho-Chunk Nation and the Menominee Indian Tribe of Wisconsin regarding the potential for traditional cultural resources in the region would be conducted.

2. *Evaluation*. All identified cultural resources within the area of potential ground disturbance would be formally evaluated according to National Register criteria. Formal determinations of National Register eligibility would be made by the ANG. The Wisconsin SHPO would have the opportunity to review the recommendations.

3. *Mitigation Plan*. The ANG, in consultation with the Wisconsin SHPO, the Advisory Council on Historic Preservation (ACHP), and the Ho-Chunk Nation, would develop a mitigation plan to implement avoidance or mitigation measures for National Register-eligible resources adversely affected by the action.

4. *Memorandum of Agreement*. A Memorandum of Agreement would be developed and signed by the ANG, SHPO, ACHP, and Ho-Chunk Nation to provide for on-going and future management of cultural resources within the area of potential effect. The mitigation plan would accompany the Memorandum of Agreement.

5. *Monitoring*. If appropriate, the ANG would develop a set of procedures for monitoring cultural resources within the area of potential effect for possible damage. The ANG would conduct data recovery at National Register-eligible cultural resources within the area of potential ground disturbance and would monitor cultural resources near that area for possible damage.

6. *Native American Consultation*. The ANG would continue to communicate with the Ho-Chunk Nation and other interested Native American groups whose traditional values, customs, and properties might be adversely affected by military overflights. If necessary, measures to avoid or mitigate adverse effects could be incorporated into the Mitigation Plan and Memorandum of Agreement.

4.9.1.3 General Findings

Based on the results of previous investigations and known land-use patterns for the project area, the proposed Hardwood Range expansion has the potential to affect previously undocumented cultural resources. Modifications to airspace use, in contrast, have little potential to adversely affect existing National Register-listed and National Register-eligible properties beneath the airspace in the Volk South, Falls 1 and Falls 2 MOAs.

4.9.2 Hardwood Range Expansion and Associated Restricted Airspace (R6904)

4.9.2.1 Hardwood Range Expansion

The Proposed Action would expand the land area north of the existing boundaries of Hardwood Range by 7,137 acres. It would include a new area for potential target locations, a DZ to practice drops of combat supplies, and a landing zone in Wood County. The landing zone and DZ, presently forested, would be cleared of obstacles and drained or filled to protect from potential high water damage. The area proposed for new target locations would undergo limited tree removal and grading for target areas, fire breaks, and service roads. Noise values of 61 Ldnmr are expected for the proposed expanded range area.

If a significant cultural resource were located in the path of any of these activities, then that resource would be adversely affected. Potential effects to cultural resources could also occur from ordnance impacts and possibly from noise. However, the ROI is already subject to some noise effects from activities on the existing range and within the existing restricted airspace.

No National Register-listed cultural resources have been located on the nearby existing range. A cultural resource survey of approximately 50 percent (3,840 acres) of the existing Hardwood Range identified seven historic archaeological sites and eight architectural resources. No prehistoric Native American archaeological sites were encountered. All 15 archaeological and architectural sites were evaluated as potentially eligible for the National Register by the Wisconsin SHPO (Dexter 1995). Based on the condition of the sites, the study also found that military use of the range at that time had little negative impact on the archaeological resources there (Boszhardt 1992). Therefore, these resources would be unlikely to be impacted by the Proposed Action.

None of the proposed expansion area (7,137 acres) has been surveyed yet for cultural resources. This unsurveyed area is considered sensitive for the presence of potentially significant archaeological resources, both prehistoric and historic sites. Based on the number of sites previously encountered in the adjacent existing range, it is estimated that approximately 28 archaeological or architectural sites might be encountered during survey of the entire proposed area of expansion. Certain types of terrain may be sensitive for prehistoric archaeological sites. For example, rock outcrops can contain prehistoric rock art. Sandy terraces can contain prehistoric sites (mound sites have been located west and south of the existing range). Historic archaeological sites are found throughout the existing range because the region was the location of considerable agricultural activity between 1870 and the 1930s (U.S. West Research 1992). Given the absence of Native American archaeological sites in the surveyed portion of the existing range, it is possible that no Native American archaeological sites would be discovered in the expansion area.

Until all areas subject to potential ground disturbance within the proposed expansion area have been surveyed, it is not possible to determine if there would be

adverse effects from construction activities or ordnance delivery. If undocumented sites or artifacts are encountered during the course of construction activities (after completion of the initial cultural resource inventory), then work in the area would be halted until the resource could be evaluated by a qualified professional following procedures specified in the NHPA and guidelines provided by the Wisconsin SHPO.

To determine if eligible sites would be affected by the Proposed Action, the Wisconsin SHPO has recommended the following steps (Dexter 1995; State Historical Society of Wisconsin 1995):

- Conduct cultural resources inventory, with 100 percent coverage, of the area proposed for new facilities. This survey would identify prehistoric and historic archaeological resources and architectural resources.
- Document any cultural resources identified during the inventory.
- Evaluate any cultural resources found for National Register eligibility.
- Develop a plan, in consultation with the Wisconsin SHPO, to mitigate adverse effects to significant resources, if they exist. Mitigation could include avoidance through project redesign, data recovery, or other procedures.

Section 106 specifies that mitigation would reduce potential adverse effects to historic properties in the area of proposed expansion to insignificance.

No traditional cultural resources have been identified within Hardwood Range boundaries, or within the proposed expansion area. The process to identify the potential for such resources through consultation with Native American groups has been initiated. The goal of consultation is to determine whether significant traditional cultural resources are located within range boundaries. If such resources are identified, mitigation alternatives would be determined in consultation with the Ho-Chunk Nation.

The ANG is not aware of the existence of any traditional cultural resources within the proposed expansion area. The ANG has not completed a cultural resources survey for the expansion property. Several cultural resources lie underneath existing airspace associated with Volk Field not included in the proposed action. As additional resources are made available to the ANG, appropriate analysis will be determined and accomplished.

The ANG currently has a coordination system in place with the Ho-Chunk Nation that provides for a 5 NM avoidance area during any of their special observances or ceremonies. This system is on an “as called for” basis and is implemented by NOTAM and direct communication with daily users.

4.9.2.2 Restricted Airspace (R-6904)

The Proposed Action would modify the restricted airspace associated with the Hardwood Range by lowering the bottom altitude and expanding the airspace laterally to coincide with the proposed land expansion. Under the Proposed Action, cultural resources located beneath the expanded restricted airspace (R-6904A) would be subject to decreased noise levels (from 56 to 53 L_{dnmr}) as the total number of missions at Hardwood Range is dispersed over a wider area.

Two National Register-listed cultural resources, Sprague Bridge and Cranberry Creek Archaeological District, and 19 National Register-eligible or potentially eligible resources are located beneath the existing restricted airspace. Eligibility evaluations for known cultural resources beneath the airspace were made after Hardwood Range already existed. Aircraft using the range at the time were not considered to be detrimental to the resources' National Register eligibility. However, the Wisconsin SHPO has expressed concerns regarding the effect of aircraft noise on the setting of Cranberry Creek Archaeological District (Banker 1995; Dexter 1995) along the edge of R-6904A.

Maps provided by the Ho-Chunk Nation show tribal housing at the edge of existing R-6904A airspace. A letter from the Ho-Chunk Nation Legislator, Area IV, indicated that the Ho-Chunk Nation is concerned about the proposed expansion of Hardwood Range into Wood County and about potential flights over Native American Church activities that are held outdoors (Garvin 1996).

Although no traditional cultural resources have been formally recorded within the boundaries of R-6904, petroglyphs and mound sites may be traditional cultural resources. Both site types are found beneath R-6904A. Efforts to identify traditional cultural resources through consultation with Native American groups will continue. If such resources are identified, mitigation alternatives would be determined in consultation with the Ho-Chunk Nation.

The ANG is not aware of the existence of any traditional cultural resources within the proposed expansion area. The ANG has not completed a cultural resources survey for the expansion property. Several cultural resources lie underneath existing airspace associated with Volk Field not included in the proposed action. As additional resources are made available to the ANG, appropriate analysis will be determined and accomplished.

The ANG currently has a coordination system in place with the Ho-Chunk Nation that provides for a 5 NM avoidance area during any of their special observances or ceremonies. This system is on an "as called for" basis and is implemented by NOTAM and direct communication with daily users.

4.9.3 Reassessment of Volk South MOA Utilization

Reassessment of the use of Volk South MOA would increase the assessed number of sorties. All missions would be flown at subsonic speeds. Utilization of the Volk South MOA could potentially affect two prehistoric and two historic National Register-listed properties: Cranberry Creek Archaeological District, Gee's Slough Mound group, Sprague Bridge, and Weston-Babcock House. These cultural resources were listed after the Volk South MOA was established. The Wisconsin SHPO has expressed concerns regarding the effect of aircraft noise on the setting of Cranberry Creek Archaeological District (Banker 1995; Dexter 1995). The Cranberry Creek Mounds (part of the District) are also identified as an area of concern on maps provided by the Ho-Chunk Nation. An additional 25 eligible or potentially eligible prehistoric and historic sites also have been recorded in the area.

A noise increase in the Volk South MOA would result from the reassessed utilization. However, adverse physical effects to historic properties from vibrations caused by aircraft overflights are considered unlikely for the following reasons: noise levels will increase minimally (from 46 to 50 L_{dnmr}); and planes will fly a minimum of 500 feet AGL. This would avoid potential physical damage associated with noise at close range and high dB.

A change in audible setting could also be an adverse effect of an action if setting were an important aspect of the National Register eligibility of a specific cultural resource. If a noise increase would be considered to affect setting, then the transitory nature of aircraft noise suggests that impacts to that setting would be infrequent and temporary. Setting would not be impacted unless a person were at the site, experiencing quiet and solitude, at the moment of overflight.

Although no traditional cultural resources have been formally recorded within the boundaries of the Volk South MOA, both petroglyphs and mound sites may be traditional cultural resources, and both site types are found within Volk South MOA. Efforts to identify traditional cultural resources through consultation with Native American groups will continue. Potential effects of aircraft noise to significant traditional cultural resources must be determined in consultation with the concerned traditional group, in this case, the Ho-Chunk Nation. If significant traditional cultural resources are identified, then mitigation alternatives would be determined in consultation with the Ho-Chunk Nation.

The ANG is not aware of the existence of any traditional cultural resources within the proposed expansion area. The ANG has not completed a cultural resources survey for the expansion property. Several cultural resources lie underneath existing airspace associated with Volk Field not included in the proposed action. As additional resources are made available to the ANG, appropriate analysis will be determined and accomplished.

The ANG currently has a coordination system in place with the Ho-Chunk Nation that provides for a 5 NM avoidance area during any of their special observances or ceremonies. This system is on an "as called for" basis and is implemented by NOTAM and direct communication with daily users.

4.9.4 Reassessment of Falls 1 MOA Utilization

Reassessment of the Falls 1 MOA would increase the assessed number of sorties. Utilization of the Falls 1 MOA could potentially affect two prehistoric and one historic National Register-listed properties: Gullickson's Glen; Silver Mound Archaeological District; and Union High School in Black River Falls. A large number of unevaluated prehistoric and historic sites have also been recorded in the area.

A noise increase in the Falls 1 MOA would result from the reassessed utilization. However, adverse physical effects to historic properties from vibrations caused by aircraft overflights are considered unlikely for the following reasons: noise levels would increase minimally (from 49 to 52 L_{dnmr}); and planes would fly a minimum of 500 feet AGL. This would avoid potential physical damage associated with noise at close range and high dB.

A change in audible setting could also be an adverse effect of an action if setting were an important aspect of the National Register eligibility of a specific cultural resource. If a noise increase were considered to affect setting, then the transitory nature of aircraft noise suggests that impacts to setting would be infrequent and temporary. Setting would not be impacted unless a person were at the site, experiencing quiet and solitude, at the moment of overflight.

No traditional cultural resources have been formally recorded within the boundaries of the Falls 1 MOA. However, a map of tribal lands provided by the Ho-Chunk Nation indicates a number of areas of concern along the Black River in central Jackson County and southern Clark County. A letter from the Ho-Chunk Nation

Legislator, Area IV stated that sacred sites (as defined in E.O. 13007) exist under airspace in central Jackson County. The letter also expressed concern about flights over tribal villages in Jackson County and over Native American Church activities held outdoors in Jackson, Clark, and Wood Counties (Garvin 1996).

In general, the presence of mound sites, the Ho-Chunk Nation reservation, and the large number of Native American inhabitants of the area indicate the likely presence of traditional cultural resources. Efforts to identify traditional cultural resources through consultation with Native American groups will continue. Potential effects of aircraft noise to significant traditional cultural resources must be determined in consultation with the concerned traditional group, in this case, the Ho-Chunk Nation. If significant traditional cultural resources are identified, then mitigation alternatives would be determined in consultation with the Ho-Chunk Nation.

Traditional cultural resources identified in the EIS do not lie within the proposed expansion area. Several cultural resources lie underneath existing airspace not included in the proposed action. As additional resources are made available to the ANG, appropriate analysis will be determined and accomplished.

The ANG currently has a coordination system in place with the Ho-Chunk Nation that provides for a 5 NM avoidance area during any of their special observances or ceremonies. This system is on an "as called for" basis and is implemented by NOTAM and direct communication with daily users.

4.9.5 Reassessment of Falls 2 MOA Utilization

Reassessment of the use of Falls 2 MOA would increase the assessed number of sorties. Utilization of the Falls 2 MOA could potentially affect two historic National Register-listed architectural properties: Clark County Jail in Neillsville and the Robert Schofield House in Greenwood. A number of unevaluated prehistoric and historic sites have also been recorded in the area.

A noise increase in the Falls 2 MOA would result from the reassessed utilization. However, adverse physical effects to historic properties from vibrations caused by aircraft overflights are considered unlikely for the following reasons: noise levels would increase an undetectable amount (from 49 to 50 L_{dnmr}); and planes would fly a minimum of 500 feet AGL. This would avoid physical damage associated with noise at close range and high dB. A change in audible setting could also be an adverse effect of an action if setting were an important aspect of the National Register eligibility of a specific cultural resource. However, importance to history rather than setting, were the primary considerations when the listed properties beneath Falls 2 MOA were nominated to the National Register.

No traditional cultural resources have been formally recorded within the boundaries of the Falls 2 MOA. A map provided by the Ho-Chunk Nation shows some tribal land in Clark and Eau Claire counties. Efforts to identify traditional cultural resources through consultation with Native American groups are ongoing. Potential effects of aircraft noise to significant traditional cultural resources must be determined in consultation with the concerned traditional group, in this case, the Ho-Chunk Nation. If significant traditional cultural resources are identified, then mitigation alternatives would be determined in consultation with the Ho-Chunk Nation.

The ANG is not aware of the existence of any traditional cultural resources within the proposed expansion area. The ANG has not completed a cultural resources survey for the expansion property. Several cultural resources lie underneath existing

airspace associated with Volk Field not included in the proposed action. As additional resources are made available to the ANG, appropriate analysis will be determined and accomplished.

The ANG currently has a coordination system in place with the Ho-Chunk Nation that provides for a 5 NM avoidance area during any of their special observances or ceremonies. This system is on an "as called for" basis and is implemented by NOTAM and direct communication with daily users.

4.9.6 No-Action Alternative

Under the No-Action Alternative, neither the expanded Hardwood Range nor modifications to existing airspace would occur. Ho-Chunk tribal housing is located near, but not underneath, the existing R-6904. The Ho-Chunk Nation has expressed concern regarding existing overflights in this area (Garvin 1996).

Current conditions would continue to apply to cultural resources within the Volk South MOA, and the Falls 1 and 2 MOAs. The Cranberry Archaeological District, the Silver Mound Archaeological District, and other National Register properties would continue to be subject to the current noise levels and overflights. Neither of these adversely affect the National Register eligibility of the resources.

4.9.7 Unavoidable Adverse Impacts

The ANG is not aware of the existence of any traditional cultural resources within the proposed expansion area. The ANG has not completed a cultural resources survey for the expansion property. Several cultural resources lie underneath existing airspace associated with Volk Field not included in the proposed action. As additional resources are made available to the ANG, appropriate analysis will be determined and accomplished.

4.10 LAND USES AND RESOURCES

4.10.1 Overview

4.10.1.1 Issues and Concerns

The primary issues and concerns regarding land uses and resources include the effects of the proposed range expansion or changes in MOA utilization on land ownership or control of land use and potential impacts to sensitive land use receptors within the ROI from noise generated by the overflight of low-altitude military aircraft. A list of sensitive land use receptors including population centers and recreation land areas is provided in Appendix J.

Effects on land uses and resources would result from the loss of:

- Private land ownership
- Agricultural use of private lands
- Recreational use of public lands
- Public land ownership of county forest lands.

The potential socioeconomic impacts related to the loss of tax base from the change in land ownership, revenues from the sale of timber and forest products, revenues from cranberry production, and employment related to the agricultural and forest industries are discussed in Section 4.12 Socioeconomic Resources.

4.10.1.2 Methodology for Analyzing Impacts

Federal guidelines for determining land uses compatible with noise generated by aircraft have been developed for areas near airports. Table 4-16 presents the Federal Interagency Committee on Urban Noise (FICUN) guidelines. The Committee has established that noise levels less than 65 dB are compatible for most residential land uses, and noise levels equal to or greater than 65 dB are marginally compatible to incompatible. For a discussion of the development of these guidelines, refer to Subsection 4.2.1.2.

To assess the potential impacts of noise generated by the overflight of low-altitude military aircraft on land uses and resources, the predicted noise levels for each airspace were compared to the 65 dB threshold. The Onset Rate-Adjusted Monthly Day-Night Average A-Weighted Sound Level (L_{dnmr}) and SEL values were calculated for the land area associated with the proposed airspace alternatives. This analysis assessed the extent to which noise levels would increase or decrease as a result of the aircraft overflight activity. In addition, potential impacts to land uses and resources were assessed by comparing the predicted noise levels to the projected baseline noise levels (current conditions).

The criteria used to determine the significance of impacts on potentially sensitive land use receptors from the noise associated with the overflight of low-altitude military aircraft are based on five categories of impact ranging from beneficial to significant. Beneficial impacts are considered to occur when predicted noise levels are

Table 4-16. FICUN Guidelines for Effects of Noise on People (Residential Land Uses Only)

DAY-NIGHT AVERAGE SOUND LEVEL (DB)	*HEARING LOSS*	*PERCENT OF POPULATION HIGHLY ANNOYED 1,2*	*AVERAGE COMMUNITY REACTION 3*	*GENERAL COMMUNITY ATTITUDE*
75 and above	*May begin to occur*	*37*	*Very Severe*	*Noise is likely to be the most important of all adverse aspects of the community environment.*
70	*Will not likely occur*	*22*	*Severe*	*Noise is one of the most important adverse aspects of the community environment.*
65	*Will not occur*	*12*	*Significant*	*Noise is one of the most important adverse aspects of the community environment.*
60	*Will not occur*	*7*	*Moderate to Slight*	*Noise may be considered an adverse aspect of the community environment.*
55 and below	*Will not occur*	*3*	*Moderate to Slight*	*Noise considered no more important than various other environmental factors.*

Source: FICUN 1992 (Update); FICON 1980

Notes:
1. *Annoyance is a summary measure of the general adverse reaction of people to living in noisy environments that cause speech interference; sleep disturbance; desire for tranquil environment; and the inability to use the telephone, radio, or television satisfactorily.*
2. *The percentages of people reporting annoyance to less extents are higher in each case. An unknown small percentage of people will report being "highly annoyed" even in the quietest surroundings. One reason is the difficulty all people have in integrating annoyance over a very long time.*
3. *Attitudes or other non-acoustic factors can modify this. Noise at low levels can still be an important issue, particularly when it intrudes on a quiet environment.*

less than baseline noise levels. Negligible impacts are considered to occur when potentially sensitive land use receptors are exposed to noise levels less than or equal to 55 dB. Low adverse impacts would occur when potentially sensitive land use receptors are exposed to noise levels greater than 55 dB up to and including 65 dB. Moderate adverse impacts would occur when potentially sensitive land use receptors are exposed to noise levels greater than 65 dB up to 75 dB. Significant impacts would occur when potentially sensitive land use receptors are exposed to noise levels greater than 75 dB. To assess potential impacts to land use from the overflight of low-altitude military aircraft these criteria were applied to evaluate the proposed airspace actions.

4.10.1.3 General Findings

For the range expansion area, proposed construction activities involve a new target complex area, DZ, and landing zone. Limited tree removal, grading, and construction of fire breaks and service roads would be required in the new target complex area. Much of the land in the new target complex area consists of forest and meadow wetlands. Implementation of the Proposed Action would result in the unavoidable loss of some vegetation and habitat. In addition, access to some ground-based resources, such as forest areas and hunting areas, and recreational trails, now currently available, would be affected, as safety concerns would prohibit access during training periods. Permits will be required from State and Federal agencies concerning soil erosion, dredging, filling, and other construction activities in the wetlands areas.

For the airspace addressed in this EIS, a number of potentially sensitive land use receptors were identified in the ROI (listed in Appendix J). Generally, the predicted noise levels (see Subsection 4.2) are well below the FICON guidelines (presented in Table 4-16) of noise levels less than 65 dB in the ROI. Therefore, based on the criteria described in Section 4.10.1.2, the general potential impacts on sensitive land use receptors from the noise associated with the use of the military airspace would be negligible. Noise levels associated with aircraft operations would be highest in the immediate area of target locations on the range; however, this would be consistent with expectations for military training areas set aside for this use.

For areas under the MOAs, under the Proposed Action, existing land use patterns would not be precluded or substantially disrupted. The analysis of land uses and resources does not reveal any significant impacts to sensitive land use receptors, with noise events existing for a short period of time and then disappearing.

4.10.2 Hardwood Range Expansion and Associated Restricted Airspace

4.10.2.1 Hardwood Range Expansion

The proposed expansion of the Hardwood Range consists of 7,137 acres of Wood County, Wisconsin, north of the existing site. The land is located in Remington Township (T21N R3E), the southeast quarter of Section 24, and all of Sections 25 and 36; and Port Edwards Township (T21N R4E), Sections 19, 20, 21, 28, 29, 30, 31, 32, 33, and the western quarter of Section 34.

Of the total acreage in the proposed expansion area, 6,162 acres are owned by Wood County, and 975 acres are owned privately. Most of the privately-owned land consists of undeveloped forest or wetland with some primary rural residences situated

on several acres and some secondary homes used as hunting camps. A portion of the privately-owned land is being developed for use as a cranberry bog.

Because the proposed range expansion area into Wood County would occupy primarily Wood County Forest Land (WCFL), the impact on private land ownership would only affect a small number of people. Existing cranberry growing operations in the range expansion area do not make up a significant percentage of the state or county production totals. Socioeconomic impacts from this change in land ownership or control, and an assessment of the number of people impacted, are discussed in Subsection 4.12, Socioeconomics.

The acreage owned by Wood County that comprises part of the WCFL is administered jointly by Wood County and the Wisconsin Department of Natural Resources (WDNR) and managed for the purpose of timber production, wildlife habitat, soil and watershed protection, roads, aesthetics, and recreation. Recreational activities include wildlife and bird watching, picnicking, hiking, camping, hunting, trapping, berry picking, cross-county skiing, and snowmobiling (WCFA 1987). Statutory authority for removal of these lands from the County Forest System has been granted to the WDNR under Section 28.11(11)(a)(b), Wisconsin Statues.

Access to land areas acquired for the range expansion would continue for recreational uses based upon appropriate operational and safety parameters. The Proposed Action would have a limited impact upon sensitive land use receptors, such as hunters. Some trees in the target safety footprint would contain metal fragments and be unmarketable, however, forestry activities would in general continue to be compatible with the proposed military use of the land. Recreational land uses would be compatible based on the noise levels, through access would be limited to safe periods when training flights were not scheduled.

Proposed construction activities involve a new target complex area, DZ, and landing zone. Limited tree removal, grading, and construction of fire breaks and service roads would be required in the new target complex area. Much of the land in the new target complex area consists of undeveloped forest and forested and meadow wetlands. Permits will be required from State and Federal agencies concerning soil erosion and wetlands, especially concerning dredging and filling activities. Should any changes be proposed to the banks of Cranberry Creek, a state permit under Chapter 31 of the Wisconsin Statutes would be obtained. In addition, construction activities in excess of five acres require a permit from the Department of Natural Resources in accordance with NR 216 Wisconsin Administrative Code.

All existing structures would be cleared from the DZ and landing zone. These structures may include several existing houses and outbuildings. Demolition and proper disposal of these structures would be required.

Impacts to transportation routes as a result of the proposed range expansion would be negligible. Major roads and railroad systems in the project area would be unaffected by the range expansion. The only county road in year-round use impacted by the range expansion would be Batterman Road, which would have a portion of its western end closed to through traffic. Batterman Road is not a major connecting road and alternate routes serving the same destinations would continue to be available unchanged.

4.10.2.2 Restricted Airspace R-6904

Portions of the Necedah NWR, Juneau County Forest, Wood County Wildlife Area (WCWA), and WCFL are located under R-6904A, as discussed in Section 3.10, Land Uses and Resources. Forestry activities would be compatible with proposed military use of the land. Recreational land uses would be compatible based on the noise levels.

Portions of the Juneau County Forest and WCFL would be located under R-6904B, as discussed in Section 3.2 Land Uses and Resources. Forestry activities would continue to be compatible with proposed military use of the land. Recreational land uses would be compatible based on the noise levels.

As shown in Table 4-1, the L_{dnmr} values within R-6904A would decrease while values within the proposed R-6904B would remain below the 65 dB threshold at 61 dB. Based upon the criteria described in Section 4.10.1.2, operations in R-6904 A/B would have negligible to low impacts on sensitive land use receptors, since noise levels would be less than or equal to 65 dB.

4.10.3 MOA Utilization

A number of potentially sensitive land use areas were identified in the ROI (Appendix J). To minimize potential effects on land use areas sensitive to low-altitude flight, minimum altitude restrictions are placed over such areas. These special operation procedures are described in section 2.4.

For the proposed Falls 1, Falls 2, and Volk South MOA utilization reassessment, noise levels in the respective ROIs would increase; however, these increases would not exceed the L_{dnmr} 65 threshold level. As discussed in section 4.2 and shown in Table 4-1, the Proposed Action would increase the assessed number of annual sorties at Falls 1 from 49 to 52 dB, at Falls 2 MOA from 49 to 50 dB, and at Volk South MOA from 46 to 50 dB. Approximately 10 percent of the sorties would occur at night. Despite these increases brought about by the Proposed Action, noise levels would still remain well below the threshold level of L_{dnmr} 65. Consequently, impacts of the Proposed Action on land use in the ROI would be minimal.

Because the predicted noise levels in the airspace are well below the FICON guideline of 65 dB, and because of the FAA restrictions on low-altitude flying, the general potential impacts on sensitive land use areas from the noise associated with the overflight of low-altitude military aircraft would be negligible. Therefore, no adverse impacts on sensitive land use areas from the noise associated with the overflight of low-altitude military aircraft within the MOAs would result.

4.10.4 No-Action Alternative

Under the No-Action Alternative, no changes to the range or in MOA utilization would be implemented. As a result, existing land use conditions would remain relatively unchanged.

4.10.5 Unavoidable Adverse Impacts

Recreational and forestry uses of the land proposed for inclusion in the range expansion and of the lands underneath the proposed expanded R-6904 airspace would continue to occur within operational and safety parameters; therefore, adverse impacts

on land uses of this area are not expected to occur. Demolition of some buildings and other structures would be required for construction of the DZ and landing zone. Impacts to transportation routes would be negligible since major roads and railroad systems would be unaffected by the Proposed Actions. Because predicted noise levels fall well within Federal guidelines, the proposed reassessment in MOA utilization is expected to be compatible with existing land use patterns; no impacts are expected. ANG would prepare an Integrated Land Use Management Plan on new property regardless how the property is acquired. The ANG has already prepared Land Use Management Guidelines for the Hardwood Range (WIANG 1997), presented in Appendix K.

4.11 VISUAL RESOURCES AND AESTHETICS

4.11.1 Overview

4.11.1.1 Issues and Concerns

For the proposed Hardwood Range expansion and associated airspace changes, issues associated with the Proposed Action include whether the location of the range expansion would be in a visually sensitive area and whether there would be an alteration of the visual setting due to military flight operations.

4.11.1.2 Methodology for Analyzing Impacts

The potential impacts to visual resources and aesthetics from construction, maintenance, and operation of the proposed range expansion were assessed by determining the visual sensitivity of the lands immediately adjacent to the area proposed for the expansion. Land areas which had specific types of recreation or visual appeal were given a visual sensitivity rating of high, medium, or low. If construction and other activities on the range would be incompatible with the existing landscape character, then the impacts would be considered significant.

Military aircraft are transitory fixtures in a landscape. The nature of their impact is dependent upon the sensitivity of the resources affected, the distance from which the aircraft are viewed, and the length of time they are visible. Altitude relative to the viewer also plays a key role in determining impacts. The eyes are typically drawn to the horizon rather than overhead, so individuals are less likely to notice aircraft at higher altitudes. Also, in heavily forested areas, such as those in the vicinity of Restricted Area R-6904 and Volk South MOA, most views of aircraft would be screened by trees and would be extremely brief. In such areas, the lower the altitude, the more likely it would be that views of passing aircraft would be screened. Also, the closer the trees or other intervening objects are to the viewer, the more effectively they screen the aircraft.

The scenic value of different locations or different landscapes is subjective and, within broad cultural limits, varies from person to person. Therefore, candidates for visually sensitive areas to be addressed in this EIS were selected for their land use designation, public expectations of the visual environment, and current exposure to low-level military flights. Visual sensitivity was classified as high, medium, or low:

- High sensitivity exists where views are rare, unique, or in other ways special, such as in remote or pristine areas. Examples of areas that may have high visual sensitivity include national and state forests and parks, wilderness areas, wild and scenic rivers, and designated scenic trails and overlooks. Man-made environments with visual value and integrity (e.g., historic districts) can also be highly sensitive.

- Medium sensitivity exists where the affected views are secondary in importance or are similar to others in the region or locale. The visual character of these areas is likely to have been altered by roadways, vehicles, utility lines, and other structures that contrast with the surroundings. Examples of locations with medium sensitivity include

undesignated but protected or popular areas of recreational or cultural significance.

- Low sensitivity exists where the public can be expected to have little or no concern about changes in the landscape. Little value may be ascribed to the views, or they may be similar to many others in the area. For this EIS, visual sensitivity is considered low for all areas not identified as having medium or high sensitivity.

4.11.1.3 General Findings

Ground activities associated with the proposed Hardwood Range Expansion are expected to have low or no impacts on the visual environment. All structures and facilities constructed at the range would be low to the ground and well-screened by the forest vegetation present in the area. No structures are expected to dominate the viewshed. In the overlying restricted airspace, minimum flight altitude restrictions would minimize the visual impacts of aircraft overflights, especially with regard to the Necedah NWR and Wood County SWA. With these restrictions, and because aircraft overflights are already a feature of the visual environment, no impacts from expansion of R-6904 are expected.

In the Falls 1 and 2 and the Volk South MOAs, aircraft overflights have been a daily feature of the visual environment for many years. For some persons, however, any aircraft overflight would be considered an intrusion upon their solitude and visual experience. Flight activity over visually sensitive areas, such as parks and wildlife areas, could be restricted so as not to alter the visual environment of these areas. Impacts on visual resources as a result of the proposed changes in MOA utilization are expected to be low to none.

4.11.2 Hardwood Range Expansion and Associated Restricted Airspace

4.11.2.1 Range Expansion

The proposed expansion area is currently used for commercial forestry and agriculture. While the area may be considered scenic by some individuals, the scenery is typical of the surrounding area and does not offer unique or unusual vistas. Some tree removal, grading, and construction of fire breaks and service roads would be required in the new target complex. Additional targets, a DZ, and a landing zone would also be developed in the expansion area. These activities would be low to the ground and therefore would not dominate the viewshed. Due to forest and vegetative screening, it is unlikely that a viewer would be able to see the new target complex from public roads; therefore, visual sensitivity would be low and no impact is expected to the visual environment.

4.11.2.2 Restricted Airspace R-6904

Under the Proposed Action, the number of annual aircraft sorties in Restricted Airspace R-6904 would remain the same, but would be dispersed over a larger area. Designated land uses beneath R-6904 that have moderate to high visual sensitivity include Necedah NWR and Wood County SWA. Aircraft overflights are already restricted to no less than 1,000 feet AGL in the portions of the restricted airspace that overlie these two areas (WIANG 1992). The USFWS asserts that low-level

flights are a common occurrence (DOI 1997). Aircraft overflight restrictions would continue under the Proposed Action. Furthermore, because aircraft activity is already part of the daily visual environment in these two areas, impacts to visual resources and aesthetics from the increase in aircraft sorties are not expected.

4.11.3 Falls 1 and 2 MOAs

Specifically designated lands under the Falls 1 and 2 MOAs that have high visual sensitivity include those designated as the Black River State Forest. Areas with medium to high visual sensitivity include the Tollefson Marsh, Lowe Creek, Vosse Coulee, Lakes Coulee, and West Taylor SWAs; county forests; and major water bodies such as the Black River, Lake Arbutus, Lake Mead, and Rock Dam Lake. All of these areas provide exceptional scenery and draw visitors for recreation and wildlife viewing opportunities. Views of aircraft from these areas are most likely to occur from higher elevations. In lower topographic areas, surrounding vegetation and landforms often screen views.

The Proposed Action would reassess annual utilization of the Falls 1 and 2 MOAs. Approximately 10 percent of the sorties flown in each MOA would occur at night. In most areas under the MOAs, the viewing time of the aircraft would be brief, even at higher elevations, because of the high speed of the aircraft. Furthermore, the potential visually sensitive areas under these MOAs are already exposed to many sorties, and aircraft activity is already part of the daily visual environment.

4.11.4 Volk South MOA

Specifically designated land uses beneath the Volk South MOA that have high visual sensitivity include the Necedah NWR, Meadow Valley SWA, Mill Bluff State Park, and Buckhorn State Park. Petenwell Lake, Castle Rock Lake, and parts of the Wisconsin River also have moderate to high visual sensitivity. Views of aircraft from these areas are most likely to occur from higher elevations. In lower areas, some visual screening occurs due to the surrounding forests. In the more open agricultural areas, views become more expansive and aircraft may become visible for longer periods of time.

The Proposed Action would reassess annual utilization of Volk South MOA, approximately 10 percent of these sorties occurring at night. In most parts of the Volk South MOA, viewing time of aircraft would be brief, even at higher elevations, due to the high speed of the aircraft.

4.11.5 No-Action Alternative

Since the Proposed Action would not take place under this alternative, no change to visual resources and aesthetics would occur.

4.11.6 Unavoidable Adverse Impacts

Because low to no impacts are expected on visual resources as a result of the Proposed Actions, no unavoidable adverse impacts would occur.

4.12 SOCIOECONOMICS

Subsection 4.12.1 presents an overview of the potential impacts associated with the expansion of the Hardwood Range in Wood County. A more detailed presentation (Science Applications International Corporation (SAIC) 1996; SAIC 1998) is given in the Socioeconomic Study presented in Appendix I. The Socioeconomic Study was prepared specifically for this EIS and uses the most reasonable and conservative land acquisition scenarios that are likely to be representative of the actual process ultimately adopted. This information developed for the Socioeconomic Study has been provided in accordance with 40 CFR 1502.22(a).

4.12.1 Overview

This overview addresses the main issues and concerns, methodology and analysis of impacts and presents the general findings of the analysis.

4.12.1.1 Issues and Concerns

This subsection presents the consequences of implementing the three options for acquiring Federal land for the expansion of Hardwood Range. The impacts discussed include those associated with population, housing, employment and local economy, and public finance. Subsection 4.12.2 below presents, in more detail, the potential impacts to each resource as a result of implementation of the proposed range expansion.

4.12.1.2 Methodology and Analysis of Impacts

For the range expansion, potential impacts were assessed under three potential scenarios associated with the manner in which the land for the expansion of the Hardwood Range might be acquired. Three land acquisition options are examined. The first option (Option 1) is fee simple purchase of 7,137 acres of land by the Federal government for the range expansion, including 6,162 acres of County Forest Land (CFL) owned and managed by Wood County and 975 acres of private land. Two other options entail the Federal government leasing rather than purchasing this land, either from the existing owners (i.e., Wood County and private owners) (Option 2) or from the State of Wisconsin Department of Military Affairs (Option 3). Impacts associated with the expansion of the Hardwood Range only are addressed and Wood County is the geographical area of interest.

The approach used to characterize socioeconomic effects under each of the three acquisition options for implementing the proposed range expansion includes the following: (1) analysis of resulting changes in management or use of lands currently in forestry, recreation, farming, and transportation (i.e., public roads) uses; (2) identification of relocation requirements; (3) description of changes in employment and the local economy, especially forestry, recreation, and agriculture; and (4) estimation of changes in public revenues and expenditures of local jurisdictions resulting from each acquisition option.

General Findings

Potential socioeconomic effects common to all three options are listed immediately below:

- Acquisition of public lands (Wood County land) and withdrawal of a minimum of 1,570 acres and up to 6,162 acres of public lands from the CFL program.

- Acquisition of 975 acres of private lands.

- Relocation of seven year-round residences (three single family residences, and four mobile homes), and six seasonal residences.

- Loss of agricultural use and timber revenues on private lands, including relocation of a cranberry farm.

- Reduction in the value of CFL timber sales (i.e., stumpage value) in the expansion area.

- Potential reduction in wages and earnings from paper and timber products manufacturing and related transportation.

- Withdrawal of 280 acres of private lands entered in forest tax contracts and payments to offset past tax reductions.

- Reduction of public recreation access and use of the expansion area for hunting, trapping, hiking, wildlife viewing, and other forms of recreation; and closure or relocation of six miles of state snowmobile trails.

- Closure of approximately 12 miles of public roads through the expansion area.

- Following implementation of any of the range expansion options, a separate local action which may be taken would involve Wood County replacing the withdrawn acres of publicly managed county forest as a result of the range expansion, with private, State or Federal lands located elsewhere in the county. This action could remove private lands from the tax base, decrease revenues to local jurisdictions, and, depending on existing uses, could change the amount of land available for recreation, forest management, and related uses.

- Operation of a military training range would require restrictions on land uses and activities regardless of whether this action is associated with Federal purchase or Federal leasing of lands. However, since Federal or State purchase from the existing owners would remove lands from the tax rolls, whereas leasing would not, the three acquisition options differ primarily in terms of their potential effects on the fiscal condition of jurisdictions in the ROI. Table 4-17 summarizes the potential fiscal effects of the three acquisition options for local jurisdictions.

Table 4-17. Comparison of Potential Fiscal Effects on Local Jurisdictions in the ROI, Three Land Acquisition Options for the Expansion of Hardwood Range

	Option 1: Federal Purchase of Expansion Area		*Option 2: Federal Lease from Existing Owners*		*Option 3: Federal Lease from State*	
	Annual Revenue Loss	*Benefit*	*Annual Revenue Loss (b)*	*Benefit*	*Annual Revenue Loss*	*Benefit*
Wood County (a)	*$23,850*	*Funds from Federal purchase of CFL* *Reduced service expenditures* *$2,006 tax payments from one-time penalty on land withdrawn from Forest Crop Law contracts*	*$19,437*	*Annual lease payments* *Reduced expenditures for services* *Funds from one-time tax payments for withdrawn Forest Cropland Tax $2,006*	*Same as Option 1*	*Same as Option 1*
Town of Port Edwards	*$13,512*	*Reduced service expenditures* *One-time penalty of $3,704 on land withdrawn from Managed Forest Law contracts* *One-time penalty of $8,694 on land withdrawn from Forest Crop Law contracts*	*$13,248*	*Same as Option 1*	*Same as Option 1*	*Same as Option 1*
Town of Remington	*$5,398*	*Reduced service expenditures*	*$4,871*	*Same as Option 1*	*Same as Option 1*	*Same as Option 1*
Pittsville School District	*$5,185*	*$5,025 gain in state equalization aid*	*0*	*0*	*Same as Option 1*	*Same as Option 1*
Nekoosa School District	*0*	*Negligible change in state equalization aid*	*0*	*0*	*Same as Option 1*	*Same as Option 1*
Mid-State Technical College District	*$1,205*	*None*	*0*	*0*	*Same as Option 1*	*Same as Option 1*
TOTAL (c)	*$49,150*	*As itemized above*	*$37,556*	*As shown above*	*$49,150*	*As itemized above*

Notes: *(a)* *Fiscal effects on Wood County do not include potential indirect effect of County purchasing lands to replace County Forest Land withdrawn due to the range expansion, any related revenue losses from removing private lands from the tax rolls, or related gains in timber sale revenues or intergovernmental aid resulting from new acquisition of County Forest Land.*

(b) *Potential annual revenue losses do not account for possible reductions in assessed valuations that may result from military use of private lands leased to the federal government.*

(c) *Reduced sales of timber, cranberries, and other crops would create estimated reductions in wages and earnings from agriculture and related activities. These potential losses to the local economy would be in addition to the public revenue losses identified above and would be the same for the three acquisition options.*

4.12.2 Hardwood Range Expansion

4.12.2.1 Demographics

Option 1 — Federal Land Acquisition Through Fee Purchase

The range expansion would result in a potential increase of three range personnel needed to maintain the range and control public access. No noticeable change in population is anticipated due to personnel changes. Relocation of seven year-round residences and six seasonal residences would be required.

Option 2 — Federal Government Leases Land from Existing Owners

Effects on population would be the same as Option 1.

Option 3 — Federal Government Leases Land from the State of Wisconsin

Effects on population would be the same as Option 1.

4.12.2.2 Housing

Option 1 — Federal Land Acquisition Through Fee Purchase

Relocation of seven year-round residences and six seasonal residences would be required. Relocation assistance funds would be provided in accordance with Federal property acquisition and relocation procedures.

Option 2 — Federal Government Leases Land from Existing Owners

Effects on housing would be virtually the same as Option 1, except that relocation requirements and assistance would not apply since the Federal government would not be purchasing property. Occupied properties would need to be vacated by existing owners because of military use of these lands, but this would be addressed in the lease agreement with each owner.

Option 3 — Federal Government Leases Land from the State of Wisconsin

Effects on housing would be virtually the same as Option 1, except that state rather than Federal relocation requirements and assistance may apply since the land would be acquired by the State, and the Federal government would not be purchasing property. Occupied properties would need to be vacated because of military use of these lands.

4.12.2.3 Employment and Local Economy

Option 1 — Federal Land Acquisition Through Fee Purchase

Effects on economic activity include potential reductions in timber revenues, and income from agriculture, recreation, and tourism. Federal payments to local jurisdictions related to timber sales on non-taxable Federal land in the expansion area are discussed in Subsection 4.12.2.4 Public Finance. On a proportional acreage basis, annual gross timber sales receipts from Wood CFL generated by the expansion area averaged approximately $16,768 over the period 1992 - 1996 or 16.4 percent of total Wood CFL receipts. It is assumed that private logging firms that cut the timber received at least this amount of income from selling the timber. Timber revenues from private lands are not known. Owners of approximately 300 acres of private lands within the expansion area are enrolled in forest tax contracts and follow forest management plans and practices, which include timber harvesting. In 1997, approximately 415 acres of privately owned land were in productive forest not covered by tax contracts.

Agricultural activity in the expansion area is primarily associated with a corn, hay, and cranberry farming. There are approximately 109 acres of hay, 20 acres of corn, and 25-35 acres of planted cranberries. A cranberry farm on approximately 25 planted acres would potentially generate approximately $276,000 annually based on 1997 prices.

The potential change in timber sale revenues in the expansion area was calculated and used to determine the related change in manufacturing value and related wages. According to Juneau County, use of the existing range for military training has reduced but not eliminated timber sale revenues within the existing range. While timber sale revenues within the target area portion of the existing range have been eliminated, those within approximately one-half mile of the target area (i.e., the buffer) have been reduced by approximately 75 percent due to metal fragments from ordnance in the wood, and on the remainder of the range (i.e., the outer fringe area that constitutes the majority of the range), negligible or no reduction has occurred in the value of cut timber. These timber reduction factors were used to estimate the potential reduction in timber sale revenues in the expansion area.

Applying the above factors to the estimated $16,768 annual average Wood CFL revenue for the range, an estimated annual change in timber sale revenue due to the expansion proposal was developed. Although CFL timber sale revenues currently going to Wood County and the two affected towns would potentially be lost, Federal timber management and sales would occur, and have been calculated based on the reduced value. (Forty percent of any Federal timber profits, after expenses, would be returned to the county, in lieu of taxes, but this gain would be minimal and has not been estimated.) It is assumed that the target complex, DZ, and landing zone would generate no revenue. The half-mile strip around the target complex together with the remaining fringe area would potentially generate approximately $13,709 in total annual timber sale revenues. This constitutes a potential annual reduction in timber sales revenue of $3,059 or 18.2 percent. Assuming a similar reduction of 18.2 percent in manufacturing value, this would reduce earnings by $61,035 and associated manufacturing wages by $109,134, for a total reduction in manufacturing-related value of $170,169 per year.

Revenues from tourism and recreation activities could potentially be lost if recreation on the expansion area is limited or prohibited, and if alternate locations and revenues cannot be found. Removal of 6,162 acres of Wood CFL would leave 31,374 acres in the county program. The remaining acreage is contained in four other areas located 30 to 60 minutes from the expansion area. Meadow Valley Wildlife Area in Juneau County and WCWA, both operated by the WDNR, are located within the vicinity of the expansion area and allow hunting. However, both areas already receive substantial use for hunting and non-consumptive uses, and capacities would be strained by additional use. The recently opened Ho-Chunk Casino, operated by the

Winnebago tribe, is located less than 3 miles from the expansion area, and would continue to be an attraction for visitors to the local area who participate in other recreation activities. The range expansion would not directly affect the casino operation.

Hunters and recreationists who utilize the CFL sometimes stay in Wisconsin Rapids, the largest nearby city, which is located less than an hour from the range. If fewer tourists visit the local area, and revenues generated by recreationists who utilize the range are reduced, this would affect Wisconsin Rapids and nearby camping facilities and retail establishments. Wisconsin Rapids contains approximately a dozen motels. Revenues from lodging, restaurants, and retail establishments would be reduced if fewer tourists visit the area. Other tourists camp at Country Air Campground, a private campground located in Babcock, or at Dexter Park, which is operated by Wood County. Still others participate in roadside or car camping. A number of private hunting cabins in the vicinity of the expansion area are used during the hunting season, especially deer season.

Option 2 — Federal Government Leases Land from Existing Owners

Economic effects on forestry, agriculture, and recreation would be similar to Option 1 since the types of uses allowed through lease agreements would be similar to those allowed if the Federal government owned the land in the expansion area. Since Wood County currently manages a county-wide forestry program, it is possible that forestry activity and income might be higher if existing owners (i.e., Wood County and private owners) retain the timber rights rather than the Federal government owning these rights. However, while still owned by Wood County, it is assumed that the 6,162 acres now in the county forest program would be withdrawn from this program because of conflicts with public use requirements of the County Forest, which could potentially change the county's management of this property.

Option 3 — Federal Government Leases Land from the State of Wisconsin

Economic effects on forestry, agriculture, and recreation would be identical to those under Option 2.

4.12.2.4 Public Finance

Option 1 — Federal Land Acquisition Through Fee Purchase

Federal acquisition of the expansion area for Option 1 would affect governmental revenues and expenditures in Wood County, the towns of Port Edwards and Remington, and the Pittsville and Nekoosa school districts by removing private land from the tax rolls, changing amounts of certain forms of intergovernmental aid, and eliminating public revenues derived from County Forest Land. State shared revenues would be minimally affected. Potential revenue losses to local jurisdictions are summarized in Table 4-18. The estimated total annual revenue loss for local jurisdictions from implementation of Option 1 would be approximately $49,150.

Offsetting these losses would be: (1) funds received by Wood County from the purchase, by the Federal government, of up to 6,162 acres of County Forest Land and for a portion of back taxes on lands withdrawn from the Forest Crop Law program; (2) annual Federal payments to local jurisdictions from proceeds of Federal timber sales equaling 40 percent of the proceeds after installation or facility expenses are reimbursed

in lieu of taxes; (3) funds received by private land owners for the purchase of 975 acres of property and for any required relocation costs; (4) funds received by the towns for back taxes on lands withdrawn from the forest tax programs; and (5) reductions in expenditures for public services in the ROI. The potential revenue losses for each jurisdiction in the ROI are discussed in detail.

Table 4-18. Potential Annual Revenue Loss for Jurisdictions within the ROI

JURISDICTION	*REVENUE LOSS*
Wood County	*$23,850*
Town of Port Edwards	*$13,512*
Town of Remington	*$5,398*
Pittsville School District	*$5,185*
Nekoosa School District	*$0* [a]
Mid-State Technical College District	*$1,205*
TOTAL	*$49,150*

Note: a. Lands in the expansion area that are located in the Nekoosa School District are either private lands enrolled in Forest Crop Law contracts or public lands managed under the WCFL program, and therefore do not generate school district property taxes.

Wood County

Revenues received by Wood County for lands within the expansion area can be divided into own source revenues and intergovernmental revenues (see Table 4-19). Own source revenues include property taxes and timber sale revenues. Estimates of property tax revenues accruing to Wood County and each of the other jurisdictions in the ROI are based upon amounts reported on individual property tax bills for 1996 for each of the private parcels located in the expansion area. Intergovernmental revenues include the following state sources: road aid, wildlife habitat aid, county conservation aid, and snowmobile trail aid.

Table 4-19. Estimate of Public Revenues from Land in the Expansion Area, Wood County

REVENUE SOURCE	*REVENUE AMOUNT ($)*
Own source aid:	
Property Taxes	*$4,413*
Timber Sale Revenues	*$16,768*
Intergovernmental aid:	
County Forest Road Aid	*$514*
Wildlife Habitat Aid	*$616*
County Conservation Aid	*$339*
Snowmobile Trail Aid	*$1,200*
TOTAL REVENUES	*$23,850*

Assessed valuation in Wood County would be reduced by approximately $602,700 if Option 1 is implemented and private lands in the expansion area are removed from the tax rolls. The county property tax rate in Wood County was $6.96 per $1,000 of assessed value in 1996. Property taxes assessed on property within the expansion area, therefore, represent approximately $4,413 in annual county revenues. Lands in the expansion area that are enrolled in the forest tax programs currently generate minimal county property taxes.

Timber sale revenues from the expansion area were estimated based on a prorated (acreage) share of the average annual timber sales revenue generated by Wood CFL during the period 1992 - 1996. The estimated amount is $16,768 annually.

The State pays county forest road aid payments to counties at a rate of $336 per mile. These roads are primarily used for forest management and hunting and must meet road bed and surface width specifications to qualify for aid. The amount received by Wood County for the expansion area is $514 annually for 1.53 miles of County forest roads located in Section 33 from County Line Road to Batterman Road.

Wood County receives $0.10 per acre of Wildlife Habitat Aid from the State for County Forest Land in order to develop habitat for game and nongame species. This represents $616 per year for land within the expansion area. Wood County also receives approximately $0.55 per acre of County Conservation Aid from the state for County Forest Land in order to carry out fish or game management projects. This represents $339 per year for land within the expansion area.

Wood County receives $200 per mile for maintenance of approximately 6 miles of State snowmobile trails for Trail Corridor 23 that pass through the expansion area, for a total of $1,200 per year. The county contracts with a local snowmobile club to maintain the trail. If the trail were relocated, reconstruction costs would be incurred. Estimated costs for trail reconstruction are approximately $500 per mile, at a minimum, with higher costs depending upon terrain, rockiness, bridge crossings, and vegetation removal.

The acquisition of land by the Federal government would produce a one-time county gain if the land were purchased, possible ongoing revenues if these lump-sum funds were invested, and annual payments from federal timber sales — payments in lieu of taxes for the lands included in the range would not be applicable since these apply to federal entitlement lands and do not include active military installations. Also, reductions in county revenues due to implementation of Option 1 may be partially offset by decreases in county expenditures in the expansion area. This would result from potential reductions in services such as road maintenance, fire protection, and public safety, which would be provided by ANG or through mutual support agreements. In addition, lands withdrawn from the County Forest Land program would no longer require management under this program and related county conservation activities would not be undertaken. According to Wood County, the amount of time and money committed to the Wood County Forest as a whole is expected to remain approximately the same on an annual basis regardless of this potential change in the CFL acreage.

Since the expansion area is sparsely populated and is primarily comprised of County Forest Land, those county expenditures directly benefiting this area, with the exception of forest management and related conservation activities, are probably relatively low compared to more densely populated portions of the county. In addition, 80 acres of lands in the expansion area would be removed from the Forest Crop Law program and would generate an estimated $2,006 in back taxes for Wood County.

Town of Port Edwards

The local property tax rate in Port Edwards was $0.65 per $1,000 of assessed value in 1994. Property within the expansion area generates approximately $264 in local property taxes (see Table 4-20). The town's assessed valuation would be reduced by approximately $407,000 if private lands in the expansion area were removed from the tax rolls.

Table 4-20. Estimate of Public Revenues from Land in the Expansion Area Town of Port Edwards

REVENUE SOURCE	*REVENUE AMOUNT ($)*
Own source aid:	
Property taxes	*$264*
Timber Sale Revenues	*$1,384*
Intergovernmental aid:	
Road aid	*$10,339*
Payment in lieu of taxes	*$1,525*
TOTAL REVENUES	*$13,512*

Of the gross receipts generated from all timber sales on the county forests, 10 percent is paid annually by the county to the towns having county forest lands on the basis of the acreage of such lands in the towns. County forest land located in the expansion area in the Town of Port Edwards comprises 5,082 acres or 13.54 percent of the county forest in Wood County. Based upon an average of the last five years, the town receives approximately $1,384 in timber sale revenues per year attributable to the expansion area. This estimate is based on total average annual timber sale revenues of $102,244 per year from 1992 through 1996 for Wood County. Ten percent of this amount is then shared by qualifying towns based upon their respective share of all WCFL.

Towns in Wisconsin received approximately $1,432 per mile of transportation aid from the state for public roads in 1997. To qualify for aid, these roads must: (1) be public roads through due process of law; (2) show some evidence of travel by two-wheel drive automobiles (i.e., would not qualify for aid if only used for four-wheel drive vehicles); and (3) be open, not closed by a gate or other obstruction, but may be closed due to construction, weather conditions, etc., during short seasons of the year. Port Edwards receives approximately $10,339 in road aid on an annual basis for approximately 7.22 miles of roads that may be closed due to implementation of Option 1. Roads affected include portions of Batterman Road, County Line Road, Beaver Lane, and Range Line Road.

The state makes an annual payment of $0.30 per acre to every town containing county forest lands. This payment in lieu of taxes (PILT) helps offset the loss of property tax revenues. Port Edwards receives approximately $1,525 of PILT on an annual basis for 5,082 acres of county forest.

If lands in the expansion area were purchased by the Federal government, approximately 290 acres of private lands within Port Edwards would be withdrawn from existing forest tax contracts. Landowners participating in the Managed Forest Tax Law

program would pay an estimated $3,704 to the town in back taxes based on the current repayment formula. Initial estimates of withdrawal costs for landowners participating in the Forest Crop Law program are $13,376 of which approximately $8,694 or 65 percent would go to the town and $2,006 or 15 percent to the county. The latter estimate is based on withdrawals in another town in Wood County, since there were no examples in Port Edwards. The estimate could have been approximately three times higher if the highest examples in Wood County were used. In the event that these lands are withdrawn from the tax programs, these repayment costs, which have been estimated by the DNR Forest Tax Section, would be individually calculated. Repayments under the Forest Crop Law program would be shared by the state, Wood County, and town, with the majority of funds, approximately 65 to 75 percent, going to the town.

Town of Remington

The local property tax rate in Remington was $2.69 per $1,000 of assessed value in 1996. Property within the expansion area generates approximately $527 in local property taxes (see Table 4-21). The town's assessed valuation would be reduced by approximately $195,700 if private lands in the expansion area were removed from the tax rolls.

Table 4-21. Estimate of Public Revenues from Land in the Expansion Area, Town of Remington

REVENUE SOURCE	*REVENUE AMOUNT ($)*
Own source aid:	
Property taxes	*$527*
Timber Sale Revenues	*$294*
Intergovernmental aid:	
Road aid	*$4,253*
Payment in lieu of taxes	*$324*
TOTAL REVENUES	*$5,398*

County Forest Land located in the expansion area in Remington comprises 1,080 acres or 2.88 percent of the county forest in Wood County. Based on 1992 to 1996 annual revenues, the town receives an average of $294 in timber sale revenues per year attributable to the expansion area.

The Town of Remington receives approximately $4,253 in road aid on an annual basis for approximately 2.97 miles of roads that may be closed due to implementation of Option 1. Roads affected include portions of Batterman Road, McKeel Road, Range Line Road, and County Line Road.

The state makes an annual payment of $0.30 per acre to every town containing county forest lands. This PILT helps offset the loss of property tax revenues. Remington receives approximately $324 of PILT on an annual basis for 1,080 acres of county forest.

Pittsville School District

Lands in the proposed expansion area fall within either the Pittsville or Nekoosa school districts. The 6,162 acres of County Forest Land in the expansion area generate no property taxes for the school districts. In addition, portions of the remaining 975 acres of private land in the expansion area are contracted under various forest tax programs and pay no taxes to the school districts. Private property in the Pittsville School District not contracted under these programs had a total assessed value of $602,700 in 1996 and generated $5,185 in property tax receipts based on a tax rate of $8.60 per $1,000 of assessed value.

With the transfer of private property to Federal ownership, all property tax revenues would be lost. Based on the State equalization aid formula, if the school district lost approximately $618,200 in assessed valuation, (i.e., $602,700 on which school taxes are assessed, plus an additional $15,500 in Forest Crop land assessment for which school taxes are not paid), the amount of State equalization aid would increase by approximately $5,025 offsetting most of the revenue loss.

Nekoosa School District

Lands in the expansion area that are located in the Nekoosa School District are either private lands enrolled in Forest Crop contracts or public lands managed under the WCFL program, and therefore do not generate school district property taxes. There is one parcel of land contracted in the Forest Crop program. It is 40 acres in size and its assessed value was $17,500 in 1996.

Mid-State Technical College District

Private lands in the expansion area also generate a small amount of property taxes for the Mid-State Technical College District, which would be lost, totaling approximately $1,205.

Option 2 — Federal Government Leases Land from Existing Owners

As compared to Federal ownership, leasing would reduce the potential annual loss of public revenues by jurisdictions in the ROI, since private lands would remain on the tax rolls and property taxes would still be collected. However, this private property may be reassessed because of the change in use, and could potentially be given a lower assessment because of direct military use. This potential lower valuation would result in a reduction in property taxes collected.

Loss of intergovernmental aid such as road aid, wildlife habitat aid, county conservation aid, snowmobile trail aid, and payments in lieu of taxes would still occur. County forest sales revenues and private timber sales revenues would be retained if present owners retained the timber rights, but would be lost if the Federal government obtained these rights, except for the 40 percent previously discussed in Subsection 4.12.2.3. It is assumed that restrictions would still be placed upon timber cutting schedules and locations, even if the present owners retain the timber rights. It is anticipated that the potential loss of revenues accruing to local government agencies (property taxes, timber sale revenues, intergovernmental transfers) would be addressed in the terms of the lease negotiated between the concerned parties.

Option 3 — Federal Government Leases Land from the State of Wisconsin

Option 3 is comparable to Option 1 with regard to loss of property taxes and intergovernmental aid, since private lands would be removed from the tax rolls due to state ownership directly as a result of the Federal action.

Under this option, loss of intergovernmental aid such as wildlife habitat aid on county forests, payments in lieu of taxes on county forests, and county conservation aid, would be similar to Federal ownership or leasing from existing owners, since these losses would occur due to state ownership. Other intergovernmental aid, such as county and town road aid and snowmobile trail aid, would be lost directly as a result of Federal leasing from the State, since closure of roads and trails would occur. County timber sale revenues would be retained if the county retained the timber rights, but would be lost by the county if the Federal government obtained these rights. It is assumed that restrictions would still be placed upon timber cutting schedules and locations, even if the county retains the timber rights.

The acquisition of land by the State would produce a one-time county gain if the land were purchased (and possible additional annual revenues if funds were invested) or a one-time gain of real property assets if the land were acquired through a trade.

4.12.2.5 No-Action Alternative

Under the No-Action Alternative, Hardwood Range would not be expanded, existing range operations would continue, and socioeconomic conditions would be similar to current conditions.

4.12.3 MOA Utilization

This portion of the socioeconomic impact analysis examines the potential effects of the proposed changes in airspace utilization on the social and economic resources in each of the three MOA ROIs. Potential socioeconomic impacts associated with aircraft overflights would primarily be related to effects of noise and disturbance on tourism activity and on agricultural activity. In general, the proposed airspace utilization alternatives are expected to have negligible effects on the socioeconomic resources of the region.

4.12.3.1 Falls 1 MOA

The proposed modification in Falls 1 MOA utilization would not involve any increases in range personnel, therefore it is expected to have negligible direct effects on population, employment, or income in the ROI. Generally, the predicted noise levels for aircraft operations are well below the FICON guidelines of noise levels less than 65 dB in the ROI. In addition, the biological resource assessments indicates that there would be no adverse impacts on wildlife, vegetation, or livestock. Therefore, potential noise impacts and impacts to biological resources are expected to have negligible effects on the tourism and agricultural industries in the ROI. Each of these two industries accounts for less than five percent of all earnings in the ROI, therefore any minor effects anticipated under the proposed airspace modification would not result in any significant adverse impacts to the economy of the ROI.

4.12.3.2 Falls 2 MOA

The proposed modification in Falls 2 MOA utilization would not involve any increases in range personnel, therefore it is expected to have negligible direct effects on population, employment, or income in the ROI. Generally, the predicted noise levels for aircraft operations are well below the FICON guidelines of noise levels less than 65 dB in the ROI. In addition, the biological resource assessments indicates that there would be no adverse impacts on wildlife, vegetation, or livestock. Therefore, potential noise impacts and impacts to biological resources are expected to have negligible effects on the tourism and agricultural industries in the ROI. Each of these two industries accounts for less than five percent of all earnings in the ROI, therefore any minor effects anticipated under the proposed airspace modification would not result in any significant adverse impacts to the economy of the ROI.

4.12.3.3 Volk South MOA

The proposed modification in Volk South MOA utilization would not involve any increases in range personnel, therefore it is expected to have negligible direct effects on population, employment, or income in the ROI. Generally, the predicted noise levels for aircraft operations are well below the FICON guidelines of noise levels less than 65 dB in the ROI. In addition, the biological resource assessments indicates that there would be no adverse impacts on wildlife, vegetation, or livestock. Therefore, potential noise impacts and impacts to biological resources are expected to have negligible effects on the tourism and agricultural industries in the ROI. Each of these two industries accounts for less than six percent of all earnings in the ROI, therefore any minor effects anticipated under the proposed airspace modification would not result in any significant adverse impacts to the economy of the ROI.

4.13 HUMAN HEALTH EFFECTS OF AIRCRAFT NOISE

4.13.1 Aircraft Noise and Hearing Loss

4.13.1.1 Overview

Although the evidence is inconclusive, studies suggest concern for hearing effects of long-term exposure to high noise levels generated by aircraft. For example, the Committee of the Health Council of the Netherlands (CHCN 1996) suggests that the conservative observation threshold for a relationship between noise and hearing loss corresponds to a value of $L_{Aeq,\ 24h}$ of 70 dB(A). At 75 dB(A) and above, concerns may arise about hearing effects, especially to groups sensitive to noise from aircraft and other community noise sources. Only one study in Germany (Ising and Rebentisch 1993b) showed military low-altitude flight noise with peak sound levels about 125 dB(A) and rapid rise times could induce small hearing threshold shifts in children determined to be very sensitive to noise. These researchers concluded that risk to hearing as a result of low-altitude flight noise can generally be ruled out. Based on the minimum altitude level of 500 feet and the few flights having maximum sound levels approaching 118 dB(A), it is unlikely that noise from the training and low-altitude flight areas considered in the airspace associated with the Hardwood Range expansion would increase risk to hearing loss, even in small children.

4.13.1.2 Research on Aircraft Noise and Hearing Loss

Several laboratory studies of aircraft noise on hearing have used large temporary threshold shifts (TTS) in hearing to indicate danger of permanent hearing loss from high levels of aircraft noise. As early as 1976, a laboratory study conducted near the Los Angeles International Airport, exposed two small groups of young men to recorded aircraft overflight noise consisting of 40 events per hour with a maximum sound level of 111 dB(A) over a 6-hour period. Recorded overflights were repeated every 3 minutes for one group and every 9 seconds for a second group. The measured temporary threshold shifts were negligible and interpreted to indicate no likelihood of permanent hearing loss (Ward et al. 1976). Kabuto and Suzuki (1979) obtained the same results when they replicated the study in Japan.

Early laboratory studies were followed with field studies that were interpreted by the authors as suggesting a small effect on hearing by aircraft noise. However, even the researchers recognized that these studies had so many limitations that they could not generate evidence to claim an association between aircraft noise and hearing. No increase in percentage of students with high frequency hearing loss was found for students living near Boston's Logan Airport compared to those living further away (Andrus et al. 1975). The number of students was small, the differences in noise exposure of the two areas was not given, and other factors (e.g., age, sex, length of residence, etc.) which could affect the results were not considered.

Although a study near the Los Angeles International Airport showed residents in a noisy area had poorer hearing than residents of a demographically similar quiet community, the authors concluded their study was only suggestive since the difference in hearing acuity of the two groups was not significant and there was no correlation between hearing and length of residency near the airport (Parnell et al. 1972). Only age and sex were adjusted in the analysis.

A study of 100 children living near Heathrow airport versus 100 children living in a quiet area also gave inconclusive results as to the possible effect of aircraft noise on hearing (Fisch 1977). Again, there was no control of variables that could affect hearing and the audiograms for the exposed and nonexposed children were not done under comparable conditions.

A case-control study of students who failed hearing tests and lived in areas near John F. Kennedy and LaGuardia Airports also failed to show a statistically significant difference and had serious flaws in design (Green et al. 1982). Noise exposure forecast contours provided estimates of L_{eq} ranging from 55.4 to 66.9 dB(A); only 51 percent of the sample provided information on questionnaires to allow adjustment of other factors likely to affect hearing; and cases, but not controls, for whom questionnaires were returned were more likely to have been exposed to aircraft noise than cases for whom the questionnaires were not returned. This type of bias normally tends to increase the effect of noise in analysis.

A recent airport study also found that aircraft noise exposure did not affect hearing thresholds (Wu et al. 1995). Personal equivalent 24-hour noise exposure was determined for 242 sixth grade children and was compared to aircraft noise measured in an outdoor setting. Individual hearing threshold levels did not differ between the groups when compared in either high or low ambient noise condition. It is interesting to note that the groups did not differ on noise exposure as measured at the individual level for 24 hours.

Recently, Spreng (1993) has used animal studies to demonstrate that direct aircraft overflights averaging about 17 per day (50 direct overflights on certain days) with maximum sound levels over 100 dB(A) pose a risk of hearing damage. He suggests that a threshold shift of greater than 5 dB be considered indicative of potential damage. He further recommends that no low-altitude flight should exceed a maximum sound level peak of 115 dB(A).

Since Spreng's original work, there have been a series of studies of the effect of low-altitude aircraft overflight noise on hearing in Germany where the minimal flight altitude was 75 meters prior to September 1990. The results from these studies continue to be controversial and raise concerns as to the risk of hearing damage, especially to children. An early laboratory study reportedly showed that TTS occurred significantly more often when the sound level increased quickly than when it increased slowly (Ising and Rebentisch 1993b).

The field studies of both auditory and non-auditory effects were conducted in two 75 meter areas (Munsterland with maximum flight L_{eq} values of 115-116 dB[A] and average [over the period of approximately one month] L_{eq} values of 59-63 dB[A], and Franken with maximum L_{eq} values up to 125 dB[A] and average L_{eq} values of 64-68 dB[A]) and surrounding 150 meter regions. Overflight sound level increases up to 75 dB/second with a few 200 dB/second were measured by Spreng et al. (1988) and Spreng (1990) and reported in all of the English studies (Ising et al. 1990a). Also according to the Spreng et al. (1988) study which is published fully only in German, the average number of direct overflights in rural areas where the low-altitude flights occurred, was 17 per day with a mean peak sound level of 107.7 dB(A) +/- 5 dB.

The first study of primary school children in these noise environments was on a small sample of children who were considered to have a hearing problem if their audiograms showed a 20 dB hearing loss at any test frequency (kHz). There was no difference in incidence of abnormal hearing loss among children in the 75 m and 150 m area (Ising and Rebentisch 1993b). Only in the area where maximum overflight sound levels reached 125 dB(A) was the proportion of hearing loss significantly greater at 3

and 4 kHz than in the other areas. No information is given as to exposure to other loud noises such as firecrackers, which could also result in hearing loss in children.

Another study comparing extreme groups, those in the 75 meter area to those in the 150 meter area, showed the mean thresholds of 10 to 13 year olds to be significantly higher from 6 kHz upwards in the 75 meter area. The samples in this comparison were small and not taken to be representative.

The final representative field study in Lower Saxony began with a questionnaire on noise-induced symptoms of ear problems. Response rate was only 55 percent; tinnitus was slightly higher in the 75 meter as compared to the control areas but only 10 percent of the respondents named flight noise as the cause of the ear symptoms. Hearing thresholds from 3 kHz to 15 kHz were compared with the mean threshold values at 1 and 2 kHz. The highest thresholds were not found in the 75 meter zone, as the hypothesis would suggest, but in the 150 meter area. Thresholds were only higher in the case of earache induced by low-altitude flight noise. Ising and Rebentisch (1993b) concluded that military low-altitude flight noise with peak sound levels around 125 dB(A) and rapid rise times (i.e., rapid increase in intensity) can induce small threshold shifts in sensitive individuals. However, with adherence to the minimum flying altitudes for the MOAs associated with the proposal, the peak levels and rates of increase experienced by individuals on the ground are reduced to such an extent that "risk to hearing as a result of low-altitude flight noise can be generally ruled out." Thus, based on conclusions from the human research, risk to hearing can generally be ruled out under the minimum flying altitudes associated with the MOAs that are part of the Hardwood Range expansion proposal.

The conclusion of no risk to hearing as a result of low-altitude flight noise is also supported by a recent laboratory study which measured changes in human hearing from noise exposures from low-flying aircraft representative of MTRs (Nixon et al. 1993). In Phase 1, subjects were exposed in one ear to four overflight noise exposures at levels of 115 dB(A) to 130 dB(A). Measures of the pre- and post-study audiograms showed about one-half of the subjects with no change in hearing levels, one fourth with a 5 dB increase in sensitivity and one fourth with a 5 dB decrease in sensitivity. There were no changes at any test frequency for the exposed and protected ears. In Phase 2, a single overflight noise at a maximum level of 130 dB(A) was repeated for 8 successive repetitions each separated by 90 seconds, or until a temporary threshold shift was observed. Although the hearing thresholds shifted in the positive direction, all threshold levels remained within the criterion TTS value of 10 dB. Increases in TTS produced by aircraft overflight noise measured at 1 to 1 1/2 hour post exposure over the post exposure values reported by other investigators were not present.

4.13.2 Aircraft Noise and Cardiovascular Effects

4.13.2.1 <u>Overview</u>

Although studies have shown inconsistent results, and therefore cannot be considered definitive, the research to date indicates that aircraft noise (even low flying military jet noise) is unlikely to increase risk to elevated blood pressure or ischemic heart disease at L_{eq} values less than 65 to 70 dB(A) (CHCN 1996). For one study of traffic noise for adults, even at L_{eq} values above 70 dB(A), the risk is very minimal (Babisch et al. 1993). There is some concern that at ambient noise levels of 75 dB(A) and above, cardiovascular health risks may increase.

The effects of aircraft noise on children continue to be controversial, although only one of several studies has shown any increased risk after other factors have been taken into account. The study by Ising, Rebentisch, Poustka and Curio (Ising et al. 1990b) in Germany showed higher blood pressures among girls, but not boys, in the high noise area. However, this finding could not be replicated; and the noise levels were exceedingly high (in a 75 meter altitude flying area with maximum sound levels of 115 to 116 dB(A), L_{eq}s from 59 to 63 dB(A), and an average of 17 low-altitude flights per day). The German researchers (Ising et al. 1990a) have suggested that low-altitude flights of concern to health are those having a maximum sound level of 115 dB(A) or greater with rise time greater than 60 dB/second.

The noise levels in the MOAs associated with the Hardwood Range proposal are considerably lower than any of the noise levels associated with studies showing increase in cardiovascular health risks. No noise events associated with any airspace, under any alternative studied for the proposal, will exceed 114 dB(A) and, in the busiest areas where MTR and MOA activity combine, less than 3 events per day will have maximum sound levels above 65 dB(A). Therefore, cardiovascular risks to individuals living in the vicinity of the MOAs are unlikely to increase as a result of these overflights.

4.13.2.2 Research on Cardiovascular Effects

Cardiovascular disease, elevated blood pressure, and heart disease risk factors have been the most frequently studied effects of long-term noise exposure, where noise is believed to stimulate a stress response. Findings from studies in the workplace, where noise levels have been highest and exposure duration long, are equivocal as to any increased risk from noise exposure (Able 1990; Thompson 1981 and 1996; Thompson and Fidell 1992). Factors other than noise play a role in the development of stress-related conditions. Any estimate of the effect of noise exposure on a health state such as hypertension will be biased if it is mixed with the effects of other risk factors for the health condition. Therefore, control of extraneous factors is necessary before the health effect can be attributed to noise.

Studies which have adjusted for other risk factors have found no associations between noise level and increase in blood pressure or hypertension with noise levels above 80 to 85 dB(A) (i.e., Hirai et al. 1991; Hessel and Sluis-Cremer 1994; Kristal-Boneh et al. 1995). A few studies have shown small increases in systolic and diastolic blood pressure levels and/or small increases in risk for hypertension. These have been based on prevalence, not incidence data or have been in work environments with noise levels from above 80 dB(A) to 104 dB(A) (i.e., Lang et al. 1992; Fogari et al. 1994; Zhao et al. 1991). Thus, the consensus is that noise exposure levels established for hearing protection will also protect against any potential non-auditory health effects, at least in workplace conditions (von Gierke 1990).

Although many laboratory studies have suggested that environmental noise raises blood pressure, Ising and Rebentisch (1993a) demonstrated that long-term effects of noise in real life situations cannot be extrapolated from the effects of high noise levels in the laboratory. Research studies regarding the non-auditory health effects of traffic noise experienced by free-living populations are ambiguous and contradictory.

A mixed pattern of findings have emerged from a series of investigations in Bonn, Germany. In the original study of men and women living for more than three years on streets with either high (L_{eq} >66-73dB[A]) or low (maximum L_{eq} of 50 dB) traffic noise, significantly more persons (28 percent) in the noisy area were treated for hypertension than in the quieter area (14 percent) (von Eiff et al. 1982). However, the groups differed by social class and smoking status, which could account for the

differences observed, and actual blood pressure measurements were not made. A more carefully planned prospective follow-up of about 100 men and women from this population indicated that mean blood pressures did not differ after three years between individuals living in areas where L_{eq} exceeded 63 dB(A) compared to those living in areas with L_{eq} values less than 55 dB(A) (Otten et al. 1988).

Knipschild and Salle (1979), using blood pressure data from a cardiovascular screening program, found no association between traffic noise and hypertension, angina pectoris, or ischemia among housewives living on noisy streets (L_{eq} from 65 to 70 dB[A]) compared to those living on quiet streets (L_{eq} from 55 to 60 dB[A]).

Similarly, a larger Dutch study showed no significant relationship between traffic and aircraft noise and blood pressure after multiple confounding factors were controlled (Pulles et al. 1988).

Furthermore, the most definitive traffic noise research to date, the prospective Speedwell and Caerphilly studies, have shown no increase in blood pressure due to noise and a marginal increase in risk for ischemic heart disease after four years of follow-up of 3,176 men who were disease free at the beginning of the study. Men exposed to traffic noise levels above 66 to 70 dB(A) (6 to 22 hour L_{eq}s in front of the buildings) were compared to men exposed to the lowest noise levels of 51 to 55 dB(A), resulting in a relative risk of ischemic heart disease of 1.1 after adjusting for nine risk factors (Babisch et al. 1993).

The Berlin population-based case-control study of males exposed to somewhat higher traffic noise levels (71 to 80 dB[A] versus 51 to 60 dB[A] in the low noise area) found a slightly higher risk (OR= 1.2) for myocardial infarction (Babisch et al. 1994).

The cross-sectional Luebeck study, which gives no measured noise levels but a description that makes it reasonable to assume 70 dB(A) as the dividing line between high and low noise, reports an odds ratio of only 1.3 for hypertension, indicating a very weak association, especially for prevalence data (Herbold et al. 1989).

Only recently has research focused on the potential physiological effects of noise on children. Two studies offer contradictory evidence. A large cross-sectional study of children 3 to 7 years of age in the Slovak Republic showed a statistically significant, but small difference in mean systolic and diastolic blood pressure (SBP 4-5 mm Hg & DBP 1-2 mm Hg) and lower heart rate with higher traffic noise levels, especially around kindergartens. Mean 24-hour equivalent traffic noise emission levels during the working day were 70 dB(A) over all areas, 81 dB(A) in the very noisy areas, 61-69 dB(A) in the noisy, and < 60 dB(A) in the quiet areas. Age, weight, height and sex were adjusted univariately and in a multivariate model (Regecova and Kellerova 1995). Only 20 percent of the children attended quiet kindergartens. As the authors rightly point out “the question of whether this association reflects a causal association remains unanswered, because it cannot be excluded that traffic noise is only one of a complex of causally acting environmental factors.” Prospective follow-up of blood pressure changes in children exposed to high noise vs. blood pressure changes in children living in quieter areas are needed to put these prevalence findings in proper perspective.

Wu and colleagues (1993) observed that although both systolic and diastolic blood pressures by age level were lower in deaf children than in normal-hearing children, these discrepancies in blood pressure narrowed as the children aged. In both of these studies even the higher blood pressures were within normal levels and did not indicate hypertension. The clinical significance of small blood pressure differences in noise exposed vs. non-exposed children, as well as in adults, has yet to be determined.

Although investigations have not been designed in such a way to answer the question as to whether or not small increases in blood pressure will persist to become more permanent changes, experts are of the opinion that these changes in blood pressure in children have no health-threatening aspects (Passchier-Vermeer 1993). Considering the levels of risk and the noise levels studied, there is little indication of increased cardiovascular risk in populations exposed to traffic noise with equivalent sound levels of less than 65 to 70 dB(A) (averaged over 6 to 22 hours).

Unfortunately, there is a paucity of information on the health effects resulting from civilian airport and military aircraft noise exposure, the noise exposure of particular interest for this EIS. Several early studies of aircraft noise on the health of adults living near airports (Karagodina et al. 1969; Koszarny et al. 1976) suggested that morbidity due to hypertension and nervous disorders was higher in the areas closest to the airport.

The first substantial research to show a positive association between adverse health effects and aircraft noise was that of Knipschild (1977a and b) and Knipschild and Oudshoorn (1977). These researchers conducted a general practice survey, a community cardiovascular screening survey, and a drug survey in the vicinity of Amsterdam Schipol Airport. In these studies, noise levels were expressed in units of the Dutch measure B to correspond to DNL of 50 to 65 dB(A) for “little” aircraft noise, 60 to 70 dB(A) for “much” aircraft noise, and 65 to 75 dB(A) for “very much” aircraft noise.

In the screening survey, sex- and age-adjusted prevalence rates of medical treatment for heart disease, use of cardiovascular drugs, and hypertension were significantly higher in people from the higher compared to the lower noise area, with the most striking difference observed for hypertension (15.2 percent vs. 10.1 percent). A dose-response relationship was suggested with the weighted regression indicating that in an area having a DNL of 68 dB(A) the hypertension prevalence rate was twice as high as in an area having a DNL of 55 dB(A).

The general practice survey confirmed these results of the cardiovascular survey in that the contact rates for hypertension, cardiovascular disease, and psychosomatic and psychological problems were highest in the higher noise area. Though the results are suggestive, they have never been accepted as conclusive because of the method of sampling, the lack of control for confounding variables, the 58 percent non-response rate and exclusion of certain categories of respondents such as aged persons.

In the third exploratory study of aircraft noise effects around Schipol airport, the consumption of drugs (tranquilizers, sleeping pills, antacids, and cardiovascular/antihypertensive medications) was compared to the use of drugs in a control village which did not experience aircraft noise (Knipschild and Oudshoorn 1977). The data revealed that in the control area, the purchase of antihypertensive drugs and antacids remained at a constant level over the study period; in the aircraft noise exposed area, the purchase of these drugs increased gradually up to twice the initial quantity. No statistical testing was done, however.

According to an in-depth evaluation by Passchier-Vermeer (1993), no significant effects on blood pressure nor ischemic heart disease emerged from the IVEM epidemiological survey in Groningen, Netherlands, of 432 people exposed to aircraft noise ranging from <35 Kosten units to >55 Kosten units after intervening variables were taken into account.

In an often-quoted paper, Meecham and Shaw (1979) reportedly found higher death rates for stroke and cirrhosis of the liver due to aircraft noise levels under the

approach path to Los Angeles International Airport by using an average noise exposure level greater than 75 dB for the noise exposed population. These findings could not be replicated by others using the same data (Frerichs et al. 1980).

In a more recent study, Meecham and Shaw (1988) reported an 18 percent higher cardiovascular disease death rate among individuals 75 years or older living within the 90 dB(A) contour around the Los Angeles airport compared to a similar age group living in nearby areas. However, the ecological nature of the data, evidence of high selective migration into the high noise area, and lack of adjustment for other risk factors could easily account for the observed differences.

Cohen et al. (1980) reported that children from noisy schools (with a mean peak sound level of 74 dB[A]) located in the air corridor of the Los Angeles Airport had slightly higher blood pressures than children in quiet schools (56 dB[A] sound level). However, this cross-sectional difference in blood pressure did not replicate when reassessed one year later (Cohen et al. 1981). The relation between noise and blood pressure could be accounted for by attrition and age differences.

Virtually all of the studies to date of human health effects of military low-altitude flight noise have been conducted in Germany where flights were fairly frequent during the late 1970's and early 1980's. In West Germany, the minimal flight altitude was 75 meters prior to September 1990.

The German research program began with several laboratory studies, followed by epidemiological investigations. In one laboratory study 12 males 30 to 50 years of age were exposed to simulated overflight noise with L_{max} of 105 and 125 dB(A). At jet noise above 105 dB(A), a cortisol rise in the blood without a catecholamine increase was explained by Ising as a typical reaction toward external noxious influence impairing tissue integrity (Ising et al. 1990b). In a second laboratory study, low flying fighter jet noise gave rise to stress reactions as evidenced by increased ACTH, cholesterol and blood sugar levels in all test subjects.

Another study measured the reaction of 54 volunteers, aged 70 to 89 years living in a senior citizen's home, to overflight noise administered via earphones. L_{max} of the noise was not raised above 112 dB, but two rise times were used: sound level increases of 30 dB within 4 seconds and sound level increases of 30 dB within 0.4 seconds. Significantly higher blood pressure increases were observed in response to earphone presentation of the rapid onset noise than to the more gradual onset noise, with individual maximum systolic blood pressure increases from 23 to 40 mm Hg. When the noise exposure was repeated at intervals of 10 to 15 minutes, the subsequent cardiovascular response was intensified. The authors concluded from this experiment that increase in the intensity of noise levels smaller than 60 dB/second are unlikely to be connected with health impairments. In elderly subjects, sensitization begins at about 106 dB(A) with fast level increase in noise (Michalak et al. 1990).

The field studies conducted were in two 75 meter areas, Munsterland (with maximum overflight noise levels of 115 to 116 dB[A] and average L_{eq} values of 59 to 63 dB[A] over a period of approximately 1 month) and Franken (with maximum levels up to 125 dB[A], and average L_{eq} values of 64 to 68 dB[A]), and in surrounding 150 meter regions. Level increases up to 75 dB/second, with a few as high as 200 dB/second, were measured by Spreng et al. (1988) and Spreng (1990) and reported in all of the English studies (Ising et al. 1990a). Also, according to the Spreng et al. (1988) study, which is published fully only in German, the average number of direct overflights in rural areas where the low-altitude flights occurred, was 17 per day with a mean peak sound level of 107.7 dB(A) ± 5 dB.

The first field investigations were of children, since they were considered a special risk group. In Franken, 264 nine to thirteen year old children from the 75 meter area and 169 from the 150 meter area were examined. For girls, the mean systolic blood pressure was 9 mm Hg higher and the diastolic blood pressure 3.4 mm Hg higher in the 75 meter than in the 150 meter area after adjusting for age and body weight. There were no blood pressure differences in boys, but their heart rate was significantly lower in the 75 meter area (Ising et al. 1990a; Ising et al. 1990b). However, when similar data from the Munsterland area for 9 to 13 year olds were examined, no significant blood pressure differences were found for the children in the 75 meter and 150 meter areas (Ising et al. 1990a).

A subsequent study of low-altitude flight noise by this group of researchers consisted of a survey, followed by an examination, of a random sample of men and women aged 20 to 60 years. Of the 2,403 subjects in the low-altitude flight area, 2,368 in the rural control area, and 2,400 in the urban control area, 21.5 percent were willing to undergo examination and 413 actually completed examinations. In northern Germany, the study showed no significant differences in blood pressure, hypertension, hypercholesterolaemia, cholesterol, HDL and LDL, or diabetes mellitus between the noise exposed populations and the control subjects. The study in Southern Germany, which had particularly high exposure to low-altitude flight noise, also failed to show variations between the noisy and quiet areas on any of the risk factors (Schulte and Otten 1993).

In another study of elderly people, Ising and Michalak (1990) found a higher increase in systolic and diastolic blood pressure after exposure to noise with a fast rise time than after exposure to noise with the same maximum sound level, but with a slow rise time. Blood pressure returned to normal when the noise stimulus was stopped.

Only one field study of the immediate effects of exposure to low-altitude overflights on patients with severe cardiac disease has been conducted (Brenner et al. 1993). This study revealed no clinically relevant effects of low-altitude overflight noise on heart rate and arrhythmias. Sixty-eight patients with severe cardiac diseases in a rehabilitation clinic in Bad Rothenfelde, Germany, where low-altitude military overflights were at one time quite frequent, underwent 24-hour electrocardiogram (ECG) monitoring on days with low-altitude overflights. Overall, 38 overflights with a peak sound level above 95 dB(A) (19 of which were above 100 dB[A]) were recorded during the study: 8 days with one overflight, 7 days with two, 2 days with three, 1 day with four, and 1 day with six overflights. Patients could not be monitored as to whether they were outside or inside the rehabilitation center at the time of the overflights. The time on the ECG record when the overflights occurred were marked; four 2-minute periods representing the time before, during, and after the overflight were assessed separately for maximum heart rate, ventricular extrasystoles and supraventricular extrasystoles. The differences between the time periods were negligible compared to differences between the subgroups of conditions, leading the authors to conclude "... the potential effects on heart rate and arrhythmia of low altitude flights appear to be of limited magnitude compared to the potential effects of other factors, such as psychological or physical exposures, ...".

4.13.3 Aircraft Noise and Mental Health Effects

4.13.3.1 Overview

Since the thorough analysis of the literature by Stansfeld (1992), it is generally accepted that exposure to high levels of environmental noise does not cause or increase the risk of mental disorders.

4.13.3.2 Research on Mental Health Effects

The literature on psychological effects of aircraft and traffic noise has been extensively reviewed recently by Stansfeld (1992). In addition, Stansfeld conducted several studies to disentangle the complex interplay previously noted between noise, annoyance, noise sensitivity, and mental disorders, including symptoms of depression, and concluded that environmental noise does not cause clinically defined psychiatric disorder. However, in some subgroups of the population the meaning of noise for the individual, usually defined as noise sensitivity, was correlated with psychological morbidity, that is, the rates of psychologically impaired individuals was higher among the most noise sensitive subjects. Analysis of cross-sectional data on psychiatric caseness and noise sensitivity from the Caerphilly and Speedwell Collaborative Heart study of traffic noise also supported the conclusion that noise did not cause psychiatric disorder (Stansfeld et al. 1993).

Kryter's (1990) reanalysis of Jenkins et al. (1981) data on admission rates to psychiatric hospitals for people living near London's Heathrow airport identified an effect of aircraft noise independent of socioeconomic variables represented by percentages of individuals in the various noise exposed areas according to age, sex and marital status. These more ecological data are less persuasive in inferring cause than the cross-sectional studies of individuals conducted by Stansfield.

Schmeck and Poustka (1993) conducted a psychiatric interview of 376 children and adolescents living in areas of low-altitude flight noise. They report a higher level of anxiety in young children in the high noise area, but found no association between noise and global psychiatric or psychosomatic problems.

4.13.4 Aircraft Noise and Pregnancy

4.13.4.1 Overview

Studies of the effect of noise on birth weight are contradictory. They define low birth weight differently and do not take into account intervening factors. Furthermore, studies showing an effect have found only a small mean difference in birth weights of noise exposed and unexposed infants (Knipschild et al. 1981; Coblentz et al. 1990). Passchier-Vermeer and others (CHCN 1996) conclude that it cannot be excluded that noise exposure of pregnant women to air traffic noise may affect the birth weight of the baby, but "should a reduced weight at birth occur, this is only at noise exposures with DNL values greater than 62 dB(A)." In addition to the inconsistent and inconclusive results of aircraft noise studies in general, industrial noise exposure greater than 75 dB(A) has not shown reductions in birth rate.

No population based studies have shown increased risk for malformations from noise exposure. It is unlikely that the infrequent overflights and the small number of events exceeding 65 dB(A) (in the busiest areas, less than 3 events per day will have

maximum sound levels above 65 dB[A]) in the airspace addressed in the Hardwood Range proposal will increase risk to adverse pregnancy outcomes in the population overflown.

4.13.4.2 Research on Effects of Noise on Pregnancy

Congenital anomalies and birth weight are the most frequently studied influences of noise on the human fetus. In 1978, Jones and Tauscher reported a higher incidence of birth defects in the approach path to Los Angeles International Airport (average noise exposure greater than 75 dB[A]) when compared to a control group residing away from the airport.

Based on this report, a separate group at the U.S. Centers for Disease Control performed a more thorough study of populations near Atlanta's Hartsfield International Airport for the same years (1970 to 1972) and found no relation in their study of 17 identified categories of birth defects to aircraft DNL values above 65 dB after controlling for race, socioeconomic status, and hospital of birth (Edmonds 1979). A matched case-control analysis showed no significant association between high noise and neural tube defects, a severe and frequently occurring anomaly. Bader (1978) demonstrated, using similar birth certificate data, that the rates of birth defects in the cities near the Seattle-Tacoma airport were even lower than rates for the remaining areas.

Several early studies reported lower birth weights for babies whose mothers lived near airports (Rehm and Jansen 1978; Ando and Hattori 1977). However, these findings were not statistically significant and no other contributing factors were controlled.

Knipschild et al. (1981) found a gradient effect of low birth weight with noise exposures above DNLs of 65 dB(A) around Schipol airport after controlling for age of mother, sex of infant, and family income. Smoking, one of the strongest risk factors for low birth weight was not controlled. His data showed only an 0.8 percent difference in number of births less than 2500 grams between the high and low noise areas. The difference in mean birth weight between the noise groups is statistically significant, but only 69 grams. The extent to which such small differences in mean birth weight are meaningful for survival, growth, and development of the infant is unclear.

One study of both gestation length and birth weight found shorter gestations for female infants, but not male infants, of women living in higher aircraft noise areas than in control areas after taking into account maternal height, age, weight, smoking, and paternal weight and education. Noise exposure was not associated with birth weight (Schell 1981).

Since these early studies suggesting aircraft noise may reduce fetal growth, a study near Orly and Roissy airports showed birth weights of babies born to women living in areas exposed to aircraft noise to be lower than birth weights of babies in areas unexposed to aircraft noise. Again the differences in birth weights were small and other factors were not controlled in the analysis (Coblentz et al. 1990).

Several studies of industrial noise have shown contradictory results. Finnish researchers (Hartikainen-Sorri et al. 1988 and 1994) found no differences on birth weight and fetal mortality between noise exposed and unexposed women in industries where noise levels were relatively low, <77 dB(A) vs. >78 dB(A). Nurminen and Kurppa (1989), using industrial hygienists to assess noise levels, reported an

association between small weight for gestational age babies and noise levels at work. However, shift work was more strongly associated with low birth weight than noise level.

A case-control study in China (Zhang et al. 1992), where industrial noise levels remain high, reported no effect of occupational noise on birth weight or congenital anomalies, although there was a very small increased risk to antepartum fetal death. Using the same industrial population as that studied for birth weight, Kurppa et al. (1989) found no association between noise exposure and structural malformations in infants. A major problem in each of these studies is the lack of control for other contributing factors.

The only prospective study measuring 24-hour noise exposure (with personal dosimeter) during the first, second, and third trimesters of pregnancy found no association between personal noise exposure (with L_{eq} less than 85 dB[A]) during pregnancy and birth weight (Wu et al. 1996). No association was found when other noise exposures (occupational, traffic, music) were considered. The strongest predictors of birth weight were maternal weight and weight gain, length of gestation, and infant's sex.

4.14 CUMULATIVE IMPACTS

Cumulative impacts on environmental resources result from incremental impacts of Proposed Actions when combined with past, present, and reasonably foreseeable future activities in the area. Cumulative impacts can result from minor, but collectively substantial, actions undertaken over a period of time by various agencies (Federal, state, or local) or persons. In accordance with NEPA, a discussion of cumulative impacts is required.

Cumulative impacts are most likely to arise when a relationship exists between a proposed action and other actions expected to occur in the ROI for the resources analyzed and also in a similar time period. Projects in close proximity to the proposed action would be expected to have greater potential for a relationship that could result in potential cumulative impacts than those more geographically separated. These projects can be proposed by various agencies or persons.

In preparing this EIS, the ANG began its consideration of cumulative impacts by viewing the impacts of the Hardwood Range expansion in the broadest sense. Also, through the Interagency and Intergovernmental Coordination for Environmental Planning (IICEP) process, information from all affected state, Federal, Native American Nations and other interests were solicited (see Appendices B, C, H and O). In looking at the applicable airspace with this broad view, there is a potentially infinite combination of insignificant cumulative environmental impacts in a variety of resource areas from the proposal when it is assessed in conjunction with past, present, and future actions. However, significant cumulative impacts from ANG training operations are not readily identifiable. NEPA does not require a proponent to analyze the most remote or attenuated consequences of a Proposed Action. Therefore, a logical and practical method to quantify and assess cumulative impacts was used.

Past and present actions associated with ANG activities and other public and private entities are addressed in either Section 3, Affected Environment, or Section 4, Environmental Consequences. For example, a plan to reintroduce Trumpeter Swans in Necedah NWR was developed. The impacts from this reintroduction and those from birds in general are addressed in Section 3.

Sorties were identified as the key component of cumulative impacts analysis because they form the basis from which essentially all other analyses were derived, and in particular all those producing quantitative results, including noise level computations, air quality analyses, and safety evaluations. These analyses are presented in Section 4.0.

The maximum sortie rate analysis was developed to determine the cumulative totals and the overall affect on each resource. This analysis was based on adding together sorties from coincidental airspace (i.e., airspace overlapping the same geographic space). The results from the maximum sortie rates analysis for each airspace component were added together with coincidental airspace use associated with other airspace components of the proposal, and with military airspace components not a part of the proposal. This compilation of sorties produced a cumulative total of all military aircraft operations in these military airspaces and represented a maximum situation analysis because no other scenarios are possible that would obligate more use of the airspace, therefore, potential impacts are quantified and assessed at the highest possible level.

A sortie profile was developed for each airspace to determine cumulative totals. Under this scenario, the maximum number of training sorties possible for each airspace is assumed to occur. Table 4-22 displays the cumulative sortie totals under the alternatives studied in this EIS.

Table 4-22. Cumulative Sortie Totals

AIRSPACE	*EXISTING CONDITIONS*	*PROPOSED*
VR-1616 Falls 1 MOA	*4,180*	*4,796*
VR-1650 Falls 1 MOA	*2,494*	*3,110*
VR-1650 Falls 2 MOA	*1,668*	*1,938*
VR-1616 Range Support Airspace[1]	*N/A*	*4,503*
VR-1650 Range Support Airspace[1]	*N/A*	*2,817*

Note: 1. Range Support Airspace is a 12 NM circle around the proposed tactical range which provides support for aircraft maneuvering.

Because of the assumptions associated with this approach, the reasonable maximum situation scenario is likely to represent slightly more than the actual utilization of the airspace under the proposal.

4.15 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Short-term uses of the environment are considered those that occur over a period of less than five years. Conversely, long-term uses of the environment include those impacts that occur over a period of more than five years. However, it is apparent that the long-term impacts are directly related to the short-term usage of the land. In general, for the airspace associated with use of the Hardwood Range, short-term uses would be limited to military aircraft use of the MOAs and R-6904. Impacts associated with this airspace use are essentially short-term in nature and would not be expected to effect long-term productivity of the environment.

Use of land in the range expansion area would be accomplished by a land acquisition option that would change county forest land and private land areas to federally-controlled lands. Forestry activities could continue under Federal control. The relative changes in the total land areas involved would have a negligible impact on both short-term and long-term productivity of the environment. Minor impacts would be further mitigated in the long-term when currently cleared areas not developed as a part of the range expansion are allowed to revegetate.

4.16 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible and irretrievable resource commitments are related to the use of non-renewable resources and the effects that the use of these resources have on future generations. An irreversible resource commitment results from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable timeframe. The use of a resource that cannot be replaced is termed an irretrievable resource commitment.

One commitment of resources associated with the use of the Hardwood Range would be the jet fuel consumed by the aircraft flying the sorties to accomplish the training missions determined necessary within the subject airspace.

Another commitment of resources would be associated with development of the range expansion area. Most notably, these types of commitments would concern the materials used to construct the new areas. Varying quantities of gravel, concrete, and other construction materials would be consumed, as well as fuels and electricity to power construction equipment. Although these materials are considered irretrievable, the relative amounts of the resources used would be negligible. On a global scale, the impact of using these resources would be insignificant.

4.17 MITIGATION MEASURES

4.17.1 General Approach

Mitigations associated with the use of military airspace are primarily operational in nature. The ANG routinely employs a variety of special operating procedures (SOPs) to decrease impacts on communities and other sensitive noise receptors (i.e., hospitals, churches, schools, etc.) that exist under or near MTRs or MOAs. These would apply to any alternative chosen for implementation. These procedures include:

- Avoidance of sensitive areas along an MTR by flying to one side or by increasing altitude over the sensitive area. (Does not apply to this proposal.)

- Avoidance of sensitive areas under a MOA by increasing altitude or through other measures.

- The ANG maintains a minimum altitude over areas sensitive to low-altitude flight. These include the practice to maintain certain minimum altitudes over or avoid laterally any identified federally-designated T&E species nest sites, as determined by discussions with appropriate Federal and state agencies.

The following are examples of FAA and military flying restrictions:

- Avoid flying lower than 1,000 feet above the highest obstacle within a 2,000 feet horizontal radius when over a congested area, such as a city, town, or settlement, or over any open air assembly of people.

- Avoid flying lower than 500 feet above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure.

- Avoid public-use airports displayed on aeronautical maps by at least 1,500 feet vertically when within 3 NM.

These procedures would be followed regardless of the alternative implemented, whether the Proposed Action or the No-Action Alternative. In addition to these procedures, which are routinely applied, specific mitigations are sometimes required to deal with aircraft operations-related impacts at a specific location. Identification of such specific locations is an ongoing activity and must be adapted to respond to both known issues and public responses encountered as training programs are implemented each year.

Should specific additional measures be identified during the course of completing this EIS, they will be included in the implementing actions for the Hardwood Range expansion and described in the Record of Decision (ROD).

4.17.2 Airspace Specific Mitigations

This subsection presents examples of actions adopted by the ANG to mitigate environmental or safety impacts associated with the airspace addressed by the Hardwood Range Expansion EIS. Detailed instructions to pilots are made available and adjusted periodically through the Flight Information Publication. Another source of mitigations related to the airspace that is provided to military pilots is the Bird Avoidance Modeling results from the USAF Headquarters Safety Agency. To increase aviation safety, civilian pilots should contact Volk Field Operations (1-800-972-8673) for military flight schedules or monitor the Volk Field Airspace Information System on the Very High Frequency (VHF) radio channel (120.0) for the current operational status of each airspace. The mitigations listed below were not specifically addressed in the original description of the proposal for the Hardwood Range expansion and related airspace actions; however, they represent current practice.

Falls 1 MOA

- To minimize noise impacts, noise sensitive areas have been identified and will be avoided laterally when operations occur below 1,000 feet AGL.
- To avoid impacts to biological resources on the ground, environmentally sensitive sites have been identified and minimum altitudes will be raised over these sites during appropriate times of the year.

Falls 2 MOA

- To minimize noise impacts, noise sensitive areas have been identified and will be avoided laterally when operations occur below 1,000 feet AGL.
- To avoid impacts to biological resources on the ground, environmentally sensitive sites have been identified and minimum altitudes will be raised over these sites during appropriate times of the year.

Volk South MOA

- To minimize noise impacts, noise sensitive areas have been identified and will be avoided laterally when operations occur below 1,000 feet AGL.
- To avoid impacts to biological resources on the ground, environmentally sensitive sites have been identified and minimum altitudes will be raised over these sites during appropriate times of the year.

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- To minimize noise impacts, noise sensitive areas have been identified and will be avoided laterally when operations occur below 1,000 feet AGL.
- To avoid impacts to biological resources on the ground, environmentally sensitive sites have been identified and minimum altitudes will be raised over these sites during appropriate times of the year.

In addition to mitigation measures listed above, the WIANG works closely with local community to provide a forum for range activities. The WIANG sponsors an open house annually which invites the community to view the range and Volk Field. The WIANG has a recorded message listing the schedule of range use. In addition, the aforementioned toll free number is available to the general public to inform Volk Field Operations about upcoming special activities requiring any flight and noise avoidance considerations. Examples include Ho-Chunk Nation Silver Mound Days and certain mining operations. The

toll free number is also available to voice noise complaints. The WIANG also uses an innovative tracking program for all military aircraft using the range. They send to all units special operating procedures for using the range. For example, during a specific time of year, certain areas are avoided during animal mating/birthing season. Any special types of flying are also listed in the local newspaper.

4.18 ENVIRONMENTAL JUSTICE

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, directs Federal agencies to address environmental and human health conditions in minority and low-income communities. The general purposes of this Executive Order are as follows:

- To focus attention of Federal agencies on the human health and environmental conditions in minority communities and low-income communities with the goal of achieving environmental justice.
- To foster non-discrimination in Federal programs that substantially affect human health or the environment.
- To give minority communities and low-income communities greater opportunities for public participation in, and access to, public information on matters relating to human health and the environment.

Executive Order 12898 applies to Federal agencies that conduct activities that substantially affect human health or the environment. The concept of environmental justice therefore ensures that studies such as EISs address the issue of determining if actions of Federal agencies disproportionately impact the human health and environmental conditions in minority communities and low-income communities. The ANG also applies the Interim Guide for Environmental Justice with the Environmental Impact Analysis Process, as appropriate (USAF 1997). The majority of the airspace associated with the proposal addressed in the EIS has been in existence for many years and the changes being proposed would not alter the current configuration. Environmental justice issues would be more relevant for new airspace.

Also included with environmental justice issues are concerns pursuant to Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. This Executive Order directs Federal Agencies to identify and assess environmental health and safety risks that may disproportionately affect children.

Since MOAs and MTRs are typically configured to avoid densely populated and metropolitan or urban areas, such airspace by design would be located over rural and less developed areas. While populated areas do occur within the airspace boundaries of the airspace addressed in this EIS, they are typically scattered, relatively low in density compared to urbanized areas, and avoided to the maximum extent possible. Because population and housing conditions are inter-related, MOAs and MTRs are more likely to be configured to avoid large residential areas and developed tracts of land. While it is possible that noise-related impacts due to military overflights may still occur in areas beneath MOA and MTR boundaries, the total number of people potentially affected would be lower than if such airspace were located over cities and areas with higher population densities.

In order to assess the potential environmental justice and protection of children impacts of the proposed action, an analysis of poverty and minority status and age characteristics of populations in the counties associated with the range and the affected airspace were analyzed and compared to these population characteristics for the state of Wisconsin. The minority population is comprised of all non-white persons and persons of Hispanic origin. Data used for this analysis were collected from the 1990 *Census of Population and Housing* and the 1996 *Estimates of the Population of Counties by Age, Sex, and Race* (see Table 4-23).

Table 4-23. Project Area Demographic Data (as a Percentage of Total Population)

Area	*Persons Below Poverty (1993)*	*Minority Persons (1997)*	*Children under 18 (1997)*
State of Wisconsin	*10.9*	*10.1*	*26.0*
Hardwood Range			
Juneau County	*12.9*	*2.5*	*26.0*
Wood County	*9.0*	*3.2*	*26.8*
Falls 1 MOA			
Clark County	*12.7*	*1.2*	*28.7*
Eau Claire County	*13.1*	*5.0*	*27.0*
Jackson County	*13.2*	*6.4*	*26.4*
Monroe County	*12.2*	*2.7*	*28.0*
Falls 2 MOA			
Clark County	*12.7*	*1.2*	*28.7*
Eau Claire County	*13.1*	*5.0*	*27.0*
Wood County	*9.0*	*3.2*	*26.8*
Volk South MOA			
Adams County	*15.4*	*6.3*	*20.3*
Juneau County	*12.9*	*2.5*	*26.0*
Monroe County	*12.2*	*2.7*	*28.0*

Sources: U.S. Census 1998 and U.S. Census 1999.

The Census Bureau bases the poverty status of families and individuals on numerous threshold variables including, income, family size, number of family members under 18 and over 65 years of age, and amount spent on food. In 1993, the median household income in the state of Wisconsin was $32,200. Median household income in the ROI ranged from a low of $24,680 in Adams County to a high of $35,116 in Wood County (U.S. Census 1998). Persons living below the poverty level accounted for 10.9 percent of the population in the Wisconsin during 1993, and ranged from a low of 9.0 percent in Wood County to a high of 15.4 percent in Adams County.

The proportion of minority residents in the counties comprising the ROI is lower than state figures. The percentage of minority residents in the state of Wisconsin is 10.1 percent of the total population. The minority population in the ROI ranged from 1.2 percent in Clark County to 6.4 percent in Jackson County. According to Census estimates for 1997, 26.0 percent of the population in Wisconsin are children under the age of 18. This figure is comparable for the ROI where children comprise between 20.3 percent and 28.7 percent of the total population.

Because the actions evaluated in this EIS would not create significantly adverse environmental or health effects, no disproportionately high and adverse human health or environmental effects on minority and low-income populations have been identified. In addition, there are no known environmental health or safety risks associated with the Proposed Action that may disproportionately affect children.

4.19 SUMMARY OF ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

More detailed information on potentially adverse environmental effects from the alternatives have been presented previously in this section for each resource area, as applicable. However, the primary issue associated with this proposal is noise from aircraft operations, and the noise impacts are adverse environmental effects that cannot be avoided under either the No-Action Alternative or the Proposed Action. In addition, as was described earlier, the Hardwood Range expansion would impact access to some ground-based resources, such as forest areas and recreational trail routes, now currently available, which can be considered an adverse environmental effect. The range expansion would also result in some unavoidable loss of vegetation and habitat. This loss should not have a significant impact on any ecosystem or species based on currently available information. Ground disturbance during range construction may involve potential short-term impacts to surface water resources; however, such impacts can be mitigated through standard best management procedures.

4.20 STRUCTURE OF THIS EIS DOCUMENT

The primary presentation of the issues of concern and potential impacts associated with the alternatives is presented in the sections listed below:

Section 1: Purpose and Need for the Action

Section 2: Description of the Proposed Action and Alternatives

Section 3: Affected Environment

Section 4: Environmental Consequences

Other shorter sections address the EIS preparers (Section 5), agency coordination (Section 6), references (Section 7), an index (Section 8), and acronyms and abbreviations (Section 9). Numerous appendices support the technical analyses and are presented at the end of this document.

SECTION 5

LIST OF CONTRIBUTORS

5. LIST OF CONTRIBUTORS

This Environmental Impact Statement (EIS) was prepared under the supervision of the Air National Guard Readiness Center, National Guard Bureau. The organizations and individuals that contributed to the preparation of this document are listed below. Table 5-1 at the end of this section (page 5-5) summarizes, for each contributor, the sections of the EIS for which inputs were prepared.

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5.2 REVIEWERS OF THE EIS

This EIS has been reviewed by the Environmental Protection Committee of the National Guard Bureau. The Environmental Protection Committee is responsible for monitoring, attaining, and maintaining environmental compliance for the Environmental Division of the Air National Guard at Andrews Air Force Base, Maryland. Representatives to the Environmental Protection Committee include Engineering and Services, the Surgeon, Logistics, Operations, Plans, Judge Advocate, Public Affairs, Comptroller, Personnel, and Safety. The Environmental Protection Committee is organized under the authority of Air Force Instruction (AFI) 32-7061. The FEIS has also been reviewed by the USAF Security and Policy Office, the USAF Environmental Safety and Occupational Health Office, and by Air National Guard representatives at Volk Field.

SECTION 6

COORDINATION WITH OTHER GOVERNMENT AGENCIES, NON-GOVERNMENT ORGANIZATIONS, AND THE PUBLIC

6. COORDINATION WITH OTHER GOVERNMENT AGENCIES, NON-GOVERNMENT ORGANIZATIONS, AND THE PUBLIC

6.1 SCOPING

In scoping the Draft Environmental Impact Statement (DEIS), the National Guard Bureau (NGB) has actively solicited comments from a wide group of interested parties. The NGB published a Notice of Intent (NOI) in the *Federal Register* (see 60 F.R., No. 14, p. 4403, January 23, 1995) announcing its intent to prepare a DEIS, as required under the National Environmental Policy Act (NEPA) (see Appendix A). In addition, this NOI announced a series of six scoping meetings to be held in February 1995 in communities adjacent to the Hardwood Range and in areas associated with the related airspace components.

To further facilitate the coordination and scoping process from intergovernmental points-of-contact, the Air National Guard (ANG) developed an Interagency and Intergovernmental Coordination for Environmental Planning (IICEP) list and subsequently contacted those parties. This list is presented in Appendix B. Concurrently, coordination with Federal and state agencies was also initiated.

All comments received during the scoping process associated with this EIS were considered in the preparation of the document. Such comments, as they relate to the proposal, have helped to improve the EIS process and have become a part of the administrative record for the proposal.

As a result of the scoping process and agency consultation activities, the NGB developed its final coordination/mailing list of potentially interested parties to be contacted concerning distribution of the DEIS. More than 1,200 Federal, state, and local agencies; public organizations; and private citizens were contacted about receipt of the DEIS. The addresses shown in Appendix B and C represent the initial coordination list for the DEIS.

In addition to those receiving the DEIS through the initial direct mailing, anyone else desiring a copy of the DEIS, or wishing to comment on the document, directed their correspondence to the address given on the cover sheet. All information received during the comment period was considered during the preparation of the Final Environmental Impact Statement (FEIS).

6.2 PUBLIC COMMENT PERIOD ON THE DRAFT EIS

The Council of Environmental Quality (CEQ) provides guidelines for the preparation of EISs, and the review of EISs by the public and various government agencies. These guidelines direct agencies to “allow not less than 45 days for comments on draft statements” (Section 1506.10 of these guidelines). The comment period for the Hardwood Range DEIS officially opened August 22, 1997 with the NOA published in the *Federal Register* (see 62 F.R. No. 163; p. 44685). The initial mailing of the statement to over 475 addresses was accomplished by August 21, 1997 prior to the NOA. The close of the comment period was extended to November 21, 1997 (91 days).

6.3 PUBLIC HEARINGS AND RESPONSES TO COMMENTS

A series of three public hearings was held in September of 1997 at various locations around the area potentially affected by the Hardwood Range Expansion

Proposal. The hearing locations were selected to ensure the inclusion of a wide geographic representation of potentially interested parties within the affected areas to ensure maximum participation.

Volume II of this FEIS displays public comments on the DEIS received at the public hearings or by mail and provides the ANG responses. Volume III displays copies of other relevant correspondence on the proposal mailed to the ANG.

Every comment on the DEIS received before, or postmarked before, November 22, 1997 has been incorporated into this FEIS. All comments received on the DEIS were considered in the preparation of this FEIS. The public comment process provided the ANG with an opportunity to receive input from Federal and state regulatory agencies and the public concerning the DEIS. Public comments have enabled the ANG to improve the FEIS by clarifying existing text, adding new information or maps, and refining or expanding analyses in the document.

SECTION 7

REFERENCES

7. REFERENCES

Able 1990	Able, S.M. 1990. "The extra-auditory effects of noise and annoyance: an overview of research," Journal of Otolaryngology, 19 (1), April 1990.
AKZO Chemicals 1991	AKZO Chemicals, Inc. 1991. Titanium Tetrachloride. Material Safety Data Sheet (MSDS). Chicago, Illinois. November 1991.
Andersen et al. 1990	Andersen, D.E., O.J. Rongstad, W.R. Mytton. 1990. "Home-range Changes in Raptors Exposed to Increased Human Activity Levels in Southeastern Colorado." Wildl. Soc. Bull. 18: 134-142.
Ando and Hattori 1977	Ando, Y. and Hattori, H. 1977. "Effects of noise on human placental lactogen (HPL) levels in maternal plasma," British Journal of Obstetrics and Gynecology, 84.
Andrus et al. 1975	Andrus, W.S., Kerrian, M.E., and Bird, K.T. 1975. "Hearing in para-airport children," Aviation Space and Environmental Medicine, 46.
ANGRC 1992	Air National Guard Readiness Center (ANGRC). 1992. Environmental Assessment for Proposed Aircraft Conversions at the 132nd Fighter Wing, Des Moines, Iowa, and the 128th Fighter Wing, Madison, Wisconsin. Environmental Division, Andrews Air Force Base, Maryland. December 1992.
ANGRC 1993	Air National Guard Readiness Center (ANGRC). 1993. Amendment to Update Appendix E, Environmental Assessment for Aircraft Conversion at the 132nd Fighter Wing, Des Moines, Iowa, and the 128th Fighter Wing, Madison, Wisconsin. Environmental Division, Andrews Air Force Base, Maryland. 1993.
ANSI 1980	American National Standards Institute (ANSI). 1980. Sound Level Descriptors for Determination of Compatible Land Use. ANSI S3.23-1980.
ANSI 1988	American National Standards Institute (ANSI). 1988. Quantities and Procedures for Description and Measurement of Environmental Sound, Part 1. ANSI S12.9-1988.
Babisch et al. 1993	Babisch, W., Ising, H., Elwood, P.C., Sharp, D.S., and Bainton, D. 1993. "Traffic noise and cardiovascular risk: The Caerphilly and Speedwell Studies, Second Phase. Risk estimation, prevalence, and incidence of ischemic heart disease," Archives of Environmental Health, 48.
Babisch et al. 1994	Babisch, W., Ising, H. Kruppa, B., and Wiens, D. 1994. "The incidence of myocardial infarction and its relation to road traffic noise - the Berlin case-control studies." Environment International, 20.

Bader 1978	Bader, M. 1978. "Residence under an airport landing pattern as a factor in teratism (letter)." Archives of Environmental Health, 33.
Bailey 1980	Bailey, R. 1980. Description of the Ecoregions of the United States. U.S. Department of Agriculture, U.S. Forest Service Miscellaneous Publication No. 1391.
Bandt 1995	Bandt, K. 1995. Montgomery Watson Americas, Inc., personal communication with M. Fikel, SAIC, in regard to Environmental Baseline Survey, Hardwood Range. May 18, 1995.
Banker 1995	Banker, S. 1995. State Historical Society of Wisconsin, Madison. Personal communication with L. Gross, SAIC. May 16, 1995.
Battis 1983	Battis, J.C. 1983. "Siesmo-Acoustic Effects of Sonic Booms on Archaeological Sites, Valentine Military Operations Area." Air Force Geophysical Laboratory, Report AFGL-TR-83-0304. November 9, 1983.
Battis 1988	Battis, J.C. 1988. "The Effect of Low Flying Aircraft on Archaeological Sites, Kayenta, Arizona." AFGL Technical Memorandum No. 146. Air Force Geophysics Lab, Hanscom AFB, Massachusetts. January 27, 1988.
Black et al. 1984	Black, B.B., M.W. Collopy, H.F. Percival, A.A. Tiller, and P.G. Bohall. 1984. Effect of Low-level Military Training Flights on Wading Bird Colonies in Florida. Florida Cooperative Fish and Wildlife Research Unit, School of Forestry and Resource Conservation, University of Florida, Gainesville. Technical Report No. 7.
Boszhardt 1992	Boszhardt, R.F. 1992. An Archaeological/Historical Survey of the Hardwood Air-to-Ground Range in Juneau County, WI. Reports of Investigations No. 140. University of Wisconsin, La Crosse. August 1992.
Braid 1992	Braid, R.B. 1992. "Incorporation of Public Participation in Environmental Analyses of Low-altitude Flying Operations." *The Environmental Professional.* 14: 60-69.
Brenner et al. 1993	Brenner, H., Oberacker, A., Kranig, W., and Buchwalsky, R. 1933. "A field study on the immediate effects of exposure to low-altitude flights on heart rate and arrhythmia in patients with cardiac diseases," International Archives of Occupational and Environmental Health, 65.
Burger 1981	Burger, J. 1981. "The Effect of Human Activity on Birds at a Coastal Bay." *Biol. Conserv.* 211:231-241.

CHCN 1996	Committee of the Health Council of the Netherlands (CHCN). 1996. "Effects of noise on health: Chapter 3 of a report on noise and health prepared by a committee of the Health Council of the Netherlands," Noise/News International, 4, September 1996.
Chesser et at. 1975	Chesser, R.K., R.S. Caldwell, and M.J. Harvey. 1975. "Effects of Noise on Feral Populations of *Mus musculus*." Physiological Zoology 48:323-325.
Coblentz et al. 1990	Coblentz, A., Martel, A., and Ignazi, G. 1990. "Effects of fetal exposition to aircraft noise on the birthweight of children," Proceedings of Human Factors Society, 34th Annual Meeting, 1990.
Cohen et al. 1980	Cohen, S., Evans, G.W., Krantz, D.S., and Stokols, D. 1980. "Psychological, motivational, and cognitive effects of aircraft noise on children: moving from the laboratory to the field," American Psychology, 35.
Cohen et al. 1981	Cohen, S., Krantz, D.S., Evans, G.W., Stokols, D., and Kelly, S. 1981. " Aircraft noise and children: longitudinal and cross-sectional evidence on adaptation to noise and the effectiveness of noise abatement," Journal of Personality and Social Psychology, 40 (2).
Curtis 1959	Curtis, J.T. 1959. The Vegetation of Wisconsin. University of Wisconsin Press. Madison, Wisconsin.
D'Arms and Griffin 1972	D'Arms, E. and D.R. Griffin. 1972. "Balloonists' Reports of Sounds Audible to Migrating Birds." *The Auk*. 89:269-279. April 1972.
Dalton and Dalton 1983	Dalton, V.M. and D.C. Dalton. 1993. *Assessment of the Impacts of Low Level Military Aircraft on Leptonycteris curasoae, an Endangered Bat, at Organ Pipe Cactus National Monument, Arizona*. Final Report. March 1993.
Dannenberg 1992	Dannenberg, H.T. 1992. Wisconsin Air National Guard, Volk Field. Letter to Dick Masse, ANGRC. October 24, 1992.
Delaney et al. 1997	Delaney, D.K., T.G. Grubb, and L.L. Pater. 1997. Effects of Helicopter Noise on Nesting Mexican Spotted Owls. A Report to U.S. Air Force 49 CES/CEV Holloman Air Force Base. Project Order No. CE P.O. 95-4. July 1997.
Dexter 1995	Dexter, R . 1995. Wisconsin State Historic Preservation Officer. Personal communication with L. Gross, SAIC. May 31, 1995.
DOI 1995	U.S. Department of the Interior (DOI). 1995. Report on Effects of Aircraft Overflights on the National Park System, Report to Congress. National Park Service. July 1995.

DOI 1997 — U.S. Department of the Interior (DOI). 1997. Office of the Secretary, Office of Environmental Policy and Compliance. Letter from Don Henne, Regional Environmental Officer to Harry Knudsen, Air National Guard Environmental Division. Philadelphia, Pennsylvania. November 20, 1997.

DOI 1998 — U.S. Department of the Interior (DOI). 1998. U.S. Fish and Wildlife Service, Green Bay ES Field Office. Letter from Janet Smith, Field Supervisor, to Dick Masse, Air National Guard Environmental Division. Green Bay, Wisconsin. April 10, 1998.

DOI 1999 — U.S. Department of the Interior (DOI). 1999. U.S. Fish and Wildlife Serve, Green Bay ES Field Office. Letter from Janet Smith, Field Supervisor, to Dick Masse, Air National Guard Environmental Division, Green Bay, Wisconsin. November 9, 1999.

Edmonds 1979 — Edmonds, L.D. 1979. "Airport Noise and Teratogenesis," Archives of Environmental Health. July/August 1979.

Ellis 1981 — Ellis, D.H. 1981. Responses of Raptorial Birds to Low Level Military Jets and Sonic Booms. Results of U.S. Air Force and U.S. Fish and Wildlife Service Study. National Technical Information Service, Springfield, Virginia. NTIS ADA108-778.

Ellis et al. 1991 — Ellis, D.H., C.H. Ellis, and D.P. Mindell. 1991. "Raptor Responses to Low-Level Jet Aircraft and Sonic Booms." *Environment Pollution* 74:53-83.

Enderson 1996 — Enderson, J.H. 1996. The Colorado College. Letter to Richard Masse, ANG/CEVP, Andrews Air Force Base, MD, addressing peregrine falcons studied at Fort Carson, Colorado. September 19, 1996.

EPA 1974 — U.S. Environmental Protection Agency (EPA). 1974. Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare With an Adequate Margin of Safety. EPA-550/9-74-004. Washington, D.C.: U.S. Environmental Protection Agency. March 1974.

EPA 1992 — U.S. Environmental Protection Agency (EPA). 1992. *Procedures for Emission Inventory Preparation*. Volume IV: Mobile Sources. Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina. 1992.

FICON 1992 — Federal Interagency Committee on Noise (FICON). 1992. Federal Agency Review of Selected Airport Noise Analysis Issues. August 1992.

FICUN 1980 — Federal Interagency Committee on Urban Noise (FICUN). 1980. Guidelines for Considering Noise in Land-Use Planning and Control. Washington, D.C.: FICUN. June 1980.

Fidell et al. 1988	Fidell, S., T. Schultz, and D.M. Green. 1988. "A theoretical Interpretation of the Prevalence Rate of Noise-induced Annoyance in Residential Populations." J. Acoust. Soc. Am. 84(6). December.
Fidell et al. 1991	Fidell, S., Barger, D.S. et al. 1991. "Updating a Dosage-Effect Relationship for the Prevalence of Annoyance Due to General Transportation Noise," Journal of the Acoustical Society of America, 89. January 1991.
Fields and Powell 1985	Fields, James M. and Powell, C.A. 1985. A Community Survey of Helicopter Noise Annoyance Conducted Under Controlled Noise Exposure Conditions, NASA TM-86400, March 1985.
Finegold et al. 1994	Finegold, L.S., Harris, C.S., and von Gierke, H.E. 1994. "Community Annoyance and Sleep Disturbance: Updated Criteria for Assessing the Impacts of General Transportation Noise on People," Noise Control Eng. J., 42 (1), Jan-Feb 1994.
Fisch 1977	Fisch, L. 1977. "Research into effects of aircraft noise on hearing of children in exposed residential areas around an airport," Acoustics Letters, Vol. 1.
Fleming et al. 1996	Fleming, W.J., J.A. Dubovsky, and J.A. Collazo. 1996. An Assessment of the Effects of Aircraft Activities on Waterfowl at Piney Island, North Carolina. A Draft Final Report prepared for the U.S. Marine Corps Cherry Point Marine Air Station, Cherry Point, North Carolina. February 1996.
Fogari et al. 1994	Fogari, R., Zoppi, A., Vanasia, A., Marasi, G., and Villa, G. 1994. "Occupational noise exposure and blood pressure," Journal of Hypertension, 12.
Frerichs et al. 1980	Frerichs, R. R. et al. 1980. "Los Angeles Airport Noise and Mortality: Faulty Analysis and Public Policy," American Journal of Public Health. April 1980.
Garvin 1996	Garvin, O. 1996. Letter to the Wisconsin Air National Guard. Ho-Chunk Nation Legislature, Black River Falls, Wisconsin. August 19, 1996.
Gibbon 1986	Gibbon, G. 1986. "The Mississippian Tradition: Oneota Culture." In: Introduction to Wisconsin Archaeology. Background for Cultural Resource Planning. W. Green, J.B. Stoltman, and A.B. Kehoe, editors. *The Wisconsin Archaeologist* 67(3-4).
Gladwin and McKechnie 1993	Gladwin, D.N. and A.M. McKechnie. 1993. Review of the Treatment of Predicted Impacts to Biological Resources as Stated in the Draft Environmental Impact Statement (November 1993) for the Proposed Idaho Training Range. Prepared by Sterna Fuscata, Inc. for the Foundation for North American Wild Sheep.

Green et al. 1982	Green, K.B., Pasternack, B.S., Shore, R.E. 1982. "Effects of aircraft noise on hearing ability of school-aged children," Archives of Environmental Health, 37(5):284-289.
Griffin and Hopkins 1974	Griffin, D.R. and C.D. Hopkins. 1974. "Sounds Audible to Migrating Birds." *Animal Behavior*. 22:672-678.
Griffin et al. 1963	Griffin, D.R., J.J. McCue and A.D. Grinnell. 1963. The Resistance of Bats to Jamming. J. Exp. Zool. 152:229-250.
Grubb and Bowerman 1997	Grubb, T.G. and W.W. Bowerman. 1997. Variations in Breeding Bald Eagle Responses to Jets, Light Planes and Helicopters. The Journal of Raptor Research. 31(3): 213-222. September 1997.
Grubb and King 1991	Grubb, T.G. and R.M. King. Manuscript. Increasing Sensitivity of Disturbance Management for Breeding Bald Eagles Using Classification Tree Models. Submitted to *Condor*.
Harris 1979	Harris, C.M., Editor. 1979. Handbook for Noise Control. McGraw-Hill Book Company. 1979.
Hartikainen-Sorri et al. 1988	Hartikainen-Sorri, A.L., Sorri, M., Anttonen, H.P., Tuimala, R., and Laara, E. 1988. "Occupational noise exposure during pregnancy: a case control study," International Archives of Occupational and Environmental Health, 60.
Hartikainen-Sorri et al. 1994	Hartikainen-Sorri, A.L., Sorri, M., Anttonen, H.P., Tuimala, R., and Laara, E. 1994. "Effect of occupational noise on the course and outcome of pregnancy." Scandinavian Journal of Work and Environmental Health, 20.
Heinemann 1969	Heinemann, J.M. 1969. *Effects of Sonic Booms on the Hatchability of Chicken Eggs and Other Studies of Aircraft-Generated Noise Effects on Animals*. In: Proceedings of the Symposium on Extra-auditory Effects on Audible Sound. AAAS Annual Meeting, Boston, Massachusetts.
Henson and Grant 1991	Henson, P. and T.A. Grant. 1991. "The Effects of Human Disturbance on Trumpeter Swan Breeding Behavior." *Wild. Soc. Bull.* 19:248-257.
Herbold et al. 1989	Herbold, M., Hense, H.W., and Keil, U. 1989. "Effects of road traffic noise on prevalence of hypertension in men: results of the Luebeck Blood Pressure Study," Soz Praventivmed, 34.
Hercules 1989	Hercules, Inc. 1989. Green Dot and Red Dot Smokeless Gunpowder. Material Safety Data Sheet. Wilmington, Delaware. December 8, 1989.

Hessel & Sluis-Cremer 1994	Hessel, P.A. and Sluis-Cremer, G.K. 1994. "Occupational noise exposure and blood pressure: longitudinal and cross-sectional observations in a group of underground miners," Archives of Environmental Health,49.
Hirai et al. 1991	Hirai, A., Takata, M., Mikawa, M., Yasumoto, K., Iida, H., Sasayama, S., and Kagamimori, S. 1991. "Prolonged exposure to industrial noise causes hearing loss but not high blood pressure: a study of 2124 factory laborers in Japan," Journal of Hypertension, 9.
Ho-Chunk Historic Preservation Department, no date	Ho-Chunk Historic Preservation Department. No date. Ho-Chunk Village Sites. Black River Falls, Wisconsin.
Ho-Chunk Nation 1996	Ho-Chunk Nation. 1996. Map of Proposed Low-Level Flight Corridor. Ho-Chunk Nation Geographic Information System (GIS). August 1996.
Holloman 1995	Holloman Air Force Base. 1995. Aircraft Engine Testing. Holloman AFB, New Mexico. 1995
Holthuijzen 1989	Holthuijzen, A.M.A. 1989. *Behavior and Productivity of Nesting Prairie Falcons in Relation to Construction Activities at Swan Falls Dam*. Final Report. Idaho Power Company; Bureau of Land Management. Boise, Idaho. August 1989.
Howell 1992	Howell, D. 1992. *Noise Effect Assessment on Leptonycteris curasoae at Fort Huachuca, AZ.* Draft to Environmental Assessment, Department of the Army, Fort Huachuca Garrison, Test and Experimentation Command.
HQ TAC 1989	HQ Tactical Air Command (HQ TAC). 1989. Memo: Self Protection Flare Training. HQ TAC: Langley AFB, Virginia.
Hurley 1986	Hurley, W.M. 1986. "The Late Woodland Stage: Effigy Mound Culture." In: Introduction to Wisconsin Archaeology. Background for Cultural Resource Planning. W. Green, J.B. Stoltman, and A.B. Kehoe, editors. *The Wisconsin Archaeologist* 67(3-4).
Ising and Michalak 1990	Ising, H. and Michalak, R. 1990. "Effects of noise from military low-level flights on humans. Part II," in Noise as a Public Health Problem, 4: 305-315. New Advances in Noise Research. Part I. *Proceedings of the International Congress (5th)*, eds. Berglund, B., Berglund, U., Karlsson, J., Lindvall, T. Stockholm, Sweden: Swedish Council for Building Research.
Ising and Rebentisch 1993a	Ising, H. and Rebentisch, E. 1993a. "Comparison of acute reactions and long-term extra-aural effects of occupational and environmental noise exposure," In: M. Vallet (ed.) Noise as a public health problem. Arcueil Cedex, France: INRETS Vol. 3.

Ising and Rebentisch 1993b — Ising, H. and Rebentisch, E. 1993b. "Results of a low-altitude flight noise study in Germany: aural effects," In H. Ising and B. Kruppa (eds.) Noise and Disease, Proceedings of the International Symposium held in Berlin, September 26-28, 1991. Gustav Stuttgart: Fisher. 1993.

Ising et al. 1990a — Ising, H., Rebentisch, E., Poustka, F., and Curio, I. 1990. "Annoyance and health risk caused by military low-altitude flight noise," International Archives of Occupational and Environmental Health, 62.

Ising et al. 1990b — Ising, H., Rebentisch, E., Babisch, W., Curio, I., Sharp, D., and Baumgartner, H. 1990. "Medically relevant effects of noise from military low-altitude flights-results of an interdisciplinary pilot study," Environment International, 116.

Jackson 1961 — Jackson, H.H.T. 1961. Mammals of Wisconsin. University of Wisconsin Press. Madison, Wisconsin

Jackson et al. 1977 — Jackson, J.A., B.J. Schardien, and T.H. McDaniel. 1977. "Opportunistic Hunting of a Marsh Hawk on a Bombing Range." *Raptor Research*. 11:86.

Jagielski and O'Brien 1994 — Jagielski, K.D. and R.J. O'Brien. 1994. "Calculation Methods for Criteria Air Pollutant Emission Inventories." Armstrong Laboratory, Brooks AFB, Texas. Report No. AL/OE-TR-1994-0049. July 1994.

Jehl and Cooper 1980 — Jehl, J.R., and C.F. Cooper, eds. 1980. *Potential Effects of Space Shuttle Booms on the Biota and Geology of the California Channel Islands: Research Reports*. Center for Marine Studies, San Diego State Univ., San Diego, California Technical Report. 80-1. December 1980.

Jenkins et al. 1981 — Jenkins, L., Tarnopolsky, A., and Hand, D. 1981. "Psychiatric admissions and aircraft noise from London Airport: four-year, three hospitals' study," Psychological Medicine, 11.

Johnson and Reynolds 1996 — Johnson, C.L. and R.T. Reynolds. 1996. Responses of Mexican Spotted Owls to Military Fixed-Wing Overflights. USDA Rocky Mountain Forest and Range Experimental Station. Fort Collins, Colorado. November 22, 1996.

Jones and Tauscher 1978 — Jones, F.N. and Tauscher, J. 1978. "Residence Under an Airport Land Pattern as a Factor in Teratism," Archives of Environmental Health. January/February 1978.

Kabuto and Suzuki 1979 — Kabuto, M. and Suzuki, S. 1979. "Temporary threshold shift from transportation noise," Journal of the Acoustical Society of America, 66 (1) July 1979.

Karagodina et al. 1969	Karagodina, I.L., Soldatkina, S.A., Vinokur, I.L., and Klimukhin, A.A. 1969. "Effect of aircraft noise on the population near airports," Hygiene and Sanitation, 34 (English translation).
King et al. 1988	King, W.K., D.L. Carver, and D.M. Worley. 1988. Vibration Investigation of the Museum Building at White Sands National Monument, New Mexico. U.S. Department of the Interior, Geological Survey. Open-File Report 88-544. 1988.
Knipschild 1977a	Knipschild, P. 1977a. "Medical effects of aircraft noise: Community cardiovascular survey," International Archives of Occupational and Environmental Health, 40.
Knipschild 1977b	Knipschild, P. 1977b. "Medical effects of aircraft noise: General practice survey," International Archives of Occupational and Environmental Health, 40.
Knipschild and Oudshoorn 1977	Knipschild, P. and Oudshoorn, N. 1977. "Medical effects of aircraft noise: Drug survey," International Archives of Occupational and Environmental Health, 40.
Knipschild and Salle 1979	Knipschild, P. and Salle, H. 1979. "Road traffic noise and cardiovascular disease: a population study in the Netherlands," International Archives of Occupational and Environmental Health, 44.
Knipschild et al. 1981	Knipschild, P., Meijer, H., and Salle, H. 1981. "Aircraft noise and birthweight," International Archives of Occupational and Environmental Health, 48.
Koszarny et al. 1976	Koszarny, Z., Maziarka, S., and Szata, W. 1976. "The effect of airplane noise on the residents of regions in the area of the airport Okecie in Warsaw," Roczniki Pantstwowego Zakladu Higieny, 27 (English translation).
Krausman et al. 1986	Krausman, P.R., B.D. Leopold, and D.L. Scarbrough. 1986. "Desert Mule Deer Response to Aircraft." *Wildl. Soc. Bull.* 14:68-70.
Kristal-Boneh et al. 1995	Kristal-Boneh, E., Melamed, S., Harari, G., and Green, M.S. 1995. "Acute and chronic effects of noise exposure on blood pressure and heart rate among industrial employees: The Cordis Study," Archives of Environmental Health, 50.
Kryter 1984	Kryter, K. D. 1984. Physiological, Psychological, and Social Effects of Noise. NASA Reference Publication 1115. July 1984.
Kryter 1990	Kryter, K.D. 1990. "Aircraft noise and social factors in psychiatric hospital admission rates: a re-examination of some data," Psychological Medicine, 20.

Kurppa et al. 1989 — Kurppa, K., Rantala, K., Nurminen, T., Holmberg, P.C., and Starck, J. 1989. "Noise exposure during pregnancy and selected structural malformations in infants," Scandinavian Journal of Work and Environmental Health, 15.

Lamp 1989 — Lamp, R.E. 1989. *Monitoring the Effects of Military Air Operations at the Fallon Naval Air Station on the Biota of Nevada*. Nevada Department of Wildlife.

Lang et al. 1992 — Lang, T., Fouriaud, C., Jacquinet-Salord, M.C. 1992. "Length of occupational noise exposure and blood pressure," International Archives of Occupational and Environmental Health, 63.

Leibsch et al. 1992 — Leibsch, E.J., J.B. Harper, J.M. Bownds, M.W. Yambert, M.T. Moss. 1992. Multiple-Aircraft Instantaneous Line Source (MAILS) Dispersion Model User's Guide. Oak Ridge National Laboratory, Air Force Engineering & Services Center, ESL-TR-89-59. Tyndall Air Force Base, Florida. March 1992.

Lowe 1996 — Lowe, C.A., Jr. 1996. Memorandum to the Wisconsin Air National Guard. Ho-Chunk Nation, Office of the President. Black River Falls, Wisconsin. August 19, 1996.

Lucas and Calamia 1994 — Lucas, M.J. and P.T. Calamia. 1996. Military Operations Area and Range Noise Model: NRNMAP User's Manual. Final, Wright-Patterson AFB, Ohio: AAMRL. AL/OE-MN-1996-0001.

Lucas and Plotkin 1988 — Lucas, M. and Plotkin, K. 1988. ROUTEMAP Model for Predicting Noise Exposure From Aircraft Operations on Military Training Routes. Final, Wright-Patterson AFB, Ohio: AAMRL. AAMRL-TR-88-060. 1988.

Lurie 1978 — Lurie, N.O. 1978. "Winnebago." In Handbook of North American Indians, Vol. 15. Smithsonian Institution. Washington, D.C. 1978.

Manci et al. 1988 — Manci, K.M., D.N. Gladwin, R. Villella, and M.G. Cavendish. 1988. *Effects of Aircraft Noise and Sonic Booms on Domestic Animals and Wildlife: A Literature Synthesis*. U.S. Fish and Wildlife Service, National Ecology Research Center, Fort Collins, Colorado. NERC - 88/29

Martin 1965 — Martin, L. 1965. The Physical Geography of Wisconsin. University of Wisconsin Press, Madison, Wisconsin.

Marzluff et al. 1994 — Marzluff, J.M., L.S. Schueck, M. Vekasy, B.A. Kimsey, M. McFadzen, R.R. Townsend, and J.O. McKinley. 1994. "Influence of Military Training on the Behavior of Raptors in the Snake River Birds of Prey National Conservation Area." In: *Snake River Birds of Prey Area 1994 Annu. Rep*. K. Steenhof, ed. Pp. 41-112. U.S.D.I., BLM, Boise, Idaho.

Mason 1986	Mason, R.J. 1986. "The Paleo-Indian Tradition." In: Introduction to Wisconsin Archaeology. Background for Cultural Resource Planning. W. Green, J.B. Stoltman, and A.B. Kehoe, editors. *The Wisconsin Archaeologist* 67(3-4).
Matson 1997	Matson, G. 1997. Wildlife Technician. Wisconsin Department of Natural Resources, Black River Falls. Personal communication with C. Frost, SAIC. April 3, 1997.
McCarty and Jen 1983	McCarty, J.K. and P.H.S. Jen. 1983. "Bats Reject Clutter Interference for Moving Targets More Successfully than for Stationary Ones." *Journal of Comparative Physiology*. 152(4):447-454.
Meecham and Shaw 1979	Meecham, W. C. and Shaw, N. 1979. "Effects of Jet Noise on Mortality Rates," British Journal of Audiology. August 1979.
Meecham and Shaw 1988	Meecham, W.C. and Shaw, N. 1988. "Increase in disease mortality rates due to aircraft noise," in Noise as a Public Health Problem, Vol 3: Performance, Behavior, Animal, Combined Agents and Community Responses. *Proceedings of the International Congress (5th)*, eds. Berglund, B., Berglund, U., Karlsson, J., Lindvall, T. Stockholm, Sweden: Swedish Council for Building Research. Also reported In H. Ising and B. Kruppa (eds.) Noise and Disease, Proceedings of the International Symposium held in Berlin, September 26-28, 1991. Gustav Stuttgart: Fisher, 1993.
Michalak et al. 1990	Michalak, R., Ising, H., and Rebentisch, E. 1990. "Acute circulatory effects of military low-altitude flight noise," International Archives of Occupational and Environmental Health, 62 (5).
Montgomery Watson 1995	Montgomery Watson. 1995. Phase I Environmental Baseline Survey. Hardwood Range Expansion, Wood County, Wisconsin. Prepared for the ANGRC. Andrews AFB, Maryland. May 1995.
Moulton 1992	Moulton, C.L. 1992. Air Force Procedure for Predicting Noise Around Airbases: Noise Exposure Model (NOISEMAP) Technical Report, AL-TR-1992-059. 1992.
National Register of Historic Places 1997	National Register of Historic Places World Wide Web National Register Information System http://www.nr.nps.gov/scripts. 1997. Listing of National Register Properties for Juneau, Clark, and Jackson Counties, Wisconsin. March 27, 1997.
NATO 1994	North Atlantic Treaty Organization (NATO). 1994. Effects of Topography on Propagation of Noise in the Vicinity of Airfields. Final Report of the NATO/CLMS Working Group Study, #200. June 1994.

Naval Flight Safety Center 1996	Naval (U.S. Navy) Flight Safety Center. 1996. Personal communications throughout 1996 from various individuals of the U.S. Navy Flying Safety Center with William Wuest, SAIC. Norfolk, Virginia.
Neumann 1997	Neumann, G. 1997. Personal communications. Range Operations Officer, Hardwood Range. Wisconsin Air National Guard.
NGB 1990	National Guard Bureau (NGB). 1990. Establishment of the Air Combat Maneuvering Instrumentation (ACMI) and Modification to Airspace for the Wisconsin Air National Guard, Volk Field. Final Environmental Assessment. June 8, 1990.
NGB 1997	National Guard Bureau (NGB). 1997. Draft Biological Survey Report of the Proposed Hardwood Range Expansion, Existing Hardwood Bombing and Gunnery Range, and Volk Field. Stone and Webster for the Air National Guard. Falls Church, Virginia. May 1997.
Nixon et al. 1993	Nixon, C.W., West, D.W., and Allen, N.K. 1993. "Human auditory response to aircraft flyover noise," In: M. Vallet (ed.) Noise as a Public Health Problem. Arcueil Cedex, France: INRETS Vol. 2.
NRC NAS 1977	The National Research Council, National Academy of Sciences (NRC NAS). 1977. Guidelines for Preparing Environmental Impact Statements on Noise. 1977.
Nurminen and Kurppa 1989	Nurminen, T. and Kurppa, K. 1989. "Occupational noise exposure and course of pregnancy," Scandinavian Journal of Work and Environmental Health, 15.
Olson 1995	Olson. 1995. Public Affairs Officer. Wisconsin Air National Guard. Personal communications to William Wuest, SAIC. April 1995.
OSHA 1983	Occupational Safety and Health Administration (OSHA). "Occupational Noise Exposure Standard." *Code of Federal Regulations, title 29, part 1910, sec. 1910.95 (29 CFR 1910.95).* Federal Register vol. 48. 28 June 1983, p. 29687-29698.
Otten et al. 1988	Otten, H., Schultz, W., and von Eiff, A.W. 1988. "Traffic noise, blood pressure and other risk factors: the Bonn traffic noise study," in Noise as a Public Health Problem, 4. New Advances in Noise Research. Part I. *Proceedings of the International Congress (5th)*, eds. Berglund, B., Berglund, U., Karlsson, J., Lindvall, T. Stockholm, Sweden: Swedish Council for Building Research.
Parnell et al. 1972	Parnell, J., Nagel, D., and Cohen, A. 1972. "Evaluation of hearing levels of residents living near a major airport," DOT FAA Report No. 72-72, Washington, D.C.

Passchier-Vermeer 1993	Passchier-Vermeer, W. 1993. Noise and Health. Health Council of the Netherlands. The Hague, 1-253, 1993.
Pearsons et al. 1989	Pearsons, K. S., Barber, D. S. et al. 1989. Analyses of the Predictability of Noise-Induced Sleep Disturbance. USAF Report HSD-TR-89-029. October 1989.
Plotkin et al. 1991	Plotkin, K.J., Bradley, K.A., Molino, J.A., Helbing, K.G., and Fischer, D.S. 1991. The Effect of Onset Rate on Aircraft Noise Annoyance. Volume 1: Laboratory Experiments, Wyle Laboratories Research Report WR 91-19. November 1991.
Plotkin et al. 1993	Plotkin, K.J., C.L. Moulton, and R.A. Lee. 1993. "Incorporation of Topography Effects in Aircraft Noise Modeling." *NOISE-CON 93 Proceedings*, pp. 595-600, May.
Poole 1981	Poole, A. 1981. "The Effect of Human Disturbance on Osprey Reproductive Success." *Colonial Waterbirds* 4:20-27.
Pulles et al. 1988	Pulles, T., Biesiot, W., and Stewart, R. 1988. "Adverse effects of environmental noise on health: an interdisciplinary approach," in Noise as a Public Health Problem, 4. New Advances in Noise Research. Part I. *Proceedings of the International Congress (5th)*, eds. Berglund, B., Berglund, U., Karlsson, J., Lindvall, T. Stockholm, Sweden: Swedish Council for Building Research.
Rand McNally 1997	Rand McNally. 1997. 1997 Commercial Atlas and Marketing Guide. 128th Edition. Rand McNally & Company.
Regecova and Kellerova 1995	Regecova, V., and Kellerova, E. 1995. "Effects of urban noise pollution on blood pressure and heart rate in preschool children," Journal of Hypertension, 13.
Rehm and Jansen 1978	Rehm, S. and Jansen, G. 1978. "Aircraft noise and premature birth," Journal of Sound and Vibration, 59 (1).
Robbins 1991	Robbins, S.D., Jr. 1991. Wisconsin Birdlife/Population and Distribution Past and Present. University of Wisconsin Press. Madison, Wisconsin.
SAIC 1996	Science Applications International Corporation (SAIC). 1996. Draft Socioeconomic Study for the Hardwood Range Expansion. Prepared for Environmental Division, Air National Guard Readiness Center. Andrews AFB, Maryland. April 1996.
SAIC 1998	Science Applications International Corporation (SAIC). 1998. Final Socioeconomic Study for the Hardwood Range Expansion. Prepared for Environmental Division, Air National Guard Readiness Center. Andrews AFB, Maryland. April 1998.

Salzer 1986	Salzer, R.J. 1986. "The Woodland Tradition – An Introduction." In: Introduction to Wisconsin Archaeology. Background for Cultural Resource Planning. W. Green, J.B. Stoltman, and A.B. Kehoe, editors. *The Wisconsin Archaeologist* 67(3-4).
Sax and Lewis 1987	Sax, N.I. and R.J. Lewis. 1987. Hazardous Chemicals Desk Reference. New York: Van Nostrand Reinhold Company.
SCAQMD 1993	South Coast Air Quality Management District (SCAQMD). 1993. "California Environmental Quality Act (CEQA) Air Quality Handbook." April 1993.
Schell 1981	Schell, L.M. 1981. "Environmental noise and human prenatal growth," American Journal of Anthropology, 56.
Schmeck and Poustka 1993	Schmeck, K. and Poustka, F. 1993. "Psychophysiological and psychiatric tests with children and adolescents in a low-altitude flight region," In H. Ising and B. Kruppa (eds.) Noise and Disease, Proceedings of the International Symposium held in Berlin, September 26-28, 1991. Gustav Stuttgart: Fisher.
Schmidt and Joermann 1987	Schmidt, U. and G. Joermann. 1987. "The Influence of Acoustical Interference on Echolocation in Bats." *Mammalia.* 50(3):379-390.
Schulte and Otten 1993	Schulte, W. and Otten, H. 1993. "Results of a low-altitude flight noise study in Germany: long-term extra-aural effects," In H. Ising and B. Kruppa (eds.) Noise and Disease, Proceedings of the International Symposium held in Berlin, September 26-28, 1991. Gustav Stuttgart: Fisher.
Schultz 1978	Schultz, T.J. 1978. "Synthesis of Social Surveys on Noise Annoyance," Journal of the Acoustical Society of America, 64. August 1978.
Schweinsburg 1974	Schweinsburg, R.E. 1974. "Disturbance Effects of Aircraft to Waterfowl on North Slope Lakes, June, 1972." In: Gunn, W.W. and J.A. Livingston, eds. *Arctic Gas Biological Report Series Vol. 14.*
Simmons et al. 1974	Simmons, J.A., W.A. Lavender and B.A. Lavender. 1974. "Quantitative Effects of Noise on Sonar Performance in Bats." *J. of the Acoustical Society of America.* 56(S):S38-S38 (abstract only).
Smith 1992	Smith, D.L., Editor. 1992. Parks Directory of the United States. Frederick G. Ruffner, Publisher. Detroit, Michigan. 1992.
Spindler 1978	Spindler, L.S. 1978. "Menominee." Handbook of North American Indians, Vol. 15. Smithsonian Institution. Washington, D.C. 1978.

Spreng 1990 — Spreng, M. 1990. "Effects of noise from military low-level flights on humans. Part I," in Noise as a Public Health Problem, 4: 293-303. New Advances in Noise Research. Part I. *Proceedings of the International Congress (5th)*, eds. Berglund, B., Berglund, U., Karlsson, J., Lindvall, T. Stockholm, Sweden: Swedish Council for Building Research. Also similar data in Spreng, M. 1993. "Specific features of military low-altitude flight noise: criteria for risk of damage and physiological effects," in H. Ising and B. Kruppa (eds.) Noise and Disease, Proceedings of the International Symposium held in Berlin, September 26-28, 1991. Gustav Stuttgart: Fisher.

Spreng 1993 — Spreng, M. 1993. "Specific features of military low-altitude flight noise: criteria for risk of damage and physiological effects," in H. Ising and G. Kruppa (eds.) Noise and Disease, Proceedings of the International Symposium held in Berlin September 26-28, 1991. Gustav Stuttgart: Fisher, pp. 282-286, 1993. (In German pp. 271-281).

Spreng et al. 1988 — Spreng, M., Leupold, S., and Emmert, B. 1988. Mögliche Gehörschäden durch Tieffluglärm. Report 10501213/04, Umweltbundesamtes, Berlin. April 1988. (Original data for Spreng 1990 and 1993).

Stadelman 1958 — Stadelman, W.J. 1958. "The Effect of Sounds of Varying Intensity on Hatchability of Chicken Eggs." *Poultry Sci.* 37:166-169.

Stansfeld 1992 — Stansfeld, S.A. 1992. "Noise, noise sensitivity and psychiatric disorder: epidemiological and psychophysical studies," Psychological Medicine Monograph, Suppl. 22.

Stansfeld et al. 1993 — Stansfeld, S.A., Sharp, D.S., Gallacher, J., and Babisch, W. 1993. "Road traffic noise, noise sensitivity and psychological disorder," Psychological Medicine, 23.

Stoltman 1986 — Stoltman, J.B. 1986. "The Archaic Tradition." In: Introduction to Wisconsin Archaeology. Background for Cultural Resource Planning. W. Green, J.B. Stoltman, and A.B. Kehoe, editors. *The Wisconsin Archaeologist* 67(3-4).

Stusnick et al. 1992 — Stusnick, E., Bradley, K.A., Molino, J.A., and deMiranda, G. 1992. The Effect of Onset Rate on Aircraft Noise Annoyance. Volume 2: Rented Home Experiment, Wyle Laboratories Research Report WR 92-3 (R), March 1992.

Stusnick et al. 1993 — Stusnick, E., Bradley, K.A., Bossi, M.A., Molino, J.A., and Rickert, D.G. 1993. The Effect of Onset Rate on Aircraft Noise Annoyance. Volume 3: Hybrid Own-Home Experiment, Wyle Laboratories Research Report WR 93-22, December 1993.

Sutherland 1989 — Sutherland, L. 1989. Wyle Research Report WR 89-16: Assessment of Potential Structural Damage from Low Altitude Subsonic Aircraft. El Segundo, California.

Sutherland 1990	Sutherland, L.C. 1990. *Assessment of Potential Structural Damage from Low Altitude Subsonic Aircraft*. Wyle Laboratories Report WR 89-16(R). June 1990.
Thompson 1981	Thompson, S.J. 1981. Epidemiology feasibility study: effects of noise on the cardiovascular system. Washington, DC: EPA Report 550/9-81-103.
Thompson 1996	Thompson, S.J. 1996. "Non-auditory health effects of noise: updated review," Proceeding of Inter-Noise 96, Book 4, August 1996.
Thompson and Fidell 1992	Thompson, S.J. and Fidell, S. 1992. "A review of epidemiologic studies of the effect of hearing protection devices on cardiovascular response to noise exposure," Proceedings of the Hearing Conservation Conference, University of Kentucky, Lexington, Kentucky, 40506-0046, April 1992.
Troest and Mohl 1986	Troest, N. and B. Mohl. 1986. "The Detection of Phantom Targets in Noise by Serotine Bats; Negative Evidence for the Coherent Receiver." *J. of Comparative Physiology (A).* 159:559-567.
U.S. Air Force 1994	U.S. Air Force. 1994. Air Force Instruction (AFI) 13-212 Volume III, Hazard Methodology and Weapon Safety Footprints. December 16, 1994.
U.S. Air Force 1997	U.S. Air Force 1997. Department of the Air Force Interim Guide for Environmental Justice Analysis with the Environmental Impact Analysis Process. November 1997.
U.S. Army Corps of Engineers 1987	U.S. Army Corps of Engineers (USACE). 1987. Corps of Engineers Wetlands Delineation Manual. Waterways Experiment Station, Vicksburg, Mississippi. January 1987.
U.S. Bureau of Economic Analysis 1994	U.S. Bureau of Economic Analysis. 1994. Department of Commerce. Regional Economic Information System 1969-1992. CD-ROM. Washington, D.C. May 1994.
U.S. Bureau of the Census 1994	U.S. Bureau of the Census. 1994. Department of Commerce. USA Counties 1994. CD-94-CTY-02. Washington, D.C. December 1994.
U.S. Bureau of the Census 1996	U.S. Bureau of the Census. 1996. Department of Commerce. USA Counties 1996 CD-ROM. Washington, D.C.
U.S. Bureau of the Census 1998	U.S. Bureau of the Census. 1998. USA Counties 1998 on CD-ROM. Prepared by the U.S. Bureau of the Census. 1998
U.S. Bureau of the Census 1999	U.S. Bureau of the Census. 1999. Estimates of the Population of Counties by Age, Sex, and Race/Hispanic Origin: 1990 to 1997 on CD-ROM. Prepared by the U.S. Bureau of the Census. 1999.

U.S. Forest Service 1992	U.S. Forest Service. 1992. Report to Congress, Potential Impacts of Aircraft Overflights of National Forest System Wilderness. Prepared pursuant to Section 5, Public Law 100-91, National Park Overflights Act of 1987. January 1992.
U.S. Geological Survey 1971	U.S. Geological Survey. 1971. Water Resources of Wisconsin Central Wisconsin River Basin. Hydrologic Investigations Atlas HA-367. Washington, D.C.
U.S. Geological Survey 1989	U.S. Geological Survey. 1989. *Hydrogeology of Wood County, Wisconsin*. U.S. Geological Survey Information Circular 60
U.S. Soil Conservation Service 1991	U.S. Soil Conservation Service. 1991. Soil Survey of Juneau County, Wisconsin. U.S. Government Printing Office, Washington, D.C.
U.S. West Research 1992	U.S. West Research. 1992. *Historical Records and Literature Search of the History of the Hardwood Air-to-Ground Range Area*. Prepared under contract to the Mississippi Valley Archaeological Center for the Wisconsin Air National Guard. La Crosse, Wisconsin. March 15, 1992.
USAF BASH Team 1997	U.S. Air Force (USAF) Bird Aircraft Strike Hazard (BASH) Team. 1997. Personal communication from Richard Masse, National Guard Bureau.
USAF Flying Safety Center 1996	U.S. Air Force (USAF) Flying Safety Center. 1996. Personal communications throughout 1996 from various individuals of the USAF Flying Safety Center with William Wuest, SAIC. Kirtland AFB, NM.
USDOT 1984	U.S. Department of Transportation (USDOT). 1984. Airport Noise Compatibility Planning; Development and Submission of Airport Operator's Noise Exposure Map and Noise Compatibility Program; Final Rule and Request for Comments. 14 CFR Parts 11 and 150, *Federal Register*, Vol. 49, No. 244, December 18, 1984.
USFWS 1994	U.S. Fish and Wildlife Service (USFWS). 1994. Necedah National Wildlife Refuge, Wisconsin. GPO: 1994-0-559-143. Washington, D.C. 1994.
USFWS 1995	U.S. Fish and Wildlife Service (USFWS). 1995. Green Bay Ecological Services Field Office. Letter from Janet M. Smith, USFWS, to Jeffrey Weiler, Science and Engineering Associates, Inc. (SEA). July 11, 1995.
USFWS 1997	U.S. Fish and Wildlife Service (USFWS). 1997. Green Bay Ecological Services Field Office. Letter from Janet M. Smith, USFWS, to Harry Knudsen, Air National Guard Readiness Center. June 30, 1997.

Vogt 1981	Vogt, R.C. 1981. Natural history of amphibians and reptiles in Wisconsin. Milwaukee Public Museum. Milwaukee, Wisconsin
von Eiff et al. 1982	von Eiff, A.W., Friedrich, G., and Neus, H. 1982. "Traffic noise, a factor in the pathogenesis of essential hypertension," Contr. Nephrol., 30.
von Gierke 1990	von Gierke, H.R. 1990. "The Noise-Induced Hearing Loss Problem." NIH Consensus Development Conference on Noise and Hearing Loss. Washington, D.C. January 22 - 24, 1990.
Ward and Stehn 1989	Ward, D. and R. Stehn. 1989. *Response of Brant and Other Geese to Aircraft Disturbances at Izembek Lagoon, Alaska.* USFWS Alaska Fish and Wildlife Research Center, Anchorage.
Ward et al. 1976	Ward, W.P., Cushing, and Burns. 1976. "TTS from neighborhood aircraft noise," Journal of the Acoustical Society of America, 60 (1), July 1976.
WCFA 1987	Wisconsin County Forests Association (WCFA). 1987. Wisconsin's County Forests. Phillips, Wisconsin. 1987.
WCFA, no date	Wisconsin County Forests Association (WCFA). No date. Parks Directory. Mobil, Wisconsin.
WDNR 1986	Wisconsin Department of Natural Resources (WDNR). 1989. Wood County Wildlife Area. Publication - WM-89 86 8650. Sandhill-Meadow Valley Work Unit. Babcock, Wisconsin. 1986.
WDNR 1988	Wisconsin Department of Natural Resources (WDNR). 1988. Wisconsin Wetland Inventory Maps, T21N, R3E and R4E, Wood County.
WDNR 1992	Wisconsin Department of Natural Resources (WDNR). 1992. Wisconsin Wetland Inventory Maps, T20N, R3E and R4E, Juneau County.
WDNR 1995a	Wisconsin Department of Natural Resources (WDNR). 1995. Letter from George Meyer, WDNR, to Jeffrey Weiler, Science and Engineering Associates, Inc. (SEA). March 22, 1995.
WDNR 1995b	Wisconsin Department of Natural Resources (WDNR). 1995. Letter from Charles Pils, WDNR, to Scott Storlid, JJR Incorporated. Natural Heritage Database information, including Wisconsin threatened and endangered species and species of special concern. August 18, 1995.
WDNR 1997a	Wisconsin Department of Natural Resources (WDNR). 1997. Letter from Charles Pils, WDNR, to Michele Fikel, Science Applications International Corporation. April 23, 1997.

WDNR 1997b — Wisconsin Department of Natural Resources (WDNR). 1997. Natural Heritage Database information, including Wisconsin threatened and endangered species and species of special concern. April 1997.

WDT 1993 — Wisconsin Division of Tourism (WDT). 1993. Snowmobile Trail Map of Wisconsin. Wisconsin Department of Development, Division of Tourism. Cartographic Laboratory, University of Wisconsin - Madison. Mosinee, Wisconsin. June 1993.

Weisenberger et al. 1996 — Weisenberger, M.E., P.R. Krausman, M.C. Wallace, D.W. De Young, and O. Eugene Maughan. 1996. "Effects of Simulated Jet Aircraft Noise on Heart Rate and Behavior of Desert Ungulates." *J. Wild. Manage.* 60:52-61.

Wesler 1977 — Wesler, J. E. 1977. "Concord Operations At Dulles International Airport." NOISE-EXPO '77, Chicago, IL. March 1977.

White and Thurow 1985 — White, C.M. and T.L. Thurow. 1985. "Reproduction of Ferruginous Hawks Exposed to Controlled Disturbance." *Condor* 85:14-22.

WIANG 1992 — Wisconsin Air National Guard (WIANG). 1992. Supplement to Range Operating Procedures for the Hardwood Range. Volk Field. 1992.

WIANG 1994 — Wisconsin Air National Guard (WIANG). 1994. *Integrated Land Use Management Plan, Volk Field Air National Guard Base, Camp Douglas, Wisconsin.* T N & Associates, Inc. May 10, 1994.

WIANG 1996 — Wisconsin Air National Guard (WIANG). 1996. Draft Land Use Management Guidelines, Hardwood Air-to-Surface Gunnery Range. Montgomery Watson and Johnson, Johnson & Roy, Inc. for the Air National Guard. Andrews Air Force Base, Maryland. August 1996.

WIANG 1997 — Wisconsin Air National Guard (WIANG). 1997. Final Land Use Management Guidelines, Hardwood Air-to-Surface Gunnery Range, Juneau and Wood Counties, Wisconsin. Prepared for Air National Guard. Andrews AFB, Maryland. December 1997.

WIANG 1998 — Wisconsin Air National Guard (WIANG). 1998. Biological Survey Final Report: Proposed Hardwood Range Expansion, Existing Hardwood Bombing and Gunnery Range, and Volk Field. Volk Field Combat Readiness Training Center. Camp Douglas, Wisconsin. February 1998.

Wisconsin SHPO 1992 — Wisconsin State Historic Preservation Officer (SHPO). 1992. Letter from R. Dexter, Wisconsin SHPO, to D. Beck, Volk Field. September 13, 1992.

Wisconsin SHPO 1995	Wisconsin State Historic Preservation Officer (SHPO). 1995. Letter from R. Dexter, Wisconsin SHPO, to L. Gross, SAIC. July 6, 1995.
Wood County 1995	Wood County, Wisconsin. 1995. 1995 Statistical Report of Property Valuations.
Workman et al. 1992a	Workman, G.W., T.D. Bunch, J.W. Call, R.C. Evans, L.S. Neilson, and E.M. Rawlings. 1992a. "Sonic boom and other disturbance impacts on pronghorn antelope (*Antilocapra americana*)." In: Sonic Boom/Animal Distribution Studies on Pronghorn Antelope, Rocky Mountain Elk and Bighorn Sheep. Utah State University. February 1992.
Workman et al. 1992b	Workman, G.W., T.D. Bunch, J.W. Call, R.C. Evans, L.S. Neilson, and E.M. Rawlings. 1992b. "Sonic boom and other disturbance impacts on Rocky Mountain Elk (*Cervic canadensis*)." In: Sonic Boom/Animal Distribution Studies on Pronghorn Antelope, Rocky Mountain Elk and Bighorn Sheep. Utah State University. February 1992.
Worldwide BASH Conference 1990	Worldwide Bird Aircraft Strike Hazard (BASH) Conference. 1990. *Worldwide Bird Aircraft Strike Hazard Conference Report*. Little Rock, Arkansas. April 10-12.
Wu et al. 1993	Wu, T-N., Chiang, H-C., Huang, J-T., Chang, P-Y. 1993. "Comparison of blood pressure in deaf-mute children and children with normal hearing: association between noise and blood pressure," International Archives of Occupational and Environmental Health, 65.
Wu et al. 1995	Wu, T-N., Lai, J-S., Shen, C-Y., Yu, T-S., and Chang, P-Y. 1995. "Aircraft noise, hearing ability, and annoyance," Archives of Environmental Health, 50 (6).
Wu et al. 1996	Wu, T-N., Chen, L-J., Lai, J-S., Ko, G-N., Shen, C-Y., and Chang, P-Y. 1996. "Prospective study of noise exposure during pregnancy on birth weight," American Journal of Epidemiology, 143(8).
Zeckmeister 1992	Zeckmeister, M.T. 1992. Wisconsin Department of Natural Resources. Letter to Richard Masse, ANGRC. October 9, 1992.
Zhang et al. 1992	Zhang, J., Cai, W-W., and Lee, D.J. 1992. "Occupational hazards and pregnancy outcomes," American Journal of Industrial Medicine, 21.
Zhao et al. 1991	Zhao, Y.M., Zhang, S.Z., Selvin, S., and Spear, R.C. 1991. "A dose-response relation for noise-induced hypertension," British Journal of Industrial Medicine, 48.

SECTION 8

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SECTION 9

ABBREVIATIONS AND ACRONYMS

9. ABBREVIATIONS AND ACRONYMS

μg/m³	micrograms per cubic meter
ACHP	Advisory Council on Historic Preservation
ACMI	Air Combat Maneuvering Instrumentation
AFB	Air Force Base
AFI	Air Force Instruction
AGL	above ground level
AMRAAM	Advanced Medium Range Air-to-Air Missile
ANG	Air National Guard
ANGRC	Air National Guard Readiness Center
AST	above ground storage tank
AW	Airlift Wing
BA	biological assessment
BAM	Bird Avoidance Model
BASH	bird-aircraft strike hazard
BDU	bomb dummy unit
BLM	Bureau of Land Management
BW	Bomb Wing
CAA	Clean Air Act
$CaCO_3$	calcium carbonate
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensations, and Liability Act
CFL	County Forest Land
CFR	Code of Federal Regulations
CHCN	Committee on the Health Council of the Netherlands
CO	carbon monoxide
CRTC	Combat Readiness Training Center
CWA	Clean Water Act
cwt	hundred weight
dB	decibel
dB(A)	A-weighted sound level
DEIS	Draft Environmental Impact Statement
DOD	Department of Defense
DOI	U.S. Department of Interior
DOPAA	Description of the Proposed Action and Alternatives
DOT	Department of Transportation
DRMO	Defense Reutilization and Marketing Organization
DZ	Drop Zone
E.O.	Executive Order
EBS	Environmental Baseline Survey
ECG	electrocardiogram
EIS	Environmental Impact Statement
EOD	explosive ordnance disposal
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAC	Forward Air Controller
FAR	Federal Aviation Regulation
FEIS	Final Environmental Impact Statement
FICON	Federal Interagency Committee on Noise

FICUN	Federal Interagency Committee on Urban Noise
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FL	flight level
FW	Fighter Wing
FY	Fiscal Year
HAP	high accident potential
HQTAC	Headquarters Tactical Air Command
IFR	instrument flight rules
IICEP	Interagency and Intergovernmental Coordination for Environmental Planning
IR	Instrument Route
KIAS	knots indicated airspeed
KTAS	knots true airspeed
LATN	low-altitude tactical navigation
lbs	pounds
L_{dn}	day-night average sound level
L_{dnmr}	onset rate-adjusted monthly day-night sound average level
L_{max}	maximum sound level
LOWAT	low-altitude air-to-air training
MAILS	Multiple-Aircraft Instantaneous Line Source
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mm	millimeter
MOA	Military Operations Area
mph	miles per hour
MR_NMAP	MOA Range NOISEMAP
MSL	mean sea level
MTR	Military Training Route
NAAQS	National Ambient Air Quality Standards
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NGB	National Guard Bureau
NHI	Natural Heritage Inventory
NHPA	National Historic Preservation Act
NM	nautical miles (approximately 1.15 statute miles)
NO	nitric oxide
NO_2	nitrogen dioxide
NOA	Notice of Availability
NOI	Notice of Intent
NO_x	nitrogen oxides
NPS	National Park System
NWR	National Wildlife Refuge
O_3	ozone
OSHA	Occupational Safety and Health Administration
PILT	payment in lieu of taxes
PM_{10}	particulate matter equal to or less than 10 microns in diameter
ppm	parts per million
PSA	Pacific Southwest Airlines
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
ROI	region of influence
SAIC	Science Applications International Corporation

SAM	surface-to-air missile
SCAQMD	South Coast air Quality Management District
SEL	sound exposure level
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	sulfur dioxide
SOP	Special Operating Procedure
SR	state roads
SWA	State Wildlife Area
SWDA	Solid Waste Disposal Act
T&E	threatened and endangered
TSCA	Tosic Substance Control Act
TSP	total suspended particulates
TTS	temporary threshold shifts
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAF	United States Air Force
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
VFR	visual flight rules
VHF	very high frequency
VOC	volatile organic compound
VR	visual route
WCFA	Wisconsin County Forests Association
WCFL	Wood County Forest Land
WCWA	Wood County Wildlife Area
WDNR	Wisconsin Department of Natural Resources
WDT	Wisconsin Division of Tourism
WIANG	Wisconsin Air National Guard
WPA	Works Progress Administration