United States Department of the Interior
Fish and Wildlife Service

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21 October 2010

COL Michael J. Bennett
NGB Chief, Environmental Programs Division
111 S. George Mason Drive
Arlington, VA. 22204

Dear Colonel Bennett:

The enclosed document transmits the U.S. Fish and Wildlife Service's (Service) Programmatic Biological Opinion (PBO) regarding the effects of ongoing and future military and land management activities at the Camp Atterbury Joint Maneuver Training Center (CAJMTC) in Bartholomew, Brown and Johnson counties in Indiana and its effects on the Federally endangered Indiana bat (*Myotis sodalis*). Formal consultation was initiated with the National Guard Bureau (NGB) so that impacts to Indiana bat maternity colonies could be appropriately analyzed and to ensure that CAJMTC's activities are in compliance with section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). Based upon my staff's analysis of existing information, we concluded that this project is not likely to jeopardize the continued existence of the Indiana bat nor will it adversely modify any Critical Habitat.

Analyses summarized within the Service's PBO were primarily based upon information reviewed by the Service's Bloomington Field Office (BFO) including:

- a programmatic biological assessment (PBA) entitled "Effects on the Indiana bat (*Myotis sodalis*) with respect to future routine training and land management activities and upcoming development projects at the Camp Atterbury Joint Maneuver Training Center."
- the final Integrated Natural Resources Management Plan (INRMP), Camp Atterbury Joint Maneuver Training Center, Edinburgh, Indiana (2007 Revision, with Errata dated 22 February 2008),
- reports and scientific literature on Indiana bat research conducted in the action area and elsewhere,
- meetings, phone calls, e-mails, other written correspondence with NGB, INNG, and CAJMTC staff and their consultants, and
- numerous field visits and site investigations conducted by personnel from the Service's BFO since Indiana bats were discovered there in 1997.

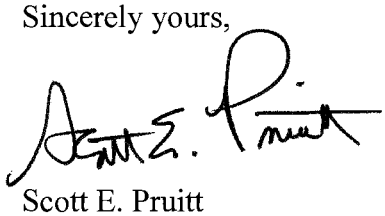
This PBO considers the broad impacts of the entire proposed action (50 CFR §402.14(k)) and was prepared in accordance with section 7 of the ESA. A complete administrative record of this consultation is on file at the BFO.

We understand that construction of a Multi-Purpose Machine Gun Range (MPMGR) will occur as part of CAJMTC's Proposed Action and will require a section 404 Clean Water Act permit(s) from the U.S. Army Corps of Engineers (COE). Because the MPMGR activities covered by the forthcoming COE permit(s) will not result in any impacts to Indiana bats beyond those already addressed in the PBO, we are also providing a copy of this formal consultation document to the COE to demonstrate that the NGB has fulfilled its obligation and the COE's to consult with the Service for this project.

To ensure that the impacts of take associated with CAJMTC's ongoing activities are appropriately minimized and that the exemption of incidental take is appropriately tracked and documented, the NGB and the Service will implement an appended programmatic consultation approach. Under this approach, the Service's PBO and Incidental Take Statement (ITS) considered and quantified anticipated amounts of incidental take of Indiana bats at CAJMTC over the next 5 to 10 years. Impacts associated with Phase 1-level projects (i.e., small-scale projects) will be summarized in an annual report prepared by CAJMTC staff and reviewed by the BFO to determine if the effects are consistent with those analyzed in the PBO and quantified within the ITS. Similarly, Phase-2 level projects (i.e., larger-scale projects) will be individually reviewed by the Service prior to their implementation to ensure their consistency with the PBO and ITS. If a Phase 1 annual report and/or Phase 2 project-specific description is found to be consistent with the parameters analyzed within the PBO and ITS, then the BFO will append it to its copy of the PBO and ITS and thereby fulfill NGB's section 7(a)(2) requirements for those projects/activities. More details regarding this approach are available in the PBO and ITS.

If you have any questions about the PBO or ITS or how subsequent project-specific consultations should proceed, please contact Andy King at 812-334-4261, extension 1216.

Sincerely yours,



Scott E. Pruitt
Field Supervisor

cc: LTC Richard Jones, INNG (via email)
Jim Mahern, JFHQ (via email)
Michael Peterkin, INNG, CAJMTC (via email)
Laban Lindley, USACE, Louisville District (via email)
Catherine Gremillion-Smith, IDNR (via email)

PROGRAMMATIC BIOLOGICAL OPINION

ON THE

EFFECTS OF ONGOING AND FUTURE MILITARY AND LAND MANAGEMENT ACTIVITIES

AT THE CAMP ATTERBURY JOINT MANEUVER TRAINING CENTER

IN BARTHOLOMEW, BROWN, AND JOHNSON COUNTIES IN INDIANA

ON THE FEDERALLY ENDANGERED INDIANA BAT (*Myotis sodalis*)

Submitted to the
National Guard Bureau
and
Indiana National Guard

October 21, 2010

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EXECUTIVE SUMMARY

This Programmatic Biological Opinion (PBO) was issued to the National Guard Bureau (NGB) and analyzed effects of future routine training and land management activities and upcoming development projects at the Indiana National Guard's (INNG) Camp Atterbury Joint Maneuver Training Center (CAJMTC) on the federally endangered Indiana bat (*Myotis sodalis*). The intent of this PBO is to be programmatic, and to help streamline the consultation process and reduce administrative costs for future routine actions as well as to address uncertainty of effects regarding known future activities. Programmatic consultations address broad activities or programs routinely implemented over large areas whereas individual site-specific consultations under Section 7 of the ESA are typically used to address one proposed project or activity at a time. This consultation analyzed all of the individual impacts from various training exercises and development projects in concert with one another and cumulatively.

The Indiana bat was first captured at CAJMTC during 1997 and 1998 surveys and has since been recorded on-site during subsequent surveys (2002, 2005, 2006 and 2007). In accordance with Army Regulation (AR) 200-1, any installation having a federally listed or proposed species or critical habitat onsite is required to prepare a biological assessment (BA) for any major construction proposal or other activities (e.g., military training) that may have an impact on the environment where a listed species or critical habitat is present.

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 United States Code [USC] §1536), requires Federal agencies (NGB in this case) to insure that their actions are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat that has been designated for those species. In addition, under section 7(a)(1) of the ESA, all federal agencies are required to carry out programs for the conservation of federally listed species. This PBO satisfies the INNG/CAJMTC's section 7(a)(2) consultation requirement and documents some of their proactive conservation efforts in accordance with Section 7(a)(1).

The Service concluded that the effects of future routine training and land management activities and upcoming development projects at the Camp Atterbury Joint Maneuver Training Center are not likely to jeopardize the Indiana bat and no critical habitat will be affected.

INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service or USFWS) biological opinion, which was primarily based on our review of a programmatic biological assessment (PBA) entitled "Effects on the Indiana bat (*Myotis sodalis*) with respect to future routine training and land management activities and upcoming development projects at the Camp Atterbury Joint Maneuver Training Center." The PBA was submitted by the Indiana National Guard (INNG) and NGB and was received at the Service's Bloomington, Indiana Ecological Services Field Office (BFO) on 4 December 2009 along with a letter requesting us to initiate formal consultation on the proposed action and its effects on the Federally endangered Indiana bat.

This PBO is prepared in accordance with section 7(a)(2) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.) and is the culmination of formal section 7 consultation under the Act. The purpose of formal section 7 consultation is to insure that any action authorized, funded, or carried out by the Federal government is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of any officially designated critical habitat of such species. This PBO covers the Proposed Action of the NGB and INNG, as these agencies are primarily responsible for the management of the CAJMTC, which is located on federally owned land.

Construction of a Multi-Purpose Machine Gun Range (MPMGR) will occur as part of the Proposed Action and will require a section 404 Clean Water Act permit(s) from the U.S. Army Corps of Engineers (COE). However, the activities covered by the COE permit(s) will not result in any impacts to Indiana bats beyond those addressed in this consultation. Therefore, the Service intends to provide a copy of this PBO to the COE to demonstrate that the NGB has fulfilled its obligation and the COE's to consult with the Service on this particular federal action.

This PBO is primarily based on information provided from the following sources:

1) The PBA referenced above (dated December 2009) (Amec 2009).
2) The final Integrated Natural Resources Management Plan (INRMP), Camp Atterbury Joint Maneuver Training Center, Edinburgh, Indiana (2007 Revision, with Errata dated 22 February 2008) (Parsons 2007),
3) Reports and scientific literature on Indiana bat research conducted in the action area and elsewhere, and
4) Meetings, phone calls, e-mails, other written correspondence with NGB, INNG, and CAJMTC staff and their consultants. Numerous field visits and site investigations have been conducted by personnel from the Service's BFO since Indiana bats were discovered there in 1997. A complete administrative record of this consultation is on file at BFO.

CAJMTC Background

Camp Atterbury Joint Maneuver Training Center (CAJMTC) has multiple military missions that it endeavors to meet. These missions are carried out in a manner that also considers and upholds their state and federal environmental obligations such as compliance with section 7 of the Endangered Species Act. The military missions carried out at CAJMTC include the following:

Federal Mission. The National Guard is "to provide properly trained and equipped units for prompt mobilization for war, National emergency or as otherwise needed." The Indiana Army and Air National Guard are reserve components of the U.S. Army and U.S. Air Force. During times of national emergency, National Guard members may be called into active federal service by the President of the United States (INNG 2007).

State Mission. The National Guard is "to provide trained and disciplined forces for domestic emergencies or as otherwise provided by state law." The National Guard's "state role" is to assist local law enforcement agencies during emergencies at the direction of the governor. The distribution of soldiers, equipment and facilities across the state allows the National Guard to respond quickly and efficiently to emergencies statewide. This dual federal-state mission is unique to the U.S. military and sets the National Guard apart from any other reserve component (INNG 2007).

CAJMTC-Specific Mission. The mission of the CAJMTC is three-fold: (1) to serve as a Forces Command Mobilization Station; (2) to serve as a premier training site for both individuals and units from all branches of service for both Reserve and Active Duty training and other special training events; and (3) to serve as a training site for all public service organizations such as Department of Homeland Security, state and local police, and other first responders (CAJMTC 2007).

To support these missions CAJMTC provides support facilities, training areas, and ranges for one combat or combat-support brigade (approximately 1,500 to 3,500 personnel) conducting battalion-level Army Training Evaluation Programs (ARTEPs). Should the need arise; Camp Atterbury can be expanded to support training and facilities for up to two brigades (Amec 2009).

In February 2003, CAJMTC was designated as a Power Generation Platform (PGP) to support Operation Noble Eagle/Enduring Freedom/Iraqi Freedom. Camp Atterbury receives and processes individual non unit-related personnel (civilians and military from all branches of the armed forces) for deployment and redeployment to/from the theater of operations. As a PGP, Camp Atterbury is responsible to coordinate medical and dental screening, soldier readiness processing, theater-specific clothing and equipment issue, weapon familiarization and qualification, theater-specific individual readiness training, and coordinate movement of personnel into areas of operation. CAJMTC receives, processes, equips, trains, and deploys personnel based on Deployment Orders published from U.S. Army Forces Command (FORSCOM) and First U.S. Army. CAJMTC also continues to satisfy its traditional National Guard training and emergency response requirements (Amec 2009).

CONSULTATION HISTORY

Camp Atterbury has been used as a military training and mobilization site since it was established during World War II in 1942. Although the species' presence was suspected earlier, Indiana bats were not documented on the base until the summer of 1997. In the intervening years, the Bloomington Field Office and the NGB and INNG have conducted numerous informal consultations and one formal consultation (for the Multi-Purpose Training Range/MPTR in 1998) under section 7 of the Endangered Species Act.

Since the bat's discovery in 1997, CAJMTC's proposed actions and projects have been carefully designed and conducted in a manner to avoid incidental take of Indiana bats. However, beginning in 2001, the BFO raised the concern that implementing many small projects and training exercises over time may lead to adverse cumulative effects on Indiana bats and their habitat at CAJMTC. The BFO recommended that CAJMTC should programmatically assess the potential of all of its ongoing military training exercises and related activities to adversely affect Indiana bats. The CAJMTC hired a contractor (Tetra Tech) to prepare a biological assessment (BA). The BFO received a copy of the BA (dated April 2003) with a letter (dated 1 August 2003) seeking our concurrence with a "not likely to adversely affect" determination for CAJMTC's ongoing and anticipated future military activities. The BFO reviewed the 2003 BA and found it did not include the best available scientific information (e.g., all known roost tree locations on the base) and failed to demonstrate and clearly articulate how all forms of potential incidental take would be avoided. The BFO provided CAJMTC with a list of general and specific concerns with the 2003 BA and did not provide a written concurrence.

A chronological summary of subsequent consultation events and actions associated with this project is presented below.

- On 12 December 2006, BFO biologist, Andy King attended a "kick-off" meeting at CAJMTC to coordinate the preparation of a new ongoing mission BA by CAJMTC's new contractor, AMEC.

- On 7 February 2008, the BFO provided comments to AMEC on a draft BA (dated October 2007).

- On 30 July 2009, BFO Field Supervisor, Scott Pruitt, emailed Lt. Colonel Rick Jones with the BFO's rationale for recommending a formal programmatic consultation with NGB and CAJMTC and how a programmatic biological opinion would be approached and function.

- On 2 September 2009, the BFO hosted a meeting with representatives of CAJMTC and the U.S. Army Corps of Engineers to discuss the proposed section 404 permitting schedule and tree-clearing schedule for construction of the proposed Multi-Purpose Machine Gun Range (MPMGR) at CAJMTC.

- On 24 September 2009 received a letter from the INNG and NGB submitting the programmatic BA (PBA) for CAJMTC and requesting initiation of formal section 7 consultation. The BFO reviewed the PBA and found that it lacked sufficient information for us to initiate formal consultation, which we relayed to the INNG via a letter dated 16 October 2009.

- On 26 October 2009, the BFO hosted a meeting with CAJMTC representatives to discuss deficiencies in the PBA and how they should be addressed.

- On 4 December 2009 the BFO received a letter from Lt. Colonel Steven Hines of the INNG transmitting a PBA assessing effects on the Indiana bat with respect to future routine training and land management activities and upcoming development projects at the CAJMTC and requesting initiation of formal section 7 consultation.

- On 8 December 2009, the BFO sent Lt. Colonel Hines a letter acknowledging receipt of the PBA and a complete formal consultation initiation package (i.e., formal consultation began on 12/4/2009). The letter stated that an attempt was being made to expedite the consultation timeline and that we hoped to provide NGB and CAJMTC with a final programmatic biological opinion (PBO) by mid-February 2010.

- On 11 March 2010, the BFO emailed CAJMTC staff a preliminary draft PBO for review.

- On 20 July 2010, the BFO received comments from NGB and CAJMTC staff on the preliminary draft PBO.

- On 17 August 2010, BFO and CAJMTC staff met at the BFO to discuss NGB and CAJMTC comments.

- On 7 September 2010, the BFO emailed CAJMTC a "final draft" PBO for review, which contained changes that had been agreed to during the 17 August meeting.

- On 6 October 2010, the BFO received additional comments from the NGB on the "final draft" PBO.

- On 19 October 2010, the BFO hosted a meeting with CAJMTC/INNG and NGB representatives participated in the meeting via a conference call. Outstanding issues were discussed and resolved.

- On 20 October 2010, the BFO issued its final PBO to NGB and INNG.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

A detailed description of the Proposed Action is provided on pages 10-35 of the PBA and is hereby incorporated by reference.

Military Training

The Proposed Action encompasses the continued/ongoing implementation of a broad range of ground- and air-based military training activities at numerous existing training areas and ranges and firing points, using a variety of vehicles, weapons, munitions, and obscurants at different times of day and night throughout the year, which support CAJMTC's military missions (Table 1; also see Appendix B of the PBA). Various land management activities that indirectly support the military mission are also part of the Proposed Action (Table 1).

Table 1. Summary of the CAJMTC Proposed Action

Future Routine Military Training and Land Management Activities by Location or Type			Upcoming Development Projects
▪ Cantonment Area ▪ Impact Area ▪ Battalion Training Areas ▪ Non-firing Training Areas ▪ Forest Training ▪ Ranges ▪ Aviation Facilities ▪ Smoke Grenade Use	▪ Trail Upgrades and Haul Road Development ▪ Vegetation and Other Maintenance Issues ▪ Pesticide Use ▪ Soil Conservation ▪ Water Resources Protection	▪ Fire Management ▪ Timber Management ▪ Indiana Bat Management Zones ▪ Special Management Zones ▪ Research Activities	▪ MPMG Range Construction & Operation ▪ Multiple small projects

Military training exercises have been continuously occurring at CAJMTC since it was originally developed in 1942. The CAJMTC provides training lands, facilities, and ranges to maintain the readiness of the Army National Guard and the Air National Guard for their assigned mission of being prepared to protect the United State in the event of mobilization. The primary users of the training facilities located on Camp Atterbury are those taking institutional courses taught by the 138th Regiment (Regional Training Institute) and the Indiana National Guard (INNG). Unit types within the INNG are light infantry (five battalions), mechanized infantry (one battalion), field artillery, and support structure [combat support (CS) and combat service support (CSS)]. Several Active Component units and other Department of Defense (DoD) agencies train intermittently on a daily basis. Area police agencies and other civilian groups use CAJMTC's facilities and ranges during off-season periods after obtaining preauthorization.

In general, the types of training at CAJMTC have not changed much in recent years, but the intensity of training use at CAJMTC has greatly increased since February 2003 when it was designated as one of three Power Generation Platforms (PGP) in the United States. Currently sized at approximately 4,200 troops, Camp Atterbury is used an average of 46 weekends and 23 weeks per year by National Guard and Reserve Component units. A typical annual reserve component training year normally includes one weekend per month. The two days per month, plus 15 days of annual training, give each unit a total of 39 days annually in which to conduct its 23 required training events. A typical training year for training facilities such as CAJMTC is 133 days, which is the sum of available training days from May through August plus weekend days during the rest of the year. However, the CAJMTC is not likely to see a normal reserve component training year due its current designation as a PGP.

CAJMTC is equipped with the Range Facility Management Support System (RFMSS), a computer-based support program. RFMSS provides a standard, integrated system to efficiently assist installation commanders in providing training support for units and schools to manage training lands and ranges at Army installations and in theaters of operations. RFMSS supports all major range management processes, including scheduling of ranges and training areas; unit and range control of approval process; automation of range firing desk operations; resolution of safety and environmental conflicts; and creation and management of Surface Danger Zones (SDZ). RFMSS allows units to reserve range and training area assets as much as two years in advance. Data within RFMSS is audited on a monthly basis to maintain its accuracy. Detailed usage data for CAJMTC captured in RFMSS is summarized in Appendix B of the PBA. Because RFMSS is relatively new, only the most recent data are currently available.

Total number of personnel trained and total number of training hours during the bat roosting seasons (01 April through 01 October) of 2003 – 2009 were calculated using RFMSS data and are provided in the charts below (Charts 1 and 2). Total monthly training site utilization for fiscal years (FY) 2004 – 2007 is presented in Chart 3 of the PBA. During the past three FYs, training levels varied by month, but total site usage consistently was highest between June and August (approx. 35 % of annual site usage).

Starting in 2003, total site usage increased greatly and has remained at a higher level because of CAJMTC's designation as a PGP. The recent trend appears to be toward greater site usage. The PBA states that it is not likely that CAJMTC will see a normal reserve component training year until the wars (i.e., Afghanistan and Iraq) conclude. In the interim, it is generally anticipated that the intensity of ongoing training types at CAJMTC may increase by as much as 10% over the next 5 to 10 years.

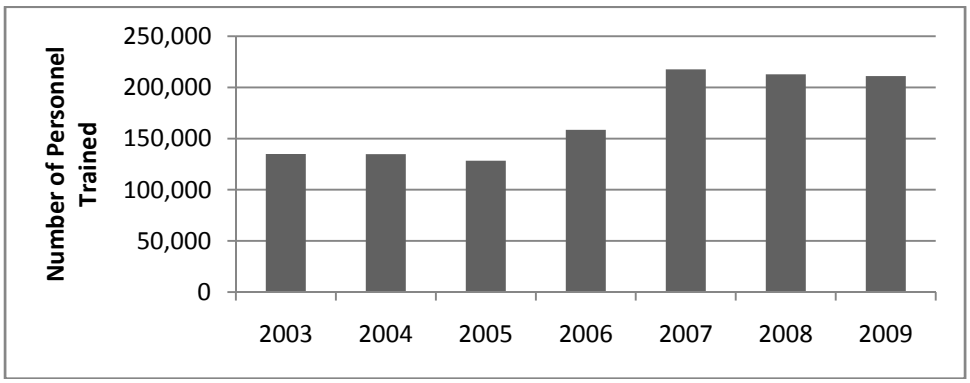


Chart 1. Total number of personnel trained during the Indiana bat roosting season by year.

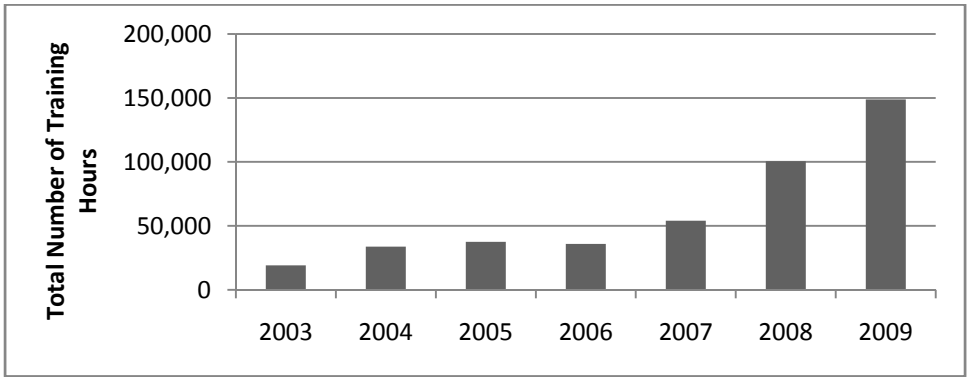


Chart 2. Total number of training hours conducted during the Indiana bat roosting season by year.

Training at CAJMTC occurs both during daytime and nighttime hours. However, the INNG estimates that no more than 20 % of training occurs during nighttime hours, and approximately 10 percent of all rotary-wing flight training occurs at night. Therefore, 80-90% of all military training occurs during daylight hours while Indiana bats are typically roosting in trees.

Multi-Purpose Machine Gun Range

Over the next 5 to 10-year period, the largest anticipated impact to existing Indiana bat habitat from new development at CAJMTC is associated with the proposed Multi-Purpose Machine Gun Range (MPMGR). The MPMGR is described in detail in section 2.4.2.1 of the PBA. As depicted in Figures 4a and 7a, the 105-acre MPMG range project area is comprised almost entirely of hardwood forest. According to preliminary design drawings, it is estimated that approximately 96 acres of forest will need to be cleared for range construction. CAJMTC is proposing to award a contract for an emergency salvage timber sale to remove the standing merchantable timber from the MPMG footprint. All tree clearing for the MPMGR would occur between 1 October and 31 March (i.e., in order to avoid the potential for direct injury/take of roosting Indiana bats) (This is a change from what was stated in the text of PBA and Appendix E). Tree clearing would occur in winter 2010-2011. Construction of the range would begin spring 2011 and would take approximately 2 years to complete. Table 8 of the PBA summarizes the type and average size of tree species by timber compartment found within the project footprint according to the on-site timber inventory conducted in April/May 2009. In addition, it provides an estimate of snags (dead trees/potential Indiana bat roost trees) per acre within the proposed footprint. Based on timber inventory data, CAJMTC staff estimated that approximately 1,310 snags ≥6" in diameter-at-breast height (DBH) and approximately 18 shagbark hickories (of merchantable size) will be cleared to construct the MPMGR. Snags of the following tree species would be cleared (from most to least abundant): sassafras, yellow poplar, and black locust.

Based on the timber cruise data collected using the variable radius plot method an estimated 75% of the MPGR timber sale volume is made up of yellow poplar. To our knowledge, Indiana bats in Indiana have not yet been documented using yellow poplar as a maternity roost tree. Therefore the BFO has considered it as having relatively low value as potential roosting habitat for Indiana bat maternity colonies. Of the remaining timber within the MPMGR timber sale area, 5.87% is composed of tree species identified as having relatively high value as potential Indiana bat maternity roost trees as listed within the February 14, 2008 revision of the *BFO Forest Management Guidelines for informal Section 7 Consultations on Indiana Bats (Myotis sodalis) within the State of Indiana*. These species include:

- white ash
- green ash
- bitternut hickory
- northern red oak
- shagbark hickory
- silver maple
- sugar maple
- white oak, and
- elm spp.

More detailed information pertaining to the proposed MPMGR timber harvest is available in Appendix E of the PBA.

A jurisdictional wetland delineation was conducted at the proposed MPMGR site in November 2007 and May 2008. Potential impacts to wetlands and streams are summarized in Table 2 below and illustrated in Figures 7b and 5c of the PBA. The proposed MPMGR was carefully configured within the 105-acre construction footprint to avoid cut/fill of approximately 4.88 acres of the 6.52 acres of wetlands within the MPMGR footprint. Therefore, only 1.61 acres of wetland will be permanently filled as a result of the construction of the MPMG range. In addition, the proposed MPMGR configuration will result in 655 linear feet of stream channel in culverts within the construction footprint.

Proposed mitigation for these wetland impacts is addressed in the *EA for the construction and operation of the MPMG range at CAJMTC*. A Jurisdictional Determination was obtained from the USACE Louisville District. Prior to any ground-disturbing activities within known wetlands or streams, Clean Water Act Section 404 and 401 permits from the USACE and IDEM, respectively, will be obtained for all wetland and stream impacts. Wetland and stream impacts will require compensatory mitigation. Based on consultation with the USACE and IDEM, it was determined the INNG will compensate stream and wetland impacts using the mitigation ratios as summarized in Table 3. Implementation of these measures will serve to reduce this impact to *less-than-significant* levels. A permit application was submitted to USACE and IDEM in May 2009. A copy of the wetland and stream mitigation plan is included as Appendix D of the PBA.

Other Projects and Activities

In addition to the proposed MPMGR, the Proposed Action includes the proposed construction, operation, and/or maintenance of other planned and as of yet unplanned, but anticipated new training/support facilities and/or operation and maintenance of existing infrastructure that may require additional forest clearing/bat habitat loss over the next 5 to 10 years. The anticipated types of projects will be smaller in scale than the MPMGR and many will be linear in nature as opposed to a MPMGR-type project that impacts a single large patch of bat habitat.

Table 2. Summary of wetland and stream impacts associated with MPMGR construction.

Wetland Impacts	**Acreage**
Tree Clearance Only (Conversion of Forested Wetland to Scrub-Shrub)	3.28
Tree Clearance Only (Conversion of Forested Wetland to Emergent)	0.72
Cut/Fill (Forested Wetland)	1.59
Cut/Fill (Scrub-Shrub Wetland)	0.05
No Impact	0.88
Stream Impacts	**Linear Feet**
Tree Clearance Only	2760
Culverted	655
Relocated	596
Temporary Disturbance (i.e., electric lines)	526
No Impact	951

Table 3. Proposed wetland and stream mitigation summary.

Impact		Required Ratio	Wetland Enhancement	Wetland Mitigation	Stream Restoration
PFO Cut/Fill	1.64 acres	4:1	--	6.56	--
Clear Trees - PFO to PEM	0.72 acre	2.5:1	1.08	0.72	--
Clear Trees - PFO to PSS	3.28 acres	1.5:1	1.64	3.28	--
Stream Channel (to culvert)	655 feet	1:1	--	--	655
		Total	**2.72 acres**	**10.56 acres**	**655 linear feet**

According to information supplied to the BFO during formal consultation and within the PBA, CAJMTC anticipates constructing several new trails and firebreaks that would require the clearing of approximately 51 acres (see Fig. 5). CAJMTC also estimates an additional 132 acres of "forest" will be cleared in order to rehabilitate existing trails/right-of-ways/line-of-sights on training ranges and other routine maintenance activities and the rerouting of a tank trail. Approximately 90% of the "forest" habitat that will be impacted during trail rehabilitation and rerouting of the tank trail (i.e., 132 acres) will be immature forest/early successional habitat (e.g., trees ≤10" dbh) that has relatively low value as Indiana bat roosting habitat (M. Peterkin, CAJMTC, pers. comm., 2010).

Based on the average number of acres of forest habitat impacted at CAJMTC from various new construction projects over the past 5 years, CAJMTC assumes that it may impact an additional 62 acres of forest habitat at CAJMTC over the next 5 to 10 years. The specific locations of these as yet undeveloped projects are uncertain. In addition, over 520 acres dominated by grassland and/or scrub-shrub habitats within and around training areas will be flailed at CAJMTC. This activity is not likely to remove any Indiana bat roosting habitat.

Over approximately the next 5 to10 years, the INNG anticipates that proposed activities and projects (both known and currently unknown, but likely to occur) at CAJMTC could directly and/or indirectly remove up to 341 acres of forest habitat (i.e., areas with trees ≥3 inches DBH) (Table 4). The INNG is committed to implementing conservation measures to offset impacts associated with the Proposed Action and to benefit or promote the recovery of the Indiana bat (see proposed Conservation Measures below).

Table 4. Anticipated sources of permanent forest loss at CAJMTC over the next 5 to 10 years.

Project/Activity Type	Estimated Impact (acres)	Anticipated Forest Type
New MPMGR Project	96	mature
New trails and firebreaks	51	mature
Various new, but as yet undefined projects	62	mature
Rehabilitation of existing trails/roads/right-of-ways/ ditches/storm drains/ lines-of-sight etc.	132	Immature/early successional
Total Impacts	341 acres	

Land Management Activities

Lastly, the Proposed Action also includes the continued implementation of various land management activities that collectively support the military missions and environmental obligations of CAJMTC. Ongoing land management activities at CAJMTC, were included in the base's Integrated Natural Resources Management Plan (e.g., forest management program) (Parsons 2007), which previously was consulted upon (written concurrence provided on INRMP on 11 April 2008). Land management activities covered within the INRMP (Parsons 2007) avoid incidental take of Indiana bats and will not be individually reassessed as part of this formal consultation, but their conservation benefits will be considered in concert with the other Proposed Action activities so a more complete assessment of CAJMTC's cumulative effects on Indiana bats can be achieved.

Research Activities

The following research activities have occurred, are occurring, or will occur in the near future at the CAJMTC: Indiana bat mist net surveys and radiotracking and various research and monitoring pertaining to water and soil conservation. Water protection and soil conservation are discussed in detail in the PBA. Indiana Bat Research: Indiana bats were first captured in August 1997 at CAJMTC during mist net surveys conducted by 3D/International Inc. Since then, periodic mist net surveys and radiotracking of adult Indiana bats has occurred in order to locate and identify roost trees at CAJMTC. Mist netting requires captured bats to be handled, which may result in a slight risk for injury and/or mortality.

In recent years, the U.S. Army ERDC - Construction Engineering Research Laboratory (CERL) has conducted research at CAJMTC. The objective of their research project is to develop innovative techniques for monitoring and inventorying local Indiana bat populations in their summer range through the use of artificial roosting structures (e.g., bat rocket houses and/or fake bark) and fecal genetic identification. A total of 42 artificial structures were placed within the southern IBMZ's adjacent to Range 37. This research is ongoing.

Because some research activities have the potential to adversely impact individual bats or result in take, most researchers are required to obtain a federal permit (and a state permit) in accordance with Section 10 of the ESA. Past and future bat surveys at CAJMTC will be conducted by experienced biologists who have obtained all necessary state and federal permits.

Indiana Bat Conservation Measures

The following Conservation Measures (CMs) were jointly developed by the INNG and the Service during the current and previous formal and informal consultations and are incorporated here as part of the Proposed Action. Some of these CMs were also included in CAJMTC's Integrated Natural Resources Management Plan (INRMP) and Endangered Species Management Plan (ESMP), both of which have been previously reviewed and approved by the Service. Because formal CMs have been incorporated as part of the Proposed Action, their implementation is required under the terms and conditions of this consultation. These CMs were specifically designed to avoid, minimize, and mitigate/offset adverse impacts of the Proposed Action on Indiana bats and to further the species' recovery. **The Service has analyzed the effects of the Proposed Action based on the assumption that all of these CMs will be fully implemented or equivalent or more beneficial alternative measures will be developed and implemented in consultation with the Service.** The beneficial effects of the following measures to Indiana bats were taken into consideration for both our jeopardy and incidental take analyses. Additional discussion of CMs is in Section 2.5 of the PBA.

1) **Siting of new developments/infrastructure** - Efforts will be made to locate new developments in areas that will completely avoid and/or minimize the clearing and/or fragmentation of forested areas and to avoid disturbance to known roost trees where reasonable.

2) **Tree Removal/Cutting** – In general, no trees with a diameter of 3 or more inches (DBH) will be removed between 1 April and 30 September, to avoid the potential of direct take of roosting Indiana bats. Tree clearing and snag removal will be kept to a minimum and limited to within the construction limits of projects. Outside project clear zones, tree clearing will be kept to a minimum with wooded areas being kept in as much a natural state as reasonable.

3) **Hazard Tree Removal** – Unless hazard trees/snags pose an imminent threat to human safety or buildings/roadways, they will not be removed/cut down between 1 April and 30 September, to avoid the potential for direct take of roosting Indiana bats.

4) **Mist Netting Surveys** - As funding allows, long-term bat monitoring surveys will be conducted approximately every 5 years. A work plan for surveying, monitoring, and reporting will be developed and implemented in coordination with and approved by USFWS's BFO. Up to approximately 20 mist netting sampling sites are anticipated per survey. If reproductively active female and/or juvenile Indiana bats are captured, radio transmitters will be employed on a subset of them in an attempt to locate diurnal roost trees (minimum of 5-days of search effort), and multiple emergence counts will be conducted at each located roost tree. These monitoring efforts will be documented and summarized within an annual report prepared for the Service.

5) **Bridge Inspections –** Prior to commencing any construction/demolition activity on or within 100 feet of a "suitable" bridge and/or any bridge that is known to have been used as a day or night roost site by Indiana bats in the past, the undersides of such bridges will be visually inspected during both the daytime and at night by CAJMTC staff (or a consultant) to determine their current pre-construction roost status. To the maximum extent practicable, all bridge inspections will be conducted between 15 May and 15 August. Additional bridge inspection protocols may be developed in coordination with the BFO. If any *Myotis* species are observed roosting beneath these bridges or obvious bat sign is found (e.g., guano deposits), then further consultation with the BFO will be required. CAJMTC staff will provide BFO with a list of potentially suitable bridges and a map of their locations in the first annual report under this BO.

6) **Maintenance / Construction of Bat-friendly bridges –** Where feasible and appropriate, new bridges will be designed to provide suitable night roosts for Indiana bats and other bat species in consultation with the USFWS. Likewise, existing bridges used by Indiana bats will be maintained in a manner that minimizes bat disturbance.

7) **Water Quality** - The primary goals of the water resources management at CAJMTC are to protect aquatic and riparian habitats, to identify and restore degraded aquatic habitats, and to prevent degradation of water quality. Per the CAJMTC INRMP, the following management measures are implemented to protect and maintain water quality:

    - Establish and/or maintain 100-foot vegetative buffers with a sufficient number of canopy species around all permanent water bodies where possible to minimize

erosion and sedimentation of water bodies located downstream of impact areas. Intermittent streams will be similarly buffered by 50 feet.

- Limit vehicle use in the vicinity of the water bodies at CAJMTC to reduce the introduction of hydrocarbons into aquatic systems.

In order to obtain baseline water quality information and to aid in water resources management efforts, the CAJMTC contracted the USGS to assess both biological and chemical water quality and to inventory aquatic macroinvertebrates on the installation (USGS, 2004a, b).

8) **Soil Conservation Measures / Erosion Control -** In order to prevent soil erosion and in turn its potential to impact water quality, habitat and endangered species, such as the Indiana bat, the following management strategies are implemented according to the CAJMTC INRMP via the Range and Training Land Analysis (RTLA) and Land Rehabilitation and Maintenance (LRAM) programs.

- Locate, design, construct, and maintain stream crossings to provide maximum erosion protection in order to protect aquatic habitat and minimize adverse impacts associated with their use.
- Maintain adequate vegetated riparian buffer zones to prevent or minimize degradation of streams associated with sediment and other pollutants in runoff.
- Maintain existing road ditches, culverts, and turnouts to ensure proper drainage and minimize the potential for the development of ruts and mud holes and other erosion related problems. Where necessary, construct new ditches, culverts, or turnouts to divert water away from roads.
- Conduct routine road and trail maintenance in all training areas. Grate, fill ruts, place gravel, and stabilize banks and edges of roads and trails as needed. Conduct inspection and repair on an annual basis.
- Stabilize, seed, and mulch eroded roadsides and new road cuts with native grasses and legumes, where feasible, in a timely manner to minimize impacts to adjacent habitats resulting from the transport and deposition of eroded soils.
- When exposure of soils is necessary to accomplish mission objectives, whether for military training or for other activities such as timber harvest, use soil conservation measures (e.g., check dams, windbreaks, diversions) to control erosion, sedimentation, and dust. To limit land maintenance expenditures and minimize environmental impacts, site physically intensive land-disturbing activities, when possible, on the least erodible lands (those requiring the least cover for erosion control). The potential erodibility of a site (as determined from existing soil types, slopes, and vegetative cover) and the location of adjacent wetlands and other surface waters will be identified and considered in order to minimize impacts on these resources.
- Implement erosion and sediment controls where appropriate. Maintain protective vegetative covers over all compatible areas, especially on steep slopes. Where necessary, gravel, fabrics, mulch, riprap, or other materials that are environmentally safe and compatible with the location, may be used, as appropriate, for control of erosion in problem areas.

- Monitor bivouac areas for signs of excessive soil compaction, rutting, or erosion. Where possible, periodically close existing bivouac areas. Implement Best Management Practices (BMP) to reduce excessive soil compaction, rutting, and erosion. Consider some form of site hardening, such as the use of geotextiles, where it would be consistent with site use, environmental conditions, and training objectives. Determine locations for alternate bivouac sites and use these on a rotational basis.
- Monitor training areas to ensure that vegetation and soils disturbed during training activities are rehabilitated in a timely manner to reduce the potential for the development of excessive erosion and sedimentation sites. Reclaim and rehabilitate severely degraded training areas to minimize erosion and the development of additional problems.

9) Forest Management - The goals of the forestry program at CAJMTC are to maintain the forest cover required for military training, maintain ecosystem viability, and provide for the production of commercial forest products. Maintaining the ecological integrity of these forested uplands and riparian corridors, the aquatic macroinvertebrate communities, and water quality is paramount to ensuring the long-term capability of the habitat to support the Indiana bat.

The forestry program is outlined in the INRMP and ESMP (an appendix to the INRMP) (Parsons 2007). As outlined in the INRMP, CAJMTC's forest management program will implement the following management measures to ensure protection of the Indiana bat:

(a) Timber harvest and Timber Stand Improvement (TSI) activities will be conducted within guidelines agreed to under section 7 consultation with the USFWS to practically enhance Indiana bat habitat within the timber harvest area. See Appendix C of PBA for a copy of the *BFO Forest Management Guidelines for Indiana Bats*.

(b) Timber management activities within the IBMZs will be limited to activities designed to promote growth of a mature forest with an open understory (see section on IBMZs for greater detail).

10) IBMZ Management – To offset the potential habitat loss from the construction of the Multi-Purpose Training Range (MPTR / Range 37), the CAJMTC previously set aside four stands comprising approximately 777 acres as Indiana Bat Management Zones (IBMZs) (see Figure 5). The IBMZs consist of 539 acres of mature and early successional (immature) forest and 238 acres of open areas vegetated with grasses and/or shrubs. IBMZs are managed to provide habitat characteristics suitable for summering Indiana bats, such as:

- Closed canopy (at least 60 %);
- Open understory;
- Presence of large diameter overstory trees;
- Presence of potential roost trees.

CAJMTC was also required to construct water resources within the designated IBMZs to improve the habitat quality. Three ponds were constructed and completed in 2002 to meet this requirement. They also serve as an emergency water source for fire protection at Range 37 with the installation of dry hydrants at each of the ponds.
Camp Atterbury will implement the following management measures for these stands:

- Timber management activities will be restricted to meeting the management goals of the IBMZ.

- Silvicultural activities within the IBMZs will be limited to activities designed to promote growth of a mature forest with an open understory.
- Thinning trees with a dbh of less than seven inches.
- Removing understory vegetation (shrubs, seedlings, exotic species, and vines growing from the base of overstory canopy down to two meters above ground) in stands where the cover of understory vegetation exceeds 40 percent.
- None of these activities are to occur between 01 April and 01 October.
- No silvicultural activities will be conducted on trees with a dbh of more than seven inches.
- Snags (trees with ≤10 % live growth) will not be removed unless they pose a safety hazard to soldiers.
- Military activities within the IBMZs will primarily consist of foot travel, bivouac activities, and surface danger zones associated with existing ranges and the MPTR.
- Tracked vehicles are restricted to existing trails and roads; off-road maneuvers with other vehicles will be minimized in the IBMZs (INNG, 2009a).

In accordance with the BO issued by the USFWS's BFO for the MPTR, CAJMTC must provide an annual report each year as well as evaluate the habitat quality in the IBMZs every three years while Range 37 is in use. A copy of the CAJMTC 3-year Forest Habitat Evaluation Report is maintained in the Natural Resources Office at CAJMTC. CAJMTC and USFWS will utilize the results of subsequent habitat evaluation reports to develop and/or modify current management prescriptions within the IBMZs. Modifications to management activities within these areas will be incorporated in the Annual Report to the USFWS.

Immediate recommendations from the 2003 report consisted of some minor bottomland plantings (approximately two to five acre areas in northeast corner of installation) and the conversion of approximately 50 acres from invasive species (e.g., autumn olive, amur honeysuckle [*Lonicera maackii*] and honeylocust [*Gleditsia triacanthos*]) to native bottomland species. This work was conducted during 2005.

11) **Additional IBMZs as Compensatory Forest Mitigation for MPMGR and other Projects -** CAJMTC will mitigate impacts associated with the loss of mature forested and early successional forest as a result of the MPMG Range and other routine training and land management activities associated with the Proposed Action. The INNG estimates that up to 209 acres of mature forest and 132 acres of immature forest will be permanently lost/converted/impacted over the next 5 to 10 years. To offset these forest impacts/loss of Indiana bat habitat from the Proposed Action, the INNG proposes to set aside additional mature forest acreage as IBMZs at a 1:1 ratio to mitigate mature forest losses and a 1:2 ratio to mitigate immature forest loss/impacts. In all, INNG proposes to set aside an additional 275 acres of existing mature forest as new IBMZs in the northeastern portion of CAJMTC (see Figures 5 and 8) that would be managed in the same manner as the existing IBMZs (see Section 2.4.1.16 in PBA). The new IBMZs are divided into three areas: a 7-acre island within Sugar Creek, a 92-acre area immediately west of Sugar Creek, and a 176-acre area within the eastern half of the restricted blast arc surrounding the Ammunition Storage Point.

12) **Compensatory Stream & Wetland Mitigation for MPMGR –** CAJMTC will offset impacts to streams and wetlands from construction of the MPMGR via compensatory

mitigation and enhancement. A detailed compensatory mitigation plan is contained in Appendix D of the PBA and is hereby incorporated by reference. The proposed wetland mitigation areas will directly benefit Indiana bats at CAJMTC.

In an effort to reduce required mitigation ratios associated with wetland conversion from forested wetland communities to scrub-shrub or emergent wetland communities resulting from unavoidable clearing activities at the MPMG site, a multi-faceted mitigation approach was developed.

The integrated mitigation approach includes:

- Development of approximately 10.56 acres of forested wetland at Site #12 (Training Area 101), also including approximately 0.7 acres of upland grassed buffer.
- Development of approximately 655 linear feet of stream channel restoration by day-lighting an existing tile and establishing 50' riparian buffers at Site #12 (TA 101).
- Enhancement of approximately 700 linear feet of intermittent channels downstream of the proposed wetland outlet structures at Site #12 (TA 101) by eliminating head-cut erosion and establishing check dams in the channels bottoms to further reduce erosion and sedimentation and promote habitat diversity.
- Functional enhancement of approximately 3.7 acres of existing wetlands at Site #15 (Waste Water Treatment Plant/TA 214) plus an additional 1.8 acres of buffers (50' wide).
- MPMG on-site mitigation of cleared/converted wetlands and stream channels, including emergent and/or scrub-shrub plantings on approximately 5.55 acres. Includes:
    - 3.28 acres wetland shrub plantings (w/ herbaceous wetland understory seeding)
    - 0.72 acres emergent wetland seeding
    - 595' open channel relocation- wetland seeding and shrub planting on approx. 0.3 acres.
        - One row low-growing shrubs on 8' spacing on both sides of new channel
    - 2,760' existing channel tree clearing- wetland seeding and shrub planting on approx. 1.25 acres.
        - One row low-growing shrubs on 8' spacing on both sides of new channel

Wetland Mitigation Location Information:

Training Area 101 Mitigation Site
County: Johnson
Civil Township: Nineveh **Section:** NE ¼ 27
Township: 11 North **Range:** 4 East
Quad: Nineveh, IN **Lat/Long**: 39.370321°N -86.068066°W
Directions: West side of Stonearch Road, approx. ½ mile north of Hospital Road.

WWTP/Training Area 214 Enhancement Site
County: Bartholomew
Civil Township: German **Section:** 5
Township: 10 North **Range:** 5 East
Quad: Edinburgh, IN **Lat/Long**: 39.339447°N -86.995847°W
8-Digit HUC: Driftwood River- 05120204
Directions: North side of Hendricks Ford Rd. approx. 1/2 mile east of CR 500 E

13) **Educational Media –** Based on availability of funds, up to $5000 will be allocated over the next 5 to 10 years for the development and distribution of updated educational media, exhibits, and/or other educational outreach materials to inform base trainees, visitors, staff, and managers about the presence and protection of bats, particularly the Indiana bat at CAJMTC.

14) **Indiana Bat GIS Data –** CAJMTC will collect data and actively maintain a GIS containing data pertinent to all aspects of Indiana bat management. The database will contain roost tree and bridge roost site data (i.e., tree species, date originally found, dates and #s of bats observed emerging, primary vs. alternate, standing vs. down, date tree first found to be down), mist net locations (survey dates, bats captured), IBMZ boundaries (dates of any management activities conducted within IBMZs), and other features that may be helpful for bat monitoring and planning purposes. This data will be updated and made available to the BFO on an annual basis or as otherwise requested.

Proposed Action Schedule

Military training and support activities/programs included in the Proposed Action are ongoing. Timber harvest and land clearing for construction of the MPMGR is scheduled to begin in the fall of 2010. All tree clearing for construction of the MPMGR and all other projects and activities that require the removal of trees $\geq$ 3 inches DBH/forest habitat will occur during the non-reproductive season when Indiana bats are not present at CAJMTC, that is from 1 October through 31 March.

ACTION AREA

The "Action Area" is defined by regulation as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02). The action area is not limited to the "footprint" of the action nor is it limited by the Federal agency's authority. Rather, it is a biological determination of the reach of the proposed action on listed species.

Because the full "reach" of the various direct and indirect effects of the activities comprising the Proposed Action remain somewhat uncertain, we assumed quantifiable effects to Indiana bats would be confined to the project footprint and a .5-mile buffer in all directions. Therefore, the Action Area defined for this consultation encompasses all of the area within the boundaries of the CAJMTC and a 0.5-mile buffer area. The CAJMTC is comprised of 33,132 acres of federally owned land and is located within portions of Bartholomew, Brown, and Johnson counties. Approximately 28,000 acres are located in Bartholomew County; 4,000 acres in Brown County; and 1,000 acres in Johnson County, Indiana (Figure 3). [**NOTE**: proposed actions/activities on land north of Hospital Road that were recently acquired by CAJMTC were not considered under this PBO, but were addressed in a separate informal consultation.]

The Service's Section 7 Consultation Approach

The Service believes that a programmatic or program- and mission-wide consultation approach is appropriate for assessing effects from CAJMTC's ongoing mission-related training and projects.

By taking a programmatic consultation approach, the Service will be able to complete one comprehensive and conservative effects analysis, up front rather than repeating the same analyses for many individual projects affecting Indiana bats. Therefore this approach should also increase the efficiency of the section 7 consultation process. Another benefit of completing this

analysis up front in a programmatic consultation document is that the anticipated effects common to each of the subsequent projects can be added into the environmental baseline prior to their actual completion. This provides predictability for CAJMTC as they are assured that the effects of their future and ongoing routine actions have already been broadly and in some cases (e.g., MPMGR) specifically accounted for.

At the programmatic level, some uncertainty exists as to the specific impacts that will occur when site-specific projects are eventually proposed. However, by providing the benefit-of-the-doubt to the Indiana bat and using "reasonable worst case" assumptions when developing this biological opinion, the Service and the action agency have broadly accounted for this uncertainty. This approach results in the Service examining the greatest levels of impacts that can reasonably occur from implementing the Proposed Action and the proposed CMs. This evaluation and subsequent impacts are then closely monitored to ensure that anticipated impacts are not exceeded. This approach will ensure that the CAJMTC can fulfill its responsibilities under section 7(a)(2) of the Act to "ensure" that actions implemented are not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated Critical Habitat.

To ensure the impacts of take associated with CAJMTC's ongoing mission are appropriately minimized and that the exemption of incidental take is appropriately tracked and documented, CAJMTC staff and the Service will implement an "appended" programmatic consultation approach. Under this approach, the PBO and Incidental Take Statement (ITS) will consider, quantify, and exempt a reasonable amount of anticipated incidental take for Indiana bats at the program level over a 5 to 10-year time frame. However, impacts associated with subsequent projects or activities that have not yet been specifically identified but are by themselves or cumulatively are likely to adversely affect Indiana bats or their habitat will be individually monitored by CAJMTC to determine if they are consistent with the findings within the PBO and the ITS's Reasonable and Prudent Measures (RPMs) and associated Terms and Conditions (TCs) and documented in an annual summary report to the Service. CAJMTC's project-by project review and the Service's annual review of project-specific impacts and projected impacts for the coming year will ensure that incidental take of bats is not exceeded. If impacts contained within the annual report is found to be consistent with the programmatic consultation, then it will be appended to the PBO and ITS. Further details as to how impacts associated with project-specific reviews will be reported and documented are included in the attached ITS.

II. STATUS OF THE SPECIES

Indiana Bat

On 15 April 2007, the Service released the *Indiana Bat (Myotis sodalis) Draft Recovery Plan: First Revision* (USFWS 2007), which contains an excellent summary of the current status of the Indiana bat. In addition, the Bloomington, Indiana Field Office (BFO) of the Service recently completed a 5-Year Review of the Indiana bat (USFWS 2009), which summarizes the current status of the species, progress towards recovery, and remaining threats to the bat. Both the draft recovery plan and 5-Year Review are available on the Service's Indiana bat website at http://www.fws.gov/midwest/Endangered/mammals/inba/index.html and are hereby incorporated by reference. The 5-Year Review found that the all of the required recovery criteria for the Indiana bat had not been achieved and thus it should remain at its current 'endangered' status.

Furthermore, since the April 2007 release of the Draft Recovery Plan, the Bloomington Field Office of the Service has collated the population data gathered during the 2007 and 2009 biennial winter hibernacula surveys throughout the range and preliminarily determined that the Indiana bat's 2009 range-wide population stands at approximately 390,000 bats, which is a 16.6% decrease over the 2007 range-wide population estimate of 468,000 bats (USFWS, unpublished data, 2010). The range-wide, biennial population estimates had been increasing since at least 2001, indicating that the species' long-term decline had been arrested and likely reversed (USFWS, unpublished data, 2010). The observed range-wide decline in 2009 is partly attributable to the recently described disease dubbed White-Nose Syndrome (WNS; see discussion below), especially for decreased population estimates in the Northeast. The species' range-wide, regional, state, and hibernacula-specific population trends are being closely monitored by the BFO.

Given the 2009 range-wide Indiana bat population estimate of approximately 390,000, we assume that there are approximately 2,438 to 3,250 maternity colonies throughout the species' entire range [assuming a 50:50 sex ratio (Humphrey et al. 1977) and an average maternity colony size of 60 to 80 adult females (Whitaker and Brack 2002) (Table 4)]. At present, the Service has location records for approximately 269 maternity colonies (USFWS 2007), which, based on the assumptions above, represents 8 to 11% of the assumed number of maternity colonies in existence (Tables 4 and 5).

Recovery Efforts

Since the Indiana bat's initial listing, the recovery program has largely been focused on protection of important hibernacula (USFWS 1983). The proposed recovery program outlined in the draft Recovery Plan (USFWS 2007) has four broad components: 1) range-wide population monitoring at the hibernacula with improvements in survey techniques; 2) conservation and management of habitat (hibernacula, swarming, and summer); 3) further research into the requirements of and threats to the species; and 4) public education and outreach. This recovery program continues to have a primary focus on protection of hibernacula but also increases the focus on summer habitat and proposes use of Recovery Units.

Table 4. Estimated number of Indiana bat maternity colonies range-wide.

Year	Estimated Rangewide Population	% Change from Previous Period	Estimated Number of Maternity Colonies[1]	Approximate Number of Known Maternity Areas[2]	% of Est. Maternity Colonies that are Known
1960/1970	883,300		5,500	1 (in 1971)	~0.02%
~1980	509,708	-42%	3,200	31	~1.0%-
~1990	373,395	-27%	2,300	70	~3.0%
2001	328,526	-12%	2,100	149	~7.1%
2009	390,000	+19%	2,400	269	~11.2%

[1] Total rounded to the nearest 100. Estimates of the number of maternity colonies rangewide were developed based on the following assumptions: a) the known hibernating population is the source of the entire summer population; b) there is a 50:50 sex ratio (Humphrey et al. 1977); c) average maternity colony size of 80 adult females (Whitaker and Brack 2002); and d) the trend in decline of the total number of maternity colonies follows that of the hibernating population. [2] This is the number of areas where reproductive females and/or juveniles have been captured during the maternity season (USFWS, unpublished data, 2006).

Table 5. States and counties with recorded Indiana bat maternity colonies (current as of 2007).[1,2,3] These colonies are considered likely to be locally extant (within limits of data noted in footnote 3).

State	No. of Recorded Maternity Colonies	Counties with Recorded Maternity Colonies (if multiple colonies, then # is shown)
Arkansas	1	Clay
Illinois	28	Adams (2), Alexander, Bond, Cass, Ford, Henderson, Jackson (3), Jersey, Macoupin, Monroe (4), Pike (2), Pulaski, Randolf, Saline, Schuyler, Scott, St. Clair, Union, Vermilion, and Washington (2)
Indiana	83	Bartholomew (3), Clinton (2), Crawford, Davies (2), Dearborn, Gibson (2), Greene (3), Hendricks (2), Henry, Howard, Huntington, Jackson (3), Jasper, Jay, Jefferson (2), Jennings (2), Johnson (3), Knox, Koskiusko, LaPorte (2), Marion, Martin, Monroe (2), Montgomery (3), Morgan (4), Newton, Parke (2), Perry (2), Pike (2), Posey, Pulaski (2), Putnam (2), Randolph (3), Ripley (2), Rush, Shelby (2), Spencer, St. Joseph, Steuben, Tippecanoe (4), Vermillion, Vigo, Wabash (2), Warren (2), Warrick (2), Wayne, and Wells
Iowa	27	Appanoose (2), Davis, Decatur (2), Des Moines (2), Iowa, Jasper, Keokuk, Lucas (2), Madison (2), Marion (7), Monroe, Ringgold, Van Buren, Wapello, and Washington (2)
Kentucky	32	Ballard, Ballard/Carlisle, Bath (3), Breckinridge, Bullitt (4), Daviess, Edmonson (3), Floyd, Harlan (3), Henderson (2), Hickman (2), Jefferson (3), Logan, McCracken (2), Pulaski, Rowan, Spencer, and Union
Maryland	2	Carroll (2)
Michigan	11	Calhoun, Cass, Eaton, Hillsdale, Jackson, Lenawee (2), Livingston, St. Joseph (2), and Van Buren
Missouri	20	Chariton, Gasconade, Iron, Jefferson, Knox (2), Lewis, Linn, Macon, Madison, Marion, Mercer, Monroe, Nodaway, Pulaski, Scotland, St. Francois, St. Genevieve, Sullivan, and Wayne
New Jersey	7	Morris (5), Somerset, and Sussex
New York	31	Cayuga, Dutchess (5), Essex, Jefferson (9), Onondaga (4), Orange (8), and Oswego (3)
Ohio	11	Ashtabula, Butler, Clermont, Cuyahoga, Greene, Hocking, Lawrence, Paulding, Pickaway, Summit, and Wayne
Pennsylvania	2	Berks and Blair
Tennessee	3	Blount (2) and Monroe
Vermont	7	Addison (6) and Chittenden
Virginia	1	Lee
West Virginia	3	Boone (2) and Tucker
Total	**269**	

[1] Unpublished data obtained in response to a data request sent to Service Field Offices in February 2006.
[2] Most maternity colony records were based upon the capture of reproductively active females and/or juveniles between 15 May and 15 August.
[3] This table includes records of maternity colonies considered to be locally extant (even though records may not have been verified in recent years). Although some additional records exist, we did not include them if subsequent surveys failed to detect their presence (i.e., the colony may have disbanded, relocated, was extirpated, or was present but not found). Records were also not included if suitable habitat no longer exists at a previously occupied site.

Recovery Units

The Service's proposed delineation of Recovery Units (RUs) relied on a combination of preliminary evidence of population discreteness and genetic differentiation, differences in population trends, and broad-level differences in macrohabitats and land use (USFWS 2007). The Indiana Bat Draft Recovery Plan proposes four RUs for the species: Ozark-Central, Midwest, Appalachian Mountains, and Northeast (USFWS 2007) (Figure 1).

CAJMTC falls within the proposed Midwest RU, which in the winter of 2008-2009 contained approximately 259,000 Indiana bats or two-thirds (66%) of the range-wide Indiana bat population (USFWS, unpublished data, 2010).

As of the winter of 2008-2009, the State of Indiana's 37 hibernacula harbored approximately 190,000 Indiana bats (49% of the range-wide population) (USFWS, unpublished data, 2010). In 2009, three of the top four most populous hibernacula were located in Indiana, with Ray's Cave in Greene County being the most populous (n=48,657 bats), followed by Wyandotte Cave in Crawford County (n=45,516 bats) and Jug Hole Cave in Harrison County (n=36,067 bats).

New Threats: WNS and Wind Turbines

Recently a new threat has emerged with serious implications for the wellbeing of North American bats, including the Indiana bat. White-Nose Syndrome (WNS) was first documented in a photograph taken in a New York cave in February 2006. Since that time, at least 160 sites in 11 states (New York, Massachusetts, Vermont, New Hampshire, Connecticut, Virginia, West Virginia, Pennsylvania, New Jersey, Maryland, and Tennessee) and two Canadian provinces (Ontario and Quebec) have been documented with WNS, including approximately 51 known Indiana bat hibernacula. In some affected hibernacula in New York and New England, 90 to 100 percent of the bats have died. Some scientists estimate that WNS has killed more than a million hibernating bats (BCI 2010). The regional population of Indiana bats in the states currently affected by WNS suffered a 30% decline (loss of 20,813 bats) from 2007 to 2009.

WNS has been characterized as a condition primarily affecting hibernating bats. Affected bats usually exhibit a white fungus on their muzzles and often on their wings and ears as well (Blehert et. al. 2009). Some affected bats may display abnormal behavior including flying during the day and in cold weather (before insects are available for foraging) and roosting towards a cave's entrance where temperatures are much colder and less stable. Many of the affected bats appear to have little-to-no remaining fat reserves which are necessary to survive until spring emergence. Recently the fungus associated with WNS has been identified as a previously undescribed species of the genus *Geomyces* (named *G. destructans*; G.d.) (Gargas et. al. 2009). The fungus thrives in the cold and humid conditions of bat hibernacula. It is unclear at this point if the fungus is causing the bat deaths directly, or if it is secondary to the cause of death. All of the possible modes of transmission are not currently known, although biologists suspect it is primarily spread by bat-to-bat contact. In addition, people may unknowingly contribute to the spread of WNS by visiting affected caves and subsequently transporting fungal spores to unaffected caves via their clothing and gear. Interestingly, G.d. has been documented growing on hibernating bats in several European countries, but the fungus does not appear to be causing widespread mortality there (Puechmaille et al. 2010).

Currently, WNS has primarily been documented within the Northeast and Appalachian Mountain Recovery Units (RUs) (Figure 1). However, in the winter of 2009-2010, WNS was also confirmed in three caves in central Tennessee, which falls within the Midwest RU and G.d. was detected on bats in Missouri, which is in the Ozark-Central RU. The Midwest RU covers the states of Indiana, Kentucky, Ohio and portions of Alabama, Georgia, Michigan and Tennessee (Figure 1). The syndrome has been confirmed in the Indiana bat, little brown bat, small-footed bat, northern long-eared bat, southeastern bat, tricolored bat and big brown bat. The *G. destructans* fungus has also been detected on two additional bat species; gray bats and cave myotis. There are many factors regarding WNS that remain unknown including if there are species' and/or regional differences in susceptibility and mortality rates, how long symptoms

may take to manifest, and the long-term population effects. Meanwhile, the Service, States and multiple researchers are continuing to learn more about the disease and options for minimizing its spread and impacts. To date, no WNS-related mortality has been documented in the Midwest or Ozark-Central RUs, but the disease will likely continue to spread throughout these regions within the next several winters and some unknown degree of mortality is likely to occur. For more information see http://www.fws.gov/WhiteNoseSyndrome/.

Lastly, there is growing concern that Indiana bats (and other bat species) may be threatened by the recent surge in construction and operation of wind turbines across the species' range. Until the fall of 2009, no known mortality of an Indiana bat had been associated with the operation of a wind turbine/farm. The first documented wind-turbine mortality event occurred during the fall migration period in 2009 at a wind farm in Benton County, Indiana. The Service is now working with wind farm operators to avoid and minimize incidental take of bats and assess the magnitude of the threat. For more information see http://www.fws.gov/midwest/News/release.cfm?rid=177.

Range-wide Status

This section is a discussion of the range-wide status of the Indiana bat and presents biological and ecological information relevant to formulating the biological opinion. It includes information on the species' life history, its habitat and distribution, and the effects of past human and natural factors that have led to the current status of the species.

The Indiana bat was officially listed as an endangered species on March 11, 1967 (Federal Register 32[48]:4001) under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U.S.C. 668aa[c]). The Endangered Species Act of 1973 extended full protection to the species. The Service has published a recovery plan (USFWS 1983) which outlines recovery actions. Briefly, the objectives of the plan are to: (1) protect hibernacula; (2) maintain, protect, and restore summer maternity habitat; and (3) monitor population trends through winter surveys.

Thirteen winter hibernacula (11 caves and two mines) in six states were designated as Critical Habitat for the Indiana bat in 1976 (Federal Register, Volume 41, No. 187). In Indiana, two winter hibernacula,Wyandotte Cave in Crawford County and Ray's Cave in Greene County, were designated as Critical Habitat. Neither of these caves is located near CAJMTC and therefore is not considered to be within the Action Area. Interestingly, Indiana bats captured and marked at CAJMTC have subsequently been observed hibernating within Wyandotte Cave (approximately 78 miles to the south).

Because the vast majority of Indiana bats form dense aggregations or "clusters" on the ceilings of a relatively small number of hibernacula (i.e., caves and mines) each winter, conducting standardized surveys of the hibernating bats is the most feasible and efficient means of estimating and tracking population and distribution trends across the species' range. Collectively, winter hibernacula survey data provide the Service with the best available representation of the overall population status and relative distribution.

For several reasons, interpretation of the census data must be made with some caution. First, winter survey data has traditionally been subdivided by state due to the nature of the data collection. As described below, each state does not represent a discrete population center. Nevertheless, the range-wide population status of the Indiana bat has been organized by state thus far. Second, as will be further discussed, available information specific to the "reproductive

unit" (i.e., maternity colony) of the Indiana bat is limited. While winter distribution of the Indiana bat is well documented, relatively little is known as to the size, location and extant number of maternity colonies for the Indiana bat. As described previously, it is estimated that the locations of approximately 90 percent of the estimated maternity colonies remain unknown.

Additionally, the relationship between wintering populations and summering populations is not clearly understood. For example, while it is known that individuals of a particular maternity colony come from one to many different hibernacula, the source (hibernacula) of most, if any, of the individuals in a maternity colony is not known. As discussed in the "Spring Emergence/Migration" section, Indiana bats have been documented to travel up to 300 miles from their hibernaculum to their maternity areas (Gardner and Cook 2002). As such, the origin of the bats (hibernacula) that comprise the maternity activity in the action area is unknown.

Rangewide Winter Hibernacula Surveys

The data regarding Indiana bat abundance prior to Federal listing are limited, but the information suggests that they were once far more abundant than they were in the 1960s. Tuttle and colleagues, for example, believe the overall abundance of Indiana bats likely rivaled that of the now extinct passenger pigeon (USFWS 2007). The basis for Tuttle's and others estimates of millions of Indiana bats prior to European settlement is primarily based on historic accounts (e.g., Blatchley 1897, Silliman et al. 1851), extensive staining left on the ceilings of several historic hibernacula (Tuttle 1997, Tuttle 1999), and other paleontological evidence (Munson and Keith 1984, Toomey et al. 2002). For example, an analysis of bone deposits in Bat Cave, KY revealed that an estimated 300,000 Indiana bats died during a single flood event at some point in history (Hall 1962). Although we are never likely to know the true historical abundance of Indiana bats, it seems clear from the evidence above that Indiana bats were much more abundant than observed in 1960.

When the Indiana bat was originally listed as endangered in 1967, there were approximately 883,300 bats (Figure 2a) and most of these hibernated in a small number of hibernacula (Clawson 2002). Since it was listed, the species' population numbers have apparently continued to decline through approximately 2001. Although some winter bat surveys began as early as the late 1950s, systematic surveys were not conducted across the range until the mid 1980s when there were an estimated 678,750 Indiana bats (Clawson 2002). Since being listed, large population declines have been observed, especially at hibernacula in Kentucky and Missouri. Caves in Kentucky suffered dramatic losses because of changes in microclimate due to poor cave gate design in two of the three most important hibernacula (Humphrey 1978), and Indiana bat numbers in Kentucky hibernacula had continued to decline until 2005 when an increase was first observed (King, personal communication 2007). Despite recovery efforts, Indiana bats in Missouri caves have continuously declined with a loss of more than 80 percent of the previous population size (Clawson 2002). From the 1960s/70s to the most recent population survey in 2009, the rangewide population of the Indiana bat has declined from approximately 883,300 Indiana bats for 1960/1970 to 390,000 in 2009, or approximately 56 percent. The 40-year population trend from 1960 – 2000 of the Indiana bat has shown a steady decline (Figure 2a).

The 2005 Indiana bat rangewide population estimate totaled approximately 425,430 bats; a 17% increase over the 2003 estimate of 364,030 bats (Andy King, USFWS, unpublished data, 2010; Figure 2a). In 2005, about 60% of the estimated 425,430 Indiana bats were hibernating in nine Priority 1 hibernacula in four states: 4 hibernacula in Indiana, 3 in Missouri, 2 in Kentucky and 1 in Illinois (A. King, USFWS, unpublished data, 2005). Priority 2 hibernacula are known from the aforementioned states, in addition to Arkansas, New Jersey, New York, Ohio, Pennsylvania,

Tennessee, Virginia, and West Virginia. Priority 3 hibernacula have been reported in 21 states, including all of the aforementioned states (see Figure 1).

Although a notable increase (10.8%) over the previous biennial rangewide population estimate first occurred in 2003, these results may not be statistically or biologically significant, and no determinations can be made with confidence from such a limited survey period. Small fluctuations from year-to-year may be attributed to such factors as weather affecting the success of reproduction for a given year (Humphrey and Cope 1977); and therefore, it is not appropriate to extrapolate long-term trends from changes between individual survey periods. Nonetheless, in 2005 there was almost a 17% increase over the 2003 estimate and another 10% increase between 2005 and 2007. Unfortunately, the rangewide population experienced an apparent 16.6% decline in 2009 (USFWS, unpublished data, 2010). This was the first observed decline in the range-wide population since 2001. The observed decline between 2007 and 2009 was partly a result of WNS-related mortality in the Northeast as mentioned above, but large, as of yet unexplained, population declines also occurred at some key hibernacula in Indiana and Kentucky as well. Nearly half of the 2009 range-wide population hibernated in caves within the bat's namesake state of Indiana (Figure 2b).

Some investigators believe that warmer winter temperatures may have resulted in less conducive microhabitat conditions (warmer temperatures) at hibernacula, particularly in the southern part of the species range (Rick Clawson, personal communication, Missouri Department of Conservation), but this has yet to be rigorously investigated. Other declines have occurred as winter hibernacula have flooded, hibernacula ceilings have collapsed, or cold temperatures kill bats through hypothermia. Exclusion of bats from hibernacula through blocking of entrances, installation of gates that do not allow for bat ingress and egress, disruption of cave air flow, and human disturbance during hibernation have been documented causes of Indiana bat declines. Because many known threats are associated with hibernation, protection of hibernacula still remains a top management and recovery priority. Although some hibernacula have been restored in order to support future wintering populations, Indiana bats have not returned to some of these hibernacula as anticipated while they have quickly recolonized others.

Despite the protection of most major hibernacula, population declines generally have continued until the apparent increases in 2003 - 2007. Continued population declines of Indiana bats, in spite of efforts to protect hibernacula, initially led some scientists to the conclusion that additional information on summer habitat is needed (Rommé et al. 1995), but others contended that the primary cause of continued declines stemmed from suboptimal microclimates within traditional hibernacula and/or high human disturbance levels (Tuttle and Kennedy 2002). In addition to increased focus on these issues, attention has also been directed to pesticide contamination. Insecticides have been known or suspected as the cause of a number of bat die-offs in North America, including endangered gray bats (*Myotis grisescens*) in Missouri (Clark et al. 1978). The insect diet and longevity of bats also exposes them to persistent organochlorine chemicals which may bioaccumulate in bat tissue and cause sub-lethal effects such as impaired reproduction.

Maternity Colonies

To date, most records of reproductively active female and juvenile Indiana bats have occurred in glaciated portions of the upper Midwest including southern Iowa, northern Missouri, most of Illinois, most of Indiana, southern Michigan, and western Ohio (Gardner and Cook, 2002; USFWS unpubl. data, 2010; Table 5). The first maternity colony was found in east-central Indiana in 1971 and most subsequent surveys and studies of Indiana bat maternity habitat have

been conducted in the upper Midwest (Cope et al. 1974, Clawson 2002). Unglaciated portions of the Midwest (southern Missouri, parts of southern Illinois, and south-central Indiana), Kentucky, and most of the eastern and southern portions of the species' range appear to have fewer maternity colonies per unit area of forest than does the upper Midwest. Increased summer survey efforts are needed elsewhere in the range, however, before final conclusions may be reached regarding relative abundance across the species' summer range.

In recent years, multiple maternity colonies have been discovered in the Champlain Valley and lower elevations of adjacent hills between Burlington, Vermont, and Ticonderoga, New York (A. Hicks, pers. comm., September 2005). In contrast, the first maternity roosts in "the South" were found in very different types of habitat, in areas of extensive mature forest in the southern Appalachian Mountains of North Carolina and Tennessee. In further contrast, these colonies were found roosting in eastern hemlock (*Tsuga canadensis*) and pines (*Pinus* spp.), rather than deciduous trees (Harvey 2002).

Based on published literature and correspondence with Service and state biologists throughout the range of the Indiana bat, maternity activity has been documented at approximately 269 locations throughout the species'range (USFWS 2007, Table 5). The majority of confirmed maternity areas are in the "core" of the range, in the glaciated Midwest in pockets of remaining forested habitat within a predominantly agricultural landscape and in the Northeast (i.e., NY and VT). Because the Indiana bat is philopatric (i.e., loyal to its traditional summering area), there is currently no evidence to suggest that all maternity colonies are located in optimal foraging and roosting habitat. A possibility that may have contributed to the species' decline is that many existing maternity colonies are senescent (i.e., deaths outnumber births) or are population sinks. This could be caused by pups being produced but not surviving their first hibernation period; or maternity areas are no longer providing a sufficient supply of suitable prey, resulting in an increase in the age of first reproduction and increasing fecundity schedules. Proof of at least several years of successful reproduction and recruitment would be needed to verify long-term survival of the Indiana bat in these highly altered and fragmented landscapes. Although data at a few maternity sites indicate that reproduction is occurring (exit counts nearly double a month after birth), long-term monitoring of maternity sites is limited. Long-term monitoring has been conducted at a maternity colony located near the Indianapolis Airport (Whitaker and Sparks 2003, Whitaker et al. 2004). This colony continues to persist, and shows evidence of reproduction, although additional monitoring is needed to make a determination regarding whether the colony is stable, increasing, or decreasing at this site.

Monitoring data, including extensive exit counts to estimate maternity colony population size and structure over more than one-year, is available for only a few of the approximately 269 maternity colonies discovered (Humphrey et al. 1977; Garner and Gardner 1992; Callahan 1993; Gardner et al. 1991b; Kurta et al. 1993; Indianapolis Airport Authority 2003; Indianapolis Airport Authority 2004). Additionally, because the vast majority of the Indiana bat maternity colonies have not been discovered, let alone studied, what little demographic data that is available, represent a fraction of the range-wide maternity activity.

Because so little is known regarding the population size and structure of maternity colonies, the Service used the same assumption as Whitaker and Brack (2002) to determine the average maternity colony size to give an approximation of the number of potential maternity colonies across the range of the Indiana bat. The Service recognizes that maternity colonies are not static in size, and the numbers of individuals that comprise a maternity colony likely vary widely as a

colony adjusts to current conditions, including the availability and quality of roosting and foraging habitat, and variable climatic conditions. Therefore, these figures should not be used to make extrapolations regarding the densities or distribution of maternity colonies present within portions of the species range (Racey and Entwistle 2003); however, these figures do serve to provide a rough estimation regarding the number of maternity colonies that might be present across the landscape. The "Maternity Colony Size – Population" section found in the "Life History" section of this biological opinion provides more information with regard to the size of a maternity colony.

Recognizing the inherent deficiency in such an assumption, these calculations illustrate that the vast majority of maternity colonies for the Indiana bat have not been documented. The location of most maternity colonies may always remain unknown because of the difficulty in detecting maternity activity for the Indiana bat. Some unknown proportion of these colonies may be at risk when land use practices and changes, such as timber harvesting and development, are carried out. Therefore, another likely cause for the decline of this species is that some maternity colonies are being reduced in numbers, and in some cases extirpated, prior to their discovery.

Indiana Bat Status in Indiana

Historic hibernating population levels in Indiana were comprehensive enough to estimate on a statewide level for the first time in 1981, resulting in an estimate of 151,676 hibernating bats (USFWS, unpublished data, 2010). Since that time, the statewide estimate fell to a low of 104,680 bats in 1985 and then rose steadily until the 2007 census when it reached 238,009 bats. In 2009, the state-wide population declined by approximately 20% to 189,994 bats. In 2009, Indiana's 37 hibernacula harbored approximately 48.7% of the range-wide population of Indiana bats. The State's (and the world's) two most populous Indiana bat hibernacula are Wyandotte Cave (n=45,516 bats in 2009) and Ray's Cave (n=48,657 bats in 2009), which are located approximately 78 miles and 45 miles from CAJMTC, respectively.

Previous Incidental Take Authorizations

Summary- All previously issued Service Biological Opinions involving the Indiana bat have been non-jeopardy. These formal consultations have involved (a) the Forest Service for activities implemented under various Land and Resource Management Plans on National Forests in the eastern United States, (b) the Federal Highway Administration for various transportation projects, (c) the U.S. Army Corps of Engineers (Corps) for various water-related projects, and (d) the Department of Defense for operations at several different military installations. Additionally, an incidental take permit has been issued under section 10 of the Endangered Species Act to an Interagency Taskforce for expansion and related development at the Indianapolis Airport in conjunction with the implementation of a Habitat Conservation Plan (HCP). Additional HCPs are being developed for a privately owned natural gas pipeline/storagefield system, a State-operated forestry program, and several private wind power developments.

It is important to note that in many of these consultations, survey information was lacking. As Federal agencies are not required to conduct surveys, often the Service relied on a host of valid factors in helping the Federal agency determine whether Indiana bats may be present. To ensure the Federal agency and the Service met the mandate of the section 7(a)(2), if the best available data indicated that Indiana bats may be present, the assumption was made that a maternity colony (in most instances) occurred within the Action Area. Although we believe this approach fully accords with the intent of Congress and the Endangered Species Act of 1973, it likely resulted in

an over-estimate of the number of individuals or colonies that may have been impacted by Federal actions.

National Forests- Within the past several years, nearly all National Forests within the range of the Indiana bat have requested formal consultation at the programmatic level including the HNF. Consultation under Section 7 of the Act is necessary to ensure agency actions do not jeopardize the continued existence of listed species. These consultations have led to non-jeopardy biological opinions with associated incidental take statements. Although some of these incidental take statements anticipated the take of reproductive females, we have not yet confirmed a loss of a maternity colony on a National Forest. The reasons for this are likely two-fold. First, the programmatic conservation measures (i.e., standard and guidelines) and second, the project-specific reasonable and prudent measures were designed to minimize maternity colony exposure to the environmental impacts of Forest Plan actions. Specifically, these measures ensured an abundance of suitable Indiana bat habitat on the National Forests, and protected all known or newly discovered maternity colonies.

Approximately 95 percent of previously authorized habitat loss on National Forests has not been a permanent loss. Rather, it has been varying degrees of temporary loss (short-term and long-term) as a result of timber management activities. Although this analysis does not include all National Forests that, to date, have received an incidental take statement, the concepts of the analysis are consistent, regardless of the location. Conservation measures provided by the USFS as part of the proposed action, as well as reasonable and prudent measures provided by the Service to minimize the impact of the annual allowable take for each of the National Forests, have been designed to: (1) ensure an abundance of available remaining Indiana bat roosting and foraging habitat on all National Forests; and (2) ensure persistence of any known or newly discovered maternity colonies to the maximum extent practicable.

Although Indiana bat presence has been verified on most, if not all, National Forests within the range of the species, confirmation of maternity activity on these lands is relatively scant. There have been less than seven maternity colonies documented on National Forests. It must be noted that maternity activity was confirmed for the first time on two national forests (Monongahela National Forest [West Virginia] and Hoosier National Forest [Indiana]) as recently as 2004.

Incidental take primarily has been exempted in the form of habitat loss because of the great difficulty of detecting and quantifying take of the individual Indiana bats because of their small body size, wide and cryptic summer distribution while roosting under loose bark of trees, and unknown spatial extent and density of their summer roosting population range within the respective National Forests. For some incidental take statements, take has also been extrapolated to include an estimated number of individual Indiana bats. The estimate of the number of individual Indiana bats likely to be taken has been wide-ranging and based on various assumptions. Legal coverage has included the take, by kill, of individual Indiana bats; or take, by harm through habitat loss, or harassment.

Other Federal Agencies or Non-Federal Entities- Several incidental take statements have been issued to other Federal agencies. Unlike those issued for the National Forest Land and Resource Management Plans, some of these projects were certain to impact known occupied habitat. To minimize the effect of these projects, the action agencies agreed to implement various conservation measures. These included: seasonal clearing restrictions to avoid disturbing female Indiana bats and young; protection of all known primary and alternate roost trees with appropriate buffers; retention of adequate roosting and foraging habitat to sustain the maternity

colony into the future; and permanent protection of areas and habitat enhancement or creation measures to provide future roosting and foraging habitat opportunities.

With the exception of three (Fort Knox, Great Smoky Mountains National Park, and Laxare East and Black Contour Coal Mining projects), none of these biological opinions and associated incidental take statements anticipated the loss of a maternity colony. Required monitoring for three formal consultations in Indiana (Camp Atterbury, Newport Military Installation, and Indianapolis Airport) has confirmed that the affected colonies persisted through the life of the project and continue to exist today (USFWS, unpublished data, 2010). We recognize that given the philopatric nature of Indiana bats and their long life-spans, the full extent of the anticipated impacts of these and other projects may not yet have occurred. Nonetheless, these monitoring results and the lack of data to suggest otherwise for the other projects, indicate that the conservation measures to avoid and minimize the impacts of Federal projects appear to be effective. Only with continued long-term monitoring will we definitively be able to determine the true effectiveness of implemented conservation measures.

In summary, we believe the take exempted to date via section 7 consultation has resulted in short-term effects to Indiana bat habitat and, in limited circumstances, on Indiana bat maternity colonies. As many of these consultations necessarily made assumptions about Indiana bat presence, we are uncertain of the actual number of maternity colonies exposed to environmental impacts of Federal actions throughout the species' range, but we believe the actual number is likely less than what we have assumed to be present. Furthermore, although not definitive, monitoring of maternity colonies pre- and post-project implementation preliminarily suggests that our standard conservation measures, when employed in concert, appear to be effective in minimizing adverse effects on the affected maternity colonies.

Indiana Bat Description and Distribution

The Indiana bat is a medium-sized bat with a head and body length that ranges from 41 to 49 mm (Thompson 1982). There are no recognized subspecies. The species range includes much of the eastern half of the United States, from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida. The Indiana bat is migratory, and the above described range includes both winter and summer habitat. The winter range is associated with regions of well-developed limestone caverns. The largest populations of this species hibernate in Indiana, Kentucky, Illinois, and New York (Figure 2b). Smaller winter populations have been reported from Alabama, Arkansas, Georgia, Maryland, Mississippi, Missouri, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Virginia, and West Virginia. Two-thirds (66%) of the entire estimated 2005 population of Indiana bats hibernated in only eight hibernacula in Illinois, Indiana, Kentucky, Missouri, and New York and more the 75% of the rangewide population hibernated in only 12 hibernacula (USFWS unpublished data, 2006).

Life History

The average life span of the Indiana bat is 5 to 10 years, but banded individuals have lived up to 14 and 15 years (Thomson 1982). Female survivorship in an Indiana population was 76% for ages 1 to 6 years and 66% for ages 6 to 10 years. Male survivorship was 70% for ages 1 to 6 years and 36% for ages 6 to 10 years (Humphrey and Cope 1977).

Summering Indiana bats (males and females) roost in trees in riparian, bottomland, and upland forests. Roost trees generally have exfoliating bark which allows the bat to roost between the bark and bole of the tree. Cavities and crevices in trees also may be used for roosting. A variety of tree species are used for roosts including (but not limited to) silver maple (*Acer saccharinum*),

sugar maple (*Acer saccharum*), shagbark hickory (*Carya ovata*), shellbark hickory (*Carya laciniosa*), bitternut hickory (*Carya cordiformis*), green ash (*Fraxinus pennsylvanica*), white ash (*Fraxinus americana*), eastern cottonwood (*Populus deltoides*), northern red oak (*Quercus rubra*), post oak (*Quercus stellata*) , white oak (*Quercus alba*), shingle oak (*Quercus imbricaria*), slippery elm (*Ulmus rubra*), American elm (*Ulmus americana*), and sassafras (*Sassafras albidum*)(Rommé et al. 1995). At one site in southern Indiana, black locust (*Robinia psuedoacacia*) was used extensively by roosting bats (Pruitt 1995). Structure is probably more important than the species in determining if a tree is a suitable roost site; and tree species which develop loose, exfoliating bark as they age and die are likely to provide roost sites. Male bats disperse throughout the range and roost individually or in small groups. In contrast, reproductive females form larger groups, referred to as maternity colonies in which they raise their offspring.

Females arrive in summer habitat as early as April 1. Temporary roosts are often used during spring until a maternity roost with large numbers of adult females is established. Indiana bats arrived at maternity roosts in April and early May in Indiana, with substantial numbers in mid-May. Most documented maternity colonies have 50 to 100 adult bats (USFWS 2007). Fecundity is low; and female Indiana bats produce only one young per year in late June to early July. Young bats can fly between mid-July and early August, at about 4 weeks of age. Mortality between birth and weaning was found to be about 8% (Humphrey et al. 1977). Many males stay near hibernacula (i.e., caves and mines) and roost individually or in small groups (Whitaker and Brack 2002). The later part of the summer is spent accumulating fat reserves for fall migration (USFWS 2007).

When arriving at their traditional hibernacula in August-September, Indiana bats "swarm". Some male bats may begin to arrive at hibernacula as early as July. Females typically arrive later and by September numbers of males and females are almost equal. Swarming is a critical part of the life cycle when Indiana bats converge at hibernacula, mate, and forage until sufficient fat reserves have been deposited to sustain them through the winter (Cope et al. 1977, USFWS 1983). Swarming behavior typically involves large numbers of bats flying in and out of cave entrances throughout the night, while most of the bats continue to roost in trees during the day. Body weight may increase by 2 grams within a short time, mostly in the form of fat. Swarming continues for several weeks and copulation occurs on cave ceilings near the cave entrance during the latter part of the period. (USFWS 1991 b, USFWS 2007). The time of highest swarming activity in Indiana and Kentucky has been documented as early September (Cope et al. 1977). By late September many females have entered hibernation, but males may continue swarming well into October in what is believed to be an attempt to breed with late arriving females. Research is needed to determine how far bats will forage in the fall. Most bats tracked have stayed within 2 to 3 miles of the hibernacula, but some have been found up to 4.2 miles away (Rommé et al. 2002). Studies suggest that the majority of foraging habitat in spring and autumn is within 2 mi of the hibernacula, but extends to 5 miles or more. Therefore, it is not only important to protect the caves that the bats hibernate in, but also to maintain and protect the quality and quantity of roosting and foraging habitat within 5 miles of each Indiana bat hibernaculum. Additional studies of fall swarming behavior are warranted to gain a better understanding of the bats' behavior and habitat needs during this part of its annual life cycle (Rommé et al. 2002).

During swarming, males are active over a longer period of time at cave entrances than females, probably to mate with females as they arrive. Females may mate their first autumn, whereas males may not mature until the second year (USFWS 2007). After mating, females soon enter into hibernation. Most bats are hibernating by the end of November, but hibernacula populations

may continue to increase (USFWS 2007). Indiana bats cluster and hibernate on cave ceilings in densities of approximately 300-484 bats per square foot, from approximately October through April. Hibernation facilitates survival during winter when prey (i.e., insects) is unavailable. The season of hibernation may vary by latitude and annual weather conditions. Clusters may protect central individuals from temperature change and reduce sensitivity to disturbance. Like other cave bats, the Indiana bat naturally arouses at intervals of 7-14 days (Dr. John Whitaker, Jr. – per. comm.) during hibernation (Sealander & Heidt 1990). Arousals are more frequent and longer at the beginning and end of the hibernation period (Sealander & Heidt 1990). Limited mating occurs throughout the winter, and in early April as bats emerge (USFWS 2007).

After hibernation ends in late March or early April, most Indiana bats emerge, and forage for a few days or weeks near their hibernaculum before migrating to their traditional summer roosting areas. Female Indiana bats emerge first from hibernation in late March or early April, followed by the males. The timing of annual emergence may vary across their range depending on latitude and annual weather conditions. Shortly after emerging from hibernation, the females become pregnant via delayed fertilization from the sperm that has been stored in their reproductive tracts through the winter (USFWS 2007). The period after hibernation but prior to spring migration is typically referred to as "staging". Most populations leave their hibernacula by late April. Migration is stressful for the Indiana bat, particularly in the spring when their fat reserves and food supplies are low. As a result, adult mortality may be the highest in late March and April.

Most bats migrate to the north for the summer, although other directions have been documented (USFWS 2007, Gardner and Cook 2002). A stronger homing tendency has been observed along a north-south axis, than the east-west direction in release studies. Females can migrate hundreds of miles north of the hibernacula. In spring staging, males have been found almost 10 miles from their hibernacula (Hobson and Holland 1995). Less is known about the male migration pattern, but many males summer near the hibernacula (Whitaker and Brack 2002, USFWS 2007).

Food Habits:
Indiana bats feed exclusively on flying aquatic and terrestrial insects. Diet varies seasonally and variations exist among different ages, sexes, and reproductive status (USFWS 2007). It is probable that Indiana bats use a combination of both selective and opportunistic feeding to their advantage (Brack and LaVal 1985). Reproductively active females and juveniles show greater dietary diversity perhaps due to higher energy demands. Studies in some areas have found that reproductively active females eat more aquatic insects than do juveniles or adult males (USFWS 2007), but this may be the result of habitat differences (Brack and LaVal 1985).

Lepidoptera (moths), Coleoptera (beetles), and Diptera (midges and flies) consititute the bulk of the diet (Brack and LaVal 1985). Moths (Lepidoptera) have been identified as major prey items that may be preferentially selected (Brack and LaVal 1985), but beetles (Coleoptera) and flies (Diptera) were also found significant (Brack and Tyrell 1990). Diptera taken are especially midges and other species that congregate over water, but are seldom mosquitoes. Other prey include wasps and flying ants (Hymenoptera), caddisflies (Trichoptera), brown leafhoppers and treehoppers (Homoptera), stoneflies (Plecoptera), and lacewings (Neuroptera) (Brack and LaVal 1985, USFWS 2007). Male Indiana bats summering in or near a hibernation cave eat primarily moths and beetles but feed on other terrestrial insects in lower percentages (USFWS 2007).

Indiana bats use small impoundments as well as permanent and intermittent streams for drinking water (HNF 2000). Water-filled road ruts may be used for drinking water in uplands, more

commonly in the eastern portion of the range (Brack, Jr. per. comm.).

Habitat: Winter Hibernacula Habitat

Indiana bats roost in caves or mines with configurations that provide a suitable temperature and humidity microclimate (Brack et al. 2003, USFWS 2007). In many caves, suitable temperatures and therefore roosts are located near the cave entrance, but roosts may be deeper where cold air flows and is trapped. When bats arrive at hibernacula in October and November, they need a temperature of 50º F (10º C) or below (USFWS 2007). Mid-winter temperatures range from 39 to 46º F (4 to 8º C) (USFWS 1983); however, recent data in Indiana has recorded increased use of hibernacula ranging from 41 to 44.5º F (5 to 7º C) (Brack, Jr. per. comm.). Only a small percentage of caves available meet these temperature requirements (Brack et al. 2003, USFWS 2007). Stable low temperature allows bats to maintain low metabolic rates and conserve fat reserves to survive the winter (USFWS 2007). Relative humidity of roosts usually ranges from 74% to just below saturation, although readings as low as 54% have been recorded. This may be an important factor for successful hibernation (USFWS 2007). Hibernacula often contain large populations of several species of bats. Other bat species found in Indiana hibernacula include: a number of little brown bats (*Myotis lucifugus*) and eastern pipistrelles (*Pipistrellus subflavus*); some northern long-eared bats (*Myotis septentrionalis*); and a few gray bats (*Myotis grisescens*), big brown bats (*Eptesicus fuscus*), and silver-haired bats (*Lasionycteris noctivagans*) (Brack et al.2003).

Habitat: Summer Roosting Habitat

FEMALE

Indiana bats exhibit strong site fidelity to their traditional summer colony areas and foraging habitat, that is, they return to the same summer range annually to bear their young. (Kurta et al. 2002, Garner and Gardner 1992, USFWS 2007). Traditional summer sites that maintain a variety of suitable roosts are essential to the reproductive success of local populations. It is not known how long or how far female Indiana bats will search to find new roosting habitat if their traditional roost habitat is lost or degraded during the winter. If they are required to search for new roosting habitat in the spring, it is assumed that this effort places additional stress on pregnant females at a time when fat reserves are low or depleted and they are already stressed from the energy demands of migration and pregnancy.

Female Indiana bats generally migrate northward from the hibernacula to summer roosting areas. Indiana bat maternity colonies typically occupy multiple roosts in riparian, bottomland, and upland forests. Roost trees generally have exfoliating bark which allows the bat to roost between the bark and bole of the tree and have a southeast or south-southwest solar exposure and an open canopy. Cavities and crevices in trees also may be used for roosting. Roost tree structure is probably more important than the tree species in determining whether a tree is a suitable roost site; and tree species which develop loose, exfoliating bark as they age and die are likely to provide roost sites. Roost trees are often located on forest edges or openings with open canopy and open understory (USFWS 2007). Maternity colonies have often been found within forests that are streamside ecosystems or are otherwise within 0.6 mi (1 km) of permanent streams. Most have been found in forest types similar to oak-hickory and elm-ash-cottonwood communities. While these characteristics are typical, research is showing adaptability in habitats used. Important summer roosting and foraging habitat for the Indiana bat is often in floodplain or riparian forests but may also be in more upland areas. A telemetry study in Illinois found most maternity roosts within 1640 ft (500 m) of a perennial or intermittent stream (Hofmann 1996). Bats in Illinois selected roosts near intermittent streams and far from paved roads (Garner and Gardener 1992). However, observations have revealed habitat use nearer paved roads than

previously thought (Brack, Jr. per. comm.). Recent research has shown bats using upland forest for roosting and upland forest, and pastures with scattered trees for foraging. Indiana bats prefer forests with old growth characteristics, large trees, scattered canopy gaps, and open understories (USFWS 2007). The Indiana bat may persist in highly altered and fragmented forest landscapes for some unknown period of time. Instances have been documented of bats using forest altered by grazing, swine feedlot, row-crops, hay fields, residences, clear-cut harvests, and shelterwood cuts (Garner and Gardner 1992, USFWS 1999). Several roosts have been located near lightly traveled, low maintenance roads, as well as near I-70 at the Indianapolis Airport (USFWS 2002). Although, Indiana bats may be more adaptable than previously thought, it still is not known how a maternity colony's stability and reproductive success responds to increasing levels of habitat alteration and fragmentation.

Suitability of a roost tree is determined by its condition (dead or alive), suitability of loose bark, tree's solar exposure, spatial relationship to other trees, and tree's spatial relationship to water sources and foraging areas. Good roost trees are species whose bark springs away from the tree on drying after dead, senescent, or injured; and living species of hickories (*Carya* spp.) and large white oaks (*Quercus alba*) with shaggy bark. Cottonwoods are probably one of the best tree species. Many maternity colonies have been associated with oak-hickory and elm-ash-cottonwood forest types. Tree cavities, hollow portions of tree boles or limbs, and crevice and splits from broken tops have been used as roosts on a very limited basis, usually by individual bats. Roost longevity is variable due to many factors such as the bark sloughing off or the tree falling down. Some roosts may only be habitable for 1-2 years, but species with good bark retention such as slippery elm (*Ulmus rubra*), cottonwood (*Populus deltoides*), Green ash (*Fraxinus pennsylvanica*), oaks (*Quercus* spp.), and hickories (*Carya* spp.) may provide habitat 4-8 years (USFWS 1999). Trees in excess of 15.7 in (40 cm) diameter breast height (dbh) are considered optimal for maternity colonies, but trees in excess of 8.6 in (22 cm) dbh are used as alternate roosts (USFWS 2002). Females have been documented using roost trees as small as 5.5 inches.(Kurta 2005).

Indiana bat roosts are ephemeral and frequently associated with dead or dying trees. Gardner et al. (1991b) evaluated 39 roost trees and found that 31% were no longer suitable the following summer, and 33% of those remaining were unavailable by the second summer. A variety of suitable roosts are needed within a colony's traditional summer range for the colony to continue to exist. Indiana bat maternity sites generally consist of one or more primary maternity roost trees which are used repeatedly by large numbers of bats, and varying numbers of alternate roosts, which may be used less frequently and by smaller numbers of bats. Primary roosts are often located in openings or at the edge of forest stands, while alternate roosts can be in either openings or the interior of the forest stand. Primary roosts are usually surrounded by open canopy and are warmed by solar radiation. Alternate roosts may be used when temperatures are above normal or during precipitation. Bats move among roosts within a season and when a particular roost becomes unavailable from one year to the next. It is not known how many alternate roosts must be available to assure retention of a colony within a particular area, but large, nearby forest tracts would improve the potential for an area to provide adequate roosting habitat (Callahan 1993, Callahan et al. 1997). In addition to having exfoliating bark, roost trees must be of sufficient diameter. Trees in excess of 16 in. diameter at breast height (dbh) are considered optimal for maternity colony roost sites, but trees in excess of 9 inches dbh are often used as alternate maternity roosts. Male Indiana bats have been observed roosting in trees as small as 2.5 inches dbh (Gumbert et al. 2002).

Exposure of trees to sunlight and location relative to other trees are important to suitability. Cool temperatures can delay development of fetal and juvenile young and selection of maternity roost sites may be critical to reproductive success. Dead trees with a southeast and south-southwest exposures allow warming solar radiation. Some living trees may provide a thermal advantage during cold periods (USFWS 2007). Maternity colonies use multiple roosts in both dead and living trees that are grouped. Extent and configuration of a use area is probably determined by availability of suitable roost sites. Distances between roosts can be a few meters to a few kilometers. Maternity colony movements among multiple roosts seem to depend on climatic changes, particularly solar radiation (Humphrey et al. 1977). Kurta et al. (1993) suggests movement between roosts may be the bats' way of dealing with a roost site as ephemeral as loose bark. The bat that is aware of alternate roost sites is more likely to survive the sudden, unpredictable, destruction of its present roost than the bat which has never identified such an alternate.

Primary roosts are often located in openings or at the edge of forest stands, while alternate roosts can be in either openings or the interior of the forest stand. Primary roosts are usually surrounded by open canopy and are warmed by solar radiation. Alternate roosts may be used when temperatures are above normal or during precipitation. Shagbark hickories (*Carya ovata*) are good alternate roosts because they are cooler during periods of high heat and tight bark shields the bats from rain (USFWS 2007). Weather has been found to have profound influence on bat behavior and habitat use (Humphrey et al. 1977).

Humphrey et al. (1977) observed that each night after the sunset peak of foraging activity the bats left the foraging areas without returning to the day roosts, which indicated the use of "night" roosts. Kiser et al. (2002) found three concrete bridges on Camp Atterbury, 25 mi (40 km) south of Indianapolis, Indiana, used by Indiana bats as night roosts and to a limited extent as day roosts. Bat species using the bridges included the big brown bat (*Eptesicus fuscus*), northern myotis (*Myotis septentrionalis*), little brown myotis (*Myotis lucifugus*), Indiana bat, and eastern pipistrelle (*Pipistrellus subflavus*). The Indiana bat was the most common species, representing 51% of all bats observed, whereas the big brown bat was the second most abundant at 38%. Clusters of Indiana bats were observed night roosting under the bridges that were lactating, post-lactating, and newly volant juveniles. Bridges used were concrete-girder (multi-beam) bridges with deep, narrow expansion joints. The bridges ranged from 46 to 223 ft in length and 26 to 39 ft in width. Average daily traffic ranged from less than 10 vehicles per day to almost 5,000 vehicles per day. All used bridges were located over streams bordered by forested, riparian corridors that connected larger tracts of forest. Riparian forest did not overhang the bridges allowing solar radiation to warm the bridges; however, forest was within 9 to 16.5 ft of each bridge. Bat clusters under bridges were located over land, near the ends of the bridges. Mean ambient temperatures at night were consistently higher and less variable under bridges than external ambient temperatures. The bridges apparently act as thermal sinks. The warmer, more stable environment presumably decreases the energetic cost of maintaining high body temperature, thus promoting fetal development, milk production, and juvenile growth. Three individuals were radio-tracked to their day roosts within 0.6 to 1.2 miles from their night roost (Kiser et al. 2002).

MALE:

Many male Indiana bats appear to remain at or near the hibernacula in summer with some fanning out in a broad band around the hibernacula (Whitaker and Brack 2002). Males roost singly or in small groups in two to five roost trees similar to those used by females. Males may occasionally roost in caves. Suitable roost trees typically have a large diameter, exfoliating bark,

and prolonged solar exposure with no apparent importance in regard to the tree species or whether it is upland or bottomland (Whitaker and Brack 2002). Because males typically roost individually or in small groups, the average size of their roost trees tends to be smaller than the roost trees used by female maternity colonies, and in one instance a roost tree only 2.5 inches (6.4 cm) in diameter was used (Gumbert et al. 2002). Male bats have also been observed using trees as small as 3.1 in (8 cm) dbh (USFWS 2007). Also, males are more likely than females to be found in disturbed areas; possibly because the roost trees in those areas are likely to be too small for colony use, but still suitable for an individual roost (Brack, Jr. per. comm.). One individual was found roosting on the Hoosier National Forest within the easement of I-64 (Brack et al. 2004). Males have shown summer site fidelity and have been recaptured in foraging areas from prior years (USFWS 2007). At Camp Atterbury in Indiana, male bats were observed using the same bridges as females for night roosts, but they roosted singly (Kiser et al. 2002).

Autumn Swarming / Spring Staging Habitat

Indiana bats use roosts in spring and fall that are similar to those used in summer (USFWS 2007). However, because habitat is used by individuals rather than colonies, sites may be much smaller (Brack, Jr. per. comm.). Females use smaller, more disturbed areas during swarming and staging than in summer in maternity colonies (Brack, Jr. per. comm.). During fall, when bats swarm and mate at their hibernacula, male bats roost in trees nearby during the day and fly to the cave during the night. Studies have found males roosting in dead trees on upper slopes and ridgetops within a few miles of the hibernacula (USFWS 2007). In Jackson County, Kentucky, research showed fall roost trees tend to be located in canopy gaps created by disturbance (logging, windthrow, prescribed burning) and along edges (Gumbert et al. 2002). Fall roost trees are often exposed to sunshine (USFWS 2007). Within-year fidelity to fall roosts has been observed, where an individual bat uses an individual roost for an average of 2 to 3 days before moving to a new tree (Gumbert et al. 2002). Bats have been observed moving among multiple roosts in an area using particular roosts alternatively (Brack, Jr. per. comm., Gumbert et al. 2002).

In the spring, upon emergence, females and some males disperse from the hibernacula. Migration within the core of the species' range is generally northward to form colonies throughout Indiana, southern Michigan, and adjoining Ohio and Illinois. Male Indiana bats remain at or near the hibernacula, although some fan out in a broad band or zone around the hibernacula (Whitaker and Brack 2002).

Spring and autumn habitat use is variable due to proximity and quantity of roosts, weather conditions, and prey availability (Rommé et al. 2002). Several studies support the idea that during the autumn and spring, bats primarily use habitat within 5 miles (8 km) of the hibernacula (Rommé et al. 2002, Brack, Jr. per. comm.). However, more studies of autumn and spring habitat use is recommended due to low sample sizes and difficulties with telemetry research techniques (USFWS 2007).

Foraging Habitat

Indiana bats forage between dusk and dawn and feed exclusively on flying insects, primarily moths, beetles, and aquatic insects. They typically forage in and around tree canopy and in openings of floodplain, riparian, and upland forests (USFWS 2007). Optimum canopy closures are 50-70% with relatively open understory (<40% of trees are 2-4.7 in (5-12 cm) dbh) (HNF 2000). Woody vegetation with a width of at least 100 ft (30 m) on both sides of a stream has been characterized as excellent foraging habitat. Streams, associated with floodplain forests and impounded water bodies, are preferred foraging habitats for pregnant and lactating Indiana bats,

some of which may fly up to 1 ½ mi from upland roosts (Garner and Gardner 1992, USFWS 2002). Brack and Tyrell (1990) found that in early summer, foraging was restricted to riparian habitats. Foraging also occurs over clearings with successional vegetation, along cropland borders, fencerows, and over farm ponds. Bats have been observed crossing Interstate 70 in Indiana to reach foraging habitat (USFWS 2002). Bats have been documented routinely flying at least 1.25 mi (2 km) from the roost to forage and some were tracked up to 3 mi (5 km) from the roost (USFWS 2002). Foraging bats usually fly between 6 – 100 feet above ground level (USFWS 2007). In Illinois, Gardner et al. (1991a) found that forested stream corridors, and impounded bodies of water, were preferred foraging habitats for pregnant and lactating Indiana bats, which typically flew up to 1.5 miles (2.4 km) from upland roosts to forage. However the same study reported the maximum distance that any female bat flew (regardless of reproductive status) from her daytime roost to her capture site was 2.5 miles (4.2 km). Females typically utilize larger foraging ranges than males (Garner and Gardner 1992).

III. ENVIRONMENTAL BASELINE

This section is an analysis of the past effects of State, tribal, local and private actions already affecting the species within the Action Area and the present effects within the Action Area that will occur contemporaneously with the consultation in progress. It includes a description of the known status of Indiana bats and their habitats within or near the Action Area.

The natural environments that comprise the CAJMTC Action Area are summarized below. Additional information available in the Integrated Natural Resources Management Plan, Camp Atterbury Joint Maneuver Training Center: Revision 2007 (Parsons 2007) is hereby incorporated by reference.

The Action Area defined for this consultation encompasses all of the area within the boundaries of the CAJMTC and extending beyond 0.5 miles. The CAJMTC is comprised of 33,132 acres of federally owned land and is located within portions of Bartholomew, Brown, and Johnson counties. Approximately 28,000 acres are located in Bartholomew County; 4,000 acres in Brown County; and 1,000 acres in Johnson County, Indiana. The nearest communities are Edinburgh, Indiana located 3 miles to the east, and Columbus, Indiana located 14 miles to the southeast. Indianapolis, the largest city in Indiana, is located about 30 miles to the north. The installation is roughly bounded by State Road 252 on the north, I-65 and US Route 31 on the east, State Route (SR) 46 on the south, and SR 135 on the west.

Two very different physiographic provinces - Norman Uplands and Scottsburg Lowlands - converge within this region, creating distinct topographic patterns in the northern and southern portions of the installation. Elevations across the installation range from 500 to 1,000 feet above mean sea level (amsl). The northern third of the installation was glaciated and is now relatively flat with gently rolling hills. This portion of the installation is dominated by bottomland hardwood forest, but in slightly drier areas the bottomland forest may be mixed with oak (*Quercus* spp.) - hickory (*Carya* spp.) forest. The southern two-thirds of the installation have steep slopes with narrow valleys. It is primarily forested with oak-hickory in the uplands and bottomland hardwood forest in the narrow floodplains of the lower drainages.

The climate is generally temperate and is characterized by warm, humid summers, and moderately cold winters. Rainfall averages 41 inches per year, most of it falling in the late winter and early spring months. The prevailing direction of surface winds is southwesterly,

except during late winter months when winds come mostly from the northwest. Wind speed averages fewer than 11.5 miles per hour, with the strongest winds usually associated with thunderstorms (INNG, 2009a).

Land Use and Cover

CAJMTC is comprised of three major land uses, which include a cantonment area, a common impact area, and range and battalion training areas (see Table 6). These areas are also illustrated in Figure 4a.

Table 6. Major land uses at CAJMTC.

Subunit Name	Acreage	Percent of Total Land Base	Primary Cover Type
Cantonment Area	508	1.5%	Numerous buildings, roads, and mowed lawns
Impact Area	5,650	17%	Early to mid-successional forest and grasslands
Training and Range Areas	26,974	81.5%	Predominately mature second-growth forest with interspersed mowed firing ranges and fire-maintained grasslands
Total	**33,132**	**100%**	

CAJMTC supports a mixture of wooded and open habitats interspersed with small waterways. Major terrestrial community types include upland hardwood forest, bottomland hardwood forest, grassland, and shrub land. CAJMTC's grasslands, or open-field habitats, are scattered throughout the installation in small patches, typically occurring in areas of periodic burning. Developed areas are mainly confined to the Cantonment Area and the roadway network.

According to historical aerial photographs dating before CAJMTC was established, the site originally was comprised of approximately 8,182 of forested acres (25% of total land area). Forested acres at CAJMTC continued to increase through 1974 to approximately 18,024 acres (54%). Between 1974 and 2005 the CAJMTC forested areas increased by an additional 4,888 acres, comprising a total of 22,912 forested acres (69%). Between 2005 and 2009, CAJMTC has implemented projects and activities that have resulted in the removal of approximately 32 acres of mature forest and impacts to approximately 175 acres of early successional (immature) forest.

Forest stand age and density vary greatly because prior to construction of the base in 1942, much of the land was used for agriculture (USFWS 1998). Common tree species in the bottomland hardwood forest include American sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), eastern cottonwood (*Populus deltoides*), red maple (*Acer rubrum*), shellbark hickory (*Carya laciniosa*), sweetgum (*Liquidambar styraciflua*), and several species of elms (*Ulmus* spp.) and oaks. Upland forests are dominated by shagbark hickory (*Carya ovata*), pignut hickory (*Carya glabra*), red hickory (*Carya ovalis*), white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), chestnut oak (*Quercus prinus*), American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and tuliptree (*Liriodendron tulipifera*) (Montgomery Watson 1999). In addition to their primary function as training areas, forested portions of the installation are managed for multiple uses, including commercial timber harvest, wildlife habitat, watershed protection, recreation, and aesthetics (USFWS 1998).

The terrestrial ecosystems of CAJMTC exist within a context of numerous other adjacent and nearby land conservation areas. Adjacent to the north of the installation is the 5,512-acre Atterbury Fish and Wildlife Area (FWA) that is owned and managed for game and non-game wildlife resources by the Indiana Department of Natural Resources (IDNR). To the north of the

Atterbury FWA is Johnson County Park, a 600-acre tract that is mostly dedicated to camping, picnicking, and other human-oriented outdoor recreational pursuits. Vietor Woods (a.k.a. Whip-poor-will Woods) is a 560-acre forest adjacent to CAJMTC's western boundary in Brown County and is protected and managed for its older growth forest habitat by the IDNR, Division of Nature Preserves and The Nature Conservancy (TNC).

Surface water features consist of numerous streams and small, seasonal ponds. The streams range from intermittent first and second order to permanent flowing second order, and include Sugar, Nineveh, Saddle, Mud, Muddy Branch, Lick, Catherine, and East Fork Salt creeks (see Figure 3). The installation lies mainly within Driftwood Watershed (USGS Hydrologic Unit Code [HUC] 05120204) with the southwestern corner located in the Lower East Fork White Watershed (USGS HUC 05120208) (USEPA 2007). Drainage primarily flows eastward into the Driftwood River on the installation with the exception of the southwestern corner of the site, which drains westward into East Fork Salt Creek.

Indiana Bats at Camp Atterbury

A report of vertebrate fauna on CAJMTC by the IDNR (1991) stated that Indiana bats were undoubtedly present, although no Indiana bats were collected during the survey. Collection methods may have influenced the results of the survey, as the level of effort, sampling locations, and survey dates were not reported. The presence of Indiana bats at CAJMTC had not been documented prior to 1997 (Montgomery Watson 1997 and 1998).

As referenced in the *Indiana Bat Draft Recovery Plan* (USFWS 2007), CAJMTC likely supports multiple Indiana bat maternity colonies. Based on the spatial distribution of adult female and juvenile bat captures during the initial mist net surveys in 1997, biologists estimated that up to five maternity colonies may have occupied the installation at that time (Montgomery Watson 1997) (Figure 9). Since the discovery of the Indiana bat, CAJMTC has established IBMZs and other management measures to help insure the long-term conservation of the species on the facility. Extensive monitoring and research has been conducted at CAJMTC, which has helped contribute to USFWS' understanding of the species' summer ecology.

Mist net surveys were conducted at CAJMTC in 1997, 1998, 2002, 2005, 2006 and 2010. Indiana bats were collected during all surveys. Survey locations are illustrated in Figure 9 for the 1997, 1998 and 2002 surveys. Although surveys were conducted in 2005 and 2006, no data is currently available on specific survey locations used during those years. Information on standing and down/fallen roost trees at CAJMTC is available for 1998, 2002, 2005 and 2007, and is illustrated in Figures 10a through 10d of the PBA and Figure 10d of this PBO. Roost trees were characterized as primary, alternate or unknown. For additional information on past studies at CAJMTC, refer to the following sections.

1.1.1 1997 Study

In August 1997, a mist net survey was conducted on Camp Atterbury to investigate the presence and distribution of Indiana bats. Eight species of bats were captured during the survey, including the northern long-eared bat, little brown bat, evening bat (*Nycticeius humeralis*), big brown bat, red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), eastern pipistrelle, and the Indiana bat (Montgomery Watson 1997). Thirteen Indiana bats, including two reproductive females and eight juveniles, were captured from nine of the 22 sites surveyed. Capture of reproductive females and juveniles indicates maternity colonies are located within approximately 1.5 miles of the capture site (Gardner *et al.* 1991b). The number and distribution of reproductive females and

juveniles captured suggested that a minimum of five Indiana bat maternity colonies are widely distributed across the installation (Montgomery Watson 1997).

1.1.2 1998 Study

An additional mist net survey was conducted in 1998 that included a total of 31 nights of sampling at 17 sites located to the north, south, and east of the impact area (Figure 9). During the 1998 survey 23 of the 196 bats (approximately 12%) captured were Indiana bats. Indiana bats were captured at seven of the 17 sites, with only one or two individuals captured at five of those sites (Montgomery Watson 1999).

Seven bridges on the installation were also sampled to determine whether Indiana bats used these bridges as roosts during nighttime foraging events. A total of 44 Indiana bats were found under the bridges over Sugar, Nineveh, and Catherine Creeks. Mauxferry Road bridge over Nineveh Creek and Hospital Road bridge over Sugar Creek were the bridges most frequently used by Indiana bats. Indiana bats were found at these three bridges each time they were checked (Montgomery Watson 1999, Kiser et al. 2002).

Seven Indiana bats were fitted with radio transmitters and tracked to their roost trees. Three primary roost trees and 17 alternate roost trees were located during the radio tracking. One of the primary roost trees is located approximately 1.1 miles northwest of the installation. Nine species of trees were used as roost trees, but the eastern cottonwood and American elm were the first and second most commonly used roost trees, respectively. The three primary roost trees consisted of two dead eastern cottonwoods and one dead American elm located in bottomland habitat. Excluding two live shagbark hickory trees that were used by a male Indiana bat, all of the roost trees that were identified during this study were dead (Montgomery Watson 1999).

1.1.3 1999 Analysis

An analysis was performed to determine the amount of suitable Indiana bat habitat on CAJMTC in 1999. Potential Indiana bat habitat suitability was assessed by calculating the acreage of potential Indiana bat habitat (defined as a stand containing at least 16 potential bat roost trees per acre) for each training area using commercial timber stand data provided by CAJMTC. Sugar maple was not included as a potential roost tree species during this analysis because it was not included in the list of potential species until 2002.

The amounts and locations of suitable habitat affected by ongoing military activities for each training area were estimated. The analysis determined that CAJMTC contained 10,500 acres of potentially suitable Indiana bat roost habitat, which comprised 39 % of the total maneuver area acreage. Because a variety of timber and forest management activities have been conducted throughout the site over the past eight years, this analysis does not likely reflect current conditions at the CAJMTC.

1.1.4 2002 Study

In 2002, Indiana State University (ISU) was contracted to determine the location and habitat of roost sites at CAJMTC and to estimate usage of these sites through emergence counts. Indiana bats were captured at five of the 17 sites and represented approximately 20% of the eight bat species captured (36 out of 184). Eleven of the captured Indiana bats were fitted with radio transmitters and tracked to 26 roost trees on or near CAJMTC. One of the bats roosted in the Impact Area the entire monitoring period, while four of them roosted periodically within this

area. Emergence counts identified four likely and two possible primary roost trees and 20 alternate roost trees. American elm was the most utilized tree species during this study (n=8) (Whitaker & Gummer 2002).

Six bridges were monitored during the 2002 study and five bat species were captured or observed. More Indiana bats were captured/observed than any other species. Indiana bats were captured or observed under bridges between 2330 and 0300 hours compared to 2230 to 0430 hrs in the 1998 study (Whitaker & Gummer 2002, Montgomery Watson 1999). Temperatures outside the bridges ranged from 50 to 59 °F when Indiana bats were observed or captured, while temperatures along the underside of the bridge ranged from 72 to 73 °F. When Indiana bats were not found under the bridges the temperature generally ranged from 64 to 73 °F, with bridge temperatures ranging from 72 to 81 °F. Thus, evidence suggests that a temperature cutoff for Indiana bats utilizing bridges as night roosts may exist.

1.1.5 Current Studies

Current geographic information system (GIS) layers for standing, down and approximate roost tree locations are maintained by the Natural Resources Office at CAJMTC. According to the most recent available data on known roost tree locations within CAJMTC and its immediate vicinity, there are approximately 84 standing and 27 down roost tree locations[1] (Amec 2009). Roost trees located outside the CAJMTC boundaries are associated with Sugar Creek, Big Blue River and Driftwood River. The majority of known roost trees within the CAJMTC boundaries occur in the northeastern quarter of the installation. The general location of the roost trees within the installation boundaries are summarized in Table 7 and illustrated throughout the majority of the figures within the PBA and PBO.

Table 7. General location of roost trees at CAJMTC.

General Location	Standing Roost Trees	Down Roost Trees
Catherine Creek	-	5
Unnamed Tributary of Driftwood River (TA 400s)	1	1
Muddy Branch Creek	2	4
Nineveh and its Tributaries	44	14
Driftwood River and its Tributaries	9	-
Prince Creek its Tributaries	2	1
Sugar Creek	4	-
Big Blue River	4	1

Source: Amec 2009

Maternity Colonies within the Action Area

Based upon a spatial analysis of the mist netting sites where Indiana bats were captured and locations of known primary and alternate roost trees at CAJMTC, the Service estimated that there currently are 3 to 5 Indiana bat maternity colonies with roosting/foraging areas within the Action Area. A maternity colony typically consists of reproductively active female Indiana bats and their young (i.e., typically 1 pup/adult female/year). A maternity colony was presumed to be

[1] "standing" roost trees were standing when last observed, whereas "down" roost trees were previously standing roost trees that have subsequently fallen down.

present if there was evidence of reproduction in an area during the summer reproductive season (the capture of a reproductive female and/or juvenile, or high emergence counts at an identified roost). Each maternity colony's roosting and foraging area was assumed to fall within a circle with a 2.5-mile radius centered on primary roosts, placed between multiple roosts, or centered on mist net sites of Indiana bat capture if no roosts were identified. The vast majority of maternity colony activity has been documented in the northeast quarter of CAJMTC with most root trees occurring along Nineveh Creek and Sugar Creek. There is also evidence of a separate maternity colony along Nineveh Creek in the extreme northwest corner of the installation. Lastly, there is evidence of a potential Indiana bat colony residing in the area between Lick and Catherine creeks in the southeastern quarter of the installation.

Maternity Colony Population Size Estimates

Emergence counts conducted at identified roost sites at CAJMTC from 1998 – 2010 have varied considerably. Because it is practically impossible, cost prohibitive, and highly disruptive to capture and radio-tag all maternity colony members, locate all of their roost trees and have a large enough field staff to conduct simultaneous emergence counts at every roost trees, **the Service has decided to conservatively assume that each maternity colony is comprised of 80 adult females and their single offspring**. **This would result in a maximum of 160 bats per colony by mid- June when the young are born and when they become volant (i.e., capable of flight) around mid-July.** The Service believes an 80-adult female colony size is a reasonable assumption based on the minimum colony estimates generated during other recent Indiana bat studies within Indiana (e.g., I-69), and the concurrence of other Indiana bat experts (see Whitaker and Brack 2002). To be conservative towards the bats, we are assuming that 100% of adult females will successfully bear a live pup and that 100% will survive to volancy, which is probably higher than reality, but gives the benefit-of-the doubt to the species. The actual reproductive rate of adult females in each maternity colony is unknown as is the current mortality rate of adults and juveniles.

Because a low number of non-reproductive females have been captured at CAJMTC, we assume that nonreproductive females in the Action Area are associated with a maternity colony and are thereby being accounted for within the 80 adult females being estimated per maternity colony. Therefore, given the documented presence of 3 to 5 maternity colonies in the Action Area and an approximate total of 80 adult females and 80 pups per colony, then we can assume that there are approximately 240 to 400 adult females and a similar number of juveniles within or adjacent to the defined Action Area and that variable proportions of the bats in these colonies are likely to be exposed to direct and/or indirect effects from the Proposed Action.

Adult Males within the Summer Action Area

A small number of adult male Indiana bats has been captured during previous mist net surveys at CAJMTC. Because most adult male Indiana bats tend to remain in the vicinity of their hibernacula during the summer and no known hibernacula are near CAJMTC, we assume that relatively few adult male Indiana bats occur at CAJMTC during the summer.

Baseline for Action Area and Maternity Colonies

According to the PBA, CAJMTC encompasses a total of approximately 33,132 acres, of which 21,985 acres or 66% is currently forested. The Service will use this forest data estimate (i.e., 21,985 acres) as an approximate baseline of currently existing forest habitat available within the Action Area, and assume that all of the forest habitat within this area is of moderate to high quality for roosting and foraging by Indiana bats. We believe this is a reasonable assumption given that the project is within the core of the Indiana bat's maternity range and that we know

from personal observations that many areas of high quality habitat are present at CAJMTC and are being utilized by Indiana bats.

Key parameters that may affect the quality of the summer habitat for bats within the action area are the overall percentage of forest cover in a specified area, the size of existing forest patches, and the degree of connectivity among forest patches. Based on a thorough review of literature on Indiana bat summer habitat, Rommé et al. (1995) concluded that areas with less than 5% deciduous forest coverage will not support summering Indiana bats. Localized areas considered as optimal habitat tend to have greater than 30% forest cover. Currently, all areas of CAJMTC outside of the 508-acre Cantonment Area, appear to have enough suitable forest habitat to support maternity colonies.

Ongoing Stressors in the Action Area

The Service believes the following State, local, and private actions are currently occurring within the Action Areas and are likely to be adversely affecting some percentage of Indiana bats to variable degrees, and are likely to continue into the reasonably foreseeable future.

- Loss and degradation of roosting and foraging habitat – Most of the forest habitat within the Action Area is on CAJMTC and is being maintained and available for use by Indiana bats. However, outside of CAJMTC's boundaries, an unknown amount of forest habitat is being lost and/or degraded by private and public, commercial and residential developments, which are converting, fragmenting, or otherwise degrading forest habitat available for roosting and foraging, especially near urban centers and along primary and heavily traveled secondary roadways and their main intersections.
- Commercial and private timber harvesting – Some private timbering likely occurs on private lands along CAJMTC's western and southern boundaries while bats are roosting in trees between 1 April and 30 September. Therefore, some unknown number are likely exposed to this stressor and may be directly killed, harmed, or displaced as trees are felled in the summer. Most of the documented maternity activity on CAJMTC has not occurred along the western and southern borders but to the north and east of the base.
- Cutting of Snags - While most primary and many alternate roost trees are dead snags that are ephemeral/short-lived, some small proportion are likely to be cut down before they would naturally fall in order to reduce safety risks (i.e., hazard tree removal), to provide firewood, or to improve aesthetics. Cutting of snags is not allowed at CAJMTC unless they pose an imminent safety hazard.
- Degraded water quality – Point and non-point source pollution and contaminants from agricultural, military training exercises, commercial, and residential areas are likely present in waterways within the Action Areas and may at times reduce aquatic insect biomass that form a portion of the Indiana bat prey base and/or have direct or other indirect adverse effects on the bats themselves (e.g., females may have reduced reproduction in heavily contaminated areas).

IV. EFFECTS OF THE ACTION

While analyzing direct and indirect effects of the Proposed Action on Indiana bats, the Service considered the following factors:

- proximity of the action to known species locations and designated critical habitat,

- distribution of the disturbances and impacts,
- timing of the effects in relation to sensitive periods in the species' lifecycle,
- nature of the effects – how the effects of the action may be manifested in elements of a species' lifecycle, population size or variability, or distribution, and how individual animals may be affected,
- duration of effects - short-term, long-term, permanent,
- disturbance frequency - number of events per unit of time, and
- disturbance severity - how long would it take a population to recover?

We deconstructed the ongoing mission into its various project elements and determined the direct and indirect environmental consequences that Indiana bats would be exposed to. We conducted various exposure analyses for each proposed activity that may directly or indirectly affect the bats and determined the likely responses of the bats and their local populations to each potential stressor. Analyses focused on Indiana bats that roost and forage on the installation during the summer season (01 April and 01 October) with a primary focus on effects to the 3 to 5 documented maternity colonies at CAJMTC. Table 16 in Section 4.5 of the PBA contains a detailed summary of all activities and their locations, quantities and assumed effects and is hereby incorporated by reference.

Stressors

The primary stressors that Indiana bats are likely to be directly or indirectly exposed to that we are reasonably certain will have adverse effects and lead to some level of "take" include:

- A wide variety of military training exercises using a wide variety of guns, ammunitions, smokes/obscurants, vehicles, aircraft, and their associated noise and chemical pollutants,
- wildfires resulting from live-fire training exercises and related activities,
- tree-clearing associated with new development projects (e.g., MPMGR) and maintenance of existing infrastructure (e.g., right-of-way maintenance along roadways),
- chemical exposures, and
- bat research/monitoring activities (mistnetting and radiotracking studies).

These stressors are analyzed in greater detail below. Other potential project-related stressors that bats may be exposed to, but are not anticipated to cause incidental take because of their insignificant or discountable effects are included in Table 16 of the PBA.

Adverse Affects from Military Training

Relatively little research has been conducted regarding how Indiana bats respond to various forms and levels of military training exercises. Shapiro and Hohmann (2005) conducted a literature search for studies that assessed the affects of military training on Indiana bats. While their search was not exhaustive, the few studies they found (e.g., at Fort Leonard Wood, MO) generally showed that noise and vibrations from military training activities apparently did not have obvious adverse impacts on Indiana bats (Shapiro and Hohmann 2005). Shapiro and Hohmann (2005) also stated that

> "current research funded by the Army basic research program will characterize the high frequency properties of relevant blast wave patterns that may pose a risk to endangered

bats on military installations. In addition, big brown bats (*Eptesicus fuscus*) will be exposed to different doses of high-pressure shock waves, and auditory brain-stem response (ABR) techniques will be used before and after exposure to measure loss of hearing. This project expects to produce dose-response functions that can be used to predict risk to endangered bats at various distances to heavy artillery blasts (Larry Pater, Acoustician, U.S. Army Engineer Research and Development Center-Construction Engineering Research Laboratory [ERDC-CERL], professional communication, 19 August 2004)."

To our knowledge, results from this ongoing research are not yet available.

Noise associated with Military Training

The effects of noise/sound generated by training activities on Indiana bats were analyzed in the PBA (and a previous BA produced for the MPTR at CAJMTC) using two approaches: 1) existing data on the auditory capabilities of Indiana bats and similar species were used to evaluate effects of sound generated by proposed training; and 2) characteristics of sound generated during proposed and past training events were compared using available data. The analysis in the PBA indicated that proposed training at existing ranges will not expose Indiana bats on Camp Atterbury to more than a 10% increase in quantity/duration of noise with no greater intensity of sound than past training events on the installation. We have assumed that sound intensity and duration associated with past training events have not adversely affected Indiana bats on Camp Atterbury. While this assumption has not been rigorously tested, it is reasonable given the high abundance and nearly installation-wide distribution of Indiana bats repeatedly captured on the base concurrent with ongoing training activity since the species discovery in 1997 (see Figure 11). Results of investigation of the effects of sound at Fort Leonard Wood (FLW), Missouri also suggest that sound generated by training events (simulated artillery and small-arms fire) do not startle, frighten, or cause bats to flee the area. Radiotelemetric monitoring of Indiana bats near active night training ranges at FLW indicated that bats did not avoid active ranges or alter foraging behavior during night-time maneuvers (3D/I 1996). Furthermore, bats in areas that are repeatedly exposed to predictable, loud noises (e.g., the maternity colony at the Indianapolis Airport) are believed to habituate to these stimuli over time (L. Pruitt, USFWS, pers. comm., 2010). Based on these analyses, it was determined that sound generated by ongoing training activities at existing ranges was not likely to adversely affect the Indiana bat. Based on the best information available, we concur with this conclusion.

In contrast, noise levels associated with the initial construction (e.g., use of heavy machinery/grading work conducted after trees have been felled when bats may be roosting nearby) and the subsequent operation of the proposed MPMGR (a new training facility) will be relatively novel to Indiana bats roosting in that immediate area of CAJMTC. Therefore, it is reasonable to assume that some unknown number of bats in newly developed areas (e.g., MPMGR) may become startled and flee from their roost tree(s) or perhaps abandon it/them. Because the noise levels in construction areas will likely continue for more than a single day the bats roosting within or close to these areas are likely to shift their focal roosting areas further away or may temporarily abandon these roosting areas. Indiana bats presumably abandoned a primary roost tree in Missouri after a bulldozer had been used to clear underbrush near it (Callahan 1993). Startled bats that fly from their roosts during daylight hours will likely have an increased risk of predation (e.g., hawks). If bats are sufficiently startled and permanently abandon a roost site while non-volant pups are present, then the pups will die. Therefore, it is reasonable to assume that some unknown level of take will occur during the initial development and operation of the MPMGR and any other project that introduces a novel, loud, sustained level of noise within the hearing range of nearby roosting bats. After the MPMGR (and similarly

noisy projects) has been operating for a year or so, we assume that Indiana bats will become habituated to the operational noise levels and frequency and will use the surrounding forest habitat in a similar manner as they had prior to construction/operation.

Live-fire impacts/explosions associated with Military Training

Live-fire training has the potential to cause direct and indirect take of Indiana bats (i.e., death and injury of bats) and harm/take their habitat by the loss or damage to their roost trees. For direct fire training, trees more than 100 meters away from targets may be only infrequently struck by ammunition fire. In this case, occasional ammunition strikes will most likely cause minimal damage to trees (Amec 2009). Significant damage could occur within 100 meters of targets, but generally the land around firing points is cleared of trees. Risks to bats are also reduced because the same firing points are repeatedly used and no new firing points are currently planned. Mortar and artillery fire from fixed firing points to remote targets in the impact area also has the potential to adversely affect Indiana bats in that errant artillery may explode and kill roosting bats and/or significantly damage habitat. We anticipate that occurrences such as these would be rare.

Wildfires associated with Military Training

Wildfires resulting from military training exercises/ammunition fire often occur at CAJMTC during the bat maternity roosting season. The majority, if not all, of the wildfires at CAJMTC are a result of training activities (as opposed to lightening strikes, unextinguished cigarette butts etc.) and that at least 50% of them occur while bats are present. Most wildfires occur within or near the Impact Area, but not all (see Figure 5). One small wildfire occurred within a quarter of a mile from a cluster of known roost trees along Prince Creek and a relatively large wildfire within ½ mile west of a cluster of root trees along the eastern edge of the Impact Area (Figure 5). Therefore, there is a potential for incidental take of adult bats and especially nonvolant pups when wildfires occur near and/or spread into forested areas. If a wildfire occurs between 1 April and 30 September, CAJMTC's policy is to immediately take actions to suppress while attempting to minimize damage to standing snags and trees[Note: CAJMTC does not suppress wildfires that occur within the Impact Area]. Following suppression, emergency consultation may be required with the BFO.

In addition to maintaining existing firebreaks and developing some additional ones (see Figure 5), we anticipate that CAJMTC may need to quickly create some emergency/uplanned firebreaks while actively suppressing wildfires over the next 5 to 10 years. Emergency firebreaks may require the removal of some snags that may be occupied by roosting Indiana bats or require the operation of chainsaws and/or heavy machinery that may startle bats roosting in nearby trees. While such circumstances are likely to be rare, we believe that they are reasonably certain to occur and that the resulting potential for take of one or more Indiana bats is not discountable.

Wildfires can quickly alter the habitat and may cause a range of adverse or beneficial effects, or some combination thereof to forest habitat used by Indiana bats at CAJMTC. Adverse impacts would result if large blocks of forested area are severely damaged, particularly areas containing known roost trees while bats are present. Potential benefits from wildfires include the creation of additional snags/roosting habitat and the clearing of underbrush (i.e., improved access to roost trees). Given the numerous variables that influence the outcomes of a wildfire, we cannot accurately estimate an amount of direct or indirect take of Indiana bats associated with this training-related impact.

Prescribed Fires at CAJMTC

Prescribed burns are not anticipated to adversely affect Indiana bats because CAJMTC follows the Forest Management Guidelines for Informal Section 7 Consultations on Indiana Bats (*Myotis sodalis*) within the State of Indiana (issued 14 Feb., 2008) that specifies management practices designed to avoid potential take of Indiana bats. These Guidelines state that "prescribed burns shall not be conducted from 15 April through 15 September in burn areas containing potential bat roost trees/snags>3" DBH", which gives CAJMTC latitude to burn grasslands between these dates and woodlands outside of these dates. In addition, prescribed burns conducted at CAJMTC are likely to indirectly benefit Indiana bats by reducing the potential for wildfire occurrences.

Habitat Alteration associated with Military Development and Maintenance Projects

Over the next 5 to10 years, the INNG anticipates that a variety of proposed activities and projects (including those currently planned and unplanned, but likely to occur) at CAJMTC will result in the clearing and permanent loss of up to 341 acres of suitable forest habitat for Indiana bats for summer roosting and foraging (see Table 4).

Cutting an Indiana bat roost tree when bats are present (1 April – 30 September) is likely to result in bats being injured or killed. Therefore, CAJMTC will generally restrict the removal of trees in the MPMGR and other project areas (e.g., new trails and planned firebreaks, rehab. of existing trails/ROWs, and various undefined projects) to the period between 1 October and 30 March when Indiana bats are not known to be present at CAJMTC. Thus, we do not anticipate any direct mortality from the felling of trees at CAJMTC. However, some indirect adverse affects could still stress some Indiana bats to the point where take is reasonably certain to occur. For example, the loss of a primary roost tree or multiple alternate roost trees during the non-occupancy season would cause displaced individuals to expend increased levels of energy while seeking out replacement roost trees when they return the following spring. If increased energy expenditure occurs during a sensitive period of a bat's reproductive cycle (e.g., pregnancy) it is assumed that spontaneous abortion or other stress-related reproductive delays or losses would be a likely response in some individuals, particularly those that may have already been under other environmental stresses or perhaps stressed by other project-related stressors (e.g., increased noise levels). It has been hypothesized that these stresses and delays in reproduction could also result in lower fat reserves being deposited prior to hibernation and ultimately lead to lower winter survival rates (USFWS 2002). For example, females that do give live birth may have pups with lower birth weights or their pups may have delayed development (i.e., late into the summer). This could in turn affect the overwinter survival of the young-of-the-year bats if their delayed development caused them to enter fall migration and winter hibernation periods with inadequate fat reserves.

Most of the loss of bat habitat associated with construction and operation of the MPMGR and other projects will be permanent. A few bats displaced by clearing for the MPMGR or other projects may perish, but the majority of displaced bats will likely establish a new summer home range in nearby habitat. The relative abundance and availability of suitable habitat in areas immediately adjacent to the MPMGR and other proposed or potential project areas at CAJMTC should greatly enhance the potential for displaced bats to successfully relocate to a new range.

Given the locations of the known roost trees to date, we have generally assumed that no primary maternity roost trees (i.e., roost trees used by $\geq$ 30 adult females and or their offspring on multiple occasions) are likely to be directly felled during the construction of the MPMGR (Figure 7a). However, we do believe it is reasonable to assume that some alternate roost trees

(typically containing far less than 30 bats) may be felled and indirectly result in the death or short-term reproductive loss of some small percentage (but not all) of the local maternity colony of bats. Because the footprint of the MPMGR project is relatively compact, the loss of this one large patch of suitable habitat will likely adversely impact members of just one maternity colony at CAJMTC.

Over the next 5 to 10 years, we do not anticipate that the MPMGR or other smaller developments will be large enough in scale to create a barrier or permanent deterrent to bat movement among forest patches at CAJMTC, but some uncertainty remains. To our knowledge, CAJMTC has not yet developed or incorporated specific conservation measures/policies that would explicitly prevent the possibility of Indiana bats from being excluded from some areas of the base over the long-term as a cumulative result of the permanent removal of forest habitat from multiple small-scale projects over time.

Tree clearing may also result in alteration of foraging habitat and/or travel corridors, forcing bats to fly farther while foraging at night. The quality of foraging habitat may also be temporarily degraded due to erosion, and subsequent sedimentation of stream corridors, associated with construction of the MPMGR. Sedimentation could also reduce the overall production of aquatic insects, which make up a portion of the prey base of Indiana bats, which in turn may exacerbate the issue of lost foraging habitat in the area.

To further minimize and to compensate for adverse impacts to Indiana bats due to habitat loss, CAJMTC will set aside 275 acres of forested habitat into three new Indiana Bat Management Zones (IBMZs) in areas within bat commuting distance of the MPMGR construction boundary. Silvicultural manipulation in IBMZs will be limited to activities which will enhance the quality of habitat for Indiana bats. While there will be a net loss of Indiana bat habitat associated with construction of the MPMGR and other small projects over the next 5 to 10 years, habitat quality within IBMZs and the MPMGR wetland mitigation areas at CAJMTC should gradually increase over time. Similarly, because forest growth has been and is expected to continue to outpace timber harvest levels by 3-4 times, the average forest conditions across timber stands at CAJMTC have continued to mature and thus improve in quality relative to Indiana bat foraging and roosting requirements (M. Peterkin, CAJMTC, pers. comm., 2010). Therefore, forest habitat in special management areas (e.g, IBMZs) and managed timber stands will remain suitable for Indiana bats indefinitely. Lastly, long-term habitat suitability for Indiana bats on CAJMTC has also been enhanced through the development of an ESMP and an INRMP which have incorporated Indiana bat management concerns.

Chemicals Bats may be Exposed to at CAJMTC

Indiana bats may be exposed to some training-related chemicals and pesticides during the summer maternity season while roosting and foraging at and around CAJMTC. In order to prevent adverse effects to Indiana bats, the INNG has developed guidelines for pesticide use at CAJMTC. In addition, insecticides are typically used only in the Cantonment Area or within or on buildings. Exceptions to this include the use of DEET-based products by soldiers while in the field; wasp or bee insecticide use in localized areas with a hive (e.g., observation points/towers); and mosquito control at bivouac areas. The BFO has previously approved/concurred with the use (according to label applications) of numerous pesticides at CAJMTC. Should CAJMTC desire to use any additional/new pesticides, these we will continue to be consulted on a case-by-case basis.

The CAJMTC ecological risk assessment (ERA) prepared for the MPTR indicated that hydro carbons (HC) found in smoke from AN-M8 smoke grenades may cause toxicological effects to roosting and foraging Indiana bats. To avoid these effects, AN-M8 grenades are no longer used at CAJMTC (Amec 2009). M18 (colored) and M83 (white) smoke grenades containing TPA are still used, because TPA is noncarcinogenic and its combustion products are less toxic than those of HC.

The CAJMTC ERA indicated that chemicals found in M18 colored smoke grenades, which contain TPA, may still cause acute toxicological effects. Therefore, to minimize effects to the Indiana bat, CAJMTC adopted a policy that restricts the release of smoke grenades, regardless of color, within 120 feet (36 meters) of trees between 1 April and 1 October to the greatest extent practicable (AMEC 2009). Because no new information is available on the effects of TPA on Indiana bats, this policy will continue to be enforced until new information dictates otherwise.

We assume that some occasional human error or miscommunication is likely to occur despite CAJMTC's existing policies pertaining to the proper use of approved pesticides and smoke grenades and one or more Indiana bats inadvertently will be exposed to a harmful chemical and cause acute toxicological effects/an injury that may result in an incidental take. We assume that this would be a very rare occurrence and that any resulting take would not have any long-lasting impacts to local bat populations/maternity colonies.

Bat research and monitoring activities

CAJMTC has committed to monitor the status of Indiana bats by periodically (approx. every 5 years) conducting/contracting mist net surveys and radio-tracking captured bats to their roost sites as funding allows. Anytime bats are physically captured and handled, there is an inherent risk for injury and the capture itself is considered as take. Therefore, take associated with bat surveys or research project is exempted under an ESA Section 10(a)(1)a/federal recovery permit that is issued by the USFWS to individual researchers, with whom CAJMTC contracts. For the purposes of this BO, the take associated with CAJMTC's future bat surveys/monitoring program activities was considered an interrelated action and was considered in our effects and jeopardy analyses.

All identified roost sites (e.g., trees and bridges) will be entered into CAJMTC's GIS database and routinely monitored by CAJMTC staff. The status of roost trees (i.e., standing or down) will be monitored until each tree naturally falls down. Bridges may also be periodically inspected (day or night) for the presence of roosting bats. Tracking known roost trees helps the INNG make informed land-management decisions and proactively avoid known roosting areas when siting new developments.

The U.S. Army Corps of Engineers (i.e., ERDC-CERL - Matt Hohmann) may continue some previously initiated research activities at CAJMTC (e.g., use of rocket houses and fake bark). Any new or additional research projects that may affect Indiana bats at CAJMTC will be coordinated with the BFO on a case-by-case basis prior to their initiation. Some research projects may directly benefit Indiana bats at CAJMTC and lead to discoveries that indirectly benefit bats throughout the species' range.

Effects of Conservation Measures

CAJMTC has incorporated conservation measures into their Proposed Action to avoid, minimize and mitigate the impacts of their proposed activities to the extent practical. Proposed Conservation Measures are discussed in the **Conservation Measures** section in this document.

Risks to Local Bat Populations

Maternity Colonies – Bat surveys and radio-tracking studies have documented the presence of 3 to 5 maternity colonies, which we are assuming are comprised of 80 adult females and their 80 young (3-5 colonies x 160/colony = 480-800 reproductive female and juvenile bats) in the Action Area. We estimate that during the next 5 to 10 years that a maximum combined total of up to 5% (24 to 40 individuals) of adult female and/or juvenile Indiana bats at CAJMTC may be directly or indirectly taken by ongoing and proposed activities. We anticipate that take of these individuals would likely be spread among the 3 – 5 maternity colonies, with most take occurring to colonies occupying areas within or near the Impact Area, MPMGR, and the northeastern quarter of the base. Under no likely scenarios, is the estimated amount of loss/take of reproductive individuals likely to cause an appreciable long-term change in viability of an individual maternity colony or to the species' regional or range-wide status. At worst, only short-term (2 or 3 maternity seasons) reproductive loss and reduction in numbers of these local maternity colonies is anticipated as a result of the Proposed Action. In none of the maternity areas is the amount of proposed tree clearing or anticipated induced development believed to be extensive enough to cause a maternity colony to be permanently displaced from its traditional summer range. If however, our suppositions are wrong and these maternity colonies are displaced, there is currently additional suitable habitat available in adjacent areas that they could relocate to with minimal effort (based on personal observations in the field and upon aerial photo interpretations).

In summary, the following effects are anticipated for the maternity colonies within the Action Area:

- Habitat loss will be minimal for most colonies: The total amount of forest loss is relatively insignificant for each assumed colony, except perhaps for the colony that presumably inhabiting the MPMGR area. It is also unlikely that any maternity area would experience a significant long-term decrease in quality of roosting or foraging habitat as a direct result of the Proposed Action.
- Seasonal tree-cutting restrictions will ensure no direct impacts/take occurs from the felling/clearing of trees during the active maternity season.
- Continuation of annual prescribed burns will decrease fuel loads in and around the Impact Area. Firebreak creation and maintenance and active suppression of wildfires will minimize, but not eliminate the chances of severe wildfires from consuming large areas of forest habitat used by maternity colonies.
- All presumed maternity colonies at CAJMTC appear to have additional habitat that is available nearby if some bats should become displaced by habitat loss/degradation.
- Establishment of the proposed 275 acres of new IBMZs will insure suitable roosting and foraging habitat persists in the northeastern quarter of CAJMTC in perpetuity.

Although there may be some short-term loss and impacts to individuals, these impacts are not likely to affect a colony's long-term reproduction and survival. Thus, all currently extant Indiana bat maternity colonies are likely to persist within the Action Area following implementation of the Proposed Action.

Local Populations of Males– Because adult males (and presumably many non-reproductive females) do not participate in the rearing of offspring, they typically lead solitary lives or in some cases small bachelor colonies during the summer. Because these individuals are not

burdened with a dependent young they presumably would be more apt to flee from their roost trees than reproductive females would be when faced with a disturbance. Therefore, it is very unlikely that the felling of an occupied roost tree would ever have more than a few adult males in it at any one time and even more unlikely for take of more than one male to occur per event. We estimated a maximum total of 5 adult males may be taken as a result of the Proposed Action. The potential loss of this relatively small number of male bats will have no measureable or significant impact on the non-breeding Indiana bat population in the Action Area or beyond.

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the Action Area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered because they require separate consultation pursuant to section 7 of the Endangered Species Act. Reasonably foreseeable non-federal activities that are anticipated to occur within the Action Area for the Indiana bat are timber harvest and planned development for residential subdivisions, and light industry.

We typically can not accurately quantify how much forest land on private lands will be converted to other habitat types, the extent of future timber harvests on private lands, nor the amount of privately owned habitat that will be developed for other purposes. However, we can look at the trends state-wide and extrapolate assumptions as to how the private lands within the Action Areas will likely be managed in the foreseeable future.

The following Indiana forest trends were highlighted within the North Central Research Station's 2005 report, "Indiana Forests: 1999-2003, Part A". Trends that we believe may be of a net benefit to Indiana bats have been *italicized* below:

- *There are no major tree die-offs anywhere in the state; natural tree mortality appears evenly across the state.*
- *The ratio of harvested tree volume to tree volume growth indicates sustainable management.*
- *Diverse and abundant forest habitat (snags, coarse woody debris, forest cover and edges) support healthy wildlife populations across the state.*
- *Indiana possesses a diversity of standing dead tree wildlife habitat with an abundance of recently acquired snags to replenish fully decayed snags as Indiana's forests mature.*
- Indiana's oak species continue to grow slower than other hardwood species.
- The average private forest landholding dropped from 22-acres in 1993 to 16-acres in 2003, indicating a continued "parcelization" of Indiana forests.
- Introduced or invasive plant species inhabit a majority of inventories plots.
- The amount of forest edge doubled from 1992 to 2001, indicating smaller forest plots.
- Due to land use history and natural factors, the forest soils of southern Indiana are generally below-average in quality.
- Although Indiana's overall forested land mass is increasing, the rate of increase has slowed over the past decade.
- *Indiana's forests continue to mature in terms of the number and size of trees within forest stands.*

- Increases in total volumes of oak species are less than those for most other hardwood species.
- The advanced ages and inadequate regeneration of Indiana's oak forests may signal a successional shift from an oak/hickory-dominated landscape to one where other hardwood species, such as maples, occupy more forested areas.
- Indiana's hardwood saw-timber resource continues to be at risk due to maturing of hardwood stands, loss of timberland to development and new pests (gypsy moth, emerald ash-borer, sudden oak death, beech-bark disease, and more).
- Ownerships of Indiana forests have changed in the past decade, resulting in more parcelization and fragmentation.

While the data shows there has been loss of continuous forest, resulting in smaller, fragmented stands, there is also an overall increase in quantity and quality/maturation of forested land across the state.

We agree with the following summation of cumulative effects provided in the PBA (section 4.4):

> Therefore, increased development is likely to occur east of the CAJMTC along the U.S. 31 corridor as well as the I-65 corridor. Small pockets of developed land are already present between the cities of Edinburgh and Columbus. These activities could result in some forest habitat loss in and around the Big Blue River and Driftwood River and their tributaries. Numerous known Indiana bat roost trees occur within the vicinity of these waterways. Therefore, increased development could lead to both direct and indirect effects on the Indiana bat as a result of habitat loss and/or water quality degradation. However, because agricultural land use dominates and land planning/zoning is underway in these areas, it is anticipated that the effects to the Indiana bat will be limited.

In short, we anticipate some limited decline in currently existing bat habitat may occur outside of CAJMTC's boundaries (most likely along the northern and eastern boundaries), although we are not aware of specific non-federal development plans in known bat habitat at this time. As we become aware of specific projects, impacts to Indiana bats will be addressed through the incidental take permit process, if appropriate.

VI. CONCLUSION

After reviewing the current status of the Indiana bat, the environmental baseline for the Action Area, the aggregate effects of the Proposed Action, and the cumulative effects, it is the Service's biological opinion that the ongoing and future training, planned development, and land management activities at CAJMTC, as proposed, are not likely to jeopardize the continued existence of the Indiana bat.

Our basis for this conclusion follows:

- The 3 – 5 Indiana bat maternity colonies in the Action Area at most represent 0.2% of the total estimated number of maternity colonies in the species' range in 2009 (n=2,438 to 3,250 colonies, see Table 4). In theory, even if proposed actions at CAJMTC were to completely destroy one or even all three of these colonies (which it most certainly will not), it would not likely constitute an appreciable reduction in the species' numbers (0.2% of colonies) nor cause an appreciable reduction in the species' range, since Indiana's caves annually shelter nearly half of all known Indiana bats across the range (49% of all *M. sodalis* hibernated in Indiana in 2009; see Figure 2b). Furthermore, no

appreciable reduction in the species' overall reproductive rate is anticipated; only a short-term reproductive loss within the 3 to 5 maternity colonies is likely to occur at any point in time.

- The total amount of forest loss associated with the Proposed Action will be insignificant for most of the extant maternity colonies at CAJMTC. Only members of one maternity colony, which presumably inhabit the area where the proposed MPMGR will be constructed, are likely to experience take from the significant amount (96 acres) of permanent habitat loss associated with the construction of the MPMGR. This maternity colony is expected to have a temporary reduction in reproduction and long-term adverse impacts from this project and other smaller ones will be largely compensated for by the establishment and permanent protection of 275 acres of nearby mature forest as new IBMZs.
- From 1998 to 2010, 139 roost trees were identified during Indiana bat radio-tracking studies at CAJMTC. None of the currently proposed projects (e.g., MPMGR, new trails/roads/firebreaks) would disturb any of the 112 known roost trees that were still standing as of the latest surveys in 2007 and/or 2010.
- We estimated the maximum overall amount of incidental take of Indiana bats within the Action Area to be no more than 45 bats (40 females/juv. and 5 males) spread over a 5 to 10-year long period. So on an annual basis, this equates to about 5 to 9 bats being taken per year, which is less than 2% of the bats that presumably occupy the Action Area each summer.
- The Proposed Action will only directly or indirectly take or otherwise reduce the fitness of a relatively small number of bats and will only have minimal, short-term effects on these bats' respective maternity colonies and hibernating populations. The estimated total amount of take (45 bats) only represents 0.02% of the estimated 2009 winter population within hibernacula in the State of Indiana (189,994 bats). Similarly, loss of these individuals will have no adverse effect on the viability of other maternity colonies in the CAJMTC region and will not make a noticeable difference at the Midwest Recovery Unit level or the species' overall range. Likewise, loss of these relatively small number of bats will not be sufficient to adversely impact any hibernating populations to which these individuals belong. So again, the Proposed Action in combination with relatively small amounts of cumulative impacts/take is not reasonably expected, directly or indirectly, to cause an appreciable reduction in the reproduction, numbers or distribution of the Indiana bat as a species.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement (ITS)

The measures described below are **non-discretionary**, and must be undertaken by the INNG/CAJMTC or their designee for the exemption in section 7(o)(2) to apply. The INNG has a continuing duty to regulate the activity covered by this incidental take statement. If the INNG fails to assume and implement the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the INNG must report the progress of the action and its impact on the species to the Service as specified in the ITS [50 CFR §402.14(i)(3)].

INDIANA BAT

AMOUNT OR EXTENT OF TAKE

The Service believes it is reasonably certain that take of Indiana bats will occur as a direct or indirect result of the Proposed Action in the following forms:

- death/kill and/or injury/wound from military training, training-associated wildfires, and inadvertent chemical exposures, and
- harassment of roosting bats from noises/vibrations/disturbance levels causing roost-site abandonment and atypical exposure to day-time predators while fleeing and seeking new shelter during the day-time, and
- harm through significant habitat degradation/loss of roosting habitat such as primary and/or alternate roost trees, and loss of foraging habitat.
- trap/capture/harass from periodic mist net surveys and bridge surveys for bats and other bat-related research activities

Based on our knowledge of the ecology of Indiana bats, and the distribution of Indiana bats within the Action Area, we assume that the habitat that will be permanently lost or otherwise impacted will adversely affect the roosting and foraging habitat of up to 3 to 5 maternity colonies of Indiana bats. We further assume that each of these colonies would be composed of up to approximately 160 bats (80 reproductive adult female Indiana bats and 80 pups). Therefore, we assume that there are approximately 240 to 400 adult females and a similar number of juveniles/pups (480 to 800 combined total) within or adjacent to the defined Action Area and that variable proportions of the bats in these colonies will be exposed to direct and/or indirect

effects from the Proposed Action and will be taken. Adult male Indiana bats also occur in relatively low densities in forest habitat at CAJMTC and an unknown number these bats will also likely to be taken.

The effect of the loss of foraging habitat is expected to result in the death of some bats (e.g., as the result of exposure to predation or overwinter mortality of bats that failed to store adequate fat reserves). Loss of roosting habitat and degradation of remaining habitat may also result in harm to individual bats. Some degradation of remaining habitat is also likely to occur from increased fragmentation and increased disturbance levels. While some adverse effects are not expected to directly result in the death of bats, they may exacerbate the effects of other ongoing stressors on the bats. Collectively, the effects of the action are expected to result in behavioral or physiological effects which impair reproduction and recruitment, or other essential behavioral patterns. We anticipate take/death of individuals, decreased fitness of individuals, reduced reproductive potential, and reduced overwinter survival of an unknown number of Indiana bats within the Action Area. The effects on the 3 to 5 known maternity colonies may be lost reproductive capacity and potentially a short-term decline in their colony sizes. No significant, long-term adverse effects to affected maternity colonies or adult male populations are anticipated.

It is unlikely that direct mortality of bats will be detected, that is, we do not expect that dead or moribund bats will be found. Although multiple forms of take are anticipated, there is no practical means to directly measure these impacts to bats. Therefore, the anticipated level of take is being expressed as the permanent loss of 209 acres of mature forest and 132 acres of immature forest that is currently serving as suitable summer roosting and foraging habitat for Indiana bats. It is anticipated that up to 341 forested acres (i.e., areas with trees ≥3 inches DBH) will need to be cleared for the construction and operation of the MPMGR and other projects and activities at CAJMTC in approximately the next 5 to 10 years. In short, we will exempt the anticipated level of take (as roughly approximated in Table 1 below) by using the total affected habitat acreage as a surrogate. Therefore, **the exempted level of take is set at 209 acres of mature forest habitat loss and 132 acres of immature forest habitat loss**. Of the209 acres of anticipated mature forest loss, no more than 96 acres may be permanently lost in association with the proposed MPMGR project. However, the remaining 113 acres of mature forest and 132 acres of immature forest may be cleared regardless of which specific project/activity type leads to the acreage loss, or how long or short of a period of time it takes to clear this aggregate amount of forest within CAJMTC's boundaries.

Table 1. Anticipated sources of permanent forest loss at CAJMTC over the next 5 to 10+ years.

Project/Activity Type	Estimated Impact (acres)	Anticipated Forest Type
New MPMGR Project	96	mature
New trails and firebreaks	51	mature
Various new, but as yet undefined projects	62	mature
Rehabilitation of existing trails/roads/right-of-ways/ ditches/storm drains/ lines-of-sight etc.	132	immature
Total Impacts	341 acres	

At times, dead/dying, diseased and storm-damaged trees present such an imminent threat to human safety that they must be immediately felled to eliminate the hazard. If such an "emergency" hazard tree is >3 inches DBH and has exfoliating bark or a hollow(s) or crack, then it may also serve as a potential Indiana bat roost site. If CAJMTC must immediately fell a hazard tree that contains suitable roosting sites between 1 April and 30 September, then an unquantifiable amount of take of Indiana bats may occur. **The exempted level of take for exceptionally hazardous/potential roost trees that may be routinely felled between 1 April and 30 September in any given calendar year is set at 10.** Felling of other "non-emergency" hazard trees/potential roost trees shall occur when Indiana bats are not present at CAJMTC, thus no take from their felling is anticipated. [Note: Contingent upon BFO's advance notice/approval, CAJMTC may be allowed to fell some non-emergency hazard trees that have exfoliating bark/hollows/cracks during the summer provided that an adequate evening emergence survey is conducted at the potential roost(s) and no bats are observed.]

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that the aggregate level of anticipated take is not likely to result in jeopardy to Indiana bats nor would it lead to the destruction or adverse modification of any designated Critical Habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following Reasonable and Prudent Measures (RPMs) are necessary and appropriate to further minimize take of Indiana bats:

1. In its Programmatic Biological Assessment (and as refined during formal consultation), the INNG proposed to investigate and/or implement numerous Conservation Measures and mitigation efforts as part of their Proposed Action and these measures are hereby incorporated by reference. These measures will benefit a variety of wildlife species, including Indiana bats. The Service will take the necessary steps to ensure that the INNG successfully implements all the Conservation Measures to the fullest extent practicable.

2. The implementation status of all the proposed Conservation Measures, mitigation efforts, and research and any related problems need to be monitored and clearly communicated to the Service on an annual basis.

3. All CAJMTC staff, military trainees, and construction personnel/contractors at CAJMTC need to be made aware of potential issues concerning Indiana bats and construction projects and their daily operations at CAJMTC.

4. The INNG and CAJMTC need to ensure that the impacts of take associated with ongoing and future actions are appropriately minimized and that incidental take at the project/activity-specific level and programmatic/aggregate level is appropriately tracked and documented so that anticipated levels of exempted incidental take will not be exceeded nor will any new forms of take occur that were not anticipated in the programmatic consultation.

The Service believes that the measures above are necessary, appropriate, and reasonable for minimizing take of Indiana bats.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the INNG (and/or CAJMTC staff and their contractors or assigns) must comply with the following terms and conditions, which implement the RPMs. These Terms and Conditions (TCs) are non-discretionary.

1. The INNG/CAJMTC must implement all proposed Conservation Measures, as detailed in the accompanying programmatic biological opinion and or alternative measures that are of equal or greater benefit to Indiana bats as developed in consultation with the Service.

2. The INNG/CAJMTC will prepare an annual report detailing all Conservation Measures, mitigation efforts, and monitoring efforts that have been initiated, are ongoing, or completed during the previous calendar year and the current status of those yet to be completed. The report will be submitted to the Service's BFO by 31 January each year (the first report will be due by 1/31/2011) and reporting will continue for at least 10 years or until otherwise agreed to with the Service.

   If proposed Conservation Measures or mitigation goals cannot be realized, then INNG/CAJMTC staff will investigate and propose alternative solutions that can be realized and are of equal or greater benefit to Indiana bats within the Action Area.

3. The INNG and CAJMTC will provide some form(s) of mandatory environmental awareness training that will be required for various managers and user groups at CAJMTC that addresses pertinent Indiana bat issues/concerns that are germane to each user group. INNG/CAJMTC's management shall identify the appropriate user groups and the form/media of awareness training needed for each group. At a minimum, awareness training will be required for all contractors working in forest habitat, military trainees, and other staff or laborers that conduct land management activities or use restricted pesticides (i.e., those that require a state-issued applicator's license) at CAJMTC. The content of most training materials should not disclose the specific locations of sensitive Indiana bat sites (e.g., roost trees) unless CAJMTC deems it necessary to ensure such sites are avoided. All training materials should present a protocol for reporting the discovery of any live, injured, or dead bats observed or found within or near construction or training areas to CAJMTC natural resources staff. The BFO will assist in the development of new training materials and/or approve of existing materials as needed. CAJMTC must include a brief description of its annual environmental training activities/accomplishments/problems within the annual report required in TC#2 above

4. The INNG/CAJMTC and the USFWS's Bloomington Field Office (BFO) will implement an appended programmatic consultation approach, to ensure that the impacts of take associated with currently proposed projects and activities are appropriately minimized and that the exemption of incidental take is appropriately documented. Under this approach, the PBO and this ITS will exempt incidental take (i.e., up to 341 acres) at the program-level that will result from the implementation of multiple site-specific projects/actions and other poorly defined projects that result from implementation of the Proposed Action as detailed in the PBA.

   Prior to project initiation, INNG/CAJMTC staff must individually review all proposed project-specific impacts to forest habitat to determine whether the types and scale of impacts are consistent with this ITS and its RPMs and associated TCs, and to ensure that

site-specific impacts of the resulting incidental take are minimized (i.e., complete a "Phase 1" review). If a proposed project is consistent with the ITS and would cause a permanent loss of ≤10 acres of forest from new construction and/or ≤20 acres of immature forest (avg. dbh ≤10 inches) impacts associated with a routine maintenance activity (e.g., periodic maintenance of line-of-sights on training ranges, road/utility right-of-ways, storm drains etc.), then CAJMTC staff will document this Phase 1 determination in their files along with a spreadsheet that tracks their cumulative forest impacts/debits and remaining balances of exempted take/forest acreage and number of exempted emergency hazard trees (i.e., a "take-tracking spreadsheet").

At the end of each calendar year, CAJMTC staff will provide: 1) a written summary of all Phase 1-level projects that were implemented that calendar year, 2) a copy of their take-tracking spreadsheet showing the remaining balance of exempted take/acreage and total number of potential Indiana bat roost trees removed as emergency hazard trees during the summer (1 April – 30 Sept.), 3) an overview map(s) depicting the specific locations of all Phase 1 projects relative to known Indiana bat roost sites, and 4) a projected number of mature and immature forest acres that will be cleared during the next year. These items will be included in the annual report required in TC#2 above. If the previous year's impacts and the projected impacts detailed within the annual report are found to be consistent with the programmatic consultation, then the BFO will document this finding (i.e., consistency analysis) and append this finding and the annual report (i.e., this constitutes an "appendix") to the PBO and ITS. If the findings are not consistent, then the BFO will request that INNG reinitiate formal consultation.

If an individually proposed project/activity would 1) cause a permanent loss of >10 acres of forest habitat (other than the MPMGR, which is already fully considered/accounted for in the programmatic consultation/ITS) and/or 2) impact >20 acres of immature forest impacts associated with a routine maintenance activity and/or 3) destroy or disturb (i.e., come within 100 ft. of) 1 or more known/standing primary roost tree and/or 4) destroy 2 or more known/standing alternate roost trees, then INNG/CAJMTC staff will forward that project to the BFO for a site-specific consultation (Phase 2) prior to its implementation. Projects/activities such as these that likely pose a higher risk to Indiana bats will be considered as a "Phase 2"- level project. If effects of a Phase 2 project are found to be consistent with those analyzed in the programmatic consultation, then it will be appended to this PBO and ITS, along with any additional project-specific RPMs and TCs that are needed to fulfill the requirements of section 7(a)(2). No incidental take shall be considered as being exempted for a Phase 2 project until after a Phase 2 biological evaluation(BE)/BA has been reviewed, found to be complete and consistent with the programmatic findings, and has been "appended" to the PBO by the Service. The Service will typically complete its review and communicate its finding to CAJMTC in writing within 30 days of receipt of a complete Phase 2 BE/BA. If a Phase 2 project is not consistent with the programmatic consultation, then it will be consulted on individually.

INNG/CAJMTC's cover letter for submitting its annual report must include 1) a determination of whether or not the proposed Phase 1 projects were consistent with this PBO and ITS and 2) a request that the proposed annual report be reviewed and appended to this PBO. The cover letter, and one bound hard copy and an electronic copy of the annual report should be submitted to the BFO by 31 January each year.

5. Track military training activity levels and day vs. night-time training every 3 years (starting in calendar year 2012) and compare/contrast the current training levels to the baseline levels established for this consultation.

6. Any dead bats located within the CAJMTC boundaries, regardless of species, should be immediately reported to BFO (812-334-4261), and subsequently transported (frozen or on ice) to BFO. No attempt should be made to handle any live bat, regardless of its condition; report bats that appear to be sick or injured to BFO. BFO will make a species determination on any dead or moribund bats. If an Indiana bat is identified, BFO will contact the appropriate Service Law Enforcement office as required.

ATTENTION: If at any point in time, the exempted program-wide habitat acreages or annual number of hazard trees quantified in the AMOUNT OR EXTENT OF TAKE section of this ITS are exceeded by more than 10%, then the Service will assume that the exempted level of take for the ongoing mission at CAJMTC may have been exceeded and the INNG should immediately reinitiate formal consultation (see Reinitiation Notice below).

In conclusion, the Service believes that the permanent loss of currently suitable summer roosting and foraging habitat for Indiana bats will be limited to 341 acres of forest habitat in the Action Area. This acreage represents approximately a 1.5% loss of the CAJMTC's forested acreage and will occur over a period of approximately 5 to 10 years. The RPMs, with their implementing TCs, are designed to minimize the impact of incidental take that might otherwise result from the Proposed Action. If, during the course of the action, this level of incidental take is exceeded (or tree clearing occurs during the period 1 April to 30 September) such incidental take represents "new information" and will require reinitiation of formal consultation and review of the RPMs provided. The INNG/CAJMTC must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the RPMs.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation Recommendations (CRs) are discretionary agency activities to minimize or avoid adverse effects of a proposed action/program on listed species or critical habitat, to help implement recovery plans, or to develop information. CRs generally do not focus on a specific project, but rather on an agency's overall program.

The Service provides the following CRs for the INNG's consideration; these activities may be conducted at the discretion of INNG/CAJMTC staff as time and funding allow:

1. Working with the Service, develop national guidelines for addressing outstanding Indiana bat issues associated with DoD/military training/readiness projects within the range of the Indiana bat.

2. Provide funding to conduct research on understanding/controlling and mitigating the effects of White-Nose Syndrome.

3. Expand on scientific research and educational outreach efforts on Indiana bats in coordination with the Service's BFO.

4. In coordination with the BFO, purchase or otherwise protect additional Indiana bat maternity habitat and/or hibernacula/swarming habitat in Indiana.

5. Provide funding to staff a full-time Indiana bat Recovery Coordinator position within the BFO, which has the Service's national lead for this wide-ranging species.

In order for the Service to be kept informed of actions for minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal programmatic consultation with the NGB on the future routine training and land management activities and upcoming development projects at CAJMTC on the federally endangered Indiana bat (*Myotis sodalis*). As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion (e.g., a significant increase in military training activity levels or significantly more night training vs. daytime); or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

LITERATURE CITED

3D/International (3D/I), Inc. 1996. Biological assessment of the master plan and ongoing mission, U.S. Army Engineer Center and Fort Leonard Wood, Missouri. Prepared for the Army Corps of Engineer, Kansas City, Missouri.

Amec 2009. Programmatic biological assessment – effects on the Indiana bat (Myotis sodalis) with respect to future routine training and land management activities and upcoming development projects at the Camp Atterbury Joint Maneuve Training Center. December 2009. 95 pp plus figures and appendices.

Bat Conservation International (BCI 2010). BCI website regarding white-nose syndrome. Accessed on 21 October 2010. http://www.batcon.org/index.php/what-we-do/white-nose-syndrome.html.

Blatchley, W.S. 1897. Indiana caves and their fauna. Indiana Department of Geological and Natural Resources Annual Report 21:121-212.

Brack, V. Jr, and R. K. LaVal. 1985. Food habits of the Indiana bat in Missouri. Journal of Mammology 66(2):308-315.

Brack, V. Jr, and K. Tyrell. 1990. A model of the habitat used by the Indiana bat (*Myotis sodalis*) during the summer in Indiana: 1990 field studies. Indiana Department of Natural Resources, Division of Fish and Wildlife, Endangered Species Program, Project E-1-4, Study No. 8. 42 pp.

Brack, V., Jr, S. A. Johnson, and R. K. Dunlap. 2003. Wintering populations of bats in Indiana, with emphasis on the endangered Indiana Myotis, *Myotis sodalis*. Proceedings of the Indiana Academy of Sciences 112:61-74.

Brack, V., Jr., J.O. Whitaker Jr. and S.E. Pruitt. 2004. Bats of the Hoosier National Forest. Proceedings of the Indiana Academy of Science 113:76-86.

CAJMTC. 2007. Camp Atterbury website. Accessed 12 March 2007. http://www.campatterbury.org/

Callahan, E.V., III. 1993. Indiana bat summer habitat requirements. M.S. Thesis. University of Missouri, Columbia. 84 pp.

Callahan, E.V., R.D. Drobney, and R.L. Clawson. 1997. Selection of summer roosting sites by Indiana bats (*Myotis sodalis*) in Missouri. J. Mammalogy: 78(3):813-825.

Clark, D.R., Jr., R.K. LaVal, and D.M. Swineford. 1978. Dieldrin-induced mortality in an endangered species, the gray bat (*Myotis grisescens*). Science 199:1357-1359.

Clawson, R.L. 2002. Trends in population size and current status in A. Kurta and J. Kennedy eds. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International, Austin, Texas.

Cope, J.B., A.R. Richter, and R.S. Mills. 1974. A summer concentration of the Indiana bat, *Myotis sodalis*, in Wayne County, Indiana. Proceedings of the Indiana Academy of Sciences 83:482-484.

Cope, J. B., A. R. Richter, and R. S. Mills. 1977. Spring and Autumn Swarming Behavior in the Indiana Bat, Myotis sodalis. Journal of Mammology 58(1):93-95.

Gardner, J.E. and E.A. Cook. 2002. Seasonal and geographic distribution and quantification of potential summer habitat. Pp. 9-20 *in* A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, TX.

Gardner, J.E., J.D. Garner, and J.E. Hofmann. 1991a. Summary of *Myotis sodalis* summer habitat studies in Illinois: with recommendations for impact assessment. Unpublished report prepared for the Indiana/Gray Bat Recovery Team Meeting, Columbia, Mo. Illinois Natural History Survey, Section of Faunistic Surveys and Insect Identification. 28 pp.

Gardner, J.E., J.D. Garner, and J.E. Hofmann. 1991b. Summer roost selection and roosting behavior of *Myotis sodalis* (Indiana bat) in Illinois. Unpublished report, Illinois Natural History Survey, Section of Faunistic Surveys and Insect Identification. 51 pp.

Garner, J. D., and J. E. Gardner. 1992. Determination of summer distribution and habitat utilization of the Indiana bat (Myotis sodalis) in Illinois. Final Report. Project E-3. Illinois Department of Conservation, Division of Natural Heritage and Illinois Natural History Survey, Center for Biogeographic Information. 25 pp.

Gumbert, M.W., J.M. O'Keefe, and J.R. MacGregor. 2002. Roost site fidelity. In A. Kurta and J. Kennedy eds. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International, Austin, Texas.

Hall, J.S. 1962. A life history and taxonomic study of the Indiana bat, *Myotis sodalis*. Reading Publ. Mus. Art., Gallery Publ. 12:1-68.

Harvey, M.J. 2002. Status and ecology in the southern United States. Pp. 29-34. *in* A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.

Hofmann, J. 1996. Indiana Bats in Illinois. INHS Reports, March-April 1996. Illinois Natural History Survey. Available: http://www.inhs.uiuc.edu/chf/pub/surveyreports/mar-apr96/bats.html (Accessed: February 5, 2003)

Hoosier National Forest (HNF). 2000. Programmatic Biological Assessment: Land and Resource Management Plan. Unpublished Report. Hoosier National Forest, Bedford, Indiana. 109 pp + Appendix.

Humphrey, S.R. 1978. Status, winter habitat, and management of the endangered Indiana bat, *Myotis sodalis*. Florida Scientist 41:65-76.

Humphrey, S. R., A. R. Richter, and J. B. Cope. 1977. Summer habitat and ecology of the endangered Indiana bat, *Myotis sodalis*. Journal of Mammology 58(3):334-346.

Humphrey, S. R., and J. B. Cope. 1977. Survival rates of the endangered Indiana bat, *Myotis sodalis*. Journal of Mammology 58:32-36.

Indiana Department of Natural Resources (IDNR) 1991. Field survey of the vertebrate fauna at the Atterbury Reserve Forces Training Area. Prepared by the Indiana Department of Natural Resources, Division of Fish and Wildlife, Nongame and Endangered Wildlife Program, Indianapolis, Indiana. Cited in Montgomery Watson and 3D/I, 1998.

INNG. 2007. Indiana National Guard website. Accessed 12 March 2007. http://www.inarng.org/mission.htm

Kiser, J.D., J.R. MacGregor, H.D. Bryan, and A. Howard. 2002. Use of concrete bridges as nightroosts. in A. Kurta and J. Kennedy eds. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International, Austin, Texas.

Kurta, A. 2005. Roosting ecology and behavior of Indiana bats (*Myotis sodalis*) in summer. Pp. 29-42 *in* K.C. Vories and A. Harrington (eds.), Proceedings of the Indiana bat and coal mining: a technical interactive forum. Office of Surface Mining, U.S. Department of the Interior, Alton, IL. Available at: http://www.mcrcc.osmre.gov/PDF/Forums/Bat%20Indiana/TOC.pdf. (Accessed October 17, 2006).

Kurta, A., D. King, J.A. Teramino, J.M. Stribley, and K.J. Williams. 1993. Summer Roosts of the Endangered Indiana Bat (Myotis sodalis) on the Northern Edge of its Range. American Midland Naturalist 129(1): 132-138.

Kurta, A., S. W. Murray, and D. H. Miller. 2002. Roost Selection and Movements Across the Summer Landscape in A. Kurta and J. Kennedy eds. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International, Austin, Texas.

Montgomery Watson. 1997. Survey of bat species at Camp Atterbury Army National Guard Training Site, Edinburgh, Indiana. Unpublished technical report submitted to Indiana Army National Guard.

Montgomery Watson. 1999. Final Indiana Bat (*Myotis sodalis*) Mist Netting and Telemetry Study, Camp Atterbury, Indiana. Unpublished technical report prepared for Camp Atterbury, Indiana.

Montgomery Watson & 3D/I. 1998. Montgomery Watson and 3D/International, Inc. 1998. Biological Assessment: Effects to Indiana Bats and Bald Eagles from Construction and Operation of the Proposed Multi-Purpose Training Range and Appendix: Ecological Risk Assessment: Toxicological Effects to Indiana Bats from Construction and Operation of the Proposed Multi-Purpose Training Range. Prepared for Military Department of Indiana.

Munson, P. J. and J. H. Keith. 1984. Prehistoric raccoon predation on hibernating *Myotis*, Wyandotte Cave, Indiana. Journal of Mammalogy 65:152-155.

Parsons. 2007. Integrated Natural Resources Management Plan Camp Atterbury Joint Maneuver Training Center, Edinburgh, Indiana (Revision 2007). Unpublished technical report prepared by Parsons, St. Louis, Missouri. Submitted to Joint Forces Headquarters, Indiana National Guard, Indianapolis, Indiana.

Pruitt, L. 1995. Summary of Jefferson Proving Ground bat surveys: 1993-1995. U.S. Fish and Wildlife Service, Bloomington Field Office, Unpublished report. 5 pp.

Puechmaille, S.J., P. Verdeyroux, H. Fuller, M.A. Gouilh, M. Bekaert, and E.C. Teeling. 2010. White-Nose Syndrome Fungus (*Geomyces destructans*) in Bat, France. Emerg. Infect. Dis. 2010 Feb.; [Epub ahead of print]

Rommé, R.C., K. Tyrell, and V. Brack, Jr. 1995. Literature summary and habitat suitability index model: components of summer habitat for the Indiana bat, *Myotis sodalis*. Report to Indiana Department of Natural Resources, Federal Aid Project E-1-7, Study No. 8. 38pp.

Rommé, R. C., A. B. Henry, R. A. King, T. Glueck, and K. Tyrell. 2002. Home range near hibernacula in spring and autumn. in A. Kurta and J. Kennedy eds. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International, Austin, Texas.

Sealander J. A., and G. A. Heidt. 1990. Arkansas Mammals. The University of Arkansas Press, Fayetteville, Arkansas. 308pp.

Shapiro, A. and M.G. Hohmann. 2005. Summary of threatened and endangered bat-related restrictions on military training, testing, and land management. Unpublished technical report. U.S. Army Corps of Engineers, Engineer Research and Development Center, Construction Engineering Research Laboratory. ERDC/CERL TR-05-13. 95 pp.

Silliman, B.S., Jr., J.D. Dana, and W. Gibbs. 1851. On the Mammoth Cave of Kentucky. American Journal of Science and Arts (Second Series) 11:332-339.

Toomey, R.S., III, M.L. Colburn, and R.A. Olson. 2002. Paleontological evaluation of use of caves: a tool for restoration of roosts. Pp. 79-85 *in* A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, TX.

Tuttle, M.D. 1997. A mammoth discovery. Bats 15:3-5.

Tuttle, M.D. 1999. Former home of more than a million endangered Indiana bats protected. Bats 17(3):8-9.

Tuttle, M.D. and J. Kennedy. 2002. Thermal requirements during hibernation. Pp. 68-78 *in* A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, TX.

U.S. Environmental Protection Agency (USEPA). 2007. U.S. Environmental Protection Agency website: Surf Your Watershed. http://cfpub.epa.gov/surf/locate/index.cfm. Accessed 27 September 2007.

U.S. Fish and Wildlife Service (USFWS). 1983. Recovery plan for the Indiana bat. Washington, D.C. 80pp.

United States Fish and Wildlife Service (USFWS). 1998. Biological Opinion on the Construction and Operation of the Multi-purpose Training Range (MPTR) at the Camp Atterbury Army National Guard Training Site. U.S. Fish and Wildlife Service Bloomington Field Office, Bloomington, Indiana. 21 pp.

U.S. Fish and Wildlife Service (USFWS). 1999. Agency Draft Indiana Bat (*Myotis sodalis*) Revised Recovery Plan. Fort Snelling, Minnesota. 53 pp

U.S. Fish and Wildlife Service (USFWS). 2002. Biological Opinion on the Application for an Incidental Take Permit for the Federally Endangered Indiana Bat (*Myotis sodalis*) for the Six Points Road Interchange and Associated Development. Unpublished Report. Bloomington Field Office, Bloomington, Indiana. 35 pp.

U.S. Fish and Wildlife Service (USFWS). 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. U.S. Fish and Wildlife Service, Fort Snelling, MN. 82 pp.

Whitaker, J.O., Jr., and V. Brack Jr. 2002. Distribution and summer ecology in Indiana. in A. Kurta and J. Kennedy eds. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International, Austin, Texas.

Whitaker, J.O., Jr. and C.L. Gummer. 2002. Bats of Camp Atterbury, with emphasis on roosting of Indiana Myotis and evening bats 2002. Report for the Military Department of Indiana. 51 pp. plus appendices.

FIGURES

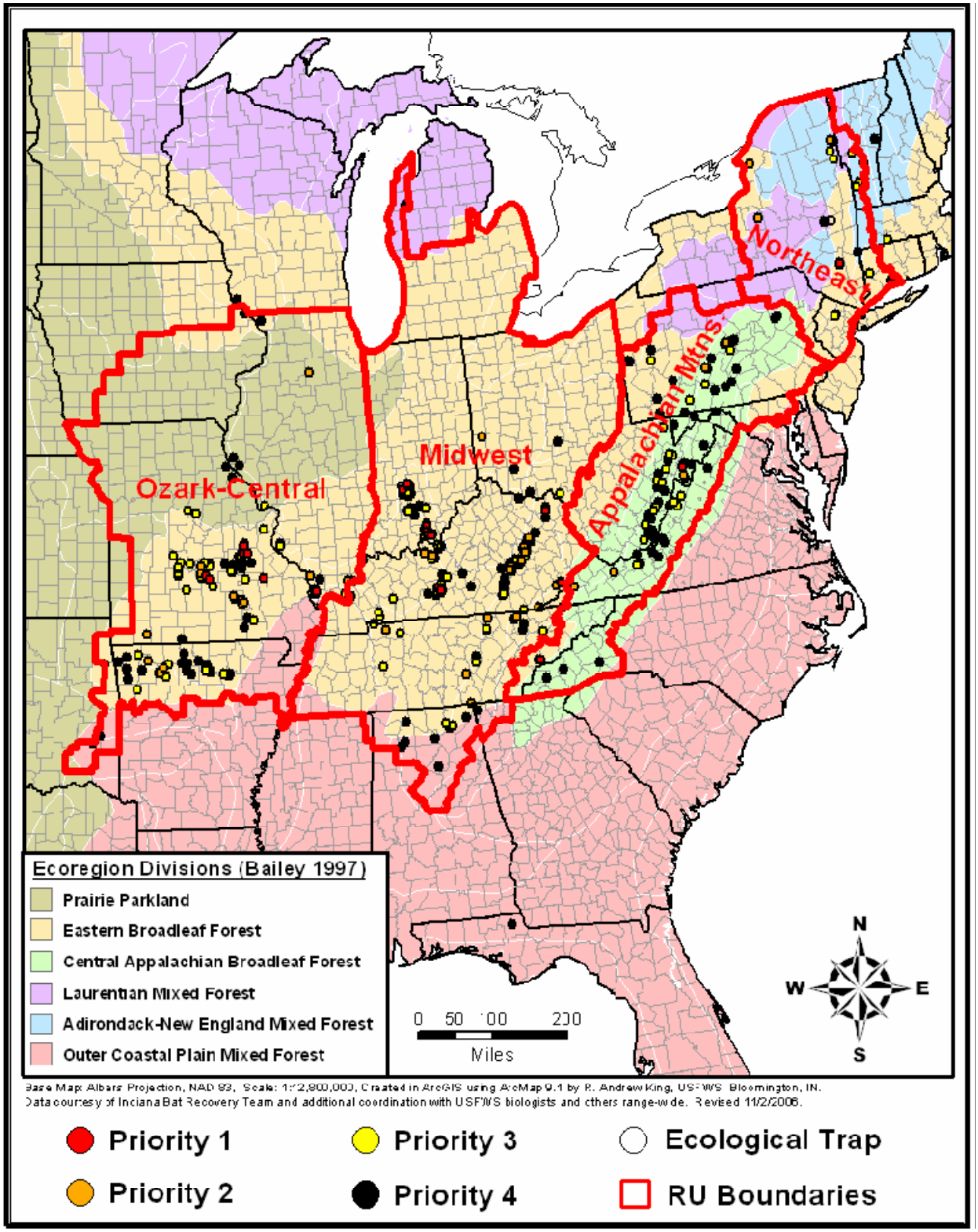


Figure 1. Proposed Recovery Units for the Indiana bat in relation to locations of known hibernacula (from USFWS 2007).

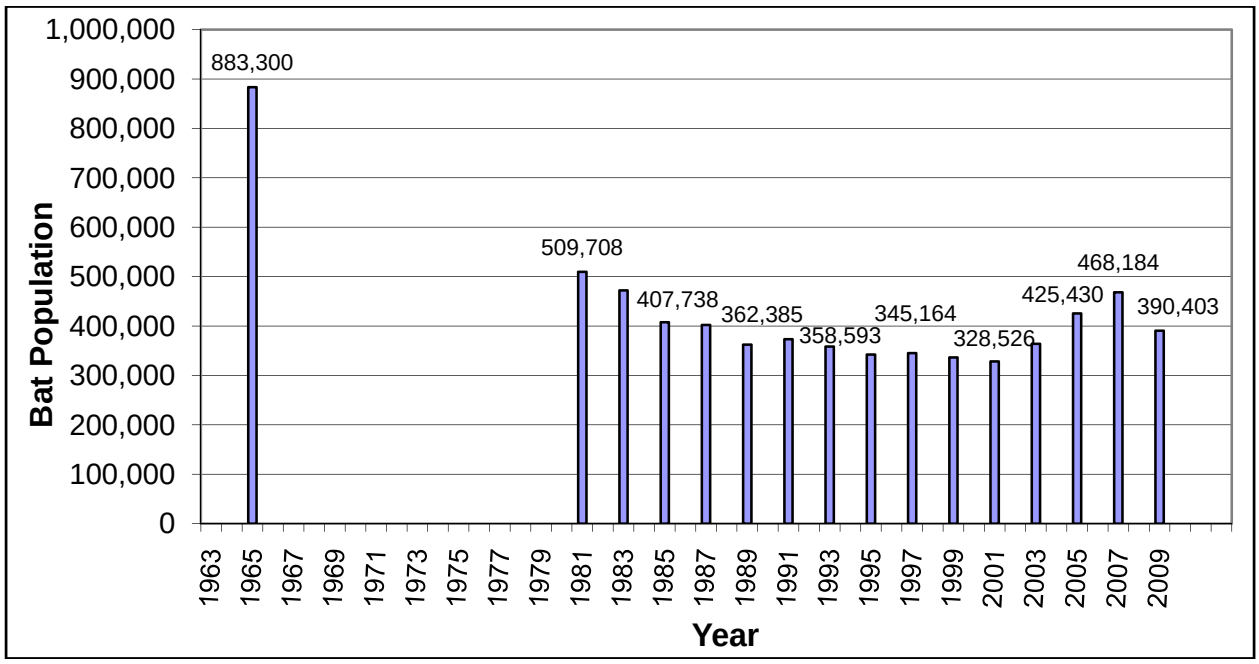


Figure 2a. Indiana bat rangewide population estimates (Data sources: 1965-1990, Clawson 2002; 2001-2005, USFWS, unpublished data, 2010). Rangewide estimates calculated from all known hibernacula were not attempted or data generally was not available for most years prior to 1980.

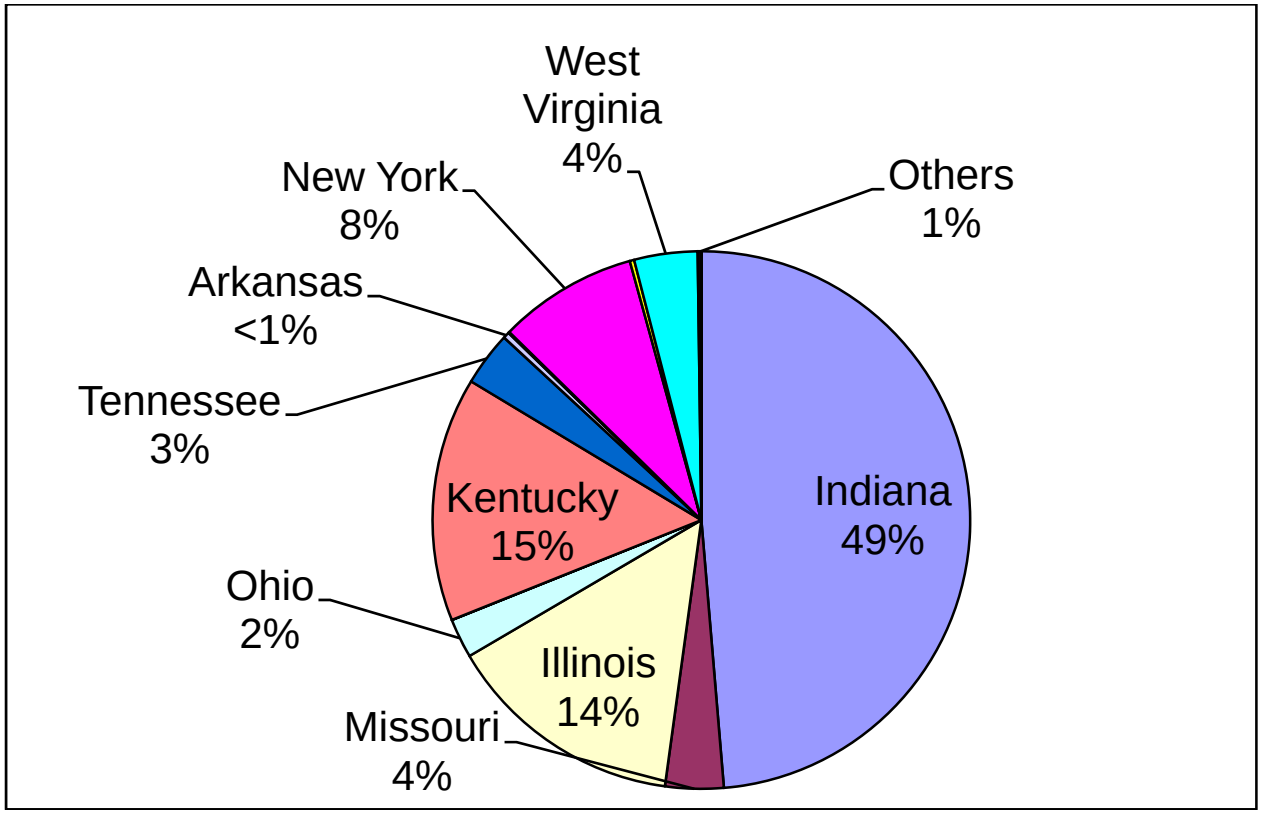
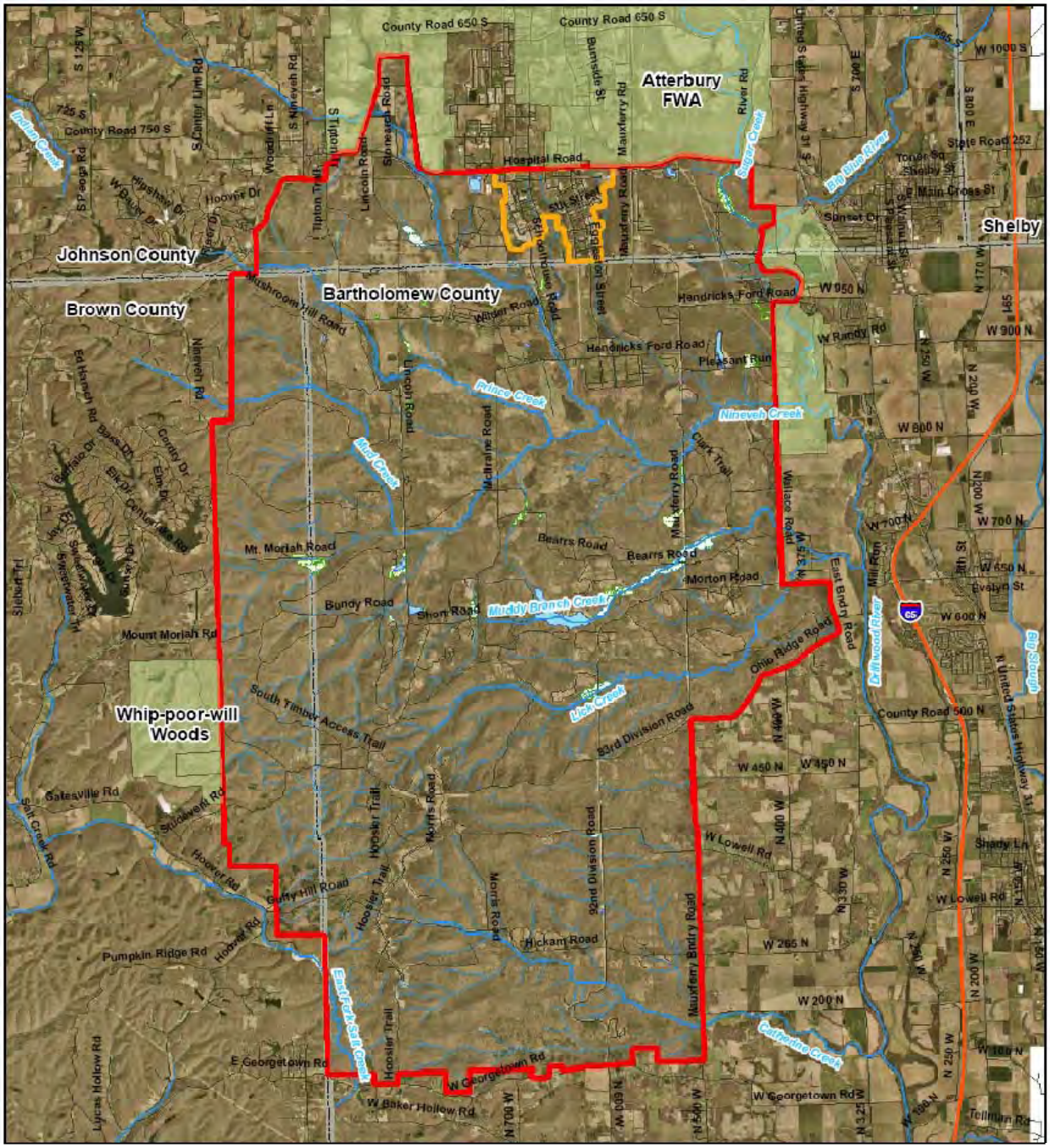


Figure 2b. Range-wide distribution of hibernating Indiana bat populations in 2009 (estimated at approx. 390,000 bats) (USFWS, unpublished data, 2010).


Atterbury FWA
Johnson County
Bartholomew County
Brown County
Shelby
Whip-poor-will Woods
County Road 650 S
Hospital Road
Handricks Ford Road
Pleasant Run
Prince Creek
Nineveh Creek
Mud Creek
Bearrs Road
Morton Road
Muddy Branch Creek
Bundy Road
Short Road
Mount Moriah Rd
Mt. Moriah Road
Ohio Ridge Road
53rd Division Road
92nd Division Road
Hickam Road
Gatesville Rd
Gulty Hill Road
Pumpkin Ridge Rd
E Georgetown Rd
W Georgetown Rd
W Baker Hollow Rd
W Lowell Rd
County Road 500 N
W 600 N
W 700 N
W 800 N
W 900 N
W 950 N
W 1000 S
State Road 252
E Main Cross St
Legend
CAJMTC Boundary
Cantonment Area
IDNR Lands
Lakes or Ponds
Wetlands
Streams and Rivers
Roads
0 1 2 Miles
Source Data: USGS Nineveh, New Bellsville, Edinburgh,& Franklin Quadrangles
Projection: NAD 1983 UTM Zone 16N
FIGURE 3
LAND COVER MAP
Biological Assessment for the Indiana Bat
Camp Atterbury Joint Manuever Training Center
Brown, Bartholomew and Johnson Counties, Indiana
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Prepared by:
amec
Columbus, Ohio

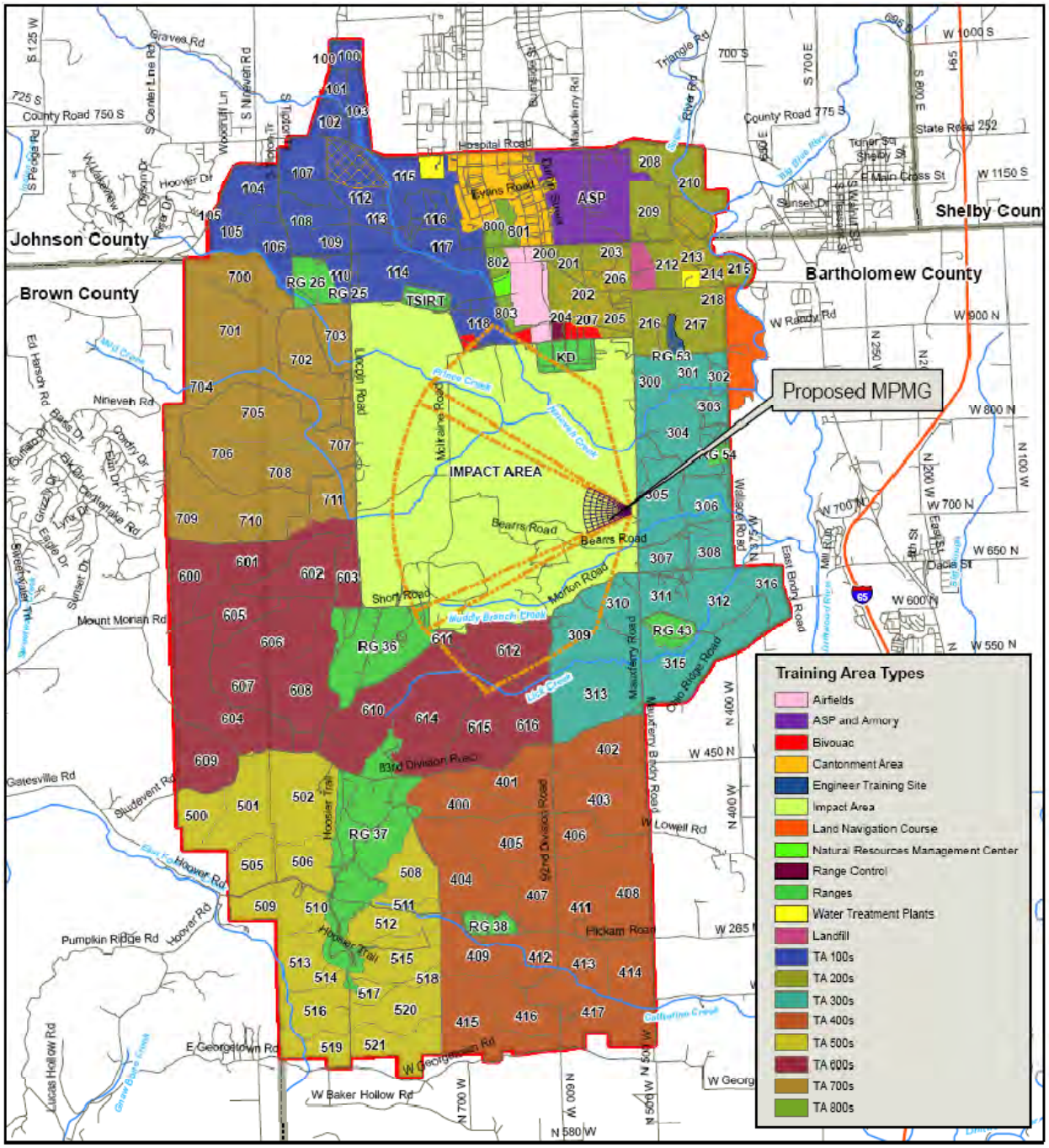

FIGURE 4a
SITE FACILITY MAP

Biological Assessment for the Indiana Bat

Camp Atterbury Joint Manuever Training Center
Brown, Bartholomew and Johnson Counties, Indiana

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Prepared by:
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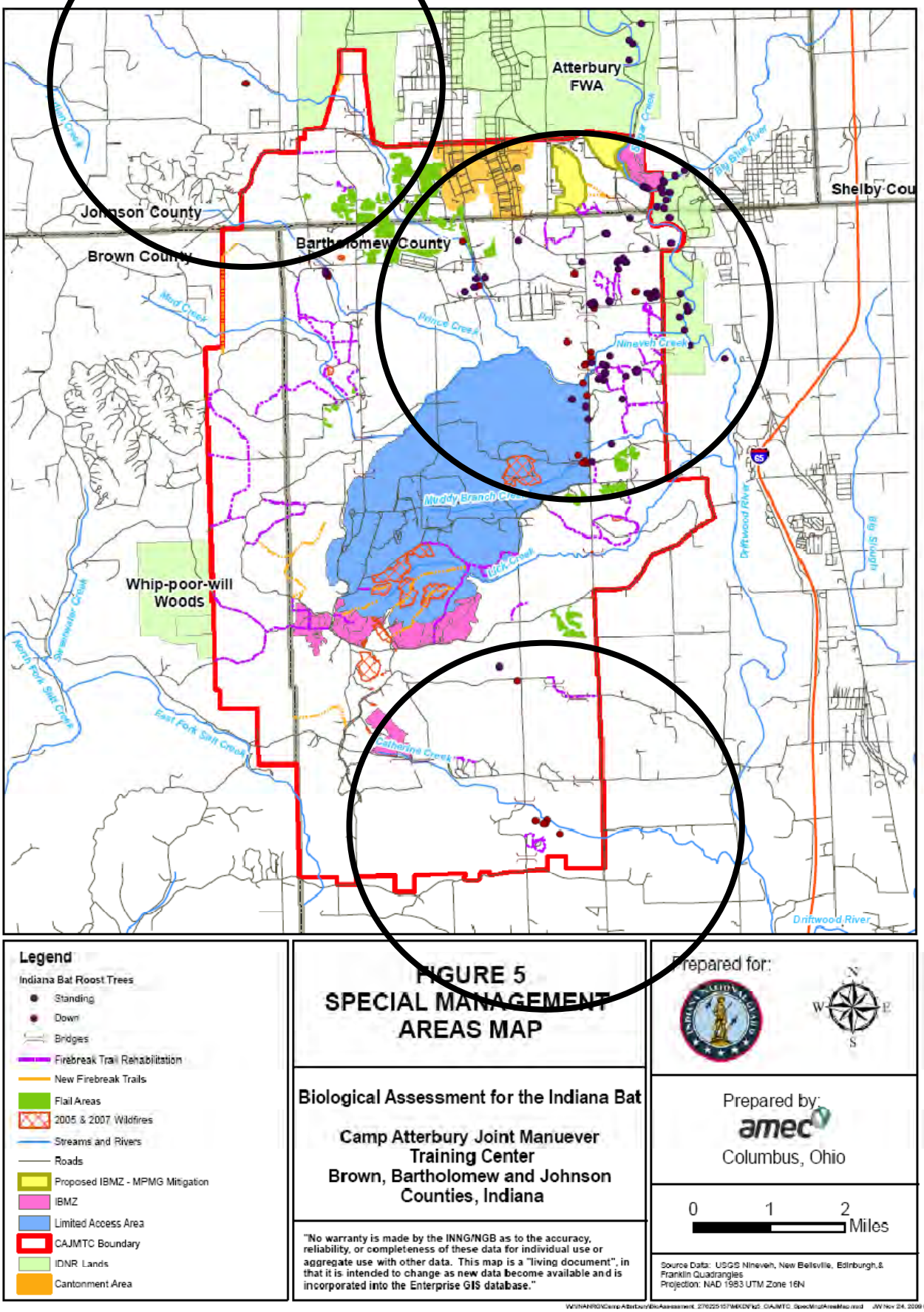
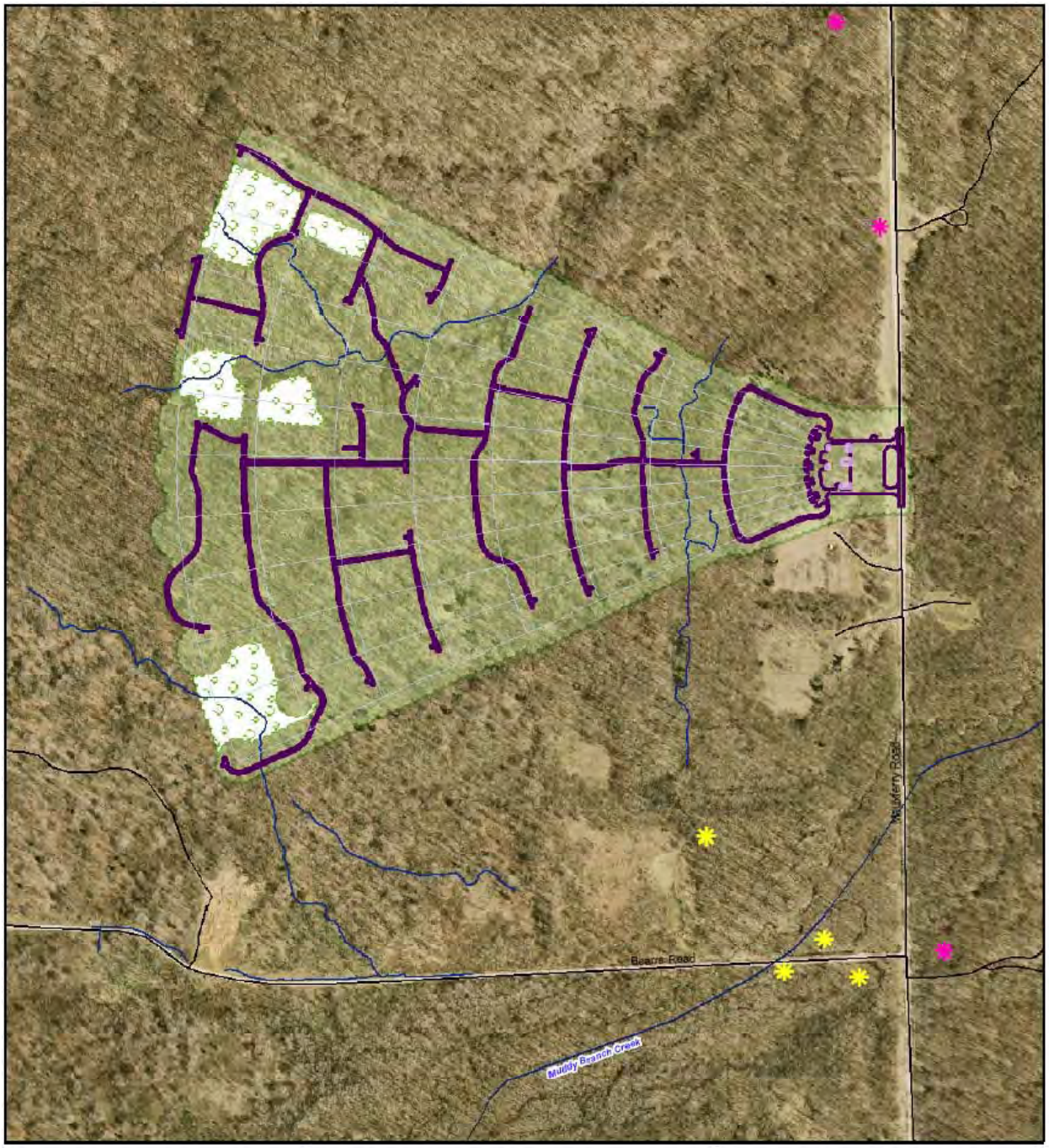
Columbus, Ohio



*black circles (2.5-mi. radii) represent presumed focal areas of 3 Indiana bat maternity colonies.



Legend

Indiana Bat Roost Trees
- Standing
- Down

Buildings

Range Footprint

Gravel Roads

Roads

Streams

Forest Area Not Cleared

Limits of Forest Clearing

Source Data: USGS Nineveh, New Bellsville, Edinburgh,& Franklin Quadrangles
Projection: NAD 1983 UTM Zone 16N

FIGURE 7a
PROPOSED MPMG RANGE FOREST IMPACTS

Biological Assessment for the Indiana Bat

Camp Atterbury Joint Manuever Training Center
Brown, Bartholomew and Johnson Counties, Indiana

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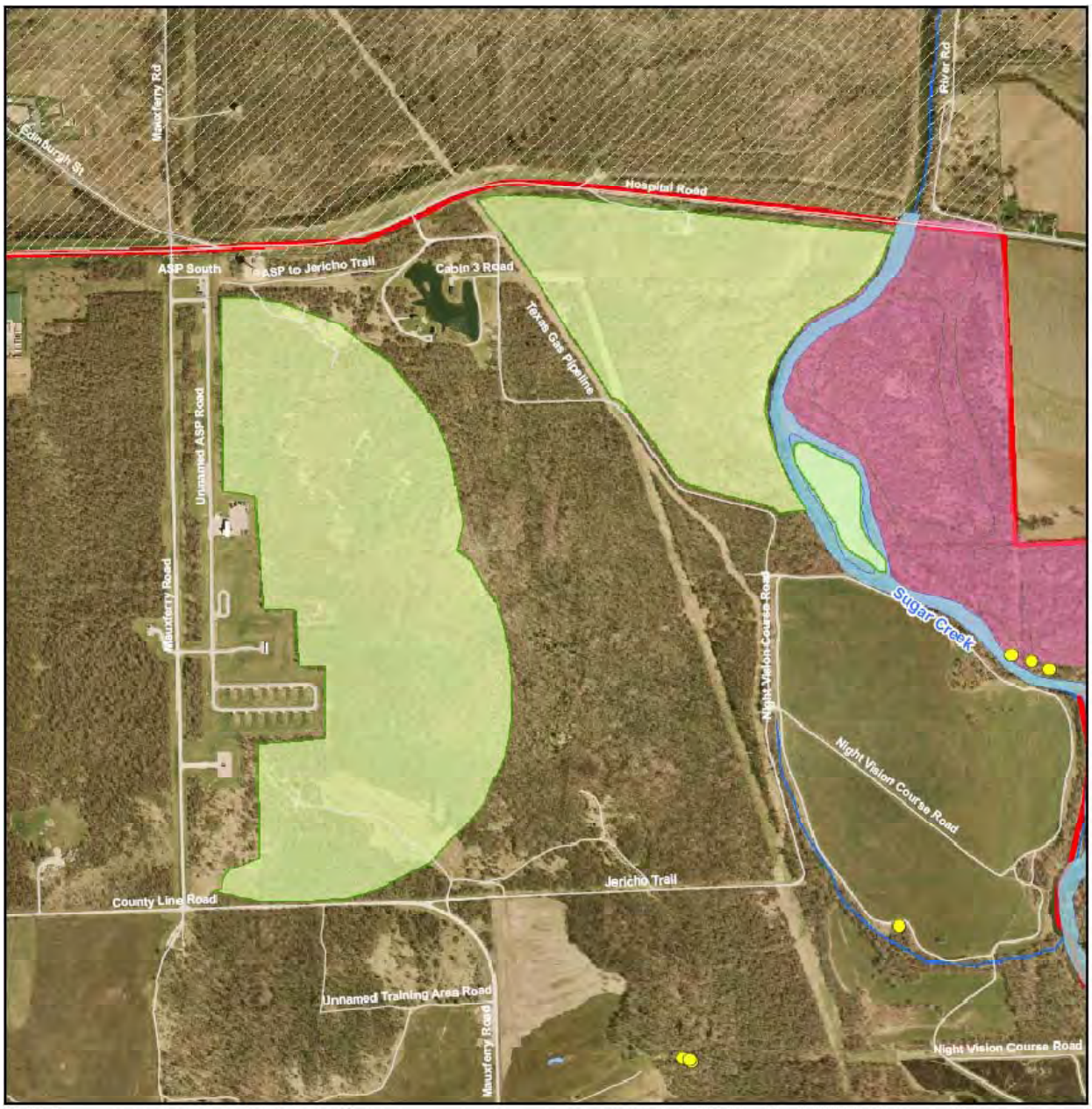
Prepared by:
amec
Columbus, Ohio

0 500 1,000 Feet



Legend

Indiana Bat Roost Trees
- Standing
- Down

Roads
Streams
Proposed IBMZ - MPMG Mitigation
Existing IBMZ
Waterbodies
IDNR Lands
CAJMTC Boundary

FIGURE 8
PROPOSED IBMZ FOR MPMG RANGE IMPACTS

Biological Assessment for the Indiana Bat

Camp Atterbury Joint Manuever Training Center
Brown, Bartholomew and Johnson Counties, Indiana

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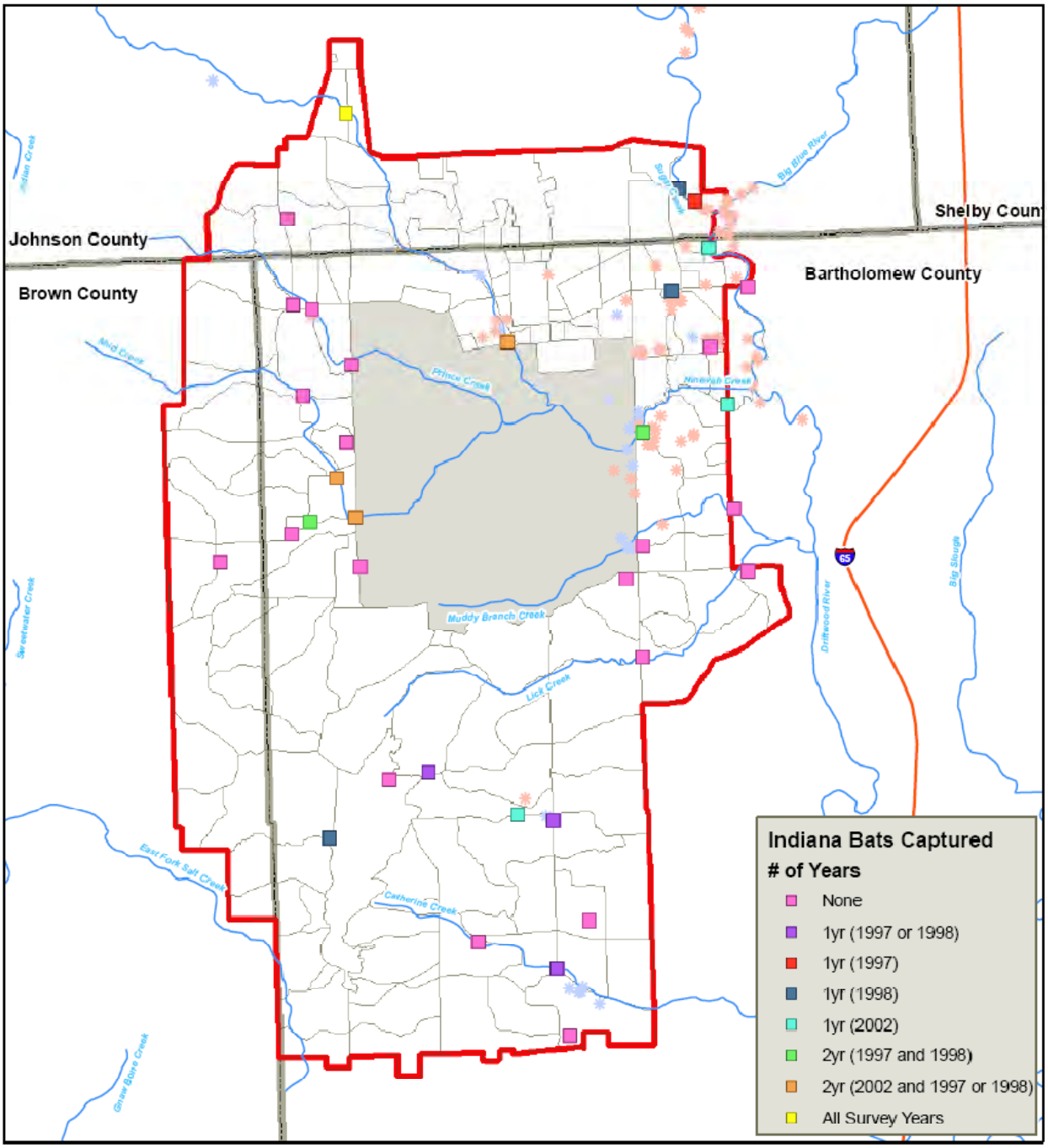
Prepared by:
amec
Columbus, Ohio

0 1,000 2,000 Feet

Source Data: USGS Nineveh, New Bellsville, Edinburgh,& Franklin Quadrangles
Projection: NAD 1983 UTM Zone 16N

W:\NAM\IO\Camp Atterbury\Bio Assessment\ 27622515?\MXD\Fig8. CAJMTC - Proposed IBMZsMap.mxd JW Nov 24, 2009


Johnson County
Brown County
Bartholomew County
Shelby Coun
Indiana Bats Captured
# of Years
None
1yr (1997 or 1998)
1yr (1997)
1yr (1998)
1yr (2002)
2yr (1997 and 1998)
2yr (2002 and 1997 or 1998)
All Survey Years
Legend
Bat Mist Net Sites
Indiana Bat Roost Trees
Standing
Down
Freeway System
Streams and Rivers
Training Areas
Impact Area
CAJMTC Boundary
County Boundary
FIGURE 9
BAT MIST NET SITES - 1997, 1998, and 2002 SURVEYS
Biological Assessment for the Indiana Bat
Camp Atterbury Joint Manuever Training Center
Brown, Bartholomew and Johnson Counties, Indiana
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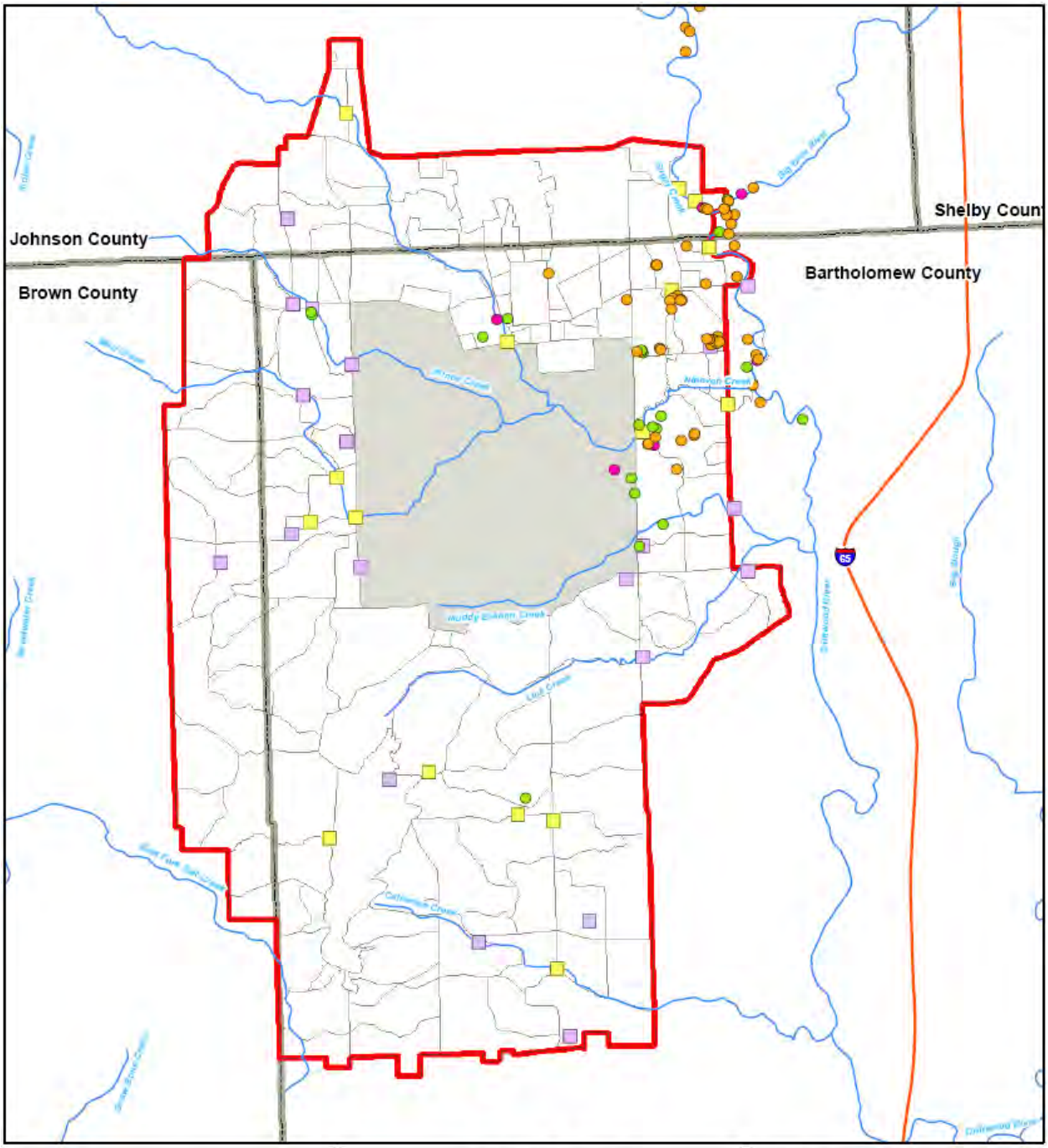
Prepared for:
Prepared by:
amec
Columbus, Ohio
0 1 2 Miles
Source Data: USGS Nineveh, New Bellsville, Edinburgh,& Franklin Quadrangles
Projection: NAD 1983 UTM Zone 16N


Johnson County
Brown County
Bartholomew County
Shelby Coun
65
Legend
Known Standing Roost Trees
Primary
Alternate
Unknown
Bat Mist Net Sites (1997, 1998 & 2002)
None Captured
Indiana Bats Captured
Freeway System
Streams and Rivers
Training Areas
Impact Area
CAJMTC Boundary
FIGURE 10d
INDIANA BAT ROOST TREES - 2007
Biological Assessment for the Indiana Bat
Camp Atterbury Joint Manuever Training Center
Brown, Bartholomew and Johnson Counties, Indiana
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Prepared for:
N
W
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Prepared by:
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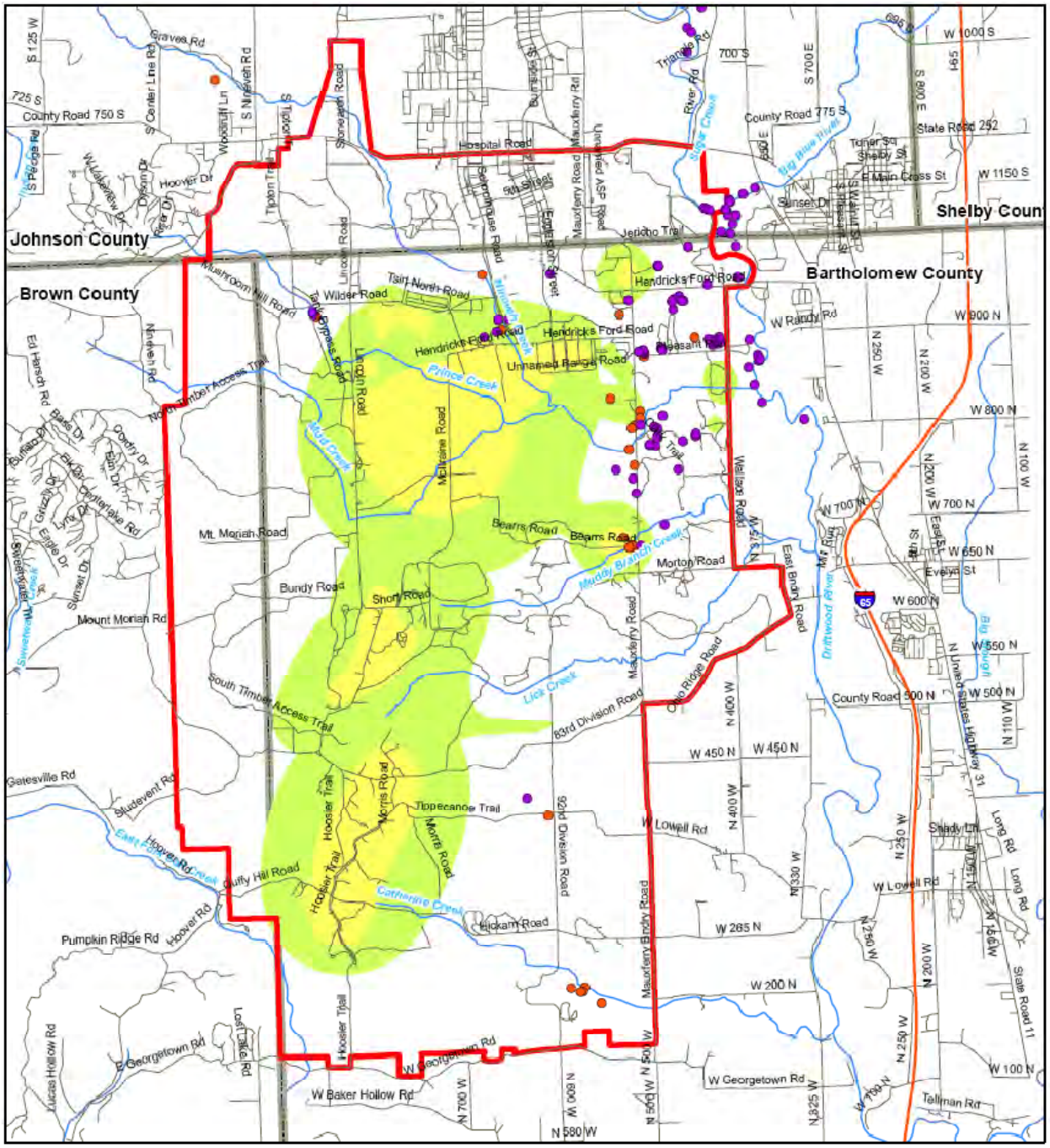
Columbus, Ohio
0 1 2
Miles
Source Data: USGS Nineveh, New Bellsville, Edinburgh,& Franklin Quadrangles
Projection: NAD 1983 UTM Zone 16N


Johnson County
Brown County
Bartholomew County
Shelby Coun
Legend
Indiana Bat Roost Trees
Standing
Down
Noise Zones
Zone II (62-70 dBC; 65-75 dBA)
Zone III (>70 dBC; >75 dBA)
Streams and Rivers
Roads
CAJMTC Boundary
County Boundary
Source Data: USGS Nineveh, New Bellsville, Edinburgh,& Franklin Quadrangles
Projection: NAD 1983 UTM Zone 16N
FIGURE 11
NOISE MAP
Biological Assessment for the Indiana Bat
Camp Atterbury Joint Manuever Training Center
Brown, Bartholomew and Johnson Counties, Indiana
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Prepared for:
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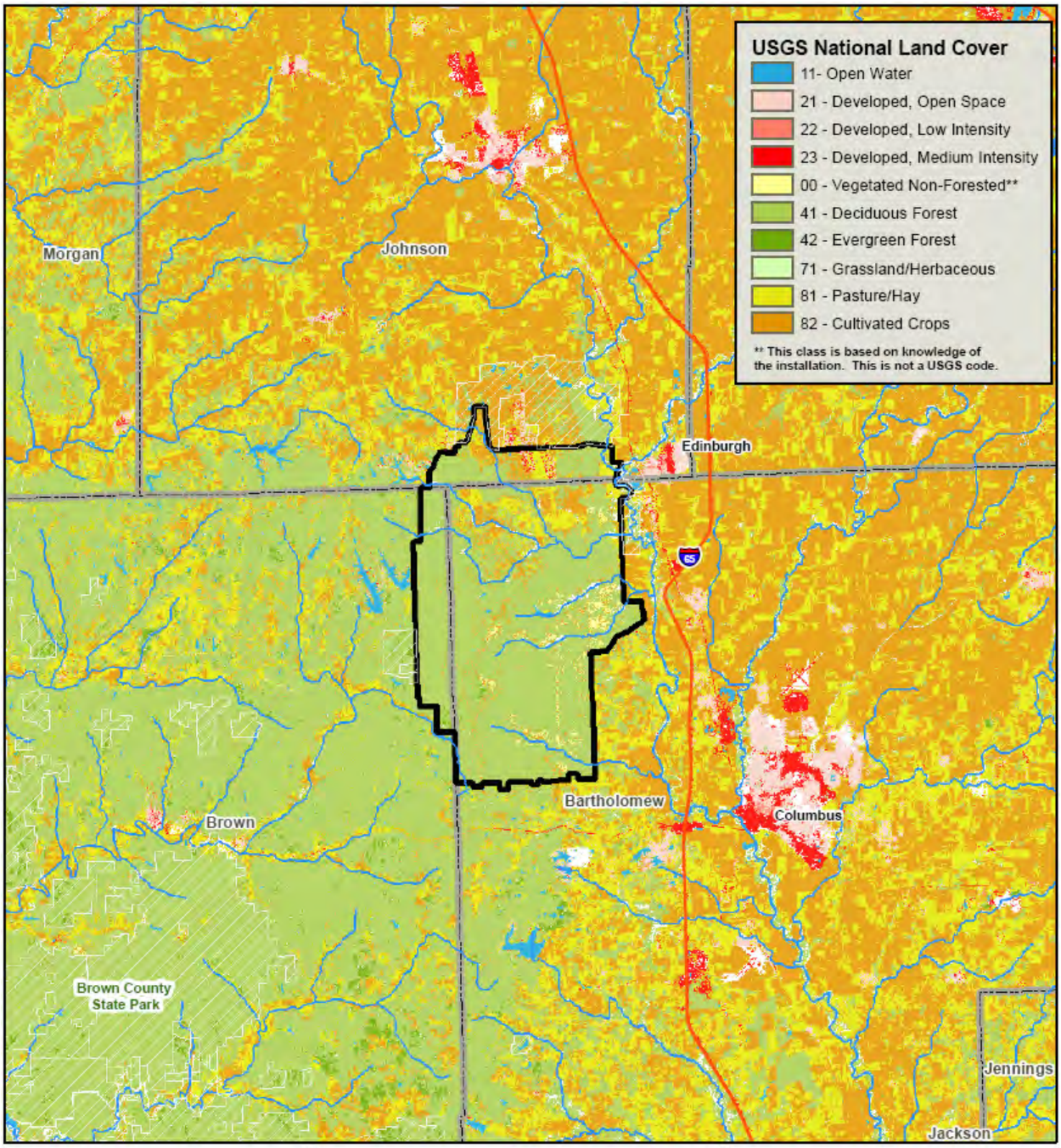
amec
Columbus, Ohio
0 1 2 Miles



Legend

- Streams and Rivers
- CAJMTC Boundary
- County Boundary
- IDNR Lands

0 2.5 5 Miles

Source Data: USGS, 2002 - National Land Cover Data
Projection: NAD 1983 UTM Zone 16N

FIGURE 12
CAJMTC LAND COVER MAP

Biological Assessment for the Indiana Bat

Camp Atterbury Joint Manuever Training Center
Brown, Bartholomew and Johnson Counties, Indiana

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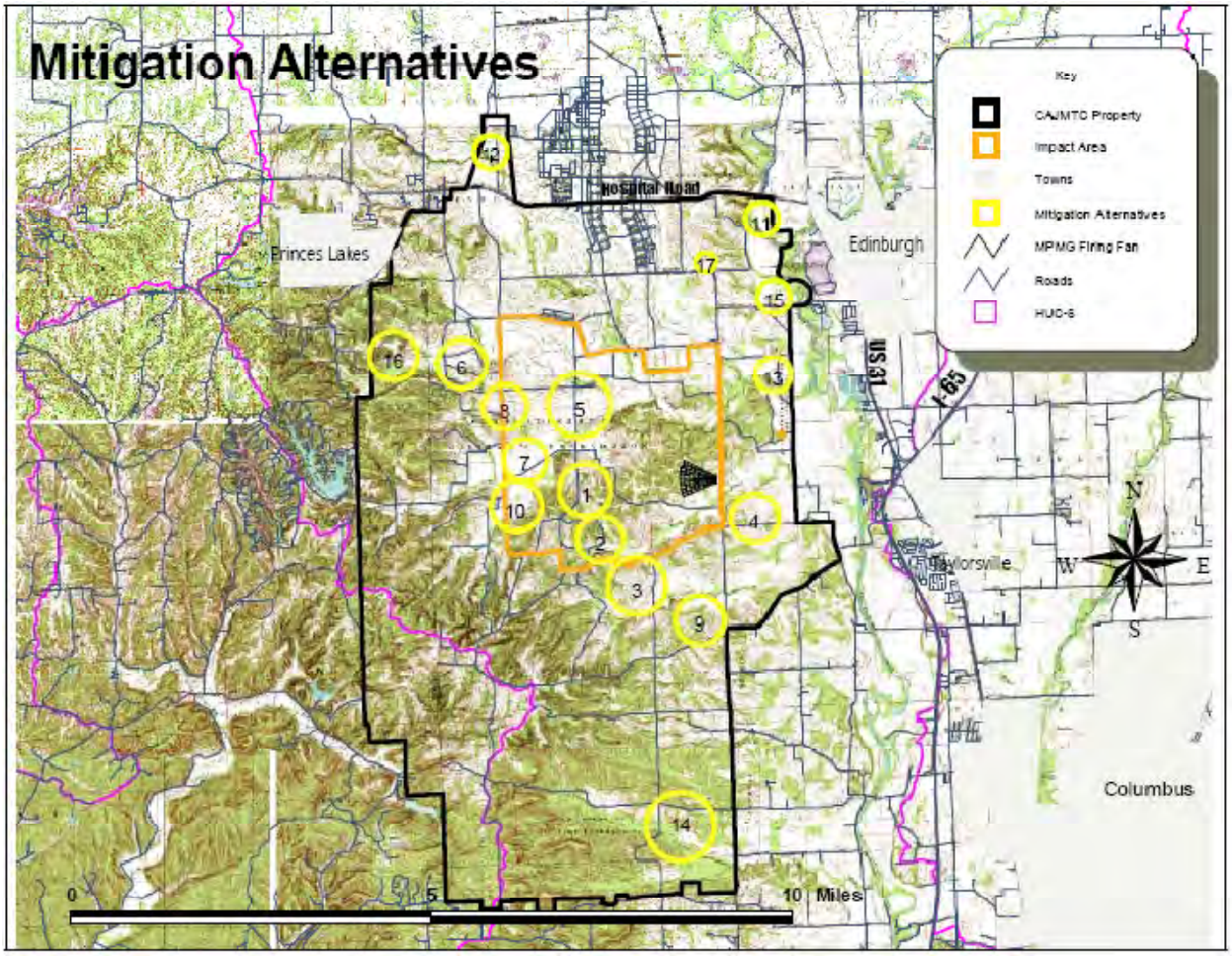


Figure 13. Alternative sites for wetland and stream mitigation to compensate for construction impacts associated with the MPMGR at CAJMTC.

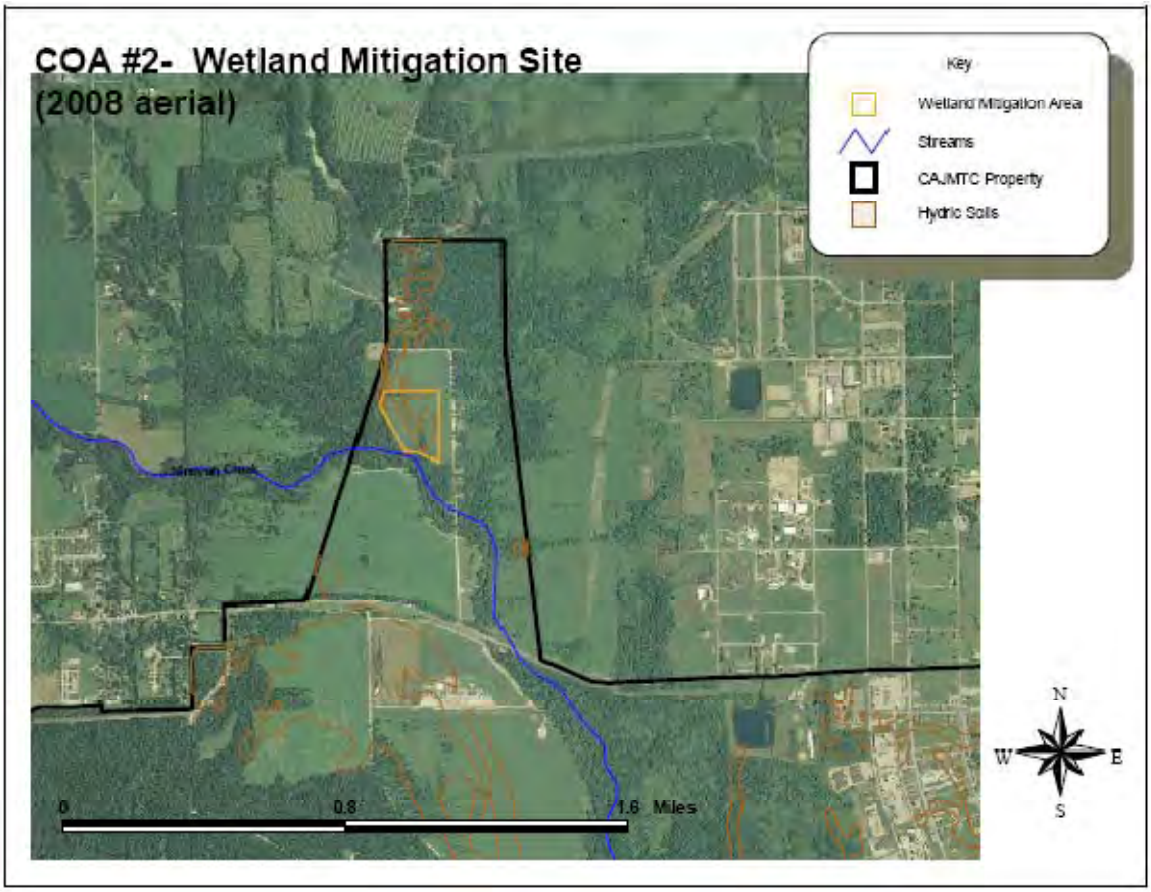


Figure 14. Training Area 101 Wetland Mitigation Area.

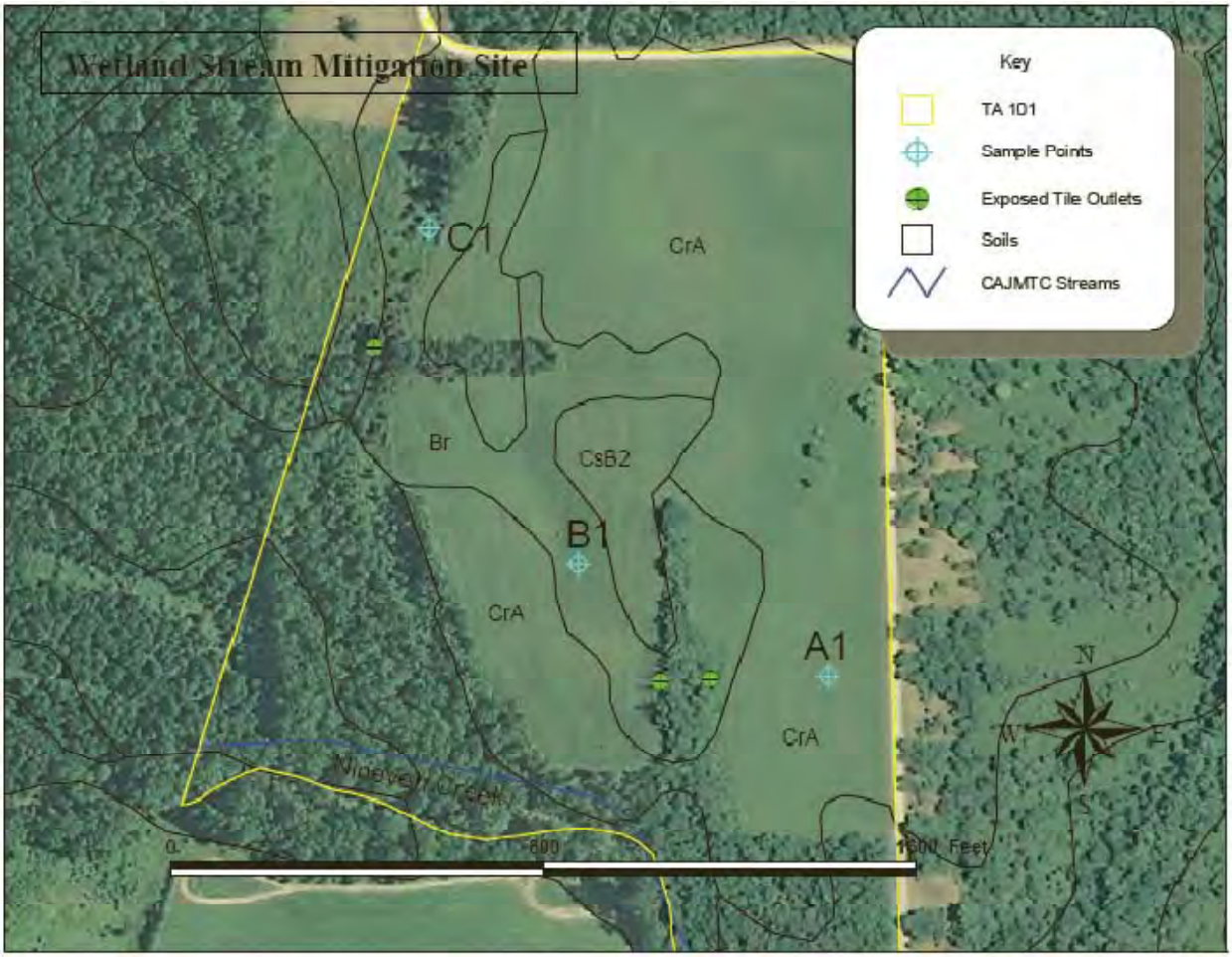


Figure 15. Training Area 101 Wetland Mitigation Area – Delineation Map.

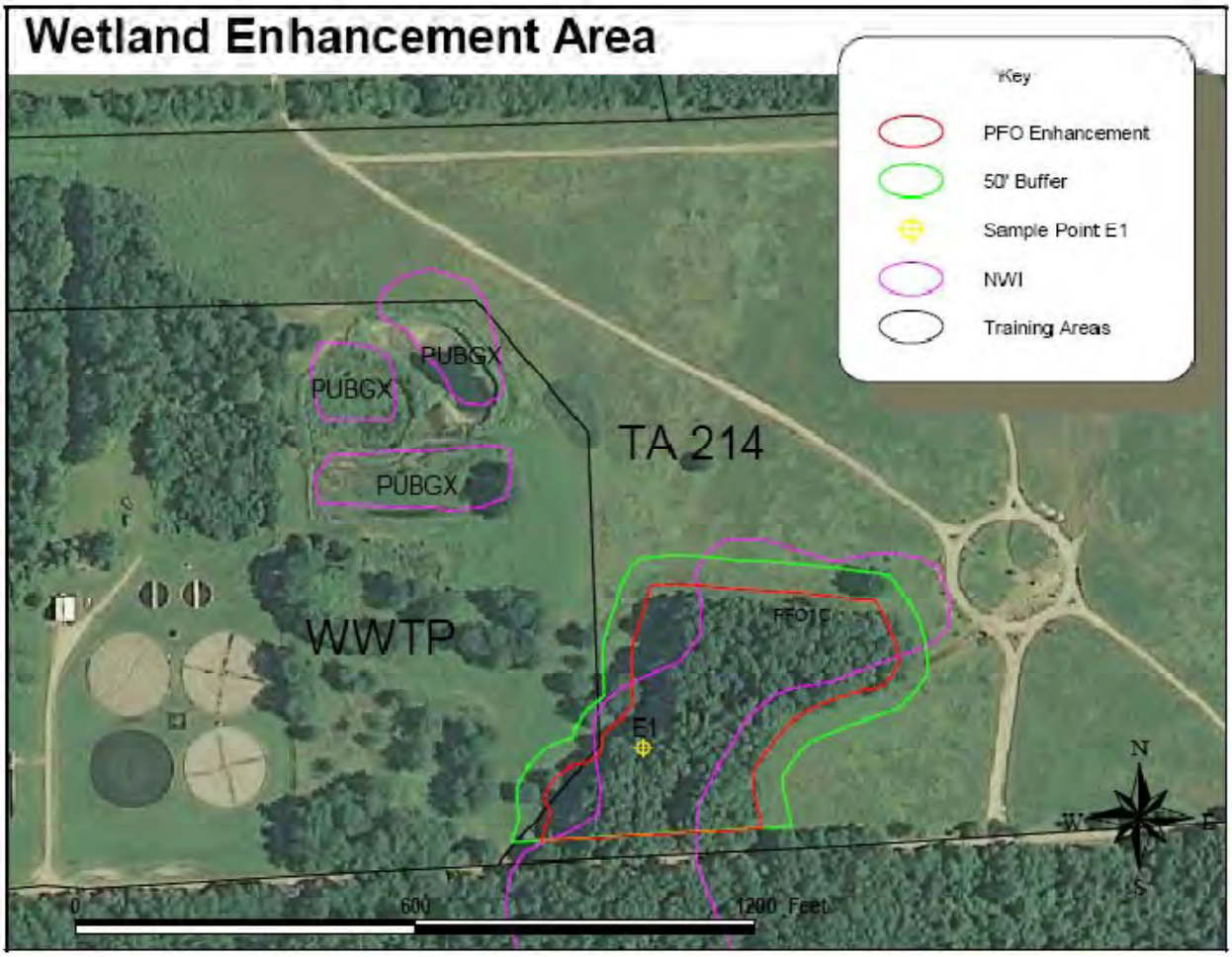
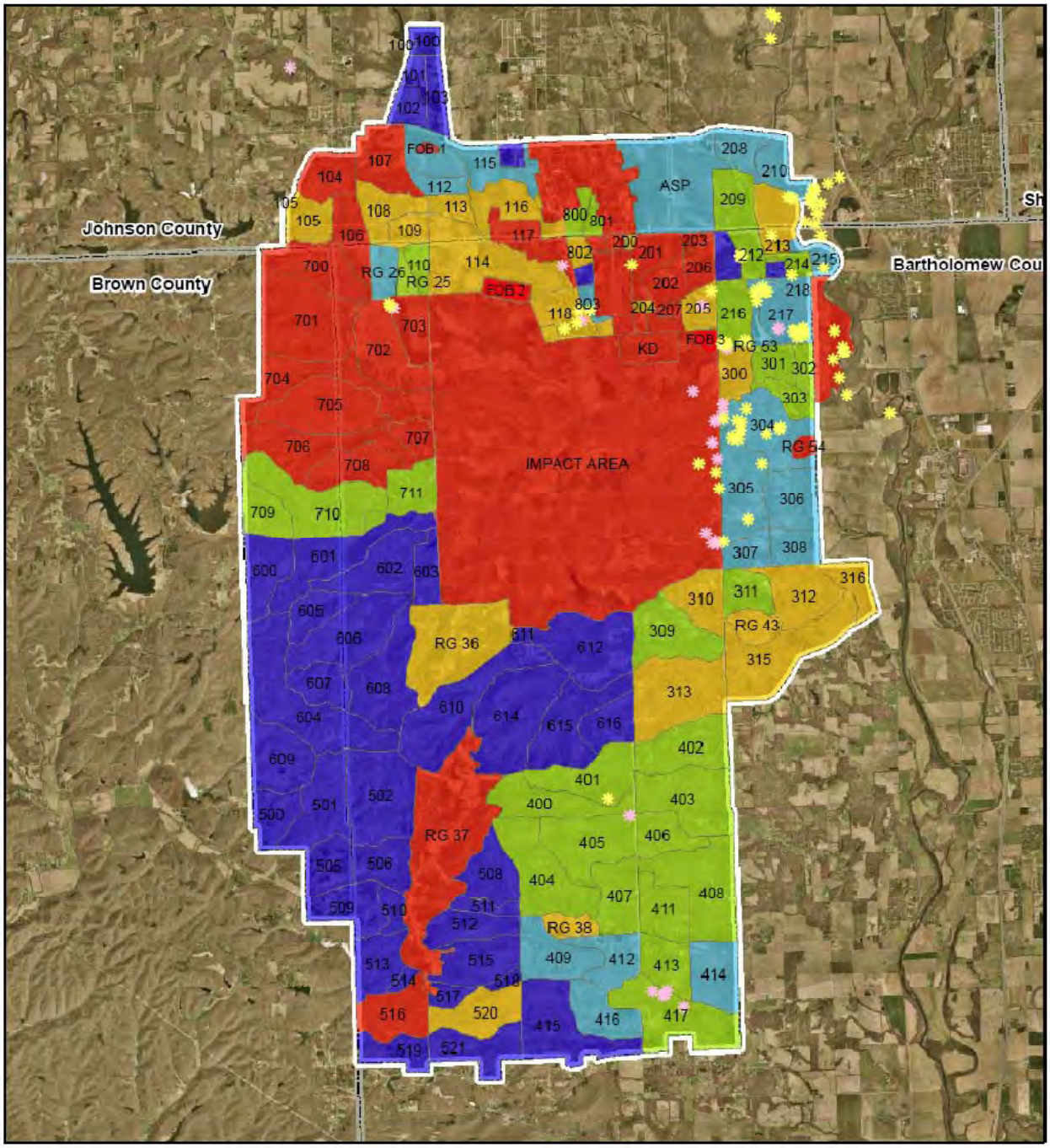


Figure 16. Training Area 214 Wetland Enhancement Area.


Johnson County
Brown County
Bartholomew Cou
IMPACT AREA
ASP
KD
FOB 1
FOB 2
FOB 3
RG 25
RG 26
RG 36
RG 37
RG 38
RG 43
RG 53
RG 54
Legend
CAJMTC Boundary
Indiana Bat Roost Trees
Standing
Down
# of Personnel Trained
0 - 1000
1001 - 2000
2001 - 4000
4001 - 10000
10001 - 100000
FIGURE B-1
PERSONNEL TRAINED BY LOCATION (2003 - 2009)
Biological Assessment for the Indiana Bat
Camp Atterbury Joint Manuever Training Center
Brown, Bartholomew and Johnson Counties, Indiana
"No warranty is made by the INNG/NGB as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the Enterprise GIS database."
Prepared for:
Prepared by:
amec
Columbus, Ohio
0 1 2
Miles
Source Data: USGS Nineveh, New Bellsville, Edinburgh,& Franklin Quadrangles
Projection: NAD 1983 UTM Zone 16N

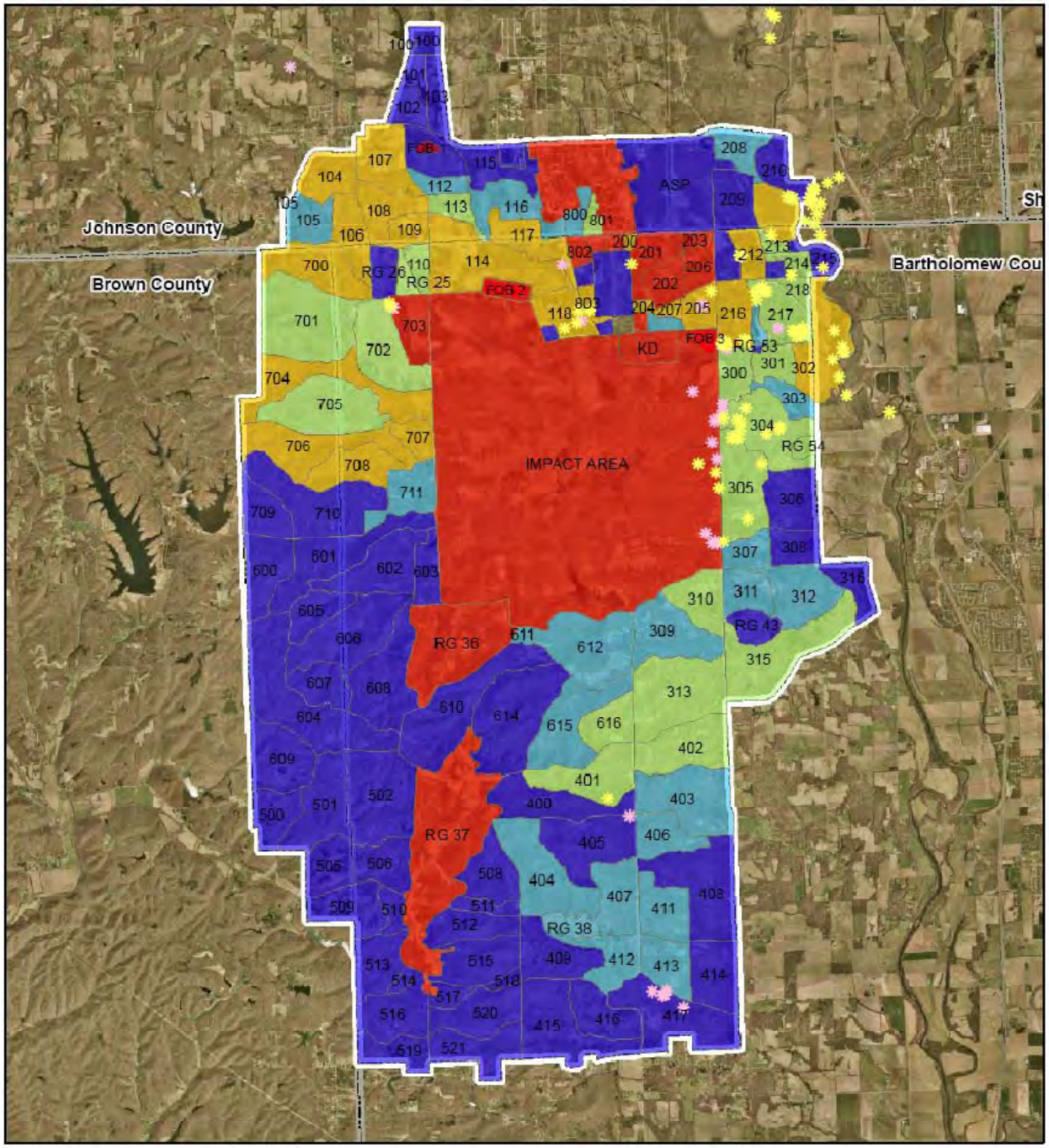


FIGURE B-2
TOTAL TRAINING HOURS BY LOCATION (2003 - 2009)

Biological Assessment for the Indiana Bat

Camp Atterbury Joint Manuever Training Center
Brown, Bartholomew and Johnson Counties, Indiana

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Prepared for:

Prepared by:
amec
Columbus, Ohio

0 1 2 Miles

Source Data: USGS Nineveh, New Bellsville, Edinburgh, & Franklin Quadrangles
Projection: NAD 1983 UTM Zone 16N

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