APPENDIX N: Indiana Bat Surveys

Tier 2 Environmental Impact Statement

I-69 Section 6

Martinsville to Indianapolis

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SUMMER HABITAT FOR THE INDIANA BAT (*MYOTIS SODALIS*) WITHIN THE MARTINSVILLE HILLS FROM MARTINSVILLE TO INDIANAPOLIS, INDIANA

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SUMMER HABITAT FOR THE INDIANA BAT (*MYOTIS SODALIS*) WITHIN THE MARTINSVILLE HILLS FROM MARTINSVILLE TO INDIANAPOLIS, INDIANA

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Abstract

During the summer of 2004, as part of the Tier II Environmental Impact Statement (EIS) for the proposed I-69 corridor from Evansville to Indianapolis, 29 sites within Section 6 were mist-netted to determine the presence/absence of the federally endangered Indiana bat (*Myotis sodalis*) and the state endangered evening bat (*Nycticeius humeralis*). A total of 253 bats representing seven species were captured. Indiana bats were captured at 8 of the 29 sites. Transmitters were attached to five Indiana bats, resulting in the location of four roosts. Most notable of the four roosts was a powerpole used as a maternity roost and a dead ash (*Fraxinus* sp.) located approximately 375 ft from the existing SR 37.

Key words: Indiana, Indiana bat, *Myotis sodalis*, evening bat, *Nycticeius humeralis*, Martinsville, Interstate 69, telemetry, maternity roosts

Destination

INTRODUCTION

The United States (U.S.) government protects endangered and threatened species under the Endangered Species Act of 1973 (ESA, 16 U.S.C.A. 1531-1543, P.L. 93-205. The primary goal of the ESA is to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved.

Pursuant to Section 7 of the ESA, the Indiana Department of Transportation (INDOT) has initiated consultation with applicable federal and state agencies to assist in meeting requirements of the ESA regarding the occurrence of endangered, threatened, and protected species along the proposed I-69 project alignment. This report is the result of said consultation.

The Indiana bat (*Myotis sodalis*) was added to the U.S. list of endangered and threatened wildlife and plants on March 11, 1967 due to drastic declines in the species' population. Critical habitat was designated September 4, 1966 which protected 11 caves and 2 mines in 6 states throughout the range of the Indiana bat. These caves and mines were located in the following states: Illinois – ; Indiana – , , Kentucky – ; Missouri – ; Tennessee – ; and West Virginia – . Despite conservation and management of critical habitat (hibernacula), Indiana bat populations have continued to decline (Clawson, 2001).

In support of the Tier II Environmental Impact Statement (EIS) for Section 6 of the proposed I-69 from Evansville to Indianapolis, Indiana, Ecological Specialties, LLC (ES) was contracted to conduct summer mist net surveys for the Indiana bat and evening bat (*Nycticeius humeralis*). ES conducted the aforementioned mist netting under Federal Endangered Species Permit No. TE-11301-0 and State of Indiana Division of Natural Resources Permit No. 3036.

PROJECT LOCATION

The aforementioned project corridor is located within the Tipton Till Plain section of the Central Till Plain Natural Region of Central Indiana, as well as the Brown County Hills section of the Highland Rim Natural Region (Figure 2). Located within the Central Lowland Physiographic Region, a level or slightly undulating plain crossed here and there by broad, low ridges, the Central Till Plain is the largest natural region in Indiana, extending south from the Wabash and Eel river drainages to the southern-most boundary of the Wisconsinan ice sheets. This section's deep, fertile glacial soils once supported vast beech, maple, oak, ash, and elm forests. However, these pre-settlement forests now only exist in remnants scattered through the region (Jackson, 1997).

The Highland Rim Natural Region extends north from the Ohio River to the approximate southern extent of the Wisconsinan glacial maximum. This region is predominantly forested, rugged, and biologically rich. As a major section of the Interior Low Plateaus Physiographic Region, the highland rim contains some of the most rugged terrain east of the Rockies. The Interior Low Plateau is a hilly area that was never glaciated by the ice sheets. Long subjected to erosion, it is an area of sharp ridges, deep gorges and scenic waterfalls. There are also numerous caves and sinkholes, which have been formed in places where water action has dissolved the underlying limestone of the plateau (Jackson, 1997).

NATURAL HISTORY

Summer Habitat

Summer habitat includes mature riparian and adjacent upland forests, preferably with a full canopy and open understory (MDC, 1999). Indiana bats roost and establish maternity colonies primarily beneath loose bark (exfoliating) of hickories (*Carya* spp.), oaks (*Quercus* spp.), elms (*Ulmus* spp.) and ash (*Fraxinus* spp.) trees, and may also utilize the cavities of living and dead/dying trees (MDC, 1999). The physical characteristics of trees dictate their suitability as roosts, including the presence of bark that separates from the main trunk of dead, dying, or injured trees. However, space between exfoliating bark and the bole of the tree appears to be the primary characteristic needed for bats to use a particular tree. Some tree species, such as shell and shagbark hickories, provide adequate bark characteristics in mature, living trees.

While it is generally accepted that Indiana bats use floodplain and riparian forests for their primary habitats during the summer, research has also indicated the importance of upland forest in the Indiana bat's natural history. Several studies have found that upland forests are important areas for roost locations (Clark et al., 1987; Gardner et al., 1991; Callahan et al., 1997, MacGregor, 2001).

Indiana bats tend to exhibit annual site fidelity, returning to the same roosting and hibernation sites, and often the exact maternity trees (MDC, 1999). Although maternity roosts are usually assumed to consist predominantly of females and young [or gravid females before parturition (giving birth)], males and reproductive females have also been documented within the same roosts (Hendricks, unpublished, 1991). Colonies ranging from single bats (mostly males) to more than 140 individuals have been found (Hendricks unpublished, 1991).

Considerable data are being collected regarding the use of alternate roosts by Indiana bats. Apparently, there is a tendency for colonies to use multiple roost trees; colonies have been documented using as many as 17 roost trees (USFWS, 1999a). These trees are described either as primary or alternative roosts, depending upon the proportion of time that the colonies spend at each roost. Most colonies have at least one primary roost, often as many as three. Populations often have multiple primary roosts, located as far apart as 1.8 miles (Callahan, 1993). The use and importance of alternative roosts is yet to be fully understood; however, the existence of alternative roosts suggests that not only are single trees important to the species, but that forested areas within several miles of roost trees may be integral to the species' success.

Apparently, alternative roosts are used during periods of precipitation or during other inclement weather conditions.

Parturition occurs in late June and early July (Easterla and Watkins, 1969; Humphrey et al., 1977). The young become volant (capable of flight) between mid-July and early August (Mumford and Cope, 1958; Cope et al., 1974; Humphrey et al., 1977; Clark et al., 1987; Gardner et al., 1991; Kurta et al., 1996).

The foraging areas of Indiana bats include tracts of floodplain forests and riparian areas up to approximately 524 acres (MDC, 1999). Foraging areas include areas in and around the tree canopy in floodplains, riparian forests, and upland forests. In riparian situations, Indiana bats forage around stream corridors and associated bottomland forests. Impounded bodies of water, streams, and their associated bottomland forests are considered preferred foraging areas for gravid and lactating female Indiana bats (USFWS, 1999a). Often, these bats fly up to 1.5 miles from upland roosts to forage in their preferred foraging areas (USFWS, 1999a).

In upland situations, Indiana bats forage among the canopies of upland forests, upland ponds and waterholes, and oftentimes along the borders of agricultural fields and pastures (USFWS, 1999a).

The range of a colony's foraging habitat from roost trees varies from 0.5 to 0.75 miles (Belwood, 1979; Cope et al., 1974; Humprey et al,. 1977; Cope et al., 1978). According to Gardner et. al. (1991), Indiana bats exhibit fidelity to their foraging areas, often returning nightly.

Based upon an initial investigation of the study area, much of the area contains summer habitat that is suitable for the Indiana bat. Those areas that might comprise suitable habitat include forested wetlands, upland oak/hickory forests, and open fields.

Winter Habitat

Mating occurs in the fall of each year at the hibernacula. According to the USFWS (1999a), males remain active at the hibernacula longer than the females. This may be to mate with females as they arrive. The females store sperm through the winter and become pregnant through delayed implantation after emerging in the spring. Young females can mate their first autumn.

Indiana bats hibernate in caves or mines with a relatively specific winter temperature range of 37 to 43 degrees Fahrenheit (°F). Relative humidity in preferred caves is usually above 74 percent, but below saturation (USFWS, 1999a). Both temperature and humidity appear to play important roles in successful hibernation of the Indiana bat.

Specific features and morphology of caves determine their suitability for use by Indiana bats by influencing the temperature and humidity microclimates. The importance of existing, known hibernacula, is evidenced by the unique conditions that create the temperature and humidity conditions favored by hibernating Indiana bats.

METHODS

Standard mist netting techniques were used during this study. The apparatus described by Gardner et al. (1989) is likely the best overall description of an effective mist net setup to date. Apparatus commonly used by ES closely follows that described by Gardner et al. (1989) and the USFWS Mist Netting Guidelines.

Mist netting locations were selected prior to the main field phase of the project, although there was flexibility for additional or alternate sites. Typical mist netting locations included road corridors, stream corridors, water holes/ponds/road ruts, and other areas as determined by the Principal Ecologist.

The USFWS Mist Netting Guidelines (Table 1) provided considerable guidance with respect to what qualifies as a minimum approach to mist netting. Two net sites, netted for two nights, are required for each square kilometer of habitat. It was determined, through consultation with the USFWS, that 29 net sites (Table 2, Figure 1) would provide adequate coverage for the Section 6 study area (Martinsville to Indianapolis).

Suitable netting locations were finalized by the Principal Ecologist immediately prior to commencement of netting activities for each separate survey area. William D. Hendricks, Principal Ecologist with ES was responsible for location of mist netting sites, adherence to protocol, and identification of captured bats. John Timpone, Project Biologist, supervised field crews and ensured data integrity.

Radio Telemetry

Telemetry for bats consists of specialized equipment. Very small transmitters are needed to avoid overloading myotine bats, which typically weigh approximately 6 grams. Current USFWS guidance dictates that transmitters for Indiana bats weigh less than 0.8 grams. Appropriately sized transmitters (approximately 0.6 grams) were obtained from Wildlife Materials, Inc. (Carbondale, Illinois). Hand-held yagi antennas and TRS-1000S receivers were used to locate transmitters (Wildlife Materials, Inc.). Skin Bond© non-toxic surgical adhesive was used to attach the transmitters to individual bats.

Radio transmitters were affixed to captured female and male Indiana bats using standard techniques; lightly trimming the fur on the dorsal surface of the body and adhering the transmitter to the bat with Skin Bond ® non-toxic surgical adhesive. The decision to affix transmitters to juvenile Indiana bats was dependent upon the perceived vigor of the individual and the discretion of the biologist.

AnaBat Technology

AnaBat Technology (Titley Electronics, Australia) was used to supplement the mist netting efforts. The AnaBat System equipment (AnaBat II Detector, ZCAIM – Zero Crossing Analysis Interface Module, and supporting software) is capable of converting ultrasonic echolocation calls of bats into audible signals which can be processed and used to aid in the determination of species. AnaBat data were collected at six sites: 3, 5, 6, 24, 27, and 29. These data are being provided to the USFWS for analysis.

RESULTS

During the period of July 12 through July 28, 2004, ES personnel mist netted a total of 29 locations distributed throughout the Section 6 study corridor. These sample sites are represented in Figure 1.

Roost trees were classified based upon the radio-tagged individual that was tracked to a roost. Thus, a maternity roost would be defined as a roost to which a radio-tagged lactating female Indiana bat was tracked. A male roost is defined as a roost to which a radio-tagged male was tracked. No adult males were radio-tagged during this study.

A total of five radio-transmitters were used during the study. Transmitter failures occurred on two occasions: once after already locating the roost of a lactating female and once immediately following the release of a radio-tagged female. One juvenile male was radio-tagged at Site 10. It was heard three nights later in the general vicinity of the capture site, but its location was never verified. The adult female radio-tagged at Site 19 was released and never heard from again. Considerable frequency shift was noticed on transmitters prior to release. It is possible that frequencies changed enough on these two transmitters after release to make recovery extremely difficult. A more detailed discussion of the radio-tagged bats and their associated roosts can be found below.

It should be noted that it is assumed that the bats emerging from each roost tree are all Indiana bats. Without actually catching each bat, it would be impossible to be certain. Although Indiana bats are known to roost with other species (Butchkoski and Hassinger, 2001), the approach of this study was to treat each roost as if it were inhabited solely by Indiana bats.

Mist Net Results

A total of 253 bats were captured representing seven species, including big brown bat (*Eptesicus fuscus*, n=67), red bat (*Lasiurus borealis*, n=25), little brown bat (*Myotis lucifigus*, n=72), northern long-eared bat (*Myotis septentrionalis*, n=21), Indiana bat (*Myotis sodalis*, n=10), evening bat (*Nycticeius humeralis*, n=28) and Eastern pipistrelle (*Pipistrellus subflavus*, n=30) (Table 3). Indiana bats were captured at 8 of the 29 sites; evening bats were captured at 4 of the 29 sites.

Maternity Roosts

The first female lactating Indiana bat was tagged on 14 July, 2004 at Site 7/Net 1 (Tag No. 203). This individual was tracked using radio telemetry to a maternity roost (Roost No. 203R1) approximately (Photo 1) (Table 4). The roost was a dead ash snag (*Fraxinus* sp.). An emergence count was conducted and a total of 64 bats emerged from the roost tree during the first count. Subsequent counts (five counts total) ranged from 23 to 67 bats emerging. As the bats emerged, they traveled southeast along the unnamed tributary located adjacent to the roost tree.

A post-lactating female Indiana bat captured July 17, 2004 at Site 14/Net 1 (Tag No. 105) was tracked to a second maternity roost located in a large power pole (Roost No. 105R1) approximately (Photo 2). Site 14 was located beneath . The initial emergence count yielded 90 bats exiting the pole. During the following four nights, the emergence count ranged from 98 to 109 bats. The radio-tagged bat roosted in an alternate roost (Roost No. 105R2, Photo 3), approximately .

Emergence counts for this alternate roost ranged from 1 to 29 bats exiting a shagbark hickory (*Carya ovata*) over three nights of observation. According to Hendricks (2001), this is the second time a maternity roost has been located in a power pole.

The fourth maternity roost (Roost No. 022R1) was located on July 15, 2004 after tracking a post-lactating female captured at Site 8/Net 1 (Tag No. 022). The roost was located in a dead elm (*Ulmus* sp.) within the (Photo 4). This roost was approximately . Evening counts ranged from 11 to 15 bats emerging from underneath exfoliating bark.

Bridge Survey Results

Eighteen bridges were inspected as part of this study (Table 5); however, bats were present under only two bridges. On July 24, 2004, eight big brown bats were observed under the bridge over , while only six were observed on July 25, 2004. Additionally, on July 21, 2004, a group ranging from 3 to 20 big brown bats occupied the bridge over .

DISCUSSION

As previously noted, the purpose of this study was to determine the presence/absence of the federally endangered Indiana bat and the state endangered evening bat within the proposed I-69 corridor from Evansville to Indianapolis; specifically, this study mist-netted 29 sites along the Section 6 corridor between Martinsville and Indianapolis, Indiana.

In addition to determining presence/absence of the aforementioned species, this study also evaluated the roosting habitat within the Section 6 study corridor, as well as the nighttime use of bridges as roosts.

During the course of this study, 10 Indiana bats and 28 evening bats were captured at the 29 mist net sites. Of the 10 Indiana bats captured, four reproductive females, five juveniles, and one non-reproductive male were identified. Additionally, based on the locations of the sites where Indiana bats were captured (Figure 2), it appears as though this species is utilizing suitable habitat throughout the project area.

Six of the captured evening bats were identified as males, while 17 were identified as females. Of this, all six males identified were juveniles; five of the females were juveniles; eight of the females were adult reproductive females, while four were non-reproductive females; and the sex and maturity of five of the captured evening bats is unknown. The mist net sites where evening bats were captured, although few, are concentrated in the central portion of the Section 6 study corridor (away from Indianapolis and Martinsville), indicating that this species may tend to avoid human disturbances.

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Jason Babcock-Stiner provided the graphics and N. Hendricks reviewed the manuscript and provided editorial support.

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“Figure 1. Mist net site locations” has been removed for confidentiality reasons related to the federally endangered Indiana bat.

“Figure 2. Indiana bat and evening bat locations” has been removed for confidentiality reasons related to the federally endangered Indiana bat.

“Figure 3. Roost site and originating mist net site locations” has been removed for confidentiality reasons related to the federally endangered Indiana bat.

Table 1. U.S. Fish and Wildlife Service Mist Netting Guidelines (1999)

1. Netting Season:
    a. May 15 to August 15, when Indiana bats occupy summer habitat
2. Equipment (Mist Nets):
    a. Constructed of the finest, lowest visibility mesh commercially available - monofilament or black nylon - with mesh size approximately 1.5 inches (38 mm)
3. Net Placement
    a. Mist nets extend approximately from water or ground level to tree canopy and are bounded by foliage on the sides. Net width and height are adjusted for the fullest coverage of the flight corridor at each site. A typical net set consists of three (or more) nets stacked on top of one another; width may vary up to 60 feet (20 m)
4. Net Site Spacing:
    a. Streams: one net site per 0.50 mile (1 km)
    b. Land tracts: two nets per 250 acres (1 square km)
5. Minimum Level of Effort per Net Site:
    a. Two net locations per site, with locations (sets) at least 100 feet (30 m) apart.
    b. Two calendar nights of netting
    c. At least three net nights; typically, two net sets are deployed at one site for two nights, resulting in four net nights.
    d. Sample period: begin at dusk and net for five hours (approximately 0200)
    e. Nets are monitored at approximately 20-minute intervals
    f. No disturbances near the nets between checks
6. Weather Conditions (Net only if the following weather conditions are met):
    a. No precipitation
    b. Temperature greater than or equal to 50 degress F (10 degrees C)
    c. No strong winds
7. Moonlight:
    a. Avoid net sets with direct exposure to a moon half-full or greater (typically by utlizing forest canopy cover

"Table 2. Summary of Bat Survey Locations for I-69 Evansville to Indianapolis – Section 6" has been removed for confidentiality reasons related to the federally endangered Indiana bat.

Table 3. Summary of Bat Survey Results for I-69 Evansville to Indianapolis - Section 6

Site Number	Survey Date (first night)	Survey Date (last night)	Number of Repro. Adult Female *M. sodalis*	Number of Non-repro. Adult Female & Adult Male *M. sodalis*	Number of Juvenile *M. sodalis*	Total Number of *M. sodalis*	Number of Radio-tagged *M. sodalis*	Radio-Tag ID	Total Number of Diurnal Roosts Identified	Roost ID	*M. lucifugus*	*M. septentrionalis*	*E. fuscus*	*P. subflavus*	*L. borealis*	*L. cinereus*	*N. humeralis*	*L. noctivagans*	Total Number of *Bats Captured*
1	15-Jul-04	16-Jul-04	--	--	--	0	--	--	--	--	--	--	--	--	--	--	--	--	0
2	15-Jul-04	15-Jul-04	--	--	--	0	--	--	--	--				1	2				3
3	12-Jul-04	14-Jul-04	--	--	--	0	--	--	--	--	5		4	1					10
4	15-Jul-04	16-Jul-04	--	--	--	0	--	--	--	--									0
5	12-Jul-04	12-Jul-04	--	1	--	1	--	--	--	--	5	1							7
6	26-Jul-04	28-Jul-04	--	--	--	0	--	--	--	--	1	6			1				8
7	12-Jul-04	14-Jul-04	1	--	--	1	1	203	1	203R1	7		1	2					11
8	15-Jul-04	16-Jul-04	1	--	--	1	1	022	1	022R1	1		1						3
9	26-Jul-04	27-Jul-04	--	--	--	0	--	--	--	--	8			13			1		22
10	12-Jul-04	14-Jul-04	--	--	1	1	1	185	--	--	3	1	3		1		3		12
11	24-Jul-04	25-Jul-04	--	--	--	0	--	--	--	--					3				3
12	17-Jul-04	18-Jul-04	--	--	--	0	--	--	--	--	1	3							4
13	12-Jul-04	14-Jul-04	--	--	--	0	--	--	--	--	1			1					2
14	17-Jul-04	18-Jul-04	1	--	1	2	1	105	2	105R1, 105R2	2	1	2	6	1				14
15	17-Jul-04	18-Jul-04	--	--	--	0	--		--	--	1	1	3	1			14		20
16	24-Jul-04	25-Jul-04	--	--	--	0	--		--	--									0
17	17-Jul-04	18-Jul-04	--	--	--	0	--	--	--	--									0
18	17-Jul-04	18-Jul-04	--	--	--	0	--	--	--	--	2		6	1	5				14
19	19-Jul-04	20-Jul-04	1	--	--	1	1	149	--	--		1	1						3
20	19-Jul-04	20-Jul-04	--	--	1	1	--	--	--	--	7	3	3	4	5				23
21	21-Jul-04	23-Jul-04	--	--	--	0	--	--	--	--	2	2	4		1				9
22	19-Jul-04	20-Jul-04	--	--	--	0	--	--	--	--	1		1						2
23	21-Jul-04	23-Jul-04	--	--	2	2	--	--	--	--	1		13		2		10		28
24	19-Jul-04	20-Jul-04	--	--	--	0	--	--	--	--	19	1	11	--	--	--	--	--	31
25	21-Jul-04	23-Jul-04	--	--	--	0	--	--	--	--		1			1				2
26	24-Jul-04	25-Jul-04	--	--	--	0	--	--	--	--			2		1				3
27	24-Jul-04	24-Jul-04	--	--	--	0	--	--	--	--	5		1						6
28	19-Jul-04	20-Jul-04	--	--	--	0	--	--	--	--			10		1				11
29	15-Jul-04	23-Jul-04	--	--	--	0	--	--	--	--			1		1				2
Section 6 Totals:			**4**	**1**	**5**	**10**	**5**	**--**	**4**	**--**	**72**	**21**	**67**	**30**	**25**	**0**	**28**	**0**	**253**

Table 4. Summary of Roost Survey Results for I-69 Evansville to Indianapolis - Section 6

Roost ID	Radio-Tag ID	Mist Net Site	Northing	Easting	Distance to I-69 Centerline (feet)	Roost Type	Emergence Count Summary[1]	Radio-Tag Date	Comments
203R1	203	7			844	Maternity	64	14-Jul-04	Located in dead ash
105R1	105	14			5,475	Maternity	90	17-Jul-04	Located in light pole
105R2	105	14			3,943	Alternate	11	17-Jul-04	Located in shagbark hickory
022R1	22	8			6,635	Maternity	12	15-Jul-04	Located in dead elm

1. Data from first night's emergence count

“Table 5. Summary of Bride Survey Locations for I-69 Evansville to Indianapolis – Section 6 has been removed for confidentiality reason related to thefederally endangered Indiana bat.

Table 6. Weather Summary for Indiana Bat Surveys for I-69 Evansville to Indianapolis - Section 6

Site	Date	Temperature (20:00 to 02:00)	
		Low (degress F)	High (degress F)
1	15-Jul-04	60.80	71.08
2	15-Jul-04	60.80	71.08
3	12-Jul-04	62.85	86.60
4	15-Jul-04	60.80	71.08
5	12-Jul-04	62.85	86.60
6	26-Jul-04	55.28	65.59
7	12-Jul-04	62.85	86.60
8	15-Jul-04	60.80	71.08
9	26-Jul-04	55.28	65.59
10	12-Jul-04	62.85	86.60
11	24-Jul-04	61.48	66.96
12	17-Jul-04	61.48	70.39
13	12-Jul-04	62.85	86.60
14	17-Jul-04	61.48	70.39
15	17-Jul-04	61.48	70.39
16	24-Jul-04	61.48	66.96
17	17-Jul-04	61.48	70.39
18	17-Jul-04	61.48	70.39
19	19-Jul-04	64.22	73.15
20	19-Jul-04	64.22	73.15
21	21-Jul-04	64.91	80.12
22	19-Jul-04	64.22	73.15
23	21-Jul-04	64.91	80.12
24	19-Jul-04	64.22	73.15
25	21-Jul-04	64.91	80.12
26	24-Jul-04	61.48	66.96
27	24-Jul-04	61.48	66.96
28	19-Jul-04	64.22	73.15
29	15-Jul-04	60.80	71.08

Photo 1. Maternity Roost No. 203R1.

Photo 2. Maternity Roost No. 105R1.

Photo 3. Alternate Roost No. 105R2

Photo 4. Maternity Roost No. 022R1

Field Data Sheets have been removed for confidentiality reason related to the federally endangered Indiana bat.

Identification of Indiana Bat Roost Trees Along the Proposed Interstate 69 Between Bloomington and Indianapolis, Indiana

April 5, 2006

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IDENTIFICATION OF INDIANA BAT ROOST TREES ALONG THE PROPOSED INTERSTATE 69 BETWEEN BLOOMINGTON AND INDIANAPOLIS, INDIANA

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Abstract

BHE Environmental, Inc. (BHE) investigated roost trees used by four reproductive female Indiana bats during the summer 2005 maternity season along the proposed Interstate Highway 69 between Bloomington and Indianapolis in Morgan and Johnson counties, Indiana. Mist nets were used at ten sites to trap bats. Captures included four reproductive adult female Indiana bats from four sites. Radio transmitters were attached to each of the four bats, which were each tracked to diurnal roost trees. Between two and four roost trees were identified for each individual. Emergence counts were conducted at roost trees to determine the number of bats present, and to estimate the size of maternity colonies. Two of the ten roost trees identified were occupied by greater than 30 individuals on several occasions. Eight were occupied by fewer than 30 individuals during each of the emergence counts. Based upon distances between groups of roost trees, we concluded maternity colonies are present near Bryant Creek, Clear Creek, and Pleasant Run Creek. None of the roost trees identified in 2005 is located within the proposed I-69 corridor. However, the roosting and foraging areas that may be used by the three maternity colonies include the proposed road corridor.

Key words: Indiana bat, *Myotis sodalis*, radio telemetry, mist net, maternity roost

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Introduction

The Indiana Department of Transportation (INDOT) and the Federal Highway Administration (FHWA) are completing six Tier 2 Environmental Impact Statements for the proposed Interstate Highway 69 (I-69) from Indianapolis to Evansville, Indiana. A detailed description of the proposed road corridor was presented in the Tier 1 Final Environmental Impact Statement (Tier 1 FEIS; FHWA and INDOT 2003a). The study described herein is part of the Tier 2 Environmental Impact Statement (EIS) for the proposed I-69 project. The proposed I-69 interstate is approximately 142 miles (228.5 kilometers [km]) in length and is divided into six sections to facilitate Tier 2 EIS studies. Investigations described herein address Section 5 between Bloomington and Martinsville, and Section 6 between Martinsville and Indianapolis. Studies were conducted in Morgan, Johnson, and Marion counties along Corridor 3C, which was identified as the preferred alternative in the Tier 1 FEIS (FHWA and INDOT 2003a).

The FHWA and the U.S. Fish and Wildlife Service (USFWS) are conducting ongoing consultation under Section 7 of the Endangered Species Act to evaluate potential impacts of the proposed action. Methods used in these investigations were developed in consultation with the USFWS, Bloomington Field Office.

The purpose of this study was to identify maternity roost trees used by Indiana bats in Sections 5 and 6. Each Indiana bat maternity colony typically has at least one roost ("primary") that is used by a majority of the bats during most of the summer (Callahan et al. 1997, USFWS 1999). An Indiana bat maternity colony also inhabits other roosts ("alternate"), which typically are used intermittently and by fewer bats (USFWS 1999, Kurta et al. 2002, Kurta and Williams 1992).

Callahan (1993) described primary and alternate maternity roost trees. Primary roost trees in Missouri were characterized as large dead trees that are exposed to direct sunlight, and occupied by greater than 30 bats on more than one occasion. Alternate roosts in Missouri were either dead or live trees usually occupied by fewer than 30 individuals. Alternate roost trees in Missouri were similar to primary roost trees, except that many were located in the forest interior and were shaded by tree canopy (Callahan 1993). The terms primary and alternate roost tree, as defined by Callahan (1993) are used herein to maintain consistency with terminology established by the USFWS Bloomington Field Office for this study. However, those terms must be used with caution. While 30 individuals may be an appropriate threshold for distinguishing primary and alternate roosts among trees studied by Callahan, other maternity colonies may vary in size. Long-term studies of two Indiana bat maternity colonies in Michigan indicated fewer than 30 Indiana bats typically occupy a single tree during one night (Kurta et al. 2002). In Tennessee, three trees identified as primary Indiana bat roosts contained a maximum of 28, 23, and 81 bats (Britzke et al. 2003). Additionally, the number of bats using a certain tree may vary among years. In Michigan, of 38 Indiana bat roost trees identified during a four-year study, only six trees were occupied by bats for more than one year (Kurta et al. 2002).

During surveys in July 2004, five reproductive female and five juvenile Indiana bats were captured in Sections 5 and 6 (Henry et al. 2004, Hendricks et al. 2004). Using radio telemetry, several of the Indiana bats captured were followed to roost trees. Two roost trees were identified in Section 5, and four were identified in Section 6 (Henry et al. 2004, Hendricks et al. 2004). However, except for three roost trees in Section 6, none of the roost trees identified in 2004 was occupied by more than 15 bats on nights when emergence counts were conducted. Primary maternity roosts likely exist near sites where reproductive female and juvenile Indiana bats were captured in 2004, but primary roost trees could not be identified for all capture areas in 2004. The purpose of this study conducted in 2005 was to return to Bryant Creek in Section 5, and Clear Creek and Pleasant Run Creek in Section 6 to capture and track Indiana bats to primary maternity roost trees. Documenting the location of primary maternity roosts and the number of bats using those roosts supports the evaluation of potential effects to Indiana bats from the proposed I-69.

Secondarily, results of this study will provide data regarding the evening bat (*Nycticeius humeralis*), which is not listed by the USFWS, but is designated by the State of Indiana as endangered.

Materials and Methods

Sections 5 and 6 cover approximately 48 miles (77 km) of the proposed I-69 in Indiana. The proposed road alignment will be within a corridor extending 1000 feet (305 meters [m]) on each side of the Corridor 3C centerline (total width of 2000

feet [610 m]). The 2000-foot wide corridor represents the area in which a preferred alignment would be located. The actual width of the alternative is expected to range from 240 to 470 feet. In some instances, interchanges and connector roads may extend outside the corridor. The Corridor 3C Indiana Bat Study Area is defined by a 5-mile (8-km) wide corridor, 2.5 miles (4 km) wide along either side of the corridor centerline. The 2.5-mile (4 km) distance approximates the maximum distance an Indiana bat travels from its daytime roost to its foraging area (1.5 miles in Gardner et al. 1991; 2.8 miles in Butchkoski and Hassinger 2002). The Tier 1 Biological Assessment established the 5-mile (8 km) wide Study Area and identifies it as the "Indiana bat summer action area" (FHWA and INDOT 2003b). This survey was conducted in the same Study Area as investigations conducted during summer 2004 (Henry et al. 2004, Hendricks et al. 2004).

Access permission was sought and provided by landowners prior to implementation of the mist net survey, radio telemetry study, and roost tree identification described below.

Mist Net Survey

The goal of the 2005 mist net survey was to capture reproductive female or juvenile Indiana bats suitable for radio telemetry. Mist netting was conducted near Bryant Creek (Section 5), Clear Creek (Section 6) and Pleasant Run Creek (Section 6), where Indiana bats were captured but not tracked to primary roost trees in 2004 (Appendix A, Figures 1–3). Mist net sites were also established at the White River, Travis Creek, Honey Creek, and Goose Creek.

Ten mist net sites were surveyed between July 12 and July 19, 2005 (Appendix A, Figures 1–3, Appendix B, Table 1). The ten net sites were selected in consultation with FHWA, INDOT, and the USFWS, Bloomington Field Office (BFO). All ten net sites were located within the Indiana bat summer action area. Mist net sites were between approximately 200 and 11,000 feet (61 and 3,353 meters) from the corridor centerline, with four of the ten net sites within the proposed corridor (Appendix A, Figures 1–3; Appendix B, Table 1). Mist net sites are identified herein using site numbers assigned in 2004 (Henry et al. 2004, Hendricks et al. 2004), preceded by the section number, i.e., Site 22 in Section 6 is Site 6-22.

Mist nets were deployed at one upland and nine stream sites. Detailed descriptions of mist net sites are provided in Appendix C and in previous reports (Henry et al. 2004, Hendricks et al. 2004).

Two mist nets were deployed at each net site for two nights, or until two Indiana bats suitable for radio telemetry were captured. The survey was conducted in accordance with Indiana Bat Recovery Team guidance regarding the seasonal timing of surveys, equipment, net placement, and acceptable weather conditions (USFWS 1999). One mist net was composed of 2–4 nets stacked vertically and suspended by a system of poles, ropes, and pulleys (Gardner et al. 1989). Nets were constructed of two-ply, 50-denier nylon with a mesh size no larger than 1.75 inches (4.4 cm). Mist nets were 18–42 feet (5.6–13.8 m) wide and 20–30 feet (6.6–9.9 m) tall. When possible, nets were bounded by vegetation above and on both sides to facilitate capturing bats. Mist nets were monitored at least every 20 minutes. Disturbance near nets between checks was minimized.

Upon capture, bats were removed from mist nets, identified to species, measured, and

released unharmed at the capture site. Data recorded for each bat captured included species, age, gender, reproductive condition, right forearm length (RFA), and body weight. Bats were identified to species based upon distinctive morphological characteristics (e.g., body size, hair color, ear length, tragus length and shape, presence/absence of a keeled calcar). Adult female bats were classified as reproductive if they were pregnant (determined by palpation of abdomen), lactating (i.e., teats conspicuous and enlarged, lack of hair around teats), or post-lactating (visible regrowth of hair around teats). Male bats with testicles descended into the scrotum were considered reproductive. Young-of-the-year of both sexes were classified as juveniles. Young-of-the-year were distinguished from adults by examining ossification (bone growth) in phalangeal joints.

Weather conditions were documented hourly during the mist net survey; air temperature, wind speed, cloud cover, precipitation, and visibility of the moon were recorded. A standard thermometer was used to record temperature. Wind speed, percent cloud cover, and moon phase were estimated (Appendix C). Each net site was photographed and the location recorded using a hand-held Global Positioning System (GPS) receiver (Garmin International, Inc., Olathe, Kansas).

Each captured Indiana bat was photographed, specifically the face, the whole body, and the calcar (Appendix D).

Radiotelemetry

The primary goal of radiotelemetry was to identify Indiana bat maternity colonies and their primary and alternate roost trees.

Upon capture, a 0.25-ounce (0.7-gram) radio transmitter (Wildlife Materials, Inc., Carbondale, Illinois) was attached to the mid–scapular fur of each bat using non-toxic surgical cement. A TRX-2000 radio receiver (Wildlife Materials, Carbondale, Illinois) was used to ensure each transmitter was functioning properly before the transmitter was attached. Transmitter-equipped bats were released unharmed from the point of capture (Appendix C).

Attempts were made to locate radio signals from transmitters on day-roosting Indiana bats for ten days following release of each bat. Radiotracking generally was conducted between approximately 1000 h and 1600 h each day. Searches for radio signals were conducted most intensively within the 2000-foot (609-meter) wide proposed corridor, but occurred throughout the Indiana bat Study Area (summer action area) in Sections 5 and 6.

Roost Tree Characterization and Emergence Counts

Upon identification of a transmitter-equipped Indiana bat roosting in a tree, characteristics of the tree were recorded and the tree was observed to monitor emergence of bats.

We recorded the tree species (if recognizable), status (live or dead), estimated diameter-at-breast-height (dbh), area type (riparian/upland), distance from roost tree to capture site, percent of the tree exhibiting exfoliating bark, and the stage of tree decay (USFS 1979) (Appendix C). To characterize habitat surrounding the roost tree, dominant and co-dominant tree species; estimated canopy closure, average dbh of canopy trees, and topographic slope; estimated distance to nearest water source; estimated distance to nearest flight corridor (i.e., space beneath the tree canopy that

offers protected foraging and travel space for bats); and estimated height from ground to roost were recorded (Appendix C). A GPS receiver was used to record the tree location, and each roost tree was photographed (Appendix D). The location of each roost tree was identified with plastic flagging; care was taken to avoid marking the roost tree to avoid attracting passersby that may disturb roosting bats.

Emergence counts were conducted at each roost tree. The counts commenced at dusk and emerging bats were counted for at least one hour per night. An ultrasound detector (QMC Instruments, Ltd., London, UK) was used to assist in detection of bats at some roost tree sites. Emergence counts were conducted for at least five nights at trees where 15 or more bats were detected emerging during any one of the first three nights of monitoring. Emergence counts were conducted for at least three nights at trees containing fewer than 15 bats.

Documenting Colony Size

An Indiana bat maternity colony may use several roosts up to approximately 5 miles (8 km) apart (Kurta et al. 2002). Alternate roosts have been reported as far as 2 miles (3.2 km) from the primary roost tree. During a 4-year study in Michigan, the greatest distance between roost trees was 5.7 miles (9.2 km) (Kurta et al. 2002). Roost trees greater than 6 miles (9.6 km) apart are likely used by different colonies. To collect data on the population of Indiana bats in maternity colonies, BHE simultaneously monitored emergence from all roost trees believed to be associated with a colony.

Simultaneous counts of bats emerging from roost trees identified in a colony were conducted for at least two nights. Four roost trees in Section 5 were monitored on July 26 and 27. Two roost trees in Section 6 near Pleasant Run Creek were monitored on July 25, 26, and 27. Four other roost trees in Section 6 near Clear Creek were monitored on July 27 and 28. Methods for the emergence count were identical to those previously described.

Data from emergence counts must be interpreted carefully. Because emergence counts document the number of bats emerging, only adults and newly-volant juveniles would be included in the count. Non-volant juveniles, which could comprise up to half the individuals in a maternity colony, would not be observed during an emergence count.

Results of simultaneous emergence counts will be interpreted using a formula developed by the USFWS, Bloomington Field Office to estimate the size of an Indiana bat maternity colony. Developing such estimates is outside the scope of this report.

Results

Mist Net Survey

Between July 12 and 19, 2005, ten net sites were surveyed using mist nets (Appendix A, Figures 1–3). Eighty-five bats representing eight species were captured, including four reproductive adult female Indiana bats and 15 evening bats (Appendix B, Table 2). The little brown bat (*Myotis lucifugus*) was the species most commonly encountered, making up 38 percent of the total capture. Other species captured included the northern long-eared bat (*M. septentrionalis*), big brown bat (*Eptesicus fuscus*), eastern pipistrelle (*Pipistrellus subflavus*), red bat (*Lasiurus borealis*), and hoary bat (*L. cinereus*).

Captures at four sites included a reproductive female Indiana bat (Appendix A, Figures 1–3; Appendix B, Table 3).

Lactating adult female Indiana bats were captured at Net Sites 5-22, 6-8, and 6-23. A post-lactating adult female Indiana bat was captured at Net Site 6-7. All four Indiana bats were equipped with radio transmitters.

Fourteen evening bats (six adult males, four reproductive females and four juveniles) were captured at Net Site 6-23 over Pleasant Run Creek. One juvenile evening bat was captured at Net Site 6-10 over an unnamed tributary to the White River.

Radiotelemetry and Roost Tree Identification

In the following discussion, and in Appendix A, Figures 1–3, Indiana bats are identified by the frequency of the radio transmitter attached to each bat (Appendix B, Table 3).

Lactating female Indiana bat No. 150.046 was released near Net Site 6-8 on July 12 at 0235 h (Appendix A, Figure 2). The radio signal was detected to the northeast of the net site until 0320 h. On July 13, the bat was tracked to Roost Tree 6-1, approximately 5085 feet (1550 m) east of Net Site 6-8. The bat was observed in the roost tree beneath a crack in the bark. Bat No. 150.046 was not detected near Net Site 6-8 during the night of July 13. On July 14, Bat No. 150.046 was detected southeast of Telemetry Station 6S-13, toward Roost Tree 6-1, at 1110 h. However, the bat was not present in Roost Tree 6-1 during the emergence count the evening of July 14. On July 15, the radio signal was detected in Roost Tree 6-2, approximately 5100 feet (1554 m) northwest of Roost Tree 6-1 and 2700 feet (823 m) from Mist Net Site 6-8. Between July 17 and 21, telemetry was conducted from several stations around Clear Creek (Appendix C) but the signal was not detected. The transmitter may have failed or fallen off the bat due to heavy rains that occurred the night of July 16. After July 21, while tracking Bat No. 150.025 near Clear Creek, BHE occasionally attempted to detect Bat No. 150.046, but the radio signal was not detected.

Lactating female Indiana bat No. 150.025 was released near Net Site 6-7 on July 17 at 2245 h (Appendix A, Figure 2). The radio signal was detected southwest and southeast of the mist net site, and crossing over State Route 37 several times until 0055 h. On July 18, the bat was tracked to Roost Tree 6-3, approximately 6360 feet (1938 m) north of Net Site 6-7. The bat was detected emerging from Roost Tree 6-3 at dusk on July 18. On July 19 and 20, Bat No. 150.025 was detected in Roost Tree 6-3 during the day and later during the evening emergence count. However, the radio signal remained located at Roost Tree 6-3 after dusk on July 20. Bearings to the signal were recorded from several locations throughout the night of July 20, with the signal apparently remaining in Roost Tree 6-3. On July 21, 22, and 23 the signal was detected from Roost Tree 6-3 and we suspected the transmitter had fallen off the bat into the tree. However, on July 25, Bat No. 150.025 was tracked to the bank of the White River opposite Roost Tree 6-3, indicating the radio-equipped bat had moved. No roost tree was located on July 25. On July 27 and 28 the radio signal was detected in Roost Tree 6-3. During the evening of July 28, the radio signal was detected near, but not in, Roost Tree 6-3. On July 29, Bat No. 150.025 was tracked to Roost Tree 6-4, approximately 85 feet (26 m) from Roost Tree 6-3 and 6470 feet (1972 m) from Mist Net Site 6-7. During the evening of July 29, the radio signal faded during telemetry monitoring, and the signal was not detected during monitoring attempts around Clear Creek conducted on July 30 or 31. No telemetry was conducted after July 31.

Lactating female Indiana bat No. 151.046 was released near Net Site 5-22 on July 17 at 0220 h (Appendix A, Figure 1). The radio signal was detected to the west of the net site until 0404 h. On July 18, the bat was tracked to Roost Tree 5-1, approximately 3300 feet (1005 m) from Net Site 5-22. During the evening of July 18, the radio signal was detected at Roost Tree 5-1, and the signal faded, suggesting the bat emerged from the tree. The radio signal was detected in Roost Tree 5-1 during the day and evening of July 19. On July 20, Bat No. 151.046 was detected in Roost Tree 5-1 at 1330 h. During the night of July 20, the radio signal was detected northeast of Telemetry Station 5-2, toward the White River, where the bat was likely foraging. On July 21, the bat was tracked to Roost Tree 5-2, approximately 2700 feet (823 m) west of Net Site 5-22 and 1540 feet (469 m) south of Roost Tree 5-1. The radio signal was detected from Roost Tree 5-2 during the evening of July 21, then the signal faded, suggesting emergence from the tree. On July 22, Bat No. 151.046 was tracked to Roost Tree 5-3, approximately 4500 feet (1372 m) west of Net Site 5-22 and 1820 feet (555 m) west of Roost Tree 5-2. On July 23, the signal was tracked to Roost Tree 5-4, approximately 3750 feet (1143 m) west of Net Site 5-22 and 1130 feet (344 m) southeast of Roost Tree 5-3. No telemetry was attempted on that signal between July 24 and 26. Between July 27 and 31, telemetry monitoring was attempted daily from several stations around Bryant Creek (Appendix C), but the signal from 151.046 was not detected. No telemetry was attempted after July 31.

Lactating female Indiana bat No. 150.068 was released near Net Site 6-23 on July 19 at 2200 h (Appendix A, Figure 3). The radio signal was detected southeast of the net site until 2335 h. The signal was not detected again that night during attempts made between 2336 h and 0129 h. On July 20 at 1651 h, the bat was tracked to Roost Tree 6-5, approximately 1300 feet (396 m) northwest of Net Site 6-23. The radio signal was not detected at Roost Tree 6-5 during emergence counts the evening of July 20, suggesting the bat may have moved to another roost during the day. The radio signal was tracked to Roost Tree 6-5 on July 21 at 1130 h, but again was not detected in that tree during the emergence count. On July 22, the radio signal was detected from Telemetry Station 6N-7 toward the northwest, i.e., toward Roost Tree 6-5, but high water from heavy rains the previous night prevented tracking the bat to a tree. On July 23, Bat No. 150.068 was detected in Roost Tree 6-6 approximately 1230 feet (375 m) north of Net Site 6-23 and 700 feet (213 m) east of Roost Tree 6-5. However, the radio signal was not detected in Roost Tree 6-6 during the emergence count the evening of July 23. This radio signal was not monitored during daytime between July 24 and 26. The radio signal was not detected in Roost Trees 6-5 or 6-6 during emergence counts conducted on July 25. The radio signal from Bat No. 150.068 was detected in Roost Tree 6-6 on July 27 and July 28. Between July 29 and 31, monitoring was attempted from stations around Pleasant Run Creek (Appendix C), but the radio signal was not detected.

Roost Tree Characterization and Emergence Counts

Roost Tree 5-1 is a dead American elm (*Ulmus americana*) located in a wooded riparian strip adjacent to the White River approximately 3,300 feet (1,005 m) from Net Site 5-22 (Appendix A, Figure 1; Appendix B, Table 4). The tree is approximately south of the White River, which provides the nearest

water source and the nearest apparent flight corridor. It is approximately west of the center line of the proposed I-69 corridor.

Roost Tree 5-1 has a dbh of 9.8 in (25 cm). Most bark is intact, and about 5 percent of bark is exfoliating. The tree is at the edge of the woodlot, and there is no canopy vegetation covering the tree. During emergence counts, bats were observed emerging from under a section of loose bark approximately 15 feet (4.5 m) above the ground. The radio signal from Bat No. 151.046 was detected in Roost Tree 5-1 between July 18 and July 20. Emergence counts at Roost Tree 5-1 were conducted for five evenings between July 18 and 27 (Appendix B, Table 5). Between 1 and 3 individuals were observed emerging during three of the counts, and no bats were observed on two occasions.

Roost Tree 5-2 is a live silver maple (*Acer saccharinum*) located in a woodlot bordering the White River approximately 2,700 feet (832 m) west of Net Site 5-22 (Appendix A, Figure 1; Appendix B, Table 4). Canopy closure over the tree is approximately 30 percent. The tree is approximately south of the White River, which provides the nearest water source and the nearest apparent flight corridor. It is approximately 1.9 miles (3.1 km) west of the proposed I-69 center line.

Roost Tree 5-2 has a dbh of 18 in (45 cm) and has no exfoliating bark. Bats were observed emerging from the top of the tree approximately 40 feet (12 m) above the ground. The presence of a crevice or loose bark in the top of the tree is assumed, but could not be clearly distinguished from the ground. The radio signal from Bat No. 151.046 was detected in Roost Tree 5-2 on July 21. Emergence counts were conducted at Roost Tree 5-2 for five evenings between July 21 and 27 (Appendix B, Table 5). Between one and four individuals emerged from the tree on each of the five nights.

Roost Tree 5-3 is a dead tree that could not be identified to species. The tree is broken at the trunk and the tree top has fallen away. Bat No. 151.046 was tracked to the tree. Roost Tree 5-3 is located in the same wooded area as roost trees 5-1, 5-2, and 5-4. The tree is approximately 4,500 feet (1,371 m) west of Net Site 5-22, where Bat No. 151.046 was released (Appendix A, Figure 1; Appendix B, Table 4). The tree is approximately south of the White River, which provides the nearest water source and the nearest apparent flight corridor. It is approximately 2.2 miles (3.6 km) from the proposed I-69 center line.

Roost Tree 5-3 has a dbh of 14 in (35 cm). The bark is intact, with no loose or exfoliating patches. Bats were observed emerging from the broken top of the tree 23 feet (7 m) above the ground. Canopy closure over the tree is approximately 75 percent. The radio signal from Bat No. 151.046 was detected in Roost Tree 5-3 on July 22. Emergence counts at Roost Tree 5-3 were conducted for three evenings between July 22 and 27 (Appendix B, Table 5). Between three and 13 individuals were observed emerging from the tree on each of the three nights.

Roost Tree 5-4 is a dead tree that could not be identified to species. Bat No. 151.046 was tracked to the tree. It is located in the same wooded area as roost trees 5-1, 5-2, and 5-3. The tree is approximately 3,750 feet (1,143 m) from Net Site 5-22 (Appendix A, Figure 1; Appendix B, Table 4). The tree is about from the nearest water source (tributary to the White River) and 10 feet (3 m) from the nearest apparent

flight corridor. It is about 2000 feet (610 m) south of the White River, and approximately west of the centerline of the proposed corridor.

Roost Tree 5-4 has a dbh of 25.5 in (65 cm), and 50 percent exfoliating bark. Bats were observed emerging from under loose bark above a fork in the trunk approximately 33 feet (10 m) above the ground. Canopy closure above the tree is approximately 75 percent. The radio signal from Bat No. 151.046 was detected in Roost Tree 5-4 on July 23. Emergence counts at Roost Tree 5-4 were conducted for five evenings between July 23 and 29 (Appendix B, Table 5). Six individuals were observed emerging on July 23. The number of emerging bats increased each subsequent night and a maximum of 128 bats was observed leaving the tree on July 29.

Roost Tree 6-1 is a dead silver maple located in a riparian area approximately 5,085 feet (1,550 m) east of Net Site 6-8 (Appendix A, Figure 2; Appendix B, Table 4). The tree is in a woodlot adjacent to the White River, approximately 164 feet (50 m) southwest of the river, and approximately 32 feet (10 m) from the nearest apparent flight corridor. The tree is approximately northwest of the centerline of the proposed corridor.

Roost Tree 6-1 has a dbh of 16.5 in (42 cm). Much of the bark is gone; the remaining ten percent is loose. Canopy closure over the tree is approximately ten percent. Bat No. 150.046 was observed roosting near the bottom of a crack in the bark that begins approximately 15 feet (4.5 m) above the ground and extends to the top of the tree. Bat No. 150.046 was detected roosting in Roost Tree 6-1 on July 13 but was not detected there on the other nine days the radio signal was tracked. Roost Tree 6-1 was monitored for five evenings between July 13 and 28 (Appendix B, Table 5). Between 1 and 2 individuals were observed emerging on four nights, and no bats emerged on one night.

Roost Tree 6-2 is a dead American elm to which Bat No. 150.046 was tracked. It is located in a fence line approximately 2730 feet (832 m) north of Net Site 6-8 (Appendix A, Figure 2; Appendix B, Table 4). This tree was identified during 2004 Tier 2 studies as an Indiana bat roost tree. The tree is approximately southwest of the White River, which provides the nearest water source and the nearest apparent flight corridor. It is approximately west of the proposed centerline of the proposed corridor.

Roost tree 6-2 is 8.6 in (22 cm) in diameter. About 60 percent of the bark is gone, and the remaining 40 percent is loose. Bats were observed emerging from a cavity approximately 26 feet (8 m) above the ground. Canopy closure over the tree is about ten percent. The radio signal from Bat No. 150.046 was detected in Roost Tree 6-2 each day between July 15 and July 17. Emergence counts were conducted at Roost Tree No. 6-2 for five evenings between July 15 and 28. Between 1 and 5 bats emerged from the tree on four evenings, and no bats emerged from the tree during the last count. In 2004, emergence counts were conducted at Roost Tree 6-2 during four nights. Between 11 and 15 bats emerged from the tree on each of the four nights.

Roost Tree 6-3 is a live silver maple with no loose bark (all bark is intact), and a dbh of 16.5 in (42 cm). Canopy closure over the tree is approximately 30 percent. The limb of a large cottonwood (*Populus deltoides*) is lodged in a fork of the silver maple, and the

bats apparently roost in the space between the limb and the silver maple, approximately 20 feet (6 m) above the ground. Bat No. 150.025 was tracked to the tree, which is located in a riparian area approximately 6,360 feet (1,939 m) north of Net Site 6-7, where the bat was released (Appendix A, Figure 2; Appendix B, Table 4). The tree is approximately 2340 feet (713 m) west of the proposed corridor centerline. Of all ten roost trees found, this is the closest to the proposed road alignment (1340 feet [408 m]). The tree is

south of the White River, which provides the nearest water source and the nearest apparent flight corridor.

Bat No. 150.025 was detected roosting in Roost Tree 6-3 from July 18 to July 22; the tree was monitored for five evenings between July 19 and 28. Between 6 and 7 bats were observed emerging during four of the evenings, and no bats emerged from the tree during the last count.

Roost Tree 6-4 is a dead silver maple to which Bat No. 150.025 was tracked. The tree is broken at the trunk, with the top half of the trunk leaning at a 220-degree angle to the bottom half (Appendix D). It is located in the same woodlot as roost trees 6-1 and 6-3, approximately 6,470 feet (1,972 m) from Net Site 6-7, where Bat No. 150.025 was released (Appendix A, Figure 2; Appendix B, Table 4). The tree is approximately

from the White River, which provides the nearest water source and the nearest apparent flight corridor. The tree is approximately 2,430 feet (741 m) west of the proposed centerline.

Roost Tree 6-4 has a dbh of 11 in (28 cm), and intact bark. Bats appeared to be roosting in a cavity 23 feet (7 m) above the ground. Canopy closure over the tree is about 25 percent. The radio signal from Bat No. 150.025 was detected in Roost Tree 6-4 on July 29. Emergence counts at Roost Tree No. 6-4 were conducted for five evenings between July 29 and August 2. Between 29 and 52 bats were observed emerging from the tree on each of the five nights (Appendix B, Table 5).

Roost Tree 6-5 is a dead cottonwood to which Bat No. 150.068 was tracked. The tree is located approximately 1300 feet (396 m) northwest of Net Site 6-23 where the bat was released (Appendix A, Figure 3; Appendix B, Table 4). The tree is approximately east of the White River, which provides the nearest water source and the nearest apparent flight corridor. The tree is about 1 mile (1.7 km) west of the proposed corridor centerline.

Roost Tree 6-5 has a dbh of 24 in (61 cm), and intact bark. Bats appeared to be roosting in a cavity located 20 feet (6 m) above the ground. Canopy closure over the tree is approximately 50 percent. The radio signal from Bat No. 150.068 was detected in Roost Tree 6-5 on July 20 and 21. It is likely the bat roosted in Tree 6-5 on July 22 as well, but high water in the White River prevented access to the tree. Emergence counts at Roost Tree No. 6-5 were conducted for four evenings between July 20 and 27. No bats were observed emerging from the tree during the counts.

Roost Tree 6-6 is a live silver maple in which Bat No. 150.068 was detected. It is located in the same woodlot as Roost Tree 6-5 approximately 1230 feet (374 m) northwest of Net Site 6-23. The tree is approximately east of the White River, which provides the nearest water source and the nearest apparent flight corridor. It is west of the proposed corridor centerline.

Roost Tree 6-6 has a dbh of 16 in (41 cm), and intact bark. Bats appeared to be roosting in a cavity located 25 feet (7.62 m) above the ground. Canopy closure over the tree is approximately 70 percent. The radio signal from Bat No. 150.068 was detected in Roost Tree 6-6 on July 23, 27, and 28. Emergence counts were conducted at Roost Tree No. 6-6 for three evenings between July 25 and 27. One bat was observed emerging from the tree on July 26, but none was observed during the other two nights. The presence of other trees and vegetation around Roost Tree 6-6 made observation of the cavity and emerging bats difficult.

Documenting Colony Size

In 2005, groups of roost trees used by lactating or post-lactating female Indiana bats were identified near Bryant Creek, Clear Creek, and Pleasant Run Creek (Appendix A, Figures 1–3). Two additional roost trees used by reproductive Indiana bats were identified in 2004 near Crooked Creek in Section 6, approximately 4 miles (6.4 km) northeast of Roost Tree 6-2 (Hendricks et al. 2004).

The minimum distance between roost trees near Bryant Creek and near Clear Creek is approximately , and the minimum distance between roost trees near Clear Creek and Pleasant Run Creek is about . Distances among roost trees used by a maternity colony may vary, in part due to habitat conditions. During a 4-year study in Michigan, an Indiana bat maternity colony used roost trees up to 5.7 miles (9.2 km) apart (Kurta et al. 2002). In Missouri, known roost trees used by a single maternity colony were within 0.9 miles (1.5 km; Callahan et al. 1997).

On July 26 and 27, all four roost trees near Bryant Creek (5-1, 5-2, 5-3 and 5-4) were monitored at dusk to assess the number of bats in the colony. A total of 31 bats emerged from the four roost trees on July 26, and a total of 81 emerged on July 27. However, on July 28 and 29, the number of bats emerging from Roost Tree 5-4 was 115 and 128, respectively.

On July 27 and 28 we monitored emergence from roost trees 6-1, 6-2, 6-3, and from 203R1, which was identified in 2004 (Hendricks et al. 2004). Although none of the Indiana bats radio-tagged in 2005 was tracked to Roost Tree 203R1, it is within 2.5 miles of roost trees 6-1, 6-2, and 6-3, and is within the range of the Clear Creek Colony. Roost Tree 6-4 was not monitored on those dates because it was not identified until July 29. A total of 15 bats emerged from the four roost trees monitored on July 27, and two bats emerged from the four trees on July 28. However, between 29 and 52 bats emerged from Roost Tree 6-4 between July 29 and August 2. Because Roost Tree 6-4 is only 85 feet (26 m) from Roost Tree 6-3, and Bat No. 150.025 roosted in both 6-3 and 6-4, we conclude Roost Tree 6-4 was also used by the Clear Creek maternity colony.

Furthermore, data collected in 2004 from roost trees near Clear and Crooked creeks should be considered. Roost trees near Clear and Crooked creeks are approximately On July 19, 2004, a total of 140 bats was observed emerging from Roost Tree 6-2 and the two trees upstream along Crooked Creek.

On July 25, 26, and 27 emergence counts were conducted simultaneously at roost trees 6-5 and 6-6, used by the Pleasant Run Creek Maternity Colony. No bats were observed emerging from the trees on July 25 or 27, and a single bat emerged from one tree on July 26. Because no primary roost tree was identified for the Pleasant Run Creek colony, emergence counts from roost trees

6-5 and 6-6 likely do not represent the actual size of the colony.

Discussion

Reproductive female Indiana bats were captured at four net sites in Sections 5 and 6. All four Indiana bats were captured between approximately 600 feet (183 m) and 1.5 miles (2.4 km) from the proposed corridor centerline. The bat trapped at Net Site 6-7 was captured within 1000 feet (2400 m) of existing State Road 37, an established, four-lane divided highway. All Indiana bats were captured over tributaries to the White River.

Between two and four roost trees used by each radio-equipped Indiana bat were found. Near Bryant Creek (Section 5), four roost trees occupied by Bat No. 151.046 were identified. Three of the trees (5-1, 5-2, and 5-3) each contained fewer than 15 individuals, and meet Callahan's (1993) definition of alternate roost trees. Roost Tree 5-1 has a small amount of exfoliating bark, while roost trees 5-2 and 5-3 have no loose bark but provide broken tops or cavities as roost sites.

Between 76 and 128 bats emerged from Roost Tree 5-4 during three evenings, indicating the tree is a primary roost tree for the Bryant Creek Colony. Roost Tree 5-4 is larger in diameter and has more exfoliating bark than the other three roost trees used by this colony. Previous studies indicate primary maternity roost trees tend to be exposed to sunlight, whereas alternate roost trees tend to be shaded by canopy vegetation (Callahan 1993; Kurta et al. 1993). However, canopy closure over Roost Tree 5-4 was greater than over roost trees 5-1 and 5-2.

All four roost trees near Bryant Creek are located greater than 1.9 miles (3 km) from the proposed centerline of the I-69 corridor. The three alternate roost trees are within 2110 feet (643 m) of each other. However, Kurta (2001 and Kurta et al. 2002) found Indiana bat maternity colonies using up to 18 roosts, which were up to 5.7 miles (9.2 km) apart.

Four roost trees used by two reproductive female bats were identified near Clear Creek. Roost trees 6-1 and 6-2 were occupied by Bat No. 150.046 and roost trees 6-3 and 6-4 were used by Bat No. 150.025. Bat No. 150.046 used two trees nearly 1.0 mile (1.6 km) apart. Although Roost Tree 6-3 is within about 200 feet (61 m) of roost trees 6-1, Bat No. 150.046 was not detected roosting in Tree 6-3. Because all four trees are less than 1.0 mile (1.6 km) apart, we conclude all four trees are used by a single maternity colony. Roost Trees 6-1, 6-2, and 6-3 each contained 15 or fewer bats during emergence counts in 2004 and 2005, and are therefore alternate roost trees. Roost Tree 6-4 contained between 40 and 52 bats during four evenings, and therefore meets this study's definition of a primary maternity roost tree.

All four roost trees near Clear Creek are somewhat atypical of maternity roost trees identified in some other studies. Roost trees near Clear Creek are between 8.6 and 17.7 inches (22 and 45 centimeters) dbh, which is smaller than many roost trees reported in some other studies. Callahan et al. (1997) found primary maternity roost trees averaged 23 inches (58.4 cm) dbh and alternate maternity roost trees averaged 21 ± 1.6 inches (53 ± 4.1 cm) dbh. However, Gardner et al. (1991) found the diameter of maternity roost trees in Illinois averaged 14.4 inches (36.7 cm). Two of the roost trees near Clear Creek, including the primary roost tree, have no exfoliating bark; bats apparently roost in cavities in those trees. Roost Tree 6-2 has 40 percent loose

bark, but is a small tree (8.6 inches dbh) and bats occupying the tree roost in a cavity. Previous studies suggest alternate roosts are typically in forest interiors mostly shaded from sunlight and primary roost trees more exposed to sunlight (Callahan 1993). However, canopy closure at all roosts identified near Clear Creek does not exceed 30 percent. Variation from the "traditional" characteristics of Indiana bat roosts is demonstrated in other recent studies. Greater than 100 Indiana bats were identified roosting beneath a sheath covering an electric transmission line pole (Hendricks et al. 2004). In Tennessee, three Indiana bats were identified roosting in three conifers, each between 15 and 43 inches (39 and 109 cm; Britzke et al. 2003). These studies indicate the characteristics of Indiana bat roosts may be more variable than previously thought.

All four roost trees near Clear Creek are located greater than 2330 feet (710 m) from the proposed centerline of the I-69 corridor, and at least 1330 feet (405 m) from the proposed road corridor.

Two roost trees used by a single lactating female Indiana bat were identified near Pleasant Run Creek. No more than a single bat was observed emerging from roost trees 6-5 and 6-6 during emergence counts, indicating both are alternate roost trees. No primary roost tree was identified for the colony near Pleasant Run Creek. However, at least one primary roost tree is likely to exist within 5.7 miles of roost trees 6-5 and 6-6.

Bats inhabiting trees 6-5 and 6-6 appeared to roost in cavities, as neither tree has loose bark. Both trees are within a woodlot and are shaded by 50 percent or greater overstory canopy closure.

Roost trees 6-5 and 6-6 are approximately 1.0 mile (1.6 km) from the proposed centerline of the I-69 corridor.

The two primary and eight alternate roost trees identified in this study are located in woodlots bordering the White River. The trees are 98 to 2,000 feet (30 to 610 m) from the river, suggesting these riparian woodlots provide important roost habitat for Indiana bat maternity colonies. Three of six roost trees identified in Section 5 and 6 in 2004 were similarly located in woodlots along the White River. None of the ten roost trees identified in 2005 is within the proposed I-69 corridor. However, potential roosting and foraging areas for the Bryant Creek, Clear Creek, and Pleasant Run Creek maternity colonies do overlap the corridor.

Fourteen evening bats were captured at Net Site 6-23, which is located 4650 feet (1417 m) from the proposed corridor centerline. Captures included reproductive females and juveniles, suggesting an evening bat maternity colony is located near Net Site 5-23. Evening bats typically roost during summer in buildings or under exfoliating bark of trees.

In addition to Indiana bats and evening bats, six other bat species were captured. Each commonly occurs in southeastern Indiana, and none of the species was unexpected in Morgan, Monroe, and Johnson counties. None of the six species is listed by the USFWS or the State of Indiana as rare, threatened, or endangered.

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We appreciate the cooperation and access landowners provided during the surveys. Special thanks to INDOT, FHWA, Tom Cervone, Jason DuPont, and Kia Gillette of Bernardin, Lochmueller and Associates, Inc., and Andrew King, Scott Pruitt, and

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Appendix A
Figures

Figure 1. (“Mist net sites, radiotelemetry stations and Indiana bat roost trees identified near Creek in Section 5 of the proposed I-69 between July and August 1, 2005”) has been removed for confidentiality reasons related to the federally endangered Indiana bat.

Figure 2. (“Mist net sites, radiotelemetry stations and Indiana bat roost trees identified near Creek in Section 5 of the proposed I-69 between July and August 1, 2005”) has been removed for confidentiality reasons related to the federally endangered Indiana bat.

Figure 3. (“Mist net sites, radiotelemetry stations and Indiana bat roost trees identified near Creek in Section 5 of the proposed I-69 between July and August 1, 2005”) has been removed for confidentiality reasons related to the federally endangered Indiana bat.

Appendix B
Tables

Table 1. Location of ten sites surveyed with mist nets during 2005 in the Section 5 and Section 6 Indiana Bat Study Areas.

Site no.	County	Habitat feature surveyed	Approximate distance to proposed Corridor 3C centerline in feet (meters)
5-16	Morgan	Bryant Creek	830 (253)
5-19	Morgan	Bryant Creek	11,370 (3,466)
5-22	Morgan	Unnamed tributary to White Fork and adjacent gravel road	7,676 (2,340)
6-7	Morgan	Clear Creek	600 (183)
6-8	Morgan	Clear Creek	5,830 (1,777)
6-10	Morgan	Tributary to the White River	3,380 (1,030)
6-19	Morgan	Tributary to Bluff Creek	200 (61)
6-20	Morgan	Goose Creek	9,050 (2,758)
6-22	Johnson	Honey Creek	220 (67)
6-23	Johnson	Pleasant Run Creek	4,650 (1,417)

Table 2. Number of Indiana bats captured and radio-tagged, number of Indiana bat roost trees identified, and number of other species captured from ten mist net sites during 2005 in Sections 5 and 6.

Site no.	Survey dates (2005)	Reproductive adult female *M. sodalis*	No. radio-tagged *M. sodalis*	Total no. diurnal roosts identified	*M. lucifugus*	*M. septentrionalis*	*E. fuscus*	*P. subflavus*	*L. borealis*	*L. cinereus*	*N. humeralis*	Total no. bats captured
5-16	7/18, 7/19					1	2			1		4
5-19	7/12, 7/13				2		1	1	2			6
5-22	7/14, 7/17	1	1	4	4		1					6
6-7	7/17	1	1	2	7	1						9
6-8	7/12	1	1	2	1				1			3
6-10	7/14, 7/15				5	2	1	1			1	10
6-19	7/12, 7/13				1	1	1					3
6-20	7/14, 7/15				8		4					12
6-22	7/19											0
6-23	7/17, 7/18, 7/19	1	1	2	4	2	10		1		14	32

Table 3. Description of Indiana bats captured during 2005 within the Section 5 and Section 6 Indiana Bat Study Areas.

Site no.	Date captured (2005)	Time captured	Gender	Age	Reproductive condition*	Weight (g)	Radio-transmitter frequency (mHz)	Dates of radiotracking
6-8	7/12	0100	F	A	L	7.75	150.046	7/12-7/21
5-22	7/17	0145	F	A	L	8.0	151.046	7/17-7/31
6-7	7/17	2140	F	A	PL	8.25	150.025	7/17-7/31
6-23	7/19	2130	F	A	L	6.25	150.068	7/19-7/31

*L= lactating, PL=post-lactating

Table 4. Description of roost trees used by Indiana bats within the Section 5 and Section 6 Indiana Bat Study Areas.

Roost tree no.	Latitude[1]	Longitude[1]	Species	Condition	Diameter at breast height inches (cm)	Percent exfoliating bark	Percent canopy closure at roost	Distance to capture site feet (meters)	Distance to proposed Corridor 3C centerline feet (meters)
5-1			*Ulmus americana*	dead	9.8 (25)	5	0	3,300 (1,005)	10,975 (3,345)
5-2			*Acer saccharinum*	live	18 (45)	0	30	2,700 (832)	10,100 (3,079)
5-3			could not be identified	dead	14 (35)	0	75	4,500 (1,371)	11,760 (3,584)
5-4			could not be identified	dead	25.5 (65)	50	75	3,750 (1,143)	10,660 (3,249)
6-1			*A. saccharinum*	dead	16.5 (42)	10	10	5,085 (1,550)	2,330 (710)
6-2			*U. Americana*	dead	8.6 (22)	40	5	2,730 (832)	7,150 (2,179)
6-3			*A. saccharinum*	live	17.7 (45)	0	30	6,360 (1,939)	2,340 (713)
6-4			*A. saccharinum*	dead	11 (28)	0	25	6,470 (1,972)	2,430 (741)
6-5			*Populus deltoides*	dead	24 (61)	0	50	1,300 (396)	5,610 (1,710)
6-6			*A. saccharinum*	live	16 (41)	0	70	1,230 (375)	4,950 (1,509)
203R1[2]			*Fraxinus* sp.	Dead	unknown	unknown	unknown	n/a[3]	844 (257)

[1]Latitude and longitude provided in decimal degrees
[2]Data describing this roost from Hendricks et al. 2004
[3]No bats equipped with transmitters described herein utilized this roost tree.

Table 5. Number of bats observed in 2005 emerging from each Indiana bat roost tree identified in Sections 5 and 6.

Roost tree no.	Date identified	Roost of bat no.	Emergence Count										Primary/ Alternate Roost[1]
			Date	No. bats	Date	No. bats	Date	No. bats	Date	No. bats	Date	No. bats	
5-1	7/19/2005	151.046	7/18	2	7/19	1	7/21	0	7/26	3	7/27	0	Alternate
5-2	7/21/2005	151.046	7/21	4	7/22	4	7/23	3	7/26	2	7/27	1	Alternate
5-3	7/22/2005	151.046	7/22	13	7/26	3	7/27	4					Alternate
5-4	7/23/2005	151.046	7/23	6	7/26	23	7/27	76	7/28	115	7/29	128	Primary
6-1	7/13/2005	150.046	7/13	2	7/14	1	7/15	0	7/27	2	7/28	1	Alternate
6-2	7/15/2005	150.046	7/15	4	7/16	5	7/17	3	7/27	1	7/28	0	Alternate
6-3	7/19/2005	150.025	7/18	6	7/19	7	7/20	7	7/27	6	7/28	0	Alternate
6-4	7/29/2005	150.025	7/29	40	7/30	42	7/31	52	8/1	29	8/2	41	Primary
6-5	7/20/2005	150.068	7/20	0	7/25	0	7/26	0	7/27	0			Alternate
6-6	7/23/2005	150.068	7/25	0	7/26	1	7/27	0					Alternate
203R1[2]	2004	203	7/27	7	7/28	1							Alternate

[1]As defined in Callahan 1993
[2]Roost tree identified in Hendricks et al. 2004. The Hendricks et al. report identified an emergence count (unspecified date in 2004) of 64 bats at this tree.

Appendix C
Field Data Sheets

Appendix C: Field Data Sheets have been removed for confidentiality reason related to the federally endangered Indiana bat.

Appendix D
Selected Photographs of Indiana Bats and Roost Trees Used by Indiana Bats

Bat No. 150.046, lactating female *M. sodalis* captured at Net Site 6-8 on July 12, 2005.

Bat No. 151.046, lactating female *M. sodalis* captured at Net Site 5-22 on July 17, 2005.

Bat No. 150.025, post-lactating female *M. sodalis* captured at Net Site 6-7 on July 17, 2005.

Bat No. 150.068, lactating female *M. sodalis* captured at Net Site 6-23 on July 19, 2005.

Roost Tree No. 5-1

Roost Tree No. 5-2

Roost Tree No. 5-3

Roost Tree No. 5-4

Roost Tree No. 6-1

Roost Tree No. 6-2

Roost Tree No. 6-3

Roost Tree No. 6-4

Roost Tree No. 6-5

Roost Tree No. 6-6

I-69 PRESENCE/ABSENCE
MIST NETTING SURVEY FOR
INDIANA BAT (*MYOTIS SODALIS*)
AND NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*)
SECTION 6 (MORGAN, JOHNSON AND MARION COUNTIES, IN)
UPPER WHITE RIVER WATERSHED

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Appendices

I-69 PRESENCE/ABSENCE MIST NETTING SURVEY FOR INDIANA BAT (*MYOTIS SODALIS*) AND NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*) SECTION 6 (MORGAN, JOHNSON AND MARION COUNTIES, IN) UPPER WHITE RIVER WATERSHED

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ABSTRACT

The presence/absence survey was conducted to provide documentation for preparation of the I-69 Section 6 Tier 2 Biological Assessment for the Indiana Department of Transportation (INDOT) and Federal Highway Administration (FHWA) Section 7 Consultation with the U.S. Fish and Wildlife Service (USFWS). The Section 6 representative alignment from the Tier 1 phase of the project begins just south of Martinsville and extends to I-465 on the south side of Indianapolis. This survey was conducted between 3 July and 6 August to establish presence and general distribution of the federally endangered Indiana bat (*Myotis sodalis*) and the recently listed federally threatened northern long-eared bat (*Myotis septentionalis*) using mist net capture techniques and to identify maternity roost trees through the use of radio-telemetry tracking. While the primary objective of the survey is to provide annual monitoring of the Indiana bat presence in the vicinity of the I-69 corridor, data was also collected on other species native to Indiana, including the possible presence of the state endangered evening bat (*Nycticeius humeralis*).

This survey includes 19 sites, 15 of which were previously surveyed in 2004 and in part again in 2005. For the 2015 effort, a total of 126 bats representing seven species were captured: 72 big brown bats (*Eptesicus fuscus*), 18 eastern red bats (*Lasiurus borealis*), 24 evening bats, 4 little brown bats (*Myotis lucifigus*), 3 Indiana bats, 3 northern long-eared bats, and 1 tri-colored bat (*Perimyotis subflavus*). One captured bat escaped before identification could be obtained. Overall capture rates for the survey were 1.5 bats per net night.

Radio transmitters were attached to all three of the Indiana bats (all juvenile females), but only one captured at Site 21 was tracked to two different dead cottonwood trees (dbh = 45cm and 35cm) west of the White River in northwest Johnson County. Emergence counts from four nights of observation for these two roosts ranged from 7 to 35. Radio telemetry conducted on two of the three northern long-eared bats captured resulted in the identification of a single roost tree east of the White River (Morgan County) from a post-lactating female captured at Site 20.

INTRODUCTION

This presence/absence survey was conducted for the Tier 2 Environmental Impact Statement (EIS) studies for Section 6 of I-69. On 5 December 2004, the Federal Highway Administration (FHWA) approved the I-69 Tier 1 Environmental Impact Statement (EIS) identifying Alternative 3C as the preferred alternative. Subsequently the Record of Decision (ROD) was approved on 24 March 2004. As part of the Endangered Species Act Section 7 consultation for the Indiana bat in the Tier 1 phase, a presence/absence survey was conducted in 2004 for all six section of the I-69 project to document the distribution of the species in the vicinity of the Tier 1 corridor and to obtain roost data for the purposes of identifying maternity colonies. As part of Section 7 formal consultation a final Biological Assessment (BA) was submitted to the U.S. Fish and Wildlife Service (USFWS) on 21 July 2003 and the Tier 1 Biological Opinion (BO) was issued on 3 December 2003.

Given that nearly 10 years have passed since the original Indiana bat presence/absence survey was conducted, coordination between USFWS, FHWA and INDOT on 9 April 2014 concluded that a follow-up survey was warranted for Section 6 to update and supplement the 2004 and 2005 capture distribution and roost data. This was coordinated with the USFWS in greater detail at the 2 March 2015 Section 6 proposed mist netting meeting. Since the northern long-eared bat was to be listed as threatened (4(d) rule) on 2 April 2015, the 2015 survey was also to serve as a means to generate supplemental capture distribution data for the species, as well as roost/emergence data lacking from the 2004 and 2005 surveys in an effort to potentially better characterize colonies and locations from which project impacts would be assessed.

PROJECT AREA

The southern end of the Section 6 project area at Martinsville is within the Brown County Hills section of the Highland Rim Natural Region, while the remainder of the project area north to Indianapolis is within the southern extent of the Tipton Till Plain section of the Central Till Plain Region. The Brown County Hills Section has deeply dissected uplands underlain by siltstone, shale and sandstone (Homoya et al. 1985).The Tipton Till Plain is an undissected plain with remnants of beech-maple-oak northern flatwoods communities (Homoya et al. 1985). Existing SR 37 north of Martinsville is located within the White River valley and generally runs parallel east of the river. The principal watersheds (14 digit HUC) for the project area from south to north include Indian Creek-Sand Creek, Clear Creek-East/West/Grassy Forks, White River-Henderson Bridge, Stotts Creek-Exchange, White River-North Tributary, Crooked Creek-Banta Creek, White River-Sinking Creek, White River-North Bluff/Bluff Creeks, Honey Creek-Turkey Pen Creek, Pleasant Run Creek-Buffalo Creek, White River-Mann Creek/Harness Ditch, Little Buck Creek and White River-Hide Creek.

INDIANA BAT

Status

The Indiana bat (*Myotis sodalis*) was first described as a distinct species by Miller and Allen (1928) from a female specimen collected by J. O. Sibert on 7 March 1904 from Wyandotte Cave in Crawford County, Indiana. *Myotis* means "mouse ear" while *sodalis* is derived from the Latin word for "companion." The Indiana bat was listed as being in danger of extinction by the USFWS under the Endangered Species

Preservation Act of 1966 on 11 March 1967 (32 FR 4001) and was subsequently listed as endangered under the Endangered Species Act of 1973, as amended. Critical habitat consisting of eleven caves (including Ray's Cave and Wyandotte Cave in Indiana) and two mines was established in 41 FR 41914 on 24 September 1976. A recovery plan was developed for the species in 1983 (USFWS 1983) and a draft revised version was prepared in April 2007 (USFWS 2007).

Morphological Description

The Indiana bat is a small bat similar to the little brown bat in general appearance; however, it has a keel on the calcar, and small hind feet with sparse hairs on toes that do not extend beyond the claws. The fur is brownish gray and hair around the nose is sparse and sometimes gives a pink look to the nose. The sagittal crest is narrower than in the little brown bat (Hall 1981, Barbour and Davis 1969). Total length ranges from 73 to 100 mm (2.87 to 3.94 inches) and weight ranges from 6 to 11 grams (0.21 to 0.39 ounces) (Kurta 1995).

Range

The Indiana bat range includes the eastern United States from Vermont to southern Wisconsin to eastern Oklahoma to northern Florida. USFWS (2007) reports that based on winter 2005 surveys, there are 23 Priority 1 hibernacula in Illinois (n=1), Indiana (n=7), Kentucky (n=5), Missouri (n=6), New York (n=2), Tennessee (n=1) and West Virginia (n=1). However, in 2012 a new Priority 1 site was discovered in Missouri, thus bringing the total to 24. USFWS biennial population estimate data from 1981 through 2015 indicate that the population experienced a low of 496,027 in 2001 with an apparent resurgence to 635,349 in 2007 (http://www.fws.gov/Midwest/Endangered/mammals/inba/index.html as revised 8-25-2015). Possibly due to increased mortality resulting from white-nose syndrome, population estimates declined to 523,636 in 2015. Based on the 2015 Range-wide Population Estimate, Indiana (35%), Missouri (35%), Kentucky (13%), and Illinois (11%) provided hibernacula for 94% of the population in the winter range.

A total of 34 priority hibernacula exist in Indiana (USFWS 2007). Indiana populations seemingly increased slightly from estimates of 160,300 in 1965 to 238,068 in 2007; however, estimates before standardized surveys began in 1980 are unreliable (USFWS 2007). From 2007 populations have experienced a small decline to 226,365 in 2013 (USFWS unpublished data 2014). Redistribution of local winter populations from one cave to a nearby cave over the span of a few years has been reported in some instances (USFWS unpublished data 2006). Ray's Cave and Wyandotte Cave are critical habitat in Indiana.

A total of 269 summer maternity colonies have been documented from 16 states as of 2006, but this is considered to represent only a fraction of those that exist based on winter population estimates and average maternity colony size (USFWS 2007). Maternity colonies appear to be more abundant in the glaciated portions of the upper Midwest than the unglaciated regions of the Midwest or the Mideast portion of the range (USFWS 2007).

Feeding

Indiana bats eat aquatic and terrestrial flying insects, and in this, benefit people by consuming insects that are considered pests. Their role in insect control is remarkable when you consider they eat about half their body weight in insects each night. Examples of preferred prey include moths, beetles, midges,

flies, wasps, stoneflies, flying ants, caddisflies, brown leafhoppers, treehoppers, lacewings, and weevils (Kiser and Elliott 1996, Murray and Kurta 2002, Whitaker 2004).

Some scientists believe that their population is declining today due to pesticide use, possibly through eating contaminated insects, drinking contaminated water, or absorbing the chemicals while feeding in areas that have been recently treated with pesticides (Mohr 1953, Schmidt et al. 2002, USFWS 2007, http://www.fws.gov/midwest/endangered/mammals/inba/inbafctsht.html).

Predation

Feral cats are potential predators within their hibernacula. They are also killed by natural predators such as snakes, owls, hawks, opossums, minks, and raccoons. They can also die from natural disasters such as flooding of caves, collapse in caves and mines, freezing in winter, climate and weather changes, and summer habitat deforestation.

Winter Hibernation

In southern Indiana, winter hibernation in caves and mines generally occurs as late as November or December to as early as mid-March. Hall (1962) and LaVal and LaVal (1980) report hibernation typically from October to April, while Kurta et al. (1997) and Hicks (2004) extend hibernation from September to May in northern areas including New York, Vermont and Michigan (USFWS 2007).

In 2005, 30 percent of the population was considered to hibernate in man-made hibernacula (i.e., mines, tunnels, dams) (USFWS unpublished data 2006). Caves used by Indiana bats are well ventilated (usually have a chimney effect), and store large volumes of cool air with constant temperatures between 3°C to 7.2°C (37.4°F to 45°F) (Tuttle and Kennedy 2002). Brack et al. (2003) observed that in hibernacula in Indiana the highest concentrations of Indiana bats were found at sites with mid-winter temperatures of 6°C to 7°C (42.8°to 44.6°F). The Indiana bat is very sensitive to temperature changes and do not use caves that flood. They prefer caves that have domes, caverns, and diversity in form.

Hibernating bats form large, compact clusters with as many as 5,000 individuals, but averaging 500 to 1,000 bats per cluster (USFWS 2004). Pennsylvania Natural Heritage reported clusters with 250 per square foot (http://www.naturalheritage.state.pa.us/factsheets/11449.pdf), while the New York Department of Environmental Conservation (http://www.dec.ny.gov/animals/6972.htmlreports) reported more than 300/square foot. Several researchers have noted an inverse relationship between ambient roost temperature and the size of hibernating clusters (Clawson et al. 1980, Brack et al. 1984) as reported in USFWS (2007).

Bats go into deep hibernation (torpor) in winter, but have the ability to arouse very quickly which may be an adaptive mechanism for survival. During the hibernation period, bats arouse about once every two weeks or so and stay aroused for a short time period of 1-2 hours (Reeder et al. 2012). Cumulative arousals throughout hibernation cause much of their stored fat energy to be metabolized and lost to the individual. The function of the arousal is not known for sure, but it may be to drink, to exercise, or to get rid of some waste products. Arousal is not to feed though.

Disturbances in the winter can be deleterious. Awaking these bats can use up their fat reserves. For this reason, gates at the entrance or fences around these caves have been used as conservation measures. When huddled together (clustered), individuals on the perimeter of the group are more susceptible to

freezing that those in the middle of the mass. Caves are most important in the survival of this species. During hibernation, bats cluster in large groups and some winter hibernacula may support from 20,000 to 50,000 or more bats.

Spring Staging

Spring staging generally occurs from mid-March to mid-May when males and females emerge from caves. They are hungry and thin after three to four or more months of hibernation. Indiana bats feed and congregate around these caves before migrating to their summer homes. Males usually stay near the hibernacula, but may leave the area entirely (USFWS 2007). Indiana bats have been found to migrate 64 to 80 km (40 or 50 miles) a day with total distances of several hundred kilometers. One female released in southeastern New York moved 56 kilometers (35 miles) in approximately 85 minutes (Sanders et al. 2001), while one female bat released from Canoe Creek Mine in Pennsylvania traveled approximately 96 kilometers (60 miles) in one evening (USFWS 2007) as reported by C. Butchkoski in 2005. Twelve female Indiana bats from maternity colonies in Michigan migrated an average of 476 kilometers (296 miles) to their hibernacula in Indiana and Kentucky, with a maximum migration of 574 kilometers (357 miles) (Winhold and Kurta 2006). Females usually migrate further than males.

The females (as in other bats) show delayed fertilization, that is, they mate with males in the fall, and store sperm alive in pouches connected to the uterus. Upon an egg moving down into the uterus, sperm are discharged from these pockets and fertilize the egg. The fertilized egg (embryo) then implants itself into the uterus. When females leave the cave, they are pregnant and on a mission to start a new generation in their summer home.

Summer Habitat

Indiana bats occupy summer habitat from mid-May to mid-August. Females and males arrive at their summer habitat (home) in May. Summer roosting sites include primarily dead trees with cavities and/or exfoliating bark or living trees with shaggy bark (e.g., shagbark hickory). Larger trees are usually preferred over smaller trees where there is an ample amount of solar radiation, and protection from the wind and rain. Numerous studies indicate that Indiana bats exhibit site fidelity to their traditional summer maternity areas (Humphrey et al. 1977, Gardner et al. 1991a, 1991b, Gardner et al. 1996, Callahan et al. 1997, Whitaker and Sparks 2003, Whitaker et al. 2004).

These nursery colonies often use several roost trees. Roost trees may be primary roost trees (emergence count ≥ 30 bats) or alternate roost trees (emergence count < 30 bats). Ideal primary roost trees are large trees with sloughing bark in the sun where they secure themselves under the bark, in crevices or cavities during the day. While at night, they are active feeding on insects and use the underside of bridges on occasion as night roosts (Kiser et al. 2002). The majority of summer maternity colonies are in large dead or live trees near major streams in both bottomland and upland areas.

A maternity colony can vary greatly in size (USFWS 2007), but typically consists of 25 to 325 adult females (average is 80 adult females per Whitaker and Brack 2002). Although most documented maternity colonies contained 100 or fewer adult females (Harvey 2002), as many as 384 bats have been reported emerging from one maternity roost tree in Indiana (Whitaker and Brack 2002).

Young are born between late June and early July. This process is called parturition and the adult females are lactating (producing milk) at that time. Females do not carry the young unless they need to move

them, and under such conditions, they will carry them on their abdomen. The young become volant (able to fly) between early July and early August at which time the adult females become non-reproductive. Most young are volant by mid-July. Males may form bachelor colonies during the summer.

Fall Swarming

Fall swarming generally occurs mid-August to November. With the onset of fall and cooler temperatures, males return to the caves. They are at the entrances to the caves when the females and young arrive. Hormones run high and males mate with females. Swarming is a milling of the bats around and out of the cave entrance. It may have several functions, but one seems to bring the sexes together for mating. It is not known if juvenile females mate their first autumn. Limited mating may occur in the spring, and in the cave in winter (Hall 1962).

Members of both sexes feed and gain weight through the fall, thus putting on fat (energy) needed to help them through hibernation. LaVal and LaVal (1980) found females to reach maximum weight in early October, while the males reached maximum weight in late October. The males follow the females into hibernation, and both sexes stay in the cave when outside temperatures trend towards freezing.

Cumulative Impacts

Cumulative impacts resulting from human disturbances at winter hibernacula, summer and winter habitat loss, wind farm fatalities and white nose syndrome (WNS) are threats to the species and chief factors for population declines. However, in recent years WNS and wind farms are considered the primary causes of death for Indiana bats (Boyles *et al.* 2011).

WNS is a disease caused by the cold-loving fungus *Pseudogymnoascus destructans (formerly called Geomyces destructans),* that affects bats during winter hibernation. It was first reported in 2006 from New York. Since then, the USFWS estimates that at least 5.7 million to 6.7 million bats have died from WNS (http://www.batcon.org/pdfs/USFWS_WNS_Mortality_2012_NR_FINAL.pdf). The disease originally spread south along the Appalachian Mountains and north into Canada, and then westward into Tennessee, Missouri and Iowa in the south; and Canada in the north. WNS was first reported in Indiana in January 2011.

It takes some time for the fungus to attach to the skin of the bat, but once embedded into the epidermis; it causes open sores (lesions) in the epidermis and dermis in especially bare areas like the nose, forearms and wings. If the bat survives, such lesions heal as scars. The fungus grows around 4°C to 20°C (39.2°F to 68.0°F) (https://en.wikipedia.org/wiki/Pseudogymnoascus_destructans). The upper critical temperature for growth is between 19°C and 19.8°C (66.2°F and 67.6°F) with temperatures above 12°C (53.6°F) displaying atypical morphology in the fungus that may have implications its proliferation (Verant et al. 2012).

Bats usually come into hibernation with extra grams of fat, of which, much of this fat are used in arousals. The remaining grams of fat in the bat are needed to sustain it through the duration of hibernation. Fungal lesions caused by *Pseudogymnoascus destructans* cause the bat to become more active and waste critical energy reserves. When this happens, bats may leave the cave in winter in search of food, and ultimately die in or out of the cave from starvation. This is one theory for the many deaths from WNS.

Wind farms (as becoming more prevalent in the landscape) are also reported to kill many bats. The majority of such losses affect bats that migrate long distances such as the hoary bat, eastern red bat, and silver haired bat. However, an Indiana bat was killed in a wind farm in Benton County, Indiana. Bats that die from WNS and wind farms may lower the Indiana bat population.

Boyles *et al.* (2011) reported that the loss of some 1 million bats equates to about 660 to 1,320 metric tons of insects that would not be consumed each year in WNS-affected areas. Farmers would need to offset such losses with investing more money to control insect infestations. It is reported that from $3.7 billion/year to $53.0 billion/year ($22.9 billion/year average) would be needed to control unwanted agricultural insect pests. This equates to a most likely scenario of $74/acre that the farmer would need to spend on pesticides.

NORTHERN LONG-EARED BAT

Status

The northern long-eared bat (*Myotis septentionalis*) was first recognized as a distinct species instead of a subspecies of Keen's long-eared myotis (*Myotis keenii*) by van Zyll de Jong in 1979 based on geographic separation and morphologyical characteristics (78 FR 61051). On October 2, 2013 the USFWS published a proposed rule (78 FR 61046) to list the northern long-eared bat as endangered. Subsequently, a proposed species-specific rule under Section 4(d) of the Act was published on January 15, 2015 (80 FR 2371) to list the species as threatened. On 2 April 2015 the USFWS published the final rule listing the species as threatened with an Interim 4(d) Rule (80 FR 17974). The listing became effective on 4 May 2015.

Morphological Description

It is a medium sized bat, the most distinguishing character of which is its long ear and long, narrow, pointed tragus (Whitaker *et al.* no date; Kurta 1995). Fur is typically light to dark brown with a yellowish venter. Size and weight are generally consistent with the little brown and Indiana bat, although the northern long-eared bat tends to be slightly smaller on average (Kurta 1995).

Range and Distribution

The species range includes eastern and north-central United States, as well as all Canadian provinces west to the southern Yukon Territory and eastern British Columbia. Specifically, in the United States it includes 39 states from Maine west to Montana, south to eastern Kansas, eastern Oklahoma, Arkansas, and east to northern Florida. In the U.S., it was more commonly observed in the northeastern portion of its range than in the southern and western regions (Caceres and Barclay 2000; Amelon and Burhans 2006). Within this range, more than 780 hibernacula have been identified from 27 states, more than 60% of which are in Pennsylvania, Missouri, West Virginia, Michigan and Kentucky (Whitaker and Hamilton 1998). Twenty-five hibernacula have been documented in Indiana (80 FR 17974).

The U.S. range has been divided into four populations (eastern, midwest, southern and western), although these are not considered isolated populations from each other (78 FR 61052). It is less common in the southern and western portions of the range, but is fairly common within the Midwest population (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin). Although Indiana has fewer known hibernacula than most of the other states that comprise the Midwest

population, it has historically been considered the fourth or fifth most abundant species statewide, and most frequently captured at mine entrances. A USFWS comparison of a three year survey conducted in northern Indiana where only 4 percent of the captures were northern long-eared bats versus a three summer survey in south-central Indiana where 38 percent of the captures were northern long-eared bats suggest that habitat abundance or other environmental conditions are more favorable in the southern portion of the state. Range-wide or Indiana population estimates have not currently been generated by the USFWS.

Feeding

The northern long-eared bat has a diverse diet including moths, flies, leafhoppers, caddisflies, spiders and beetles with diet composition differing geographically and seasonally (Brack and Whitaker 2001). The most common insects found in the diets of northern long-eared bats are moths and beetles (Feldhamer *et al.* 2009; Brack and Whitaker 2001) with spiders also being a common prey item (Feldhamer *et al.* 2009). Foraging techniques include hawking (catching insects in flight) and gleaning (picking insects off stationary features such as leaves or branches) in conjunction with passive acoustic cues (Nagorsen and Brigham 1993; Ratcliffe and Dawson 2003). Present in their feces are spiders, other non-flying insects, and green plant material suggest considerable gleaning behavior. The northern long-eared bat has a very high frequency call. Gleaning allows this species to gain a foraging advantage for preying upon moths because moths are less able to detect high frequency echolocation calls (Faure *et al.* 1993). Emerging at dusk, most hunting occurs above the understory, 3 to 10 feet about the ground, but under the canopy (Nagorsen and Brigham 1993) on forested hillsides and ridges, rather than along riparian areas (Brack and Whitaker 2001; LaVal *et al.* 1977). This coincides with data indicating that mature forests are important habitat for foraging in this species (Caceres and Pybus 1998).

Winter Hibernation

Caves and mines are used by the northern long-eared bat in winter. Hibernacula used are typically large, with large passages and entrances, relatively constant and cooler temperatures, and with high humidity and no air currents. The sites favored by them are often in very high humidity areas to such a large degree that droplets of water are often observed on their fur. They are typically found roosting in small crevices or cracks in cave or mine walls and can often be overlooked in surveys. To a lesser extent, they have been found overwintering in habitats that resemble caves or mines, such as abandoned railroad tunnels and storm sewers (Goehring 1954), hydro-electric dams (Kurta and Teramino 1994), aqueducts (French 2012 unpublished data) or other "unsuspected retreats" where caves and mines are not present. Northern long-eared bats have shown a high degree of philopatry (using the same site multiple years) for a hibernaculum. Other species in Indiana that commonly occupy the same hibernacula with the northern long-eared bat are the little brown bat, big brown bat, tri-colored bat, and Indiana bat. Northern long-eared bats often move between hibernacula throughout the winter, which may further decrease population estimates. Similarly, this species has been found to fly in and out of some of the mines and caves in southern Indiana throughout the winter (Whitaker and Mumford 2009).

Spring Staging

Both males and females emerge from caves and mines in spring. Northern long-eared bats exhibit significant weight loss during hibernation. One Indiana study showed a 41-43 % loss (Whitaker and Hamilton 1998). During staging, northern long-eared bats are flying in and out of caves to feed and congregate around these caves before migrating to their summer homes. The northern long-eared bat is not considered a long-distance migratory species. Short migratory movements between summer roost

and winter hibernacula are typically between 35 to 55 miles (Nagorsen and Brigham 1993; Griffin 1945). However, movements may range from 5 to 168 miles (Griffin 1945). When females leave the cave, they are pregnant and on a mission to start a new generation in their summer home. Gestation is approximately 60 days (van Zyll de Jong 1985). Males are reproductively inactive until late July, with testes descending in most males during August and September (Caire *et al.* 1979; Amelon and Burhans 2006).

Summer Habitat

During the summer, northern long-eared bats typically roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags. Males and non-reproductive females' summer roost sites may also include cooler locations, including caves and mines (Barbour and Davis 1969). They also have been found roosting in man-made structures, such as buildings, barns, a park pavilion, sheds, cabins, under eaves of buildings, behind window shutters, and in bat houses (Mumford and Cope 1964, Barbour and Davis 1969, Cope and Humphrey 1972; Amelon and Burhans 2006; Whitaker and Mumford 2009; Timpone *et al.* 2010; Joe Kath 2013 pers. comm.). This species appears to be somewhat opportunistic in roost selection. Canopy cover at northern long-eared bat roosts has ranged from 56% (Timpone *et al.* 2010) to greater than 84% (Lacki and Schwierjohann 2001). Females tend to roost in more open areas than males, likely due to the increased solar radiation, which aids in pup development (Perry and Thill 2007). Roosts are also largely selected below the canopy, which could be due to the species' ability to exploit roosts in cluttered environments; their gleaning behavior suggests an ability to easily maneuver around obstacles (Foster and Kurta 1999; Menzel *et al.* 2002).

One study found that northern long-eared bats roost more often on upper and middle slopes than lower slopes, which suggests a preference for higher elevations due to increased solar heating (Lacki and Schwierjohann 2001). Northern long-eared bats switch roosts often (Sasse and Perkins 1996), typically every 2-3 days (Foster and Kurta 1999; Owen *et al.* 2002; Carter and Feldhamer 2005; Timpone *et al.* 2010). Reasons for switching may be temperature, precipitation, predation, parasitism, and ephemeral roost sites (Carter and Feldhamer 2005).

The northern long-eared bat is comparable to the Indiana bat in terms of summer roost selection, but appear to be more opportunistic (Carter and Feldhamer 2005; Timpone *et al.* 2010). Although northern long-eared bats are more opportunistic than Indiana bats, there may be a small amount of roost selection overlap between these two species (Foster and Kurta 1999; Timpone *et al.* 2010). Maternity colonies, consisting of females and young, are generally small, numbering from about 30 (Whitaker and Mumford 2009) to 60 individuals (Caceres and Barclay 2000). Adult females give birth to a single pup. Birth likely occurs in late May or early June (Caire et al 1979; Easteria 1968, Whitaker and Mumford 2009), but may occur as late as July (Whitaker and Mumford 2009). Juvenile volancy (flight) occurs by 21 days after birth (Krochmal and Sparks 2007; Kunz 1971). Adult longevity is estimated to be up to 18.5 years (Hall *et al.* 1957) with the greatest recorded age of 19 years (Kurta 1995).

Fall Swarming

With the onset of fall and cooler temperatures, males return to the caves. They are at the entrances when females and young arrive. Elevated hormone levels trigger males to mate with females. Hibernating females store sperm until spring, exhibiting delayed fertilization (amphigonia retardata). Swarming is a milling of the bats around and out of the cave entrance. This behavior may have several functions, but one seems to bring the sexes together for mating. Members of both sexes feed and gain

weight through the fall, thus putting on fat (energy) to help them survive through hibernation. It is not known if juvenile females mate their first autumn. Limited mating may occur in the cave in winter and may even occur in the spring. When temperatures are 50 degrees F or less, the bats start to stay inside the cave.

Cumulative Impacts

Under Section 4(a)(1) of Act (16 U.S.C. 1533) and its implementing regulations at 50 CFR part 424, USFWS has the authority to list a species based on any of the following 5 factors: (A) present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence.

No other threat is as severe and immediate to the northern long-eared bat's persistence as WNS, although habitat loss continues to be a contributing factor and a potential limiting factor in its potential for recovery.

EVENING BAT

Status

The evening bat (*Nyctesius humeralis*) was described by Rafinesque in 1818. It is considered a species of "least concern" by the IUCN, but is currently listed as endangered by the Indiana DNR under IC 14-22-34.

Morphological Description

A small bat with blackish (juvenile) to bronze-brown (adult) fur often greasy in appearance that is best differentiated from other myotis bats by its shorter, rounded tragi and shorter ears (Mumford and Whitaker 1982). Additionally, the evening bat has a single pair of upper incisors compared to a double set for all other Indiana species except those of the *Lasiurus* genus (Kurta 1995; Menzel *et al.* 2002) and uniform size molariform teeth behind the canines (Whitaker *et al.* undated). Wing and tail membranes are hairless with total length ranges from 86 to 103 mm and weight ranges from 6 to 12 grams (Kurta 1995).

Range and Distribution

Evening bat range is the eastern United States extending north to Nebraska, Iowa, southern Michigan, Pennsylvania, New Jersey, west to Kansas, eastern Texas, south to the Gulf Coast and along the mid-Atlantic Coast (Kurta 1995). In Indiana, it is currently considered to be restricted more to the southern portion of the state. From records of Cope *et al.* (1961), Humphrey and Cope (1970), and Whitaker and Gummer (1993), the known pre-1990s distribution of the species included southeast Indiana (Orange, Washington and Clark counties), west-central (Clay County) and north-central (Montgomery, Tippecanoe, Clinton, Carroll, White and Cass counties). Records from the 1993 suggest that evening bats appear to be closely associated with the lower Wabash and White Rivers (Whitaker and Gummer, 2003), particularly the Prairie Creek area of Vigo County.

Feeding

Evening bat diet generally consists of beetles (particularly chrysomelid beetle or spotted cucumber beetle), moths, flies, leafhoppers and true bugs (Kurta 1995; Feldhamer *et al.* 1995)). A colony of 100

evening bats is estimated to consume 1.25 million insects in a season (Kurta 1995), thus providing a notable contribution to pest insect control.

Summer Habitat

Typically, females form maternity colonies in buildings and tree hollows from late April to early May (Whitaker and Gummer 2003, Whitaker *et al.* undated). Males usually remain in the southern portion of the range and do not migrate much to the north (Kurta 1995), as such females and juveniles are more likely to occur in Indiana that males. Parturition within a colony (two or sometimes three pups) occurs within a period of roughly six days in June (Kurta 1995) although births have been reported in July (Whitaker *et al.* undated). Boyles and Robbins (2006) noted from a yearlong survey in Missouri that maternity colonies were only occupied for a ten day period in mid-June 2003. By July, volant males leave the colony and disperse, while juvenile females remain at the colony roost to forage and continue nursing with their mother (Whitaker *et al.* undated). From capture data available as of 2003, Whitaker and Gummer (2003) concluded that maternity colonies were present in at least five counties (Vigo, Sullivan, Posey, Hendricks and Bartholomew).

Although they occupy man-made buildings, evening bats generally inhabit rural landscapes where they forage in open fields, agricultural fields and within woodlands (Whitaker *et al.* undated). However, Whitaker and Gummer (2003) noted that from mist net surveys conducted from 1994 to 1999 in Indiana, evening bats were predominantly captured in bottomland woods which lacked development (i.e., structures) and that within Prairie Creek in Vigo County, evening bats were tracked to hollows in silver maple trees. It is not uncommon for evening bats to move from tree to tree, with some trees harboring large numbers and others just a few individuals. Boyles and Robbins (2006) identified eight different species of trees used as roosts by evening bats; however, 88 percent (30 of the 34 roosts) were oak species. Also, they tended to prefer trees in more advanced stages of decay than live or recently dying trees.

Winter Hibernation

Fall migration southward begins around mid-October in Indiana and has been documented to cover as much as 547 km or 340 miles (Whitaker *et al.* undated). In the winter, they migrate to areas between Arkansas and South Carolina (Kurta 1995) where they likely hibernate in hollow trees, but apparently don't use caves for hibernacula (Whitaker *et al.* undated). It has also been suggested that evening bats summering in "middle latitudes" may not migrate south (Boyles and Robbins 2006). Whitaker and Gummer (2003) surmised that they do not hibernate in Indiana and likely reside in trees associated with large rivers south of the state. Boyles and Robbins (2006) captured both males and females during the winter in south-central Missouri and tracked them to oak roosts (primarily white oaks and post oaks) in the same areas, but not the same trees as roosting was observed in the summer.

Cumulative Impacts

Threats to the evening bat include natural predators, principally cats, as well as snakes, raccoons, owls and hawks (Kurta 1995). As with other bats in Indiana, habitat loss is also likely a contributing limiting factor to population size. White nose syndrome has not yet been detected in evening bats.

PREVIOUS STUDIES

Tier 1 NEPA Phase Monitoring

There have been two previous I-69 Tier 1 NEPA Phase bat studies conducted within Section 6 in 2004 and 2005.

- Hendricks, William D. et al. (15 December 2004) – Summer habitat for the Indiana bat (*Myotis sodalis*) within the Martinsville Hills from Martinsville to Indianapolis, Indiana.
- Henry et al. (27 February 2006) – Identification of Indiana bat roost trees along the proposed Interstate 69 between Bloomington and Indianapolis, Indiana.

In 2004, 29 sites were mist net surveyed for two nights at each location between 12 July and in accordance with the USFWS Mist Netting Guidelines active at that time. A total of ten Indiana bats from eight survey sites (27% of sites surveyed) and 21 northern long-eared bats from eleven survey sites (38% of sites surveyed) were captured. Indiana bat captures included four reproductive females, one non-reproductive male and five juveniles (male = 3, female = 2). Radio transmitters were attached to four adult female and one juvenile female Indiana bats for the purposes of tracking to individual or multiple summer roost trees. Three of the five bats were tracked to four different roost trees along the White River and within the Clear Creek tributary drainage. Roost counts from a dead ash snag and a power pole were in excess of 60 individuals/night from multiple counts suggesting these were likely primary roosts for a local colony. Northern long-eared bat captures included two adult reproductive females, one adult non-reproductive female, twelve adult males, and six juveniles (males = 3, females = 3). Because the 2004 survey pre-dates the USFWS listing of this species as threatened, no radio telemetry and roost tree identification was conducted. From 18 bridge inspections, bats were observed roosting at two bridges across although no Indiana bats or northern long-eared bats were found. Mist netting was supplemented with AnaBat II detector acoustic data collection at six of the 29 locations, but no automated program analysis or manual hand vetting for species identification was conducted.

In 2005, seven of the 29 sites surveyed in 2004 were revisited from 12 July to 19 July to generate additional data on Indiana bat roost trees within the Section 6 portion of the I-69 corridor. A total of three Indiana bats (all reproductive females) from three different mist net sites were captured and fitted with radio transmitters. Each bat was tracked to two different roosts within the White River floodplain. Only one of the six roost trees yielded nightly emergence counts greater than 10 bats/night. From five nights of observations, exit counts at this roost ranged from 29 to 52 bats per night, thus it was either an alternative roost or a low count primary roost. A total of six northern long-eared bat captures included an adult reproductive female, an adult male and four juvenile females. Again, no telemetry or roost tree identification was conducted on this species since this survey pre-dated USFWS listing. Acoustic data collection was not a part of the scope for this survey.

MATERNITY COLONIES

Indiana Bat

Capture and roost tree emergence count data from the 2004 and 2005 surveys for the entire I-69 length was utilized by the USFWS to define twelve maternity colonies along the Tier 1 corridor. As a result of continuing monitoring surveys in 2010, a thirteenth colony was defined within Section 4 of the project between US231 and Bloomington. Three of these 13 Indiana bat 2.5 mile radius maternity colonies are located within Section 6.

- West Fork White River / Clear Creek colony: Determined by the centroid of three 2004 and 2005 roost locations associated with the White River and Clear Creek approximately (There is a small amount of overlap with the adjacent West Fork White River / Crooked Creek colony.
- West Fork White River / Crooked Creek colony: Determined by a pair of 2004 maternity roosts (utility pole and shagbark hickory) immediately (There is a small amount of overlap with the adjacent West Fork White River / Clear Creek colony.
- West Fork White River / Pleasant Run Creek colony: Determined by the centroid of multiple 2004 capture locations associated with the White River to the (/

Northern Long-Eared Bat

Since the northern long-eared bat was not listed as threatened (4(d) rule) until 2 April 2015, it was not within the scope of the 2004 and 2005 surveys performed in Section 6 to conduct radio telemetry, roost tree identification and emergence count surveys for the purposes of defining maternity colonies for the species. However, as part of Conferencing coordination with the USFWS during development of the Tier 1 Biological Assessment addendum for the northern long-eared bat the Bloomington Field Office staff utilized capture data from the 29 survey sites in 2004 and 2005 to define four 1.5 mile radius maternity colonies within Section 6. Two of these are located in the southern half of the survey area and two are located in the northern half.

- Clear Creek East Fork: Determined by the centroid from captures of a post-lactating female, and five juveniles at Site 6 in 2004 and a juvenile female at Site 7 in 2005 associated with Clear Creek and Clear Creek East Fork approximately (There is approximately 20 percent overlay with the adjacent White River colony.
- White River: Determined by the capture of two juvenile females at Site 10 in 2004 immediately adjacent to the White River approximately (There is approximately 20 percent overlay with the adjacent Clear Creek East Fork colony.
- White River / Goose Creek: Determined by the centroid from captures of a post-lactating female at Site 20 in 2004 and a lactating female at Site 19 in 2005 associated with the White River in the vicinity of the Goose Creek confluence approximately (/ The 1.5 mile radius boundary of this colony abuts, but does not overlap, the Pleasant Run colony limits to the north.

- Pleasant Run: Determined by the centroid from captures of a juvenile male at Site 25 in 2004 and a non-reproductive female at Site 23 2005 associated with the White River in the vicinity of

  The 1.5 mile radius boundary of this colony abuts, but does not overlap, the Pleasant Run colony limits to the north.

REPRESENATIVE ALIGNMENT HABITAT ASSESSMENT AND MIST NETTING SITE SELECTION

Section 6 of the Tier 1 I-69 corridor begins south of Martinsville on SR 37 just south of Indian Creek in Morgan County, proceeds north along SR37 through Johnson and Marion counties and ends at I-465 on the south side of Indianapolis. The total length of the Section 6 corridor is approximately 41.7 km (25.9 miles). As per the 2015 Range-Wide Indiana Bat Summer Survey Guidelines (April 2015) for the applicable Midwest Recovery Unit, the number of net nights required for the 2015 Section 6 Phase 2 presence/absence survey was based on a minimum of 4 net nights per km (0.6 mile) of suitable summer habitat. The cumulative linear distance of suitable summer habitat for Section 6 was determined using the "representative alignment" for Section 6 and the "Tier 2 forest GIS data". The representative alignment for Section 6 has the footprint for the alternative with the largest Tier 2 forest impacts, among those alternatives that were still under consideration as of November 14, 2005. The Tier 2 forest GIS data was created through photo interpretation of the best available aerial photographs and supplemented by field reconnaissance.

An analysis of available summer habitat (i.e., forested tracts) within and immediately adjacent to either side of the representative alignment right-of-way for Section 6 indicated that approximately 19.3 km of forested land use along this linear corridor supports potential Indiana bat and northern long-eared bat habitat. The majority of this potential habitat was located between Martinsville and Egbert Road, and from Ennis Road to Big Bend Road. As such, a minimum of 76 net nights of survey effort was required to satisfy the USFWS criteria. To keep the survey scheme similar to Sections 1 through 5, it was decided that a total of 19 sites, each consisting of two nets surveyed for two nights, would be selected for a total of 76 net nights.

The 29 sites in Section 6 surveyed in 2004 (Hendricks, William D. et al., 2004) and 2005 (Henry et al., 2006) as part of the Tier 1 study were used as the initial base for the 2015 Tier 2 site selection survey. Fourteen of these sites yielded Indiana and or northern long-eared bat captures in 2004-2005 and were therefore given priority consideration as candidate sites for 2015; however, two of these sites were more than 1.5 miles from SR37 and deemed to be too far removed from the representative alignment for consideration. The remaining seven sites consisted of three sites surveyed sites in 2004 that did not yield either Indiana bats or northern long-eared bats but exhibited quality habitat characteristics and good capture potential. Additionally, four new locations associated with the White River and Pleasant Run were selected to fill in gaps along the corridor where smaller areas of potential habitat occur. The proposed survey sites were identified in the study plan submitted to the USFWS (Bloomington Field Office) on 28 June 2015 and approved on 29 June 2015. Appendix A, Figure 1 provides the location of the sites.

METHODOLOGY

Lochmueller Group, Inc. and Environmental Solutions and Innovations, Inc. completed the field survey in Section 6 under Federal Endangered Species Permit TE06845-A3 (Lochmueller Group) and TE02373A-6 (Environmental Solutions and Innovations, Inc.) State of Indiana Department of Natural Resources Permits issued to Mr. Rusty Yeager (15-046), Dr. Thomas Cervone (15-047), Jason Damm (15-141) and Kory Armstrong (15-151).

Property owner permission to access and conduct the mist net survey at each of the nineteen sites was obtained via phone or personal contact prior to conducting the investigation. Additionally, local law enforcement was notified of the survey dates prior to commencing each night's activity. In the event that the use of radio-telemetry was required to track an Indiana bat or northern long-eared bat fitted with a transmitter to roosts on other properties, all efforts were made to contact the relevant property owners prior to entry.

Mist Netting

This survey was conducted in accordance with the Phase 2 Presence/Absence Surveys guidelines in the *2015 Range-Wide Indiana bat Summer Survey Guidelines*, April 2015 (USFWS, 2015). The mist netting guidelines are summarized in Appendix B. The locations for 15 of the 19 sites (Sites 3, 5, 6, 7, 8, 10, 13, 14, 17, 19, 20, 21, 23, 24, and 25) were generally in the same locations as when surveyed in 2004 and 2005. The four new sites were coordinated with and approved by USFWS BFO staff prior to initiation of the survey. Each site included two net sets and was surveyed for a minimum of two nights for a total of four minimum net nights each. Sites 6, 13, 25 and 33 were surveyed for an additional third night due to "rain outs" on either the first or second day of the survey. Mist net site locations are shown on USGS topographic maps relative to the I-69 Section 6 representative alignment in Appendix A, Figures 2A, 2B 2C and 2D. GPS coordinates (UTMs) for the nets are provided in Appendix C, Table 1. Sites were surveyed on the nights indicated on Appendix C, Table 2.

Decontamination of field equipment and measures to reduce the potential transfer of *Pseudogymnoascus destructans* was conducted in accordance with the National White-Nose Syndrome Decontamination Protocol –Version 06.25.2012 (Appendix B).

Habitat and meteorological conditions were documented for each mist netting site. Habitat assessment at net sites focused on features indicative of suitability for Indiana bats and northern long-eared bats. Temperature (digital thermometer), percent cloud cover, wind (Beaufort scale) , and rainfall were monitored and recorded every half hour during the mist netting effort to insure compliance with weather conditions outlined in the netting guidelines. Appendix C, Table 2 includes temperature ranges for each site for each night. Bat habitat description sheet, site sketch, net photographs and capture data sheets for each site are included in Appendix D.

All captured bats were identified to species using a combination of morphological and meristic characteristics (e.g., ear and tragus, calcar, pelage, size/weight, length of right forearm, and overall appearance of the animal). The species, sex, reproductive condition, age, weight, length of right forearm, and time and location/net site of capture were recorded for all bats. Age (adult or juvenile) of bats is determined by examining epiphyseal discs of long bones in the wing. Weight was measured to

0.25 gram using a Pesola® 30g spring scale. Length of the right forearm of each bat was estimated to the nearest 1.0 mm (0.04 inch) using either calipers or metric rule. The reproductive condition of captured bats was classified as non-descended male, descended male, non-reproductive female, pregnant female (gentle abdominal palpation), lactating female, or post-lactating female. Additionally, wing damage was assessed in accordance with the "Wing-Damage Index for Characterizing Wing Condition of Bats Affected by White-nose Syndrome" (Reichard 2008) by examining wing membranes, uropatagium and forearms with direct light and translumination. A score of "0" indicates no damage, while a score of "3" means heavy damage involving tissue necrosis, holes in wing membranes, and/or receding plagiopatagium or chiropatagium. A suffix "P" is used for conditions in which physical damage not associated with splotching or necrotic tissue are observed. Wing damage noted and scored is not however necessarily the result of WNS.

Bats were not banded as part of this survey. Bat processing and data collection was typically completed within 30 minutes of the time the bat was removed from the net. If two or more bats were captured at similar times, they were carefully placed in paper sacks for temporary containment until such time that they could be processed and released. Storage sacks were used only once and disposed of as a WNS transmission prevention measure. Captured bats were marked with a small dab of white correction fluid prior to release in order to document any recaptures.

Radio-telemetry

When warranted, radio-telemetry was conducted in accordance with guidelines provided by USFWS in Appendix B. Indiana bats and northern long-eared bats which were captured and suitable for radio-telemetry use were to be fitted with a Holohil Systems Ltd. LB-2N radio-transmitter weighing approximately 0.36 grams (0.01 ounce). The transmitter would be activated and tested at the manufacturer's designated frequency before attachment to the bat. A small inter-scapular area would be trimmed of fur and the transmitter would be attached to this area with non-toxic bonding cement (Torbot Group, Inc., Cranston, Rhode Island). This cement degrades over time allowing the transmitter to eventually become detached from the bat. Transmitter weight, weight of the bat without and with transmitter, and holding time were recorded. Radio-transmitters were not placed on bats where the weight of the transmitter exceeded 5 percent of the bats weight. Documentation of radio-transmitter attachment is provided in Appendix E.

The decision to place transmitters on captured Indiana bats or northern long-eared bats is summarized as follows:

- The first adult female or juvenile male/female captured at any site (1st or 2nd night) received a transmitter.
- A second adult female or juvenile male/female captured at any site on the 1st night would not receive a transmitter.
- A second adult female or juvenile male/female captured at any site on the 2nd night can receive a transmitter at the discretion of the field crew if for instance the bat captured the previous night could not be tracked to a roost.
- If an adult male was captured on the 1st night, no transmitter was attached.
- If an adult male was captured on the 2nd night and no other female had been fitted with a transmitter, then the male can receive a transmitter.

On subsequent days following release, transmitter bats would be tracked to daylight roosts using a Wildlife Materials, Inc. TRX-2000S multiple band receiver equipped with a Wildlife Materials, Inc. three element folding Yagi directional antenna. When possible transmitted bats would be tracked to roosts for a minimum of seven days. Mobile telemetry would be performed by driving public roads and screening likely roost habitats within 4 km (2.5 miles) of the capture site to establish the general location of the transmitter signal, after which pedestrian tracking was employed to locate the specific roost. Mobile telemetry routes were tracked using either GPS or mobile telemetry data sheets (Appendix E).

Roost Emergence Counts

Evening emergence counts, if warranted, were conducted for each roost tree discovered through radio-telemetry tracking. Exit counts at roost trees would begin at sunset, and last approximately 1 hour or until bats quit emerging and/or darkness precluded accurate counting. Unless otherwise indicated, emergence counts at roost trees identified are to be conducted for a minimum of two nights. In instances where more than 30 bats are observed emerging, up to five nights of emergence counts are recommended. Roost tree characterization and habitat were documented for each tree identified by a transmitted bat.

Acoustic Data Collection and Analysis

This Phase 2 presence/absence survey has been based on mist netting techniques as per the 2015 Range-Wide Indiana Bat Guidelines; however, at the request of USFWS BFO, acoustic data was collected in the vicinity of each bat survey site on each night; however this data was not analyzed using approved automated software or via visual identification of call sequences. Zero-crossing high-frequency acoustic data were collected at each of the eleven Section 4 monitoring locations using AnaBat SD2 devices (Titley Electronics, PTY, LTD) using firmware V6061g. Lochmueller Group detectors used include SN 81581 and SN 83108. Detector placement, orientation and monitoring period were conducted in accordance with USFWS Phase 2 Acoustic Survey guidelines (USFWS, 2015). The detectors were deployed in Titley waterproof mobile monitoring stations consisting of Pelican waterproof case and a waterproof Hi Mic with a 3 meter (9.8 feet) cable. The waterproof microphone was mounted on a tripod at a minimum height of 1.5 meters (4.9 feet) above ground and positioned such that the axis for the cone of detection was at approximately a 30˚ to 40˚ incline. Sensitivity was adjusted to the maximum (typically between 6 and 7) that conditions would permit without collecting continuous background “noise”. Data division ratio was set at 8 and audio division ratio was set at 16. One detector was deployed at each monitoring location each night that mist netting was conducted. For each deployment, detectors were positioned and oriented to minimize interference and clutter, and maximize the potential for obtaining optimal call sequences. Typically, detectors were placed at appropriate locations for collecting quality acoustic data at the closest locations to the mist netting locations, but were not deployed within the stream channels or directed over bodies of water. Preferred habitats include open riparian corridors, open areas adjacent to woodland edges and fencerows, open trails, logging roads and utility corridors. GPM coordinates for the detector placement are included in Appendix C, Table 1. Aerial based mapping showing the location of each detector and photographs of the deployment habitat are provided in Appendix E. The specific limits of the “cone of detection” were not established.

The AnaBat devices at all sites were programmed to turn on at 8:30pm EDT and turn off at 7:00am EDT each night. The acoustic files will be provided to USFWS along with those generated from the bat survey sites in Sections 1 through 5 of the I-69 survey area.

RESULTS

Section 6 Mist Net Survey Results Summary

The 2015 Section 6 survey included a total of 38 complete survey nights and four partial survey nights. "Cold out" conditions precluded completion of complete surveys on 15, 16, 17 and 18 May. "Rain out" conditions precluded completion of full survey nights at Sites 6, 13, 25 and 33 on 26 July, 14 July, 8 July and 20 July respectively. The 38 complete and four partial survey nights yielded a total of 126 bats representing seven species: 72 big brown bats, 24 evening bats, 18 eastern red bats, 4 little brown bats, 3 Indiana bats, 3 northern long-eared bats, and 1 tri-colored bat. One bat escaped from the net at Site 3 before it could be retrieved and identified. USFWS listed species included three Indiana bat (endangered) captures collectively at Site 3 and Site 21, and three northern long-eared bat (threatened 4(d) rule) captures at Site 7 (West Fork Clear Creek), Site 13 (Stotts Creek) and Site 20 (Goose Creek). All three Indiana bats were non-reproductive females. The northern long-eared bats included a post-lactating female, and a juvenile female and a juvenile male. No gray bats (endangered) were captured. Additionally, Indiana state endangered bat species included 24 evening bat at seven different sites (Site 10, 14, 19, 20, 23, 30 and 31), each of which included either of reproductive female or juveniles.

Appendix C, Tables 3, 4 and 5 include capture data by species and reproductive condition for each net site. Big brown bats comprised 57.1 percent of those captured (excludes unidentified escapees), evening bats comprised 19.0 percent of those captured, eastern red bats comprised 14.2 percent, while little brown, Indiana, northern long-eared and tri-colored bats comprised 8.7 percent collectively.

Site 5 on West Fork Clear Creek did not result in any bat captures on either night. Site 6 (East Fork Clear Creek), Site 7 (Clear Creek), Site 17 (Banta Creek) and Site 24 (Pleasant Run east of SR37) only yielded a single bat for the two nights of survey at each location. The remaining sites yielded multiple captures on either one or both nights. Site 23 (Pleasant Run near White River confluence), Site 31 (UNT to White River at Waverly), Site 19 (Bluff Creek near SR37) and Site 20 (Goose Creek near White River confluence) and Site 3 (West Fork Clear Creek) yielded the greatest number of captures at 22, 16, 14, 13 and 11 bats respectively. Of the 15 sites from the 2004 survey that were resurveyed in 2015, only Sites 23 and 20 were among the top five most producing sites in both survey years.

Including data from partial survey nights, the mean number of bats captured per site was 6.6 and the mean number of bats per night was 3.0. The mean number of species per site was 2.3. The diversity index of MacArthur ($D= 1/\sum P_i^2$, where P_i is the proportion of each species of bat for the survey population) for the 2015 survey is 2.6 (Appendix C, Table 10).

Age, gender and reproductive condition were determined for 113 of the 126 bats captured (Appendix C, Tables 3, 4 and 5). Thirteen bats escaped before age, gender and reproductive data could be collected and are therefore not included in this synopsis. Adults (n=64) accounted for 56.6 percent and juveniles (n=49) represented 43.4 percent of those captured between 3 July and 6 August. Females (n=84) accounted for 74.3 percent of the bats captured and 58.3 percent of these (n=49) displayed signs

(pregnant, lactating or post lactating) of reproduction. Species that showed at least one reproductively active female included: big brown bat (n=35), evening bat (n=7), eastern red bat (n=4), little brown bat (n=1), northern long-eared bat (n=1), and tri-colored bat (n=1). Adult and juvenile male captures included the big brown bat (n=18), northern eastern red bat (n=6), northern long-eared bat (n=1) and evening bat (n=4).

Individual Mist Net Site Summaries

Habitat data sheets and bat capture data sheets for each site are included in Appendix D.

Site 3

This survey site is located on West Fork Clear Creek northeast of Martinsville, Indiana

A 6 m X 4.5 m (19.7 ft. x 14.8 ft.) and a 12 x 6.5 m (39.4 ft. x 21.3 ft.) mist net were set up over the channel. The channel is approximately 10 m (32.8 ft.) wide with 0.2m (8 inches) of water depth. Dominant canopy species (>40 cm [16 inch] dbh) were sycamore *(Plantanus occidentalis)*, green ash *(Fraxinus pennsylvanica*), and sugar maple (*Acer saccharum)* with subdominant canopy (<40 cm [16 inch] dbh) of cottonwood and sugar maple. The canopy is closed along this reach of the stream. Subcanopy clutter was moderate consisting of shrubs. Within the immediate area, roost tree potential is considered moderate, consisting mostly of a few large snags with quality habitat features and scattered shagbark hickory (*Carya ovata*) trees.

Four net nights at this site yielded eleven individuals from two species: big brown bat (n=8), Indiana bat (n=2) and unknown escapee (n=1). The capture rate was 2.8 bats/net night. The juvenile female Indiana bat captured on 20 July at 2328 was fitted with a 150.306 megahertz frequency transmitter and designated as bat 306. The juvenile female Indiana bat captured on 21 July at 0247 was fitted with a 150.936 megahertz frequency transmitter and designated as bat 936. Both bats were considered to be in a healthy state at the time of release.

Site 5

This survey site is located on West Fork Clear Creek northeast of Martinsville, Indiana

Two 9 m X 4.5 m (29.5 ft. x 14.8 ft.) mist nets were set up over the channel. The channel is approximately 11 m (36.1 ft.) wide with 0.1m (4 inches) of water depth. Dominant canopy species (>40 cm [16 inch] dbh) were red oak (*Quercus* rubra), sycamore, and sugar maple with subdominant canopy (<40 cm [16 inch] dbh) of black walnut (*Juglans nigra*), hackberry (*Celtis occidentalis*) and sugar maple. The canopy is closed along this reach of the stream. Subcanopy clutter was moderate consisting of saplings and shrubs. Within the immediate area, roost tree potential is considered moderate, consisting mostly of large trees and some snags.

Four net nights at this site yielded no bats. The capture rate was 0.0 bats/net night.

Site 6

This survey site is located on East Fork Clear Creek northeast of Martinsville, Indiana

A 9 m x 6.5 m (29.5 ft. x 21.3 ft.) mist net and a 6 m x 6.5 m (19.7 ft. x 21.3 ft.) mist net were set up over the channel. The channel is approximately 11 m (36.1 ft.) wide with 0.1m (4 inches) of water depth. Dominant canopy species (>40 cm [16 inch] dbh) were sycamore, and black walnut with subdominant canopy (<40 cm [16 inch] dbh) of sycamore, black walnut and boxelder. The

canopy was moderately open and the subcanopy clutter was closed consisting of low branches of canopy trees. Within the immediate area, roost tree potential is considered moderate, consisting mostly of large trees and some snags.

Six net nights (4 complete and 2 partial) at this site yielded one bat: big brown bat (n=1). The capture rate was 0.2 bats/net night (including the partial net nights).

Site 7

This site is located on Clear Creek A 9 m x 6.5 m (29.5 ft. x 21.3 ft.) mist net and a 6 m x 6.5 m (19.7 ft. x 21.3 ft.) mist net were set up over the channel. The channel is approximately 9 m (29.5 ft.) wide with 0.2 m (8 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were sycamore, black walnut and green ash with subdominant canopy (<40 cm [16 inch] dbh) composition of cottonwood, sycamore and sugar maple. The canopy closure was moderate and the subcanopy clutter was moderate, consisting of mostly shrubs. Within the immediate area, roost tree potential is considered low, consisting of only a few tall dead snags.

Four net nights at this site yielded one individual: northern long-eared bat (n=1). The capture rate was 0.3 bats/net night. The juvenile female northern long-eared bat captured on 28 July at 2228 was fitted with a 150.028 megahertz frequency transmitter and designated as bat 028.

Site 8

This site is located on Clear Creek approximately A 12 x 6.5 m (39.4 ft. x 21.3 ft.) and a 9 m x 6.5 m (29.5 ft. x 21.3 ft.) mist net were set up over the channel. The channel is approximately 12 m (39.4 ft.) wide with 0.2 m (8 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were sycamore and silver maple (*Acer saccharinum*) with subdominant canopy (<40 cm [16 inch] dbh) composition of sycamore, black walnut and silver maple. The canopy closure was moderate and the subcanopy clutter was moderate, consisting of mostly saplings. Within the immediate area, roost tree potential is considered high, consisting of large trees with quality habitat features and small dead snags.

Four net nights at this site yielded five individuals from two species: big brown bats (n=4) and eastern red bat (n=1). The capture rate was 1.3 bats/net night.

Site 10

This site is located on the confluence of an unnamed tributary with the White River A 9 m x 6.5 m (29.5 ft. x 21.3 ft.) net was set up at the confluence of the small unnamed tributary with the White River. A 12 x 6.5 m (39.4 ft. x 21.3 ft.) net was set up immediately west of N Henderson Road at the eastern end of an open water wetland. The channel is approximately 10 m (32.8 ft.) wide with 0.15 m (6 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were eastern cottonwood, sycamore and green ash, with subdominant (<40 cm [16 inch] dbh) canopy composition of green ash, sugarberry (*Celtis laevigata*) and boxelder. The canopy was moderately closed with open subcanopy clutter consisting of only a few small saplings. Within the immediate area, roost tree probability is considered moderate, consisting mostly of large trees and scattered dead snags.

Four net nights at this site yielded two individuals from two species: big brown bat (n=1) and evening bat (n=1). The capture rate was 0.5 bats/net night.

Site 13

This site is located on adjacent Stotts Creek A 12 m X 7.8 m (39.4 ft. x 25.6 ft.) and a 6 m x 7.8 m (19.7 ft. x 25.6 ft.) net were set up across a driveway adjacent to Stotts Creek. Dominant canopy (>40 cm [16 inch] dbh) species were sycamore, sugar maple, and ash species (*Fraxinus sp.*), with subdominant canopy (<40 cm [16 inch] dbh) composition of sugar maple, ash species, and sycamore. The canopy was moderately closed with moderate subcanopy clutter consisting of saplings, shrubs, and lower branches of canopy trees. Roost tree potential is low and limited to a few snags in the immediate vicinity.

Six net nights (4 complete and 2 partial) at this site yielded six individuals from three species: big brown bats (n=3), eastern red bats (n=2), and northern long-eared bat (n=1). The capture rate was 1.0 bats/net night (including the partial net nights). The juvenile male northern long-eared bat captured on 14 July at 2210 was not fitted with a transmitter because the 0.36 gram (0.01 ounce) transmitter was greater than 5 percent of the bats body weight.

Site 14

This site is located on Crooked Creek On 5 July a 12 m X 6 m (39.4 ft. x 19.7 ft.) net and a 9 m x 6 m (29.5 ft. x 19.7 ft.) net were set up across the channel immediately downstream and upstream of a bridge on an abandoned road. On 6 July two 6 m x 6 m (19.7 ft. x 19.7 ft.) nets were set up across the abandoned road. The channel is approximately 12 m (39.4 ft.) wide with 1 m (3.3 ft.) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were cottonwood and black walnut, with subdominant (<40 cm [16 inch] dbh) canopy composition of boxelder and Ohio buckeye (*Aesculus glabra*). The canopy was moderately closed with moderately open subcanopy clutter consisting of mostly saplings. Roost tree potential in the immediate vicinity is considered high consisting of large trees with quality habitat features and many snags.

Four net nights at this site yielded eight individuals from three species: big brown bats (n=6), eastern red bats (n=1), and evening bat (n=1). The capture rate was 2.0 bats/net night.

Site 17

This site is located on Banta Creek Two 9 m X 5.2 m (29.5 ft. x 17.0 ft.) nets were set up across the channel. The channel is approximately 8 m (26.2 ft.) wide with 20 cm (7.8 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were sycamore, ash species, and silver maple, with subdominant canopy (<40 cm [16 inch] dbh) composition of red elm (*Ulmus rubra)*, ash species, and black walnut. The canopy was moderately closed with moderate subcanopy clutter consisting of saplings, shrubs, and lower branches of canopy trees. Roost tree potential is low and limited to a few small snags in the immediate vicinity.

Four net nights at this site yielded one individual from one species: big brown bat (n=1). The capture rate was 0.3 bats/net night.

Site 19

This site is located on Travis Creek A 6 m X 6 m (19.7 ft. x 19.7 ft.) net was set up across the channel and a 9 m x 6 m (29.5 ft. x 19.7 ft.) net was set up across a dirt path adjacent to the creek. The channel is approximately 2 m (6.6 feet) wide with 0.15 m (5.9 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were sugar maple and hackberry, with subdominant canopy (<40 cm [16 inch] dbh) composition of sugar maple and white ash (*Fraxinus americana)*. The canopy was moderately closed with moderate subcanopy clutter consisting of saplings, shrubs, and lower branches of canopy trees. Roost tree potential is considered moderate and consists of a few large trees and scattered small snags in the immediate vicinity.

Four net nights at this site yielded fourteen individuals from three species: big brown bats (n=9), evening bats (n=3), and eastern red bats (n=2). The capture rate was 3.5 bats/net night.

Site 20

This site is located on Goose Creek

Two 9 m x 7.8 m (29.5ft. x 25.6 ft.) nets were set up across the channel. The channel is approximately 9 m (29.5 ft.) wide with 0.5 m (20 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were ash species, red elm, and silver maple, with subdominant canopy (<40 cm [16 inch] dbh) composition of ash species, mulberry species (*Morus sp.*), and silver maple. The canopy was moderately closed with moderate subcanopy clutter consisting of lower branches of canopy trees. Roost tree potential is considered low and consists of scattered small snags in the immediate vicinity.

Four net nights at this site yielded thirteen individuals from five species: big brown bats (n=7), evening bats (n=2), little brown bats (n=2), northern long-eared bat (n=1), and eastern red bat (n=1). The capture rate was 3.3 bats/net night. The adult post-lactating female northern long-eared bat captured on 2 August at 2350 was fitted with a 172.189 megahertz frequency transmitter and designated as bat 189.

Site 21

This site is located in a forested corridor adjacent to the White River One 9 m x 7.8 m (29.5ft. x 25.6 ft.) net was set up at the edge of the corridor and one 12 m x 7.8 m (39.4 ft. x 25.6 ft.) net was set up in an open field adjacent to the White River. Dominant canopy (>40 cm [16 inch] dbh) species were hackberry, ash species, and black walnut, with subdominant canopy (<40 cm [16 inch] dbh) composition of mulberry species, ash species, and hackberry. The canopy was considered open with open subcanopy clutter consisting of lower branches of canopy trees. Roost tree potential is considered low and consists of scattered snags in the immediate vicinity.

Four net nights at this site yielded four individuals from two species: big brown bats (n=3) and Indiana bat (n=1). The capture rate was 1.0 bats/net night. The juvenile female Indiana bat captured on 25 July was fitted with a 172.283 megahertz frequency transmitter and designated as bat 283.

Site 23

This site is located on Pleasant Run Creek One 9 m x 7.8 m (29.5ft. x 25.6 ft.) net and one 12 m x 7.8 m (39.4 ft. x 25.6 ft.) net were set up across the channel. The channel is approximately 15 m (49 ft.) wide with 0.5 m (20 inches) of water depth. Dominant canopy

(>40 cm [16 inch] dbh) species were silver maple and sycamore, with subdominant canopy (<40 cm [16 inch] dbh) composition of boxelder and sycamore. The canopy was moderately closed with open subcanopy clutter consisting of a few lower branches of canopy trees. Roost tree potential is considered moderate and consists of large tree and scattered small snags in the immediate vicinity.

Four net nights at this site yielded 22 individuals from three species: evening bats (n=12), big brown bats (n=9), and eastern red bat (n=1). The capture rate was 5.5 bats/net night.

Site 24

This site is located on Pleasant Run Creek

Two 9 m x 7.8 m (29.5 ft. x 25.6 ft.) nets were set up across the channel. The channel is approximately 11 m (36 ft.) wide with 0.25 m (10 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were ash species and sycamore, with subdominant canopy (<40 cm [16 inch] dbh) composition of ash species, black locust (*Robinia pseudoacacia*), and sycamore. The canopy was moderately closed with moderate subcanopy clutter of shrubs and lower branches of canopy trees. Roost tree potential is considered low and consists of a few large tree and scattered small snags in the immediate vicinity.

Four net nights at this site yielded one individual from one species: big brown bat (n=1). The capture rate was 0.3 bats/net night.

Site 25

This site is located on a trail immediately adjacent to the White River

A 9 m x 7.8 m (29.5ft. x 25.6 ft.) net and a 9 m x 5.2 m (29.5ft. x 17.1 ft.) net were set up on ATV trails in a bottomland forest adjacent to the White River and a matrix of oxbows, sloughs and quarry ponds associated with the White River. Dominant canopy (>40 cm [16 inch] dbh) species were cottonwood, red elm and silver maple with subdominant canopy (<40 cm [16 inch] dbh) composition of cottonwood, red elm and black walnut. The canopy was moderately closed with moderate subcanopy clutter consisting of shrubs and lower branches of canopy trees. Roost tree potential is considered moderate and consists of a few large trees with quality habitat features and small snags in the immediate vicinity.

Four net nights at this site yielded four individuals from one species: big brown bat (n=4). The capture rate was 1.0 bats/net night.

Site 30

This site is located on an unnamed tributary to the White River

One 9 m x 7.8 m (29.5 ft. x 25.6 ft.) net and one 9 m x 7.8 m (29.5 ft. x 25.6 ft.) were set up across the channel upstream from the confluence between the tributary and the White River. The channel is approximately 7 m (23 ft.) wide with 0.75 m (30 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were cottonwood, ash species and sycamore, with subdominant canopy (<40 cm [16 inch] dbh) composition of ash species, mulberry species, and silver maple. The canopy was moderately closed with moderate subcanopy clutter consisting of saplings and lower branches of canopy trees. Roost tree potential is considered moderate and consists of several large snags in the immediate vicinity.

Four net nights at this site yielded six individuals from three species: evening bats (n=3), big brown bats (n=2) and eastern red bat (n=1). The capture rate was 1.5 bats/net night.

Site 31

This site is located in a slough wetland

One 12 m x 7.8 m (39.4 ft. x 25.6 ft.) net was set up across the slough and one 9 m x 7.8 m (29.5 ft. x 25.6 ft.) net was set up in a flyway across a farm lane adjacent to the slough. Dominant canopy (>40 cm [16 inch] dbh) species were silver maple, with subdominant canopy (<40 cm [16 inch] dbh) composition of silver maple, red elm, and mulberry species. The canopy was moderately closed with moderate subcanopy clutter consisting of saplings and lower branches of canopy trees. Roost tree potential is considered moderate and consists of medium-high quality snags in the slough.

Four net nights at this site yielded sixteen individuals from four species: eastern red bats (n=7), big brown bats (n=6), evening bats (n=2), and little brown bat (n=1). The capture rate was 4.0 bats/net night.

Site 32

This site is located on Bluff Creek approximately

Two 9 m x 7.8 m (29.5 ft. x 25.6 ft.) nets were set up across the channel downstream from the Old SR 37 bridge. The channel is approximately 11 m (36 ft.) wide with 1 m (39 inches) of water depth. Dominant canopy (>40 cm [16 inch] dbh) species were silver maple, honeylocust (*Gleditsia* triacanthos) and hackberry, with subdominant canopy (<40 cm [16 inch] dbh) composition of silver maple, hackberry, and sycamore. The canopy was moderately closed with closed subcanopy clutter consisting of dense saplings, shrubs, and lower branches of canopy trees. Roost tree potential is considered low with few large trees or quality snags in the immediate vicinity.

Four net nights at this site yielded five individuals from two species: big brown bats (n=4) and eastern red bat (n=1). The capture rate was 1.3 bats/net night.

Site 33

This site is located on Little Buck Creek

Two 9 m x 7.8 m (29.5 ft. x 25.6 ft.) nets were set up across the channel downstream from the Belmont Avenue bridge. The channel is approximately 11 m (36 ft.) wide and was dry at the time of the survey. Dominant canopy (>40 cm [16 inch] dbh) species were silver maple, sycamore, and cottonwood, with subdominant canopy (<40 cm [16 inch] dbh) composition of ash species, sycamore and silver maple. The canopy was moderately closed with moderate subcanopy clutter consisting of saplings, shrubs, and lower branches of canopy trees. Roost tree potential is considered low with few large trees or quality snags in the immediate vicinity.

Four net nights at this site yielded four individuals from four species: big brown bat (n=1), tri-colored bat (n=1), little brown bat (n=1) and eastern red bat (n=1). The capture rate was 1.0 bats/net night.

Endangered Species, Radio-telemetry, Roost Tree Description and Emergence Count Results

Radio-telemetry data sheets are included in Appendix E. Roost tree habitat and emergence count data sheets are included in Appendix F.

Indiana bat
All three of the juvenile female Indiana bats captured (Site 3 n=2, Site 21 n=1) were fitted with radio transmitters (Table 6).

The female juvenile Indiana bat (Bat 306) captured at Site 3 on West Fork Clear Creek at 2328 on 20 July was tagged with a 150.306 MHz transmitter. Mobile telemetry for Bat 306 was attempted on 21, 24, 27 and 28 July along public roads within the local West Fork Clear Creek watershed and throughout the fish hatchery property, but no signal was ever detected. The transmitter was functioning properly at the time of attachment and was transmitting a signal post-release through monitoring from the capture site that evening.

The female juvenile Indiana bat (Bat 936) captured at Site 3 on West Fork Clear Creek at 0247 on 22 July was tagged with a 150.936 MHz. Mobile telemetry for Bat 936 was conducted on 22, 23, 24, 27, 28 and 30 July along public roads within the local West Fork Clear Creek watershed and throughout the fish hatchery property, but no signal was detected. The transmitter was functioning properly at the time of attachment and was transmitting a signal post-release through monitoring from the capture site that evening.

The juvenile female Indiana bat (Bat 283) captured at Site 21 on the east side of the White River at 2215 on 25 July was tagged with a 172.283 MHz transmitter and tracked to Roost 283-1 on two consecutive days (26 and 27 July) and Roost 283-2 for five consecutive days (28 July through 1 August). Roost 283-1 is a partially dead (stage 6 decay) eastern cottonwood with a 45 cm (18 inch) dbh. Emergence counts on 27 and 30 July were 13 and 7 respectively. Roost 283-2 is a dead eastern cottonwood with a 35 cm (14 inch) dbh. Emergence counts on 28 and 29 July were 30 and 38 respectively (Table 9). Both roost trees are approximately and approximately 48 meters (157 feet) from each other (Table 7). These roosts are approximately from the center of the 2.5 mile radius West Fork White River/ Pleasant Run Creek maternity colony defined from the Tier 1 data in 2004 and 2005.

Northern long-eared bat
Two of the three northern long-eared bats captured at Sites, 7, 13 and 20 were fitted with radio transmitters.

The juvenile male northern long-eared bat captured at Site 13 on 14 July was not fitted with a transmitter because the transmitter (approximate 0.35g) was more than 5 percent of the bats body mass and therefore not an acceptable candidate for radio telemetry.

The juvenile female bat (Bat 028) captured at Site 7 at 2228 on 28 July was tagged with a 150.028 MHz transmitter and tracked on 29 July. The active transmitter was found on the ground in a wetland woods

south of Clear Creek, east of SR37, approximately 217 meters southeast from the point of capture (Appendix E). The habitat for the area where the transmitter became detached from the bat includes numerous potential roosts (i.e., dead and dying trees with high quality roost potential).

The adult post-lactating female bat (Bat 189) captured at Site 20 at 2350 on 2 August was tagged with a 172.189 MHz transmitter and tracked to roost 189-1 on four consecutive days (3 August to 6 August). No signal was detected on tracking attempts on 7 and 8 August, and no additional roosts were identified. Roost 189-1 is a partially dead (stage 4 decay) black cherry (*Prunus serotina*) with a 39 cm (15 inch) dbh. Emergence counts on 4 and 5 August were 3 and 6 respectively (Table 9). The roost trees is approximately

from the center of the 1.5 mile radius White River-Goose Creek maternity colony defined from the 2004 and 2005 Tier 1 data.

Evening bat

The IDNR state endangered evening bat was the second most abundant species captured (n=24), comprising 19.0 percent (including escaped bats not identified) of the captures. It was identified at seven of the 19 sites (37 percent), most of which are in the central third of the study area. None were captured within the Clear Creek watershed in the south or in the Pleasant Run Creek watershed to the north. Half of the captures (n=12) were from Site 23. Reproductive adult females (n=7) and juvenile females (n=12) dominated the gender and reproductive classes, with the remainder consisting of one non-reproductive female and four juvenile males.

DISCUSSION

In 2004 the entire proposed route of I-69 from Evansville to Indianapolis, Indiana was sampled to determine the presence/probable absence of the federally endangered Indiana bat. The route was broken into six sections with Section 6 following the route of SR37 between the cities of Martinsville and Indianapolis, Indiana.

A presence/absence survey is typically considered valid between three and five years. As such, the U.S. Fish and Wildlife Service requested Section 6 be resurveyed using the current 2015 Range-Wide Indiana Bat Summer Survey Guidelines to provide up-dated data for the Section 6 Biological Assessment and the pending Environmental Impact Statement.

From 12 July to 26 July 2004, 29 net sites were surveyed for bats using mist nets as part of the Tier 1 EIS investigation for a total of 116 net nights. This effort yielded 253 bats representing seven species, or 2.18 bats per net night. Bats were captured from all but four of the 29 sites. The little brown bat was the most abundant (n=72, 18 sites), making up 28.4 percent of the total captures. The remaining species captured included the big brown bat (n=67, 17 sites), eastern tri-colored (n=30, 9 sites), evening bat (n=28, 4 sites), eastern red bat (n=25, 13 sites), northern long-eared bat (n=21, 11 sites) and Indiana bat (n=10, 8 sites). The greatest number of bats (n=31) was captured at Site 24; however, only three species were identified. Sites 10, 14, 15, and 20 each yielded five species.

From 12 July to 19 July 2005, seven of the 29 net sites from 2004 were resurveyed (Sites 7, 8, 10, 19, 20, 22 and 23) for a total of 24 net nights. This effort yielded 69 bats representing seven species, or 2.88 bats per net night. Bats were captured from all but one site (Site 22). The little brown bat was again the

most abundant (n=26, 6 sites), making up 37.7 percent of the total captures. The remaining species captured included the big brown bat (n=16, 4 sites), evening bat (n=15, 2 sites), northern long-eared bat (n=6, 4 sites), Indiana bat (n=3, 3 sites), eastern red bat (n=2, 1 site) and the eastern tri-colored (n=1, 1 site). Site 23 yielded the greatest number of bats (n=32) although this site was surveyed for three nights, while the other locations were only surveyed for one or two nights.

The 3 July to 6 August 2015 survey of 19 sites (84 net nights) yielded 126 bats representing seven species, or 1.5 bats per net night (includes partial night captures). The seven species for 2015 are the same as those from both the 2004 and 2005 surveys. The hoary bat, silver-haired bat and gray bat are the only other resident bats from Indiana (excluding the extirpated southeastern bat) not captured in these surveys. In stark contrast to the 2004 and 2005 surveys, the little brown bat was not the most abundant species captured in 2015. Only four individuals from three sites were captured in 2015 in comparison to the 72 individuals from 18 sites in 2004 and 26 individuals from six sites in 2005. While the big brown bat was the second most captured species in 2004 and 2005, it now appears to have replaced the little brown bat dominance, at least within the habitats that are being surveyed for the I-69 project. The eastern red and evening bats continue to be frequently encountered; however, the eastern tri-colored bat which was a relatively common capture in 2004 was only captured at one site (the new Site 33) from the 2015 effort.

The MacArthur diversity index for 2004 (29 sites) and 2005 (7 sites) was 5.3 and 3.9 respectively. For the 19 sites surveyed in 2015 the index experienced a reduction to 2.6.

Ten Indiana bats from eight sites were captured in the 2004 survey including four reproductive females, five juveniles and a non-reproductive adult resulting in a species capture rate of 0.09 bats per net night. In 2005 three individuals (all adult reproductive females) captured from three sites resulted in a species capture rate of 0.12 per net night. In contrast, the three Indiana bats captured (all juvenile females) in 2015 from two sites resulted in a species capture rate of just 0.04 per net night. Table 11 provides a comparison of Indiana bat captures by site for the three years of surveys conducted in Section 6.

In 2004, four Indiana bat roost trees were identified within Section 6. Roost 203R1 was along West Fork Clear Creek Roost 022R1 was in a White Lick Creek oxbow Roosts 105R1 and 105R2 are a pair of ridgetop roosts west of the White River between Martinsville and Waverly. In 2005, six additional roost trees were identified. Roost 6S2 was the same roost as 022R1 identified the previous year. Roosts 6S1, 6S3 and 6S4 are a group of trees within a White River oxbow slough located on the east side of the river between Roosts 6N1 and 6N2 are in the northern portion of the survey area in the bottomland wetland habitat associated with the White River and Pleasant Run Creek to the east of the White River.

Of the three Indiana bats that were fitted with radio transmitters (Bat 306, Bat 936 and Bat 283) only Bat 283 from Site 21 was tracked to roost trees. This pair of roosts (283-1 and 283-2) is associated with White River bottomland habitat west of the river

These roosts are approximately 1 kilometer (0.6 mile) west of the 6N1 and 6N2 roosts discovered in 2005. 2015 emergence counts from the two cottonwood trees (283-1 and 283-2) were 7, 13, 30 and 35 suggesting moderate use. In contrast, the counts from 6N1 and 6N2 in 2005 were 0 and 1.

Twenty-one northern long-eared bats from eleven sites were captured in the 2004 survey including two reproductive females, one non-reproductive female, twelve adult males and six juveniles resulting in a species capture rate of 0.18 bats per net night. In 2005, six individuals including a reproductive female, an adult male and four female juveniles captured from four sites resulted in a species capture rate of 0.24 per net night. In contrast, the three northern long-eared bats captured (reproductive female and two juveniles) in 2015 from three sites resulted in a species capture rate of just 0.04 per net night, considerably less that the 2004 and 2005 efforts. Table 12 provides a comparison of northern long-eared bat captures by site for the three years of surveys conducted in Section 6.

As previously noted, no roost identification for the northern long-eared bat was conducted as part of the 2004 and 2005 surveys since the species was not listed as threatened by the USFWS at that time. The single roost discovered for the species from an adult female captured at Site 20 along Goose Creek in 2015 is located in bottomland wetland habitat east of the White River

Emergence counts on 4 and 5 August of just 3 and 6 suggest that this is likely an alternate roost.

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Appendix A

Figures

Figures have been removed for confidentiality reasons related to the federally endangered Indiana bat and threatened northern long-eared bat

Appendix B

USFWS Indiana Bat Mist Netting Guidelines

I-69 Radio Telemetry Guidelines

Disinfection Protocol for Bat Field Studies – USFWS Region 3

USFWS INDIANA BAT MIST NETTING GUIDELINES

Summer Acoustic Survey Season

- 15 May to 15 August

Personnel

- A qualified biologist must select or approve of mist net sites as suitable for capturing Indiana bats, be present at each site throughout the survey and confirm all bat species identifications
- A qualified biologist can monitor multiple sites provided they can be monitored every 10 minutes via walking.

Equipment:

- Fine mesh (38 cm = 1.5 inch) nets of 50 or 75 denier 2 ply nylon.

Level of Effort (Midwest)

- Linear projects require a minimum of 4 net nights per km (0.6 miles) of suitable summer habitat.
- Non-linear project require a minimum of 4 net night per 0.5 km^2 (123 acres) of suitable summer habitat.
- Generally, no more than two nights at a single net location.

Net Placement

- Place approximately perpendicular across potential travel corridors extending from one side of the corridor to the other and extend from stream/ground surface up to overhanging canopy.
- Net width and overall height should be dictated by the size of the corridor being surveyed. Typical minimum size is 6 meter (19.7 ft) wide and two stacked panels high (approximately 2.5 meter [8.2 ft]).
- Distribute net set-ups throughout suitable habitat.
- Avoid net set-ups illuminated by artificial light.
- Photo document net placements.

Mist Netting Operations

- Check nets approximately every 10 to 15 minutes.
- Minimize noise, lights and movement near nets.
- Remove bats within 3 to 4 minutes
- Indiana bats should not be held for more than 30 minutes, or no longer than 45 minutes if targeted for radio telemetry.

Monitoring Period

- Continuous survey for 5 hours beginning at sunset.
- If site conditions (i.e., landscape setting) result in bats flying before sunset, survey should commence at dusk.

Weather Conditions: Cancel or terminate monitoring if any of the following occur for a particular night:

- Temperatures fall below 50˚F (10˚C) during the survey period.
- Precipitation (rain and/or fog) exceeds 30 minutes or continues intermittently during the first 5 hours of the survey period.
- Sustained high wind speeds > 4 meters/second (9 miles/hour; Beaufort = 3) during the first 5 hours of the survey period.

Indiana Bat Captures

- Photograph all Indiana bats showing
    - ¾ view of face showing ear, tragus and muzzle
    - View of calcar showing presence/absence of keel
    - Transverse view of toes showing extent of toe hairs
- Document all capture and individual measurements/observations (i.e, time of capture, gender, age, reproductive condition, weight, RFA, etc.)
- If species cannot be readily determined in the field, collect one or more fecal pellets for DNA analysis by temporarily placing the bat in a holding bag for no more than 30 minutes.
- Contact the appropriate USFWS FO within 48 hours of captures

Source: 2014 Range-Wide Indiana Bat Summer Survey Guidelines (January 2014)

I-69 RADIO TELEMETRY GUILDLINES

The primary goal in conducting radio telemetry is to locate and enumerate as many maternity colonies and their maternity roost trees (primary and alternate) as possible that may be present within the I-69 Action Area so that I-69 related impacts may be avoided and/or minimized. For this reason, surveyors should attach radio transmitters to the first two bats that are either reproductively active adult females or juveniles at each site. As a general rule, the attached transmitter and adhesive should not weigh more than 5% of a bat's weight. Transmitters may be placed on pregnant females, but professional judgment should be used to determine whether the bat will be overly stressed from the additional weight.

Guidelines for placing transmitters on captured Indiana bats or northern long-eared bats is summarized as follows:

- The first adult female or juvenile male/female captured at any site (1st or 2nd night) received a transmitter.
- A second adult female or juvenile male/female captured at any site on the 1st night would not receive a transmitter.
- A second adult female or juvenile male/female captured at any site on the 2nd night can receive a transmitter at the discretion of the field crew if for instance the bat captured the previous night could not be tracked to a roost.
- If an adult male was captured on the 1st night, no transmitter was attached.
- If an adult male was captured on the 2nd night and no other female had been fitted with a transmitter, then the male can receive a transmitter.

To fulfill Term and Condition No. 1 of the December 3, 2003 I-69 Biological Opinion and Incidental Take Statement, surveyors are to track all radio-tagged bats to their diurnal roosts for at least 5 days (do not necessarily have to be consecutive days). However, surveyors are encouraged to voluntarily continue daily tracking each bat for as long as feasible to generate more data and to allow a more complete picture of each colony's roosting behavior. An exhaustive search should be conducted during daylight hours in an attempt to locate each radio-tagged bat's diurnal roost tree each day. Land owners should be notified before entering their property to search for a roost tree.

National White-Nose Syndrome Decontamination Protocol - Version 06.25.2012

The fungus *Geomyces destructans* (*G.d.*) is the cause of white-nose syndrome (WNS), a disease that has devastated populations of hibernating bats in eastern North America. Since its discovery in New York in 2007, WNS has spread rapidly through northeastern, mid-Atlantic, and Midwest states and eastern Canada. It continues to threaten bat populations across the continent. For the protection of bats and their habitats, comply with all current cave and mine closures, advisories, and regulations on the federal, state, tribal, and private lands you plan to visit. In the absence of cave and mine closure policy, or when planned activities involve close/direct contact with bats, their environments, and/or associated materials, the following decontamination procedures should be implemented to **reduce the risk of transmission** of the fungus to other bats and/or habitats. For the purposes of clarification, the use of the word "decontamination," or any similar root, in this document entails both the 1) cleaning and 2) treatment to disinfect exposed materials.

Under no circumstances should clothing, footwear, or equipment that was used in a confirmed or suspect WNS-affected state or region be used in a WNS-unaffected state or region. Some state/federal regulatory or land management agencies have supplemental documents[1] that provide additional requirements or exemptions on lands under their jurisdiction.

I. TREATMENTS TO REDUCE RISK OF TRANSFERRING *GEOMYCES DESTRUCTANS*[2]:

Applications/Products:

The most universally available option for treatment of submersible gear is:

Submersion in Hot Water: Effective at sustained temperatures ≥50ºC (122ºF) for 20 minutes

Secondary or non-submersible treatment options (for a minimum of 10 min.) include:

	PRODUCT	Clorox® (6% HOCl) Bleach	Lysol® IC Quaternary Disinfectant Cleaner	Professional Lysol® Antibacterial All-purpose Cleaner	Formula 409® Antibacterial All-Purpose Cleaner	Lysol® Disinfecting Wipes
APPROVED USES	**Hard, non-porous surfaces**	Yes	Yes	Yes	Yes	Yes
	Non-porous personal protective safety equipment	No	Yes (headgear, goggles, rubber boots, etc.)	No	No	No
	All surfaces, including: porous clothing, fabric, cloth footwear, rubber boots	Yes (Do not use on ropes, harnesses or fabric safety gear.)	No	No	No	No
DILUTION / TREATMENT (as per label)		Effective at 1:10 dilution (bleach : water) [3,4]	Effective at 1:128 dilution (1 ounce: 1 gallon of water) [3,4]	Effective at 1:128 dilution (1 ounce: 1 gallon of water)[3,4]	Effective at concentrations specified by label[3,4]	Effective at 0.28 % di-methyl benzyl ammonium chloride[3,4]

[1] To find applicable addenda and/or supplemental information, visit http://www.whitenosesyndrome.org/topics/decontamination

[2]The use of trade, firm, or corporation names in this protocol is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by state and/or federal agencies of any product or service to the exclusion of others identified in the protocol that may also be suitable for the specified use.

[3] Product guidelines should be consulted for compatibility of use with one another before using any decontamination product. Also, detergents and quaternary ammonium compounds (i.e. Lysol® IC Quaternary Disinfectant Cleaner) should not be mixed directly with bleach as this will inactivate the bleach and in some cases produce a toxic chlorine gas. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

[4] Final determination of suitability for any decontaminant is the sole responsibility of the user. Use of some treatments which utilize such method need to be applied carefully, especially in confined spaces, due to inhalation or contact risks of the product. All users should be aware of these risks

Other effective disinfectant(s) with similar chemical formulas (e.g., a minimum of 0.3% quaternary ammonium compound) or water based applications may exist but are unknown and not recommended at this time.

REMEMBER, the product label is the law!

It is the responsibility of the users of this protocol to read and follow the product label and MSDS.

Products must be used in accordance with the label:

Ensuring the safety of those who use any of the above products for treatment is of utmost importance. Material safety data sheets (MSDS) developed by product manufacturers provide critical information on the physical properties, reactivity, potential health hazards, storage, disposal, and appropriate first aid procedures for handling or working with substances in a safe manner. Familiarization with MSDS for chemical products prior to use will help to ensure appropriate use of these materials and assist in emergency response.

It is a violation of federal law to use, store, or dispose of a regulated product in any manner not prescribed on the approved product label and associated MSDS.

- Disinfectant products, or their contaminated rinse water, should be managed and disposed of as per product label directions to avoid contamination of groundwater, drinking water, or non-municipal water feature such as streams, rivers, lakes, or other bodies of water. Follow all local, state and federal laws. State-by-state requirements for product disposal may vary. Note: Quaternary ammonium wastewaters should not be drained through septic systems because of the potential for system upset and subsequent leakage into groundwater.

II. PLAN AHEAD AND CAVE CLEAN:

Dedicate your Gear: Many types of rope and webbing have not been thoroughly tested for integrity after decontamination. Dedicate your gear to a single cave/mine or don't enter caves/mines that require this gear.
Bag it Up: Bring bags on all of your trips. All gear not decontaminated on site should be isolated (quarantined) in a sealed plastic bag/s or container/s to be cleaned and disinfected off-site.

Before Each Cave/Mine or Site Visit:

1.) Determine *G.d.*/WNS status[5] of the state/county(s) where your gear was previously used.

2.) Determine *G.d.*/WNS status[5] of state/county(s) to be visited.

3.) Determine whether your gear is permitted for your cave/mine visit or bat related activity, as defined by the current WNS case definitions[6] and the flowchart below.

4.) Choose gear that can be most effectively decontaminated [i.e., rubber wellington type (which can be treated with hot water and/or secondary treatment options in section I.) vs. leather boots] or dedicated to a specific location**. Remember, under no circumstances should any gear that was used in a WNS-affected state or region be used in a WNS-unaffected state or region.** Brand new gear can be used at any location where access is otherwise permitted.

5.) Determine if any state/federal regulatory or land management agency addendum or supplemental document[1] provides additional requirements or exemptions on lands under its jurisdiction that supplement the final instruction identified in the flowchart below.

6.) Prepare a "Clean Caving" strategy (i.e., how and where all gear and waste materials will be stored, treated and/or disposed after returning to your vehicle and base area) for your particular circumstances that provides for cleaning and treatment of gear on a daily basis **unless** instructed above to do so more frequently throughout the day.

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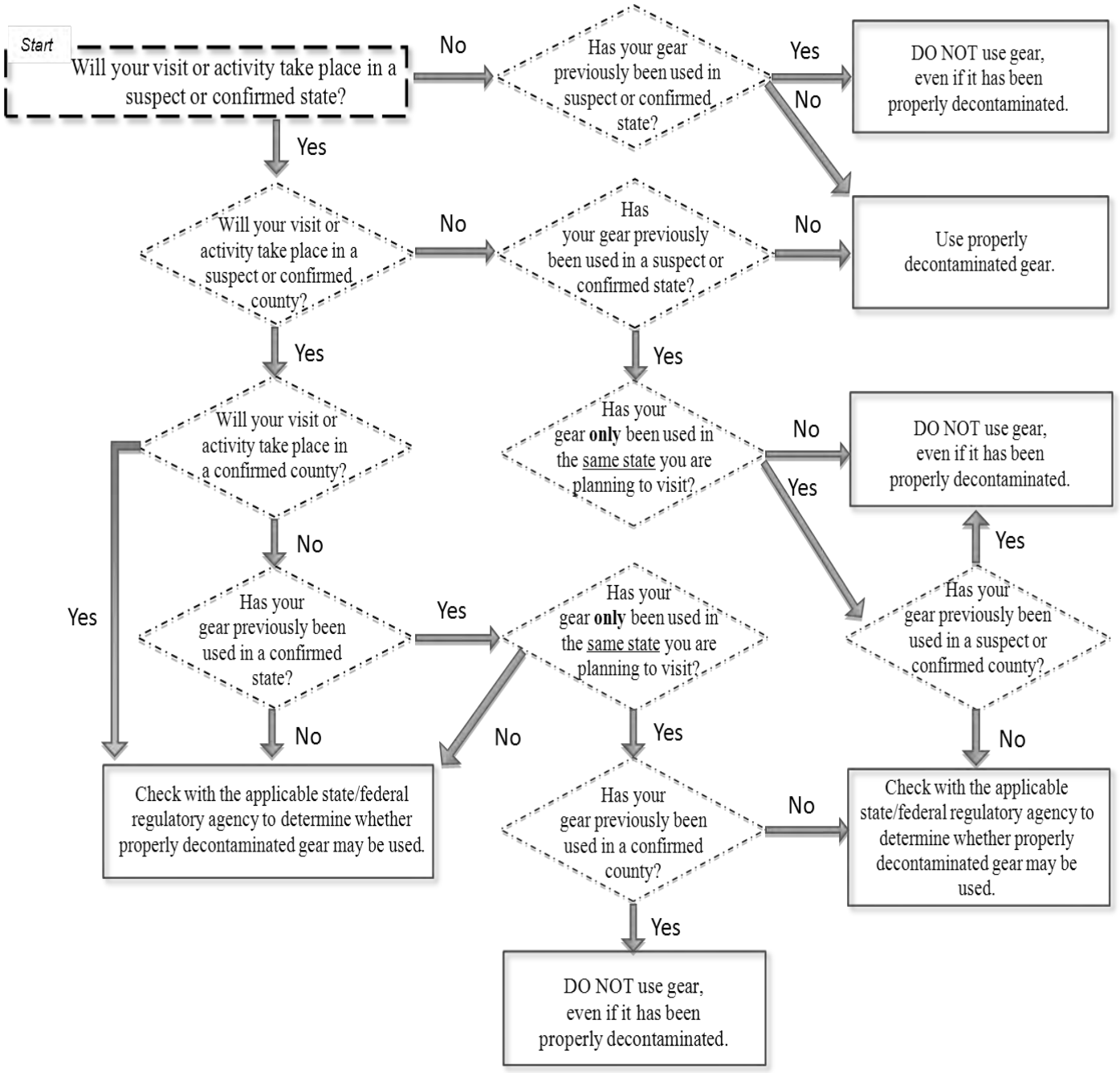
prior to entering cave environments and understand that products and corresponding procedures may cause irreversible harm. Always use personal protective equipment to reduce contact with these products, particularly when recommended by the manufacturer.

[5] Visit http://www.whitenosesyndrome.org/resources/map to determine the WNS status of a county or state.

[6] Visit http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/wns_definitions.jsp for current WNS case definitions.

7.) When visiting multiple caves/mines or bat research sites on the same day, clean and treat all gear between **each** cave/mine/site, **unless** otherwise directed in an agency/landowner addendum. It is recommended that known confirmed or suspect caves/mines be visited only after those sites of unknown *G.d.* status have been visited, to further reduce the risk of inadvertent transmission.

Flowchart to Determine Gear Use or Decontamination



After Each Cave/Mine or Site Visit:

1.) Thoroughly scrub and remove sediment/dirt from clothing, footwear, and other gear immediately upon emerging from the cave/mine or bat research site. Avoid contamination of vehicles; store exposed gear separately from unexposed gear.

2.) Once fully scrubbed and rinsed of all soil and organic material, clothing, footwear, and any appropriate gear should be sealed, bagged in a plastic container and once at home, machine or hand-washed/cleaned using a conventional cleanser like Woolite® detergent or Dawn® antibacterial dish soap in water (the use of Dawn® antibacterial dish soap is **not intended** for use in conventional washing machines.) Once cleaned, rinse gear thoroughly in water. Clean/treat gear used in a suspect or confirmed state prior to transport when traveling back to or through a state **without** known cases of *G.d.*/WNS. Use the treatments listed under Applications/Products on page 1 for a minimum of 10 (products) or 20 (hot water) minutes.

Remember: Many types of rope and webbing have not been thoroughly tested for integrity after decontamination. Dedicate your gear to a single cave/mine or don't enter caves/mines that require this gear.

A.) Submersible Gear (i.e. clothing, footwear, and/or equipment that can be submerged in liquid)**:**

Clothing, footwear, and other submersible gear:

Following steps 1 and 2 above, the primary treatment for all submersible gear should always be submersion in **water of at least 50ºC (122ºF) for a minimum of 20 minutes, where possible**. Some submersible gear (depending on material) could be soaked for a minimum of 10 minutes in the appropriate products listed in the Applications/Products chart on page 1, rinsed thoroughly in water again, and air dried. Note: Although commercially available washing machines with sanitation cycles often sustain desirable water temperatures**,** their efficacy for killing the conidia of *G.d*. is unknown.

B.) Non-submersible Gear:

Gear that may be damaged by liquid submersion should be cleaned according to the manufacturer's recommendation between cave/mine visits and when appropriate, follow steps 1 and 2 above in addition to following:

Cameras and Electronic Equipment:

Until effective techniques are developed to comprehensively disinfect cameras and electronics, it is recommended that these items only be used in caves when absolutely necessary. Regardless of the cave/mine visited, clean/treat cameras and electronics after each visit using an appropriate product listed in the Applications/Products chart on page 1. Equipment that must be used in the cave/mine may be placed in a sealed plastic casing (i.e., underwater camera housing), plastic freezer bag, or plastic wrap that permits operation of the equipment (i.e., glass lens is exposed) and reduces the risk of exposure to the cave environment. Prior to opening or removing any plastic protections, wipe the outside surfaces with an appropriate product described in the Applications/Products chart on page 1. Plastic freezer bag or wrap should be removed and discarded after each visit. A sealed plastic casing may be reusable if properly submersed in appropriate product as described in the Applications/Products chart and the functionality and protective features of the casing are not sacrificed (check with manufacturer). After removal of any outside plastic protection, all non-submersible equipment surfaces (i.e., camera body, lens, etc.) should be wiped using an appropriate product described in the Applications/Products chart.

3.) Reduce the risk of vehicle contamination and transport of *G.d*. to new areas by making sure to

A) transport gear in clean containers,

B) remove outer clothing/footwear and isolate in a sealed plastic bag or container prior to entering a vehicle. Storage container options vary considerably depending on the type of vehicle; but **always clean and disinfect the outside surfaces of storage containers prior to putting them in the vehicle**.

C) remain outside of the vehicle after exiting a cave/mine or completing field work,

D) change into clean clothing and footwear prior to entering the vehicle, and

E) clean dirt and debris from the outside of vehicles (especially wheels/undercarriage).

OBSERVATION OF LIVE OR DEAD BATS

If you observe live or dead bats (multiple individuals in a single location) that appear to exhibit signs of WNS, contact a wildlife professional in your nearest state (http://www.fws.gov/offices/statelinks.html) or federal wildlife agency (http://www.fws.gov/offices/, http://www.fs.fed.us/, http://www.blm.gov/wo/st/en.html, or http://www.nps.gov/ index.htm). **Do not handle bats unless authorized in writing to do so by the appropriate government agency.**

Note on the use of Pesticides/Products listed above:

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. §136 et seq. (1996))
http://www.epa.gov/oecaagct/lfra.html

defines a pesticide as follows:

(u) Pesticide
The term "pesticide" means (in part)
(1) any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest.

FIFRA defines a pest at §136:
(t) Pest
The term "pest" means (in part)
(1) any insect, rodent, nematode, fungus, weed, or (2) any other form of terrestrial or aquatic plant or animal life or virus, bacteria, or other micro-organism (except viruses, bacteria, or other micro-organisms on or in living man or other living animals) which the Administrator declares to be a pest under section 25(c)(1).

This document is the product of the multi-agency WNS Decontamination Team, a sub-group of the Disease Management Working Group established by the National WNS Plan (A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats, finalized May 2011). On 15 March 2012 a national decontamination protocol was adopted by the WNS Executive Committee, a body consisting of representatives from Federal, State, and Tribal agencies which oversees the implementation of the National WNS Plan. This version of the protocol contains some modifications to the 15 March version, intended to clarify the recommendations for the appropriate use of treatment options. This decontamination protocol will continue to be updated as necessary to include the most current information and guidance available.

Appendix C

Tables

Table 1. GPS coordinates for mist netting survey sites for I-69 Section 6

Site	County	Previous Survey IB and NLEB Captures			UTM Coordinates (meters)			
					Device	Northing	Easting	UTM Zone
Site 3	Morgan	2004			Net 1 Net 2 Detector			16S
Site 5	Morgan	2004	IB	NLEB	Net 1 Net 2 Detector			16S
Site 6	Morgan	2004		NLEB	Net 1 Net 2 Detector			16S
Site 7	Morgan	2004	IB	NLEB	Net 1 Net 2 Detector			16S
Site 8	Morgan	2004	IB		Net 1 Net 2 Detector			16S
Site 10	Morgan	2004	IB	NLEB	Net 1 Net 2 Detector			16S
Site 13	Morgan	2004			Net 1 Net 2 Detector			16S
Site 14	Morgan	2004	IB	NLEB	Net 1 Net 2 Net 3 Net 4 Detector			16S
Site 17	Morgan	2004			Net 1 Net 2 Detector			16S
Site 19	Johnson	2004	IB	NLEB	Net 1 Net 2 Detector			16S
Site 20	Morgan	2004	IB	NLEB	Net 1 Net 2 Detector			16S
Site 21	Johnson	2004		NLEB	Net 1 Net 2 Detector			16S
Site 23	Johnson	2004	IB	NLEB	Net 1 Net 2 Detector			16S
Site 24	Johnson	2004		NLEB	Net 1 Net 2 Detector			16S
Site 25	Marion	2004		NLEB	Net 1 Net 2 Detector			16S

Site	County	Previous Survey IB and NLEB Captures			UTM Coordinates (meters)			
					Device	Northing	Easting	UTM Zone
Site 30	Morgan	New			Net 1 Net 2 Detector			16S
Site 31	Morgan	New			Net 1 Net 2 Detector			16S
Site 32	Morgan	New			Net 1 Net 2 Detector			16S
Site 33	Marion	New			Net 1 Net 2 Detector			16S

IB = Indiana bat
NLEB = northern long-eared bat

Table 2. Maximum and minimum temperatures recorded during surveys for I-69 Section 6 in 2015

Site	Date	Maximum Temp		Minimum Temp	
		°C	°F	°C	°F
3	20 July 2015	25.0	77	20.6	69
	21 July 2015	20.6	69	14.4	58
5	21 July 2015	22.2	72	17.2	63
	22 July 2015	21.7	71	17.8	64
6	24 July 2015	21.7	71	22.8	62
	26 July 2015	22.8	73	21.7	71
	29 July 2015	27.2	81	17.8	64
7	27 July 2015	26.1	79	23.9	75
	28 July 2015	25.6	78	23.3	74
8	27 July 2015	26.7	80	21.7	71
	28 July 2015	not available	not available	not available	not available
10	22 July 2015	25.0	77	16.7	62
	23 July 2015	20.6	69	17.2	63
13	13 July 2015	not available	not available	not available	not available
	14 July 2015	26.2	79	22.2	72
	15 July 2015	25.0	19.0		66
14	5 July 2015	23.1	74	18.5	65
	6 July 2015	28.6	83	24.0	75
17	16 July 2015	27.2	81	20.4	69
	19 July 2015	29.3	85	22.9	73
19	3 July 2015	22.7	73	20.4	69
	4 July 2015	23.7	75	18.4	65
20	1 August 2015	26.3	79	18.8	66
	2 August 2015	26.8	80	23.7	75
21	25 July 2015	24.7	76	22.9	73
	27 July 2015	26.6	80	23.6	74
23	30 July 2015	25.5	78	20.5	69
	31 July 2015	26.3	79	21.3	70
24	5 August 2015	25.0	77	22.5	73
	6 August 2015	18.9	66	16.9	62
25	8 July 2015	21.6	71	20.3	69
	11 July 2015	25.1	77	21.7	71
	12 July 2015	23.8	75	21.4	71
30	28 July 2015	28.3	83	24.4	76
	29 July 2015	26.8	80	21.0	70
31	3 August 2015	27.1	81	19.1	66
	4 August 2015	25.0	77	19.9	68
32	23 July 2015	21.4	71	18.3	65
	24 July 2015	23.6	74	19.0	66
33	20 July 2015	24.5	78	24.5	76
	21 July 2015	24.0	75	16.2	61
	22 July 2015	23.4	74	21.7	71

Red highlight: Survey terminated due to "rain out" conditions

Table 3. Site specific and date specific data for mist net survey bat captures by sex and reproductive condition in Section 6

Site #	Date	Indiana bat										Little brown bat										Northern longear bat									
		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped	
Site 3	20-Jul					1																									
	21-Jul					1																									
Site 5	21-Jul																														
	22-Jul																														
Site 6	24-Jul																														
	26-Jul																														
	29-Jul																														
Site 7	27-Jul																														
	28-Jul																									1					
Site 8	27-Jul																														
	28-Jul																														
Site 10	22-Jul																														
	23-Jul																														
Site 13	13-Jul																														
	14-Jul																													1	
	15-Jul																														
Site 14	5-Jul																														
	6-Jul																													1	
Site 17	16-Jul																														
	19-Jul																														
Site 19	3-Jul																														
	4-Jul																														
Site 20	1-Aug																														
	2-Aug												1								1			1							
Site 21	25-Jul					1																									
	27-Jul																														
Site 23	30-Jul																														
	31-Jul																														
Site 24	5-Aug																														
	6-Aug																														
Site 25	8-Jul																														
	11-Jul																														
	12-Jul																														
Site 30	28-Jul																														
	29-Jul																														
Site 31	3-Aug													1																	
	4-Aug																														
Site 32	23-Jul																														
	24-Jul																														
Site 33	20-Jul																														
	21-Jul													1																	
	22-Jul																														
Species Totals		0	0	0	0	3	0	0	0	0		0	0	1	0	2	0	0	0	1		0	0	1	0	1	0	0	1	0	
Study Totals		3										4										3									
P_i^2		0.000576										0.001024										0.000576									
$D=1/\Sigma P_i^2$		2.6																													

Site #	Date	Evening bat										Silver-haired bat										Big brown bat									
		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Juvenile male - reproductive	Escaped
Site 3	20-Jul																					1	2	2		1			1		
	21-Jul																							1							
Site 5	21-Jul																														
	22-Jul																														
Site 6	24-Jul																							1							
	26-Jul																														
	29-Jul																														
Site 7	27-Jul																														
	28-Jul																														
Site 8	27-Jul																							2							1
	28-Jul																												1		
Site 10	22-Jul																					1									
	23-Jul								1																						
Site 13	13-Jul																														
	14-Jul									1														1							
	15-Jul																							1					1		
Site 14	5-Jul																							1					1		
	6-Jul								1															1		1			2		
Site 17	16-Jul																								1						
	19-Jul																														
Site 19	3-Jul		1																							1		1	1		1
	4-Jul						1			1												1						2	1		1
Site 20	1-Aug		1																												
	2-Aug						1																	3		3			1		
Site 21	25-Jul																									1					2
	27-Jul																														
Site 23	30-Jul								3	1	4													5							
	31-Jul								1		3													4							
Site 24	5-Aug																												1		
	6-Aug																														
Site 25	8-Jul																					2									
	11-Jul																														
	12-Jul																							1		1			1		1
Site 30	28-Jul								1		1													1							
	29-Jul								1															1							
Site 31	3-Aug								1		1													1		2			1	1	
	4-Aug																									1					
Site 32	23-Jul																							1			1				
	24-Jul																							1			1				
Site 33	20-Jul																												1		
	21-Jul																														
	22-Jul																														
Species Totals		0	1	6	1	12	0	0	4	0		0	0	0	0	0	0	0	0	0		2	5	28	1	11	2	6	9	1	7
Study Totals		24										0										72									
P_i^2		0.036864										0										0.331776									
$D=1/\Sigma P_i^2$																															

Site #	Date	Hoary bat										Eastern red bat										Tri-colored bat										Unknown	Total # of bat per site & night	Total # of bats per site	Average # of bats per night	Number of Species	Diversity Index
		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped		Adult female - pregnant	Adult female - lactating	Adult female - post lactating	Adult female - non-reproductive	Juvenile female	Adult male - reproductive	Adult male - non-reproductive	Juvenile male	Escaped								
Site 3	20-Jul																															1	9	11	5.5	2	1.8
	21-Jul																																2				
Site 5	21-Jul																																0	0	0	0	0.0
	22-Jul																																0				
Site 6	24-Jul																																1	1	0.33	1	1.0
	26-Jul																																0				
	29-Jul																																0				
Site 7	27-Jul																																0	1	0.5	1	1.0
	28-Jul																																1				
Site 8	27-Jul																																3	5	2.5	2	2.0
	28-Jul																																2				
Site 10	22-Jul																																1	2	1	2	2.0
	23-Jul																																1				
Site 13	13-Jul																																1	6	2	3	2.6
	14-Jul																																3				
	15-Jul																																2				
Site 14	5-Jul																																2	8	4	3	1.7
	6-Jul																																6				
Site 17	16-Jul																																1	1	0.5	1	1.0
	19-Jul																																0				
Site 19	3-Jul												1																				6	14	7	3	2.1
	4-Jul												1																				8				
Site 20	1-Aug																												1				2	13	6.5	5	2.9
	2-Aug																																11				
Site 21	25-Jul																																4	4	2	2	1.6
	27-Jul																																0				
Site 23	30-Jul																																14	22	11	3	2.1
	31-Jul																																8				
Site 24	5-Aug																																1	1	0.5	1	1.0
	6-Aug																																0				
Site 25	8-Jul																																2	6	3	1	1.0
	11-Jul																																0				
	12-Jul																																4				
Site 30	28-Jul																																4	6	3	3	2.6
	29-Jul																																2				
Site 31	3-Aug																																13	16	8	4	2.8
	4-Aug																																3				
Site 32	23-Jul																																3	5	2.5	2	1.5
	24-Jul																																2				
Site 33	20-Jul																																3	4	2	4	4.0
	21-Jul																																1				
	22-Jul																																0				
Species Totals		0	0	0	0	0	0	0	0	0		0	2	2	1	3	1	3	2	4		0	0	1	0	0	0	0	0	0	1	126				
Study Totals		0										18										1									1						
P_i^2		0										0.020736										0.000064														
$D=1/\Sigma P_i^2$																																				

Red shading indicates partial survey nights due to “rain out” conditions.

Table 4. Bat capture summary by sex and reproductive condition in Section 6

Species	Adult					Juvenile		Escaped	Total
	Male	Female				Male	Female		
		P	L	PL	NR				
Indiana bat							3		3
little brown bat				1			2	1	4
northern long-eared bat				1		1	1		3
evening bat			1	6	1	4	12		24
silver-haired bat									
big brown bat	8	2	5	28	1	10	11	7	72
hoary bat									
eastern red bat	4		2	2	1	2	3	4	18
tri-colored bat				1					1
escaped unknown								1	1
Total	12	2	8	39	3	17	32	13	126

[1] P = pregnant; L = lactating; PL = post-lactating; NR = non-reproductive

Table 5. Bats captured by sex and capture/net-night data in Section 6

Species	Male		Female		Escaped	c^2	*P*	Capture /net-night**
	Number	Percent	Number	Percent	Number			
Indiana bat		0.0%	3	3.6%		*	*	0.04
little brown bat		0.0%	3	3.6%	1	*	*	0.05
northern long-eared bat	1	3.4%	2	2.4%		*	*	0.04
evening bat	4	13.8%	20	23.8%		*	*	0.29
silver-haired bat		0.0%		0.0%		*	*	0.00
big brown bat	18	62.1%	47	56.0%	7	*	*	0.86
hoary bat		0.0%		0.0%		*	*	0.00
eastern red bat	6	20.7%	8	9.5%	4	*	*	0.21
tri-colored bat		0.0%	1	1.2%		*	*	0.01
unknown		0.0%		0.0%	1	*	*	0.01
Total	29	100.0%	84	100.0%	13			1.50

*The use of the Chi-squared test is not appropriate because in each case more than 20% of the expected frequencies are less than 5.

**Includes data from partial net nights

Table 6. Condition and telemetry information for Indiana bat and northern long-eared bat captured from in Section 6.

Bat Number	Capture Date	Capture Site	Transmitter Frequency	Species	Sex	Age Class	Reproductive Condition	Number of Roosts
NT	14-Jul	13	NT	MYSE	M	Juvenile	Non-descended	NA
306	20-Jul	3	150.306	MYSO	F	Juvenile	Non-reproductive	None
936	21-Jul	3	150.936	MYSO	F	Juvenile	Non-reproductive	None
283	25-Jul	21	172.283	MYSO	F	Juvenile	Non-reproductive	2
028	28-Jul	7	150.028	MYSE	F	Juvenile	Non-reproductive	None
189	2-Aug	20	172.189	MYSE	F	Adult	Post-lactating	1

MYSE = *Myotis septentrionalis*
MYSO = *Myotis sodalis*
NT = no transmitter

Table 7. Capture site and roost tree distance matrix for Indiana bat 283

Bat 283	Capture Site 21	Roost 283-1	Roost 283-2
Capture Site 21		1203 m	244 m
		3947 ft.	801 ft.
Roost 283-1	1203 m		48 m
	3947 ft.		157 ft.
Roost 283-2	244 m	48 m	
	801 ft.	157 ft.	

Table 8. Capture site and roost tree distance matrix for northern long-eared bat 189

Bat 189	Capture Site 20	Roost 189-1
Capture Site 20		749 m
		2457 ft.
Roost 189-1	749 m	
	2457 ft.	

Table 9. Summary of roost tree information and emergence counts

Bat Number	Roost ID	Tree Species	Condition	dbh (cm)	Exfoliating bark %	Canopy closure %	Roost height (m)	Roost Habitat	Emergence Count Date	Emergence Count
189	189-1	*Prunus serotina* black cherry	dead	39	25-30	40	10	forest swamp	4 Aug 2015 8 Aug 2015	3 6
283	283-1	*Populus deltoides* cottonwood	partial dead	45	10	5	12	forest swamp	27 July 2015 30 July 2015	13 7
	283-2	*Populus deltoides* cottonwood	dead	35	30-40	40	10	forest swamp	28 July 2015 29 July 2015	30 35

Table 10. Section 6 diversity indices for 2004, 2005 and 2015 surveys

Site ID	NEPA Surveys		
	2004	2005	2015
Site 1	0.0		
Site 2	1.8		
Site 3	2.4		1.8
Site 4	0.0		
Site 5	1.8		0.0
Site 6	1.7		1.0
Site 7	2.2	1.6	1.0
Site 8	3.0	3.0	2.0
Site 9	2.0		
Site 10	4.8	3.1	2.0
Site 11	1.0		
Site 12	1.6		
Site 13	2.0		2.6
Site 14	3.9		1.7
Site 15	1.9		
Site 16	0.0		
Site 17	0.0		1.0
Site 18	2.9		
Site 19	3.0	3.0	2.1
Site 20	4.8	1.8	2.9
Site 21	3.2		1.6
Site 22	2.0	3.2	
Site 23	2.9	0.0	2.1
Site 24	2.0		1.0
Site 25	2.0		1.0
Site 26	1.8		
Site 27	1.4		
Site 28	1.0		
Site 29	2.0		
Site 30			2.6
Site 31			2.8
Site 32			1.5
Site 33			4.0
Entire survey	5.3	3.9	2.6

Table 11. Section 6 2004, 2005 and 2015 Indiana bat capture summary and number of roosts identified

Site	Indiana bat		
	2004	2005	2015
Site 1			
Site 2			
Site 3			2 J-F
Site 4			
Site 5	1 A-M (1 roost)		
Site 6			
Site 7	1 A-F-PL	1 A-F-PL (2 roosts)	
Site 8	1 A-F-PL (1 roost)	1 A-F-L (2 roosts)	
Site 9			
Site 10	1 J-F		
Site 11			
Site 12			
Site 13			
Site 14	1 A-F-PL (2 roosts) 1 J-M		
Site 15			
Site 16			
Site 17			
Site 18			
Site 19	1 A-F-PL		
Site 20	1 J-M		
Site 21			1 J-F (2 roosts)
Site 22			
Site 23	1 J-M 1 J-F	1 A-F-L (2 roosts)	
Site 24			
Site 25			
Site 26			
Site 27			
Site 28			
Site 29			
Site 30			
Site 31			
Site 32			
Site 33			

Shaded cells indicate sites that were not surveyed in the respective year.
A = adult, J = juvenile, M = male, F = female
P = pregnant, L = lactating, PL = post-lactating

Table 12. Section 6 2004, 2005 and 2015 northern long-eared bat capture summary

Site	northern long-eared bat		
	2004	2005	2015
Site 1			
Site 2			
Site 3			
Site 4			
Site 5	1 A-M		
Site 6	1 A-F-PL 3 J-F 2 J-M		
Site 7		1 J-F	1 J-F
Site 8			
Site 9			
Site 10	1 J-F	2 J-F	
Site 11			
Site 12	3 A-M		
Site 13			1 J-M
Site 14	1 A-M		
Site 15	1 A-M		
Site 16			
Site 17			
Site 18			
Site 19	1 A-M	1 A-F-L	
Site 20	1 A-F-PL 2 A-M		1 A-F-PL (1 roost)
Site 21	2 A-M		
Site 22			
Site 23		1 A-M 1 J-F	
Site 24	1 A-M		
Site 25	1 J-M		
Site 26			
Site 27			
Site 28			
Site 29			
Site 30			
Site 31			
Site 32			
Site 33			

Shaded cells indicate sites that were not surveyed in the respective year.
A = adult, J = juvenile, M = male, F = female
P = pregnant, L = lactating, PL = post-lactating

Appendix D

Net Site Habitat and Bat Capture Data Sheets

This material has been removed for confidentiality reasons related to the federally endangered Indiana bat and threatened northern long-eared bat.

Appendix E

Radio-telemetry Tracking Data

This material has been removed for confidentiality reasons related to the federally endangered Indiana bat and threatened northern long-eared bat.

Appendix F

Roost Tree and Emergence Count Data Sheets

This material has been removed for confidentiality reasons related to the federally endangered Indiana bat and threatened northern long-eared bat.