United States Department of the Interior
Fish and Wildlife Service

Bloomington Field Office (ES)
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273

June 7, 2011

Mr. Robert Talley
Division Administrator
Federal Highway Administration
575 North Pennsylvania Street, Room 254
Indianapolis, Indiana 46204

Dear Mr. Talley:

This document transmits the Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed State Road 641 Terre Haute Bypass located in Vigo County, Indiana, and its effects on the Indiana bat (*Myotis sodalis*), in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Your request for formal consultation dated November 3, 2009 was received on November 3, 2009. Formal consultation was suspended at your request in a meeting of April 28, 2010 to await the results of additional bat surveys. We received your email dated February 7, 2011 requesting resumption of formal consultation, and concurred with it in an email dated February 14, 2011.

This biological opinion is based on information provided in the October 30, 2009 biological assessment; revised early coordination for an Environmental Assessment for new Phases 3 and 4 alignment alternatives initiated on September 25, 2007; the Indiana bat Habitat Fragmentation and Loss report dated December 22, 2008; the addendum to the biological assessment dated January 21, 2011; various telephone conversations and e-mails; field investigations; and other sources of information. A complete administrative record of this consultation is on file at the Service's Bloomington, Indiana Field Office.

Sincerely,

Scott E. Pruitt
Field Supervisor

cc: Regional Director, USFWS, Twin Cities, MN (ES-TE) Attn: Jennifer Szymanski

ES: MLitwin/812-334-4261/June 6, 2011

Endangered Species Act Section 7 Consultation - Biological Opinion

Action Agency: Federal Highway Administration

Action Considered: Construction of Phases 3 and 4 of SR 641

Consultation By: Region 3, U.S. Fish and Wildlife Service

Date of Issuance: June 2, 2011

CONSULTATION HISTORY

Section 7 consultation with the Federal Highway Administration (FHWA) and the Indiana Department of Transportation (INDOT) for the SR 641 project was first initiated in January, 1997, during early coordination (scoping) for the NEPA environmental document. The only listed species whose range includes the project area is the Indiana bat (*Myotis sodalis*). At that time the Service stated that summer habitat for the Indiana bat was present in the SR 641 study area, and recommended conducting mist net surveys to determine whether Indiana bats were present in the study area.

A bat survey was conducted in June and July, 1997, with negative results for Indiana bats. Subsequent to the bat survey, and in our review of the draft Environmental Impact Statement (EIS) in 1999, the Service concurred that the project was not likely to adversely affect the Indiana bat. After the final EIS (November, 1999) there was essentially no further Section 7 consultation until 2006.

Beginning in March, 2006 a series of new route alternatives was proposed for Phases 3 and 4 at the east end of the proposed route. By that time construction was underway on Phases 1 and 2. The first new alignment proposal was Line C, which was similar to the original Line Cx but with considerably less impacts to Indiana bat habitat along Little Honey Creek. During 2007 four new alignments were proposed for consideration: two east alignments (Line E1 and Line E2) and two south alignments (Lines E3(a) and E3(b)).

In May, 2007 another mist net survey for bats was conducted in response to the new alignments, the increased study area and the elapsed time since the previous survey. That survey resulted in the capture of a pregnant female Indiana bat on May 22. The capture location was adjacent to the east side of the existing State Road 46 alignment, which is also the shared routes of Lines C, Cx, E3(a) and E3(b). A radio-telemetry study of the captured bat was attempted, but the transmitter signal was not detected. Shortly thereafter the Service concluded that the project "may affect" the Indiana bat, and the Service, FHWA and INDOT entered into informal Section

7 consultation. The Service stated that a habitat impact analysis would be necessary to determine whether formal Section 7 consultation would be required.

The alternatives under consideration were later reduced to Lines E3(b) and E1, and in a letter of November 24, 2008 INDOT announced that Line E1 had been eliminated and that Line E3(b) was the new preferred alignment.

On December 23, 2008 INDOT finalized a document entitled "*Habitat Fragmentation and Loss for the Indiana Bat on Indiana Department of Transportation's Proposed SR 641 Bypass (Phases III and IV) in Terre Haute, Vigo County, Indiana*". That document provided a detailed analysis of the forest impacts associated with Line E3(b). On January 29, 2009 the agencies met to discuss the findings of the habitat loss document. At that meeting it was agreed that formal Section 7 consultation would be necessary, and the Service informed INDOT and FHWA of the type of additional information that would be necessary to complete a Biological Opinion. FHWA expressed the intent to repackage all of the previous information on the project, along with some additional information requested by the Service, into a Biological Assessment.

On September 10, 2009 the Service received the document entitled "Biological Assessment for the Indiana Bat on Indiana Department of Transportation's Proposed SR 641 Bypass (Phases III and IV) in Terre Haute, Vigo County, Indiana" (BA), dated August 7, 2009. After reviewing the BA the Service determined that it was not adequate to proceed with formal consultation, although FHWA had concurrently sent a request to initiate formal consultation. The Service did not concur with the BA's finding of "not likely to adversely affect".

Subsequently the Service continued informal consultation with the FHWA through its agent, Beam, Longest and Neff (BLN), and Environmental Solutions & Innovations, Inc. (ESI). ESI developed a conceptual list of modifications for the BA, and on October 19, 2009 the Service participated in a telephone conference call with FHWA , INDOT, BLN and ESI to discuss the proposed modifications.

On November 3, 2009 the Service received a modified BA dated October 30, 2009, and a concurrent request from FHWA to initiate formal consultation. After review of the modified BA the Service notified the FHWA by e-mail and letter dated November 16, 2009 that the Service had sufficient information to initiate formal consultation as of the date of FHWA's request (November 3, 2009). A draft Biological Onion was submitted to the FHWA for review on March 11, 2010.

After reviewing the draft biological opinion FHWA and INDOT expressed concerns about their ability to acquire and/or restore adequate habitat to compensate for habitat losses associated with the project (determined by the Service to be 3 acres of acquisition for each acre lost). During a conference call on April 28, 2010 among the Service, transportation agencies, and consultants, INDOT and FHWA stated that they had elected to perform additional, more extensive mist net surveys to reassess the project's impact on the Indiana bat. Because previous radio-telemetry efforts were unsuccessful, the primary focus of the additional surveys was to more accurately determine the Indiana bat's primary foraging and roosting habitat in relation to the project's Action Area. The Service agreed that if the results of the new bat survey demonstrated that the maternity colony was not using the project area, a conclusion of "not likely to adversely affect" would be issued. Formal consultation was suspended pending the results of the mist net survey.

The mist net survey plan was approved by the Service in a letter dated July 7, 2010 and the survey was conducted from July 26 through August 12, 2010. Radio-telemetry and roost tree emergence monitoring were conducted from July 30 through August 15. On August 11, 2010 the Service was notified by telephone call of the results of the bat survey, and the draft bat survey report dated October 15, 2010 was provided to the Service on December 15, 2010.

Mist net surveys during 2010 resulted in the capture of 4 Indiana bats at 3 sites, including 2 sites along the Little Honey Creek corridor (one of which was the previous 2009 capture site) and one site along the Honey Creek corridor. During telemetry studies 3 roost trees were located within a mile of the Project Area. The report concluded that a maternity colony of Indiana bats is present in the Project area.

Subsequent telephone calls and emails focused on the process and time frame for acquisition and/or protection of compensatory Indiana bat habitat. Due to the difficulty of finding suitable and available land parcels in the project area the Service agreed that, after reasonable land acquisition efforts had been exhausted, a post-construction demographic study of Indiana bats could be conducted in the project area as a surrogate for a shortfall in land acquisition. The study scope would reflect a cost equivalent to the value of the land acquisition shortfall. On January 6, 2010 INDOT's consultant, Beam Longest and Neff, submitted to the Service a proposed process for identification and acquisition of land parcels and approximate timetable for completion of the process and the formal consultation. The proposal indicated that multiple preliminary alternatives would be developed for the scope of the bat study, with a range of costs. The final study scope could not be determined until the land acquisition process had been completed and the extent of the land shortfall determined. The Service concurred with this approach.

On February 7, 2011 INDOT's environmental consultant provided an amendment to the BA and the FHWA requested resumption of formal consultation. The Service notified the FHWA on February 14, 2011 that the amendment provided adequate information to proceed with formal consultation.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The SR 641 bypass is a new terrain, freeway-quality road project extending from US 41 Highway south of Terre Haute to Interstate 70 Highway east of Terre Haute. The project consists of 4 phases, of which only Phases 3 and 4 are being considered in this biological opinion. Section 7 consultation for Phases 1 and 2 was completed in 1999 and those phases are under construction. The following project description was taken from the Environmental Assessment for Phases 3 and 4.

Phase III

The entire mainline length of SR 641 in Phase III (from the southern terminus to south of Moyer Road) would consist of two 12 ft. travel lanes in each direction with 10 ft. paved (11 ft. graded) outside shoulders and 4 ft. paved (5 ft. graded) inside shoulders. The median would be a 60 ft. depressed grass median. The design speed along SR 641 in Phase III will be 70 mph.

Beginning at the southern terminus, Alternative E3b veers further to the south than Line C and Line CX, crossing an unnamed tributary to Little Honey Creek located within a large forested tract. The crossing would consist of a three-span precast, pre-stressed concrete I-beam bridge, the size of which is yet to be determined. Upon emerging from the forested tract, it crosses an agricultural field and upland field before crossing Little Honey Creek approximately 1,930 ft. to the west of existing Riley Road. A three-span precast, pre-stressed concrete I-beam bridge is proposed at the Little Honey Creek crossing. Continuing eastward, Alternative E3b traverses a forested and agricultural parcel before crossing existing Riley Road.

A bridge would not be provided at Riley Road, but the road would be realigned along an estimated 2,000 ft. section converging at a full diamond interchange with SR 641 and SR 46. Existing Riley Road south of the proposed SR 641 route would dead end with a cul-de-sac to prevent movement across the proposed highway and would form a three legged intersection at Tucker Street. Riley Road east of Tucker Street to SR 46 would become a local access road. SR 46 would also require realignment beginning at a point approximately 275 ft. northwest of its existing intersection with Riley Road. The SR 46 typical section would consist of one 12 ft. travel lane in each direction with 8 ft. paved (9 ft. usable) shoulders. The Riley Road realignment along the north side of SR 641 would continue to the northwest for approximately 1,150 ft. before intersecting the southern ramp junction of the full diamond interchange. At this ramp junction, a roundabout is proposed, providing a reduced speed/continuous access flow from SR 46 to Riley Road and SR 641. A similar roundabout is proposed at the connection of the northern ramps providing access for Riley Road traffic to SR 641 and SR 46. Each roundabout would have an entry design speed of 20 mph, reduced to 15 mph for the circulating roadway. The two roundabouts would be separated by a two-span precast concrete I-beam bridge approximately 195 ft. in length that carries Riley Road over SR 641. On the north side of SR 641, approximately 700 ft. of existing Riley Road would be realigned for approximately 2,000 feet. The Riley Road realignment would commence at a point approximately 200 feet south of the Little Honey Creek crossing. Riley Road would consist of two 11 ft. travel lanes and 8 ft. paved (9 ft. usable) shoulders.

Tucker Street would be reconstructed and realigned to (perpendicularly) intersect with realigned SR 46. Work along Tucker Street would begin approximately 275 ft. south of its intersection with Riley Road and would continue 760 ft. to the northeast to proposed SR 46. Tucker Street would consist of two 11 ft. travel lanes bordered by 4 ft. usable shoulders. Continuing north of the SR 46/Tucker Street intersection, a local service road would be provided that extends approximately 1.2 miles (6,363 ft.) to the north, terminating at Sony Drive. The service road would consist of two 11ft. travel lanes bordered by 2 ft. paved (4 ft graded) shoulders.

Phase IV

The mainline of SR 641/SR 46 in Phase IV (from Moyer Road to Margaret Avenue) would consist of two 12 ft. through lanes in each direction with 10 ft paved (11 ft graded) outside shoulders. The median would transition from a 60 ft. depressed grass median, which is proposed in Phase III, to a 26 ft. paved median with barrier wall. North of the I-70 southern ramp terminal, the median would transition from a barrier wall to a raised median before terminating at a point approximately 150 ft. north of Margaret Avenue. The design speed of SR 641/SR 46 in Phase IV will be 55 mph from Moyer Road to the southern I-70 ramp junction and reduced to 45 mph to Margaret Avenue.

At Moyer Road a grade separation is proposed that would elevate Moyer Road over SR 641/SR 46. Furthermore, the existing structure that carries Moyer Road over Little Honey Creek is proposed to be replaced. Moyer Road would consist of one 11 ft. travel lane in each direction bordered by a 2 ft. paved (4 ft. graded) shoulder. The design speed for Moyer Road will be 35 mph.

Alternative E3b would continue north of Moyer Road, shifted to the east of the existing SR 46 alignment to provide for sufficient area for relocation of Little Honey Creek. It will be necessary to relocate approximately 3,550 ft. of Little Honey Creek. The creek would be realigned along a meandering section that would extend approximately 3,775 ft. in length. The realignment would begin at a point approximately 185 ft. upstream of the Moyer Road crossing and would terminate at approximately the existing crossing that carries Little Honey Creek under SR 46.

North of the Moyer Road Bridge SR 641/SR 46 would include additional acceleration and deceleration lanes for the I-70 interchange. The proposed SR 641/SR 46 interchange at I-70 would be modified from a folded diamond to a Parclo-B interchange. The Parclo-B interchange would utilize two collector/distributor roads with loop ramps: one in the northwest quadrant and the other in the southeast quadrant. Directional ramps are proposed in all four quadrants. With the exception of the northeast quadrant, the interchange ramps are proposed to be single 16 ft. lanes with an 8 ft. paved (11 ft. graded) outside shoulder and a 4 ft. paved (7 ft. graded) inside shoulder. The northeast ramp will consist of two 12 foot lanes after diverging from the westbound collector/distributor road. The design speed for directional ramps and collector distributor roads will be 50 mph. The design speed of loop ramps will be 25 mph.

Improvements are also proposed for the I-70 mainline. The improvements include raising the profile grade of the roadway while maintaining the two travel lanes in each direction and replacing the existing twin bridges. No changes to the existing geometric configuration of the travel lanes or median are anticipated. Grade changes are necessary to provide the required vertical clearance of I-70 over SR 641. The existing clearance of I-70 over SR 46 is approximately 14 ft. 5 in. The minimum vertical clearance of I-70 over the proposed SR 641 will be 16 ft. 6 in. It is not feasible to retain the existing I-70 bridges and profile grade by lowering the grade along SR 641 due to geometric constraints, and drainage and maintenance of traffic concerns; therefore, the I-70 interchange bridges over SR 46/SR 641 will require

replacement along with a raise in the grade. In addition, the existing bridges will not accommodate the proposed lanes for SR 641; therefore, widening of the structure will be required.
A local service road would be provided along the eastern side of existing SR 641/SR 46 providing access to Moyer Road and properties east of SR 641. The local service road would consist of one 11 ft. travel lane in each direction bordered by a 2 ft. paved (4 ft. graded) shoulder. The alignment of the local service road would begin at the intersection of realigned SR 46 and Tucker Street and extend northward, roughly parallel to SR 641/SR 46, approximately 1.2 miles terminating at Sony Drive.

At its intersection with Moyer Road, the alignment of the local service road would shift approximately 377 ft. to the east of the proposed Moyer Road bridge that would traverse SR 641/SR 46. The shift in alignment is necessary to provide proper intersection sight distance in relationship to the proposed bridge. The design speed of the local service road would be 35 mph. Additionally, access to farmland south of I-70 and west of an existing pond in the southwest quadrant of the I-70/SR 46 interchange will be provided. It is proposed to extend existing 30th street approximately 1,700 feet to the east as a local access road. This access road would consist of one 11 ft. travel lane in each direction bordered by a 2 ft. paved (4 ft. graded) shoulder with a cul-de-sac east terminus. The design speed of this local service road would be 35 mph.

Proposed Right-of-Way

The proposed right-of-way would be full limited access, providing points of access at only two interchanges, one at SR 46 and Riley Road and the other at I-70. Beginning at the southern terminus of Phase III, a band of right-of-way extending approximately 246 ft. on either side of the centerline would be required to the proposed SR 641 interchange with Riley Road and SR 46. At the interchange the right-of-way would expand from a total minimum width of approximately 470 ft. to a total maximum width of approximately 2,000 ft., and incorporate the realignment of Riley Road and SR 46, as well as the local service road that is along the east side of the interchange. Right-of-way along SR 46 from the proposed SR 641 interchange to the southeast would be a typical width of 83 ft. either side of the centerline (166 ft. total).

Proposed right-of-way along Tucker Street would be a typical width of 45 ft. either side of the centerline (90 ft. total). The right-of-way is necessary for the realignment of Tucker Street to intersect with realigned SR 46.

North of the proposed SR 641 interchange with Riley Road and SR 46, SR 641 would utilize the existing SR 46 corridor, but would still require additional right-of-way. Right-of-way requirements from this point north to the I-70 interchange would be irregular in width due to the relocation of Little Honey Creek to the west and the local service road to the east. Additionally, right-of-way would be required along Moyer Road for its grade separation from SR 641/SR 46. Along Moyer Road the proposed right-of-way would expand from a total minimum width of 100 ft. to a total maximum width of 383 ft. Continuing northward, and not taking into consideration the existing SR 46 right-of-way, the limits of the proposed right-of-way would expand from a minimum of approximately 192 ft. (west of the proposed centerline) and 250 ft. (east of the

proposed centerline) to a maximum width of 430 ft. (west of the proposed centerline) and 570 ft. (east of the proposed centerline). North of the I-70 interchange, right-of-way would be a typical width of 114 ft. (west of the proposed centerline) and 100 ft. (east of the proposed centerline).

Temporary right-of-way will be required in certain locations. Upon the completion of construction, any acquired temporary right-of-way would revert to the original property owner(s).

Land use of the acquired right-of-way is primarily agricultural, upland field and forest. North of the I-70 interchange, land use of the proposed right-of-way becomes commercial in nature.

Conservation Measures

On pages 8-10 the BA lists several design features to minimize adverse effects of construction on fish and wildlife, under the headings of Construction, Operation and Maintenance, and Additional Avoidance and Minimization Measures. The majority of those measures are not directly related to conservation of Indiana bats, however several measures may serve to minimize impacts to bat habitat, and the following measures are specific for Indiana bats:

1. Do not cut any trees greater than 3 inches dbh from April 1 through September 30.
2. Implement seasonal tree clearing in areas near suitable maternity roosts to preclude the possibility of roost abandonment due to excessive disturbance.
3. Provide foraging habitat for Indiana bats through restoration of cleared areas.
4. Provide habitat replacement at forest mitigation sites. (The wetland mitigation site for the SR 641 project is in the Wabash River floodplain west of Terre Haute, approximately 6 miles from the Phase 3 and 4 project site and outside the Action Area. Other mitigation locations were not specified.)

Other mitigation measures which will benefit Indiana bats are preservation of habitat within the right-of-way outside the construction zone, relocation of the Little Honey Creek channel and riparian zone using a natural channel design, and compensatory mitigation for wetlands. Section 2.3 on Page 11 provides “Measures for Further Conservation and Recovery [of the Indiana bat]. Listed measures are paraphrased as follows:

1. Avoid future tree removal along SR 641 except for vehicle safety and compliance with federal regulations. INDOT would consult with the Service for future tree removal when potential Indiana bat habitat may be affected.

2. Preserve and protect remaining habitat for the Indiana bat maternity colony, potentially including:

a. Permanent protection via conservation easement.
b. Incorporation of bat habitat into wetland mitigation areas.
c. Forest management [to enhance Indiana bat habitat].
d. Bat box installation.
e. Development of an Indiana bat Conservation Plan to coordinate all conservation measures.

The amendment to the BA provided a process and timetable for mitigation land acquisition and for development of the aforementioned surrogate Indiana bat study.

SPECIES DESCRIPTION

The Indiana bat is a medium-sized bat in the genus *Myotis*. Its forearm length is 1 3/8-1 5/8 in), and the head and body length ranges from 1 5/8-1 7/8 in. This species closely resembles the little brown bat (*M. lucifugus*) and the northern long-eared bat (*M. septentrionalis*). The Indiana Bat Draft Recovery Plan (US Fish and Wildlife Service 2007) provides a comprehensive summary of the description of the species and is incorporated by reference.

Listing Status

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates in caves and mines in the winter and summers in wooded areas. The Indiana bat was officially listed as an endangered species on March 11, 1967 (Federal Register 32[48]:4001), under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U.S.C. 668aa[c]). The ESA extended full protection to the species.

Critical Habitat

Critical habitat was designated for the species on September 24, 1976 (41 FR 14914). Thirteen hibernacula including 11 caves and two mines in six states were listed as critical habitat:

Illinois - Blackball Mine (LaSalle Co.);
Indiana - Big Wyandotte Cave (Crawford Co.), Ray's Cave (Greene Co.);
Kentucky - Bat Cave (Carter Co.), Coach Cave (Edmonson Co.);
Missouri - Cave 021 (Crawford Co.), Caves 009 and 017 (Franklin Co.), Pilot Knob Mine (Iron Co.), Bat Cave (Shannon Co.), Cave 029 (Washington Co.);
Tennessee - White Oak Blowhole Cave (Blount Co.); and
West Virginia - Hellhole Cave (Pendleton Co.).

Life History

The average life span of the Indiana bat is 5 to 10 years, but banded individuals have been documented living as long as 14 and 15 years (Humphrey et al. 1977). Female survivorship in an Indiana population was 76% for ages 1 to 6 years and 66% for ages 6 to 10 years. Male survivorship was 70% for ages 1 to 6 years and 36% for ages 6 to 10 years (Humphrey et al. 1977).

The Indiana bat is a migratory bat, hibernating in caves and mines in the winter (typically October through April) and migrating to summer habitat. Although some aggregations of male Indiana bats have been observed (Hall 1962, Carter et al. 2001), males and non-reproductive females typically do not roost in colonies and may stay close to their hibernaculum (Whitaker

and Brack 2002) or migrate long distances to their summer habitat (Kurta and Rice 2002). Reproductive females may migrate up to 357 miles to form maternity colonies to bear and raise their young (Winhold and Kurta 2006, Kurta and Murray 2002). However, much shorter movements have been observed in New York. Both males and females return to hibernacula in late summer or early fall to mate and enter hibernation. The Indiana Bat Draft Recovery Plan (US Fish and Wildlife Service 2007) provides a comprehensive summary of Indiana bat life history and are incorporated by reference.

Food Habits

The Indiana bat feeds primarily on aquatic and terrestrial insects. Diet varies seasonally and variations exist among different ages, sexes, and reproductive status (US Fish and Wildlife Service 2007). Numerous foraging habitat studies have been completed for the Indiana bat. These studies found that Indiana bats forage in closed to semi-open forested habitats and forest edges located in floodplains, riparian areas, lowlands, and uplands. Forested habitats are very important for foraging bats, but old fields and agricultural areas seem to also be somewhat important habitats in studies completed in Indiana (US Fish and Wildlife Service 2007). At a study site near the Indianapolis International Airport, (Sparks et al. 2005) found Indiana bats spending nearly 51% of their time foraging over agricultural fields with movements focused along a riparian corridor. Indiana bats, foraging in open habitats at other sites, are probably utilizing forest-field edges and crowns of large scattered trees within the open canopy habitats.

Habitat Requirements

The Indiana Bat Draft Recovery Plan (US Fish and Wildlife Service 2007) and the BA for the SR 641 project provide more comprehensive summaries of habitat requirements and are incorporated in this biological opinion by reference.

During winter, Indiana bats are restricted to suitable underground habitats known as hibernacula. The majority of hibernacula consist of limestone caves, especially in karst areas of east central United States, but abandoned underground mines, railroad tunnels, and even hydroelectric dams can provide winter habitat throughout the species' range (US Fish and Wildlife Service 2007). In New York, the largest and most rapidly growing populations of Indiana bats occured in abandoned underground mines (Hicks and Novak 2002) before the onset of White-nose Syndrome (discussed later in this document). Hibernacula with stable and/or growing populations of Indiana bats have stable low temperatures that allow the bats to maintain a low rate of metabolism and conserve fat reserves through the winter.

Spring emergence occurs when outside temperatures have increased and insects (forage) are more abundant (Richter et al. 1993). In New York, spring emergence studies have consistently shown that Indiana bats emerge once evening temperatures remain higher than 50ºF after April 15 (A. Hicks, pers. comm.). Some bats may remain in close proximity of the cave for a few days before migrating to summer habitats. This activity is known as spring staging. Others head directly to summer habitat. Roost trees used by adult females during this mid-spring period are similar to those used during the summer in terms of species, size, and structure (Britzke et al. 2006).

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

Summering Indiana bats (males and females) roost in trees in riparian, bottomland, and upland forests. Roost trees generally have exfoliating bark which allows the bat to roost between the bark and bole of the tree. Cavities and crevices in trees also may be used for roosting. A variety of tree species are used for roosts including, but not limited to, silver maple (*Acer saccharinum*), sugar maple (*Acer saccharum*), shagbark hickory (*Carya ovata*), shellbark hickory (*Carya laciniosa*), bitternut hickory (*Carya cordiformis*), green ash (*Fraxinus pennsylvanica*), white ash (*Fraxinus americana*), eastern cottonwood (*Populus deltoides*), northern red oak (*Quercus rubra*), post oak (*Quercus stellata*), white oak (*Quercus alba*), shingle oak (*Quercus imbricaria*), slippery elm (*Ulmus rubra*), American elm (*Ulmus americana*), and sassafras (*Sassafras albidum*) (Rommé et al. 1995). Structure is probably more important than the species in determining if a tree is a suitable roost site; tree species which develop loose, exfoliating bark as they age and die are likely to provide roost sites. Male bats disperse throughout the range and roost individually or in small groups. In contrast, reproductive females form larger groups, referred to as maternity colonies in which they raise their offspring. Non-reproductive females may roost individually or in small groups but occasionally are found roosting with reproductive females. While Indiana bats primarily roost in trees, some colonies have been found in artificial roost sites. Only four maternity colonies have been found in buildings; in comparison, more than 400 roost trees have been documented for female Indiana bats (US Fish and Wildlife Service 2007).

Indiana bat roost trees have been described as either primary or alternate depending on the number of bats in a colony consistently occupying the roost site. In Missouri, Callahan (1993) defined primary roost trees as those with exit counts of more than 30 bats on more than one occasion; however, this number may not be applicable to small-to-moderate sized maternity colonies. Kurta (2005) summarized summer habitat information from 11 states and found most exit counts at primary roosts are at least 20-100 adults with a typical maximum of 60-70 adults in a primary roost at any given time. Primary roost trees are almost always located in either open canopy sites or in the portion of a tree used by bats that is above the canopy cover of the adjacent trees (Callahan et al. 1997; Kurta et al. 2002). Alternate roost trees can occur in either open or closed canopy habitats. Maternity colonies use a minimum of 8-25 trees per season (Callahan et al. 1997; Kurta et al. 2002). On the average Indiana bats typically switch roosts every two to three days, with reproductive condition of the female, roost type, weather conditions, and time of year affecting switching behavior (Kurta et al. 2002; Kurta 2005).

Exposure of trees to sunlight and location relative to other trees are important to suitability. Cool temperatures can delay development of fetal and juvenile young and selection of maternity roost sites may be critical to reproductive success. Dead trees with southeast and south-southwest exposures allow warming solar radiation. Maternity colonies use multiple roosts in both dead and living trees that are grouped. Extent and configuration of a use area is probably determined by availability of suitable roost sites. Distances between roosts can be a few meters to a few kilometers. Reasons for frequent roost switching may be a response to weather changes, changing needs of females in different reproductive conditions, parasite control, or an attempt by the bats to maintain social contacts or knowledge of alternate roost sites (Barclay and Kurta 2007).

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

Very little research has focused on the use of travel corridors by Indiana bats. Most information pertaining to bat movements and travel corridors is incidental to other portions of a study and/or general observations. However, Murray and Kurta (2004) showed that Indiana bats increased commuting distance by 55% to follow tree-lined paths rather than flying over large agricultural fields, some of which were at least 0.6 mile (1 km) wide. Apparently suitable forest patches may not be available to Indiana bats unless they are connected by a wooded corridor, however, we do not know the maximum size of an opening Indiana bats may cross.

There are numerous observations of Indiana bats crossing interstate highways and open fields. Recent work conducted in this area found that on average, Indiana bats crossed a road some 11.5 times per night, with small unpaved and gravel roads being readily crossed (Dale Sparks, personal communication). Bats did cross an interstate highway, but much less frequently at <0.5 times per night. In New York, Indiana bats tracked from hibernacula to spring and summer roosts have crossed I-81, the Hudson River, Interstate 87, and other highways. These crossings primarily occurred during the initial migration from hibernacula to spring and summer habitats, rather than during nightly foraging bouts.

During the study for the Fort Drum Connector Route, an Indiana bat was captured on the east side of I-81 and roosted in a tree on the west side. Another bat was radio-tracked and observed foraging along a tree line on one side of the Highland Meadows Golf Course and then flew approximately 0.25 mile (0.40 km) straight across the open, well-manicured field to reach a different forest. As stated above, even though some data exists, biologists still do not know how large an open area must be before Indiana bats hesitate or refuse to cross, but the distance seems to be greater than the width of an interstate highway.

Status of the Species

The Service originally published a recovery plan in 1983 which outlined recovery actions. Briefly, the objectives of the plan are to: (1) protect hibernacula; (2) maintain, protect, and restore summer maternity habitat; and (3) monitor population trends through winter censuses. An agency draft of a revised plan was published in 1999 but this was never finalized.

On 15 April 2007, the Service released the *Indiana Bat (Myotis sodalis) Draft Recovery Plan: First Revision* (USFWS 2007), which contains an excellent summary of the current status of the Indiana bat and is hereby incorporated by reference. At that time the Recovery Priority of the Indiana Bat was determined to be 8, which means that the species has a moderate degree of threat and high recovery potential.

Since the April 2007 release of the Draft Recovery Plan, the Bloomington Field Office of the Service has collated the population data gathered during the 2007 biennial winter hibernacula surveys throughout the range and the Indiana bat's range-wide population at that time stood at approximately 469,000 bats (USFWS, unpublished data, 2009) , which was a 10.4% increase over the 2005 range-wide population estimate of 425,000 bats (USFWS, unpublished data, 2007, revised 2009). 2009 biennial winter hibernacula surveys throughout the range preliminarily determined that the Indiana bat's 2009 range-wide population stands at approximately 414,000 bats, which is an 11.8% decrease over the 2007 range-wide population estimate. The range-wide population estimate had been increasing since at least 2001, indicating that the species' long-term decline had perhaps been arrested and possibly reversed (USFWS 2007 and USFWS, unpublished data, 2007). The observed decline in 2009 is partly attributable to the disease White-nose Syndrome (see discussion below), specifically for decreased population estimates in the Northeast. The species' range-wide, regional, state, and hibernacula-specific population trends are being closely monitored by the BFO.

Given the 2009 range-wide Indiana bat population estimate of 414,000, we assume that there are approximately 2570 to 3450 maternity colonies throughout the species' entire range [assuming a 50:50 sex ratio (Humphrey et al. 1977) and an average maternity colony size of 60 to 80 adult females (Whitaker and Brack 2002)].

Population estimates for the proposed Midwest Recovery Unit in 2008-2009 were near 284,000; this accounts for over two-thirds of the Indiana bat population.

As of the winter of 2008-2009, the State of Indiana's 37 hibernacula harbored approximately 215,000 Indiana bats (52% of world-wide population) (USFWS, unpublished data, 2009). In 2009, three of the top four most populous Indiana bat hibernacula were located in Indiana, with Ray's Cave in Greene County being the most populous, followed by Wyandotte Cave in Crawford County and Jug Hole Cave in Harrison County.

New Threats: White-nose Syndrome

Recently a new threat has emerged with serious implications for the well-being of North American bats, including the Indiana bat. White-Nose Syndrome (WNS) was first documented in a photograph taken in a New York cave in February 2006. Since that time, over 160 sites in

17 states (New York, Massachusetts, Vermont, New Hampshire, Connecticut, Virginia, West Virginia, Pennsylvania, New Jersey, Maryland, Missouri, Oklahoma, Tennessee, North Carolina, Indiana, Ohio, and Kentucky) and three Canadian provinces (Ontario, Quebec, and New Brunswick) have been documented with WNS, including over 50 known Indiana bat hibernacula. In some affected hibernacula in New York and New England, 90 to 100 percent of the bats have died. Some scientists estimate that WNS has killed more than a million hibernating bats (BCI 2010). The Northeast Recovery Unit population of Indiana bats has suffered an approximate 60% decline (loss of at least 32,292 bats, primarily in New York) between 2007 and 2010 (USFWS unpublished data 2011) much of which is attributed to WNS.

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

Despite all of the unanswered questions about WNS, there are now four years of population monitoring data which provide valuable insights into the effects of WNS. Considering WNS has been affecting hibernating bat populations for the longest in New York (since February 2006), data from that State may provide the best indication of the effects of this disease on bats, including Indiana bats. By 2009, all known Indiana bat hibernacula in New York, except for a recently-discovered site (P3 or P4) in Orange County (Bull Mine), had been documented with WNS. However, the apparent effects of WNS on Indiana bats varied between affected hibernacula. Some Indiana bat hibernating populations have declined by 92 to 100% (Hicks *et al*. 2008), while counts of Indiana bats at other WNS-affected New York hibernacula (*e.g.*, Jamesville and Barton Hill Mine) have remained somewhat steady (USFWS unpublished data, 2011).

Biologists with New York State Department of Environmental Conservation conducted photographic surveys of all New York Indiana bat hibernacula in March 2008, to compare with the 2006-2007 counts. There were some notable differences in the population trends between

affected sites. For example, Indiana bat numbers and roosting locations appeared normal at both Barton Hill and Williams Hotel in 2008 (Service unpublished data). However, at Glen Park Cave, the "K-cluster" of Indiana bats appeared to be where expected at the end of March 2008, but preliminary analyses indicate that there were approximately 600-800 fewer individuals that season compared to the 2006-2007 count of 1,932 Indiana bats (a decrease of 30-40%). Preliminary 2008-2009 winter counts were back up to 1,719 Indiana bats, although in 2010, survey results indicate the colony was down to only 509 bats, an approximate 74% decrease from 2007. Recent numbers for this colony in 2011 were approximately 430.

Another significant decline (100%) was observed at Hailes Cave, where Indiana bats had been documented during every survey since 1981. In 2004-2005, 685 Indiana bats were observed at the site, but no Indiana bats (living or dead) were found at Hailes Cave during surveys in 2007, 2008, or 2009 (Hicks and Newman 2007, A. Hicks, NYSDEC, pers. comm.). Hailes Cave has been classified as an ecological trap hibernaculum in the Indiana Bat Draft Recovery Plan (USFWS 2007) due to the history of occasional flooding and freezing events at this site; however, the total and persistent loss of all Indiana bats at this site is unprecedented.

The 2007-2008 counts at the Williams Preserve and Williams Lake hibernacula were down by 92-99% when compared to 2006-2007 mid-winter surveys. In 2006-2007, there were approximately 13,014 and 1,003 Indiana bats in the Williams Preserve and Williams Lake hibernacula, respectively. In April 2008, counts were closer to 124 and 80 Indiana bats, respectively (Hicks *et al*. 2008). Count data collected during the February 2009 survey found 341 and 32 Indiana bats at the Williams Preserve and Williams Lake hibernacula, respectively. In 2010, preliminary counts at Williams Preserve found 190 bats and 26 bats at Williams Lake, for overall declines of approximately 97% to 98% since 2006-2007. Williams Hotel, which is in the same complex of hibernacula, had declined by only 29% (24,307 to 17,255) from 2007 to 2009; however, preliminary survey data in 2010 found only 8,152 bats hibernating at the site, a decline of almost 64% from 2007 (USFWS unpublished data). One deviation from the post-WNS population trend data from New York is the Barton Hill Mine site. The population at this WNS-affected site has remained stable, and actually slightly increased from 9,393 bats in 2007 to 10,678 bats in 2010, despite being positive for G.d. (USFWS unpublished data, 2011).

Up until recently, WNS has primarily been documented within the Northeast and Appalachian Mountain Recovery Units (RUs). However, in the winter of 2009-2010, *G. destructans* was detected on bats in Missouri, which is in the Ozark-Central RU, and WNS was confirmed in three caves in central Tennessee, which falls within the Midwest RU. In addition, one site has recently been confirmed with WNS in both Ohio and Kentucky, and at least three sites, including three separate species, have been confirmed with WNS in Indiana (USFWS 2011). The Midwest RU covers the states of Indiana, Kentucky, Ohio and portions of Alabama, Georgia, Michigan and Tennessee. To date, WNS has not been found in Alabama or Michigan. There are many factors regarding WNS that remain unknown including if there are species' and/or regional differences in susceptibility and mortality rates, how long symptoms may take to manifest, and the long-term population effects. Meanwhile, the Service, States and multiple researchers are continuing to learn more about the disease and options for minimizing its spread and impacts. To date, no WNS-related mortality has been documented in the Ozark RU and no mortality to Indiana bats has been found in the Midwest RU; however, based on the pattern seen in the

northeast and Appalachians, we believe the disease will continue to spread throughout these regions within the next several winters, with some level of mortality likely to occur. For more information on WNS see http://www.fws.gov/WhiteNoseSyndrome/.

ENVIRONMENTAL BASELINE

Definition of Action Area

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

As applied to this biological opinion the Action Area generally includes the following categories:

1. All land within the permanent right-of-way of Phases 3 and 4 as well as all land that is within temporary right-of-way or that would be altered for any reason during construction of the proposed highway.

2. Borrow areas, disposal areas, and equipment access/staging areas that are associated with construction of the highway but may be geographically removed from the construction zone.

3. All areas that will be indirectly affected by impacts which are later in time, and which are reasonably certain to occur, including secondary development.

The final BA for the proposed action provides an analysis and delineation of the Action Area based on all anticipated direct impacts from construction (Project Area), potential indirect impacts from secondary development which is reasonably certain to occur, and the extent of Indiana bat habitat which may be used by the affected maternity colony (Kudlu et al. 2009). Figure 3 in the BA depicts a Maternity Area (871 acres) within the Little Honey Creek corridor and tributaries where impacts of the proposed action would occur, along with areas of Additional Available Habitat and areas of expected secondary development which would be facilitated by the new highway.

The Maternity Area is the area assumed to be used by an Indiana bat maternity colony and was originally represented by the single Indiana bat captured within a mile of the Project Area in 2007. The reproductive females and juvenile captured in 2010 indicate a different configuration for the Maternity Area. Two of the capture sites and one of the roost trees were within the original Maternity Area, but one capture site and one roost tree are located along the Honey Creek corridor approximately ½ mile south/southeast of the closest boundary of the original Maternity Area, and the third roost tree (Sup C) is located approximately ½ mile west of the original Maternity Area. We conclude that the Maternity Area should be expanded to include

the additional capture sites and roost trees, increasing the size of the Maternity Area by 400 – 450 acres. The center of the Maternity Area would be in the vicinity of the confluence of Little Honey Creek and its major forested tributary.

Approximately 85 acres of the Maternity Area habitat would be eliminated by the project, and additional impacts would occur from fragmentation caused by habitat loss and the possible barrier effect of the road. Additional Available Habitat (estimated in the BA at 4536 acres) includes approximately 8 miles of the Honey Creek corridor from the Little Honey Creek confluence extending upstream (east and north), several tributaries of Honey Creek, an extensive area of defunct surface coal mine with numerous strip pits, and a segment of the Wabash and Erie Canal corridor.

Areas of expected secondary development consist of 14 parcels of land totaling 380 acres located adjacent to existing SR 46, Riley Road and Moyer Road. The selected parcels were in areas of cleared land, based on the assumption that secondary development was more likely to occur in cleared land than in forest. No specific evidence is provided demonstrating that development in those parcels is reasonably likely to occur and is related to the highway construction project, however the BA refers to data provided by the West Central Economic Development District which depicts zoning and land use patterns in the vicinity of the SR 641 project.

The Action Area includes impact areas which were identified in the BA, as well as other areas subject to direct or indirect project impacts whose location is not known at the time of writing of this Biological Opinion. More specifically, the Action Area includes the Project Area, Maternity Area and Secondary Development Areas as depicted in Figure 3 of the BA, plus the following areas:

1. All areas where activities directly related to construction will occur (e.g. areas disturbed for access, borrow and disposal activities).
2. All other lands where secondary development may reasonably be expected to be induced or expedited by the SR 641 bypass.
3. Roads which will experience increases in traffic as a result of secondary development (thus contributing to road mortality of Indiana bats).
4. Streams which are impaired during or after construction to the extent that they no longer provide travel corridors or sources of aquatic insect forage.

Inclusion of a geographic area in the Action Area does not confirm that take will occur in that area, only that it will be affected directly or indirectly by the project in some manner that may adversely affect Indiana bats.

Indiana bats in the General Project Vicinity

Critical Habitat

The nearest site designated as critical habitat for the Indiana bat is Ray's Cave in Greene Co. about 40 miles to the southeast of the Action Area.

Maternity Colonies

There are numerous recent records of Indiana bats and a documented maternity colony in the Prairie Creek watershed approximately 15 miles south of Terre Haute (Whitaker, 1996). There are also multiple records of the species and documented maternity roosts at the Newport Army Ammunition Plant approximately 20 miles north of Terre Haute (Whitaker, 1997). There is one recent record from western Vigo County near the Illinois state line. None of these Indiana bat occurrences are in or adjacent to the project right-of-way, and to our knowledge they are not within the Action Area.

Indiana Bats within the SR 641 Action Area

Maternity Colonies

As referenced in the consultation history section of this document and discussed in the BA, a pregnant female Indiana bat was captured during mist-net surveys of the Action Area early in the 2007 summer reproductive season, and 2 reproductive females and a juvenile male Indiana bat were captured in the 2010 survey. Anabat acoustic monitoring was conducted but did not detect any signals which could be attributed to Indiana bats. Radio-telemetry efforts identified 3 roost trees, including one on a Little Honey Creek tributary upstream (north) from the impact area, one on Honey Creek upstream from the mouth of Little Honey Creek (south of the project area) and one in a wooded area near the Wabash and Erie Canal west of Little Honey Creek. A maximum of 25 Indiana bats were observed using the Honey Creek roost (Site 8 roost tree) on 7 separate days over an 11 day span. Up to 10 bats were observed using the Little Honey Creek tributary roost (Sup A roost tree) on 3 separate days, with no bats observed on a fourth day. An Indiana bat was tracked to the third roost tree (Sub C roost tree) but that tree was monitored on 6 nights with no bats observed leaving the tree. The survey report concludes that none of the 3 roost trees are likely to be a Class 1 primary roost, postulating that the Site 8 roost tree is a Class 2 primary roost, the Sup A roost tree is a Class 1 alternate roost and the Sup C roost tree is a class 2 alternate roost. It should be noted in this context that the captures occurred late in the Indiana bat summer season, when most juveniles are volant and fall migration is imminent, therefore primary roost trees may have less bat use than during the period when females are pregnant and nursing their young.

Based on the capture of these reproductive Indiana bats and the location of the roost trees, a maternity colony is centered within the area bounded by the capture sites and known roost trees. One adult female bat was tracked during a foraging flight, however no triangulation was performed. We have concluded that the maternity colony habitat is most likely focused along the Little Honey Creek corridor within the Action Area (and the Maternity Area described in this Biological Opinion), due to the distribution and proximity of habitat. The forested Honey Creek corridor southeast of the Action Area may also provide foraging habitat for the maternity colony, although it is less likely to contain the core foraging and roosting area due to weaker direct habitat connectivity and the distribution of the Indiana bat captures and occupied roost trees.

Adult Males

One adult male was captured in the 2010 bat survey at Site Sup C. A transmitter was attached to the bat, however the signal was not detected again despite multiple days of searching. There are no other records of adult males in the Action Area.

EFFECTS OF THE ACTION

Direct Effects on Indiana Bat Foraging Habitat

Key factors that affect the quality of summer habitat for bats within the action area are the distribution and extent of forest cover, the size and quality of existing forest patches, and the degree of connectivity among forest patches. The proposed project would adversely affect the size, distribution and connectivity of summer habitat.

The Habitat Fragmentation and Loss analysis (Duffy et al. 2008) and the BA (Kudlu et al. 2009) concluded the project would result in the elimination of a total of approximately 108 acres of forested summer habitat. More recently the estimated loss was refined to a total of 85 acres. Habitat loss and degradation could also occur from ancillary actions directly associated with construction of the project, such as equipment access and staging, acquisition of borrow and disposal of waste material.

In addition to immediate habitat loss, the proposed action will result in a decrease in the quality of remaining habitat within the Action Area. Factors that may lead to a loss in the quality of remaining habitat include increased habitat fragmentation, loss of habitat diversity, the barrier effect of the 4-lane divided highway, and increased human disturbance. Significant habitat fragmentation would occur at the crossings of Little Honey Creek and its large tributary near Albany Road, and some level of habitat fragmentation would occur within the smaller forested habitat areas along the route. If the maternity colony is using the Little Honey Creek corridor for access to foraging habitat in the Honey Creek corridor, as appears to be the case based on the 2010 radio-telemetry study, the project may affect access to those areas also. Some foraging habitat areas will have reduced utility and accessibility due to the barrier and fragmentation effects.

Impacts on water resources may also adversely affect Indiana bats in the Action Area. Stream travel corridors and water quality may be adversely affected during construction activities. Foraging habitat and aquatic insect production associated with relocated stream segments will be relatively poor until the riparian zone and aquatic community become re-established.

Indirect Effects on Habitat

Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 C.F.R. § 402.02). Indirect effects may result from offsite migration of impacts via degradation of water quality or air quality, noise disturbance, light pollution, and secondary development.

There is no literature to suggest that take of Indiana bats has resulted from highway-related impairment of air quality. Water quality in the Action Area may be negatively impacted in the short term from construction runoff and over the long-term from road salts and other pollutants resulting from vehicular traffic and accidental spills. Potential adverse impacts on Indiana bats include contamination of drinking water and reduction or contamination of the aquatic insect forage base, however scientific literature on these impacts is lacking. If appropriate best management practices are used to minimize runoff of soil and other pollutants during construction we do not anticipate take of Indiana bats due to degradation of water quality from normal highway activities.

It is expected that habitat loss, fragmentation and human disturbance in some portions of the Action Area will increase over time, as new secondary development occurs, particularly near the proposed SR 46/Riley Road interchange. The BA states that based on current zoning and land use plans, most new residential and commercial growth in the vicinity of the action area will occur in 14 parcels of open land totaling 380 acres, located adjacent to existing SR 46, Riley Road and Moyer Road, with little growth planned in the remainder of the Action Area. As previously stated, we believe that additional development will occur, and that some development will be induced or expedited by the presence of SR-641, but it is not possible given the current information available to establish which developments have a causal relationship with SR 641.

Effects on Adult Females and Juveniles in Maternity Roosts

We anticipate that the project will result in adverse effects on the maternity colony within the Little Honey Creek corridor. Adverse effects will be caused by loss of suitable roost trees, reduction and fragmentation of foraging habitat and travel corridors, human disturbance, road mortality, and possibly by indirect impacts. A nursery roost near the construction zone that is not directly taken by the project may be disrupted by construction noise, resulting in take of Indiana bats through abandonment of roost trees, disruption of the maternity colony and/or reproductive impairment. The impact this anticipated take will have in light of the presence of WNS is discussed below.

There is abundant literature regarding the adverse effects of roads on wildlife movements, although relatively little is known about effects on the Indiana bat. Whereas some species avoid roads entirely, restricting their movement patterns and distribution, others show little avoidance behavior and attempt to cross roads at inappropriate times, resulting in vehicle collisions and mortality. Indiana bats associated with a maternity colony near the Indianapolis Airport have been observed to readily cross small roads (e.g., dirt, gravel, and paved) while foraging at night, but multilane divided highways were only rarely crossed and most of those crossings occurred when bats followed a stream under Interstate 70 (Dale Sparks, Indiana State University, personal communication, 2007). Most recently, a study of bat interactions with roads at the Indianapolis Airport demonstrated that commuting bats were twice as likely to avoid crossing a road when vehicles were present (60% avoidance vs 32% avoidance), demonstrating that roads with higher traffic volumes have an increased barrier effect on foraging bats (Zurcher et. al. , 2010). Due to the substantial width of the SR 641 corridor and the volume of traffic that will use the new

highway, it will act as a partial barrier and deterrent to foraging females and juveniles which remain in the area, impairing access to preferred foraging areas, thus reducing the colony's foraging efficiency.

Recent research at a highway in Pennsylvania demonstrated that an Indiana bat and several bats of other species were killed by automobile collisions (Russell et al. 2008, Butchkoski, 2002). Assuming that some individual bats will continue to use this area, due to the large increase in vehicle velocity and highway width, combined with increased traffic from secondary development, we anticipate that a small number of bats will be killed by vehicle collisions while attempting to cross the highway at low altitudes, especially when following stream corridors or other travel corridors.

The impact WNS may have on the ability of the Indiana bat to persist and recover is presently unknown. We currently do not have estimates of adult survivorship, juvenile survivorship, or fecundity for Indiana bat populations affected by WNS. Based on a small amount of New York survey data from 2007 to 2010, Indiana bat hibernating populations in New York appear to have declined by 61% overall with affected individual hibernacula having population growth rates ranging from –99% to 14% during this time period. To determine the effects of the proposed project on the Indiana bats in the Action Area in light of WNS, we used a reasonable worst-case scenario of a 60% decline in the estimated maternity colony population in the Action Area over the next three years. Using the assumption that a maternity colony consists of on average 80 adult females and their single offspring, a 60% decline would reduce the maternity colony to 32 adult females by the end of three years. Based on the range of known sizes of maternity colonies, a colony of 32 adult individuals would still be considered a viable colony. Although final survey results in Indiana are not yet available for 2011, preliminary information suggests that there have not been any significant population shifts or declines in the numbers of Indiana bats at hibernacula visited this year and no evidence of WNS in the largest hibernating caves in Indiana.

Most project impacts to the maternity colony will be as a result of direct loss and fragmentation of roosting and/or foraging habitat. We anticipate that these impacts will most likely be realized by the maternity colony before significant impacts from WNS occur in Indiana (if the spread and the effects of the disease follow the pattern observed in the Northeast), and that this affected colony will likely recover from most project related habitat impacts prior to any substantial WNS-related population reductions. Thus, the effects of most project impacts will be occurring to individuals and a maternity colony not yet affected by WNS.

If WNS effects manifest earlier than anticipated, we believe the effect of the project impacts could be greater. However, we anticipate that with declining numbers of bats, the number of bats exposed to the project impacts will be fewer as well, and hence, so too will the number of Indiana bats taken. With declining numbers of bats in an area, the colony's foraging and roosting requirements would be less as well and we would anticipate that the loss of habitat would not cause the level of effects previously identified.

As with the other estimated forms of take, roadkill estimates were based on a percentage of the entire maternity colony being affected. If the number of colony members is decreased as a result

of WNS, then the amount of bats exposed to roadkill, and therefore killed, would decrease as well.

Effects on Adult Males

Due to the apparently low density of adult males in the Action Area and the adult male behavior of roosting singly and in relatively lower quality roost trees, we conclude that take of adult males as a result of the proposed action is likely to occur but will be substantially lower than for females and juveniles.

Summary of Effects

In summary, the following effects are anticipated:

- Take from direct habitat loss, modification and fragmentation from highway construction and related activities.
- Disruption of north-south travel corridors by the proposed highway, resulting in take from decreased foraging efficiency and road mortality.
- Disturbance of roosts during construction.
- Vehicle collision mortality.

Seasonal tree-cutting restrictions, as proposed in the BA, will ensure that no direct take of Indiana bats occurs in the form of direct physical harm from the construction of SR 641 during the maternity colony roosting season. This restriction should be extended to include all access, staging, borrow and disposal areas used by construction contractors.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. In general, a cumulative effects analysis considers actions that are not related to or dependent on the action which is the subject of this biological opinion.

The BA discusses cumulative effects of the project but does not provide information regarding cumulative effects that are reasonably likely to occur. Potential cumulative effects include future municipal or private development which affects the maternity colony but would not be considered an indirect effect of this agency action, changes in municipal planning and zoning ordinances or policies which promote development in Indiana bat habitat, and county actions such as highway projects and drainage improvements. We are not aware of any cumulative effects which are reasonably certain to occur.

CONCLUSION

After reviewing the current status of the Indiana bat, the environmental baseline for the action area, updated information regarding WNS, the effects of the proposed highway construction and the cumulative effects, it is the Service's biological opinion that the highway construction, as proposed, is not likely to jeopardize the continued existence of the Indiana bat, and is not likely to destroy or adversely modify designated critical habitat. Critical habitat for this species has been designated at Wyandotte Cave and Rays Cave, however this action does not affect those areas and no destruction or adverse modification of that critical habitat is anticipated.

Our basis for this conclusion is as follows: We anticipate that the Little Honey Creek colony will not be destroyed or decimated by direct or indirect effects associated with the construction, operation, and maintenance of SR 641. Take is likely to occur in the form of reduced foraging and reproductive efficiency, lowering the Action Area's carrying capacity for the colony, and of vehicle collision mortality. Much of the take will be short term and temporary in nature and the population will be able to absorb that amount of loss. The colony will continue to exist but probably with a smaller number of reproductive females. In summary we believe reproductive loss will occur within a single maternity colony and take of Indiana bats will occur as a result of vehicle collision mortality.

INCIDENTAL TAKE STATEMENT

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

The measures described below are non-discretionary, and must be undertaken by the Federal Highway Administration so that they become binding conditions of any grant or permit issued to the Indiana Department of Transportation, as appropriate, for the exemption in section 7(o)(2) to apply. The Federal Highway Administration has a continuing duty to regulate the activity covered by this incidental take statement. If the Federal Highway Administration (1) fails to assume and implement the terms and conditions or (2) fails to require the Indiana Department of Transportation to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Federal

Highway Administration must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)]

AMOUNT OR EXTENT OF TAKE

The Service anticipates that Indiana bats could be taken as a result of this proposed action. The incidental take is expected to be in the form of harm/harassment from permanent loss of foraging habitat, loss of suitable roost trees and disruption of travel corridors and foraging patterns; and wounding and death of individuals (highway traffic collision mortality).

The Service anticipates that the amount of incidental take of Indiana bats will be difficult to detect for the following reason(s):

1. The primary maternity roost tree(s) were not identified and the foraging range was not characterized, therefore the size of the colony and the relationship of project impacts to the colony's foraging range are unknown.

2. The Indiana bat's small body size, nocturnal habits and secretive daytime roosts make finding a dead or injured specimen unlikely.

3. Population monitoring is conducted in hibernation caves rather than in maternity colonies, and the species' distributional patterns between summer maternity colonies and winter hibernacula are poorly understood, therefore population monitoring cannot be used to estimate take.

However, we can quantify and track the level of anticipated take by monitoring the amount of habitat modification as a surrogate. The Proposed Action will result in the loss of approximately 85 forested acres. We also anticipate take of 1 individual every 2 years as a result of traffic collision mortality.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of the Indiana bat:

1. Design the project footprint to have the minimum feasible width within the forested corridors.

2. Do not clear any trees during the Indiana bat summer reproductive occupancy season.

3. Develop a plan to acquire and to manage and/or permanently protect a minimum of 255 acres of Indiana bat habitat in the Maternity area. In the event that 255 acres cannot be acquired after a reasonable effort, as defined in the timetable in the addendum to the BA, develop a multiple year demographic study of the Indiana bat maternity colony in the Action Area.

4. Develop and implement a monitoring plan for Indiana bats.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Federal Highway Administration must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. Use design measures such as guardrails and steeper road slopes, where feasible, to minimize tree removal in riparian zones.

2. Tree clearing may not occur between April 1 - September 30. Prohibit contractors from destroying Indiana bat summer habitat for borrow areas and spoil disposal areas. Require contractors to locate access routes and equipment staging areas to minimize summer habitat impacts.

3. The 255 acres may be a combination of permanent protection of existing forested habitat and restoration of lost forested habitat. Restoration may not comprise more than 33% of the total acreage. The most effective measure to minimize reproductive take is to ensure that resident individuals are provided adequate foraging and roosting habitat. Submit the study design(s) for habitat restoration, and for an Indiana bat demographic study if needed, for Service approval prior to implementation. The demographic study design should focus on enhanced demographic studies of the impacted maternity colony. The agreed parcel acquisition process and timeline for developing a demographic study are described in the Amendment to the Biological Assessment for the SR 641 Bypass Project dated January 21, 2011.

4. Monitor the post-construction use of the project corridor by the resident Indiana bat maternity colony by conducting a two-year follow-up bat survey of the action area, with telemetry, in the summer following completion of the project. This survey will be used to determine whether the conservation measures and reasonable and prudent measures were successful in maintaining useable foraging habitat. Monitoring must consist of a mist net survey following the Service's standard protocols, and should be initiated in the summer following the completion of the SR 641 project. The surveys must encompass the entire Action Area (as defined in this biological opinion) but can cover a larger area at the discretion of FHWA or INDOT.

   Dead bats located in the action area during construction or monitoring activities are to be

reported immediately to the Service's Bloomington Field Office [(812) 334-4261], and subsequently transported on ice to that office. Sick or injured bats should also be reported to the Service. No one except researchers contracted to conduct bat monitoring activities should attempt to handle a live bat, regardless of its condition. The Service will make a species identification of dead, injured or sick bats. If an Indiana bat is identified the Bloomington Field Office will notify the appropriate Service law enforcement office. This information on the disposition of dead or injured bats should be incorporated into instructions provided to project personnel and included in the construction specifications.

The Service believes that no more than 85 acres of summer habitat and 1 individual/two years of the Indiana bat will be incidentally taken as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Consider designing bridges on SR 641 to be "bat-friendly" by providing appropriate structure for bat roosts. This conservation measure is appropriate in some locations**.**

2. Avoid or minimize additional Indiana bat habitat losses from highway maintenance activities.

3. Conduct additional post-construction monitoring to evaluate the effect of the project on Indiana bats and to explore methods of reducing adverse impacts from traffic and highway maintenance.

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

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the Federal Highway Administration's request for formal consultation and accompanying Biological Assessment. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary

Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

LITERATURE CITED

Barclay, R.M.R. and A. Kurta. 2007. Ecology and behavior of bats roosting in tree cavities and under bark. Pp. 17-59 *in* M.J. Lacki, J.P. Hayes, and A. Kurta (eds.), Bats in forests: conservation and management. Johns Hopkins University Press, Baltimore, MD. 329 pp.

Blehert, D.S., A.C. Hicks, M. Behr, C. Meteyer, B. Berlowski-Zier, E.L. Buckles, J.T.H. Coleman, S.R. Darling, A. Gargas, R. Niver, J.C. Okoniewski, R.J. Rudd, and W.B. Stone. 2009. Bat white-nose syndrome: an emerging fungal pathogen? Science 323 (5911): 227.

Butchkoski, C.M. 2002. Indiana bat (*Myotis sodalis)* investigations at Canoe Creek, Blair County, Pennsylvania (draft). Pennsylvania Game Commission. 28pp.

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

Callahan, E.V., R.D. Drobney, and R.L. Clawson. 1997. Selection of summer roosting sites by Indiana bats (*Myotis sodalis)* in Missouri. Journal of Mammalogy 78(3):818-825.

Carter, T.C., G. Feldhamer, and J. Kath. 2001. Notes on summer roosting of Indiana bats (abstract). Bat Research News 42(4):197.

Carter, T. C. 2006. Indiana bats in the Midwest: the importance of hydric habitats. Journal of Wildlife Management 70(5):1185-1190.

Duffy, J., C. Swecker and V. Brack. Jr. 2008. Habitat fragmentation and loss for the Indiana bat on Indiana Department of Transportation's Proposed SR 641 Bypass (Phases III and IV) in Terre Haute, Vigo County, Indiana. Report to INDOT. Environmental Solutions and Innovations, Inc., Cincinnati, Ohio.

Duffey, J. and V. Brack Jr. 2010. Additional surveys for the Indiana bat (Myotis sodalis) on the Indiana Department of Transportation's proposed SR 641 Bypass (Phases III and IV) in Terre Haute, Vigo County, Indiana. Report to INDOT. Environmental Solutions and Innovations, Inc., Cincinnati, Ohio.

Gargas, A., M.L. Trest, M. Christensen, T.J. Volk, and D.S. Blehert. 2009. *Geomyces destructans* sp. Nov. associated with bat white-nose syndrome. Mycotaxon 108:147-154.

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

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

Hicks, A.C. and P.G. Novak. 2002. History, status, and behavior of hibernating populations in the northeast. Pages 35-47 *in* A. Kurta and J. Kennedy, eds. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.

Hicks, A. and D. Newman. 2007. Bat Management and Protection in New York State, Fiscal Year April 1, 2006-April 1, 2007. New York Department of Environmental Conservation, Albany, NY.

Hicks, A.C., C.J. Herzog, R.I. von Linden, S.R. Darling, and J.T.H. Coleman. 2008. White-nose syndrome, field observations from the first two winters. Proceedings of the first national white-nose syndrome meeting, Albany, New York, 9-11 June 2008.

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

Kudlu, P. and V. Brack Jr. 2008. Summer mist net survey for the Indiana bat (*Myotis sodalis*) on the Indiana Department of Transportation's proposed SR 641 Bypass (Phases III and IV) in Terre Haute, Vigo County, Indiana. Report to INDOT. Environmental Solutions and Innovations, Inc., Cincinnati, Ohio.

Kudlu, P., J. Duffey, V. Brack Jr. and D. Sparks. 2009. Final Report: Biological assessment for the Indiana bat on Indiana Department of Transportation's proposed SR 641 bypass (phases 3 and 4) in Terre Haute, Vigo County, Indiana. Report to INDOT. Environmental Solutions and Innovations, Inc., Cincinnati, Ohio.

Kurta, A. and H. Rice. 2002. Ecology and management of the Indiana bat in Michigan. Michigan Academician XXXIV (2002), 175-190.

Kurta, A., S.W. Murray, and D.H. Miller. 2002. Roost selection and movements across the summer landscape. Pages 118-129 *in* A. Kurta and J. Kennedy, eds. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas.

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

Murray, S.W. and A. Kurta. 2004. Nocturnal activity of the endangered Indiana bat (*Myotis sodalis).* Journal of Zoology, London 262, 1-10. UK.

Puechmaille, S.J., P. Verdeyroux, H. Fuller, M. ArGouilh, M. Bekaert, E.C. Teeling. 2010. White-nose syndrome fungus (*Geomyces destructans*) in bat, France. Emerging Infectious Diseases 16:290-293.

Richter, A.R., S.R. Humphrey, J.B. Cope and V.W. Brack, Jr. 1993. Modified Cave Entrances: Thermal effect on body mass and resulting decline of endangered Indiana bats (*Myotis sodalis*). Conservation Biology 7(2):407-415.

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

Russell, A. L., C. Butchkoski, A. Tibbels, and G. F. McCracken. 2002. Bats, road-kill, and the FBI (flat bat investigation). Bat Research News 43 (4): 180.

Russell, A. L., C. Butchkoski, L. Saidak, and G. F. McCracken. 2008. Roadkilled bats, Highway design and the commuting ecology of bats. Endang. Species Res. Online preprint, September 9, 2008.

Sparks, D. W., C. M.Ritzi, J. E. Duchamp and J. O. Whitaker. 2005. Foraging habitat of the Indiana bat (*Myotis sodalis*) at an urban-rural interface. Journal of Mammalogy 86:7131-718.

Tuttle, N. M., D. P. Benson, and D. W. Sparks. 2006. Diet of *Myotis sodalis* (Indiana bat) at an urban/rural interface. Northeastern Naturalist 13:435-442.

U.S. Fish and Wildlife Service (USFWS). 1983. Recovery Plan for the Indiana Bat. Fort Snelling, Minnesota. 77 pp.

U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). 1998. Endangered Species Consultation Handbook - Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act. Washington, D.C.

U.S. Fish and Wildlife Service (USFWS). 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. Fort Snelling, Minnesota. 258 pp.

U.S. Fish and Wildlife Service. 2009. Indiana Bat (*Myotis sodalis*) 5-Year Review: Summary and Evaluation. Bloomington, Indiana.

Whitaker, J.O., Jr. 1996. Bats of Prairie Creek, Vigo County, Indiana. Indiana Academy of Science 105:87-94.

Whitaker, J.O., Jr. 1997. Bats of Newport Chemical Depot, Newport, Vermillion County, Indiana. Report to the Newport Chemical Depot.

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

Winhold, L. and A. Kurta. 2006. Aspects of migration by the endangered Indiana bat, *Myotis sodalis*. Bat Research News 47:1-11.

Zurcher, Arthur A., D. W. Sparks and V. J. Bennett. 2010. Why did the bat not cross the road? Acta Chiropterologica 12(2): 337-340.