United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pennsylvania Field Office
315 South Allen Street, Suite 322
State College, Pennsylvania 16801-4850

October 2, 2007

Mr. James A. Cheatham
Division Administrator
Federal Highway Administration
228 Walnut Street, Room 558
Harrisburg, PA 17101-1720

RE: USFWS Project #2007-1091

Dear Mr. Cheatham:

Enclosed is the Fish and Wildlife Service's biological opinion on the effects of the proposed U.S. 6219, Section 019 Transportation Improvement Project (Meyersdale, Somerset County, Pennsylvania to I-68 in Garrett County, Maryland) on the Indiana bat (*Myotis sodalis*), a species that is federally listed as endangered. We are providing this to the Federal Highway Administration in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq*.).

This biological opinion is based on information provided in the June 2006 biological assessment, the February 20, 2007, amendment to the biological assessment, telephone conversations, meetings, site visits, and other sources of information. A complete administrative record of this consultation is on file at this office.

Please use the above-referenced USFWS project tracking number in any future correspondence regarding this project.

Please contact Robert Anderson of my staff at 814-234-4090 if you have any questions or require further assistance.

Sincerely,

David Densmore
Supervisor

Enclosure

BIOLOGICAL OPINION

The Effects of the U.S. 6219, Section 019, Transportation Improvement Project on the Indiana bat (*Myotis sodalis*)

Somerset County, Pennsylvania and Garrett County, Maryland

Submitted to the Federal Highway Administration

October 2, 2007

U.S. Fish and Wildlife Service
Pennsylvania Field Office
315 South Allen Street, Suite 322
State College, Pennsylvania 16801

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CONSULTATION HISTORY

DATE	EVENT/ACTION
May 30, 2002	Fish and Wildlife Service responds to a May 6, 2002, letter from Attilio Squillario of L. Robert Kimball and Associates, requesting information regarding federally listed endangered, threatened, or proposed species in the U.S. 6219 Transportation Improvement Project study area. The Service notified the project proponents that Indiana bats where known to hibernate in the project area and recommended seasonal restrictions on tree-cutting.
February 3, 2003	Service receives a January 31, 2003, letter from A.D. Marble and Company, representing FHWA and PennDOT, and requesting information regarding environmental and cultural resources described on submitted maps depicting project alignments under consideration.
February 18, 2003	Peter Dodds of A.D. Marble and Company contacted the Service to request that their February 3, 2003, letter be disregarded due to an incorrect depiction of the study area.
June 14, 2004	Service receives a June 11, 2004, letter from Stephen Toki of L. Robert Kimball and Associates, requesting updated information regarding federally listed endangered, threatened, or proposed species in the U.S. 6219 Transportation Improvement Project study area, and providing a map depicting the three alignments under consideration.
July 28, 2004	Agency Coordination Meeting held to present alternatives under consideration for the U.S. 6219 Transportation Improvement Project, and request concurrence on Alternative E as the Recommended Preferred Alternative
September 2, 2004	Service responds to the letter of June 11, 2004, from Stephen Toki, and recommends that bat surveys be conducted due to the proximity of two of the proposed alignments to a known Indiana bat hibernaculum, and the extent of forest removal being considered.
October 4, 2004	Site visit held between the Service, FHWA, PennDOT, Maryland State Highway Administration, and their consultants, to discuss the project's effects on Indiana bats.
December 21, 2004	Meeting held between the Service, FHWA, and PennDOT to discuss the project's effects on Indiana bats.
September 25, 2006	Service receives FHWA's September 22, 2006, request for concurrence that the project is "not likely to adversely affect" federally listed species. FHWA requests that formal consultation be initiated if the Service cannot concur with FHWA's effects determination.
October 31, 2006	Service responds that they cannot concur with FHWA's conclusion regarding effects expected from the project. Service requests additional information needed to initiate formal consultation.
November 8, 2006	Meeting held between the Service and FHWA to discuss the project's effects on Indiana bats.

February 26, 2007	Service receives FHWA's February 20, 2007, letter providing requested additional information, and requesting initiation of formal consultation on the project.
May 27, 2007	90-day formal consultation period concluded.
July 25, 2007	Service requests a 45-day extension of formal consultation period to September 8, 2007.
August 21, 2007	FHWA acknowledges receipt of Service request for extension.
October 2, 2007	Final biological opinion completed and delivered to FHWA.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

U.S. Route 219 runs for 535 miles (861 km) from West Seneca, New York, at Interstate 90 to Rich Creek, Virginia, at U.S. Route 460. It passes through the States of New York, Pennsylvania, Maryland, West Virginia, and Virginia. The proposed project is a new, limited-access, four-lane highway section of U.S. 219 (also referred to as U.S. 6219) in portions of Elk Lick and Summit Townships in Somerset County, Pennsylvania, and in the northeastern corner of Garrett County, Maryland. The roadway alignment passes through predominantly forested and agricultural areas interspersed with residential developments and abandoned surface mines. The project is within the Casselman River watershed, and includes the Meadow Run and Piney Creek sub-basins.

Project Description

The proposed project is called U.S. 6219, Section 019, Meyersdale, Pennsylvania, to I-68 Maryland Transportation Improvement Project (U.S. 6219 Project). The multiple project purposes are to:

1. improve the level of safety for vehicles traveling on U.S. 219;
2. improve the level of service on U.S. 219;
3. improve the system linkage between I-68 and the completed portion of the existing four-lane Meyersdale Bypass and Pennsylvania Turnpike; and

4. provide a safe and efficient access to southern Somerset County, Pennsylvania, and Garret County, Maryland, to improve economic development potential.

To meet the above needs, a new, limited-access, four-lane highway section is proposed to extend for approximately eight miles (13 kilometers) from the southern end of the Meyersdale Bypass in Somerset County, Pennsylvania, to Interstate 68 (I-68) in Garrett County, Maryland. The proposed project (described as "Alternative E" in the assessment) would start at Hunsrick Summit and follow the western side of Meadow Mountain in Pennsylvania, at an elevation of approximately 2,400 feet above sea level. The new roadway would cross the Piney Creek valley. At the Pennsylvania/Maryland border, the alignment would become more southwesterly, eventually tying into a new I-68 interchange just east of the existing interchange with U.S. 219. The proposed project schedule calls for right-of-way acquisition between 2009 and 2011, followed by a two-year construction period from 2012 to 2014.

The highway will have a standard width of 130 feet; however, in the vicinity of the Piney Creek crossing in Pennsylvania, and along the entire section of the highway in Maryland, the roadway will be narrowed to 100 feet to reduce the project footprint. This section of U.S. 6219 is about eight miles long, and the 100- to 130-foot-wide roadway alignment accounts for approximately 96 to 125 acres that will be permanently converted to pavement, median, or shoulder. The Federal Highway Administration (FHWA), Pennsylvania Department of Transportation (PennDOT), and Maryland State Highway Administration (MDSHA), hereinafter referred to as the project proponents, estimate that the project will require clearing of 375 acres of habitat described as "agricultural land, rangeland, and forestland" (also described as *foraging area impact* in the assessment), including 208 acres of forest. The additional acreage of land disturbance, beyond that needed for the road, is based on the preliminary engineering estimates of the area of cut and fill needed to maintain the desired road grade. For example, just south of the Piney Creek Bridge, a road cut approximately 100 feet deep and 600 feet wide is proposed.

In addition to terrestrial habitat impacts, the project will affect wetlands and streams. Of the 31 stream crossings, 16 are over ephemeral streams, while the largest crossing is over Piney Creek (described below). The project will disturb five acres of wetland, and result in 13 residential displacements.

Piney Creek Bridge. The bridge proposed over Piney Creek will be approximately 1,500 feet long and 175 feet high. It will span the Piney Creek Valley and adjacent Greenville and Piney Run Roads. The bridge will be 130 feet wide, with reduced shoulder and median widths. If shown to be feasible during geotechnical investigations, the road cut through the ridge at the bridge approach will be narrowed. The normal road width through this section will be 130 feet, resulting in an approximately 150-foot wide gap in the natural vegetative canopy. The highway from Station 3150+00 to Station 3200+00, which is approximately one mile to the north and south of Piney Creek, and near Salisbury Mine, will be narrowed to 100 feet. This would be achieved through steeper maximum roadway grades (from 4 percent to 6 percent) and reduced median and shoulder widths. Despite the reductions in road width, the project designs included in the assessment show that a substantial roadway cut of 500 to 600 feet will remain at the bridge approaches. The bridge and right-of-way in the immediate vicinity of the structure will cross approximately five acres of forest habitat, some of which will remain forested.

I-68 Interchange. Two different interchange designs are proposed for connection with I-68. The proposed location is approximately two miles east of the existing I-68/U.S. 219 interchange. The interchange would require a 1,500-foot long, two-lane access road to existing U.S. 219.

Avoidance and Minimization Measures

The following measures have been incorporated into the project description; these measures are expected to minimize impacts of the proposed roadway construction on Indiana bats. The Fish and Wildlife Service has analyzed the effects of the proposed action based on the assumption that all avoidance measures will be implemented. More detailed descriptions of these measures are provided in the biological assessment (in part, on pages 18 to 21, and in the February 2007 Addendum).

1. The proposed timber restrictions in the amended assessment are "from March 31 to November 16 in the vicinity of the mine (hibernaculum)" which "approximates a five mile radius around the hibernaculum". "All other timbering along the proposed alignment would occur from October 30 to March 31." Based on other statements related to forest and building removal in the assessment, we interpret this to mean that timber-cutting and building demolition within five miles of Salisbury Mine (an Indiana bat hibernaculum) will only occur after November 15 and prior to March 31, during which time Indiana bats are expected to be hibernating, thereby avoiding injury to roosting Indiana bats during the warmer season.

2. Trees under the proposed Piney Creek bridge will remain until their removal is necessary for bridge construction, thereby maintaining riparian tree cover for a flight path.

3. A blasting plan will be prepared in accordance with Pennsylvania Game Commission (PGC) guidelines, and submitted to the Service and PGC for review and approval prior to any blasting activities.

4. No blasting will occur within one mile north or south of Salisbury Mine between October 30 and March 31.

5. In coordination with the Service and PGC, all blasting will be monitored with seismographic and sound equipment in the area of Salisbury Mine. Blasting will be altered to ensure that vibrations stay below thresholds established by PGC.

6. No construction activities will occur within 2.5 miles of Salisbury Mine from one-half hour before sunset to one hour after dawn, from September 15 to November 16, when Indiana bats are believed to be engaged in fall swarming in the vicinity of Salisbury Mine.

7. The typical roadway width will be narrowed by 30 feet (to 100 feet) from just under one mile to the north and south of Piney Creek (in the area of the Salisbury Mine), to reduce crossing distance for any Indiana bats crossing over the bridge or roadway in this area.

8. Vegetation within the right-of-way beneath the bridge over Piney Creek, and the additional 10 acres of buffer (as described in the *On-site Measures* below) in the vicinity of the mine, will be based on a planting plan approved by PGC that does not hinder safe highway design.

9. Up to $75,000 is committed to monitor the effectiveness of conservation measures. The proposed monitoring consists of measuring air temperature and airflow in Salisbury Mine, identification and observation of roost trees with the highway footprint, and observation of artificial roost structures for three years (one pre-construction year, one construction year, and one year post-construction).

<u>Conservation Measures</u>

Conservation measures represent actions pledged in the project description that the action agency or the applicant will implement to further the species' recovery. Such measures may be tasks recommended in the species' recovery plan, should be closely related to the action, and should be achievable within the authority of the action agency or applicant. The beneficial effects of conservation measures are taken into consideration in the Service's conclusion of jeopardy or non-jeopardy to the listed species, and in the analysis of incidental take. Such measures, however, must minimize adverse effects to listed species within the action area in order to be factored into the Service's analyses.

On-site Measures:

1. In coordination with the Service and PGC, two bat boxes will be erected in the project area, and up to 10 trees girdled under the proposed Piney Creek bridge, to promote roosting habitat.

2. In addition to the five acres of forest habitat included in the normal right-of-way directly beneath the Piney Creek Bridge, an additional 20 acres would be purchased and placed in a conservation easement, including 10 acres to the east of the bridge and 10 acres to the west of the bridge. This would serve as added buffer for the riparian habitat, and preserve riparian areas that the project proponents assume will be used as an Indiana bat travel corridor beneath U.S. 6219.

Off-site Measures:

1. The project proponents will attempt to acquire Salisbury Mine if the private property owner is determined to be a willing seller. Failing this, they will attempt to extend the 20-acre conservation easement along Piney Creek, including the mine, through an agreement in perpetuity held between the property owner, PennDOT, and the Pennsylvania Game Commission. If purchase of the mine or expansion of the conservation easement that incorporates the mine are not achievable, the project proponents offer no other alternative conservation measure.

2. Mitigation being conducted to offset other resource losses may also eventually benefit Indiana bats. This includes 1) conservation of a 17-acre herbaceous meadow approximately two miles from Salisbury Mine, 2) preservation of a 540-acre Meadow Run fen approximately three miles south in Maryland, and 3) replanting of 50 acres of land in Maryland, as required by the Maryland Reforestation Law to offset forest removal along that part of the roadway in Maryland.

Action Area

The proposed project will include construction, operation, and maintenance of a new section of limited-access highway. The “action area” is defined by regulation as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action [50 CFR §402.02]. The action area is not limited to the “footprint” of the action, nor is it limited by the federal agency’s authority. The U.S. 6219 project is a long, linear project that cuts across waterways, forests, agricultural land, residential areas, and barren land. Indiana bats are known to hibernate in a cave/defunct limestone mine complex known as Salisbury Mine, which is located approximately 1,100 feet east of the proposed roadway (Figure 1).

The action area includes the paved roadway surface, median, developed roadway shoulders, maintained road-cut slopes, and areas that are affected by roadway-induced noise, runoff, invasive species, and changes in vegetation patterns. Forman and Deblinger (2000) found that the ecological effects area along a studied section of Massachusetts Route 2 was highly irregular. In that study, the habitat area affected by the road was documented to average just over 990 feet wide on each side of the road; however, sensitive forest-interior bird populations were reduced at more than twice this distance, up to 2,100 feet from the road. Indiana bats are ecologically similar to forest-interior bird species in that they depend on forest habitat for foraging and roosting, although their home ranges may be significantly larger. For the purpose of this opinion, we have defined the action area as 1,500 feet on each side of the pavement (*i.e*., the mean of the two distances above).

Much of the roadway alignment contains forested land that is potentially suitable as Indiana bat maternity foraging and roosting habitat. The disturbances occurring within the action area may overlap maternity colony foraging and roosting habitat that is centered up to two miles away on either side of the roadway. In addition, the action area nearly bisects the five-mile radius around Salisbury Mine. As a consequence, potential Indiana bat maternity, summer roosting, spring staging and migration, fall swarming, and fall foraging and roosting areas could be affected through direct alteration, fragmentation, or isolation induced by the new roadway, and subsequent traffic use, as explained in the *Effects of the Action* section below.

STATUS OF THE SPECIES

The Service listed the Indiana bat (*Myotis sodalis*) as endangered pursuant to the Endangered Species Preservation Act on March 11, 1967 (32 *Federal Register* 4001). Listing was warranted based primarily on large-scale habitat loss and degradation, especially at winter hibernation sites, and significant population declines. Critical habitat for the Indiana bat was designated on September 24, 1976, and consisted of 11 caves and two mines in West Virginia, Tennessee, Kentucky, Illinois, Indiana, and Missouri (41 FR 41914). Approximately 75 percent of the Indiana Bat population is thought to hibernate in the 13 hibernacula designated as critical habitat. The original recovery plan for the species (USFWS 1983) identified winter disturbance as a factor in the species decline, and ranks hibernacula based upon Indiana bat population sizes at the various sites. Hibernacula are designated as Priority 1, 2, or 3. Priority 1 hibernacula are sites with a recorded population >30,000 Indiana bats in a given survey since 1960 (although two of these sites currently have extremely low numbers of bats); Priority 2 hibernacula have

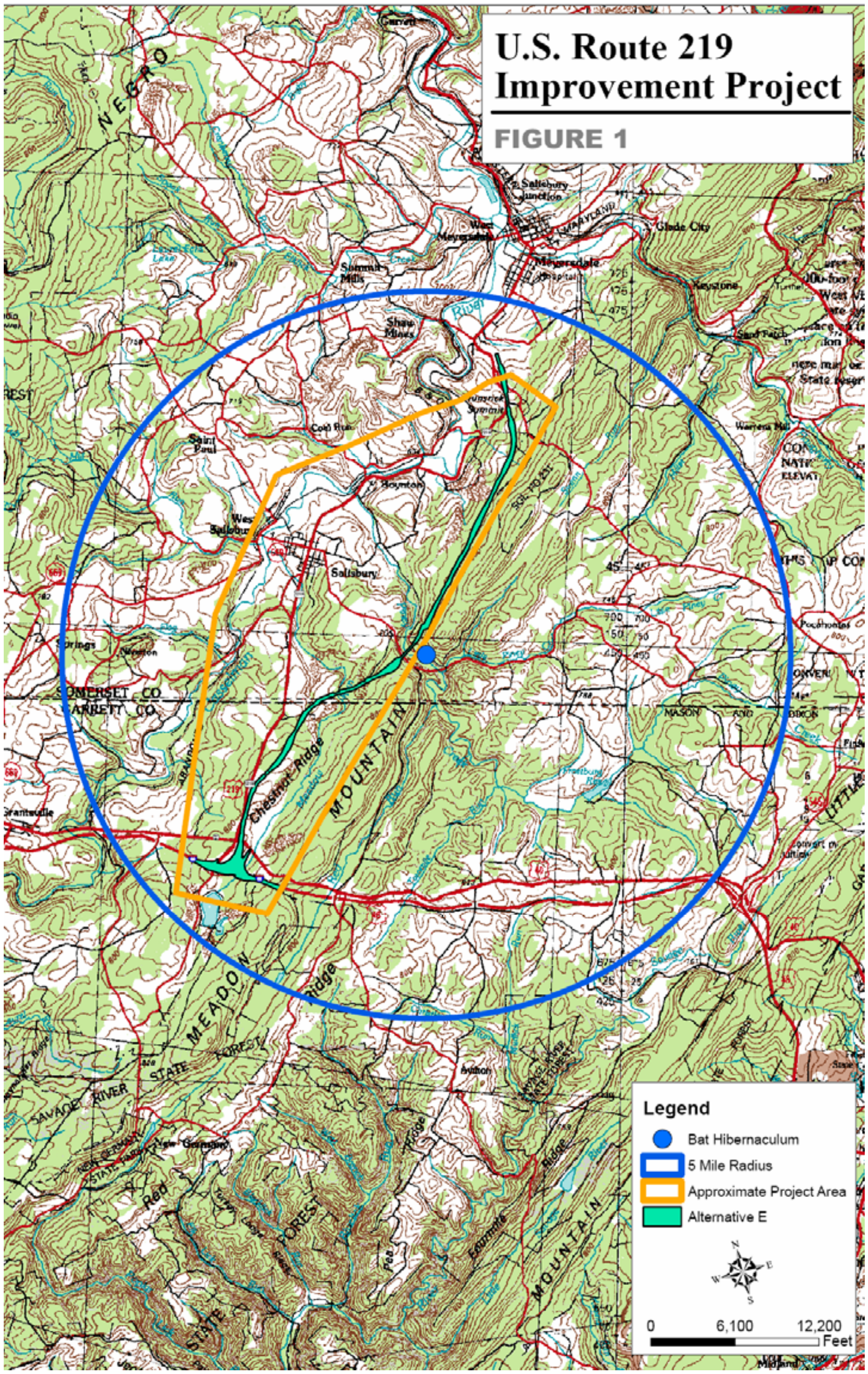

Figure 1. Map depicting the location of Salisbury Mine ("Bat Hibernaculum"); the 5-mile habitat radius likely used by the associated Indiana bats for swarming, staging, foraging, and roosting; the proposed roadway alignment ("Alternative E"); and the area studied by the project proponents for alignment selection. Figure adapted from FHWA's February 20, 2007, amended biological assessment.

recorded populations >500 but <30,000 Indiana bats in a given survey since 1960; and Priority 3 hibernacula have <500 bats (USFWS 1983).

Species Description

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates in mines and caves in the winter, and summers in wooded areas. The species was first differentiated from the related little brown bat (*Myotis lucifugus*), and described as a new species by Miller and Allen (1928), based on museum specimens collected in 1904 from Wyandotte Cave in Crawford County, Indiana. Because of the relatively recent recognition of the species, historic population characteristics have been reconstructed from early historical accounts and the study of bat remains in caverns in the eastern United States. Indiana bats appear to have been "one of the most common mammals in the Eastern United States" (Tuttle *et al.* 2004).

Life History

The Indiana bat's annual life cycle consists of hibernation, spring migration, birthing (parturition), raising of young by females (lactation), fall migration, mating (swarming), and hibernation. Each of these critical stages in this complex cycle is integral to the species survival and recovery. The following discussion provides a general overview of the life cycle of the Indiana bat.

Mortality between birth and weaning has been estimated at eight percent (Humphrey *et al.* 1977). Humphrey and Cope (1977) determined that female survivorship in an Indiana population of Indiana bats was 76 percent for ages one to six years, and 66 percent for ages six to 10 years; for males, survivorship was 70 percent for ages one to six years, and 36 percent for ages six to 10 years. The maximum ages for banded individuals were 15 years for females and 14 years for males. There are limited data available regarding current or historical survival rates for this species.

Winter – Hibernation. Hibernation facilitates survival during winter when prey (*i.e.*, insects) is unavailable. Indiana bats cluster and hibernate on cave and mine ceilings. Clusters of bats protect central individuals from temperature change and reduce sensitivity to disturbance. A majority of bats of both sexes hibernate by the end of November (by mid-October in northern areas) (Hall 1962; LaVal and LaVal 1980), but hibernacula populations have been observed to increase throughout the fall and even into early January (Clawson *et al.* 1980). Generally, Indiana bats hibernate from October through April (Hall 1962; LaVal and LaVal 1980), depending upon local weather conditions. Indiana bats often hibernate in the same hibernaculum with other species of bats, and are occasionally observed clustered with or adjacent to other species, including gray bats (*M. grisescens*), Virginia big-eared bats (*Plecotus townsendii virginianus*), little brown bats, and northern long-eared bats (Myers 1964; LaVal and LaVal 1980; Kurta and Teramino 1994).

The Indiana bat requires specific roost sites in caves or mines that attain appropriate temperatures for hibernation (Tuttle and Taylor 1994). In southern parts of the bat's range, hibernacula trap large volumes of cold air, and the bats hibernate where resulting rock temperatures drop. In northern parts of the range, however, the bats avoid the coldest sites. In both cases, the bats choose roosts with a low risk of freezing. Ideal sites are 50^{o} F or below when the bats arrive in October and November. Early studies identified a preferred mid-winter temperature range of 39-46^{o} F, but a recent examination of long-term data suggests that a slightly lower and narrower range of 37-43^{o} F is more suitable for this species (Hall 1962; LaVal and LaVal 1980; LaVal *et al.* 1976). Only a small percentage of available caves meet this specialized requirement. Stable low temperatures allow the bats to maintain a low rate of metabolism and conserve fat reserves through the winter until spring (Humphrey 1978; Richter *et al.* 1993).

Spring – Emergence, Staging and Migration. Female Indiana bats emerge first from hibernation in late March or early April, followed by the males (Hall 1962). The timing of annual emergence varies across the species range, depending on latitude and annual weather conditions; however, most Indiana bats have left their hibernacula by late April (Hall 1962). Indiana bats in the Barton Hill Mine hibernaculum in northeastern New York have been observed to move in clusters towards the entrance as they ready for emergence in early April (S. von Oettingen, USFWS, personal communication). Males from the same hibernaculum have been observed leaving as late as the end of May. Approximately 200 miles south of the Barton Hill Mine, at the Mt. Hope mine complex in New Jersey, peak spring emergence of females was documented in early April. No females were captured in mid-April and only a single female was captured at the end of April. Emergence of males peaked at the end of April (USFWS 2000). Exit counts from several hibernacula in southern Pennsylvania and Big Springs Cave in Tucker County, West Virginia, suggest that peak emergence from hibernation is mid-April for these two areas (Butchkoski and Hassinger 2002a).

Although Indiana bats mate in the fall, egg fertilization and gestation do not begin until spring. Shortly after emerging from hibernation, females become pregnant via delayed fertilization from sperm stored in their reproductive tracts through the winter (Hall 1962; Cope and Humphrey 1977; LaVal and LaVal 1980; Ransome 1990). The period after hibernation but prior to spring migration is typically referred to as *staging*. During this staging period, which can last for as little as one day or as long as a few weeks, most female Indiana bats emerge and forage near their hibernaculum before migrating to their previous summer maternity areas to give birth and raise young. Data collected during a two-year spring migration study tracking females to their summer roost sites in the Lake Champlain valley of New York, and in a separate Vermont study, suggest that females do not remain in the area surrounding the hibernaculum after emerging from hibernation, but leave for summer habitat soon after emergence (Britzke *et al.* 2004).

Data indicate that the area within an approximate five-mile radius of a hibernaculum is important foraging and roosting habitat for the Indiana bat in the spring and fall, although males have been found almost 10 miles from hibernacula (USDA 2000). Indiana bat roost trees used in the spring and fall are similar in physical structure to those selected during the summer. Little or no information is available to determine habitat use and needs for the Indiana bat during migration.

In the core of their range, most pregnant Indiana bats migrate north for the summer (Gardner and Cook 2002), and exhibit a stronger homing tendency along a north-south axis, rather than east-west (Gardner and Cook 2002; NatureServe 2004). In the northeastern part of their range, Indiana bats have been documented to migrate in other directions. In the Lake Champlain Valley of New York and Vermont, female Indiana bats migrated east and southeast to their summer habitat. In Pennsylvania, Indiana bats migrated south-southeast to their summer habitat (Butchkoski and Hassinger 2002a).

Females dispersing from a Kentucky hibernaculum in the spring moved 4 to 10 miles within 10 days of emergence, eventually traveling more than 300 miles from the hibernaculum to the maternity area (Gardner *et al.* 1996; Gardner and Cook 2002). However, maternity colonies have also been located within 2 to 25 miles of hibernacula (Butchkoski and Hassinger 2002a; Britzke *et al.* 2004). As previously discussed, migration is stressful for pregnant Indiana bats, particularly in the spring when their fat reserves and food supplies are low. In the northeastern part of their range, female Indiana bats that migrate shorter distances maximize energy reserves by arriving at their summer habitat quickly (Britze *et al.* 2004).

Colder spring temperatures in the northeast sometimes force the bats into temporary torpor, although some females were observed switching roosts when nighttime temperatures were below freezing. Cold temperatures also increase the likelihood of mortality. Adult mortality is thought to be highest in late March and April (Tuttle and Stevenson 1977). Springtime temperatures were unusually cold during a 2002 spring emergence study in New York, and two Indiana bats were found dead in or near their roosts (Britzke *et al.* 2004).

Less is known about the male migration pattern, but many males summer near hibernacula (Whitaker and Brack 2002). Some males disperse throughout the range and roost individually or in small numbers in the same types of trees and in the same areas as females.

Summer – Roosting and Maternity Colony Formation. Upon emergence from hibernation in the spring, the specific summer roosting behavior differs between males (and non-reproductive females) and reproductively active females, although actual roosting habitat is similar (Gardner *et al.* 1991b).

Some adult male Indiana bats form colonies in caves in summer, but most are solitary and roost in trees, often remaining near hibernacula to roost and forage in mature forest. Movements of 2.5 to 10 miles have been reported in Kentucky, Missouri, and Virginia (Gumbert *et al.* 2002; Hobson and Holland 1995; 3D/International 1996), while other males leave the area entirely. Solitary roosting Indiana bats do not appear to be as selective of roosts (*e.g.*, they may use smaller trees with fewer crevices, less exfoliating bark, *etc*.) as are reproductively active females attempting to rear young.

In contrast to males and non-reproductively active females, pregnant females migrate to specific locations to group into maternity colonies. Females begin to arrive in their maternity habitat as early as April 15 in Illinois (Gardner *et al.* 1991a, Brack 1983). Indiana bats were found at known maternity areas by March 29 at a site in Indiana (J. Whitaker, Indiana State University, personal communication). Humphrey *et al.* (1977) determined that Indiana bats first arrived at their maternity roost in Indiana in early May, with substantial numbers arriving in mid-May. The colonial behavior of the species likely reduces thermoregulatory costs, which in turn increases the amount of energy available for birthing and the raising of young (Barclay and Harder 2003). The number of bats comprising a maternity colony is difficult to determine because colony members are often dispersed among various roosts (Kurta, in press). While most of the documented maternity colonies have contained 100 or fewer adult bats (Harvey 2002), as many as 384 bats have been reported emerging from one maternity roost tree in Indiana (L. Pruitt, USFWS, personal communication). Based on results from 12 studies compiled by Kurta (in press), the mean maximum emergence count after young began to fly is 119 bats. This information suggests 60-70 adults in a primary roost and a similar number of young at any one time.

Indiana bats exhibit site fidelity to their traditional summer maternity areas. This life history strategy is thought to provide an advantage to the species by increasing the probability of successful reproduction. Evidence of philopatry (the tendency of a migrating animal to return to a specific location to breed or feed) is based on the documentation of female Indiana bats returning to the same general area to establish maternity colonies from year-to-year (Humphrey *et al.* 1977; Gardner *et al.* 1991a, b; Callahan *et al.* 1997; Indianapolis Airport Authority 2003, 2004; Kurta and Murray 2002; Butchkoski and Hassinger 2002b; Gardner *et al.* 1991a, Gardner *et al.* 1996), and to the same roost tree as long as that tree is available.

The occurrence of Indiana bats in any particular location within the range of the species may be governed by the availability of suitable roost structures, primarily standing dead or live trees with loose bark (Carter 2003; Kurta *et al.* 2002; Kurta *et al.* 1993a; 3D/E 1995; Gardner *et al.* 1991b). The suitability of any tree as a roost site is determined by 1) its condition (dead or alive); 2) the quantity of loose bark; 3) the tree's solar exposure and location in relation to other trees; and 4) the tree's spatial relationship to water sources and foraging areas. Indiana bats utilize interstitial spaces within trees, or parts of trees, as roost sites. For example, roosts have been found in tree cavities or hollow portions of tree boles (Gardner *et al.* 1991a; Kurta *et al.* 1993b); a crevice in the top of a lightning-struck tree (Gardner *et al.* 1991a); and splintered, broken tree tops (Kurta, *et al.* 1996; Callahan *et al.* 1997; Gardner *et al.* 1991b; Garner and Gardner 1992). The often dead or damaged conditions of roost trees indicate that suitable roosts are ephemeral resources. Indiana bats are probably not dependent on the continued suitability of a specific tree, as long as adequate roosting opportunities are available nearby. Indiana bats have been documented to have the ability to relocate after the loss of a roost tree (Kurta *et al.* 2002).

Indiana bats select roost trees based on structural characteristics, diameter of the tree, solar exposure, and position in the canopy (Kurta *et al.* 2002; 3D/E 1995). Maternity roost trees throughout the species' range apparently share these characteristics. Roost tree structure is probably more important than the tree species in determining whether a tree is a suitable roost site (Farmer *et al.* 1997). Maternity roosts are generally found in dead or dying trees with exfoliating bark, or live trees of species with exfoliating or shaggy bark, such as hickories and white oaks.

Occasionally, female Indiana bats have been observed to roost in crevices or tree cavities, but maternity colonies are rarely found in these situations (Menzel *et al.* 2001). Maternity roost trees generally receive a high amount of solar exposure, either because they are larger canopy trees, or are located near forest edges or openings (Callahan *et al.* 1997; Menzel *et al.* 2001). Solar exposure at northeastern maternity colonies may be a more important factor in roost tree selection than for colonies in the southern part of the range.

Indiana bat maternity roosts can be described as "primary" or "alternate," depending upon the proportion of maternity colony members using the roost site (Callahan *et al.* 1997; Kurta *et al.*

1996). Most primary roosts are found in large, dead trees, generally ranging in size from 12.2 to 29.9 inches dbh (3D/E 1995). Maternity colonies have at least one primary roost (up to five have been identified for a single colony in Vermont) used by the majority of the bats throughout the summer. Primary roosts must be able to provide a roosting site for many female Indiana bats with young. Primary roosts are often located in openings or at the edge of forest stands, while alternate roosts can be in the open or in the interior of forest stands. Thermoregulatory needs are likely to be a contributing factor in roost site selection, and primary roosts are generally in locations where they can be warmed by solar radiation, thus providing a favorable microclimate for growth and development of young.

Alternate roosts tend to be more shaded, frequently are within forest stands, and are selected when temperatures are above normal or during periods of precipitation. Shagbark hickories seem to be particularly good alternate roosts because they provide cooler roost conditions during periods of high heat, and their tight bark shields bats from rainfall (Callahan *et al.* 1997). In Vermont, maternity roosts ranged from 19 inches to 36 inches dbh (Palm 2003, Britzke *et al.* 2004). Alternate roost trees also tend to be large, mature trees, but the range in size is somewhat wider than that of primary roosts (7.1 to 32.7 inches dbh) (3D/E 1995). A colony's alternate roost trees are typically used less frequently, and by smaller numbers of bats.

A variety of suitable roosts are needed within a colony's summer range for the colony to continue to exist. Gardner *et al.* (1991), and Garner and Gardner (1992) suggested the optimal density of potential roost trees within an area is 6.9 per acre in uplands, and 10.9 per acre in floodplains. Most roost trees may be habitable for only 2 to 8 years (depending on the species and condition of the roost tree) under natural conditions. Gardner *et al.* (1991b) evaluated 39 roost trees and found that 31 percent were no longer suitable the following summer, and 33 percent of those remaining were unavailable by the second summer. The presence of live, large-diameter trees within a forested area is important to the long-term sustainability of the area as Indiana bat habitat, since these trees will eventually die and develop the characteristics of primary maternity roosts.

Humphrey *et al.* (1977) observed that each night after the sunset peak of foraging activity, the bats left the foraging areas without returning to the day roosts, which indicated the use of "night" roosts. When young are present, but not yet volant (capable of flight), the female bats will return occasionally throughout the night, presumably to care for the young.

Maternity colony movements among multiple roosts, particularly from primary roosts to alternate roosts, seem to depend on weather changes, particularly in solar radiation (Humphrey *et al.* 1977) or precipitation. Maternity movement between primary roosts from season to season is dependent upon roost availability. Kurta *et al.* (1993a) suggests movement between roosts is an adaptation for dealing with roost sites that have ephemeral qualities such as loose bark. The bat that is aware of alternate roost sites is more likely to survive the sudden, unpredictable destruction of its present roost than the bat that has never identified such an alternative (Kurta *et al.* 2002; Kurta and Murray 2002).

The coordinated relocation of a maternity colony is only known to occur in a slow, methodical manner, into familiar habitat (Kurta *et al.* 2002). In a Michigan study, the focal point of a maternity colony's activity shifted 1.24 miles over a three-year period after the primary roost tree fell. The area that bats shifted into had been previously used by a single radio-tracked female for roosting during the summer prior to loss of the primary roost tree (Kurta *et al.* 2002). This is consistent with a number of other situations where the primary roost tree of a maternity colony had been lost and the bats moved to nearby roosts but retained the same commuting corridors and foraging areas (Humphrey 1977; USFWS 2002). Although Carter (2003) recognizes that female Indiana bats are faithful to a colony site, he suggests that, in the long term, Indiana bat maternity colonies must be "nomadic" because of their dependence on an ephemeral resource. Despite this theory, there is no evidence to suggest that bats are able to adapt to a sudden, abrupt loss of familiar gathering places and familiar roosting and foraging habitat. The availability and quality of adjacent habitat is also important to the maintenance of a maternity colony (USFWS 2004c).

After grouping into maternity colonies, females give birth to a single offspring in June or early July (Easterla and Watkins 1969, Humphrey *et al.* 1977). Belwood (2002) documented asynchronous births among members of a colony resulting in great variation in size of juveniles (newborn to almost adult size young) in the same colony. In Indiana, lactating females have been recorded from June 10 to July 29 (Whitaker and Brack 2002). Young Indiana bats are capable of flight within a month of birth. Young born in early June have been observed to be flying as early as the first week of July (Clark *et al.* 1987), others from mid- to late July.

When young become capable of flight (early to late July), the maternity colony begins to disperse from the primary maternity roost(s). Bats become less gregarious and the colony utilizes more alternate roosts, possibly because there is no longer a need for the adult females to cluster to assist with thermoregulation and nurture the young (Indianapolis Airport Authority 2003, 2004). The use of primary maternity roosts diminishes, though the bats stay in the area prior to migrating back to their respective hibernacula.

Summer – Foraging. After Indiana bats emerge from hibernation, fat stores become further depleted as they migrate to their summer maternity areas. Fat stores in most bat species decline rapidly during hibernation (Fleming and Eby 2003), and migration can subsequently use between 10 and 25 percent of a bats' body weight in fat reserves (Fleming and Eby 2003). Upon arrival at summer maternity habitat, bats must restore their body weight and increase their food intake to prepare for giving birth. Reproductively active bats need to elevate this biosynthesis to support pregnancy and lactation (Speakman and Thomas 2003). For example, basal metabolism of pregnant and lactating brown long-eared bats (*Plecotus auritus*) is nearly double that of non-reproducing individuals (Speakman and Thomas 2003). Furthermore, the foraging efficiency of bats declines during pregnancy, which is a time when energy demands increase (Barclay and Harder 2003). Female little brown bats spend 66 percent of their daily energy on foraging (Barclay and Harder 2003).

Streams, associated floodplain forests, and bodies of water (*e.g.*, ponds, wetlands, reservoirs) are preferred foraging habitats for pregnant and lactating Indiana bats, some of which have been observed to fly up to 1.5 miles from upland roosts (Gardner *et al.* 1991b). In riparian areas, Indiana bats primarily forage near riparian and floodplain trees (*e.g.*, sycamore [*Platanus occidentalis*], cottonwoods [*Populus* spp.], black walnut [*Juglans nigra*], black willow [*Salix nigra*], and oaks [*Quercus* spp.]), and along forest edges on the floodplain (Belwood 1979; Cope *et al.* 1978; Humphrey *et al.* 1977; Clark *et al.* 1987; Gardner *et al.* 1991b). Within floodplain forests where Indiana bats forage, canopy closures range from 30 to 100 percent (Gardner *et al.* 1991b). Cope *et al.* (1978) characterized woody vegetation within a width of at least 30 yards of a stream as excellent foraging habitat. Indiana bats also forage within the canopy of upland forests, over clearings with early successional vegetation (*e.g.*, old fields), along the borders of croplands, along wooded fencerows, and over farm ponds in pastures (Clark *et al.* 1987; Gardner *et al.* 1991b). Seidman and Zabel (2001) documented the use of intermittent and perennial streams by bats to forage. While this did not include Indiana bats, four of the seven species studied were of the genus *Myotis*. Sparks *et al.* (in press) suggest that in heavily forested landscapes, the edges of open spaces provide important foraging habitats.

Linear distances between roosts and foraging areas for females ranged from between 0.3 mile to 5.2 miles, although most distances were less than half that maximum distance (Murray and Kurta 2004; Sparks *et al.* in press). The maximum distance listed above was reported for one individual at a colony in Indiana. However, when 41 bats from this colony were tracked, the mean distance between roosting and foraging areas was 1.86 miles. Given the large and variable range of this species, large differences in home ranges would be expected, and the variations in distances to foraging areas might be due to differences in habitat type, interspecific competition, and landscape terrain.

Roosts occupied by individuals ranged from 0.33 mile to more than 1.6 miles from preferred foraging habitat, but are generally within 1.2 miles of water (*e.g.*, stream, lake, pond, natural or man-made depression). In Illinois, the mean nightly foraging distance from a roost ranged from 0.34 mile to 0.65 mile (Garner and Gardner 1992). Average foraging areas for individual Indiana bats varied from approximately 70 acres (juvenile males) to over 525 acres (post-lactating adult females) (A. King, personal communication). The extent of foraging area used by an Indiana bat maternity colony has been reported to range from a linear strip of creek vegetation 0.5 mile in length (Belwood 1979; Cope *et al.* 1978; Humphrey *et al.* 1977), to a foraging area 0.75 mile in length, within which bats flew over the river or around riverside trees. The mean foraging area of three individual, reproductive female Indiana bats was 128 acres (pregnant), 232 acres (lactating), and 526 acres (post-lactating) (Garner and Gardner 1992). In Illinois, foraging area for a lactating female was reported to be 850 acres, while a post-lactating female that had been subject to timbering activities used 625 acres (Gardner *et al.* 1991a, b).

Maternity colonies have often been found within forests that are streamside ecosystems or are otherwise within 0.6 mile of permanent streams. Garner and Gardner (1992) suggested that suitable Indiana bat roosting and foraging habitat will be within 0.62 mile of water. Indiana bat roosts in Illinois were less than 0.68 mile from perennial streams (Gardner *et al.* 1991). Kurta *et al.* (2002) found that 38 roosts in Michigan were on average 0.409 $\pm$ 0.36 mile from lakes or ponds and 0.258 $\pm$ 0.45 mile from perennial streams. These water sources and associated forested riparian habitat not only provide drinking water and food, but also serve as flight corridors to suitable foraging habitat. A telemetry study in Illinois found most maternity roosts within 1640 feet of a perennial or intermittent stream (Hofmann 1996). Bats in Illinois selected roosts near intermittent streams and far from paved roads (Garner and Gardner 1992).

Sparks *et al.* (in press) suggest that the perfect foraging habitat for the Indiana bat would include forested streams interspersed with grasslands, croplands, or shrublands. 3D/E (1995) identified essential summer habitat as including at least 30 percent forested cover on a landscape scale.

Farmer *et al.* (1997) indicated that optimal summer habitat has 20 to 60 percent forest cover, and that areas with less than five percent forest cover are not suitable for Indiana bats.

Because most Indiana bats caught in mist-nets are captured over streams and other flyways at heights greater than six feet (Gardner *et al.* 1989), it is believed that Indiana bats usually forage and fly within an air space from six to 100 feet above ground level (Humphrey *et al.* 1977), although because sampling at more than 100 feet above ground level is uncommon, predicted flight heights maybe an artifact of sampling.

Indiana bats feed solely on aquatic and terrestrial flying insects (Brack and LaVal 1985; Kurta and Whitaker 1998; Belwood 1979; USFWS 1983). They are habitat generalists and their selection of prey items reflects the environment in which they forage (LaVal and LaVal 1980). Because of the large and variable distribution of the Indiana bat (Gardner and Cook 2002; Brack *et al.* 2002), it is not surprising that differences in foraging habitat have been recorded between different parts of the summer range, or between bats in maternity habitat and those near hibernacula. For example, in the southern part of the range, terrestrial prey (moths and beetles) are more common in the tree canopy where Indiana bats have been observed to forage, predominantly near treetops (Brack and LaVal 1985). In the northern part of the range, where foraging areas are more limited to riparian zones, aquatic prey dominates the diet.

Diet varies seasonally and variation is observed among individuals of differing age, sex, and reproductive status (Belwood 1979). It is likely that Indiana bats use a combination of both selective and opportunistic feeding to their advantage (Brack and LaVal 1985). Reproductively active females and juveniles exhibit greater dietary diversity than males and non-reproductively active adult females, perhaps due to higher energy demands. Studies in some areas have found that reproductively active females eat more aquatic insects than do juveniles or adult males (Kurta and Whitaker 1998), and this may be the result of habitat differences (Brack and LaVal 1985). Differences in habitat availability and competition with other species may be two explanations for such seasonal or geographic differences in selection of foraging habitat (Sparks *et al.*, in press). Preliminary analysis of data collected in Pennsylvania (Butchkoski and Hassinger 2002a), Missouri (Romme *et al.* 2002), and Indiana (Sparks *et al.*, in press) show no clear association between size of foraging area and sex, age, or reproductive class. It is apparent that Indiana bats show fidelity to foraging areas between years by bats in different reproductive classes (Sparks *et al.*, in press).

Drinking water is essential when bats actively forage. Throughout most of the summer range, Indiana bats frequently forage along riparian corridors and obtain water from streams. However, ponds and water-filled road ruts in the forest uplands are also very important water sources for Indiana bats.

Fall – Swarming. Indiana bats begin to return to their respective hibernacula as early as August. Females from the same maternity colony do not necessarily go to the same hibernaculum. Breeding takes place and fat reserves are replenished as bats congregate at hibernacula and prepare for hibernation. Racey (1982) notes that a particular ratio of fat to lean mass is normally necessary for puberty and the maintenance of female reproductive activity in mammals. He suggests further that the variation in the age of puberty in bats is due to nutritional factors, possibly resulting from the late birth of young and their failure to achieve threshold body weight in their first autumn. Once puberty is achieved, reproductive rates frequently reach 100 percent among healthy bats of the family Vespertilionidae, and young, healthy female bats can mate in their first autumn as long as their prey base is sufficient to allow them to reach a particular fat to lean mass ratio. Limited mating activity occurs throughout the winter and in late April as the bats leave hibernation (Hall 1962).

In the fall, male Indiana bats tend to roost and forage in upland and ridgetop forests, but also forage in valley and riparian forests. Movements of 1.8 to 4.2 miles from hibernacula have been reported in Kentucky and Missouri (Kiser and Elliott 1996; 3D/International 1996).

Upon arrival at hibernation caves in August through September, Indiana bats "swarm," a behavior in which "large numbers of bats fly in and out of cave entrances from dusk to dawn, while relatively few roost in the caves during the day" (Cope and Humphrey 1977). Very little is known about behavior and habitat use by Indiana bats during the fall, and what little is known is based primarily on observations of males.

Swarming continues for several weeks (August through October) and mating occurs during the latter part of this period. Fat supplies are replenished as the bats forage prior to hibernation. Indiana bats tend to hibernate in the same cave around which they swarm (LaVal *et al.* 1976), although swarming has occurred in caves other than those in which the bats hibernated (Cope and Humphrey 1977). Male Indiana bats sometimes make several stops at multiple caves during the fall swarming period. During swarming, males remain active over a longer period of time at cave entrances than do females (LaVal and LaVal 1980), probably to mate with the females as they arrive. The time of highest swarming activity in Indiana and Kentucky has been documented as early September (Cope and Humphrey 1977). After mating, females enter directly into hibernation.

During the fall, when Indiana bats swarm and mate at their hibernacula, male bats roost in trees nearby during the day and fly to the cave at night. In Kentucky, Kiser and Elliott (1996) found male Indiana bats roosting primarily in dead trees on upper slopes and ridgetops within 1.5 miles of their hibernaculum. During September in West Virginia, male Indiana bats roosted within 3.5 miles in trees near ridgetops, and often switched roost trees from day to day (Ford, *et al.* 2002). Fall roost trees tend to be exposed to sunshine rather than shaded (Menzel *et al.* 2001).

<u>Status of the Indiana bat within its Range</u>

Due to the colonial nature of Indiana bats, conducting censuses of hibernating bats is the most reliable method of tracking population/distribution trends range-wide, and provides a good representation of the overall population status and distribution. As such, winter distribution of the Indiana bat is well documented.

Between 1960 and 2004, a 56 percent population decline was documented (Clawson 2002). A variety of factors have contributed to the range-wide Indiana bat population decline, including flooding and ceiling collapse in winter hibernacula (USFWS 1983). This often resulted in adverse changes to the hibernaculum microclimate by affecting temperature and humidity. Other documented causes of Indiana bat decline include 1) blocking cave entrances or installing gates that do not allow for bat ingress and egress, or disrupt cave airflow; and 2) human disturbance during hibernation. These events resulted in either die-off during hibernation due to freezing, or starvation as the higher temperatures increased the bats' metabolism. This can result in the burning of limited fat reserves that are required for the bats to survive hibernation and successfully emerge in the spring. Indiana bats do not have the ability to awake from hibernation, leave the cave, forage for additional sustenance, and return to the cave to complete hibernation. If fat reserves are not sufficient, they will starve.

Because of the importance of hibernacula to Indiana bats, protection of hibernacula has always been a management priority. Despite the protection of approximately half of the major known hibernacula (Currie 2002), range-wide population declines continue. In the last fifteen years, appropriately constructed bat gates have been correctly installed at cave entrances, allowing for protection of hibernating bats and restoration of the microclimate. Although most of these efforts were completed by 1990 and resulted in some recolonization of traditional hibernacula, there have not been corresponding overall population increases (Clawson 2002). Possible reasons for this may be due to the species' low reproductive capacity, since it takes much longer than 10 to 20 years to show population gains, or other environmental factors that continue to adversely affect the species. A hypothesis for population declines is that warmer winter temperatures have resulted in less conducive micro-habitat conditions (warmer temperatures) at hibernacula, particularly in the southern part of the species range (R. Clawson, Missouri Department of Conservation, personal communication).

It should be noted that hibernating populations in northern portions of the species range appear to be stable or increasing, while hibernating populations in the south are decreasing. However, because of the migratory behavior of this species and other reasons described below, it is not prudent to differentiate between different geographical ranges with regard to wintering populations. The range-wide decline has led scientists to conclude that additional information on Indiana bat summer habitat is needed (3D/E 1995).

In contrast to hibernacula, relatively few Indiana bat maternity colonies have been documented. The location of most maternity colonies will likely remain unknown due to the difficulty in detecting maternity activity for the Indiana bat. This places these colonies at risk when land use practices, such as timber harvesting and development, are carried out. Therefore, another likely cause for the species decline is reductions in the size or number of maternity colonies due to habitat loss.

Land use practices have been identified as a suspected cause in the decline of the Indiana bat, particularly because habitat in the Indiana bats' maternity range has changed dramatically from pre-settlement conditions. The majority of old-growth forests have been harvested, and remaining forests fragmented to varying degrees. In addition, fires have been suppressed, prairies have been replaced with agricultural systems, native plants have been replaced with exotics, and plant community diversity has been reduced. These changes reduce the quantity and quality of suitable roosting habitat, and the diversity and abundance of insects on which Indiana bats prey (USFWS 1983; Kurta and Murray 2002; Kurta *et al.* 2002; McCracken 1988; Racey and Entwistle 2003).

In addition to changes in Indiana bat summer habitat over time, there is also an increased risk of pesticide contamination (Clark *et al.* 1987; Clawson 1987; Garner and Gardner 1992; Callahan *et* *al.* 1997; 3D/E 1995; O'Shea and Clark 2002; Kurta and Murray 2002). Insecticides have been known or suspected as the cause of a number of bat die-offs in North America, including endangered gray bats in Missouri (Mohr 1972; Reidinger 1972; Clark and Prouty 1976; Clark *et al.* 1978). The insect diet and longevity of bats also exposes them to persistent organochlorine chemicals that may bioaccumulate in body tissue and cause sub-lethal effects, such as impaired reproduction (O'Shea and Clark 2002).

Status of the Indiana Bat in Pennsylvania

In Pennsylvania, Indiana bats use a variety of subterranean areas for hibernation, including limestone caves, mines (limestone, anthracite coal), and a tunnel. Potential summer habitat occurs throughout Pennsylvania, and maternity colonies have been recently documented in four counties.

Hibernating Population. There are 17 known Indiana bat hibernacula in Pennsylvania. The largest concentration of hibernating Indiana bats is found in the J.D. Hartman Mine, Blair County. This is the State's only Priority 2 hibernaculum, and it currently supports about 1,000 Indiana bats representing 90 percent of Pennsylvania's hibernating Indiana bat population (PGC 2002, 2003). The winter Indiana bat population trend in Pennsylvania differs from the range-wide trend, in that Pennsylvania numbers appear to be stable or increasing. The increase at these sites apparently followed efforts to prevent disturbance through gating and, in some cases, by implementing predator control measures.

Summer Population. Four Indiana bat maternity colonies have been identified in Pennsylvania. They occur in Blair, Bedford, Berks, and Greene Counties. The Blair County site was identified in 1997 near Canoe Creek State Park. The Bedford and Berks County sites were located during spring migration telemetry studies, which tracked bats exiting a tunnel in Somerset County (2007) and an abandoned coal mine in Luzerne County (2006), respectively. The Greene County site was found during mist-netting in 2007.

In the spring of 2005, the Pennsylvania Game Commission placed transmitters on six female Indiana bats emerging from the Hartman Mine. Two of these bats were successfully tracked to destinations in Carroll County, Maryland, where roost-tree exit counts have confirmed the presence of a maternity colony at each of the two sites. The two Maryland sites are approximately 84 and 92 miles, respectively, to the southeast of the Hartman Mine (C. Butchkoski, Pennsylvania Game Commission, personal communication).

While some spring telemetry studies have led to the discovery of maternity colonies, others have not. In the spring of 2000, four Indiana bats were tracked from a railroad tunnel used as a hibernaculum in Somerset County. These bats were lost when transmitter power stopped, although one female bat was tracked eastward for 60 miles before being lost (Sanders and Chenger 2000). In 2007, Indiana bats were tracked from a limestone mine in Armstrong County. These bats traveled southwest, around Pittsburgh, before being lost in the West Virginia panhandle on a trajectory to southern Ohio or Kentucky (C. Butchkoski, personal communication).

Individual male Indiana bats have also been captured during mist-net surveys at two sites in or near the Allegheny National Forest. However, mist-netting in subsequent years failed to locate Indiana bats at either location.

Previous Incidental Take Authorizations

All previously issued Service biological opinions involving the Indiana bat have been non-jeopardy. These formal consultations have involved 1) the Forest Service for activities implemented under various Land and Resource Management Plans on National Forests in the eastern United States, 2) the Federal Highway Administration for various transportation projects, 3) the U.S. Army Corps of Engineers (Corps) for various water-related projects, and 4) the Department of Defense for operations at several different military installations. Additionally an incidental take permit has been issued under section 10 of the Endangered Species Act to an Interagency Taskforce for expansion and related development at the Indianapolis Airport in conjunction with the implementation of a habitat conservation plan.

It is important to note that in many of these consultations, survey information was lacking. As federal agencies are not required to conduct surveys, often the Service relied on a host of factors in helping the federal agency determine whether Indiana bats may be present. To ensure the federal agency and the Service met the mandate of section 7(a)(2), if the best available data indicted that Indiana bats may be present, the assumption was made that a maternity colony (in most instances) occurred within the action area. Although this approach meets the intent of Congress and the Endangered Species Act of 1973, it likely resulted in an overestimate of the number of individuals or colonies that may have been affected by federal actions.

Nearly all National Forests within the range of the Indiana bat have requested formal consultation at the programmatic level. Approximately 95 percent of previously authorized habitat loss on National Forests has not been a permanent loss. Rather, it has been varying degrees of temporary loss (short-term and long-term) as a result of timber management activities. Conservation measures implemented by the Forest Service as part of the proposed action, as well as reasonable and prudent measures provided by the Service to minimize the impact of the annual allowable take for each of the National Forests, have ensured an abundance of available remaining Indiana bat roosting and foraging habitat on all National Forests, and the persistence of any known or newly discovered maternity colonies.

The remaining incidental take statements have been issued to other federal agencies, including the Federal Highway Administration. Unlike those issued for National Forest land and Resource Management Plans, some of these projects were certain to affect habitat known to be occupied. To minimize the effects of the projects, the action agencies agreed to implement various conservation measures. These included seasonal clearing restrictions to avoid disturbing female Indiana bats and young; protection of all known primary and alternate roost trees with appropriate buffers; retention of adequate roosting and foraging habitat to sustain critical life history requirements of Indiana bats in the future; permanent protection of habitat; and habitat enhancement or creation measures to provide future roosting and foraging habitat.

With the exception of three (Fort Knox, Great Smoky Mountains National Park, and Laxare East and Black Castle Contour Coal Mining Projects), none of these biological opinions and associated incidental take statements anticipated the loss of a maternity colony or hibernaculum. We believe most of the take exempted to date has resulted in short-term effects to Indiana bat habitat and in limited circumstances, Indiana bat maternity colonies. As many of these consultations necessarily made assumptions about Indiana bat presence, we are uncertain of the actual number of maternity colonies exposed to environmental impacts of federal actions throughout the species' range, but we believe the actual number is likely less than what we have assumed. Furthermore, although not definitive, monitoring of several maternity colonies pre- and post-project implementation preliminarily suggests that our standard conservation measures, when employed in concert, appear to be effective in minimizing adverse effects on the affected maternity colonies.

ENVIRONMENTAL BASELINE

The environmental baseline includes the past and present impacts of all federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed federal projects in an action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process (50 CFR 402.02).

Salisbury Mine/Cave (Winter)

The Salisbury Cave/Mine is a defunct limestone mine cut into a natural cave system formed in the limestone of the Mississippian Mauch Chunk Formation. The entrance is located approximately half a mile north of the Pennsylvania/Maryland state border. It is the hibernaculum for a small number of Indiana bats. Salisbury Cave/Mine is a privately-owned Priority 3 hibernaculum (*i.e.*, <500 bats), and is one of 17 identified Indiana bat hibernacula in Pennsylvania, eight of which are in limestone mines.

The PGC has monitored Indiana bat use of Salisbury Mine by conducting mid-winter counts of the bats in 1986, 1991, 1999, and in March 2005. In 1986, only 315 bats of all species were counted, and no Indiana bats were recorded. Salisbury Mine's two entrances were gated in October 1992 by PGC and volunteers from the Loyalhanna Grotto, with partial funding from the Service to limit access to the Mine. In addition to three Indiana bats counted in 2005, more than 2000 other bats were counted (Pennsylvania Game Commission, unpublished data). The mine is used by all six cave-hibernating bat species in Pennsylvania, which in addition to the Indiana bat, also includes a small number of eastern small-footed myotis (*Myotis leibii*), a species that is listed as threatened by the Commonwealth of Pennsylvania (Pennsylvania Game Commission, unpublished data). Based on this diversity, Salisbury Mine is listed by the Pennsylvania Biological Survey as one of two *Important Mammal Areas* in Somerset County (Western Pennsylvania Conservancy 2005).

Due to the complex nature of the mine and cave passages, only about 90 percent of the mine is accessible. It is estimated that up to 15,000 bats hibernate here (Western Pennsylvania Conservancy 2005), including perhaps a few dozen Indiana bats (C. Butchkoski, Pennsylvania Game Commission, personal communication). The inaccessibility of part of the mine may, in part, account for the fluctuations in survey numbers of the overall bat population, particularly if bats move into or out of the less visible areas from year to year. However, even considering the fluctuations, it appears that the bat population, including the number of Indiana bats, has increased following gating. From the limited available data, it appears that the small Indiana bat hibernating population in Salisbury Mine is stable, if not gradually increasing.

In addition to Salisbury mine, the assessment describes a 2005 study of 28 additional mine openings in the project area. These were assessed for bat use as part of the U.S. 6219 project. Only four of these mines appeared to have potential for bat use. Harp traps set at the entrances of these four mine openings resulted in the capture of up to 29 bats, and the higher numbers may indicate a fairly large hibernating bat population. An opening identified as "mine 1" is located approximately 1,000 feet east of the northern-most section of the proposed roadway alignment. Twenty-six bats representing three species were collected at this opening, including little brown bats (*Myotis lucifugus*), long-eared bats (*Myotis septentrionalis*), and eastern pipistrelles (*Pipistrellus subflavus).* No Indiana bat activity was documented at Mine 1, but at low densities detection would be unlikely with limited sampling. Because Indiana bats have not been documented at this location, no avoidance measures have been proposed, although if this mine is occupied by Indiana bats, the effects of roadway construction and operation would be similar to those expected at Salisbury Mine.

<u>Foraging and Roosting (Spring, Summer and Fall)</u>

Aside from harp traps placed at four mine openings in the study area described above, there appears to have been no past efforts to assess Indiana bat activity in the action area during spring emergence/migration or fall swarming at Salisbury Mine. In the absence of direct documentation of Indiana bats in the area (*e.g.,* mist net or radio-telemetry survey data), the project proponents are assuming that the species is in the action area all year. This assumption is supported by data from other sites in Pennsylvania, where survey data indicate Indiana bats may migrate large distances from a hibernaculum in the spring (*e.g.,* more than 70 miles) or may remain relatively close to the hibernaculum, establishing maternity colonies only a few miles away (*e.g.*, approximately one mile from the hibernaculum in Blair County, and approximately 10 miles from the hibernaculum in Bedford County). These colonies include bats from the nearby hibernaculum, but may also include individuals that migrated from more distant hibernacula, perhaps as far as 300 miles away.

Spring – Habitat Use and Migration. Relatively little is known about habitat use by Indiana bats during the spring and fall periods. Pre- and post-hibernation activity is expected to occur within five to 10 miles of a hibernaculum (USFWS 1983; Romme *et al*. 2002), an area that for the Salisbury Mine hibernaculum encompasses the entire proposed U.S. 6219 project. Those bats leaving the hibernaculum in early spring probably stay relatively near the mine until migration and then quickly leave the area. Since 2001, spring radio-tracking of female Indiana bats leaving several different Pennsylvania hibernacula have documented that individuals tend to quickly leave the area of the hibernaculum, unless their maternity habitat is nearby.

Some adult males use mature forests near their hibernacula for roosting and foraging from spring through fall. Other male bats have been found to leave the hibernacum area completely (USFWS 1999b). Male Indiana bats have been found to use the same summer habitat in subsequent years (USFWS 1999b).

Summer – Maternity Colonies. There have been no surveys completed in the action area to identify maternity colonies; therefore, there is no direct information regarding potential colony size, location, or land use. The best scientific and commercially available information regarding maternity colonies in central Pennsylvania come from two nearby maternity colonies, one associated with the Hartman Mine (Canoe Creek) hibernaculum in Blair County and the other associated with the Pennsylvania Turnpike Tunnel hibernaculum in Somerset County. Both of these hibernacula, and associated maternity colonies, are in an ecological setting that is similar to the setting of the action area. These hibernacula and Salisbury Mine are situated in the Appalachian Ridge and Valley Province, with the hibernacula located on the ridge face and the maternity colony in the adjacent valley. While some female Indiana bats from Hartman Mine and the Turnpike Tunnel remain in the vicinity to establish nearby maternity colonies, it is not clear if individuals from other hibernacula join these colonies. Indiana bats that hibernate in Salisbury Mine may similarly remain in the valley adjacent to the mine and be joined by individuals migrating to the Casselman River Valley from other locations during the summer. Based on the above information it is reasonable to presume that a maternity colony may be present in the project area.

Summer – Non-maternity Habitat Use. During summer months, it is likely that some males that hibernate in Salisbury Mine remain near the mine and forage in riparian areas (including Piney Creek, Meadow Run, the Casselman River and wetlands associated with these systems), pastures, forests, and on ridge tops. Male Indiana bats generally travel between 1.2 and 2.6 miles from their summer roosts to summer foraging areas (USFWS 1999b), and have a minimum foraging area of about 400 acres, surrounding a higher use area of 115 acres (Kiser and Elliott 1996). Roost trees are expected to be primarily dead snags; however, live shagbark hickory and pignut hickory (*Carya glabra*) trees have been recorded as roost trees. Male Indiana bats have been found to roost singly during autumn in scarlet oak (*Quercus coccinea*), Virginia pine (*Pinus virginiana*), red maple (*Acer rubrum*), shagbark hickory, and red oak. These trees ranged in diameter from 4.6 to 26 inches, with an average diameter of 13 inches, and had bark coverage ranging from 1 to 100 percent. However, the majority of roost trees had bark coverage of at least 60 percent (Kiser and Elliott 1996). During the fall, male bats have been observed to forage in upland, ridgetop forest as well as valley and riparian forest areas (USFWS 1999b).

Fall – Habitat Use. There have been no direct observations of fall foraging, swarming, or roosting activity in the action area. Therefore, the following discussion is based on observations made regarding the species habitat use and behaviors in other locations, since this represents *the best scientific and commercially available information*.

Habitat use during the fall probably varies somewhat from year to year due to weather conditions, prey availability, and the proximity and quality of available roosts. Early in the period, the bats are likely to have a larger range and spend little time day-roosting in the mine. As cooler temperatures become more common, the animals are likely to become more dependent on Salisbury Mine, particularly females that enter hibernation soon after mating. During October, male Indiana bats have been observed to travel 0.89 to 1.5 miles from the hibernaculum to forage (Kiser and Elliott 1996), although a male Indiana bat in Pennsylvania was observed to travel approximately nine miles from its hibernaculum to foraging areas (C. Butchkoski, PGC, personal communication).

During cool weather, warmer air rises in the evening, thereby providing a seasonal temperature refuge at higher elevations that can support insect populations for a longer period into the fall. Indiana bats, particularly males that remain active later in the season, are thought to use the ridgetops and higher slopes increasingly through the fall (LaVal and LaVal 1980; C. Butchkoski, PGC, personal communication). This effect would be most pronounced near landscape features that tend to absorb and later slowly release heat, as compared to other surrounding habitat. Unfortunately, neither mist-netting nor radio-tracking has been conducted following the maternity period to determine where foraging and roosting habitat is located for local resident Indiana bats or bats returning in the fall.

EFFECTS OF THE ACTION

"Effects of the action" refers to the direct and indirect effects of an action on listed species or critical habitat, together with the effects of other activities interrelated and interdependent with that action, which will be added to the environmental baseline. The Endangered Species Act defines indirect effects as those caused by the proposed action and that are later in time, but are still reasonably certain to occur (50 CFR §402.02). Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

The effects of the action depend, to a great extent, on the reaction of Indiana bats to changes in their environment. Most of the effects of the U.S. 6219 project are indirect effects, occurring after construction and while the new road is in operation. Below we have deconstructed the U.S. 6219 project into its various components, and outlined the anticipated direct and indirect impacts and their effects on Indiana bats. Where the project proponents have proposed relevant Indiana bat avoidance and minimization measures, these are listed in italics and considered herein.

Effect on Salisbury Mine and Hibernating Bats

The proposed roadway alignment passes within 1,100 feet of Salisbury Mine, nearly bisecting the potential foraging and roosting habitat within five miles of the hibernaculum (Figure 1). Construction of the proposed project will require blasting to create the desired road grade. The assessment indicates that this may require earth excavation of 100 feet or more, depending on the location along the alignment. Using explosives to blast through rock in karst areas can disturb or kill bats swarming, hibernating or staging in nearby caves and mines. Blasting may cause cave and mine ceilings to collapse, which could directly kill hibernating bats or trap them inside. Blasting that results in partial cave or mine collapse would also alter the airflow patterns and microclimates, which could make the cave unsuitable as an Indiana bat hibernaculum. Suitable mine/cave hibernacula are a non-renewable resource in limited supply.

Investigations conducted as part of the development of the biological assessment indicate the passageways of the mine/cave complex generally run parallel to the new roadway alignment. None of the identified passageways run beneath the proposed roadway alignment. The assessment concludes that any shear waves induced by blasting during road construction will have negligible or no adverse impact on the hibernaculum, which is located slightly more than 1,000 feet from the limit of earth disturbance. Shear waves will be monitored as described in

Appendix F of the biological assessment, with prior plan approval by PennDOT, PGC, and the Service.

To minimize impacts to hibernating bats, seasonal blasting restrictions will be used. The project proponents have committed to *no blasting within one mile north or south of Salisbury Mine between October 30 and March 31.* These seasonal blasting restrictions do not encompass the entire period that bats are likely to be present in or near Salisbury Mine. As described above, Indiana bats are likely to begin returning to the mine in August to engage in fall swarming. During this period, bats are expected to fly in and out of the hibernaculum, and roost and forage in nearby forests within approximately five miles of the mine entrance. As the season progresses, the bats are expected to day roost closer to the mine entrance, and begin roosting in the mine as colder nights become more frequent.

The project proponents have committed that *no construction activities will occur within 2.5 miles of Salisbury Mine from one-half hour before sunset to one hour after dawn from September 15 to November 16*, when Indiana bats are believed to be engaged in fall swarming in the vicinity of Salisbury Mine. Again, this seasonal restriction fails to encompass the entire period fall bat activity is likely to be centered on Salisbury Mine, and does not extend to the entire habitat area where Indiana bats are likely to be active during the period covered (see Figure 2).

Based the commitment to control blasting according to PGC guidelines, and to monitor the effect of blasting on Salisbury Mine, we anticipate that bats hibernating between November 1 and March 31 will experience minimal or no direct effects from roadway construction. No construction is proposed during the night (*i.e.*, one-half hour before sunset to one hour after dawn) from September 15 to November 16 within 2.5 miles of Salisbury Mine, thus reducing the direct effect of construction on fall swarming, foraging, and night-roosting near the mine entrance. However, the proposed blasting restrictions are not likely to avoid harm or harassment of any Indiana bats that roost or forage near blasting from spring through early fall within five miles of the mine, nor those that forage and roost farther than 2.5 miles from the mine. Blasting near day roosting bats may disturb the animals enough that they have to relocate. These effects may be temporary in nature, causing bats to move away from the disturbance, or may result in avoidance or abandonment of foraging or roosting areas during the period of blasting.

Individual Indiana bats may enter, and remain in, the hibernaculum prior to October 30, particularly during colder than normal years. As depicted in Figure 2, Indiana bats may enter the hibernaculum as early as September. Bats that enter hibernation in September or October, when the proposed seasonal blasting restriction will not be in effect, may be disturbed when blasting occurs in the vicinity of the mine. Blasting within a mile of the mine may cause the bats to awaken and relocate within the mine. As a result, they would expend energy reserves unnecessarily, leading to an increased risk of mortality or reduced reproductive fitness. It is also possible that blasting in September and October will cause some bats to abandon Salisbury Mine as their hibernaculum. Relocation to an alternate site late in the season will increase the risk of mortality if the bats are unable to locate an another hibernaculum, or if they are unable to restore lost energy reserves prior to re-entering hibernation at a new location.

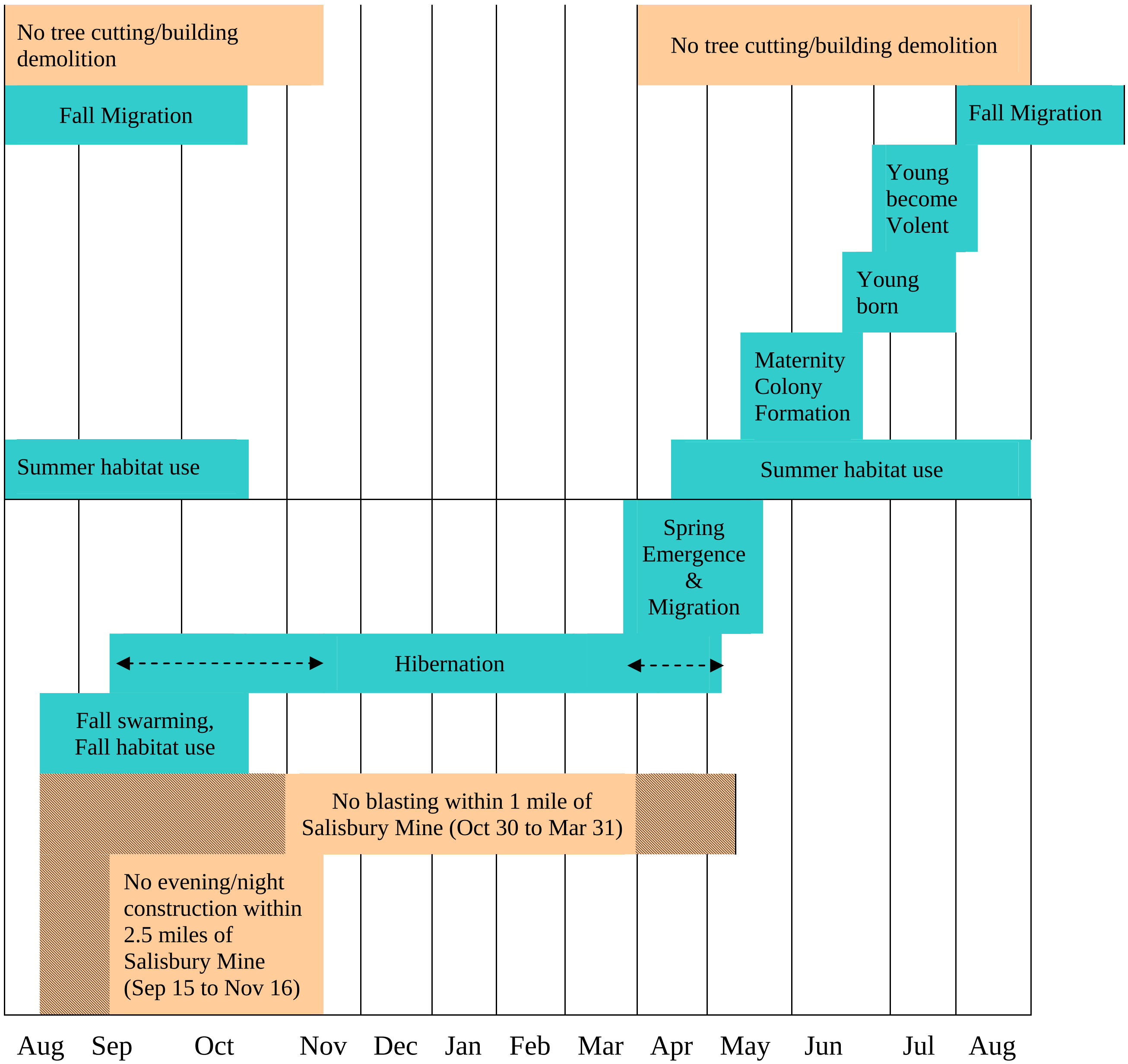

Figure 2. The annual life cycle of the Indiana bat (depicted in blue), and proposed seasonal avoidance measures (depicted in orange without shading). Dotted arrows indicate periods when Indiana bats transition to and from hibernation; this is influenced by local weather conditions. Diagonal shading indicates time periods when project activities will be undertaken without seasonal restrictions that would minimize adverse effects on Indiana bats.

Seasonal restrictions on blasting within one mile of the hibernaculum would end March 31. As with blasting and construction in September and October, blasting and construction in April and early May might harass or harm Indiana bats in the mine, which is particularly likely during a colder than normal spring season. Blasting in proximity to the mine (*i.e.*, within one mile) may prematurely induce the bats to move within the mine, causing them to expend valuable energy reserves. These animals may fail to reproduce successfully or fail to reach maternity colonies later in the spring, dying enroute. The bats may also abandon Salisbury Mine when outside weather is harsh and increased risk of mortality is likely.

The biological assessment concludes that the predicted noise levels at the mine due to roadway operation "would not differ substantially, if at all, from the existing noise levels" and would not affect Indiana bats. Although there are existing secondary roads within 1,000 feet of Salisbury Mine, these are limited use roads compared to the proposed U.S. 6219, and therefore have substantially different vehicle use patterns and environmental effects than would the proposed limited-access interstate highway. Indiana bats appear capable of becoming habituated to the nearby presence of traffic in at least some settings, and during particular life history stages.

With the exception of the Pennsylvania Turnpike, we could find no examples of major roadways in proximity to the entrance to known Indiana bat hibernacula. At the Pennsylvania Turnpike site, the hibernaculum entrance is situated above a tunnel, and traffic noise comes from one direction and is limited in duration as traffic either approaches or leaves the area under the hibernaculum entrance. The entrance to this hibernaculum is located above the roadway before it enters a tunnel and is therefore located at one edge of the predicted five-mile foraging and roosting area. Although little information is available regarding bat flight paths from the tunnel, the bats entering and leaving the hibernaculum can avoid crossing the highway in several directions. The presence of the U.S. 6219 project, passing approximately 1,100 feet from the entrance to Salisbury Mine, may have limited effects on Indiana bats utilizing Salisbury Mine during spring staging and fall swarming if suitable foraging and roosting habitat remain available. However, if the species is unable to become habituated to the presence of the roadway, significant and permanent loss of this habitat may result. If the area surround Salisbury Mine becomes unavailable during the spring and fall, those bats unable to find alternate hibernacula will likely die.

<u>Effect on Bats During Summer and Fall</u>

Loss of Foraging and/or Roosting Habitat. The proposed roadway alignment will physically remove four percent (375 acres) of the potential foraging and roosting habitat within a five-mile radius of Salisbury Mine. The biological assessment concludes that this only represents a small amount of habitat loss relative to what is present in the area. The assessment further concludes that this amount of foraging habitat loss would not be expected to cause any adverse impacts on the Indiana bat, and that highway construction will "open-up" the forest canopy, potentially promoting optimal Indiana bat roosting habitat. Finally, the assessment concludes that mitigation required by the State of Maryland to compensate for forest removal (*i.e.,* planting of 72 acres of trees to replace lost forest habitat) will reduce the long-term forest loss due to the project to two percent within five miles of Salisbury Mine. The project proponents speculate that this level of forest loss would "not be expected to cause any adverse impacts on the Indiana bat." When considering the indirect effects of the project on bats associated with Salisbury Mine, we considered the impact of road operation near the mine entrance, and the impact the road would have on bats that may need to traverse the road in spring or fall.

Removal of a roost tree or building roost while Indiana bats are present would likely result in direct killing, injuring, or harassing of individuals or a colony. To avoid this potential, the project proponents propose to remove potential roost trees and buildings within the U.S. 6219 project area when the bats are hibernating. Therefore, *no forest clearing or building removal will occur between March 31 and November 16 within five miles of Salisbury Mine* (includes the entire alignment). Based on these seasonal restrictions, we do not anticipate any direct Indiana bat mortality from felling of the trees or removal of buildings.

The degree to which roads influence the availability of potential roosting habitat is not clearly understood, and few examples exist of major roadways passing near Indiana bat hibernacula. Garner and Gardner (1992) report that Indiana bats select roosts near intermittent streams and far from paved roads, particularly adult females (pregnant, lactating, post-lactating) who rarely roosted within 1,640 feet of a paved road in Illinois, as compared to juveniles and males. However, in Michigan, Kurta *et al.* (2002) found no difference between roost trees and random points in distance to roads of any type. At the Indianapolis Airport, Indiana bats occur in an urban/suburb landscape near interstate highways, high volume secondary roads, and residential streets (D. Sparks, Indiana University, personal communication). In Pennsylvania, the primary maternity roost structure for the Canoe Creek maternity colony is located approximately 0.4 mile from the roadway, and alternate day roosts were found 1,000 to 3,000 feet from the nearest road. The hibernaculum at Hartman Mine in Blair County is more than a mile from S.R. 22. In nearby Bedford County, an Indiana bat hibernaculum is located within 1,000 feet of the Pennsylvania Turnpike.

Bridge and road construction is likely to increase local disturbance due to noise, and the presence of activity to which bats have not become habituated. Most identified Indiana bat roosts are located away from roadways. During construction, day-roosting bats near construction areas are likely to relocate to avoid construction-related noise and activity. *The construction contractor will be required to ensure that equipment is maintained properly and has functioning mufflers to minimize noise. The contractor will also be required to follow Pennsylvania Department of Environmental Protection Rules and Regulations, Title 25, to minimize air quality effects*. The noise during construction is likely to result in harassment to one or more Indiana bats; however, this effect is expected to be temporary and localized.

Fragmentation/Isolation of Foraging and/or Roosting Habitat. The biological assessment concluded that only four percent of potential foraging habitat will be lost within the roadway footprint (only two percent, long-term). This estimate is only meaningful if one presumes that all potentially available habitat within five miles of Salisbury Mine is used by Indiana bats. Although Indiana bats have been observed traveling five miles or more between their hibernaculum and foraging and roosting habitat, it is unlikely that the species uses all potentially suitable habitat. Similarly, it is unlikely that the species disperses evenly over habitat within five miles of a hibernaculum.

The entrance to Salisbury Mine is located above the valley floor on the slope of Meadow Mountain. The mine entrance is positioned between the proposed roadway and summit of

Meadow Mountain. The proposed roadway will pass to the west of the mine entrance, nearly bisecting habitat within a five-mile radius of the hibernaculum. Indiana bats that hibernate in Salisbury Mine and currently forage or roost in habitat to the west of the proposed road alignment will either have to traverse the road or become separated from nearly 50 percent (approximately 25,000 acres) of the total area within five miles of the mine. If they cross the road, but fail to cross under the proposed bridge, their risk of mortality will increase due to collisions with vehicles. If they abandon foraging and roosting habitat due to the presence of the new road, they will have to establish themselves in other suitable habitat and potentially face increased competition with other bats adopting the same strategy. This may lead to decreased reproductive success or an increased risk of mortality.

A minimum threshold, or optimum amount of fall swarming, foraging, and roosting habitat has yet to be defined for Indiana bats. However, we assume that Indiana bats are more likely to have their foraging and roosting needs met if their hibernacula are immediately surrounded by large, relatively undisturbed contiguous tracts of mature and over-mature forest, as opposed to small, highly fragmented woodlots interspersed with agriculture, commercial, and residential areas. Because the U.S. 6219 project is linear in shape, loss of forest habitat in any particular area important to the bats is minimized as compared to the effects that might be anticipated due to clearing of large blocks of forest. However, the gap that the road will create in the forest canopy has the potential to act as a barrier, separating the mine from roosting and foraging areas, as well as separating roosting and foraging areas currently located on opposite sides of the roadway.

The assessment concludes that Indiana bats will be able to cross safely along the Piney Creek riparian corridor by passing under the bridge proposed over the creek and Greenville and Piney Run Roads. Any bats that fail to cross under the bridge at the desired location must either fly over the highway, forage on Meadow Mountain, or cross the mountain to forage and roost in the opposite valley, assuming that habitat on the ridge and in the eastern valley is suitable and accessible to the species.

Landscape connectivity is the degree to which the landscape facilitates animal movement and other ecological flows (Forman *et al.* 2003). The effect of a road acting as a barrier will likely take several wildlife generations to be observed (Forman *et al.* 2003). Those animals not able or willing to cross the road will be forced to use less desirable habitat, which in turn may reduce reproductive vigor and success. Ultimately, increased mortality will result. Such effects will be difficult to detect, since the adult may survive but fail to reproduce successfully. Ensuring habitat connectivity between roosting and foraging areas is necessary to maintain suitable habitat conditions for Indiana bats. *Permanently protected plantings along stream corridors* will have a secondary, long-term benefit to water quality, since the plantings will provide a vegetated buffer that will reduce runoff and associated sedimentation from adjoining roadways, commercial/industrial developments, and agricultural areas. In the long term, mitigation plantings will provide a diverse woodland that is well stocked with species of trees that are known to provide Indiana bat roosting habitat.

Many species of bat, including the Indiana bat, follow tree-lined travel corridors (sometimes only a single tree in width) to reach foraging habitat, rather than cross wide, open areas (Carter 2003; Chenger 2003; Gardner *et al.* 1991b; Murray and Kurta 2004). Indiana bats roosting at the Indianapolis Airport sometimes appear to cross a multi-lane interstate highway, but may actually be passing under the approximately 50-foot high interstate highway bridge, following the forested stream corridor in the sparsely forested, low topographic relief landscape (D. Sparks, Indiana University, personal communication). Bach *et al.* (2004) provided observations that document bats of several species traveling under bridges to cross roadways in Germany; however, no information was provided regarding the landscape conditions, locations of bat roosts and foraging areas, or, significantly, whether bats also crossed over the roadway surface as well. Kiser *et al.* (2002) documented Indiana bats night-roosting under bridges in Indiana.

There have been no observations made regarding current Indiana bat (or surrogate bat species) travel patterns to and from Salisbury Mine. There have also been no studies to identify important spring and fall foraging and roosting areas. During both fall and spring, Indiana bat travel corridors, roosting patterns, and foraging habitat are likely shifting or adjusting in response to seasonal changes. If the bats behave as the project proponents hope, the long-term effects on the Indiana bat due to the presence and operation of the U.S. 6219 project may be minimal. However, those Indiana bats that do not both perceive and use the safe passage under the Piney Creek bridge will experience an increased risk of mortality from vehicle strikes if they cross over the road. They may also avoid crossing and becoming restricted to the eastern side of the roadway and to Meadow Mountain. Any bats that fail to reach suitable foraging areas may be unable to forage sufficiently prior to entering winter hibernation, and will subsequently die or experience reduced reproductive success.

The U.S. 6219 project is a limited-access highway that will have a new effect on Indiana bats that hibernate, roost, and forage in the vicinity of the road. This is an area dominated by forest, with some low-use, rural roadways, and the proposed highway represents a substantial change in the landscape. If the bats do not habituate to the presence of the highway and ongoing disturbance associated with highway operation, they may abandon the site as a hibernaculum. Chronic individual and population effects on Indiana bats in response to highway-induced effects (*e.g.*, noise, air quality changes, and invasive plant introduction) have not been investigated and cannot be ruled out. The actual behavioral response of the bats to the presence of the proposed road and, therefore, the resulting extent of effects to Indiana bats associated with Salisbury Mine, are difficult to predict. These effects could range from temporary and not measurable to significant alterations in behavior and survival.

As described above under *Environmental Baseline – Maternity Colonies*, no surveys have been conducted in the action area to identify maternity colonies. Therefore, the best scientific and commercially available information are that 1) Indiana bats maintain maternity colonies in central Pennsylvania forests; 2) suitable roosting and foraging habitat occur in the action area; and 3) maternity colonies have been identified within 10 miles of two other central Pennsylvania hibernacula (Blair County, and just north of the action area in Somerset County) within an ecological setting similar to the action area. Based on this information, it is reasonable to presume that a maternity colony may be present in the project area.

The U.S. 6219 project may indirectly affect any Indiana bat maternity colonies located in the vicinity of the road corridor. The seasonal restriction on tree-cutting and building removal will avoid mortality due to those project effects. The effect of habitat loss will be similar to that discussed in relation to the hibernaculum. The actual acreage of forest removal from any individual maternity colony’s foraging and roosting habitat is an important factor to consider, but in terms of Indiana bat viability, it is not just the amount of forest that influences the fitness of Indiana bats but also the function of the habitat. For example, the loss of a single tree could have substantial impacts if alternative roosts are not available, while the loss of multiple acres of forest may have only minimal impact if a sufficient amount of suitable alternate habitat is accessible. The paramount factors are the specific ecological functions that the area serves for Indiana bats, such as travel corridor, roosting habitat, or foraging habitat.

The assessment concludes that because the proposed roadway alignment avoids the forest edges, the opening created in the tree canopy will expose the forest interior to sunlight and consequently promote maternity roosts in exposed trees. Indiana bat management, rather than promoting forest openings, seeks to enhance habitat in the long term by providing forest habitat, improving connectivity among blocks of existing habitat, and creating larger blocks of forest habitat. We believe that increased maternity activity adjacent to the U.S. 6219 project is unlikely in any case because Indiana bats appear to avoid roosting near roadways. Further, attempting to induce roosting near an interstate highway, if successful, may result in increased Indiana bat mortality. This threat would extend not only to resident individuals, but also to future generations and new colonizers, potentially creating a population sink. Indiana bats are not expected to roost in isolated trees (*i.e.*, trees that are not part of, or connected to, a larger forested area via a tree-lined linear flight corridor) (Murray and Kurta 2004; Gardner *et al.* 1991b; Verboom and Huitema 1997; Carter 2003; Chenger 2003; Winhold *et al.* 2005).

As was described above, the conclusion in the biological assessment is that Indiana bats that must cross the roadway will do so by traveling along Piney Creek, and they will fly under the new 175-foot high and 1,500-foot long bridge spanning Piney Creek and two adjacent roads. This pathway is potentially available to those bats whose foraging and roosting areas are located close to Salisbury Mine. This travel corridor may also be available to any maternity colonies whose habitat spans the roadway within approximately two miles of the bridge. Individual Indiana bats whose home ranges are not in proximity to the Piney Creek bridge are unlikely to detect this crossing. Even if they did detect the crossing, they are not likely to use it due to the increased energetic costs associated with a longer commuting distance to use the bridge.

Once forest clearing is completed, maternity colony foraging and roosting habitat may no longer be available due to fragmentation, or it may be reduced in quality and/or quantity when the bats return the following spring. The effects on bats are anticipated to be minimal when maternity habitat lies entirely or largely outside of the U.S. 6219 project corridor. A maternity colony whose home range areas are only marginally fragmented by the road corridor may be able to shift their foraging and roosting habitat to avoid the most severe effects of the presence of the roadway, and not have to cross the road during the maternity season. However, Indiana bats with a significant amount of maternity habitat on each side of the proposed alignment will probably be forced to use habitat on only one side of the alignment. Indiana bats in this situation will be disconnected from habitat due to the project (*i.e.*, loss of a suitable travel corridor), and can be expected to expend an increased amount of energy to establish new commuting patterns and/or home ranges. Due to the species site fidelity, members of maternity colonies that lose habitat at this level may continue to attempt to roost and forage in the vicinity despite the existence of insufficient habitat and the presence of the highway. Bats in this scenario could be harmed due to displacement from their home range, thereby incurring decreased fitness and reproductive success, and increased mortality. The potential range of effects on any maternity colonies present in the action area will, therefore, range from temporary and transient to significant and permanent.

If the bats fail to travel along pathways that the project proponent hopes for, the result may be increased mortality from vehicle collisions, loss of vigor resulting from increased travel distance, or refusal to cross the roadway. Any bats traveling along the length of new roadway to get to the bridge crossing are at increased risk of a vehicle collision, and some will be traveling substantially greater distances as opposed to direct routes from roosting to foraging habitat that are present now. There are variable risks to the bats that follow each of the routes that involve increased risk of being hit by traffic, or substantially increased travel distance and energy expenditure.

The rate of wildlife successfully crossing a road decreases significantly with the upgrade of the road to accommodate greater traffic volume (Barnett *et al*. 1978; Reijnen *et al*. 1995; Mumme *et al*. 2000). Forman *et al*. (2003) found that the effect of road mortality on wildlife populations increases one or two generations after the road has been in place, and that animal mortality on roads is largely determined by the interactions between the structure of the road, structure of the nearby landscape, driver behavior and animal behavior.

The ability of an animal to avoid a traffic collision influences road mortality. Several investigators report that road and traffic experience reduces the probability of an individual animal being killed on the road; juveniles and inexperienced adults undergo a higher rate of mortality than experienced adults. Mumme *et al*. (1999) found that Florida scrub jays that immigrated to nesting areas near the road had a very high mortality rate during the first two years, but this dropped to equal the rate of birds not nesting near the road by the third year. A significant factor in the ability of an animal to avoid a traffic collision is the relative rate of traffic speed and animal speed. Slower traffic allows more time between when an animal perceives a vehicle as a threat and engages in avoidance behavior. Birds are more often hit by vehicles traveling at speeds of 50 mph or greater compared to those traveling less than 50 mph (Dhindsa *et al.* 1988; Erritzoe 2002). Indiana bats fly at about 10 mph (Butchkoski and Hassinger 2002a) between foraging areas and the maternity roost, and are a maneuverable species adapted to foraging in and over dense vegetation. Studies with captive bats have shown that they can avoid colliding with moving objects more successfully than stationary ones, presumably because their foraging habits program them to detect moving objects (Jen and McCarty 1978). However, as vehicle speed increases, bats are less likely to perceive a distant but rapidly approaching vehicle as a threat, and are less likely to have sufficient reaction time to avoid a collision once the threat is perceived. The proposed limited-access highway is likely to have posted speeds of 55 miles per hour or above. In addition, Lode (2000) found that wildlife deaths increased exponentially with increased traffic volume.

In summary, the risk factors most likely to influence bat mortality include traffic volume, traffic speed, the bats' flight behavior relative to the road and road-side vegetation, and the bats' need to cross the U.S. 6219 project corridor over the road rather than under the Piney Creek bridge. The proposed project will introduce traffic of a significantly increased volume and speed to the action area, and will nearly bisect habitat within a five-mile radius of Salisbury Mine with a potentially impassable barrier. The Piney Creek bridge would only be available to any Indiana bat maternity colonies within approximately two miles of the bridge, because it wouldn't be energetically feasible for colonies further than this to use the bridge location as a travel corridor. Therefore, if any colonies have home ranges divided by the project, habitat on the opposite side of the road will most likely be lost. We expect that few Indiana bats engaged in local foraging and roosting activity will attempt to cross over the roadway due to the 130- to 500-foot-wide expanse of paved or mowed habitat; therefore, the risk of individuals of the species being struck by vehicles and being killed is small and likely discountable[1], based on the documented avoidance the species exhibits to crossing open areas, and the relatively low population density of Indiana bats that might need to cross. In contrast, Indiana bats migrating past the action area from other hibernacula are likely to do so well above the roadway, and are not expected to be at risk of predation or vehicle strikes above baseline conditions.

Water Quality. There will likely be temporary air and water quality changes during construction due to earth disturbance, associated runoff, and use of construction vehicles. Siltation resulting from construction may temporarily reduce aquatic insect abundance in Piney Creek, Meadow Run, and unnamed ephemeral tributaries to these streams. Spills of hazardous materials and soil erosion could occur during construction, and degrade the quality of both surface and ground water. Water quality effects on Indiana bats may be caused by alteration of the flying insect prey-base due to changes in the aquatic insect community, degradation of drinking water quality, and a less favorable environment in the hibernaculum if groundwater is degraded. The potential for adverse water quality impacts may be highest at the bridge crossing of Piney Creek and Meadow Run.

Surface water quality is an element that was not considered in the assessment, but one that may be degraded by the project. Implementation of the project will require the filling or alteration of wetlands and stream habitat by relocating or diverting streams through drainage structures. Sediment, herbicides, and other contaminants could affect water quality through erosion, vegetation management, and accidental spills during any phase of a project, from construction to operation. Insects associated with these aquatic habitats make up part of the diet of the Indiana bat; therefore, a change in water quality can affect the prey base of the species. Decreases in water quality through contamination and the destruction of wetlands and stream habitats may reduce the availability of aquatic insects, and reduce the availability or quality of suitable drinking sources.

Adverse effects on Indiana bats due to reductions in aquatic insect prey and drinking water sources could range from insignificant to a significantly impaired ability to feed. Of course, the level of impact on individual bats will vary depending upon the magnitude and duration of water quality impacts, and the availability of suitable foraging and drinking opportunities in the surrounding landscape. Moreover, the diet of Indiana bats is not restricted to aquatic insects, since they also forage on terrestrial insects. Their diet also appears to vary across the species range, as well as seasonally and with age, sex and reproductive-status (Murray and Kurta 2002; Belwood 1979).

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[1] Discountable effects are those that are extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

Finally, substantial roadway cut and fill area proposed appears to be situated in the Pottsville Formation, which is typically composed of sandstone, shale, and coal, with limited calcareous deposits. Road building activities moving the large volumes of rock proposed can have an effect similar to coal mining. The Pottsville Formation has been responsible for production of acid mine drainage, and has the potential for acid production in the action area (Pennsylvania Geological Survey 2005). We anticipate that the response of Indiana bats exposed to decreased water quality will range from no response, to a temporary modification of foraging patterns, to avoidance. Acid drainage that enters the groundwater could also affect conditions in the hibernaculum. Although we anticipate that temporary reductions in water quality will not cause a decrease in fitness of individual Indiana bats, production of acidic drainage from cut and fill areas could result in reduced reproductive vigor or mortality.

Effects of U.S. 6219 Project Conservation Measures

In coordination with the Service and PGC, the project proponents propose to *construct two bat boxes in the project area, and girdle up to 10 trees under the proposed Piney Creek bridge* to promote roosting habitat. Evidence of Indiana bats using artificial structures is extremely limited, with only three cases of documented use by adult females (C. Butchkoski, PGC, personal communication). In these cases, bat boxes were installed in forest habitat near natural water sources where known roost trees or foraging areas were present. Indiana bat use of these structures was not noted for many years after installation (Carter 2002; Indianapolis Airport Authority 2004; Butchkoski and Hassinger 2002b; Kurta, in press). At the Six Points Interchange project in Indiana, approximately 3,000 artificial structures of various designs were installed to mitigate the loss of potential roost trees. The bats took between 9 and 10 years to begin using the bat boxes, and most of the structures were never used (D. Sparks, Indiana University, personal communication).

The assessment did not conclude that roost trees are limiting in the action area, nor that Indiana bat habitat would be enhanced by the creation of potential roost trees under the Piney Creek bridge. Based on the small number of trees involved, the beneficial effects of girdling trees to create roost trees are expected to be negligible.

Compensatory mitigation is being conducted to offset other resource losses, and some of this mitigation may also eventually benefit Indiana bats, including purchase of a 17-acre herbaceous meadow approximately two miles from Salisbury Mine, and the 540-acre Meadow Run fen approximately three miles south in Maryland. In addition, 72 acres of new forest will be created as required by the Maryland Reforestation Law to offset forest removal along the roadway. These habitats may eventually provide some foraging or roosting habitat, but they are not equivalent to large blocks of forest habitat needed by Indiana bats in areas under greatest threat from the project, which is the immediate vicinity of Salisbury Mine. In addition, it will be decades before the 72 acres of new forest matures to the point that it will become suitable roosting and foraging habitat.

The project proponents will *attempt* to acquire Salisbury Mine if the private property owner is determined to be a willing seller. Failing that, they state that they will *attempt* to extend the 20-acre conservation easement along Piney Creek to include the entrance to Salisbury Mine through a conservation easement held in perpetuity between the property owner, PennDOT and the

Pennsylvania Game Commission. Aside from moving the alignment away from Salisbury Mine, long-term protection of the mine and surrounding forest habitat for swarming, foraging and roosting is the measure most likely to benefit Indiana bats. While most direct effects resulting from the U.S. 6219 project appear to have been avoided, indirect effects may be significant, particularly if the bats fail to use the passage under the Piney Creek bridge. The use of this passage is in large part contingent upon maintaining a forested corridor along Piney Creek; however, the project proponents do not have control over forest management options in this corridor unless purchase or easement of the corridor is accomplished.

Overall, the conservation measures proposed either do not fulfill a habitat need, or their implementation is speculative (*i.e.*, they may not occur) and cannot be factored into the effects analysis for the U.S. 6219 project.

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 Endangered Species Act.

A number of residential developments are planned in the action area over the next 20 years. Although one of the stated project purposes is to spur economic development, the project proponents maintain that development will occur regardless of the project, and that development resulting due to the project will occur near interchanges to the north and south. Regardless of whether such development is induced by the presence of the new road, or coincidental, the effects of these non-federal actions must be considered with respect to the project.

Most of the forest lands within the action area are privately owned and vulnerable to timber extraction and other activities that may degrade or destroy habitat suitable for Indiana bats. The project proponents noted several residential developments, including one in proximity to Salisbury Mine. The largest new growth area is the anticipated Highlands Residential Development to the east of the proposed new I-68 interchange in Maryland and extending to near the Pennsylvania border. The RJR Construction Residential Development project to the north of this is on 775 acres of land immediately adjacent to Salisbury Mine. The assessment concludes that this 20- to 100-lot development would attempt to preserve forest as a “recreational subdivision”. Additional construction is expected near Meyersdale to the north, and near Salisbury, Pennsylvania, and Grantsville, Maryland.

Commercial and private timber harvesting and other tree-clearing is likely to continue, in addition to that which would be removed during construction of the U.S. 6219 project. The likely result is the loss, degradation and fragmentation of foraging and roosting habitat. Loss of additional forest near Salisbury Mine to forestry and proposed residential developments, in addition to the presence of the U.S. 6219 Project, has the potential to significantly degrade bat habitat outside of Salisbury Mine and hinder further recovery of Indiana bats at this site.

Finally, the roadway will increase access to the area. Salisbury Cave is in private ownership, with access granted to spelunkers and others. Repeated human disturbance of hibernating bats will also degrade habitat within the mine.

CONCLUSION

After reviewing the current status of the Indiana bat, the environmental baseline for the action area, the effects of the proposed U.S. 6219 project, and the cumulative effects, it is the Service's biological opinion that the U.S. 6219 project, as proposed, is not likely to jeopardize the continued existence of the Indiana bat.

Critical habitat for this species has been designated at 11 caves and two mines in West Virginia, Tennessee, Kentucky, Illinois, Indiana, and Missouri. However, this action does not affect those areas. Consequently, no destruction or adverse modification of critical habitat is anticipated.

As indicated in the consultation history, the FHWA initially requested the Service’s concurrence that the U.S. 6219 project was not likely to adversely affect Indiana bats. We were unable to agree with that determination due to 1) the proximity of the proposed roadway to a known Indiana bat hibernaculum, 2) the uncertainty regarding the potential project effects on any maternity colonies near or in the action area, and 3) seasonal restrictions during construction that only partially encompass the expected activity area or period when the species is likely to be present. The FHWA also did not estimate any incidental take of Indiana bats in their biological assessment, and through a series of assumptions regarding Indiana bat behavior and distribution, did not identify any aspects of the project that are likely to result in take of the species. The assumptions in the biological assessment are summarized below:

- Construction, operation, and maintenance of the proposed roadway section will have no effect on the suitability of Salisbury Mine as an Indiana bat hibernaculum due to seasonal blasting restrictions, and tree and building removal restrictions that avoid direct take of Indiana bats.

- Construction, operation, and maintenance of the proposed roadway section will not create a barrier to Indiana bat travel corridors for bats moving to and from Salisbury Mine to foraging and roosting habitat during spring or fall because the bats will use the riparian corridor under the Piney Creek Bridge.

- Construction, operation, and maintenance of the proposed roadway section may result in the removal of one roost tree in the project footprint. This may disturb (harass) the species. However, Indiana bat maternity colony activity along the roadway corridor has been avoided by avoiding forest edges and cleared agricultural fields and because suitable habitat exists elsewhere in the action area. Further, the bats will relocate to alternate habitat and utilize a travel corridor at Piney Creek bridge.

- Permanent loss of 375 acres of potential Indiana bat foraging habitat, including 208 acres due to forest clearing, will be offset by protection of 25 acres of habitat in the vicinity of the Piney Creek bridge to ensure long term protection of the travel corridor under U.S. 6219, Section 19. Additional mitigation required for other aspects of the project will secure habitat that may eventually be suitable for Indiana bats in the action area, including the planned creation of 72 acres of forest in Maryland.

Many aspects of these assumptions are plausible, if perhaps optimistic. As considered under *Effects of the Action*, equally plausible scenarios are conceivable that would result in significant adverse affects to Indiana bats, resulting not only in take of the species, but also potentially eliminating it from Salisbury Mine and maternity habitat. For the effects analysis presented in their biological assessment to remain valid, it is incumbent on the project proponents to ensure that their assumptions are realized through the implementation of conservation measures needed to support the assumptions, as confirmed through monitoring.

The U.S. 6219 project will permanently convert 375 acres of suitable Indiana bat foraging habitat, 208 acres of which is forested and suitable for roosting during the spring, summer, and fall. We anticipate that any Indiana bats that use this habitat will be harmed or harassed. There is currently no commitment to implement meaningful minimization and mitigation measures that might offset the indirect effects of habitat loss, and ensure long-term conservation of the species in the area. Therefore, we cannot factor these measures into the analysis of project effects.

Due to the seasonal restrictions on tree felling and building removal, we believe no reproductive females or young will be directly exposed to tree-felling activities or building demolition. Reproductive females returning to summer maternity ranges disturbed by the project may be indirectly affected, but as assumed in the assessment, if only a single roost tree is removed, we believe that the responses to this indirect exposure will be stress that leads to only a short delay in parturition.

Indiana bats engaged in fall swarming between August and October may be harassed or harmed by blasting within a mile of Salisbury Mine, and these individuals may temporarily or permanently avoid the area. The loss of Salisbury Mine as an important hibernaculum would be significant for bat conservation in Pennsylvania. However, if the bats behave as the project proponents anticipate, we do not expect any perceivable losses. This depends on the bats finding and using safe passage under the Piney Creek Bridge to access sufficient suitable roosting and foraging habitat near the mine.

As such, we also do not anticipate any measurable reductions in the reproduction, numbers, or distribution of the species rangewide. Therefore, we believe the proposed action is not reasonably expected to appreciably reduce the likelihood of survival and recovery of the species.

INCIDENTAL TAKE STATEMENT

Sections 4(d) and 9 of the Endangered Species Act, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as 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 any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the federal agency or the applicant. 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 a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Because incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity, this Incidental Take Statement is valid only upon receipt by the applicant of all appropriate authorizations and permits from Federal, State and local permitting authorities. These permits/authorizations may include, but are not limited to, a permit under section 404 of the Clean Water Act from the Corps of Engineers; a section 401 Water Quality Certification and a Chapter 105 Dam Safety and Encroachment Permit from the Pennsylvania Department of Environmental Protection; and approved Erosion and Sedimentation Control Plans from the Somerset County Conservation District. It is incumbent upon the Service to make it clear to the FHWA and the applicant that the incidental take statement (along with its exemption from the section 9 prohibitions of the Endangered Species Act) is valid only upon receipt of all required permits and authorizations.

The measures described below are non-discretionary, and must be undertaken by the FHWA so that they become binding conditions of any funding, permits, and/or approvals, as appropriate, issued to PennDOT for the exemption in section 7(o)(2) to apply. The FHWA has a continuing duty to regulate the activity covered by this incidental take statement. If the FHWA 1) fails to require PennDOT, MDSHA, and their contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, authorization, or funding document; and/or 2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the FHWA, PennDOT and MDSHA 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

We anticipate that incidental take of the Indiana bat will be difficult to detect and quantify for the following reasons: 1) individuals are small; 2) Indiana bats form small (*i.e.*, 50 or fewer, to 100 individuals), widely dispersed colonies under loose bark or in cavities of trees; 3) only a portion of the Indiana bat population is likely to be visible during hibernaculum counts among thousands of bats of other species; 4) finding dead or injured specimens is unlikely; 5) the areal extent and density of the species' spring, summer, and fall population in the action area is unknown; and 6) some habitat, including the hibernaculum, is under private ownership, making monitoring the bat population dependent on access.

The Service anticipates that take in the form of harm and harassment (as defined in 50 CFR §17.3) will occur as a result of the direct and indirect effects of the proposed action. Due to the nature of the project, effects are not limited to the period of construction, but become permanent and ongoing with operation of the road. The extent of take will depend on the location of foraging and roosting habitat for Indiana bats associated with Salisbury Mine, and any maternity colony in the area.

Blasting and construction during the non-hibernation season could kill bats roosting in proximity to the disturbance, but we believe that this is unlikely because other disturbances prior to blasting are likely to drive the bats farther away. Blasting is likely to force any roosting bats, including any maternity colony present, to find an alternate roost, and may force the bats to abandon a roost in the area. Relocation to less suitable habitat may be a repeated occurrence on subsequent nights until that stage of construction is complete. This is expected to harm and harass all Indiana bats roosting near blasting and construction, potentially resulting in lower reproductive success, reduced vigor, and reduced individual survival.

The removal of approximately 375 acres of potential Indiana bat foraging habitat, including 208 acres of potential roosting habitat, will be permanent when it is converted to roadway pavement and associated cut and fill slopes. We expect that this conversion will result in take in the form of harm for all Indiana bats that had depended upon this habitat for use in spring, summer, or fall.

Tree and building removal associated with road construction may result in alteration of roosting and/or feeding activities by the bats (*i.e.*, the bats may have to fly farther to forage, or seek alternate roosts) or may disrupt travel corridors to the extent that the bats are forced to abandon the area altogether. All Indiana bats, whether engaged in spring staging, fall swarming, or maternity colony activity that fail to use the Piney Creek riparian corridor to access their foraging and roosting habitat to the west of the road will need to find alternate accessible habitats that don't require crossing the new road. Bats that both fail to use the Piney Creek bridge corridor and fail to find habitats to the east of the road will likely experience reduced reproduction or reduced survival.

As discussed in the "Cumulative Effects" section of this opinion, additional forest habitat in and around the action area, particularly near Salisbury Mine, is expected to be lost due to future development and timber operations. These effects, in combination with the road, may continue to alter viable Indiana bat travel corridors and access to available habitat. Failure to maintain suitable travel corridor habitat under the Piney Creek bridge would result in loss of more than 25,000 acres west of the proposed roadway, substantially increasing the adverse effects of the project beyond what was considered in the biological assessment. While this could result in the loss of Salisbury Mine as a hibernaculum, we anticipate that either the travel corridor under the bridge will be used, or bats will adjust their foraging and roosting areas in response to the new road. *Therefore, while individuals associated with the hibernaculum will likely be harmed or harassed during road construction and operation, we do not anticipate the project will cause a reduction in the size of the Indiana bat hibernating population at Salisbury Mine.*

Monitoring to determine take of individual bats within the extensive area surrounding the U.S. 6219 project is a complex and difficult task. Ongoing monitoring of the Indiana bat hibernating population at Salisbury Mine, along with the overall bat population in the mine, will provide important information about the amount of take, and the effectiveness of minimization and conservation measures. In addition, monitoring of travel corridors and summer habitat in the project area will identify the degree of effects on maternity colonies, and bats using the area for spring and fall foraging and roosting.

Although, to the best of our knowledge, no Indiana bat maternity colony or individual Indiana bats have been incidentally taken in the action area to date, incidental take of this species can be anticipated due to the loss of roost trees, loss of usable travel corridors, and fragmentation of foraging and roosting habitat due to the road. We believe that if a maternity colony or roosting individual is present in an area proposed for timber harvest, blasting, construction, or other disturbance, loss of suitable roosting habitat would result in incidental take of Indiana bats. *However, while some take of individuals associated with a maternity colony is possible, we do not anticipate the project will result in loss or a significant reduction in the size of a maternity colony.*

Critical habitat for the Indiana bat has been designated at hibernacula in Illinois, Indiana, Kentucky, Missouri, Tennessee and West Virginia; however, this action does not affect these areas, and no destruction or adverse modification of critical habitat is anticipated.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that the level of expected take due to the U.S. 6219 Project is not likely to result in jeopardy to the Indiana bat, 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 incidental take of Indiana bats, and ensure that the assumptions made by the project proponents regarding the effectiveness of project minimization and conservation measures are realized:

1. The project proponents proposed to implement avoidance and minimization measures as part of the proposed action (these measures are hereby incorporated by reference). These measures, including those recognized to maintain, improve, or enhance its habitat, shall be implemented to protect the Indiana bat. These non-discretionary measures include, but are not limited to the terms and conditions outlined in this opinion.

2. The Federal Highway Administration shall monitor Indiana bats before and during construction, and during operation of the U.S. 6219, Section 019 project to identify areas that are used by the Indiana bat and to quantify the amount and type of take. All conservation measures, mitigation efforts, research, and any related problems will be monitored and clearly communicated to the Service on an annual basis.

3. The effects of roadway maintenance activities on federally listed species were not evaluated or considered in this opinion. Therefore, consult with the Service prior to implementing any future maintenance activities that may directly or indirectly affect any federally listed species, including Indiana bats or their habitat (*e.g.*, forest clearing, *etc*.).

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the Act, FHWA 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. The FHWA, PennDOT, MSHA, and their agents and contractors will implement all proposed avoidance and minimization measures to reduce adverse effects to the Indiana bat. These obligations include, but are not limited to:

   A. During the bidding process, prospective project contractors will be notified regarding the presence of endangered species in the project area and the special provisions necessary to protect them. The selected contractor(s) will be instructed on the importance of the natural resources in the project area and the need to ensure proper implementation of the avoidance and minimization procedures.

   B. To avoid increased take of Indiana bats through degradation of surface and groundwater quality, ensure that rock removed during road cut and fill operations is not pyretic. Pyretic rock can produce acidic runoff, resulting in stream and groundwater degradation in the action area.

   C. Extend the blasting restriction to encompass a greater portion of the fall swarming period, as well as the hibernation period, so that no blasting occurs within one mile of Salisbury Mine between September 1 and March 31.

   D. Extend the construction restriction to encompass the entire fall swarming period, so that no construction activities occur within 2.5 miles of Salisbury Mine from one-half hour before sunset to one hour after dawn from August 1 to November 16.

   E. The level of effects on Indiana bats described in the assessment, and considered in this opinion, depend on bats associated with Salisbury Mine being able to use habitat around the mine and along Piney Creek under the proposed bridge. Therefore, permanent conservation of these areas is integral to the project, as it will ensure take does not exceed that estimated in the biological assessment and this opinion.

      i) In addition to the five-acre right-of-way under the bridge, and 10 acres of upstream and downstream buffers, protect travel corridors to ensure the U.S. 6219 project does not eliminate Salisbury Mine as an Indiana bat hibernaculum.

      ii) Permanently protect 208 acres of forest habitat within one mile of Salisbury Mine to ensure that suitable forested travel corridor, foraging habitat, and roosting habitat are available to partially offset habitat lost due to construction.

      iii) To reduce the need for future disturbance in what the project proponents have identified as a key bat crossing area, utilize materials in the construction of the Piney Creek bridge that do not require maintenance sandblasting or painting.

   F. Monitoring in and around Salisbury Mine will be done during all blasting events that are within one mile of the mine/cave complex and identified subterranean passages. Access to the mine and cave complex will require entry to private property. Ensure that access is possible through fee simple purchase, conservation easement, or lease.

i) The monitoring protocol must be submitted to the Service for review and approval at least three months prior to blasting, and include specify vibration monitoring devices that will be used. It will also include the number and estimated location of all monitoring devices, as well as the threshold level of vibration above which disturbance will be assumed.

ii) If monitoring reveals any effects on the mine/cave complex, the Service will be notified and blasting will immediately cease, since this represents an effect not considered in this biological opinion.

2. It is anticipated, based on the analysis presented in this biological opinion, that foraging and roosting areas currently used by Indiana bats will be destroyed, degraded, and fragmented. Bats will be displaced from current foraging and roosting areas. These impacts will result in reduced survival, reproduction, and fitness of individual bats, but are not anticipated to reduce the overall size of the hibernaculum or eliminate a maternity colony. Monitoring studies have the potential to identify these effects. A plan for surveying, monitoring, and reporting on the Indiana bat within and adjacent to the project area shall be developed and conducted in consultation with the Service.

   The purpose of the monitoring plan is to 1) ensure compliance with the established level of incidental take; 2) assess the effectiveness of RPMs and conservation measures over time; 3) determine the need for adjustments to management of Indiana bat habitat; and 4) evaluate the response of bats to the disturbance that will occur in the project area. The monitoring plan shall be designed to meet these minimum specifications and include mist-netting, telemetry, emergence counts, and reporting of results.

   A. For each of the monitoring events described below, site-specific survey protocols will be submitted to the Service for review and approval at least three months prior to the survey. Surveys for Indiana bats will be performed by Service-approved, qualified personnel who are thoroughly briefed on the techniques to be used. These personnel will survey the area utilizing methods approved by the Service based on habitat access (*e.g.*, either internal mine counts or by mist-netting accessible habitat). All bats located shall be identified to species, recorded, and released.

   B. Conduct mid-winter counts of bats hibernating in Salisbury Mine to monitor Indiana bat use of this hibernaculum. Counts will be conducted one year immediately prior to construction (anticipated to occur 2010/2011), the winter during construction (anticipated to occur 2012/2013), and every other year for 10 years post-roadway construction (*i.e.*, five post-construction monitoring events).

      i) Mid-winter bat counts will be performed by PGC staff, or by Service- and PGC-approved, qualified personnel who are thoroughly briefed on the techniques to be used in accordance with methods approved by the Service and PGC. Within 30 days of each survey event, provide the Service and PGC with a report detailing the following: date of survey, names of surveyors, percent of hibernaculum surveyed, and number of each bat species found.

ii) Access to the mine and cave complex will require entry to private property. Ensure that access is possible through fee simple purchase, conservation easement, or lease.

iii) If monitoring reveals the action has affected Indiana bats in a manner or to an extent not considered in this opinion, FHWA will reinitiate consultation. *This trigger for reinitation will be met if 1) two consecutive mid-winter counts document a decline in the Indiana bat hibernating population, or 2) a 20 percent decline in the total number of bats of all species is documented*. Other monitoring data may also form the basis for reinitiation.

C. Document whether Piney Creek bridge is serving as a travel corridor, as predicted, by monitoring Indiana bats (or surrogate *Myotis* species) during the fall to identify travel corridors between the mine, and roosting and foraging areas. This will be done one year prior to construction, and again two to four years after road construction (2014 to 2018).

i) The project proponents shall conduct telemetry studies during fall swarming to identify, characterize, and map current foraging areas, roost trees, and home ranges, as well as determine bat use of, and movement between, these areas.

D. No less than one year prior to starting construction, conduct mist-netting during the summer maternity season following the most current Service guidelines. Mist-netting will be done along the roadway corridor to determine the location of maternity roosts and foraging habitat to ensure the level of take estimated in the biological assessment, and in this opinion, is not exceeded. If any Indiana bats are captured during mist-netting, more detailed monitoring will be necessary to identify travel corridors, roost trees, roosting habitat, and foraging habitat, as detailed below:

i) When Indiana bats weighing 6.5 grams or more are captured during mist-netting surveys they shall be fitted with a radio transmitter. Telemetry studies will prioritize tracking of female Indiana bats, although tracking of males and juveniles may also be conducted.

ii) The bats will be tracked as long as the signal can be detected. Roost trees will be identified and mapped during daylight hours and used as starting points for the next night's tracking. Triangulation methods will be used to establish bat locations during night tracking.

iii) Because monitoring must be geared to evaluating the response of bats to the project at both the individual and colony level, mist-netting and telemetry work will be designed to track as many different bats as possible (at least four per sampling period). Mist-netting and tracking will be conducting during three sampling periods within the maternity season: pregnancy (May 15 to June 15); lactation (June 15 to July 15); and post-lactation/juvenile volancy (July 15 to August 15).

iv) Upon identification of a roost tree, document its location (latitude and longitude), and record site-specific data relative to the roost tree and roosting area. For each tree containing a roost used by an Indiana bat, record the tree species, height, diameter at breast height (dbh), condition (alive or dead), aspect, elevation, and percentage of exfoliating bark. Also include distances from the roost tree to other roosts used by the bat(s), distance to the nearest perennial and intermittent stream, and distance to the edge of tree-clearing. Percent canopy closure above roost trees and habitat cover type near each roost will also be recorded. Roost trees shall be marked in a manner sufficient to identify the trees in the field, but not obvious enough that the mark is conspicuous to passers-by.

E. All Indiana bats captured in spring, summer and fall shall be fitted with a numbered, lightweight band. Follow the most current banding procedures approved by the Pennsylvania Game Commission.

F. Other data collected on captured bats shall include species, age, sex, right forearm length, weight, and reproductive condition. Capture specifics such as vertical location in the net, flight direction, and time of capture shall also be recorded. Detailing photographs of each captured Indiana bat will be taken, including close-ups of the face, toe hairs, and keeled calcar. All bats shall be released at the net site unharmed in compliance with procedures designated by the Indiana bat recovery team, or other Service protocols.

G. Reports documenting the above efforts will be prepared and submitted to the Service's Pennsylvania Field Office and the Pennsylvania Game Commission within six months of completion of monitoring. The report shall include an introduction, methods section, results section, conclusion and/or summary, and any relevant supplementary information (*e.g.*, names and qualifications of surveyors). The methods section should describe the survey protocol used. The results section should include the total number of individuals of each bat species found; date found; water and air temperatures; river stage; total number of Indiana bats found; data regarding non-endangered bats, particularly those species such as the little brown bat that have similar behaviors; maps or figures showing project features; maps of mist-net locations, roost trees, roosting habitat, foraging habitat, and travel corridors; dates of surveys; and names of surveyors.

3. Operation and maintenance of the U.S. 6219 project over its expected life represents an ongoing potential effect on the Indiana bat A plan should be developed to limit this effect.

4. The Service’s Pennsylvania Field Office and Region 5 Division of Law Enforcement are to be notified within 24 hours should any endangered or threatened species be found dead or injured as a direct or indirect result of the implementation of this project. Notification must include the date, time, and location of the carcass, and any other pertinent information. Any dead bats located within a project area, regardless of species, should be immediately reported to PGC and the Pennsylvania Field Office [(814) 234-4090], and subsequently transported (frozen or on ice) to the latter office. No attempt should be made to handle any live bat, regardless of its condition; report bats that appear to be sick or injured to the Pennsylvania Field Office, who will make a species determination on any dead or moribund bats. Notification must also be made to the following Service office at least two weeks prior to blasting activities:

   - State College, Pennsylvania Field Office (Attn: Endangered Species Specialist); 315 South Allen Street, Suite 322, State College, PA 16801 (telephone: 814-234-4090).

5. If this project is not completed by 2018, FWHA will reinitiate consultation with the Service to re-evaluate project impacts on the Indiana bat, and to determine the appropriateness of the reasonable and prudent measures contained in this biological opinion.

The Service believes that all Indiana bats associated with the Salisbury Mine hibernaculum will be harmed or harassed due to road construction and operation. However, due to the project minimization and conservation measures, and the expectation that Indiana bats will adjust their habitat use in response to the road, we do not believe this level of take will reduce the size of the Indiana bat hibernating population at Salisbury Mine.

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. In coordination with the Pennsylvania Field Office of the Fish and Wildlife Service, purchase or otherwise protect Indiana bat habitat, including hibernacula, identified maternity habitat, and fall habitat in the vicinity of hibernacula in Pennsylvania.

2. Develop a programmatic transportation conservation plan that facilities FHWA and PennDOT participation with ongoing Pennsylvania Game Commission, Pennsylvania Turnpike Commission, and Service efforts to identify Indiana bat summer habitat via radio-tracking bats departing for spring migration.

3. Work with the Service to develop national guidelines for addressing Indiana bat conservation associated with FHWA projects within the range of the Indiana bat.

4. Batch all segments of the S.R. 219 Corridor Improvement Project into a single consultation to comprehensively evaluate and address effects on Indiana bats.

The Service should be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, and requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the SR 6219, Section 19 project. As is 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.

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