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FISH AND WILDLIFE SERVICE
Rock Island Ecological Services Field Office
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Final Biological Opinion

for

Pioneer Trail Wind Farm Habitat Conservation Plan and Incidental Take Permit, Ford and Iroquois County, Illinois

April, 2015

Prepared by:
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Summary

This document transmits the biological opinion of the Fish and Wildlife Service (Service) prepared under the authority of and in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). This opinion is based on information provided in the March 2015 Final Habitat Conservation Plan for the Indiana Bat and the Northern Long Eared Bat (HCP), the April, 2015 Final Environmental Assessment for the Proposed Habitat Conservation Plan and Incidental Take Permit (EA), the 2014 Bird and Bat Conservation Strategy (BBCS), and other literature and data sources, as cited herein.

This biological opinion evaluates the Service's issuance of an incidental take permit (pursuant to section 10 of the Act), as the issuance of this permit is considered a federal action requiring consultation under section 7 of the Act. It evaluates the potential direct and indirect effects to Indiana bats that may occur as a result of implementing the covered activities as described in the associated HCP. Furthermore, this opinion only assesses impacts to federally listed species and does not address the overall environmental acceptability of the proposed action. The purpose of formal section 7 consultation is to ensure that any action authorized, funded, or carried out by the Federal government is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of the species.

The activities covered under the HCP developed for the Pioneer Trail Wind Farm may incidentally cause take of the federally endangered Indiana bat and the federally threatened northern long-eared bat (NLEB). The Service has determined in this opinion that the activities described in the Habitat Conservation Plan will not jeopardize the continued existence of the Indiana bat or the NLEB but will result in incidental take of these species. The eastern prairie fringed orchid (*Platanthera leucophaea*) and Mead's Milkweed (*Asclepias meadii*), are also listed as threatened for Ford and Iroquois County, respectively, but this action is not expected to affect these species.

Consultation History

This section 7 analysis was triggered by the submission of the HCP in June, 2014 and its subsequent publication in the Federal Register on August 6, 2014. The comment period closed on September 22, 2014. The HCP was developed in coordination with the Rock Island Ecological Services Field Office between 2011 and 2014.

1. Description of the Proposed Action

The Service received an application for an Incidental Take Permit (ITP), pursuant to the provisions of section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (ESA;16 United States Code [USC] §§ 1531–1544.) for the Pioneer Trail Wind Farm (PTWF or Project). If issued, the ITP would authorize the incidental take of the federally endangered Indiana bat (*Myotis sodalis*), and the federally threatened northern long-eared bat (*Myotis septentrionalis*) during operation of the PTWF in Iroquois and Ford counties, Illinois (See the HCP for site location details). Under section 10 of the ESA, applicants may be authorized, through issuance

of an ITP, to conduct activities that may result in take of a listed species as long as the take is incidental to, and not the purpose of, otherwise lawful activities.

The PTWF is a wind energy facility with a nameplate capacity of 150-megawatts (MW) and comprises 94 1.6-MW wind turbine generators, an operations and maintenance building, access roads, collector line system, and substation. Approximately 3 miles of overhead transmission line extends from the existing Paxton West substation to a newly constructed substation on the Project site.

The project is currently operating under the provisions of the Bird and Bat Conservation Strategy for Pioneer Trail Wind Farm (BBCS) and a technical assistance letter issued by the Service in March of 2012. The BBCS calls for several wildlife conservation measures, including the curtailment of turbines to a cut-in wind speed of 6.9 m/s one half hour before sunset to one half hour after sunrise from August 15 through October 15. This time period coincides with the expected fall migration season of the Indiana bat, and this measure is expected to make take of the Indiana bat by the wind facility unlikely.

Under the Preferred Alternative put forth in the HCP, the Service would issue a 43-year ITP that would authorize incidental take of Indiana bats and NLEBs associated with the operation of 94 turbines at cut-in speeds below 6.9 m/s. The ITP would include provisions for authorizing take of northern long-eared bats that would become effective if and when they become listed. PTWF would implement an HCP that includes:

1) Operational measures to reduce take of listed bats: turbine feathering at low wind speeds and raised cut-in speeds of 5.0 m/s from sunset to sunrise when the ambient temperature is above 10°C (50°F) for the period from August 15 through October 15.
2) Off-site conservation measures to mitigate for the impact of the taking of Indiana bats and NLEBs; and
3) Post-construction monitoring and an adaptive management plan to measure and ensure the effectiveness of turbine operations in reducing bat mortality. Adaptive management of operations will include raising and/or lowering operational cut-in speeds according to results from the mortality monitoring regime.

PTWF would also implement the BBCS to reduce the potential for impacts to migratory birds. Elements in the BBCS that address Indiana bats would be replaced by the conservation measures addressed in the HCP. The two documents will be consistent with each other.

1.1 Conservation Measures

The biological goals stated in the HCP are to minimize Indiana bat and NLEB mortality in the project area, protect a vulnerable wintering population of Indiana bats, and to augment summer Indiana bat and NLEB habitat to increase their survival and reproductive capacity. These goals will be achieved through the implementation of conservation measures designed to avoid, minimize, monitor, and mitigate impacts of the proposed action on Indiana bats and NLEBs. The Service has analyzed the effects of the proposed action based on the assumption that all

conservation measures will be implemented. A more detailed description of the project's conservation measures can be found in Section 7 of the HCP, but they are summarized briefly here. Note that the applicant implemented additional avoidance and minimization measures during project construction that are detailed in the BBCS.

1) Avoidance Measures:

- In the event that hazard or other trees have to be removed during maintenance and decommissioning activities the applicant will make every effort to schedule the removal prior to April 1 or after September 30 of any given year or will otherwise survey to insure that bats are not occupying trees prior to removal.

2) Minimization Measures

- The turbines will be fully feathered up to wind speeds of 5.0 meters per second (mps) between August 15 and October 15 from sunset to sunrise when temperatures are above 50 degrees F (10 degrees Celsius). Based on existing research (Arnett et al. 2011, Young et al. 2011), this measure is expected to reduce total bat mortality, including Indiana bat and northern long-eared bat mortality, by at least 50 percent.
- Based on monitoring results, cut-in speeds may be lowered incrementally if estimated take is less than half of permitted take (calculated on an annual basis). However, if follow-up monitoring indicates that lowered cut-in speeds are likely to result in exceedance of permitted take, cut-in speeds will be raised again.

3) Mitigation Measures

- The applicant will preserve 49 acres of existing Indiana bat and NLEB habitat and restore 157 acres of forested habitat in the riparian corridor of the Middle Fork of the Vermilion River. Success of this mitigation will be measured through performance standards that will be coordinated among the mitigation entity, the applicant, and the Service. Performance standards will be habitat-based and will include standards for installed plant material density, diversity, and survival as well as invasive species presence/control.
- The applicant will implement a hibernacula gating project to restrict human access and significantly reduce winter disturbance at an important hibernacula in southern Illinois.
- To supplement the summer habitat mitigation component, the applicant has planned to install 10 artificial roost structures and study their effectiveness. The material proposed in the HCP (Brandenbark ™) has been highly successful in southern Illinois and Kentucky (USFWS, 2014 unpublished data), and is expected to attract and house bats in the proposed mitigation areas also. The anticipated effect is to reduce lag-time in the ability of newly restored/planted areas to provide roosting habitat. The applicant will monitor the use of these artificial roost structures for the first three years, and subsequently every 5 years for the life of the permitted project. Results will be reported to the Service.
- Monitoring to evaluate the success of the mitigation projects will be conducted by the applicant, the applicant's contractor, and/or their representative performing the mitigation. Monitoring of the effect of the cave gating project to the hibernating bat populations will be coordinated with ongoing hibernacula monitoring performed by

State and Federal biologists.

4) Mortality Monitoring

- Post-construction mortality monitoring will be conducted during the first two years of operations and every fifth year after that, unless adaptive management measures are implemented. Should adaptive management be implemented, additional monitoring will be conducted for two years following each adjustment of cut-in speeds at baseline monitoring effort levels.
- The objective of the baseline monitoring (first two years) is to assess take of Indiana bats and NLEBs through observations and calculations of total bat mortality. Follow-up monitoring occurring every five years thereafter will be conducted to ensure that total bat mortality under the operational regime has not significantly increased and remains within expected levels.
- Baseline monitoring will include carcass searches of 50 of the 94 turbines weekly during spring (April 1 through May 15) and fall (August 15 through October 15) during years one and two. Cleared plots measuring 80 m x 80 m will be searched at 10 of the turbines, and roads and pads out to 80 m will be searched at 40 of the turbines.
- Follow-up monitoring will include spring and fall carcass searches of 28 of the 94 turbines, of which 6 turbines will be full plot searches and 22 will be roads and pad searches.
- Monitoring results will include corrections for carcass removal, searcher efficiency, and searchable area. Also, annual reports following the completion of each year of post-construction monitoring will be provided to the Service. However, should a listed or candidate species be found during monitoring, the Service will be notified within 48 hours of discovery and identification.
- A report with the results and conclusions of the mortality monitoring will be submitted to the Service following the completion of each year of monitoring. The report will include: 1) cumulative and annual assessment of take; 2) an assessment of the effectiveness of the conservation plan; 3) status of the mitigation project; 4) if applicable, recommendations for future research, monitoring, and mitigation; 5) a list of any changed circumstances that apply and strategies to address them; 6) written confirmation that funding is available or committed for the full implementation of the HCP for the ensuing year; and 7) a summary of any adaptive management measures that have been or will be implemented.

2. Status of the Species

This section presents the biological or ecological information relevant to formulating this Biological Opinion. Appropriate information on the species' life history, its habitat and distribution, and other data on factors necessary to its survival are included to provide background for analysis in later sections. This analysis documents the effects of past human and natural activities or events that have led to the current range-wide status of the species. Portions of this information are also presented in listing documents, the recovery plan (USFWS 1983), and the draft revised recovery plan (USFWS 1999), and are referenced accordingly.

2.1 Species Description and Life History

Indiana bat

The Indiana bat is an insectivorous, temperate, medium-sized bat that migrates annually from winter hibernacula to summer habitat in forested areas. The bat has a head and body length that ranges from 41 to 49 mm, with a forearm length of 35 to 41 mm. The fur is described as dull pinkish-brown on the back but somewhat lighter on the chest and belly, and the ears and wing membranes do not contrast with the fur (Barbour and Davis 1969). Although the bat resembles the little brown bat and the northern long-eared bat, it is distinguished by its distinctly keeled calcar and a long, pointed, symmetrical tragus.

Generally, Indiana bats hibernate from October through April (Hall 1962, LaVal and LaVal 1980), depending upon local weather conditions. Figure 3 provides a depiction of the annual cycle. They hibernate in large, dense clusters, ranging from 300 bats per square foot to 484 bats per square foot (Clawson et al. 1980, Clawson, pers. observ. October 1996 in USFWS 2000). Upon arrival at hibernating caves in August-September, Indiana bats "swarm", a behavior in which large numbers of bats fly in and out of cave entrances from dusk to dawn, with relatively few roosting in the caves during the day (Cope and Humphrey 1977). Swarming continues for several weeks and mating occurs during the latter part of the period. Fat supplies are replenished as the bats forage prior to hibernation.

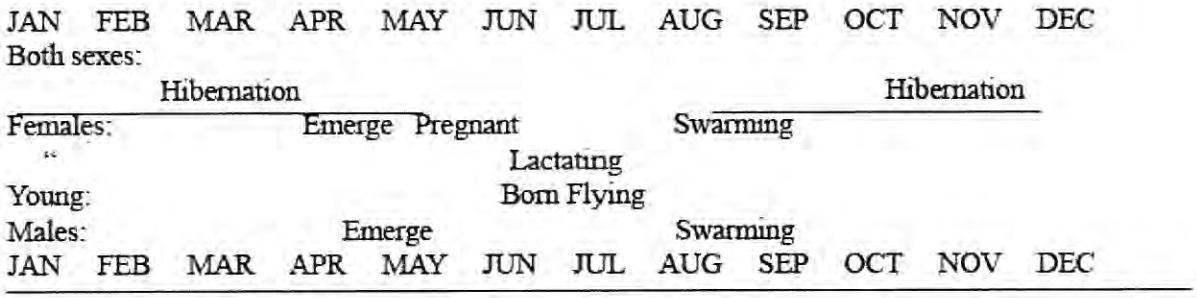

Figure 3. Indiana Bat Annual Chronology

Females emerge from hibernation ahead of males; most winter populations leave by early May. Some males spend the summer near hibernacula in Missouri (LaVal and LaVal 1980) and West Virginia (Stihler, pers. observ. October 1996, in USFWS 2000). In spring when fat reserves and food supplies are low, migration is probably hazardous (Tuttle and Stevenson 1977). Consequently, mortality may be higher in the early spring, immediately following emergence.

Females may arrive in their summer habitats as early as April 15 in Illinois (Gardner et al. 1991, Brack 1979). During this early spring period, a number of roosts (e.g., small cavities) may be used temporarily, until a roost with larger numbers of bats is established. Humphrey et al. (1977) reported that Indiana bats first arrived at their maternity roost in early May in Indiana, with substantial numbers arriving in mid-May. Birth of young occurs in late June and early July (Easterla and Watkins 1969, Humphrey et al. 1977) and the young are able to fly between

mid-July and early August (Mumford and Cope 1958, Cope et al. 1974, Humphrey et al. 1977, Clark et al. 1987, Gardner et al. 1991a, Kurta et al. 1996). Female Indiana bats exhibit strong site fidelity to summer roosting and foraging areas. That is, they return to the same summer range annually to bear their young (Garner and Gardner 1992).

In general, Indiana bats roost in large, often dead or partially dead trees with exfoliating bark and/or cavities and crevices (Callahan et al. 1997; Farmer et al. 2002; Kurta et al. 2002). Trees in excess of 16 inch diameter at breast height (dbh) with exfoliating bark are considered optimal for maternity colony roost sites, but trees in excess of 9 inch dbh appear to provide suitable maternity roosting habitat (Romme et al. 1995). Indiana bat maternity roosts can be described as primary or alternate based upon the proportion of bats in a colony consistently occupying the roost site. Maternity colonies typically use 10 to 20 trees each year, but only one to three of these are primary roosts used by the majority of bats for some or all of the summer (Gardner and Gardner 1992). Alternate roosts are used by individuals, or a small number of bats, and may be used intermittently throughout the summer or used on only one or a few days. Females frequently switch roosts to find optimal roosting conditions, switching roosts every few days on average, although the reproductive condition of the female, roost type, and time of year affect switching. When switching between day roosts, Indiana bats may travel as little as 23 feet (7 m) or as far as 3.6 miles (5.8 km) (Kurta et al. 1996; Kurta et al 2001; Kurta et al. 2002). In general, moves are relatively short and typically less than 0.6 mile (1 km) (USFWS 1997).

The range of maternity colony sizes observed for the Indiana bat is 10-100 adult females (Kurta and Rice 2002), and 60 females is the average of the overall variability in maternity colony size. Birth of young occurs in late June and early July (Easterla and Watkins 1969, Humphrey et al. 1977). The young are able to fly between mid-July and early August (Mumford and Cope 1958, Cope et al. 1974, Humphrey et al. 1977, Clark et al. 1987, Gardner et al. 1991, Kurta et al. 1996).

The home range of a maternity colony is the area within a 2.5-mile radius (i.e., 12,560 acres) around documented roosts or within a 5-mile radius (i.e., 50,265 acres) around capture location of a reproductive female or juvenile Indiana bat or a positive identification of Indiana bat from properly deployed acoustic devices. Based on data provided in the Indiana bat draft revised Recovery Plan (USFWS 2007), a maternity colony needs at least 10% suitable habitat (i.e., forested habitat) to exist at a given point on the landscape.

After the summer maternity period, Indiana bats migrate back to traditional winter hibernacula. Some male bats may begin to arrive at hibernacula as early as July. Females typically arrive later and by September the number of males and females are almost equal. Autumn "swarming" occurs prior to hibernation. During swarming, bats fly in and out of cave entrances from dusk to dawn, while relatively few roost in the caves during the day. By late September many females have entered hibernation, but males may continue swarming well into October in what is believed to be an attempt to breed with late arriving females.

Male Indiana bats may be found throughout the entire range of the species. Males appear to roost singly or in small groups, except during brief summer visits to hibernacula. Males have been observed roosting in trees as small as 3 inches dbh.

NLEB

The NLEB is a medium-sized bat with an average adult weight of 5 to 8 grams, average body length from 77 to 95 millimeters, and forearm length between 34 and 38 millimeters (Caceres and Pybus 1997). Its fur ranges from medium to dark brown on the dorsal side, and tawny to pale-brown on the ventral side. Its ears and wing membranes are dark brown, and the NLEB is most readily distinguished from other species of *Myotis* by its longer tragus and ears, ears which average 17 millimeters in length and extend beyond the nose when laid forward. (Whitaker and Mumford 2009).

During the summer, the NLEB occupies forested habitat and roosts (singly or in colonies) in the cracks, crevices, and bark of both live and dead trees (Lacki and Schwierjohann 2001), but they also have been found to roost in human made structures, such as buildings, barns, sheds, cabins, etc. Also, it appears that the NLEB does not depend on any specific species of tree, but rather the tree characteristics and/or tree decay structure are the most important factors in roost selection (Foster and Kurta 1999). The NLEB has been found to roost below the canopy in forests with a variety of canopy cover percentages, but research has indicated that females do tend to roost in more open areas than males (Perry and Thill 2007). Open areas receive greater solar insolation, which increases roost temperature and therefore pup development.

The NLEB occupy their summer habitat from approximately March through August and then begin to swarm near their hibernacula in August or September (Caire et al. 1979), depending on the geographical region. In Indiana, the majority of NLEB's in Copperhead Cave have been observed to enter hibernation during October, and emerge from about the second week of March to mid-April (Whitaker and Mumford 2009). Hibernation periods farther north may begin earlier and last longer (Stones and Fritz 1969; Fitch and Shump 1979). The NLEB has been observed to share hibernacula with other bat species (Whitaker and Mumford 2009), but is rarely observed in concentrations over 100 in one hibernaculum (Barbour and Davis 1969). NLEB individuals also rouse and may switch hibernacula throughout the winter, which makes it difficult to accurately estimate winter population numbers (Griffin 1940; Whitaker and Rissler 1992b; Caceres and Barclay 2000).

2.2 Diet and Foraging

Indiana Bat

Indiana bats forage over a variety of habitat types but prefer to forage in and around the tree canopy of both upland and bottomland forest or along the corridors of small streams. Bats forage at a height of approximately 2-30 meters under riparian and floodplain trees (Humphrey et al. 1977). They forage between dusk and dawn and feed exclusively on flying insects, primarily moths, beetles, and aquatic insects. Females in Illinois were found to forage most frequently in areas with canopy cover of greater than 80%, and typically utilize larger foraging ranges than males (Garner and Gardner 1992).

NLEB

The NLEB forages on a variety of insect types and does so primarily above the understory, but under the canopy in forested habitats (Nagorsen and Brigham 1993). It is capable of both capturing prey in midair and gleaning perched insects from surfaces. This gleaning ability, combined with agile flight capabilities, enables the NLEB to forage in dense forests with heavy understory (Foster and Kurta 1999). The NLEB has shown a preference for forested hillsides and ridges, as opposed to riparian areas (Brack and Whitaker 2001; LaVal et al. 1977) and other data indicates that mature forests are important foraging habitat for the NLEB (Caceres and Pybus 1998). It is estimated that the NLEB has a home range of 47 to 425 acres (Lacki et al 2009, with an average maternal home range of approximately 160 acres (Owen et al. 2003).

In general, the NLEB consumes moths, flies, leafhoppers, caddisflies, and beetles. However, the most common insects found in the diet of the NLEB are moths and beetles (Feldhammer et al. 2009; Brack and Whitaker 2001). The NLEB's foraging patterns include a peak activity period within five hours of sunset, and a second peak within 8 hours of sunset (Kunz 1973). Insects consumed during these periods do not seem to be significantly different (Brack and Whitaker 2001).

2.3 Range, Population Dynamics, and Migration

Indiana Bat

The historical summer range of the Indiana bat is thought to be similar to its modern range. However, the bat has been locally extirpated due to fragmentation and loss of summer habitat. The current species range includes much of the eastern half of the United States, from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida.

Based on censuses taken at all hibernacula, the total known Indiana bat population is estimated to number about 534,239 bats (Figure 4). Population trend data have shown a relatively stable population from 2005 to present. However, with the advent of White-nose syndrome, future population trends are uncertain.

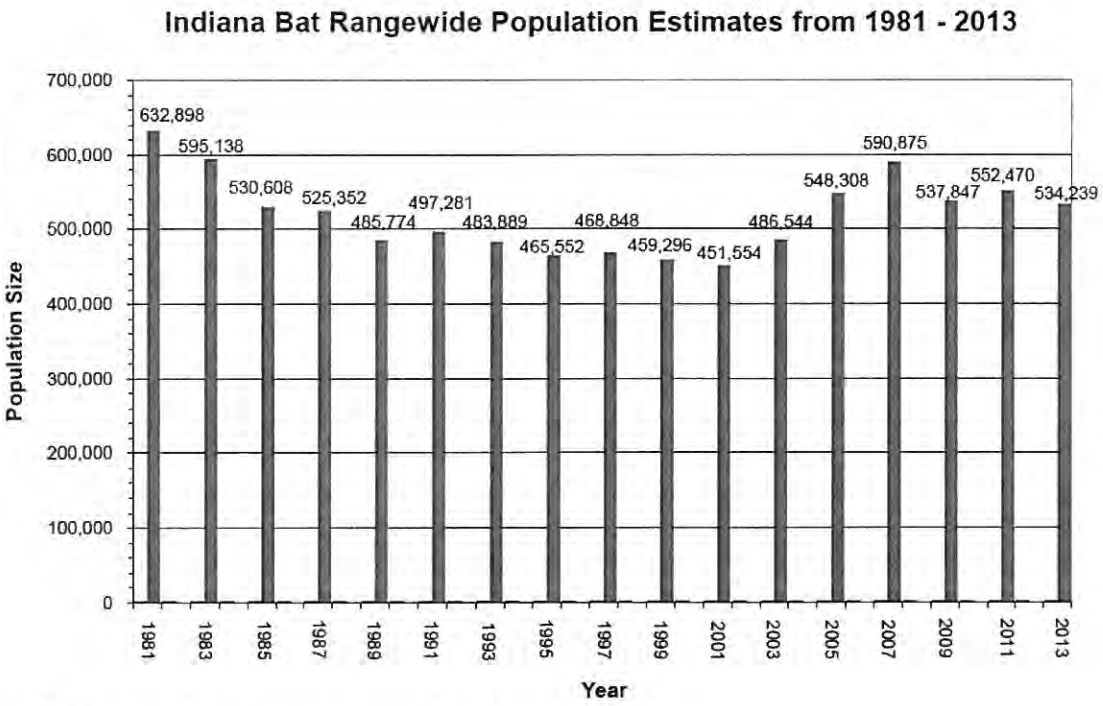

Figure 4. Indiana bat rangewide population estimates from (http://www.fws.gov/midwest/Endangered/mammals/inba/index.html).

NLEB

The NLEB is a wide-ranging North American species that is considered to be present in all Canadian provinces across to the southern Yukon Territory and eastern British Columbia (Nagorsen and Brigham 1993, and Caceres and Pybus 1997). In the United States, the bat can be found in 39 states (including the District of Columbia) from Maine to Montana, south to Kansas and eastern Oklahoma, and southeast to the Florida Panhandle (Whitaker and Hamilton 1998; Caceres and Barclay 2000; Amelon and Burhans 2006).

While the species is wide ranging, it appears to be unevenly distributed, and found in low numbers in both roosts and hibernacula (Amelon and Burhans 2006; Whitaker and Hamilton, 1998). However, populations are generally categorized into the Eastern Population, the Midwest Population, the Southern Population, the Western Population, and the Canada Population, although these will not be considered to be Distinct Population Segments under Endangered Species Act (ESA) (USFWS 2013b). The NLEB has been noted in typically small numbers in numerous hibernacula across its range, but insufficient data is available at this time to estimate a range-wide population. Population estimates are also unavailable for the Midwest Population, although mist net survey data indicate that the species is commonly captured in this region during mist-netting efforts.

Migration of Indiana bats and NLEBs

A 2011 spring migration study at the Blackball Mine hibernacula documented that the majority of the tracked Indiana bats emerging from Blackball travelled south and west down the forested Illinois River corridor (Hicks et al. 2011). This suggests that during spring migration, Indiana bats may follow watershed drainage corridors enroute to their summer habitats in Illinois. Because Indiana bats and NLEBs share hibernacula and have many overlapping summer habitats in Illinois, it is logical to infer that NLEBs may have similar spring migration patterns. However, no direct spring migration data from Illinois exists for the NLEB, at present. Also, at present, no *Myotis* fatalities have been reported to the Service from spring wind power mortality monitoring efforts in Illinois. An Indiana bat mortality was noted at a facility in western Ohio, but this is the only spring mortality known to-date. This information implies that spring fatality risk of these two species in Illinois may currently be low, and therefore represent a less significant effect on their baseline population dynamics than habitat and white nose syndrome concerns.

Fall migration routes or patterns for both species are currently unknown. The recent discovery of four Indiana bat and five NLEB carcasses at various wind facilities in Illinois, Indiana, Iowa, Missouri, and Ohio in the fall demonstrates that some individuals cross open, treeless landscapes during their fall migration. Additionally, a 2014 fall migration telemetry study conducted on a population of Indiana bats and NLEBs living in the Middle Fork of the Vermillion River riparian corridor showed that most tagged individuals did not appear to follow the river corridor when the maternity colonies broke up, but rather headed northeast across the open landscape (Boyles and McGuire, unpublished report). If other bats from other maternity colonies have the same tendency to cross open landscapes during fall migration, some level of mortality risk during fall migration is likely associated with wind turbines in the region. This risk is difficult to quantify with currently available data. The Service continues to engage with our partners to gather information to inform this risk.

2.4 Status

Indiana Bat

The Indiana bat (*Myotis sodalis*) was listed as an endangered species via notice in the Federal Register on March 11, 1967 (32 Fed. Reg. 48) under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U. S. C. 668aa(c)). The reasons for listing the species are summarized in the 2007 Draft Recovery Plan and include destruction/degradation of hibernation habitat, loss/degradation of summer habitat, migration habitat, and swarming habitat, disturbance of hibernating bats, disturbance of summering bats, disease and parasites, predation, and various anthropogenic factors (USFWS 2007). Relevant to the project area, the closest known Indiana bat occurrences are from the upper portion of the Middle Fork of the Vermilion River. Currently, the Service has knowledge of approximately 485 Indiana bat captures (males and females inclusive) statewide.

NLEB

The NLEB was proposed for listing as endangered on October 2, 2013, via a notice in the Federal Register (78 Fed. Reg. 191) and was formally listed as threatened on April 2, 2015. The primary reason for listing is the recent severe and ongoing decline of the species due to white-nose syndrome. Relevant to the project area, the closest known NLEB occurrences are from the upper portion of the Middle Fork of the Vermilion River. Currently, the Service has knowledge of approximately 222 NLEB captures (males and females inclusive) statewide.

2.5 Reasons for Decline

Indiana bat

Not all of the causes of Indiana bat population declines have been determined. Although several known human-related factors have caused declines in the past, they may not solely be responsible for recent declines.

Documented causes of Indiana bat population decline include:

Disturbance and vandalism. A serious cause of Indiana bat decline has been human disturbance of hibernating bats during the decades of the 1960s through the 1980s. Bats enter hibernation with only enough fat reserves to last until spring. When a bat is aroused, as much as 68 days of fat supply is used in a single disturbance (Thomas et al. 1990). Human use (e.g., including recreational cavers and researchers) near hibernating Indiana bats can cause arousal (Humphrey 1978, Thomas 1995, Johnson et al. 1998). If this happens too often, the bats' fat reserves may be exhausted before the species is able to forage in the spring.

Active programs by State and Federal agencies have led to the acquisition and protection of a number of Indiana bat hibernacula. Of 127 caves/mines with populations >100 bats, 54 (43%) are in public ownership or control, and most of the 46 (36%) that are gated or fenced are on public land. Although such conservation efforts have been successful in protecting Indiana bats from human disturbance, they have not been sufficient to reverse the downward trend in many populations.

Improper cave gates and structures. Some hibernacula have been rendered unavailable to Indiana bats by the erection of solid gates in the entrances (Humphrey 1978). Since the 1950's, the exclusion of Indiana bats from caves and changes in air flow are the major cause of loss in Kentucky (an estimated 200,000 bats at three caves) (USFWS 1999). Other cave gates have so modified the climate of hibernacula that Indiana bats were unable to survive the winter because changes in air flow elevated temperatures which caused an increase in metabolic rate and a premature exhaustion of fat reserves (Richter et al. 1993).

Natural hazards. Indiana bats are subject to a number of natural hazards. River flooding in Bat Cave, Mammoth Cave National Park, drowned large numbers of Indiana bats (Hall 1962). Other

cases of hibernacula being flooded have been recorded by Hall (1962), DeBlase et al. (1965), and USFWS (1999). A case of internal cave flooding occurred when tree slash and debris (produced by forest clearing to convert the land to pasture) were bulldozed into a sinkhole, blocking the cave's rain water outlet and drowning an estimated 150 Indiana bats (USFWS 1999).

Another hazard exists because Indiana bats hibernate in cool portions of caves that tend to be near entrances, or where cold air is trapped. Some bats may freeze to death during severe winters (Humphrey 1978, Richter et al. 1993). Indiana bats are vulnerable to the effects of severe weather when roosting under exfoliating bark during summer. For example, a maternity colony was displaced when strong winds and hail produced by a thunderstorm stripped the bark from their cottonwood roost and the bats were forced to move to another roost (USFWS 1999).

Suspected causes of Indiana bat decline include:

Microclimate effects. Changes in the microclimates of caves and mines may have contributed more to the decline in population levels of the Indiana bat than previously estimated (Tuttle, in lit. August 4, 1998). Entrances and internal passages essential to air flow may become larger, smaller, or close altogether, with concomitant increases or decreases in air flow. Blockage of entry points, even those too small to be recognized, can be extremely important in hibernacula that require chimney-effect air flow to function. As suggested by Richter et al. (1993) and Tuttle (in lit. August 4, 1998), changes in air flow can elevate temperatures which can cause an increase in metabolic rate and a premature exhaustion of fat reserves.

Land use practices. The Indiana bats' maternity range has changed dramatically since pre-settlement times (Schroeder 1991; Giessman et al. 1986; MacCleery 1992; Nigh et al. 1992). Most of the forest in the upper Midwest has been fragmented, fire has been suppressed, and native prairies have been converted to agricultural crops or to pasture and hay meadows for livestock. Native plant species have been replaced with exotics in large portions of the maternity range, and plant communities have become less diverse than occurred prior to settlement. Additionally, numerous chemicals are applied to these intensely cropped areas. The changes in the landscape and the use of chemicals (McFarland 1998) may have reduced the availability and abundance of the bats' insect forage base.
In the eastern U.S., the area of land covered by forest has been increasing in recent years (MacCleery 1992; Iverson 1994; Crocker et al. 2006). Whether or not this is beneficial to the Indiana bat is unknown. The age, composition, and size class distribution of the woodlands will have a bearing on their suitability as roosting and foraging habitat for the species outside the winter hibernation season.

Chemical contamination. Pesticides have been implicated in the decline of a number of insectivorous bats in North America (Mohr 1972, Reidinger 1972, Reidinger 1976, Clark and Prouty 1976, Clark et al. 1978, Geluso et al. 1976, Clark 1981). The effects of pesticides on Indiana bats have yet to be studied. McFarland (1998) studied two sympatric species; the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*M. septentrionalis keenii*) as surrogates in northern Missouri and documented depressed levels of acetylcholinesterase, suggesting that bats there may be exposed to sublethal levels of organophosphate and/or

carbamate insecticides applied to agricultural crops. McFarland (1998) also demonstrated that bats in northern Missouri are exposed to significant amounts of agricultural chemicals, especially those applied to corn. BHE Environmental, Inc. (1999) collected tissue and guano samples from five species of bats at Fort Leonard Wood, Missouri, and documented the exposure of bats to p,p'-DDE, heptachlor epoxide, and dieldrin.

New Threats/Disease epidemics: White-nose syndrome (WNS): WNS was first documented in New York in February of 2006 and has since been observed to have spread to western Virginia and Pennsylvania (www.nwhc.usgs.gov). It is currently unknown if WNS is the primary cause or a secondary indicator of another pathogen, but it has been correlated with erratic behavior such as early or mid-hibernation arousal that leads to emaciation and mortality in several species of bats, including the Indiana bat (www.fws.gov).

Overall mortality rates, primarily of little brown bats, for 2007 and 2008 ranged from 81% to 97% among four study sites. It is currently estimated that 1 million bats have died from WNS in infected regions (www.dnrec.delaware.gov). Apparent losses of 685 Indiana bats in Hailes Cave and all but 124 of 13,014 Indiana bats in the Williams Preserve Mine in New York were documented during the first winter WNS was observed at each site. Additionally, Indiana bat surveys conducted at hibernacula in New York during early 2008 estimated the population to be down by 15,662 bats, which represents 3.3% of the 2007 revised rangewide population estimate.

WNS is thought to be transmitted by direct bat contact with an infected bat and by transmission of the causative agent from cave to cave. The distribution of WNS appears to be expanding in all directions from its epicenter in Albany and Scoharie Counties, New York. Between 2007 and 2008, it was documented to have spread from a 9 km radius to a 200 km radius, and at the end of the 2008-2009 winter, it was documented in all major hibernacula in New York. Most recently it has been found as far west as Illinois and Missouri. The Service and partners are conducting research to develop management strategies to reduce the spread and impacts of WNS. However, it remains a significant and immediate threat to the Indiana bat.

In response to many of these threats and in accordance with Federal law, a Recovery Plan has been drafted for the species that outlines strategies and actions believed to be necessary for the recovery of a species. In summary, the objectives of the Recovery Plan are to: (1) protect hibernacula; (2) maintain, protect, and restore summer maternity habitat; and (3) monitor population trends through winter censuses.

NLEB

The NLEB has been listed as threatened based on the severity of population impacts that have been realized in areas with WNS, and the expected population impacts that will likely occur with the spread of the disease in the future. There are other reasons for decline that are discussed in the listing package, but none as serious as WNS (USFWS 2015).

2.6 Collisions with Wind Turbines

To-date, seven Indiana bat fatalities have been documented at wind facilities throughout the range of the species. Five of these fatality events occurred in the fall, one occurred in the spring, and the other occurred in July. Several NLEB fatalities have been reported in publically-available literature from several eastern and Midwestern states, as well as Canada. (The Environmental Assessment for the PTWF project identifies 24 specific fatalities). This information, combined with the fact that bat fatalities of several other species are ubiquitous at wind facilities, suggests that operating wind turbines pose some lethal risk to both species across their ranges. It should also be noted that one existing take permit has been issued to an operational facility in Region 3. The Fowler Ridge Wind Farm in northwestern Indiana is currently authorized to take 184 Indiana bats over the project's permitted life (2014-2035), which is approximately nine bats per year. A second take permit has been issued to the Buckeye Wind Project for the taking of up to 130 Indiana bats over a 25-year permit term. This facility has not yet been constructed.

According to the American Wind Energy Association (www.awea.org), 11,384 MW of wind power capacity are currently installed in the Midwest and Ozark Central Recovery Units (IA, IL, IN, OH, MO). It is important to note, however, that the majority of installed wind power capacity in Iowa is outside of the Indiana bat range, but within the NLEB range. Because of the fatalities mentioned above, it is plausible to assume that some of these facilities pose some level of risk, and may be taking some Indiana bats and NLEBs annually. Given the difficulty of detecting rare events during ground searches at wind facilities, the uncertainty surrounding migration paths of bats from summer to winter habitat, and the variation in topography, habitat configuration, and wind resources at each wind facility, the baseline mortality from wind turbine operation is unknown and very difficult to estimate. Consequently, the effect of wind energy alone, on local, regional, or range wide populations is also exceedingly difficult to quantify.

3. Environmental Baseline

The purpose of the environmental baseline is to describe past and ongoing human and natural factors that have contributed to the current status of the species and its habitat in the project action area. Range-wide factors affecting the species include those listed previously under Reasons for Decline. Other factors with the potential to adversely affect roosting habitat include forest clearing by private industry or landowners, woodlot management and wetland drainage by landowners, other private and municipal land management activities that affect the structure and abundance of forest resources, and deleterious interactions with other wind power turbines.

3.1 Status of the Indiana Bat and NLEB within the Action Area

The action area includes the entire 26,000 acres associated with the wind energy project. The project area and surrounding landscape consist almost entirely of row-crop agricultural fields, with the occasional farmstead on field edges. A few grass waterways with sparse trees do extend into the project area, but all turbines are located at least 1000 feet from those waterways that may function as bat foraging corridors. The turbine nearest to the Middle Fork of the Vermillion

River is approximately two miles away.

Indiana bats have been known to occupy the stretch of the Middle Fork between the Middle Fork Forest Preserve and I-57 since 1988 (Copperhead 2010). Mist-net surveys conducted in 2010 (Copperhead 2010) and 2014 (Boyles et al, unpublished data) indicate that Indiana bats continue to occupy the area. In addition reproductively active NLEBs were also caught during the 2010 survey, but not radio-tracked. Exit counts of located roost trees show that at least 45 Indiana bats occupy the 2010 mist-netted area. However, it is plausible that the population in the area is larger and may harbor more maternity colonies. Of the eight Indiana bats captured, only two Indiana bats were transmittered and tracked to their respective roost trees, which were found near their capture site. In addition, juvenile and adult Indiana bats were caught approximately two miles to the south of these roost trees, and still other Indiana bats were captured two miles to the north of the roost trees. Given the three mile approximate foraging radius (USFWS 2007), it is quite plausible that this long distance between captures indicates the presence of at least two maternity colonies. Furthermore, it is plausible that these bats may venture and forage up into the small wooded drainages that are present in the southern half of the project action area.

The nearest winter hibernacula is near LaSalle, Illinois (Blackball Mine), but several other Priority 1 and 2 hibernacula are within a 200 mile radius of the project site and could serve as hibernacula for the Middle Fork bat population and other bats on the landscape that may migrate through the project area. These are well within the maximum known migration distance of an Indiana bat. Because turbines in the project area have been sited at least 1000 feet away from potential summer foraging corridors or roosting habitat, no summering Indiana or NLEBs are expected to be at risk of deleterious interaction with turbines in the project area. At this point in time (prior to permit issuance), the implementation of a 6.9 m/s per second cut-in speed operational protocol is expected to make take of migrating Indiana bats and NLEBs unlikely.

3.2 Factors Affecting the Indiana Bat Environment within and adjacent to the Action Area

The action area is expected to continue to produce agricultural crops as normal, and no major land use changes are expected during the term of the action. Some agricultural crops may need to be cleared around turbines to facilitate mortality searches, but it is not expected that this will impact the foraging of Indiana bats or NLEBs. No commercial development that will greatly alter bat habitat in or adjacent to the action area is expected, as these communities are agricultural based. No Federal actions that would affect the Indiana bat in the immediate vicinity of the area are known to be proposed at the time of this Biological Opinion.

4. Effects of the Action

"Effects of the action" refers to the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated and or interdependent with that action which will be added to the environmental baseline. The Act defines direct effects as those considered immediate effects of the project on the species or its habitat. Indirect effects are those caused by the proposed action 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 upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consultation. This section includes an analysis of the direct and indirect effects of the proposed action and associated interrelated and interdependent activities on the Indiana bat and its potential and critical habitat.

As a result of the operation of the wind turbines, collisions with turbine blades and/or barotrauma are likely to be the primary cause of take of both species. Compensatory mitigation for take will be implemented as part of the HCP and will have long-term benefits, but may involve short term harassment. Specifically, if bachelor colonies of Indiana bats or NLEBs are present in Griffiths Cave at the time of gating, the installation of the gate may disturb them or temporarily displace them. This action is not expected to directly kill any Indiana bats, however. Therefore, the lethal take of turbine operation is the focus of the analysis below. Moreover , the effects of this lethal take is analyzed first at the local colony scale, then at the hibernacula, Recovery Unit, and finally the species range wide level.

4.1 Direct Effects of Federally Permitted Actions

As presented in Section 6.4 of the HCP, the applicant has estimated that the project will involve lethal take of up to 129 Indiana bats and 86 NLEBs over the 43 year permitted life of the project. Furthermore, the applicant expects that take will generally be evenly distributed during the permit life, which suggests an annual take estimation of 3 Indiana bats and 2 NLEBs per year. The applicant also expects that this take will occur in the fall primarily, but an occasional take in the spring is possible, but unlikely. (Should a take event occur in the spring, this will count toward the annual take count.) Lethal take is expected to occur from blunt force trauma or barotrauma caused by bats striking or flying very close to turbine blades.

Due to natural variability in any biological system, it is expected that bat migration patterns and associated collision risk may vary a little from year to year. Therefore, annual take may not be exactly three and two per year, each year. To address this uncertainty and help guard against exceedance of permitted take, the applicant has committed to mortality monitoring and will be implementing an adaptive management regime. Under the adaptive management strategy in the HCP, the applicant will raise cut-in speeds and implement additional mortality monitoring with each cut-in speed change, should the estimated take of Indiana bats exceed three each year following two years of monitoring or greater than six in any given year. Adaptive management would also be implemented if estimated take exceeds greater than two NLEBs each year, following two years of monitoring, or greater than four in any given year.

With the adaptive management regime in place, it is possible that greater than three Indiana bats or two NLEBs per year may be taken. However, this is expected be a rare, isolated event after which adaptive management would be implemented to bring annual take back down to permitted levels. Likewise, there could be a year or years where no bats are taken at all. Given this uncertainty, the most plausible scenario to consider as the direct effect of the project is the consistent taking of three Indiana bats and two northern long-eared bats per year.

The take estimate in Section 6.4.3 of the HCP states that fall migrating Indiana bats are most

likely to be made up of female bats and their young of the year offspring, which have a sex ratio of 50:50. This means that approximately 75% of migrating bats will be female, and the number of female Indiana bat mortalities per year would be 2.25. Effect of the take must be analyzed in whole bats, and the primary effect of the take on the species is the lost reproductive capability of female Indiana bats. Therefore we conducted our population effects analysis on the loss of 2 female bats per year.

Regarding NLEBs, it is estimated in Section 6.4.3 of the HCP that the sex ratio of NLEBs migrating through the project area is expected to be closer to 50:50. Therefore, it is expected that in general, 43 males and 43 females would be taken over the life of the project. For the purposes of the population effects analysis below, one female and one male NLEB were estimated be taken each year.

4.2 Interrelated Activities, Interdependent Activities, and Indirect Effects

The project proponent has proposed to conduct mitigation to offset the impact of the requested take. The mitigation actions are considered interrelated activities, as they would not occur but for the project. The applicant has committed to the restoration of 159 acres of forested habitat and the preservation of 49 acres of forested habitat. Also, the applicant has proposed to install a gate on a known Indiana bat hibernacula that is subject to human disturbance.

The hibernacula gating is expected to increase winter survival of hibernating Indiana bats in the cave (and any other bat species present) by significantly reducing winter arousal and stress from hibernation caused by human disturbance. Winter arousals from hibernation deplete energy reserves of hibernating bats, and can affect the survival of hibernating bats (Thomas, 1995)

The quantity of summer habitat mitigation proposed was informed by using the Service's REA model (Version 3.0, March 29, 2014), and, in combination with the winter hibernacula gating, is expected to offset the impacts of the permitted take. Also, the applicant has identified tracts of land to satisfy this requirement along the riparian corridor of the Middle Fork of the Vermilion River. These tracts will be selected based on their connectivity to suitable habitat and the proximity to known maternity colonies of Indiana bats and NLEBs. Summer habitat mitigation will involve the conversion of land currently in row-crop agriculture to forest, prairie, and savanna habitat. Summer habitat mitigation will also involve the preservation of tracts of existing forest that are expected to provide intact roosting and/or foraging habitat. These areas are expected to increase the carrying capacity of existing maternity habitat in the area (east central IL, Vermilion River watershed), and allow for the growth of size, and ideally number of maternity colonies in the area.

Finally, the applicant proposes to install and study several artificial roost structures in the summer habitat restoration areas. These artificial roosts have proven successful in Kentucky in attracting and harboring Indiana bats (Copperhead 2011). These roosts will be monitored to determine use by Indiana bats (and potentially NLEB). If the structures prove successful, the information gathered from this effort will inform future use of the roosts for other projects in the region, which could include using them to offset the temporal lag associated with growing

summer roosting habitat or mitigating the effects of roost tree felling.

5. Cumulative Effects

Cumulative effects include the effects of State, local or private actions that may occur in the action area. 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 ESA. The Service is unaware of any other Federal or non-Federal actions that are reasonably certain to occur which may adversely affect the Indiana bat in the project action area. The action area is located in a landscape that is predominantly agricultural. Many of the core forested areas that provide suitable habitat for the NLEB and Indiana bat in the nearby corridor of the Middle Fork of the Vermilion River are owned by the Champaign County Forest Preserve District. Other core forested areas are privately owned, but are largely located along streams and other waterways which do not lend themselves to easy clearing or land use conversion. Tree clearing (summer habitat alteration) could occur on privately owned tracts. However, the amount and intensity of these actions on private land in the action area are not expected to change the scope or magnitude of effects anticipated from this project. Therefore, the cumulative level of effects anticipated from these activities, combined with the project effects, is not anticipated to have measurable changes to Indiana bat populations or habitat within the action area.

6. Incidental Take Statement

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

6.1 Extent of Take Anticipated

In conjunction with the project, no more than 129 Indiana bats and 86 NLEBs will be taken over the 43-year life of the project and permit. This take is expected to be distributed fairly evenly across the permit period, with approximately three Indiana bats and two NLEBs taken each year. However, due to environmental stochasticity, this number may vary a little from year to year. Take coverage will begin upon issuance of the Section 10(a)(1)(B) permit and extend through 2058. Monitoring and adaptive management will be implemented to ensure that this take

number is not exceeded.

6.2 Effect of the Take

Effect of the take on Indiana bats at the local population level

In order to understand how take could be distributed at the local maternity colony level, we asked WEST to run the migration model (WEST 2015) to estimate the number of maternity colonies that may have bats flying through the project area (a summary of the migration model methods, model assumptions, and outputs are on file at the Rock Island Ecological Services Field Office). In sum, the model analyzes the potential location of maternity colonies in suitable habitat on the landscape, overlays the known hibernacula, and simulates trajectories of bats between hibernacula and modelled maternity colony locations. For this project, we assumed an open boundary between the Ozark Central Recovery Unit (OCRU) and the Midwest Recovery Unit (MWRU) because the project is very close to the border between the two units.

The output yielded the number of maternity colonies that may have bats that fly through the project area depending on simulated migration path widths. Specifically, the model outputs indicated that an average of between 18 maternity colonies (5 km migration path width) and 33 maternity colonies (20 km migration path width) may contribute bats to project area. These numbers assume that bats from each modelled maternity colony on the landscape only fly to a maximum of 10 hibernacula (modelled based on proximity of hibernacula to maternity colony). An unrestricted run of the model was also conducted and produced a range of 83 to 121 maternity colonies. However, it is more plausible, and also more conservative, to analyze the effects of the take to the smaller number of maternity colonies, i.e. 18, as generated by the restricted run (bats in each maternity colony only using up to 10 hibernacula).

To understand the effect of the take at the maternity colony level, we used the Thogmartin demographic model (BatTool version 5.3) to explore the main question of whether or not take associated with the project appreciably changes the probability of extinction of these colonies. Because the bats passing through the area are migrating bats, we assumed that take was evenly distributed among at least 18 maternity colonies, which would equate to one bat every 6 years from any given colony. Because a) WNS has been documented, b) its full effects have not yet been realized in the OCRU and MWRU, and c) population recovery times and rates are very difficult to predict with current information, we ran the model without WNS in the equations. This modelling effort yielded a probability of maternity colony persistence of approximately 97% in 25 years, and 76% in 50 years. Under a no-take scenario (without project), the probability of persistence at 25 and 50 years was 99% and 84%, respectively.

Effect of the take on Indiana bats at the hibernacula population level

We also modelled the effect of the project on hibernacula populations in the OCRU and MWRU. The WEST migration model, under the restricted scenario mentioned above, indicated that 23 hibernacula could contribute one or more bats that fly through the project area. Of these, we chose to analyze the effects of the project to the two closest hibernacula locations to the project

area, as we felt that was the most conservative. These hibernacula are Blackball Mine in central Illinois and the Coon/Grotto/Ray's cave cluster located southeast of Indianapolis. The estimated populations in these hibernacula were pooled, the total population count was used in the Thogmartin model run with a stable lambda (populations were assumed to be stable), and WNS effects excluded per the reasons in the preceding paragraph. The probability of persistence of this population both with and without the project was greater than 99%.

Effect of the take on Indiana bats at the recovery unit and rangewide population level

Given that the effect of the take at the hibernacula level was negligible, the effect of the take at the recovery unit and rangewide level, which have much larger population sizes, is also negligible.

Effect of the take of NLEBs

The project proponent has estimated that take of NLEBs will be approximately two per year, most likely taken in the fall migration season. Adaptive management measures are in place, as described in Section 7.4 of the HCP, to keep take at or below permitted levels. Because little data exists on summer or winter colony dynamics, migration pathways, and hibernacula locations, it was not possible to model the effects of the project to this species to the degree possible for Indiana bats. However, given that a) the permitted take number is less, b) reproductive rates of NLEBs are likely to be comparable to Indiana bats (USFWS 2014), and c) regional populations of NLEBs are expected to be larger than regional Indiana bat populations, it is logical to infer that effects on this species would be similar or less than the above modelled effects to the Indiana bat.

7. Jeopardy Analysis

After reviewing the current status of the Indiana bat and NLEB, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects as described above, it is the Service's biological opinion that the proposed project, interdependent, and interrelated actions are not likely to jeopardize the continued existence of the Indiana bat or the NLEB. There is no critical habitat for the Indiana bat in the project action area, and therefore, destruction or adverse modification of critical habitat as a result of the project is not expected.

8. Reinitiation Notice

This concludes formal consultation on the Pioneer Trail Wind Farm project and associated issuance of a Section 10(a)(1)(B) take permit. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the 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 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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