United States Department of the Interior

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Memorandum

To: Assistant Regional Director, Division of Ecological Services, Great Lakes Region, U.S. Fish and Wildlife Service, Bloomington, MN

From: Field Office Supervisor, Missouri Ecological Services Field Office, Division of Ecological Services, Great Lakes Region, U.S. Fish and Wildlife Service, Columbia, MO KAREN HERRINGTON Digitally signed by KAREN HERRINGTON Date: 2021.05.10 07:58:33 -05'00'

Subject: Biological Opinion and Conference Opinion on the U.S. Fish and Wildlife Service's approval of a Habitat Conservation Plan and the issuance of an associated Endangered Species Act Section 10(a)(1)(B) Permit (High Prairie Wind Energy Center, Adair and Schuyler Counties, MO, TAILS No. 03E14000-2016-TA-1577).

The U.S. Fish and Wildlife Service Ecological Services Program (ES) proposes to issue an incidental take permit (ITP) under §10(a)(1)(B) of the Endangered Species Act (ESA) for incidental take resulting from implementing the Habitat Conservation Plan (HCP) for High Prairie Wind Energy Center (Project or Facility). The HCP was submitted by the Ameren Missouri (the Applicant, previously TG High Prairie, LLC) as part of their ITP application. This document transmits our biological opinion and conference opinion (Opinion) based on our review of the subject action and its effects to the Covered Species, including the Indiana bat (*Myotis sodalis*), northern long-eared bat (*M. septentrionalis*), and little brown bat (*M. lucifugus*). This action occurs at the edge of the range of the endangered gray bat (*M. grisescens*); however, there will be no effect to gray bats. No gray bats were found during extensive surveys, and the HCP includes a changed circumstance to address gray bats should any be found in the future. We are issuing this Opinion in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.).

The HCP and the ITP includes conservation measures that avoids and minimizes impacts to the Covered Species and fully offsets the impact of the taking through habitat preservation at Chariton Hills Conservation Bank. Based on the overall net impact of these conservation measures, we conclude the proposed action is not likely to jeopardize the species' continued existence. The measures the Applicant will implement under the ITP and HCP will ensure that the consequences caused by the proposed action are not likely to jeopardize the continued existence of any endangered, threatened, or proposed species and will not destroy or adversely modify proposed or designated critical habitat.

We base this Opinion on the Habitat Conservation Plan for High Prairie Wind Energy Center; the Environmental Assessment of the proposed action; reports and scientific literature related to the Covered Species and similar bat species; and meetings, phone calls, and written correspondence with the Applicant and their consultants.

Biological Opinion and Conference Opinion for the Issuance of an Incidental Take Permit for the Endangered Indiana Bat, Northern Long-eared Bat, and Little Brown Bat

Associated with the Habitat Conservation Plan for High Prairie Wind Energy Center in Adair and Schuyler Counties, Missouri

May 7, 2021
U.S. Fish and Wildlife Service
Missouri Ecological Services Field Office

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1.0 Description of the Proposed Action

As defined in the ESA section 7 regulations (50 CFR 402.02), "action" means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas." The following is a summary of the proposed action and a detailed description can be found in the Habitat Conservation Plan for High Prairie Wind Energy Center.

1.1 Incidental Take Permit and Habitat Conservation Plan

The U.S. Fish and Wildlife Service, Ecological Services program (ES) proposes to issue an incidental take permit (ITP) under §10(a)(1)(B) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq. [ESA]) for incidental take resulting from implementing the six-year Habitat Conservation Plan (HCP) for High Prairie Wind Energy Center (Project) in Adair and Schuyler counties, Missouri (Figure 1). The HCP was submitted by Union Electric dba Ameren Missouri (the Applicant, previously TG High Prairie, LLC) as part of their ITP application and describes how the Applicant will minimize and mitigate incidental impacts to the Covered Species, including the Indiana bat (*Myotis sodalis*), northern long-eared bat (*M. septentrionalis*), and little brown bat (*M. lucifugus*).

Specifically, the proposed federal action is the potential issuance of the six-year ITP and includes the incidental take authorization, along with the associated conservation measures, adaptive management, and monitoring provisions in the HCP, that would go into place upon issuance.

1.2 High Prairie Wind Energy Center

The Project is an approximately 400 megawatt (MW) wind-energy facility, which consists of 175 wind turbine generators and associated access roads, an underground electrical collection system, substations, a switchyard, meteorological (MET) towers, an operations and maintenance building, and overhead transmission lines. The Project is located in Adair and Schuyler counties in northern Missouri.

The Project consists of 163 V20 2.2-MW and 12 V112 3.45-MW Vestas wind turbines. The Vestas V120 2.2-MW turbines have a hub height of approximately 92 meters (m), and the Vestas V112 3.45-MW turbines have a hub height of approximately 94 m. The manufacturer's rated cut-in wind speed for these turbine models is 3.0 meters per second (m/s). The pad around the turbine base extends out approximately 5.5 m at each turbine.

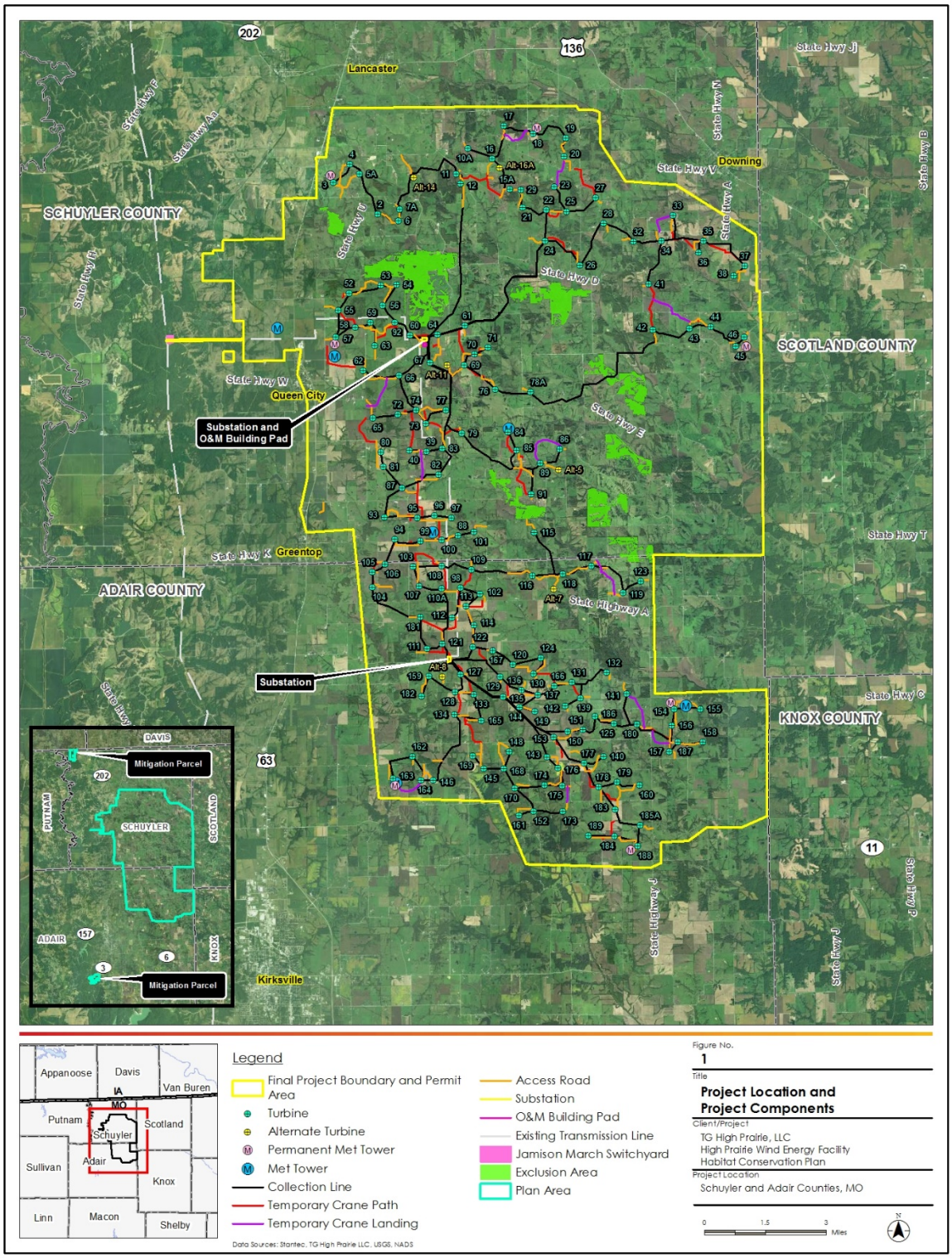

Figure 1 Action Area: High Prairie Wind Energy Center Project Area and Mitigation Area at Chariton Hills Conservation Bank

1.3 Action Area

The Action Area is defined (50 CFR 402.02) as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." ES has determined the Action Area for this project includes the 114,090 acres encompassed by Project Area and the Mitigation Area (Figure 1). The Project Area is the outer project boundary of High Prairie Wind Energy Center, where impacts to Covered Species occur and the area for which ITP coverage is requested. The Mitigation Area includes 217 acres of the approximately 1,324 acre Chariton Hills Conservation Bank[1] in Adair and Schuyler counties.

1.4 Conservation Strategy

The purpose of the HCP is to avoid, minimize, and mitigate effects to the Covered Species. The conservation strategy contains the following (as summarized below): (1) identification and implementation of incidental take avoidance and minimization measures to reduce impacts to Covered Species; (2) mitigation measures to offset impacts to Covered Species; and (2) monitoring, reporting, and adaptive management requirements. The applicant assures funding for the conservation strategy, and all obligations under the HCP, using a variety of financing mechanisms including: the Project's annual Operation and Maintenance budget; provision of a contract with Chariton Hills Mitigation Bank; and a security for changed circumstances and contingency funding (HCP Chapter 8). A summary of the conservation measures follows, and a more detailed description of the Project's conservation measures can be found in the HCP (see Chapter 7 – Conservation Plan).

1.4.1 Avoidance and Minimization Measures:

- No turbines were sited within 305 m (1,000ft) of 'turbine exclusion areas', portions of the Action Area containing some of the largest tracks of suitable bat habitat (totaling 3,952.6 acres).
- During construction, substations were sited in areas that avoided clearing potential bat habitat, and the gen-tie line running from the substations to the existing transmission line was rerouted to reduce potential woodland impacts from 61.3 acres to 39.5 acres. Tree removal was limited to seasons when bats were not active (November 1-March 31). Tree removal also avoided clearing known roost trees.
- Where possible, turbines were sited greater than 305 m (1,000ft) from bat habitat.
- Any tree removal over the term of the HCP will be conducted during the inactive season for listed species of bats (November 1- March 31)

[1] ES authorized Chariton Hills Conservation Bank pursuant to a Conservation Bank Enabling Instrument (dated July 11, 2018; USFWS 2018)

- From April 1 – October 31st, turbines will be cut-in at wind speeds of 5.0 m/s at night (45 minutes before sunset to 45 minutes after sunrise). Below the 5.0 m/s cut-in speed, turbine blades will be "feathered" (i.e., turbine blades will be pitched into the wind to minimize spinning to less than two rotations per minute). The only exception to turbine operational adjustments are when temperatures are at or below 40˚F. Turbines will be allowed to operate at full capacity at or below this temperature.

- Previous studies at other wind facilities have shown that feathering turbine blades at specific wind speeds significantly reduces the number of bat fatalities (see HCP Section 7.2.1.4). These studies suggest that feathering below 5.0 m/s (i.e. proposed action), would reduce bat mortality by an average of 62 percent.

- Mitigation activities will have beneficial effects to Covered Species during migration and as summer roosting habitat. The action includes mitigating the impacts to Covered Species by protecting occupied habitat in perpetuity at Chariton Hills Conservation Bank. Based on the outputs from the Resource Equivalency Analysis Models (REA Model) for Wind Energy Projects (USFWS 2016a, b, c) 162.2 mitigation credit acres are required to fully offset the taking, however 217 credit acres were purchased as part of this Action. Therefore, the Action includes 54.8 more mitigation acres than needed to offset the taking and has a net neutral or minor beneficial impact to Covered Species.

1.4.2 Monitoring, Reporting and Adaptive Management Measures:

- Standardized fatality monitoring will be conducted throughout the permit term, annually from April 1 – October 31st. The Applicant will use Evidence of Absence software (EoA) (Dalthorp et al. 2017) based on the prior year's site-specific data to design annual search protocols such that the average detection probability is at least 0.2 for the term of the HCP. For details see HCP Section 7.3-Monitoring Protocols.

- Maternity colony monitoring will occur as a result of adaptive management (HCP Appendix B), or in years 4 and 5. The persistence of maternity colonies within the Permit Area will be monitored using mist-net surveys, with subsequent radio telemetry and emergence counts. The focus of maternity colony monitoring will be on the Indiana bat, but little brown bats will also be monitored if take is documented through the standardized fatality monitoring. Maternity colony monitoring of northern long-eared bats will occur only if they are captured during monitoring for the other Covered Species. For details see HCP Section 7.4-Maternity Colony Monitoring.

- Adaptive management will ensure impacts do not exceed the permitted level of take includes thresholds based on the annual take rate, calculated take, and the number of fatalities detected annually and cumulatively. Actions include adjustments to turbine cut-in speeds and feathering regimes, based on the results of post-construction mortality monitoring. For a detailed discussion of adaptive management see HCP Section 7.5.2-Adaptive Management for Permitted Level of Take.

- Adaptive management for maternity colony impacts limits the amount of impact to individual maternity colonies. Thresholds are based on the location of detected Covered

Species fatalities and proximity of fatalities to each other. The adaptive management strategy is first triggered if 4 Indiana bat fatalities, or 1 northern long-eared bat fatality, or 4 little brown bat fatalities occur and have the potential to impact the same resident maternity colony population (as determined by average foraging distances, see HCP Section 7.5.1). Adaptive management could also be triggered if the calculated number of fatalities reaches 21 Indiana bats, 6 northern long-eared bats, or 21 little brown bats and these calculated fatalities have the potential to impact the same resident maternity colony populations. If any one of the triggers are met (for any Covered Species), turbines within the foraging distance of the potential maternity colony will avoid further impacts by modifying operations and potentially ceasing turbine operation at night. For a detailed discussion of adaptive management see HCP Section 7.5.1- Adaptive Management for Maternity Colony Impacts.

- The Applicant will prepare a monitoring report describing methods and results of take compliance monitoring following completion of the field surveys and data analysis for each year. The report will be submitted to ES by December 15th each year. Seasonal summaries will also be provided to the USFWS within 30 days of each season ending (i.e., by June 15 for Spring, by September 15 for Summer, and November 31 for Fall).

2.0 Status of the Species

2.1 Indiana Bat

This section presents the biological and ecological information relevant to formulating this BO. Appropriate information on the species' life history, habitat and distribution, and other data on factors necessary to survival are included to provide background for analysis in later sections. Portions of this information are also presented in listing documents, the recovery plan (USFWS 1983), and the draft revised recovery plan (USFWS 2007) and available literature.

The Indiana bat was originally listed as an endangered species by the Service in 1967. Listing was due to long-term population decreases across the range of the species. Range-wide estimates from 2017 totaled 530,705 bats (USFWS 2017), a two-thirds decrease from the 1960 estimated population. Missouri is currently the most populous state for Indiana bats containing 36 percent of the 2019 population estimate (195,157) (USFWS 2019).Thirteen winter hibernacula (11 caves and two mines) in six states were designated as critical habitat for the Indiana bat in 1976 (USFWS 1976). Six of these hibernacula are in Missouri.

2.1.1 Range and Distribution

The Indiana bat ranges from the northeast United States to the Midwest, reaching its western range limit in Iowa, Missouri, and Oklahoma (Figure 2). In winter, the range of the species is restricted to areas with caves or underground mines. Large wintering populations (more than 50,000 individuals) are found in Indiana, Illinois, Kentucky, and Missouri with smaller hibernacula

occurring in 24 additional states. White-nose syndrome (WNS) has decimated hibernating populations in the Appalachian and Northeast recovery units.

During summer months, the Indiana bat is considered a “tree bat” because it roosts in forests, woodlands, and savannas as opposed to caves and mines. Therefore, the summer range of the Indiana bat is more widespread with distribution of individuals varying across the landscape. The summer range extends from the Eastern Sea Board to the edge of the High Plains with the highest summer occurrences in Northern Missouri, Illinois, Indiana and Southern Iowa and Michigan. Bat densities do not correlate solely to tree density, cooler summer temperatures can also affect summer distribution and reproductive success of Indiana bats (Johnson et al. 2002). Relatively warmer regions of the Midwest and higher elevations in the eastern portion of the range are less suitable for Indiana bats (Johnson et al. 2002, Loeb and Winters 2013).

The current revised recovery plan (USFWS 2007) delineates recovery units based on population discreteness, differences in population trends, and broad level differences in land-use and macro-habitats. There are currently four recovery units for the Indiana bat: Ozark-Central, Midwest, Appalachian Mountains, and Northeast. The project falls within the Ozark-Central Recovery Unit (OCRU).

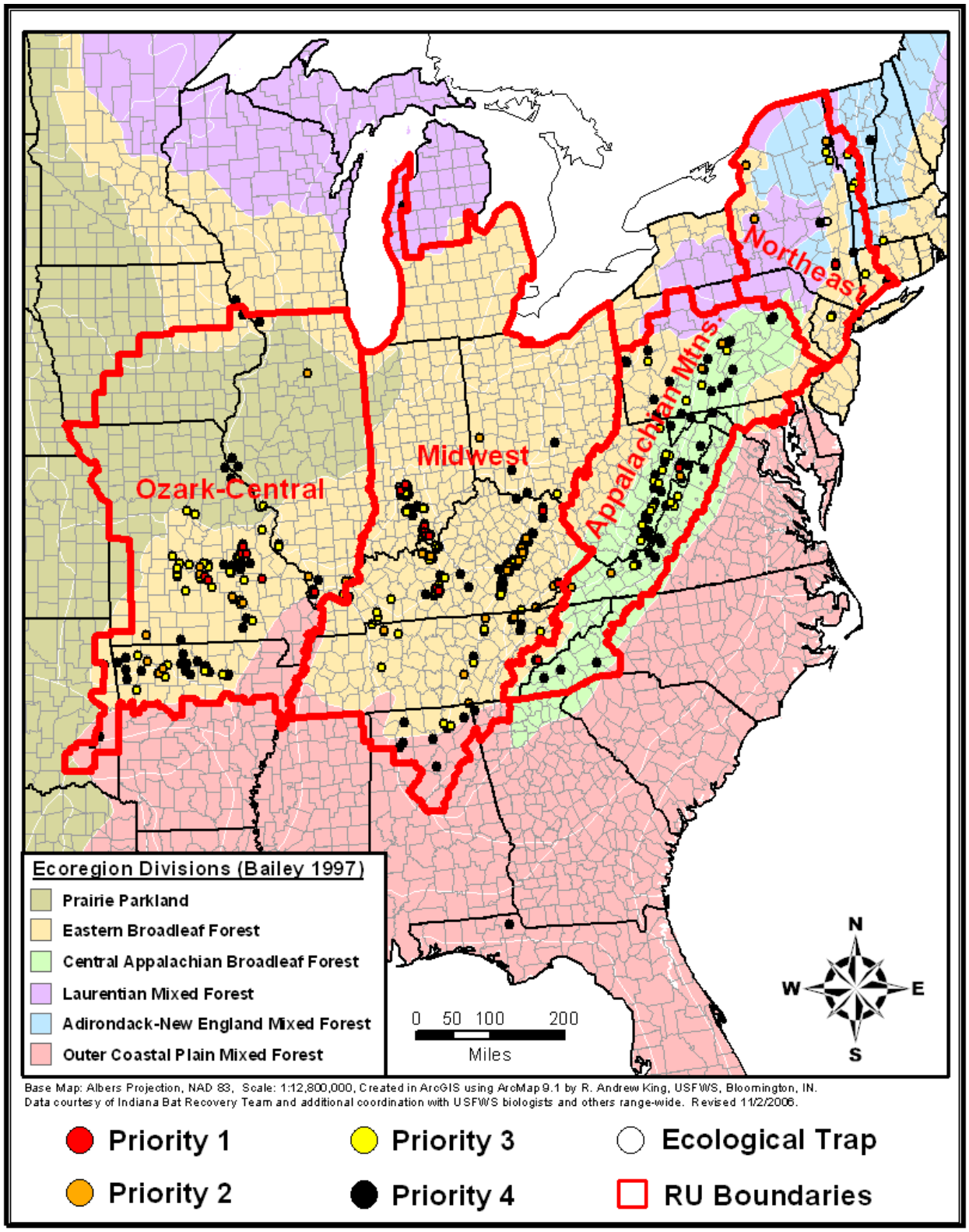

Figure 2. Indiana Bat Current Range (delineated by outer red line) and Recovery Units

2.1.2 Life History and Habitat Use

The timing of the annual cycle of Indiana bats is relevant to the periods of risk at the project. Indiana bats are exposed to risk at the project during the following key stages: *spring migration*, *summer habitat use*, and *fall migration*. A generalized chronology of the annual cycle in Indiana bats is found in Figure 3. Note that this figure depicts peaks for each phase of annual chronology but does not capture outliers.

While there is variation based on weather and latitude, generally bats begin winter torpor in mid-September through late-October and begin emerging in April. Females depart shortly after emerging and are pregnant when they reach their summer area. Birth of young occurs between mid-June and early July and then nursing continues until weaning, which is shortly after young become volant (able to fly) in mid- to late-July. Migration back to the hibernaculum may begin in August, peak in September, and continue into October.

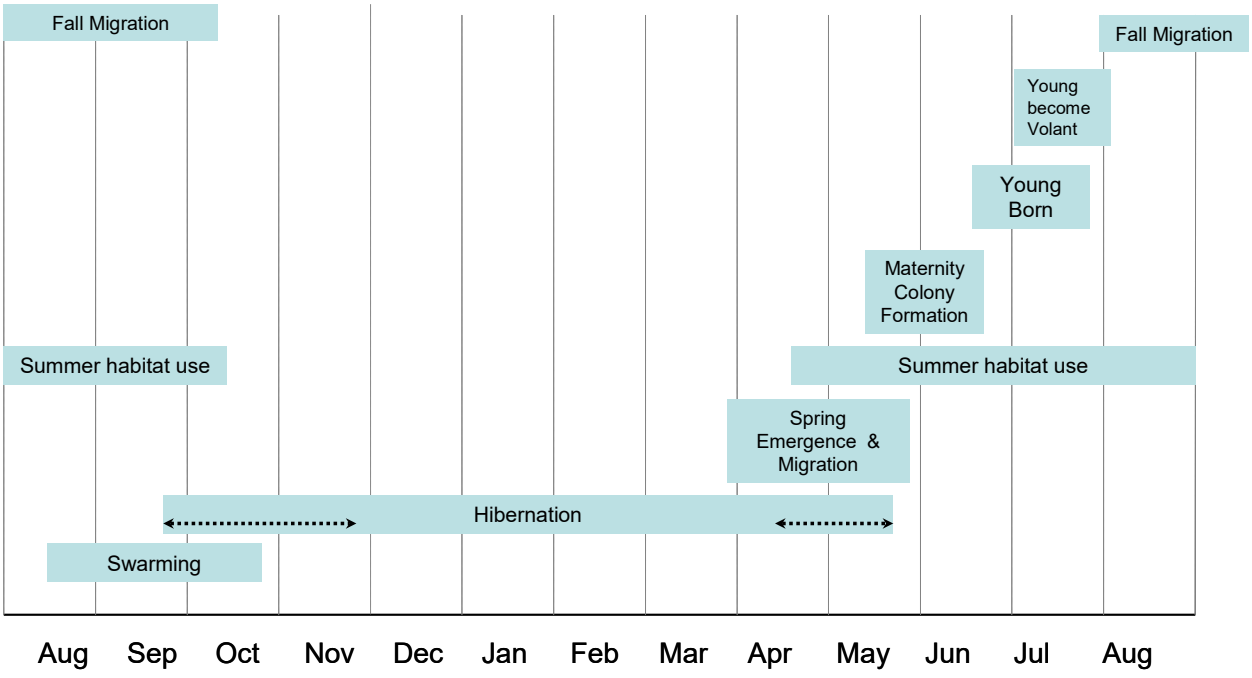

Figure 3. Generalized Indiana Bat Annual Chronology

2.1.2.1 Spring migration

In spring, Indiana bats emerge from hibernation. Female Indiana bats emerge first, generally late March and through April, and most males emerge later. The timing of annual emergence varies, depending in part on latitude and annual weather conditions. Most reproductive females appear to initiate migration to their summer habitat quickly after emerging from hibernation. Females migrate to their traditional roost sites, where they find other members of their maternity colony. Most documented maternity colonies have 50 to 100 adult female bats; average colony size of 80

adult females (Whitaker and Brack 2002) is a widely used estimate. However, we estimate the average colony size in the Project Area is approximately 60 adult females (Kurta 2005).

2.1.2.2 Summer habitat use

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. Female Indiana bats form maternity colonies in forested areas where they bear and raise their pups. Maternity colony habitats include riparian forests, bottomland and floodplain habitats, wooded wetlands, and upland forest communities. Maternity roost sites are most often under the exfoliating bark of dead trees that retain peeling bark (Kurta 2005, Lacki et al. 2009, Timpone et al. 2010). Live trees, especially shagbark hickory, are also used if they have flaking bark under which the bats can roost (Callahan et al. 1997, Sparks 2003, Brack et al. 2004). Primary roosts, those used frequently by large numbers of female bats and their young, are usually large diameter snags (dead trees) (Callahan et al. 1997, Kurta and Rice 2002, Whitaker and Brack 2002). Roost trees are often in mature mostly closed-canopy forests, but in trees with solar exposure (i.e., sunlight on the roost area for at least part of the day) – these may be in canopy gaps in the forest, in a fence line, or along a wooded edge (Vonhof and Barclay 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 and acceptable analysis of data. 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 that provides adequate roost sites and foraging areas) to exist at a given point on the landscape.

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, but the average roost diameter for male Indiana bats is 13 inches (USFWS 2007).

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, along roads, or along the corridors of small streams. Menzel et al. (2005) found that females foraged significantly closer to forests, roads, and riparian habitats than agricultural land and grasslands. Womack et al. (2012) documented selection by reproductive females of forests with higher canopy cover but more open mid-stories caused by management via prescribed fire. Bats forage between dusk and dawn at a height of approximately 6-90 feet above ground level and feed exclusively on flying insects, primarily moths, beetles, and aquatic insects (Humphrey et al. 1977).

Fecundity is low with female Indiana bats producing only one pup per year in late June to early July (USFWS 2007). Young bats can fly at about four weeks of age. The sex ratio of the Indiana bat is generally reported as equal or nearly equal (Hall 1962; Myers 1964; LaVal and LaVal 1980; Humphrey et al. 1977).

2.1.2.3 Fall migration

Cohesiveness of maternity colonies begins to decline after young bats become volant (Kurta et al. 1996). That is, the bats tend to roost together in the same roosts less frequently and at lower densities. A few bats from maternity colonies may commence fall migration in August, although at many sites some bats remain in their maternity colony area through September and even into October. Members of a maternity colony do not necessarily hibernate in the same hibernacula, and may migrate to hibernacula that are over 300 kilometers (km) (190 miles (mi)) apart (Kurta and Murray 2002, Winhold and Kurta 2006).

Indiana bats arrive at their hibernacula in preparation for mating and hibernation as early as late July; usually adult males or non-reproductive females make up most of the early arrivals (Brack 1983). The number of Indiana bats active at hibernacula increases through August and peaks in September and early October (Cope and Humphrey 1977, Hawkins and Brack 2004, Hawkins et al. 2005). Return to the hibernacula begins for some males as early as July, but most females arrive later.

2.1.3 Population Status and Threats

2.1.3.1 Species Population Status

The population of the Indiana bat has decreased significantly from an estimated 808,000 in the 1950s (USFWS 2007). Based on censuses taken at all hibernacula, the current total known Indiana bat population in 2019 is estimated to number approximately 537,297. Recent population estimates by recovery unit are displayed in Figure 4.

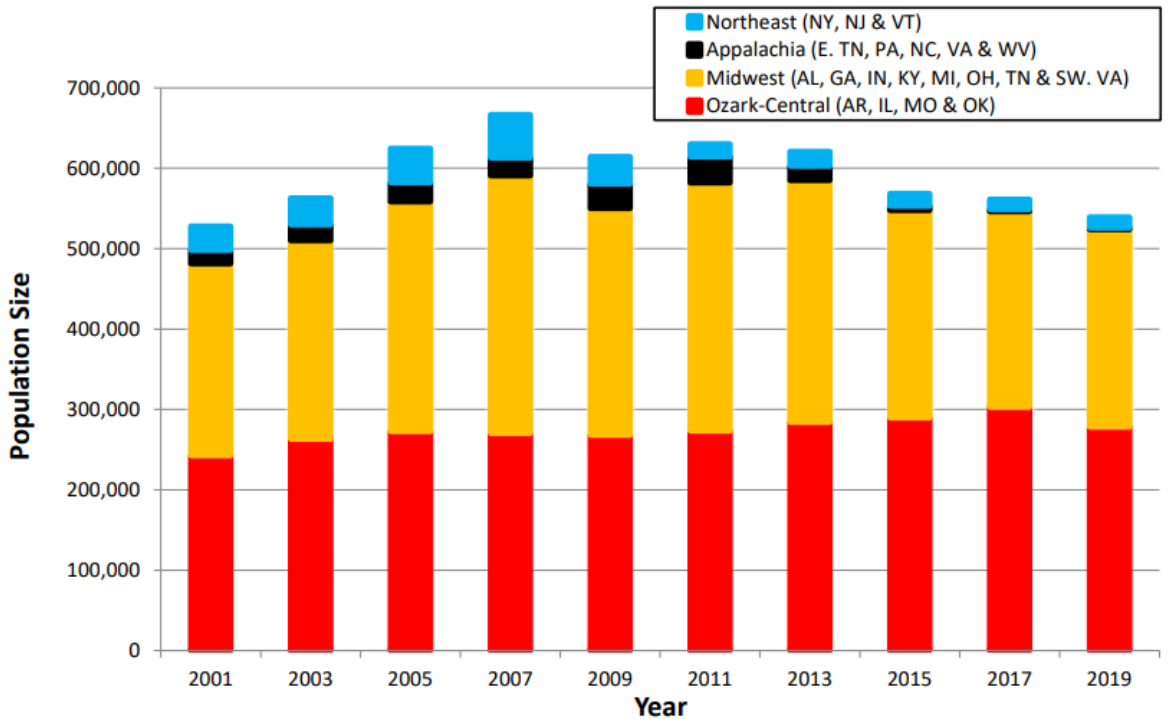

Figure 4. Indiana Bat Population Estimates by Recovery Unit from 2001 to 2019

2.1.3.2 Status within the Ozark-Central Recovery Unit

The Indiana bat populations in the Ozark-Central Recovery Unit (OCRU) have declined significantly since 1990 but has been relatively stable from 2009 to 2017 (USFWS 2017, 2019). Prior to 2012, the majority of hibernating bats in the OCRU were assumed to overwinter in Pilot Knob Mine in Missouri. Dramatic declines in the hibernating population at this site occurred since the early 1980s from an original estimation of approximately 100,000 in the 1970s to an estimation of 1,678 in the 2000s. The discovery of the Sodalis Nature Preserve (SNP) population in Hannibal, Missouri has increased the baseline size of the population in the OCRU, but not the overall trend across the range of the species. Based on observations by private cavers, the site has been occupied by Indiana bats since the 1970s. Therefore, these bats are not considered to be bats that moved from Pilot Knob Mine following a partial collapse of the mine. In 2017, SNP housed approximately 197,000 hibernating Indiana bats. The most recent survey in 2019 showed the first signs of a WNS-caused decline in this population with the count being approximately 180,000 hibernating Indiana bats. The current 2019 population estimate for the OCRU is approximately 271,965.

2.1.3.3 Threats

The reasons for listing the Indiana bat were summarized in the original Recovery Plan (USFWS 1983) including: declines in populations at major hibernacula despite efforts to implement cave protection measures, the threat of mine collapse and the potential loss of largest known

hibernating population at Pilot Knob Mine, Missouri, and other hibernacula throughout the species range were not adequately protected. 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: 1) human disturbance of hibernating bats; 2) improper cave gates and structures rending them unavailable or unsuitable as hibernacula; and 3) natural hazards like cave flooding and freezing. Suspected causes of Indiana bat declines include: 1) changes in the microclimate of caves and mines; 2) dramatic changes in land use and forest composition; and 3) chemical contamination from pesticides and agricultural chemicals. Current threats from changes in land use and forest composition include forest clearing on private and public land within the summer range, woodlot management and wetland drainage by landowners, and other private and municipal land management activities that affect the structure and abundance of forest resources.

The greatest current threat to Indiana bats is white nose syndrome (WNS). WNS was first documented in New York in February of 2006 and has since been confirmed in 20 states and 4 Canadian Provinces (www.whitenosesyndrome.org/resources/map). 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 (http://whitenosesyndrome.org/; www.fws.gov).

Overall mortality rates, primarily of little brown bats, have ranged from 90 to 100 percent in hibernacula in the northeastern United States. It is currently estimated that 5.7 to 6.7 million bats have died from WNS in infected regions (www.whitenosesyndrome.org/about-white-nose-syndrome). Apparent losses of 685 Indiana bats in Hailes Cave and 12,890 (previous population was 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 declined 15,662 bats, which represents 3.3% of the 2007 revised range wide population estimate. Overall, the biennial Indiana bat population surveys indicate a 4% decline since 2017 and 19% decline since 2007 when WNS was first discovered. The number of confirmed cases of WNS has increased significantly in the Ozark-Central Recovery Unit since 2011 (www.whitenosesyndrome.org/resources/map) and if trends continue, it is likely that additional reductions in the Indiana bat population will occur in this region. However, the impacts of WNS have been less pronounced in Missouri populations of Indiana bats, when compared to little brown bats and northern long-eared bats.

Climate change is also an emerging threat to the Indiana bat, primarily because temperature is an essential feature of both hibernacula and maternity roosts. Potential impacts of climate change on temperatures within Indiana bat hibernacula were reviewed by V. Meretsky (pers. comm., 2006

in USFWS 2007). Climate change may be implicated in the disparity of population trends in southern versus northern hibernating populations of Indiana bats (Clawson 2002), but Meretsky noted that confounding factors are clearly involved. Potential impacts of climate change on hibernacula can be compounded by mismatched phenology in food chains (e.g., changes in insect availability relative to peak energy demands of bats) (V. Meretsky, pers. comm., 2006 in USFWS 2007). Changes in maternity roost temperatures may also result from climate change, and such changes may have negative or positive effects on development of Indiana bats, depending on the location of the maternity colony. The effect of climate change on Indiana bat populations is a topic deserving additional consideration.

Lastly, there is growing concern that bats, including the Indiana bat (and other bat species) may be threatened by the recent surge in construction and operation of wind turbines across the species' range. Mortality of Indiana bats has been documented at multiple operating wind turbines/farms. The Service is actively working with wind farm operators to avoid, minimize, and mitigate incidental take of bats.

2.2 Northern Long-eared Bat

This section presents the biological and ecological information relevant to formulating this BO. 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. Portions of this information are also presented in listing documents (USFWS 2016d), the final Biological Opinion on the 4(d) rule (USFWS 2016e), and available literature.

The northern long-eared bat was proposed for federal listing as endangered on 2 October 2013. On 2 April 2015, the species was given a proposed listing of threatened with an interim 4(d) rule, which was finalized on 14 January 2016 (USFWS 2016f). No critical habitat has been proposed for the species.

2.2.1 Range and Distribution

The northern long-eared bat ranges across much of the eastern and north central United States, and all Canadian provinces west to the southern Yukon Territory and eastern British Columbia (Nagorsen and Brigham 1993; Caceres and Pybus 1997; Environment Yukon 2011). In the United States, the species range reaches from Maine west to Montana, south to eastern Kansas, eastern Oklahoma, Arkansas, and east through the Gulf States to the Atlantic Coast (Whitaker and Hamilton 1998; Caceres and Barclay 2000; Amelon and Burhans 2006). The species range includes the 37 states (plus the District of Columbia). Historically, the species has been most frequently observed in the northeastern United States and in Canadian Provinces, Quebec and Ontario, with sightings increasing during swarming and hibernation (Caceres and Barclay 2000). However, throughout the majority of the species range it is patchily distributed, and historically

was less common in the southern and western portions of the range than in the northern portion of the range (Amelon and Burhans 2006).

Although they are typically found in low numbers in inconspicuous roosts, most records of northern long-eared bat are from winter hibernacula surveys (Caceres and Pybus 1997). More than 780 hibernacula have been identified throughout the species range in the United States, although many hibernacula contain only a few (1 to 3) individuals (Whitaker and Hamilton 1998). Northern long-eared bats are documented in hibernacula in 29 of the 37 States in the species' range. Other States within the species' range have no known hibernacula (due to no suitable hibernacula present, lack of survey effort, or existence of unknown retreats).

The current range and distribution of northern long-eared bat must be described and understood within the context of the impacts of WNS. Prior to the onset of WNS, the best available information on northern long-eared bat came primarily from summer surveys (primarily focused on Indiana bat or other bat species) and some targeted research projects. In these efforts, northern long-eared bat was very frequently encountered and was considered the most common myotid bat in many areas.

Overall, the species was considered to be widespread and abundant throughout its historic range (Caceres and Barclay 2000). WNS has been particularly devastating for northern long-eared bat in the Northeast, where the species was believed to be the most abundant (Herzog and Reynolds 2012, Turner et al. 2011, Langwig et al. 2012). Similarly, there are data supporting substantial declines in northern long-eared bat populations in portions of the Midwest due to WNS. In addition, WNS has been documented at more than 100 northern long-eared bat hibernacula in the Southeast, with apparent population declines at most sites. We expect further declines as the disease continues to spread across the species' range.

2.2.2 Life History and Habitat use

The timing of the annual cycle of northern long-eared bats is relevant to the periods of risk at the project. Northern long-eared bats are exposed to risk at the project during migration and in the summer, in areas of roosting and foraging habitat.

2.2.2.1 Migration

Typical of most bat species in the eastern United States, northern long-eared bats migrate between winter hibernacula and summer roosting habitat. When female northern long-eared bats emerge from hibernation, they migrate to maternity colonies. The distance and routes traveled from winter hibernacula to summer roosting areas is not definitively known, but the species is considered to migrate shorter distances than the Indiana bat (USFWS 2014). The annual chronology of the Northern long-eared bat is similar to the generalized Indiana bat chronology in Figure 3, spring

migration from winter hibernacula usually occurs between mid-March and mid-May, whereas most fall migration from summer roosting areas back to winter hibernacula occurs from mid-August through mid-October. During migration, northern long-eared bats are often observed roosting on the side of stone buildings in Kansas (Sparks et al. 2000).

2.2.2.2 Summer habitat use

Suitable summer habitat for northern long-eared bat consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts, as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure.

Northern long-eared bat roost in cavities, underneath bark, crevices, or hollows of both live and dead trees and/or snags (typically ≥3 inches dbh). Northern long-eared bat are known to use a wide variety of roost types, using tree species based on presence of cavities or crevices or presence of peeling bark. Northern long-eared bat have also been occasionally found roosting in structures like barns and sheds (particularly when suitable tree roosts are unavailable).

Northern long-eared bat maternity colonies exhibit fission-fusion behavior (Garroway and Broders 2007), where members frequently coalesce to form a group (fusion), but composition of the group is in flux, with individuals frequently departing to be solitary or to form smaller groups (fission) before returning to the main unit (Barclay and Kurta 2007). As part of this behavior, northern long-eared bats switch tree roosts often (Sasse and Pekins 1996), typically every 2 to 3 days (Foster and Kurta 1999; Owen et al. 2002; Carter and Feldhamer 2005; Timpone et al. 2010). Northern long-eared bat maternity colonies range widely in size, although 30-60 may be most common (USFWS 2015). Northern long-eared bat show some degree of interannual fidelity to single roost trees and/or maternity areas. Males are routinely found with females in maternity colonies. Northern long-eared bat use networks of roost trees often centered around one or more central-node roost trees (Johnson et al. 2012). They also include multiple alternate roost trees and male and non-reproductive female northern long-eared bat may also roost in cooler places, like caves and mines (Barbour and Davis 1969; Amelon and Burhans 2006).

A maternity colony typically consists of 30 to 60 individuals, although colonies containing up to 100 individuals have been observed (Whitaker and Mumford 2009). The number of individuals within a maternity colony decreases as the maternity season progresses, as fewer bats roost together during the post-lactation stage than during the pregnancy stage. Northern long-eared bats show low fidelity to roosts, switching every 2 to 3 days (Sasse and Pekins 1996, Timpone et al. 2010).

Females are pregnant when they arrive at maternity roosts and produce a single young per year, as is typical for the genus *Myotis* (Asdell 1964, Hayssen et al. 1993, Sparks et al. 1999, Krochmal and Sparks 2007). Parturition typically occurs between late May and early June (Caire et al. 1979, Krochmal and Sparks 2007, Whitaker and Mumford 2009).

Juveniles become volant between late June and early August (Caire et al. 1979, Sasse and Pekins 1996, Krochmal and Sparks 2007). As is the case with other species of bats in North America, mortality for northern long-eared bat is high during the first year (Caceres and Pybus 1997). Northern long-eared bats have been observed roosting in areas of increased solar heating, which increases their developmental rate and reduces the need to lower their body temperature and metabolic rate (i.e. enter a state of torpor) (Lacki and Schwierjohann 2001).

2.2.3 Population Status and Threats

2.2.3.1 Species Population Status

Prior to the onset of WNS (see below), the species was abundant throughout much of the eastern United States and thus, was not a focus of detailed demographic studies. USFWS estimated the U.S. population in 2016 to be 6,500,000 individuals (adults and juveniles), including 428,923 in Missouri (USFWS 2016b). Populations are now in a period of catastrophic decline across most of the range (USFWS 2016b). Francl et al. (2012) documented a 77 percent decline in summer capture rates of northern long-eared bats in West Virginia and adjacent areas of Pennsylvania in the two years following the arrival of WNS.

As part of the listing process, USFWS completed an analysis of 103 hibernacula in 12 states and found an average rate of 92 percent decline in population with northern long-eared bats having been extirpated from 68 sites (USFWS 2016b). Observations at fall swarming sites indicates that these declines are both a result of increased adult mortality and lower recruitment following the arrival of WNS (Reynolds et al. 2016).

2.2.3.2 Status in Missouri

Population declines in Missouri follow the range wide trend. Missouri populations in known hibernacula nearly disappeared between the winters of 2012/2013 and 2015/2016 (Colatskie 2017). Frick et al. (2017) found no evidence of population stabilization at sites where WNS has been present for 10 years, which suggests extinction in the wild is a distinct possibility.

Northern long-eared bats are known to hibernate in 52 counties in Missouri with most of these sites located in the caves and mines of southern Missouri (Figure 2). The species is easily overlooked because of its tendency to hibernate in cracks and crevices inside caves and mines. Recent evidence indicates they hibernate in rock faces in neighboring Nebraska (Lemen et al. 2016). Therefore, northern long-eared bats may have a much wider winter range than previously suspected. Several Missouri hibernacula historically contained large numbers of northern long-eared bats and have received special attention from MDC. MDC lands in 16 counties contain hibernacula of the northern long-eared bat.

Records of northern long-eared bats are known from 61 counties in Missouri during the active months (April-October). Based on occupancy rate, the estimated pre-WNS population size in Missouri is 428,922 individuals (USFWS 2016b). Using the same methods and assumptions (as explained in USFWS 2016, Section 2.4.5, and presented in Appendix F of the Final EA), we

used Missouri occupancy rates informed by post-WNS mist-net and acoustic surveys from 2017-2019 to estimate a total population size of 140,664 (67% decline since the 2016 estimate).

2.2.3.3 Threats

No other threat is as severe and immediate for the northern long-eared bat as WNS. It is highly unlikely that northern long-eared bat populations would be declining so dramatically without the impact of WNS. Since the disease was first observed in New York in 2007 (later biologists found evidence from 2006 photographs), WNS has spread rapidly in bat populations from the Northeast to the Midwest and the Southeast. Population numbers of northern long-eared bat have declined by 99 percent in the Northeast, which along with Canada, has been considered the core of the species' range. Although there is uncertainty about how quickly WNS will spread through the remaining portions of this species' range, it is expected to spread throughout the entire range. In general, the Service believes that WNS has significantly reduced the redundancy and resiliency of the northern long-eared bat.

Climate change is also an emerging threat to the northern long-eared bat, primarily because temperature is an essential feature of both hibernacula and maternity roosts. Potential impacts of climate change on temperatures within Indiana bat hibernacula were reviewed by V. Meretsky (pers. comm., 2006 in USFWS 2007). Climate change may be implicated in the disparity of population trends in southern versus northern hibernating populations of Indiana bats (Clawson 2002), but Meretsky noted that confounding factors are clearly involved. Potential impacts of climate change on hibernacula can be compounded by mismatched phenology in food chains (e.g., changes in insect availability relative to peak energy demands of bats) (V. Meretsky, pers. comm., 2006 in USFWS 2007). Changes in maternity roost temperatures may also result from climate change, and such changes may have negative or positive effects on development of Indiana bats, depending on the location of the maternity colony. The effect of climate change on northern long-eared bat populations is a topic deserving additional consideration.

Lastly, there is growing concern that bats, including the northern long-eared bat (and other bat species) may be threatened by the recent surge in construction and operation of wind turbines across the species' range. Mortality of northern long-eared bat has been documented at multiple operating wind turbines/farms. The Service is actively working with wind farm operators to avoid, minimize, and mitigate incidental take of bats.

2.3 Little Brown Bat

This section presents the biological and ecological information relevant to formulating this BO. 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.

The little brown bat is not a federally listed, proposed, or candidate species, but it is currently undergoing a Discretionary Status Review on the National Listing Workplan. The USFWS

anticipates determining if the species warrants listing under the ESA in 2023 (USFWS 2016c) and anticipates completion of a species status assessment in 2021. Currently, no federal critical habitat, conservation plans, or recovery plans exist for this species.

2.3.1 Range and Distribution

The little brown bat is widely distributed across North America and is known to inhabit areas from central Alaska to central Mexico (Harvey et al. 1999). Prior to arrival of WNS, the largest colonies were found in the northeastern and Midwestern U.S., where some hibernacula contained tens to hundreds of thousands of individuals (Kunz and Reichard 2010). The southern edge of their distribution is limited by the lack of caves, whereas the northern edge of the range is likely defined by a limited number of suitable hibernacula and the longer length of the hibernation season (Humphries et al. 2002, Humphries et al. 2006). Like the Indiana bat, little brown bats migrate between subterranean habitats in winter to trees and a wide variety of anthropogenic structures during summer (Humphrey and Cope 1976). Most little brown bats stay within 62 miles (100 km) of their hibernacula, although some make longer migrations.

2.3.2 Life History and Habitat Use

The timing of the annual cycle of little brown bats is relevant to the periods of risk at the project. Little brown bats are exposed to risk at the project during migration and in the summer, in areas of roosting and foraging habitat.

2.3.2.1 Migration

Like many bats in the eastern United States, little brown bats migrate between winter hibernacula and summer roosting habitat. The annual chronology of the little brown bat is similar to the generalized Indiana bat chronology in Figure 3, spring migration occurs in parallel with staging with most bats moving from the hibernacula to the summer range in April and May; while fall migration occurs in late July through early August. Little brown bats have not been radio-tracked during migration in Missouri, although extensive banding efforts in the 1960s and 1970s provided some state-specific data (LaVal and LaVal 1980). Of approximately 1,600 banded little brown bats, only eight were found at both the hibernacula and a summer roost. Six bats made short migrations of approximately 25 miles (40.23 Km), but two migrated approximately 150 miles (241.40 Km). Myers (1964) banded 4,427 little brown bats in Missouri and adjacent states, 20 of which provided information on migration. Average migration distance was 94.3 miles (151.76 Km) with extremes of 18 (28.97 Km) and 240 miles (386.24 Km). These and other studies (Griffin 1940, Griffin 1945, Davis and Hitchcock 1965, Barbour and Davis 1969, Fenton 1970, Humphrey and Cope 1976) suggest many little brown bats migrate relatively short distances, but migrations of more than 100 miles are not unusual. This movement pattern produces an area of high summer density around important hibernacula, but scattered summer colonies in far-removed areas.

2.3.2.2 Summer habitat use

Most little brown bats in Missouri likely roost in buildings and other anthropogenic structures such as bridges and bat boxes, but in natural situations species roosted in tree cavities and under

exfoliating bark (Boyles et al. 2009). The ability to use a variety of summer habitats is also key to understanding a large and diverse geographic range (Bergeson et al. 2015). Bats using the interface between developed lands (that provide roosts) and undeveloped lands and water (that provide foraging habitat) tend to be healthier and have higher reproductive rates (Coleman and Barclay 2011).

Most known maternity colonies are in anthropogenic structures and prior to WNS contained many bats, such as colonies of at least 700 bats in Lewis County and 2000 bats in Sullivan County (Boyles et al. 2009). Like the Indiana bat, female little brown bats use warm roosts (Burnett and August 1981). In other areas little brown bats select roost trees that are large, dead or dying trees with substantial solar exposure (Crampton and Barclay 1998, Bergeson et al. 2015). Little brown bats make frequent use of cracks and hollows in trees as well as under sloughing bark (Crampton and Barclay 1998, Bergeson et al. 2015).

Barbour and Davis (1969) noted that females are pregnant when they arrive at maternity roosts in early- to mid-April, with individuals arriving throughout May and into June. In Indiana (Krochmal and Sparks 2007), females in one colony gave birth to a single pup between 3 June and 15 July. These pups began fluttering at 2 days of age, could complete coordinated wing strokes by 15 days and could fly by 21 days. Thus, most pups were flying by mid-July. Maternity colonies begin to break up as soon as the young are weaned in July and few remain by September (Barbour and Davis 1969).

2.3.3 Population Status and threats

2.3.3.1 Population Status

Until the arrival of WNS, little brown bats were one of the most common bat species in North America and abundant throughout most of their range. Their geographic distribution ranges from Alaska to northern Florida and into southern California. They are absent from the middle plains region (e.g., New Mexico, Texas, southern Florida). Little brown bats are extremely vulnerable to WNS, which has resulted in sharps declines in populations, especially along their eastern range. As the disease spreads geographically and regionally, population collapse has been observed and, in some cases, local species extinction has been predicted, suggesting that even limited take may have the potential for population-level effects (MidAmerican Energy Company [MEC] 2018, Frick et al. 2010, Ingersoll et al. 2013).

Die-offs of little brown bats at hibernacula have been associated with declines in summer activity (Dzal et al. 2011). Research has shown that severe declines in populations which cause population bottlenecks can trigger a rapid evolutionary response, and it has been predicted that little brown bat populations affected by WNS will stabilize due to this response within 11 years of WNS exposure (Maslo and Fefferman 2015). Empirical research has also shown increasing survival rates after exposure to WNS, and that stabilization in populations may be due to increasing survival rather than immigration (Maslo et al. 2015). Colatski (2017) found evidence of stabilization in Missouri as well. Additionally, even individuals affected by WNS have shown recovery from wing damage and infection (Dobony et al. 2011, Fuller et al. 2011).

In Missouri, the little brown bat has never been as common as Indiana, northern long-eared, or gray bats (Myers 1964, LaVal and LaVal 1980). Prior to WNS, the distribution of little brown bat could be summarized as widely scattered, but locally common, sometimes represented by hundreds of individuals in a hibernaculum. An exceptionally large concentration of 35,000 individuals was found in Pilot Knob Mine in 1958 (Myers 1964), although subsequent surveys have indicated much lower populations (LaVal and LaVal 1980, Elliott and Kennedy 2008). Missouri's winter populations, counted in hibernacula, have declined by approximately 87 percent since winter 2012/2013 (Colatskie 2017). A 2016/2017 survey found only 1,891 little brown bats in 51 of 502 hibernacula surveyed (Colatskie 2017). Notably, surveys of hibernating bats at Pilot Knob Mine are no longer conducted due to safety concerns (Elliott and Kennedy 2008, Colatskie 2017). However, fall trapping at the mine entrances suggests decreased swarming activity at the site, especially for little brown and northern long-eared bats (MDC unpub. data).

Little brown bats are known to hibernate in 61 counties in Missouri, largely in the caves and mines of southern Missouri. Important exceptions to this pattern include the hibernaculum at SNP in Hannibal, Marion County in northeastern Missouri, where little brown bats were once common. Other exceptions include some quarries in the northern portion of state and several smaller caves and quarries located along the Missouri River north of Kansas City. MDC lands in 15 counties contain hibernacula that are used by the little brown bat.

Prior to WNS, little brown bats were regularly found throughout most of Missouri in the summer. Little brown bats have been recorded in 56 counties during the active months (April-October). Using the same methods and assumptions (as explained in USFWS 2016, Section 2.4.5, and presented in Appendix F of the Final EA), we used Missouri occupancy rates informed by post-WNS mist-net and acoustic surveys from 2017-2019 to estimate a total population size of 147,306 individuals.

2.3.3.2 Threats

Tinsley (2016) reviewed potential threats to the little brown bat and determined WNS is the greatest threat faced by the species; without WNS it is unlikely the little brown bat would be a conservation priority. Other stressors of importance include deaths from other diseases, losses at wind energy sites, environmental contaminants, and loss and adverse modification of both summer and winter habitat. Like other bats, the little brown bat is frequently the subject of persecution by people. Because little brown bats can form large maternity colonies, they are often the target of exclusion efforts (Cope et al. 1991). As with other bats, chemical contamination may kill bats directly or lead to sublethal effects that eventually lead to death or reduced reproduction (Clark et al. 1978, Clark et al. 1980, Clark et al. 1982, Eidels et al. 2016).

Climate change is also an emerging threat to the little brown bat, primarily because temperature is an essential feature of both hibernacula and maternity roosts. Potential impacts of climate change on temperatures within Indiana bat hibernacula were reviewed by V. Meretsky (pers. comm., 2006 in USFWS 2007). Climate change may be implicated in the disparity of population trends in southern versus northern hibernating populations of Indiana bats (Clawson 2002), but Meretsky noted that confounding factors are clearly involved. Potential impacts of climate

change on hibernacula can be compounded by mismatched phenology in food chains (e.g., changes in insect availability relative to peak energy demands of bats) (V. Meretsky, pers. comm., 2006 in USFWS 2007). Changes in maternity roost temperatures may also result from climate change, and such changes may have negative or positive effects on development of Indiana bats, depending on the location of the maternity colony. The effect of climate change on little brown bat populations is a topic deserving additional consideration.

Lastly, there is growing concern that bats, including the little brown bat (and other bat species) may be threatened by the recent surge in construction and operation of wind turbines across the species' range. Mortality of little brown bats has been documented at multiple operating wind turbines/farms. The proposed Midwest Wind Energy HCP used pre-WNS mortality rates to estimate that current and future wind energy sites in Missouri would take 29,000 little brown bats between 2016 and 2060, but that Wind Energy HCP has not been finalized. The mortality estimate did not account for population declines caused by WNS or conservation measures that would be enacted by the plan (USFWS 2016d).

3.0 Environmental Baseline

In accordance with 50 CFR 402.02, the environmental baseline refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.

Below, we describe the baseline condition of the Covered Species' environment within the Action Area, including the Project Area and the Mitigation Lands at Chariton Hills Conservation Bank.

3.1 Status of Covered Species in the Project Area

3.1.1 Habitat in the Project Area

Primary land cover (NLCD) within the Project Area is composed of 73.7% pasture/hay and cultivated crops, 17.2% forest cover (deciduous and mixed forests). Forested areas occur as small and large tracts, many of which are associated with streams. A desktop review of recent aerial photography and Geographic Information Systems (GIS) data assessed Covered Species habitat in the project area. Of the 113,873.2-acre project area, 23,893 acres (21%) are suitable summer

habitat for Indiana and northern long-eared bats, and 100% of the area is suitable summer habitat for little brown bat (for more information, see HCP section 3.4.2.1).

The project area does not support wintering habitat for the Indiana bat; there are no caves or mines suitable for use as hibernacula. The nearest known wintering population of Indiana bats is located over 105 km (65 mi) to the West in Hannibal, MO (SNP). Band return data indicates resident maternity colonies of Indiana bats hibernate at SNP.

Northern long-eared bats may hibernate in places other than caves and mines such as rock faces and bluffs (Lemen et al. 2016; Hurt 2017), and these areas have not been surveyed in Missouri. Little information is available on hibernating populations of northern long-eared bats and little brown bats within and around the project area, and no known wintering populations of northern long-eared bats or little brown bats exist within the project area.

In summary, the Project Area includes suitable summer and migratory habitat for all Covered Species. No known hibernacula are present within the Project Area, and the closest known hibernacula is SNP, the largest known hibernating population of Indiana bats.

3.1.2 Covered Species Populations in the Project Area

Pre-construction acoustic monitoring surveys were conducted in 2010-2011, 2016, and 2018. Table 1 summarizes the studies conducted and the results of the pre-construction assessments and surveys relevant to this opinion and the analysis. For a more detailed description of these studies, please refer to the additional references noted.

The results of pre-construction studies demonstrated that suitable summer habitat for Covered Species is located within the Project Area, and all Covered Species are exposed to turbine operations at the Project during migratory and summer months. Mist-net and radio-telemetry studies identified roost trees and maternity colony areas for Indiana bats and little brown bats. Although no northern long-eared bats were captured and tracked to a roost tree, high acoustic occupancy rates and historic roost tree presence indicates maternity colonies are likely in the Project Area. Therefore, the project may impact resident and migrating maternity colony populations for each of the Covered Species.

The amount of suitable habitat, acoustic occupancy rate, and emergence count data were used to estimate the number of resident maternity colonies and population size within the Project Area. As a result, the Project Area is estimated to support:

- 8 Indiana bat resident maternity colonies and a total population size up to 906 adult females (HCP Section 4.1.9)
- 12 northern long-eared bat resident maternity colonies and a total population size up to 240 adult females (HCP Section 4.2.8)
- 4 little brown bat resident maternity colonies and a total population size up to 200 adult females (HCP Section 4.3.8)

Table 1 Summary of Pre-construction Studies and Results

Survey	Summary	References
Bat habitat assessment	• Desktop review of recent aerial photography and Geographic Information Systems data • 23,893 acres suitable habitat for Indiana bat and northern long-eared bat (21.0% of Permit Area) • 113,873.2 acres suitable habitat little brown bat (100% of Permit Area)	HCP Section 3.4.2.1 and Figure 4; Stantec (2018a)
Acoustic surveys (2010-2011)	• Conducted on 4,500 acres in Schuyler County in 2010 and 2011; detectors paired with mist-netting and deployed on ground and MET tower • Nine bat species detected including Covered Species • On average (over all detectors and years) silver haired bats were majority of recorded passes (22.25%) followed by eastern red bat (18.4%),and big brown bat (15%)	Robbins et al. (2010, 2012a,b) HCP Section 3.4.2.5
Acoustic (2016, 2018)	• Ground detectors sampled summer maternity season in Permit Area • Nine bat species detected including Covered Species • On average big brown bats were majority of recorded passes (23.2%), followed by eastern red bats (18.3%) and hoary bats (13.2%)	HCP Section 3.4.2.2 and Table 3-3; Stantec (2016, 2018a)
MET tower acoustic (2018)	• Detectors deployed on 5 MET towers in Permit Area April 26–November 7, 2018 • Nine bat species detected including the Covered Species • Species percentages: hoary bat 30.9%, big brown bat 21.0%, and eastern red bat 16.6% • Bat activity consistently higher at ground-based detectors compared to MET tower detectors	HCP Section 3.4.2.3 and Table 3-4
Mist-net and telemetry (2010-2011)	• Conducted on 4% of the Permit Area to locate and study maternity colonies • Three Indiana bat colonies; colony sizes of 180, 132, and 69 bats • Three little brown bat colonies; colony sizes of 950 (including big brown bats), 183, and 80 bats • One northern long-eared bat colony with 10 bats	Robbins et al. (2012) HCP Section 3.4.2.5

Mist-net and telemetry (2016 and 2018)	• Conducted to locate and study on-site maternity colonies • In 2016, found 13 Indiana bat roosts and 10 little brown bat roosts, highest emergence from a roost was 147 bats • In 2018, found 12 Indiana bat roosts; highest roost emergence was 48 bats	HCP Section 3.4.2.4 and Table 4-2; Stantec (2016, 2018a)

3.1.3 Factors Affecting Covered Species in the Project Area

This section describes factors affecting the environment of the species in the Project Area. The environmental baseline includes state, tribal, local, and private actions already affecting the species or that will occur contemporaneously with the consultation in progress. Related and unrelated Federal actions affecting the same species that have completed formal or informal consultation are also part of the environmental baseline, as are Federal and other actions within the Action Area that may benefit listed species or critical habitat.

The factors affecting Covered Species in the Action Area are a subset of the threats affecting the species' range-wide and in the OCRU (for Indiana bats). Since there is no plan to destroy or modify any existing Covered Species habitat in the Action Area, impacts to habitat are not relevant to this discussion; however, WNS affects Covered Species in the area. Sodalis Nature Preserve is a WNS affected hibernacula, and bats pass through the Project Area during migration to and from SNP. We do not know if Covered Species' populations in maternity colonies and other hibernacula (e.g., unknown northern long-eared bat and little brown bat hibernacula) have declined, or by how much, but we assume that they have experienced declines consistent with the OCRU and Missouri rates.

Post-construction monitoring at the Project has demonstrated affects to Indiana bats. A male Indiana bat fatality was detected on October 2, 2020. The fatality was estimated to have occurred during the September 30th -October 1st period of risk based on timing of carcass searches, and nights in which the turbine under which it was found was operating. Based on the time of year and the high wind speeds during the presumed night of the fatality, the bat was likely migrating to the hibernaculum at SNP. As explained above (Section 2.1.3.2), SNP is the largest known hibernaculum and 2019 counts estimate the population at approximately 180,000 individuals. Given the large population size, this detected fatality (and the associated number of calculated fatalities, approximately 12 individuals [<0.001% of the population]) did not affect the baseline population condition.

A female Indiana bat was also detected during post-construction monitoring at the Project on April 15, 2021. The fatality is estimated to have occurred during the April 13th-April 14th period of risk based on the level of decomposition of the carcass, and the temperatures during the nights when the fatality was likely to occur. Based on the time of year and sex of the individual, the bat was likely part of a resident maternity colony population. The presumed population size (based on pre-construction studies and the literature; HCP Section) of resident maternity colonies in the Project area is 90 females. Given the small population size of resident colonies, this detected fatality (and the associated number of calculated fatalities) may affect the population condition. Therefore the

applicant, in coordination with the Service and MDC, updated the conservation program to consider the fatality as part of the impact analyzed in the HCP. The HCP was modified to ensure the impacts of the April fatality are considered during HCP implementation such that the project stays within the sideboards of the impact of the taking analyzed in the HCP, the Service's EA, and the Service's Biological and Conference Opinion.

3.2 Status of Covered Species in the Mitigation Area

All three Covered Species are present at the Chariton Hills Conservation Bank, which is comprised of two separate parcels in Adair (649 acres) and Schuyler (675 acres) counties. This bank is owned and operated by Burns and McDonnell, and they conducted bat surveys and habitat assessments at both properties in 2017. The habitat assessments indicate that both parcels have high quality roosting and foraging habitat for the covered species. The following is an excerpt of the results from the bat surveys from Exhibit C4 of the Conservation Banking Agreement:

"Male and pregnant female Indiana bats were captured on both sites. In addition, acoustic data determined the presence of northern long-eared bats on the Adair Site, and a pregnant female northern long-eared bat was captured on the Schuyler Site. During several days of searching on both sites, signals from the transmitters were not detected, except for the male Indiana bat on the Schuyler Site. This may be partially due to the topography of the Chariton Hills area, which is characterized by heavily forested bills and valleys. On several nights, signals were received from bats with transmitters on the sites. This suggests that Indiana bat maternity roosts likely occur near the sites, and that bats from those roosts forage on the sites on a regular basis. Given the size and habitat quality of the sites, it is possible that other roost trees occur on the sites, but were not located in these surveys. Additionally, maternity roosts are likely to occur on the sites in the future due to the temporary nature of bat roost trees, which are typically dead and are only suitable for a few years.

A combination of mist net and acoustic surveys indicate that nine species of bats likely occur on both sites. Many of the eastern red bats, big brown bats, and evening bats captured on the sites were pregnant females, suggesting that the sites also contain maternity habitat for bats that are not federally protected.

Although not specifically called out in their report, Burns and McDonnell also detected little brown bats during acoustic surveys of the Adair Property. The Service approved the addition of little brown bats as a covered species on the Adair property on 26 June 2019, but they have not been documented on the Schulyer property.

4.0 Effects of the Action

In accordance with 50 CFR 402.02, effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. (See § 402.17).

Operations of the Project and mitigation are the two components of the proposed action that will be evaluated, in terms of effects to the Covered Species.

4.1 Effects of Project Operations

Operations of the Project will have negative effects to Covered Species during migration and at summer roost areas. All Covered Species have the potential to collide with spinning turbine blades, which usually causes injury or death. Additionally, flying in very close proximity to spinning turbine blades may cause barotrauma to bats, which may also be lethal. The operation of the Project, which includes spinning of wind turbine blades to generate electricity, is expected to cause lethal take of the covered species. The negative effects of the Action are confined to the Project Area, therefore we evaluate effects to Covered Species populations starting with those that could be located in the Project Area.

The effects of project operations to Covered Species are limited by the bounds of the adaptive management strategies in the HCP, and the permit term. The annual and total take of Covered Species as a result of the action is presented in Table 2 below. In the following sections (sections 4.4-4.7) we analyze how this take could impact individuals and populations of Covered Species.

Table 2 Annual and Total Take Authorization

	Indiana bat	Northern long-eared bat	Little brown bat
Annual	12	3	12
Total (over 6-years)	72	18	96

4.2 Effects of Mitigation

The Proposed Action's mitigation measures (as described in HCP section 7.2.2) are intended to provide conservation benefits to Covered Species and are wholly beneficial. The Action includes mitigating the impacts to Covered Species by protecting occupied forested habitat in perpetuity at Chariton Hills Conservation Bank. Habitat management activities will be conducted when bats are not on the landscape and will not result in take.

Based on the outputs from the Resource Equivalency Analysis Models (REA Model) for Wind Energy Projects (USFWS 2016*d*, *e*, *f*), 162.2 acresof summer habitat mitigation is required to fully

offset the taking, however 217 acres[2]will be purchased as part of this Action. Mitigation is expected to increase Covered Species populations by at least 140 Indiana bats, 23 northern long-eared bats, and 157 little brown bats. Mitigation may not benefit the same maternity colony populations that area affected by the Project, however we anticipate mitigation will benefit the same hibernating populations that are affected by the Project, as well as the Missouri population as a whole.

Maternity habitat mitigation is expected to compensate for the taking of Covered Species by increasing the carrying capacity of maternity colony habitat in an area that was otherwise threatened by development or deforestation. In addition, mitigation will occur in forested habitat occupied by Covered Species maternity colonies that have survived WNS-induced population declines (up to this point in time). Maternity colonies that survive WNS will be increasingly important to the continued survival of the species; maximizing survival and reproductive potential in those colonies will be important to recovery. We expect that targeting surviving maternity colonies for mitigation may be an important tool for species survival, and hopefully recovery.

We conclude the Action provides more mitigation than needed to offset the taking and therefore has a net neutral or minor beneficial impact to populations of Covered Species.

4.3 Framework of Analyses and Assumptions

Our analyses below evaluate the response of Covered Species to the proposed action. Results of these analyses are used to determine whether the proposed action could reduce likelihood of both survival and recovery of the species.

We considered effects to Covered Species in a step-wise approach beginning with impacts to individuals, then populations, and concluding with impacts at the species-level (sections 4.4-4.7). If there are no impacts at the population level, then it is not necessary to evaluate impacts at the species-level.

4.3.1 Demographic Model (Bat Tool)

Impacts to Covered Species' populations were analyzed using the Bat Tool (Erickson et al. 2014). The Bat Tool uses the Thogmartin et al. 2013 population model in R. Thogmartin et al. (2013) developed a stochastic, stage-based population model to forecast the population dynamics of the Indiana bat, subject to WNS. This model was developed in coordination with (and funding from) the Service as a tool for the Service to use in evaluating how the take of species of *Myotis* from various types of projects will affect their populations. This model is regularly used by the Service to evaluate impact scenarios on listed bat populations and explicitly incorporates environmental and demographic stochasticity. The Bat Tool was originally developed to model hibernacula populations; however, we were able to modify parameters (with the inputs and assumptions explained below) to specifically model the impact of the wind facility to maternity colonies affected by the Action and determine whether populations would continue to persist into the future.

[2] Reference the HCP for details, REA model parameters and outputs are presented in Chapter 6.3 for each Covered Species; the resulting summary of mitigation requirements is presented in Section 7.2.2.

To understand if take associated with the Action appreciably changes the probability of persistence of populations, we assess the impact of the anticipated take of Covered Species at two population levels: 1) maternity colony level; and, 2) winter hibernacula level for Indiana bat, and the Missouri population level for the northern long-eared bat and little brown bat.

4.3.2 Defining Model Inputs, Parameters, and Assumptions

4.3.2.1 Model Parameters and Relevant Outputs

For each analyzed scenario (below), we ran 10,000 simulations and summarized the simulation results for the following metrics: probability of extinction in 50 years (of the modeled population), median time to extinction (of the modeled population), and median ending lambda after 50 years (Table 3). We compared the results of each baseline scenario to the corresponding expected take scenario, and determined whether the Action could result in an appreciable difference to the modeled population. An "appreciable difference" is defined as a reduction of more than 5% in 1 or more metric (probability of extinction, median time to extinction, and median ending lambda after 50 years. "Appreciable difference" was not defined using biologically relevant data on population dynamics but used as a conservative threshold to determine if additional population analyses are warranted.

Table 3 Analysis Metrics and Explanations

Metric	**Explanation**
Probability of extinction in 50 years	the percentage of the 10,000 simulations in which the simulated population became extinct within 50 years
Median time to extinction	of the simulated populations that were predicted to become extinct, what was the median time to extinction
Median ending lambda at 50 years	median lambda for the 10,000 simulated populations at the end of 50 years

4.3.2.2 Impacts to Females

Because the demographic model used in this analysis (Bat Tool) only considers female bats, we cannot directly input the total take number (which includes both male and female bats); and must estimate the number of female bats taken. Impacts of the Action are expected to disproportionately effect female Indiana bats (i.e., 75% of take is to females), and equally impact both sexes of northern long-eared bats and little brown bats. More information on sex ratios and related assumptions are explained in Section 6.3.1 of the HCP. The estimated take to female Covered Species is presented in Table 4.

Table 4 Annual and Total Take of Female Covered Species

	Indiana bat	Northern long-eared	Little brown bat

		bat	
Annual	9	2[3]	8
Total (over 6-years)	54	9	48

4.3.2.3 Impacts equally likely to occur to any one maternity colony

We assume resident maternity colonies are at higher risk of impact than migratory colonies, as described in additional detail below. However, we have no evidence to support that one resident maternity colony will be disproportionately impacted compared to other resident colonies, or that one migratory maternity colony will be disproportionately impacted compared to other migratory colonies. In addition, individuals from all colonies will be similarly exposed to turbines because they are distributed throughout the Project Area. Therefore, we assume estimated take to resident maternity colonies is evenly distributed among the resident maternity colonies. We also assume estimated take to migratory maternity colonies is evenly distributed among the migratory maternity colonies.

4.3.2.4 Distribution of Impacts

Take of Covered Species females (Table 4) was distributed as explained below, to determine impact inputs into the Bat Tool.

Seasonally-We assume the seasonal distribution of impacts to Covered Species are proportional to the acoustic activity recorded at high MET tower detectors in the Project Area. At the Project, site-specific acoustic data of the three covered species from the high MET towers (see HCP Section 3.4.2.3) showed activity at 5.6% in the spring, 45.3% in the summer and 49.2% in the fall (when looking at only the passes of the three covered species).

Resident maternity colonies- We analyzed two impact scenarios to resident maternity colonies, the expected scenario, and the worst-case scenario allowed by the maternity colony adaptive management strategy. In the expected scenario (Step 2a, for all Covered Species) we assume all summer take and half of the migratory take (spring and fall) will impact local maternity colonies, and that those impacts would be evenly distributed across the estimated number of colonies in the Project Area. It is reasonable to distribute the take among all colonies because individuals from all colonies would be similarly exposed to the wind turbines. We have no evidence to support that one resident maternity colony population would be disproportionately impacted.

In the worst-case scenario (Step 2b, for all Covered Species) we analyzed the effect of the highest impact allowed under the maternity colony adaptive management plan. As summarized in Section 1.4.2., the highest impact to a single Covered Species maternity colony over the permit term is 4 Indiana bats, 1 northern long-eared bat, or 4 little brown bats (actual detected fatalities). *Note: The adaptive management thresholds are based on detected fatalities, using Evidence of Absence software, and an assumed detection probability of 0.2. Estimated total take associated with these thresholds are up to 21, 6, and 21 individuals of Covered Species, respectively. In our analysis we assume that the detected fatalities impact the associated maternity colony (i.e. 4, 1, or 4 individuals impacted the same maternity colony), and the remaining estimated fatalities are distributed evenly*

[3] Rounded to nearest whole bat

among all estimated maternity colonies (including the colony associated with the detected fatalities).

4.3.2.5 Impacts are defined by take limits

The modeled impacts of the action are limited by the bounds of the take authorization, adaptive management strategies in the HCP, and the permit term. However, actual impacts could be lower. For example, Thogmartin et al. (2013) predicts continuing population declines due to WNS, and we expect mortality caused by the project to decrease proportionally as impacted populations decrease. However, for this analysis we model the maximum impact possible, within the bounds of the HCP.

4.3.2.6 Impacts of White Nose Syndrome (WNS)

For the purpose of this analyses, we used the Bat Tool WNS schedule and specified that WNS year 0 was 2014 when modeling the maternity colony populations onsite, and the SNP population; and 2016 when modeling state populations of northern long-eared bats and little brown bats. The WNS schedule in our analyses was determined using the most recent White Nose Syndrome Spread Map (USFWS, 2020).

4.3.2.7 Starting Population Sizes

Estimates of current population size and composition for each covered species reflect the impacts of WNS. Onsite population sizes were estimated using a combination of emergence counts within the Project Area, literature reporting covered species' population sizes, and adjustments based on local and regional observed population declines. Methods are fully explained in HCP sections 4.1.9, 4.2.8, and 4.3.8, for Indiana bat, northern long-eared bat, and little brown bat respectively. The starting population sizes for the Covered Species are reported in Table 4. Hibernaculum population size (Indiana bat) was estimated from bi-annual hibernaculum counts, and State populations for northern long eared bats and little brown bats were estimated as described in EA Appendix F, and are presented in Table 5.

4.3.2.8 Number of Resident Maternity Colony Populations

The number of Covered Species populations within the Project Area were estimated using the approach in USFWS 2016, and the site-specific acoustic and capture data (further explained in HCP 6.3). A northern long-eared bat colony was identified in 2011 (Robbins et al. 2012). However, only a single bat has been captured since, during 2016 pre-construction surveys. We verified the distribution of acoustic detections for northern long-eared bat with the pre-construction study reports and confirmed 12 northern long-eared bat maternity colonies could be possible given the distribution of positive acoustic detections.

Table 5 Maternity Colony Populations

	Indiana bat	Northern long-eared bat	Little brown bat
Female population	90	30	74
Proportion of adults	0.67	0.67	0.67
Estimated number of resident maternity colonies	8	12	4
Estimated number of migratory maternity colonies affected by Action	110[4]		

Table 6 Hibernaculum and State Populations

	Indiana bat	Northern long-eared bat	Little brown bat
Female Hibernaculum Population	90040.5	NA	NA
Female State Population	NA	70,332	73,653
Proportion of adults	0.75	0.75	0.75

4.4 Step-1 Effects to individuals of Covered Species

The Proposed Action would adversely affect the fitness of individuals over the 6-year proposed permit term. Exposure is likely, and the number of individuals expected to be killed are presented in Table 2 -Annual and Total Take Authorization. Individuals of Covered Species are expected to die due to collision with wind turbines during migration, and collision with wind turbines while occupying maternity colony habitat in the Project Area.

The Service also recognizes that there is potential for sublethal or delayed-lethal effects to individuals from interactions with turbines at the Project. Particularly, potential impairment of hearing from damage to the ear has been noted, but there are no data to quantify how many bats may suffer such damage and die later. Thus, while there is insufficient information to include impaired hearing in our analyses at this time, the Service will incorporate any new information that becomes available on this topic into further evaluations of this and other projects.

As we have concluded that individuals of Covered Species are likely to be killed, in the sections below, we assess the aggregated consequences of the anticipated impacts on the population to which these individuals belong.

[4] Indiana bat migratory maternity colonies were determined Based on 250 iterations of the WEST (2013) model (version r352_v420). Results demonstrated that migration pathways of individual Indiana bats from 110 maternity colonies, on average, will "encounter" the Action Area.

4.5 Indiana Bat Response to the Proposed Action

The action will result in a loss of individuals. Therefore, we evaluated the aggregated consequences to the populations in which those individuals belong. Specifically, we analyzed how the impacts to individuals affect the associated maternity colonies and hibernating population (SNP). Note that there is no designated critical habitat for the Indiana bat in or near the Action Area, and no potential for the Action to affect critical habitat.

4.5.1 Step-2a Effects to resident maternity colonies (expected scenario)

The Action is likely to impact resident maternity colony populations in the Project Area. As explained above (Section 4.3.2.4), we expect all summer take and half of the migratory take (spring and fall) will impact resident maternity colonies, and that those impacts would be evenly distributed across the estimated number of colonies in the Project Area.

Under the expected scenario approximately five (rounded to the nearest bat) individuals could be taken from a single resident maternity colony, over the permit term. We used the Bat Tool to determine the affects the loss those five individuals would have to a given colony. The results do not demonstrate appreciable reductions (4.63% increase in extinction probability, and a one year decrease in time to extinction from baseline scenario) relative to the baseline in any of the metrics (Table 7). The results indicate that factors other than take from the project, including demographics; environmental stochasticity; and WNS, were the primary drivers of the simulated maternity colony population trajectory. Based on these results, we conclude that take from the Project will not cause a noticeable difference in the fitness of migrating maternity colonies, under the expected scenario.

Table 7 Expected impacts to Resident Indiana Bat Maternity Colonies

Resident Maternity Colony		Extinction Probability in 50 Years	Median Time to Extinction	Median Ending Lambda at 50 years
	Baseline	0.77	20	0
	Effects of the take (Step 2a)	0.81	19	0

4.5.2 Step-2b Effects to resident maternity colonies (worst-case scenario)

The Action is likely to impact resident maternity colony populations in the Project Area. The maternity colony adaptive management strategy includes take thresholds that limit the impact a resident maternity colony could be exposed to. Therefore, we analyzed the effect of the worst-

case impact scenario where maternity colony adaptive management thresholds are reached (i.e., four bats detected during systematic fatality monitoring). The adaptive management strategy includes tiered, increasingly protective thresholds, so only a single colony could experience the worst-case scenario-level of impact. Under the worst-case scenario, approximately 12 individuals (rounded to whole bat) could be taken from a single maternity colony population, over the permit term. This includes the 4 individuals detected during systematic fatality monitoring, and the estimated take determined by Evidence of Absence software, distributed evenly across the estimated maternity colonies (Section 4.3.2.4).

We used the Bat Tool to analyze the effects the loss of 12 individuals would have to a single resident maternity colony population. The results show the worst-case scenario may result in noticeable reductions relative to the baseline (Table 6). With or without the Action, a given maternity colony is likely to go extinct within 50 years. However, under the worst-case scenario a maternity colony is 8.84% more likely to go extinct within 50 years, and extinction may occur 5 years sooner. The results also indicate that factors other than take from the project, including demographics; environmental stochasticity; and WNS, are important drivers of the simulated maternity colony population trajectory. Based on these results, we conclude that take from the Project may cause an appreciable difference in the fitness of a single maternity colony experiencing the worst-case scenario level of impact (i.e., 8.84% more likely to go extinct within 50 years, and 5 years sooner than without the action).

The worst case scenario is extremely unlikely because it would require all adaptive management thresholds to be reached within the 6-year permit term, and that would require a level of take has not been observed at any permitted wind Project throughout the Service's Midwest Region. However, because the worst-case scenario demonstrates an appreciable difference from the baseline scenario, we further analyzed the impact of the take to the hibernacula population (Step-2d).

Table 8 Worst-case Scenario Impacts to Resident Indiana Bat Maternity Colonies

Resident Maternity Colony		Extinction Probability in 50 Years	Median Time to Extinction	Median Ending Lambda at 50 years
	Baseline	0.77	20	0
	Effects of the take (Step 2b)	0.84	15	0

4.5.3 Step-2c Effects to Migratory Maternity Colonies

The Project is likely to impact bats migrating through the Action Area to and from the SNP winter hibernaculum. As explained above (Section 4.3.2.4), we expect half of the migratory take (spring and fall) will impact migratory maternity colonies, and that those impacts would be evenly distributed across the estimated number of migratory colonies that pass through the Project Area. Over the term of the permit, we estimate approximately 15 (rounded to whole bat) migrating individuals to be taken from maternity colony populations existing outside of the Action Area (i.e., not part of Step 2a or 2b). The SNP hibernaculum is composed of many maternity colony populations (estimated 1000 colonies given a population size of 180,000 Indiana bats, 50:50 sex ratio, and average 90 females/colony). The WEST (2013) model was used to determine the potential migratory pathways that could pass through the Action area, and the portion of the SNP hibernaculum population that would be exposed to the Project. Results of the WEST model indicate individuals from up to 110 maternity colonies could be impacted when migrating through the Action Area.

We used the Bat Tool to determine the affects the loss of those (15) individuals would have to the 110 maternity colony populations. The results do not demonstrate noticeable reductions relative to the baseline in any of the metrics (Table 7). The results indicate that factors other than take from the project, including demographics; environmental stochasticity; and WNS, were the primary drivers of the simulated maternity colony population trajectory. Based on these results, we conclude that take from the Project will not cause an appreciable difference in the fitness of migrating maternity colonies.

Table 9 Impacts to Migratory Indiana Bat Maternity Colonies

Migratory Maternity Colony		Extinction Probability in 50 Years	Median Time to Extinction	Median Ending Lambda at 50 years
	Baseline	0.77	20	0
	Effects of the take (Step 2c)	0.77	20	0

4.5.4 Step-2d Effects to the Hibernaculum Population

Analyses in steps 2a- 2c indicate that resident maternity colony populations could be adversely affected by the Action if the worst-case scenario was realized. However, expected impacts to resident maternity colony populations, and impacts to migrating colonies would not be noticeable. We assume all maternity colony populations affected by the Project are part of the SNP hibernaculum population, because SNP is the closest Indiana bat hibernaculum and band

return data indicate bats within the Project Area hibernate at SNP. We used the Bat Tool to determine how the hibernaculum could be affected by the cumulative effects to maternity colonies.

We modeled the impact of taking 54 female bats (Table 4) from the SNP hibernacula over the permit term. For model inputs, we used complex-level lambda values (see Thogmartin et al. 2013) and 2019 Indiana bat population numbers from visual counts at the hibernaculum (Table 6).

Resulting metrics did not show appreciable reductions relative to the Baseline Scenario. Based on the result of these analyses we concluded that take from the Project will not cause an appreciable difference in the fitness of the hibernaculum population.

Table 10 Impacts to Indiana Bat SNP Hibernaculum

SNP Hibernaculum Population		Extinction Probability in 50 Years	Median Time to Extinction	Median Ending Lambda at 50 years
	Baseline	0	NA	0.94
	Effects of the take (Step 2d)	0	NA	0.94

4.5.5 Step-3 Effects to the Ozark Central Recovery Unit

Based on our conclusion that impacts of take from Project will not have hibernaculum population-level effects to the Indiana bat, we further concluded that take will not have RU-level impacts. We conclude that reductions in the likelihood that survival and recovery of Indiana bats within the OCRU were unlikely to result from the proposed action.

4.5.6 Step-4 Effects to the species

Based on our conclusion that impacts of take from the Project will not have RU-level effects to the Indiana bat, we further concluded that take will not have species-level impacts.

4.6 Northern Long-eared Bat Response to the Proposed Action

The action will result in a loss of individuals. Therefore, we evaluated the aggregated consequences to the populations in which those individuals belong. Specifically, we analyzed how the impacts to individuals affect the resident maternity colony populations, and the population of bats in Missouri. We did not evaluate impacts to migratory maternity colonies or hibernacula because we do not have enough biological information about these populations

(including where they occur), to meaningfully assess the impacts of take at those levels. There is no designated critical habitat for the northern long-eared bat.

4.6.1 Step-2a Effects to resident maternity colonies (expected scenario)

The Action is likely to impact resident maternity colony populations in the Project Area. As explained above (Section 4.3.2.4), we expect all summer take and half of the migratory take (spring and fall) will impact resident maternity colonies, and that those impacts would be evenly distributed across the estimated number of colonies in the Project Area.

Under the expected scenario approximately one (rounded to the nearest bat) individuals could be taken from a single resident maternity colony, over the permit term. We used the Bat Tool to determine the affects the loss of that individual would have to a given colony. The results do not demonstrate an appreciable increase in the extinction probability in 50 years (1.15% increase). Populations under the baseline scenario are likely to go extinct within 50 years, and the results indicate that factors other than take from the project, including demographics; environmental stochasticity; and WNS, were the primary drivers of the simulated maternity colony population trajectory. Based on these results, we conclude that take from the Project's expected scenario will not cause an appreciable difference in the fitness of migrating maternity colonies because it does not exceed our 5% threshold.

Table 11 Expected impacts to Resident Northern Long-eared Bat Maternity Colonies

Resident Maternity Colony		Extinction Probability in 50 Years	Median Time to Extinction	Median Ending Lambda at 50 years
	Baseline	0.81	11	0
	Effects of the take (Step 2a)	0.82	11	0

4.6.2 Step-2b Effects to resident maternity colonies (worst-case scenario)

The Action is likely to impact resident maternity colony populations in the Project Area. The maternity colony adaptive management strategy includes take thresholds that limit the impact a resident maternity colony could be exposed to. Therefore, we analyzed the effect of the worst-case impact scenario where maternity colony adaptive management thresholds are reached (i.e., one bat detected during systematic fatality monitoring). Under the worst-case scenario, approximately two individuals (rounded to whole bat) could be taken from a single maternity colony population, over the permit term. This includes the individual detected during systematic fatality monitoring, and the estimated take determined by Evidence of Absence software, distributed evenly across the estimated maternity colonies (Section 4.3.2.4).

We used the Bat Tool to analyze the effects the loss two individuals would have to a single resident maternity colony population. The results show the worst-case scenario may result in appreciable reductions relative to the baseline (Table 12). With or without the Action, a given maternity colony is likely to go extinct within 50 years. However, with the Action a maternity colony is 2.19% more likely to go extinct within 50 years. The results also indicate that factors other than take from the project, including demographics; environmental stochasticity; and WNS, are important drivers of the simulated maternity colony population trajectory. Based on these results, we conclude that take from the Project may cause an appreciable difference in resident northern long-eared bat maternity colonies.

The worst case scenario is extremely unlikely because it would require all adaptive management thresholds to be reached within the 6-year permit term, and that would require a level of take has not been observed at any permitted wind Project throughout the Service's Midwest Region.

Table 12 Worst-case scenario Impacts to Resident Northern long-eared bat Maternity Colonies

Resident Maternity Colony		Extinction Probability in 50 Years	Median Time to Extinction	Median Ending Lambda at 50 years
	Baseline	0.81	11	0
	Effects of the take (Step 2b)	0.82	11	0

4.6.3 Step-2c Effects to the Missouri population

Analyses in steps 2a-2b indicate that resident maternity colony populations would not be adversely affected by the Action. Because we do not have enough information about migratory maternity colony or hibernating populations of northern long-eared bats, especially in regards to where they occur, we evaluated the aggregated consequences of the Action to the Missouri population. We estimated the northern long-eared bat population in Missouri using Missouri occupancy rates informed by post-WNS mist-net and acoustic surveys from 2017-2019. The calculations and assumptions for this estimate is provided in Appendix F of the Final EA.
We modeled the impact of taking nine female bats (Table 4) from the Missouri population over the permit term. For model inputs, we used complex-level lambda values (see Thogmartin et al. 2013) and the statewide female population estimate of 70,332 bats (Table 10).

Resulting metrics did not show appreciable reductions relative to the baseline scenario. Based on the result of these analyses we concluded that take from the Project will not cause a noticeable difference in the fitness of the Missouri population.

Table 13 Impacts to Missouri Population of Northern long-eared bats

Missouri Population		Extinction Probability in 50 Years	Median Time to Extinction	Median Ending Lambda at 50 years
	Baseline	0	NA	0.98
	Effects of the take (Step 2c)	0	NA	0.98

4.6.4 Step 3- Effects to the species

Based on our conclusion that impacts of take from the Project will not have State-level effects to the northern long-eared bat, we further concluded that take will not have species-level impacts.

4.7 Little Brown Bat Response to the Proposed Action

The action will result in a loss of individuals. Therefore, we evaluated the aggregated consequences to the populations in which those individuals belong. Specifically, we analyzed how the impacts to individuals affect the resident maternity colony populations, and the population of bats in Missouri. We did not evaluate impacts to migratory maternity colonies or hibernacula because we do not have enough biological information about these populations (including where they occur), to meaningfully assess the impacts of take at those levels. There is no designated critical habitat for the little brown bat.

4.7.1 Step-2a Effects to resident maternity colonies (expected scenario)

The Action is likely to impact resident maternity colony populations in the Project Area. As explained above (Section 4.3.2.4), we expect all summer take and half of the migratory take (spring and fall) will impact resident maternity colonies, and that those impacts would be evenly distributed across the estimated number of colonies in the Project Area.

Under the expected scenario approximately nine (rounded to the nearest bat) individuals could be taken from a single resident maternity colony, over the permit term. We used the Bat Tool to determine the affects the loss those individuals would have to a given colony. The results demonstrate an appreciable increase in the extinction probability in 50 years (23% increase). Populations under the baseline scenario are likely to go extinct within 50 years, however the action may cause the median time to extinction to occur 10 years sooner (a 71% decrease in time to extinction, Table 14). The results indicate that factors other than take from the project, including demographics; environmental stochasticity; and WNS, are also primary drivers of the simulated maternity colony population trajectory. Based on these results, we conclude that take from the Project may cause an appreciable difference in the fitness of resident maternity

colonies, under the expected scenario. Therefore, we further analyzed the impact of the take to the Missouri population (Step-2d)

Table 14 Expected Impacts to Little Brown Bat Maternity Colonies

Resident Maternity Colony		Extinction Probability in 50 Years	Median Time to Extinction	Median Ending Lambda at 50 years
	Baseline	0.63	21	0
	Effects of the take (Step 2a)	0.82	6	0

4.7.2 Step-2b Effects to resident maternity colonies (worst-case scenario)

The Action is likely to impact resident maternity colony populations in the Project Area. The maternity colony adaptive management strategy includes take thresholds that limit the impact a resident maternity colony could be exposed to. Therefore, we analyzed the effect of the worst-case impact scenario where maternity colony adaptive management thresholds are reached (i.e., four bats detected during systematic fatality monitoring). The adaptive management strategy includes tiered, increasingly protective thresholds, so only a single colony could experience the worst-case scenario-level of impact. Under the worst-case scenario, approximately 17 individuals (rounded to whole bat) could be taken from a single maternity colony population, over the permit term. This includes the 4 individuals detected during systematic fatality monitoring, and the estimated take determined by Evidence of Absence software, distributed evenly across the estimated maternity colonies (Section 4.3.2.4).

We used the Bat Tool to analyze the effects the loss 17 individuals would have to a single resident maternity colony population. The results demonstrate an appreciable increase in extinction probability in 50 years (27% increase). Populations under the baseline scenario are likely to go extinct within 50 years, however the action may cause the median time to extinction to occur 17 years sooner (an 81% decrease in median time to extinction, Table 15). The results also indicate that factors other than take from the project, including demographics; environmental stochasticity; and WNS, are important drivers of the simulated maternity colony population trajectory. Based on these results, we conclude that take from the Project may cause an appreciable difference the fitness of resident maternity colonies.

The worst case scenario is extremely unlikely because it would require all adaptive management thresholds to be reached within the 6-year permit term, and that would require a level of take has not been observed at any permitted wind Project throughout the Service's Midwest Region. However, because the worst-case scenario demonstrates an appreciable difference from the

baseline scenario, we further analyzed the impact of the take to the Missouri population (Step-2c).

Table 15 Worst-case Scenario Impacts to Resident Little Brown Bat Maternity Colonies

Resident Maternity Colony		Extinction Probability in 50 Years	Median Time to Extinction	Median Ending Lambda at 50 years
	Baseline	0.63	21	0
	Effects of the take (Step 2b)	0.86	4	0

4.7.3 Step-2c Effects to the Missouri Population

Analyses ins step 2a-2b indicate that resident maternity colony populations could be adversely affected by the Action. Because we do not have enough information about migratory maternity colony or hibernating populations of little brown bats, we evaluated the aggregated consequences of the Action to the Missouri population. We estimated the little brown bat population in Missouri using Missouri occupancy rates informed by post-WNS mist-net and acoustic surveys from 2017-2019. The calculations and assumptions for this estimate is provided in Appendix F of the Final EA.

We modeled the impact of taking 48 female bats (Table 4 from the Missouri population over the permit term. For model inputs, we used complex-level lambda values (see Thogmartin et al. 2013) and the statewide female population estimate of 73,653 bats (Table 12).

Resulting metrics did not show appreciable reductions relative to the baseline scenario. Based on the result of these analyses we concluded that take from the Project will not cause a noticeable difference in the fitness of the Missouri population.

Table 16 Impacts to Missouri Population of Little Brown Bats

Missouri Population		Extinction Probability in 50 Years	Median Time to Extinction	Median Ending Lambda at 50 years
	Baseline	0	NA	0.98
	Effects of the take (Step 2b)	0	NA	0.98

4.7.4 Step-3 Effects to the species

Based on our conclusion that impacts of take from the Project will not have State-level effects to the little brown bat, we further concluded that take will not have species-level impacts.

5.0 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 (50 CFR 402.02). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.
The Service is aware of at least two wind development companies scoping new wind facilities within the migrating distance of SNP. All of these companies would work with the Service to avoid impacts or pursue HCPs that would require separate consultation under the Act.

All covered species are present in the Action Area. However, the Service is unaware of any future state, tribal, local, or private actions, other than the proposed project, which would impose significant cumulative effects on the listed bats that use the area. Similarly, there is no designated critical habitat for the Indiana and northern long-eared bats in or near the Action Area.
Thus, cumulative effects to critical habitat, from the proposed action in concert with any future state, tribal, local, or private actions in the Action Area, are not anticipated.

6.0 Conclusion

After reviewing the current status of Covered Species, the environmental baseline for the Action Area, the effects of the proposed actions of the HCP for the High Prairie Wind Energy Center, and the cumulative effects, it is Services' opinion that the operation of the Project, as proposed, is not likely to jeopardize the continued existence[5] of the Covered Species.

Briefly, the basis for this conclusion (as detailed in the Biological and Conference Opinion) is as follows:

[5] 'Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02).

- Operational Minimization: Based on research at other wind facilities, the Service anticipates seasonal turbine operational adjustments to be implemented under this HCP to average a 62% reduction in bat fatality compared to fully operational turbines.

- Standardized fatality monitoring*:* Fatality monitoring is anticipated to detect 20% percent of all bat carcasses. Detected carcasses will be corrected with EoA software to calculate take. Calculated take will inform adaptive management programs. Adaptive management has been incorporated into the HCP and provides flexibility to make modifications, as needed, to the proposed minimization measures if the measures have been ineffective or insufficient to meet permitted take levels or other objectives of the HCP. The Service finds the monitoring program sufficient to provide the data the Service needs to ensure compliance with permitted take levels.

- Analysis of Impacts: The impact of the take was analyzed using a hierarchal framework including the following steps: 1) effects to individuals; 2) effects to maternity colonies and hibernating populations; 3) effects to the OCRU (for Indiana bat) and the Missouri population (for northern long-eared bat and little brown bat as there are no established recovery units for these species); and, 4) effects to the range-wide population. There is no potential for the Project to affect critical habitat. Up to 72 Indiana bats, 18 northern long-eared bats, and 96 little brown bats may be taken as the result of interactions with wind turbines at the Project during the permit term. In step 2, we analyzed the impacts of the taking of individuals on the maternity colonies, hibernating, and State populations to which those individuals belong. In the analysis we included the impact of the take and did not consider the offset of mitigation. We concluded that take from the project does not cause an appreciable difference in the fitness of the hibernating or State populations of Covered Species. Therefore, we concluded it is unlikely the project will cause reductions in the likelihood of survival and recovery of Covered Species within the State, recovery unit or range-wide population.

- Mitigation: Mitigation acres were determined using the REA Model and acres will be managed and protected through Chariton Hills Conservation Bank. Mitigation includes protection of 217 acres of occupied forested habitat in perpetuity, which is about 54.8 more acres than required to fully offset the taking.

7.0 Incidental Take Statement

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined in section 3 of the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or

sheltering (50 CFR § 17.3). 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.

The Habitat Conservation Plan submitted by Ameren Missouri and its associated documents clearly identify expected impacts to Covered Species that are likely to result from the proposed taking and the measures that are necessary and appropriate to minimize those impacts. All conservation measures described in the HCP, together with the terms and conditions described in any section 10(a)(1)(B) permit or permits issued with respect to the HCP, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement pursuant to 50 CFR §402.14(i). Such terms and conditions are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the Act to apply. If the permittee fails to adhere to these terms and conditions, the protective coverage of the section 10(a)(1)(B) permit and section 7(o)(2) may lapse. The amount or extent of incidental take expected under the HCP, associated reporting requirements, and provisions for disposition of dead or injured animals are as described in the HCP and its accompanying section 10(a)(1)(B) permit.

In addition to the responsibilities of the Applicant, ES has the responsibility to monitor compliance with provisions of the HCP, and to take appropriate steps if compliance is deficient.

7.1 Amount or Extent of Take Anticipated

After reviewing the HCP and analyzing the effects of the proposed action, the ES anticipates that no more than 72 Indiana bats, 18 northern long-eared bats, and 96 little brown bats will be taken over the 6-year permit term. Direct lethal take of Covered Species is expected at the Project as the result of collision with wind turbines (and possibly barotrauma to the lungs caused by rapid air pressure reduction near moving turbine blades).

In this Opinion, ES has determined this level of anticipated take is not likely to result in jeopardy to the Covered Species. The ES program also determined that the Project is not likely to result in the destruction or adverse modification of critical habitat.

7.2 Reasonable and Prudent Measures

As described above, all conservation measures described in the HCP, together with the terms and conditions described in the associated Implementing Agreement and the Incidental Take Permit issued with respect to the HCP, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement.

7.3 Terms and Conditions

As described above, all conservation measures described in the HCP, together with the terms and conditions described in the Incidental Take Permit issued with respect to the HCP, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement.

The ES program has the responsibility to monitor implementation of the HCP and compliance with the provisions of the Implementing Agreement and this Incidental Take Statement.

8.0 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.

The federal Action Agency in the case of this Biological Opinion is the U.S. Fish and Wildlife Service, Ecological Services Program (ES); the federal action considered is the issuance of a 10(a)(1)(B) Incidental Take Permit for the High Prairie Wind Energy Center. In furtherance of section 7(a)(1) of the Act, the following activities may be conducted at the discretion of ES as time and funding allow:

1. Support sustainable development of wind facilities in Missouri while considering the cumulative effects of wind build out within the range of influence of Sodalis Nature Preserve. As described in the Cumulative Effects section, the Service is aware of two new wind facilities being considered for development within the range of SNP. We recommend that the Service develop a General Conservation Plan for wind projects that addresses impacts to maternity colonies and includes biological monitoring and appropriate population levels (within and beyond the Action Area).
2. Work with partners to support research focused on better understanding exposure of bats to wind turbines, measures to minimize collision risk, and monitoring methods.
3. Work with the wind industry to help wind energy developers avoid and minimize impacts of wind projects on federally listed species.
4. Incorporate new findings from research and post-construction monitoring programs into guidance documents, including the Indiana Bat Section 7 and Section 10 Guidance for Wind Energy Projects (USFWS 2011).
5. Continue and expand efforts within the Service to ensure that all offices working on wind energy projects have access to the best scientific and commercial data available on

bat/wind interactions and methods to avoid and minimize bat mortality at wind facilities.

6. Continue to develop tools for the Service to use that promote consistent, efficient, and effective methods for addressing wind impacts to federally listed species.
7. There is considerable uncertainty regarding how white-nose syndrome will impact populations of Indiana bats, northern long-eared bats, and other cave-hibernating bat species. Continue to promote the implementation of the White-Nose Syndrome National Plan and to develop tools for assessing how bat populations will respond to WNS in addition to other threats (including wind energy development).
8. Research and develop mitigation strategies that will be most effective at ameliorating the impacts of WNS on federally listed bats.

9.0 Reinitiation Notice

This concludes formal consultation on the proposed issuance of a section 10(a)(1)(B) Incidental Take Permit to the Applicant (pursuant to submission of their HCP and an ITP for High Prairie Wind Energy Center). As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiating.

10.0 Literature Cited

Literature cited throughout the BO is available upon request from the Missouri Ecological Field Office.