Hoopeston Wind, LLC

Vermilion County, Illinois

Final Habitat Conservation Plan for the Indiana Bat and the Northern Long-Eared Bat

Hoopeston Wind Project
Vermilion County, Illinois

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Table of Contents

List of Tables

List of Figures

1.0 Introduction

1.1 Applicant Information

The Hoopeston Wind project (Project) is owned by Hoopeston Wind, LLC (Hoopeston Wind), a wholly owned subsidiary of IKEA Energy US, LLC. The Project is managed by Apex Wind Asset Management, LLC, a subsidiary of Apex Clean Energy Holdings, LLC (Apex).

1.2 Background and Purpose

In August 2007, Illinois enacted legislation (Public Act 95-0481) that establishes annual benchmarks for renewable energy generation and energy efficiency.[1] Under this program, electric utilities in Illinois are required to provide at least 25% of their retail electric supply from renewable energy sources, including wind, by 2025. Illinois's renewable portfolio standard (RPS) requires that investor-owned electric utilities (EUs) obtain a minimum of 75% of their renewable energy obligation from wind power and the remaining amount (25%) from other eligible renewables. For alternative retail electric suppliers (ARES), a minimum of 60% of their renewable energy obligation must come from wind power, and the remaining amounts (40%) from other eligible renewables. For EUs, through 2011, eligible renewable resources were required to be located in-state. After 2011, equal preference has been given to resources within Illinois and adjoining states as long as they are cost effective. Given the clear legislative objectives of the state of Illinois for increased renewable energy generation, the majority of which must be met by wind energy, Hoopeston Wind has developed the Project, which began operations in March 2015.

Wind energy has grown significantly across the U.S. and within Illinois over the past several years. By 2020, 20% of our nation's energy could come from wind energy. In Illinois alone, the target for renewable energy is 25% (75% of that from wind) by 2025. These targets for renewable energy have been established to promote energy independence, environmental stewardship, and economic development. Wind energy generation is emissions free, requires little to no water, changes only a minimal portion of existing land use, and reduces the need for other traditional energy sources and thereby reduces associated harmful emissions. As an example, current installed capacity in Illinois will avoid emission of over 4.7 million metric tons of carbon dioxide annually. In 2012, wind energy became the number one source of new electricity generating capacity in the U.S., providing 42% of all new capacity. According to the American Wind Energy Association (AWEA), at the end of 2014, the U.S. had nearly 48,000 operating turbines representing 65,877 megawatts (MW), and providing 4.4% of the country's electricity. Wind is a clean and renewable fuel source that helps keep energy prices low, providing a hedge against volatile fossil fuel price fluctuations. Combined with the increased efficiency through advances in wind turbine technology, wind is now one of the most cost effective sources of new electricity generation.

In addition to the environmental and market benefits from wind, significant direct and indirect economic benefits are realized in areas where such projects are developed. A large number of construction jobs are created during construction as well as a significant number of long term operations and maintenance

[1] http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=IL04R&re=1&ee=1

(O&M) and environmental monitoring jobs. There are significant direct payments made to participating landowners, and this often increases local spending, which makes its way through the wider community. Another direct benefit to the broader community is the significant increase in tax revenue associated with wind energy projects greatly benefiting schools, fire and water departments, and other municipal services.

Beyond the local project areas, wind energy also supports a growing supply chain and manufacturing base. There are now more than 500 wind energy-related manufacturing facilities across the U.S. Thirty-six of those facilities are located in Illinois, supporting over 1,000 employees. Hoopeston Wind created the equivalent of 100 full time jobs during the construction phase and will employ up to 10 permanent positions at the local O&M facility for the life of the Project. While job creation and increased economic development activity are welcome by-products of renewable energy projects, the paramount benefit of continued careful development of responsibly sited wind energy projects is meeting our energy needs in a way that minimizes the overall environmental impact of our nation's energy footprint.

1.3 Habitat Conservation Plan Contents

This Habitat Conservation Plan (HCP) has been prepared in accordance with the requirements set forth under section 10(a)(1)(B) of the Endangered Species Act (ESA), as amended, and applicable U.S. Fish and Wildlife Service (USFWS) guidance document. The HCP has been prepared in order to manage risk associated with protected species, particularly during the operation of the Project. The Project's location is within the range of the Indiana bat (*Myotis sodalis*), a species listed as endangered under the ESA. Estimates of the size of hibernating populations of the Indiana bat vary across the state of Illinois. Maternity colonies have been recorded in 20 Illinois counties, including one colony in Vermilion County (USFWS 2007). The Project's location is also within the range of the northern long-eared bat (*Myotis septentrionalis*), a species listed as threatened under the ESA. There are 21 known northern long-eared bat hibernacula in Illinois (USFWS 2015a).

Under section 10 of the ESA, applicants may be authorized, through issuance of an Incidental Take Permit (ITP), to conduct activities that may result in take of a listed species, as long as the take is incidental to, and not the purpose of, otherwise lawful activities. Hoopeston Wind is applying for an ITP to authorize any incidental take of the Indiana bat or northern long-eared bat that may occur as a result of the activities that are proposed for coverage under the ITP.

Before the USFWS issues an ITP to Hoopeston Wind, USFWS must find that the applicant proposes measures to avoid, minimize, and mitigate the potential take of the Indiana bat or the northern long-eared bat to the maximum extent practicable. Hoopeston Wind has prepared this HCP to support the issuance of an ITP for Indiana and northern long-eared bats during the operation and decommissioning of the Project pursuant to Section 10(a)(1)(b) of the ESA. Specifically, this HCP provides the following:

- An overview of the regulatory framework of wind projects as it relates to species protection, including a summary of agency coordination;
- A discussion of the general environmental setting and biological resources within the Project Area;

- A description of the Project, including its purpose and a definition of activities to be covered under the HCP; alternatives considered; and public participation;
- A discussion of the life history and presence of the Indiana bat;
- A discussion of the life history and presence of the northern long-eared bat;
- Potential effects of the proposed action, including alternatives for minimizing risk to Indiana and northern long-eared bats;
- Estimates of the Project's take, and context defining the significance of the potential take relative to each species' overall population viability; and
- A Conservation Plan, outlining measures to avoid, minimize and mitigate potential take; conduct post-construction monitoring for effectiveness; and implement adaptive management measures as appropriate.

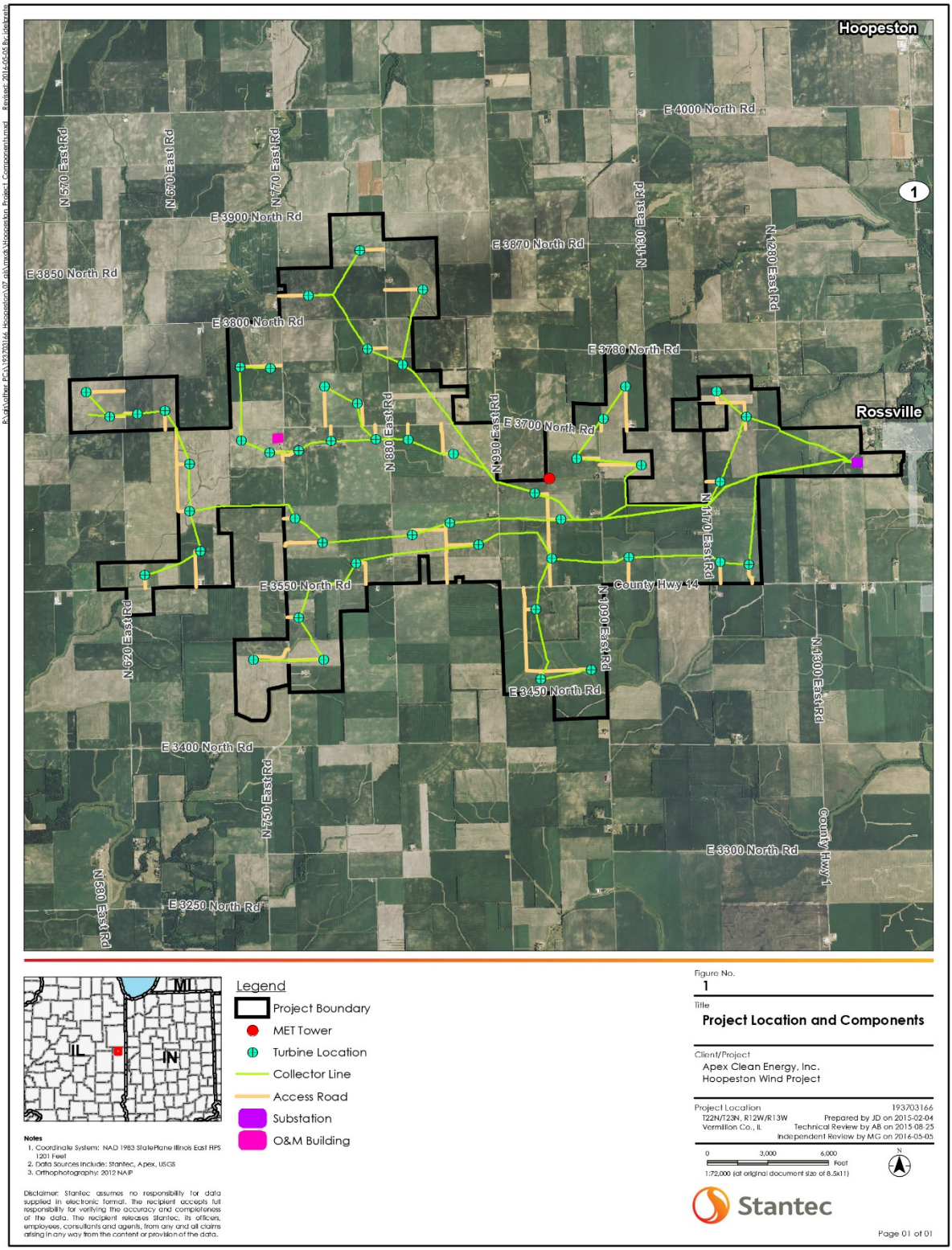
As part of the requirements for the issuance of an ITP, Hoopeston Wind has prepared this HCP to identify those actions that will avoid, minimize and mitigate the effects of covered activities on the Indiana and northern long-eared bat and their habitats.

2.0 Background

2.1 Overview

The Hoopeston Wind Project is a modern wind facility located in Vermilion County, Illinois. The Project is designed to generate approximately 98 MW with 49 2.0 MW wind turbine generators. The Project includes an O&M building, access roads, an underground electrical collection line system, a substation, and one permanent meteorological (met) tower. The Project is approximately 20 miles (mi) north of Danville, Illinois, and the 49 turbines are interspersed across active farmland west of Highway 1 and east of Highway 49, west of Rossville and southwest of the town of Hoopeston. The Project location and facilities are presented in Figure 1.

Figure 1: Project Location and Facilities



2.2 Permit Duration

Hoopeston Wind is seeking an ITP with a 30-year term. This is based on the expected life of the Project components. At the expiration of the 30-year term, the ITP may be renewed or extended with the approval of the USFWS.

2.3 Regulatory and Legal Framework

2.3.1 Endangered Species Act

Section 9 of the ESA prohibits the "take" of any fish or wildlife species listed under the ESA as endangered. Under federal regulation, take of fish or wildlife species listed as threatened is also prohibited unless otherwise specifically authorized by regulation. "Take," as defined by the ESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a listed species, or attempt to engage in any such conduct" [ESA §3(19)].

Section 9 of the ESA also prohibits the removal and reduction to possession of any listed plant species "under federal jurisdiction," as well as the removal, damage, or destruction of such plants on any other areas in knowing violation of any state law or regulation or in violation of state trespass law.

The 1982 amendments to the ESA established a provision in section 10 of the ESA that allows for "incidental take" of endangered and threatened species of wildlife by non-federal entities. Incidental take is defined by the ESA as take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity" [50 code of federal regulations [CFR] §402.02]. Under this provision, the Secretary of the Interior and Secretary of Commerce may, where appropriate, authorize the taking of federally listed fish or wildlife if such taking occurs incidentally to otherwise legal activities. The USFWS was charged with regulating the incidental taking of listed species under its jurisdiction.

Section 10 of the ESA establishes a program whereby persons seeking to pursue activities that otherwise could give rise to liability for unlawful "take" of federally protected species, as defined in section 9 of the ESA, may receive an ITP, which exempts them from such liability. Under section 10 of the ESA, applicants may be authorized, through issuance of an ITP, to conduct activities that may result in take of a listed species, as long as the take is incidental to, and not the purpose of, otherwise lawful activities.

The submission of an ESA section 10(a)(1)(B) permit application requires the development of an HCP (16 United States Code [USC] §1539(a)(1)(B) and 1539(a)(2)(A)) designed to ensure the continued existence and aid in the recovery of the listed species while allowing for any limited, incidental take of the species that might occur during the construction and operation of a project.

2.3.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969, as amended, requires federal agencies to evaluate and disclose the effects of their proposed actions on the natural and human environment. The NEPA process is intended to help federal agencies make decisions that are based on an understanding

of potential environmental consequences, and take actions that protect, restore, and enhance the environment. NEPA regulations provide the direction to achieve that purpose. The issuance of an ITP by the USFWS constitutes a federal action subject to NEPA compliance and review (42 USC §§4321-4347, as amended).

NEPA and the Council for Environmental Quality (CEQ) *Regulations for Implementing NEPA* (40 CFR 1501) contain "action-forcing" provisions to ensure that all federal agencies act according to the letter and spirit of NEPA. NEPA procedures must ensure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA. NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail.

To evaluate the environmental effects of a proposed action, the USFWS typically prepares and provides for public review an Environmental Assessment (EA). If the USFWS finds that significant impacts to the natural and human environment are not expected as a result of the proposed action, then a Finding of No Significant Impact (FONSI) is issued. If significant impacts are anticipated, then a comprehensive Environmental Impact Statement (EIS) is prepared and distributed for public review. After the USFWS completes its review of an EIS, it issues a Record of Decision of its findings. The USFWS can issue an ITP only after the NEPA review process has been completed.

2.3.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA, 16 USC §§703-712) prohibits the taking, killing, injuring, or capture of listed migratory birds. Neither the MBTA nor its implementing regulations found in 50 CFR Part 21 provide for the permitting of “incidental take” of migratory birds that may be killed or injured by wind turbines. The USFWS has and continues to provide wind developers guidance in making a good-faith effort to comply with the MBTA, as discussed in the final Land-Based Wind Energy Guidelines (LWEG; USFWS 2012a).

The Project has created a Bird and Bat Conservation Strategy (BBCS) to address impacts to migratory birds and to outline minimization measures and adaptive management strategies in place for these species.

2.3.4 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (BGEPA) of 1940 (50 CFR 22.26), and its implementing regulations, provide additional protection to bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) such that it is unlawful to take an eagle. In this statute the definition of “take” is to “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb.” The term “disturb” is defined in regulations found at 50 CFR 22.3 to include “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or

sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

2.4 Covered Lands

The Covered Lands for this HCP are defined as the Project Area, which is shown in Figure 1 and is considered to be the outermost boundary of the participating landowner property (project boundary). The Project Area contains approximately 8,884 acres (3,595 hectares [ha]). The requested ITP will cover the entire Project Area.

2.5 Covered Species

2.5.1 Indiana Bat

The range of the federally endangered Indiana bat includes the eastern and mid-western U.S., from Iowa, Oklahoma, and Wisconsin, northeast to Vermont, and south to northwestern Florida and northern Arkansas (USFWS 2007). The majority of the wintering population occurs in the limestone cave regions of Indiana, Kentucky, and Missouri.

Indiana bat maternity colonies are historically known from Vermilion County (USFWS 2007) and continue to be documented as recently as 2014 (Illinois Department of Natural Resources [IDNR] 2015). Maternity colonies are also known from Ford County, located adjacent to Vermilion County to the northwest (USFWS 2007, IDNR 2015). Recent records include a July 2010 survey that identified an Indiana bat maternity colony on the Middle Fork of the Vermilion River in Ford and Champaign counties (IDNR 2010), which was confirmed again during surveys in 2014 (IDNR 2015). The closest known hibernaculum is Copperhead Mine, located in Vermillion County, Indiana, approximately 40 mi (64 kilometers [km]) southeast of the Project. Whitaker and Risler (1992) found seven Indiana bats in this mine in 1990; however, in 2014, IDNR found no Indiana bats and the mine appeared positive for white-nose syndrome (WNS; K. Shank, pers. comm.). The closest known occupied hibernaculum is Blackball Mine located in LaSalle County, Illinois, approximately 140 mi (225 km) to the northwest of the Project Area (USFWS 2007).

Acoustic monitoring surveys conducted in 2009, 2010, and 2014 indicated that overall bat activity levels within the Project Area are moderate relative to the results of acoustic bat surveys at other wind energy projects in the Midwest. The results of the acoustic bat survey identified 16 potential Indiana bat calls (0.7% of all calls) within the Project Area. The results of the acoustic surveys suggest there are not high levels of Indiana bat migratory activity within the Project Area (see Section 3.10), but the species may occasionally pass through the area. Little is known about the migration patterns of Indiana bats, specifically how and where they disperse across the landscape during migration; however, Indiana bats have been known to occur in Vermilion County, and the Project Area is located within their migratory range. Therefore, the Indiana bat does have the potential to be at risk of collision with operating turbines and is consequently considered a Covered Species in this HCP.

As a result of effective avoidance and minimization efforts by Hoopeston Wind during siting and construction, as well as similarly effective avoidance and minimization efforts during future decommissioning, operation of the Project is the only activity covered by this HCP that is expected to result in take of Indiana bats. The primary method to minimize impacts to Indiana bats, beyond the careful siting of turbines and other project features that has already occurred, will be feathering the blades (i.e., preventing them from free-wheeling) below the cut-in speed, which is the minimum wind speed at which turbines begin rotating and producing power.

2.5.2 Northern Long-eared Bat

The northern long-eared bat was proposed for listing under the ESA by the USFWS on October 2, 2013. A final decision was made on April 2, 2015, to federally list this species as threatened (USFWS 2015a). The northern long-eared bat's range covers much of the eastern and north central U.S., from Maine to North Carolina westward to eastern Oklahoma, Wyoming and Montana, as well as all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. They have historically been found in greater abundance in the northeast, portions of the Midwest and southeast (USFWS 2014). Though widespread, their distribution may be patchy or irregular (Amelon and Burhans 2006). In Illinois, northern long-eared bats hibernate from November 1 through March 31, with a breeding season that lasts from April 1 through September 30 (USFWS 2014).

Northern long-eared bats hibernate in limestone caves and mines. During the spring and summer, females live in maternity colonies in hollow trees and under loose bark. They forage along forested hillsides, rivers and streams, feeding on true bugs, leafhoppers, wasps and flies.

During the 2009, 2010, and 2014 acoustic monitoring surveys, 13 potential northern long-eared bat calls (0.6% of all bat calls) were identified within the Project Area (see Section 3.10). These results do not suggest high levels of northern long-eared bat migratory activity within the Project Area. Little is known about the migration patterns of northern long-eared bats, specifically how and where they disperse across the landscape during migration; however, northern long-eared bats have been known to occur in Vermilion County, and the Project Area is located within their migratory range. The closest known hibernaculum is Copperhead Mine, located in Vermillion County, Indiana, approximately 40 mi (64 km) southeast of the Project. Whitaker and Risler (1992) found northern long-eared bats in this mine in 1990; however, in 2014, IDNR found no northern long-eared bats and the mine appeared WNS positive (K. Shank, pers. comm.). Additionally, there are 2014 records of maternity colonies along the Middle Fork of the Vermilion River in Ford and Champaign counties (IDNR 2015). Therefore, the northern long-eared bat does have the potential to be at risk of collision with operating turbines and is consequently considered a Covered Species in this HCP.

As a result of effective avoidance and minimization efforts by Hoopeston Wind during siting and construction, as well as similarly effective avoidance and minimization efforts during future decommissioning, operation of the Project is the only activity covered by this HCP that may potentially result in take of northern long-eared bats. The primary method to further avoid and minimize impacts to Covered Species beyond the careful siting of turbines and other Project features that has already occurred, is feathering the turbine blades below the cut-in speed.

3.0 Environmental Setting and Biological Resources

The Project Area is located in east-central Illinois along the Illinois-Indiana border. The Project Area is within the Till Plains section of the Central Lowland physiographic province (Illinois State Geological Survey 2015). This region is characterized by flat to gently rolling topography produced by glacial processes. Vermilion County is primarily agricultural, but includes small towns with residential, commercial and industrial activity, connected by a comprehensive network of local and state roads, an interstate highway, active railways, and major and minor transmission lines. Forested areas are limited to fragmented, linear tracts and small forested bands associated with larger streams in this county.

3.1 Land Use

Land use within the Project Area and surrounding counties is dominated by agriculture. Pasture and row crops, mostly of corn and soybeans, comprise the majority of land in Vermilion County. Other land uses in the county include: residential; urban; manufacturing; commercial; transport; recreational; and utilities. Larger urban areas include: Hoopeston, Danville, and Georgetown. Major transportation routes include: Interstate 74; U.S. Highways 136 and 150; and State Highways 1, 49, 119, and 9.

3.2 Topography

Vermilion County is located in parts of both the Kankakee Plain and Bloomington Ridge Plain regions of Illinois. The plains formed when the bedrock and topographic features of the region were covered by glacial till deposits during the Wisconsin glaciations 70,000 years ago (Illinois State Geological Survey 2015). The plains are crossed by several low, poorly developed end moraines, which provide the only topographic relief (Luman et al. 2015). Elevation within Vermilion County ranges from 290 to 720 feet (ft; 58 to 219 meters [m]) above mean sea level; there is even less topographic relief in the immediate area of the Project.

3.3 Geology

The geology of the northern half of Illinois is the product of the Wisconsin glaciations. Surficial geology is dominated by glacial deposits of sedimentary rocks, which range in thickness from 25 to 50 ft (8 to 15 m) in central Vermilion County, to 400 to 500 ft (122 to 152 m) in northern Vermilion County (Illinois State Geological Survey 2015). Bedrock within Vermilion County is diverse and includes formations of the Devonian, Mississippian, and Pennsylvanian periods (Kolata 2005). Devonian bedrock is approximately 417 to 354 million years old and consists of limestone, sandstone, and shale formations. The limestone, shale, and siltstone rocks of the Mississippian period formed approximately 354 to 323 million years ago. Pennsylvanian rocks consist of limestone, sandstone, clay, and shale and contain the bituminous coal resources of Illinois; these rocks formed approximately 323 to 290 million years ago (Illinois State Geological Survey 2015).

3.4 Soils

Vermilion County is comprised primarily of Drummer silty clay loam (16.5%), Ashkum silty clay loam (11.1%), Flanagan silt loam (9.6%), Elliott silt loam (8.4%), and small acreages of many other soil types. Most of the soils in the county are hydric. The Ashkum, Drummer, and Elliott series are prime farmland if drained. The Flanagan series is prime farmland. Most of the smaller acreage soils in the county are prime farmland, farmland of statewide importance, or prime farmland if drained (United States Department of Agriculture [USDA]-Natural Resource Conservation Service [NRCS] 2015).

The Drummer series consists of very deep, poorly drained soils formed in loess or other silty material and in the underlying loamy stratified outwash on nearly level or depressional parts of outwash plains, stream terraces, and till plains. The Ashkum series consists of very deep, poorly drained soils on till plains. They formed in colluvial sediments and in the underlying silty clay loam till. The Flanagan series consists of very deep, somewhat poorly drained soils that formed in loess or other silty material and the underlying loamy calcareous till on till plains. The Elliott series consists of very deep, somewhat poorly drained soils on till plains that formed in loess or other silty material and in the underlying silty clay loam till (USDA-NRCS 2015).

3.5 Hydrology

The Project Area encompasses an area within the watershed of several rivers in Illinois. The Project Area is in the Vermilion (Wabash Basin) watershed. A small area in the northwestern part of Vermilion County is within the Iroquois watershed, the southern portion of the county is in the Wabash River Valley watershed, and the southwestern corner is within the Embarras watershed (McConkey et al. 2011).

Small, intermittent streams and drainages are common within the Project Area. A few perennial streams also occur within the Project Area, including Bluegrass Creek and Fountain Creek. Larger waterways that are located outside of the Project Area include the Wabash River and the North Fork and Middle Fork of the Vermilion River.

National Wetlands Inventory (NWI) data indicate that few, small wetlands are scattered throughout the Project Area, occurring along the waterways. There are approximately 12.87 acres (5.21 ha) of NWI wetlands located within the Project Area, comprising only 0.26% of the wetlands in Vermilion County, and no forested wetlands or wetland habitats are shown within the Project Area in the National Land Cover Database (NLCD).

3.6 Land Cover

Land cover in northeastern Vermilion County was historically dominated by prairie ecosystems with small forested areas along the rivers and streams (Illinois Natural History Survey [INHS] 2015). Based on the NLCD, land cover within Vermilion County was dominated by agriculture (80.5%), mostly row crops of corn and soybeans. The Project Area is even more heavily agricultural, with 95% of land cover being cultivated crops (Table 3-1). Developed lands cover nearly all of the remaining land within the parcels. Forested areas are limited to fragmented, linear tracts and small forested bands associated with larger

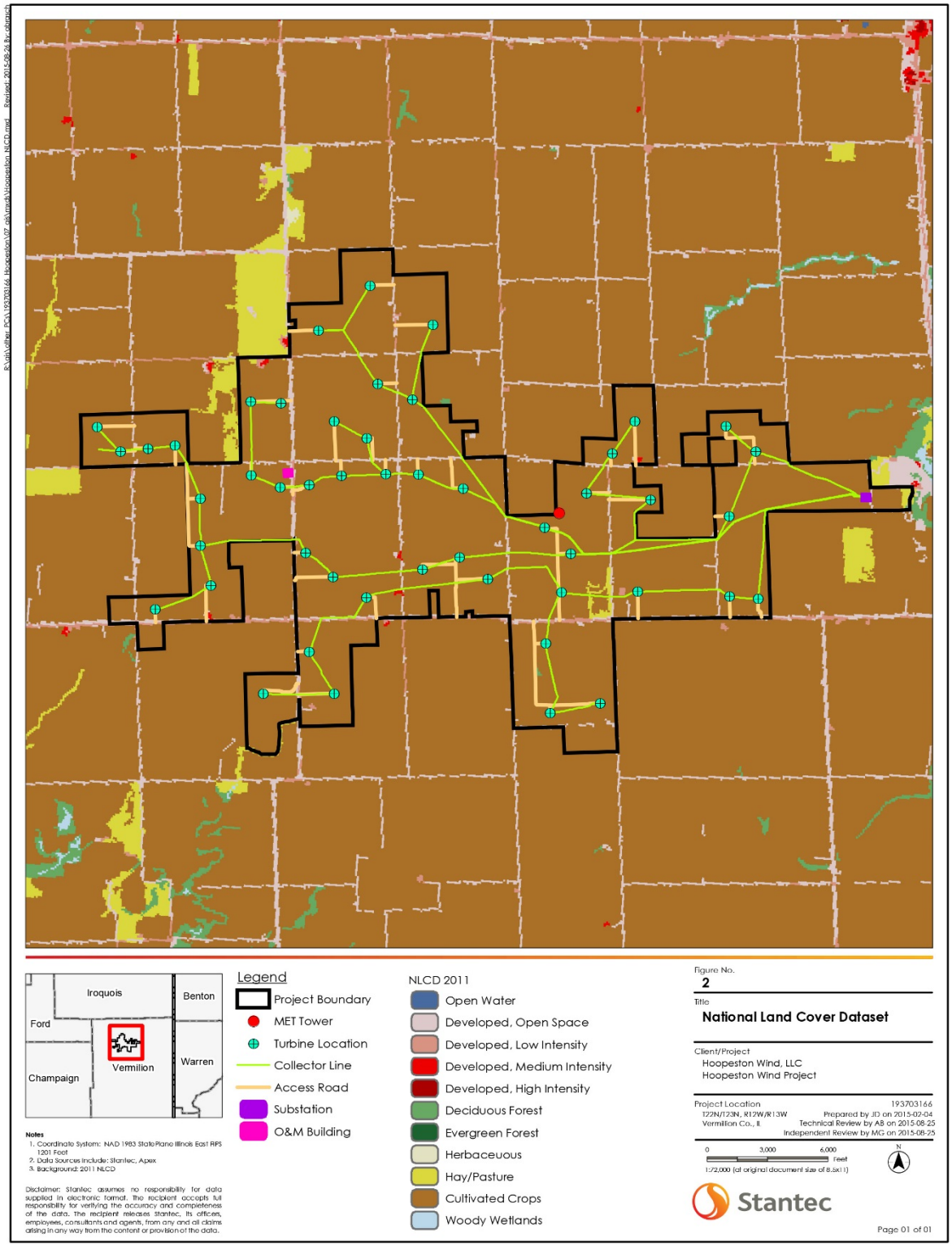
streams (Illinois Geospatial Data 2000). Figure 2 shows the distribution of land cover within the Project boundary.

Table 3-1. National Land Cover Data within the Hoopeston Wind Project Boundary

Land Cover Type	Acres	Approximate Percent Composition (%)
Developed, Urban Open Space	345.5	4.0
Developed, Low Intensity	78.1	1.0
Developed, Medium Intensity	9.5	<0.1
Deciduous Forest	2.6	<0.1
Hay/Pasture	41.8	<0.1
Cultivated Crops	8406.4	95.0
Total	8883.9	100

Source: NLCD 2011

Figure 2: National Land Cover Data Set



3.7 Wildlife in the Project Area

Wildlife in the Project Area is likely typical of the region and adapted to fragmented habitats and human disturbance associated with agricultural activity. Disturbance-tolerant mammalian species such as white-tailed deer (*Odocoileus virginianus*), raccoons (*Procyon lotor*), squirrels (*Sciurus* spp.) and coyotes (*Canis latrans*) are common and widespread in the region. Common species of vultures, hawks, owls, and various songbirds are expected to represent the majority of avian species within the Project Area. Many species of fish, amphibians, and reptiles may occur in the creeks and drainages of the Project Area and surrounding landscapes.

3.8 Threatened and Endangered Species

Vermilion County is within the range of four federally listed wildlife species; two bats (Indiana bat and northern long-eared bat) and two mollusks (clubshell [*Pleurobema clava*] and rabbitsfoot [*Quadrula cylindrica cylindrical*]) (USFWS 2015a). Additionally, IDNR and USFWS plan to re-introduce the federally listed extirpated riffleshell (*Epioblasma torulosa*) to the nearby Vermilion River (IDNR 2009a). Of these species, only the two species of bats may potentially be affected by the activities covered under this HCP and are thus treated as Covered Species. Since no potential impacts will occur to the three federally listed mussel species, they are not covered by the ITP and are not further discussed in this HCP. The biology, habitat requirements, and status within the Project Area of the two bat species are discussed in detail in Section 5.0. Expected impacts from the Project's covered activities and the conservation plan for the two bat species are described in Section 6.0.

3.9 Other Sensitive Species

3.9.1 Non-Listed Bats

A total of 14 species of bat occur in Illinois. Twelve of the 14 species are members of the family Vespertilionidae and have geographic distributions that include Vermilion County: Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), Indiana bat, evening bat (*Nycticeius humeralis*), little brown bat (*Myotis lucifugus*), northern long-eared bat, silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), southeastern bat (*Myotis austroriparius*), gray bat (*Myotis grisescens*), tri-colored bat (*Perimyotis subflavus*), and big brown bat (*Eptesicus fuscus*) (Schwartz and Schwartz 1981, Harvey 1992, Bat Conservation International Inc. 2015). Of these, only the Indiana bat and northern long-eared bat are currently federally and state listed as endangered and threatened, respectively. The USFWS is also collecting information for a status review of the little brown bat to determine if threats to the species may be increasing its risk of extinction.

All twelve bat species use woodland habitat for feeding or roosting at some time during the year. In addition, many species of bats feed along stream corridors or over water. A very limited number of shelterbelts of woodland or stream corridors are found within the Project Area (Hale et al. 2014). These areas may, at times, provide potentially suitable foraging and roosting habitat for bats. Bats, particularly big brown bats and evening bats, may occasionally forage over crops within the Project Area, but most species in the region are more likely to use forested and open water habitats (BatCon 2015).

Acoustic surveys confirmed the potential presence of seven bat species within the Project Area: big brown bat, red bat, hoary bat, silver-haired bat, tri-colored bat, evening bat, and northern long-eared bat (Appendix A). Several *Myotis* sp. calls were recorded during the acoustic surveys but, due to the quality of the calls and the overlap in call characteristics between the little brown bat, northern long-eared bat, and Indiana bat, positive identification to species was not possible (Ecosystem Management Inc. 2011, Stantec 2015). Although the Indiana bat and northern long-eared bat are the only species covered under this HCP, it is expected that the avoidance and minimization measures implemented under this HCP will benefit other bat species occurring in the Project Area as well.

3.9.2 Bald and Golden Eagles

Bald eagles and golden eagles are protected under the federal BGEPA (16 USC §§668-668d). The bald eagle was officially delisted from by the state of Illinois in 2009 (IDNR 2009b). Bald eagles have been noted by the USFWS (USFWS 2008) to occur in many Illinois counties, and the Project Area is within the historic breeding, wintering, and migration range of the bald eagle. The bald eagle population in Illinois continues to increase, with 100 pairs recorded in 2006 (USFWS 2008). By 2008, the number of counties where nesting occurs had risen to 67 counties (IDNR 2009b). The population trend for wintering bald eagles in Illinois fluctuates, due mainly to weather conditions, but recent counts have indicated a healthy age structure of both adults and immatures (IDNR 2009b). Bald eagles winter primarily along the Mississippi, Rock, and Illinois Rivers in the state, none of which is within or adjacent to the Project Area. The Illinois River is closest to the Project Area but is more than 140 mi (225 km) away at its nearest point. Bald eagles have also been recorded along the Wabash River in Indiana; however, this river is more than 30 mi (48 km) away from the Project Area at its nearest point (INDNR 2013).

Based on the lack of suitable wintering or breeding habitat in the Project Area, and lack of observations during avian studies completed during development of the Project, bald eagles are expected to occur only rarely, if at all, within the Project Area. No known nesting occurrences were listed by IDNR for Vermilion County from 1997 to 2008 (IDNR 2009a), and consultation with IDNR in 2009 indicated that there was an eagle nest recorded about 13 mi (21 km) from the Project Area on the North Fork of the Vermilion River above Lake Vermilion. IDNR indicated that it is likely that new eagle nests will appear along the North Fork and Middle Fork of the Vermilion River during the existence of the Project (IDNR 2009a).

Consultation with the USFWS in 2014 indicated the Project Area is approximately 7.25 mi (11.67 km) from the nearest known bald eagle nest, which is located along the Middle Fork of the Vermilion River. The Project Area does not contain large permanent water sources or forested riparian areas that would be expected to provide bald eagle foraging, nesting, or roosting habitat. Also, no bald eagles were observed in the Project Area during pre-project avian surveys. Hoopeston Wind has committed to implementing a wildlife carrion (i.e., road kill) removal program in the Project Area, as described in the BBCS. This will include coordination with local livestock operators and landowners for the prompt removal or covering of carcasses, as practical. These measures are expected to reduce the likelihood that wintering eagles or other raptors and aerial scavengers will be attracted to the area to forage.

Given this information, the USFWS believes that the risk of eagles colliding with turbines at the Project is low, and as such, does not recommend that Hoopeston Wind apply for an eagle take permit at this time.

Hoopeston Wind will conduct post-construction mortality monitoring to confirm this conclusion. Should post-construction monitoring indicate a change in the expected risk to eagles, Hoopeston Wind will reinitiate coordination with the USFWS. Consequently, bald eagles are not treated as Covered Species in this HCP.

Golden eagles are not currently known to occur in Illinois except as occasional transient visitors. Golden eagles will occupy a wide variety of plant communities within open habitats, but prefer cliffs and large trees with large horizontal branches for roosting, perching, and nesting (Tesky 1994). The species does not nest in Illinois (Kochert et al. 2002), and was not observed during the resident/breeding bird or migratory bird surveys conducted within the Project Area (Ecosystem Management Inc. 2011, Apex 2013). Inquiries to the USFWS and IDNR in 2014 and 2009, respectively, indicated that no golden eagle nest locations are known to occur within 10 mi (16 km) of the Project Area. Golden eagles are, therefore, not expected to occur within the Project Area and are not treated as a Covered Species in this HCP.

3.10 Pre-Construction and Operational Bat Surveys

3.10.1 Bat Habitat Assessment

A habitat assessment for the Indiana bat and northern long-eared bat was conducted at the Project in 2014 (Hale et al. 2014). The majority of the habitat within the Project Area consists of tilled agricultural lands and lacks suitable summer habitat for both the Indiana bat and the northern long-eared bat. However, 73 locations were identified by desktop and field review and evaluated in the field. Each area was classified into four habitat types: non-habitat (no forest), shrubland, immature forest, and mature forest. Dead or dying trees and their characteristics were also recorded during the assessment.

Field study confirmed that the majority of the habitat within the Project Area consists of tilled agriculture lands and lacks suitable summer habitat for both the Indiana bat and northern long-eared bat. A few mature shelterbelts were identified within the Project Area; however, most of the suitable habitat areas lie outside of the Project Area.

Fourteen of the 73 locations were classified as shrubland, 32 were classified as immature forest, and 27 were classified as mature forest. The shrubland areas were considered unsuitable habitat. Fifteen of the classified forest habitats were considered suitable for both Indiana bat and northern long-eared bat, and these consisted of nine shelterbelts, two areas of isolated roost trees, three riparian forested areas, and a six acre (2.4 ha) forest block (Hale et al., 2014). The full assessment report is included in Appendix A.

3.10.2 Acoustic Monitoring (2009, 2010, and 2014)

Acoustic surveys were conducted in the Project Area to assess bat activity and to detect the presence of various bat species in spring and fall 2009; spring and fall 2010; and fall 2014. This section provides a summary of the survey results; the full survey reports are included in Appendix A. The 2009 and 2010 surveys utilized both passive (stationary) and active (mobile) echolocation detectors, and the 2014 surveys utilized passive detectors.

3.10.2.1 Passive Monitoring 2009 and 2010

Passive acoustic bat surveys were conducted by Ecosystem Management Inc. (2011) at three sampling locations during the spring and fall of 2009 (April 16–May 3 and September 14– September 8) and at six sampling locations during the spring and fall of 2010 (April 12–May 3 and August 31–September 29). Sampling locations were determined based on the presence of bat habitat features, such as woodlots, tree rows, and riparian areas. In 2010, one of the sampling locations was on a Project met tower, located 190 ft (58 m) above ground level (agl).

The majority of calls recorded during these studies could not be identified to the species level, due to the overlap between call characteristics or the quality of the call (e.g., number of pulses, etc). Several *Myotis* sp. calls were recorded, but, due to the overlap in call characteristics between the little brown bat, northern long-eared bat, and Indiana bat and the quality of the calls, positive identification to species was not possible.

For the 2009 surveys, approximately 38.2% of the 518 classifiable calls recorded during the spring and fall were identifiable to species or species group (e.g., *Myotis* sp.). During the spring and fall of 2010 surveys, approximately 15.4% of the 2,693 classifiable calls were identifiable to species or species group. No bats were detected within the Project Area during the late summer survey.

A total of seven species or species groups were identified:

- Big brown bat
- Red bat
- Hoary bat
- Silver-haired bat
- Tri-colored bat (previously eastern pipistrelle)
- Evening bat
- *Myotis* species

3.10.2.2 Active Monitoring 2009 and 2010

Ecosystem Management Inc. (2011) conducted active acoustic surveys for four-hour periods during the spring and fall of 2009 and 2010. No bats were detected in either spring survey period. During the fall, bats were detected on all three survey nights in 2009 (September 21, 22, and 28), including 10 big brown bat calls, 3 red bat calls, 1 *Myotis* species call, and 8 calls that could not be identified to species or species group. In 2010, bats were detected on both survey nights (August 31 and September 1), including 17 big brown bat calls and 30 calls that could not be identified to species or species' group.

3.10.2.3 Passive Monitoring 2014

Additional acoustic surveys were conducted by Stantec (2015) at two sampling locations during the fall of 2014 (July 31–October 31). Surveys were focused on the fall migratory period. The sampling location in the open agricultural field contained two acoustic detectors (6.6 ft [2 m] agl and 164 ft [50m] agl) mounted

on a Project met tower. The second location was within a narrow band of trees with a detector positioned approximately 6.6 ft (2 m) agl.

Similar to the 2009 and 2010 surveys, a portion of the calls could not be identified to the species level due to the overlap between call characteristics or the quality of the call (e.g., number of pulses, etc). Several *Myotis* sp. calls were recorded during the acoustic surveys but, due to the overlap in call characteristics between the little brown bat, northern long-eared bat, and Indiana bat and the quality of the calls, positive identification of all of the calls to species was not possible.

Approximately 80.9% of the 1,261 classifiable calls were identifiable to species or species group.

A total of nine species or species groups were identified:

- Big brown bat
- Red bat
- Hoary bat
- Silver-haired bat
- Tri-colored bat (previously eastern pipistrelle)
- Evening bat
- Little Brown bat
- Northern long-eared bat
- *Myotis* species

3.10.3 Fall Migration Study (2014 and 2015)

In cooperation with USFWS, Apex and Southern Illinois University, Boyles and McGuire (2014) completed a telemetry-based autumn migration study of Indiana and northern long-eared bats by radio-tagging bats captured approximately 6 mi (9.7 km) west of the Project to determine if they passed through the Project site. A receiving antenna array with a datalogger was installed at the Project to detect movement across the Project Area by radio-tagged bats. Additional receiving arrays with dataloggers were installed at six other locations in the region, which collectively enabled the authors to evaluate movement of radio-tagged bats throughout the region from the point of capture. Twenty-six bats representing five species were captured from August 8 to 24, 2014, at the Middle Fork Forest Preserve, and eight bats (three northern long-eared bats and five Indiana bats) had transmitters attached. No bats with transmitters were detected within the Project Area.

Boyles and McGuire conducted a similar study during fall migration in 2015 in which three Indiana bats and no northern long-eared bats were captured at the North Fork Forest Preserve. The Indiana bats were radio-tagged and none were recorded as crossing the Project site during migration (J. Boyles, pers. comm.).

3.10.4 Operational Monitoring

Operational monitoring for bats has been completed at the Project in accordance with the BBCS and Technical Assistance Letters (TALs) issued for the project (West 2016, Stantec 2016, West 2017).

Fatality estimates using the Huso (2011) and Schoenfeld (2004) estimators, and the associated operational protocols are presented in Table 3-2. To date no listed bats or other *Myotis* have been found incidentally or during monitoring studies.

Table 3-2. Bat mortality estimates at Hoopeston Wind Project based on operational monitoring completed fall 2015 through August 2017.

Season	Cut in speed	Huso Estimate		Schoenfeld Estimate	
		Bats/MW	Bats/Turbine	Bats/MW	Bats/Turbine
Fall 2015	6.9 m/s	0.68	1.36	0.57	1.15
Spring 2016	n/a	0.19	0.39	0.13	0.26
Fall 2016	5 m/s	n/a[2]	n/a	2.2	4.3
Spring 2017	n/a	0.14	0.29	0.13	0.27
Fall 2017[1]	5 m/s	-	-	-	-

[1] Fall 2017 data is ongoing at time of HCP completion. No listed bats have been found as of August 30, 2017
[2] The Huso estimate was not presented in analysis of this season

4.0 Description of the Project

4.1 Project Purpose and Need

The purposes and need for the Project are:

- To provide an affordable and reliable source of renewable energy to serve the regional electrical grid and energy demand that neither emits pollutants, contributes to climate change and its effects, nor generates the adverse impacts that accompany fossil fuel extraction, processing, waste and by-product disposal, transportation, and combustion.

- To meet the renewable energy goals of the U.S. and Illinois (Illinois enacted legislation, Public Act 95-0481, established that electric utilities in Illinois are required to provide at least 25% of their retail electric supply from renewable energy sources, including wind, by 2025).

- To support and diversify the local and regional economies through job creation and increased tax revenue.

The need for the ITP reflects the uncertainty associated with Indiana and northern long-eared bat migratory activity. Although significant consideration and field study has been completed to confirm that the Project Area is an area with relatively low levels of bat activity, because the location of the Project Area is within the range of both the Indiana and northern long-eared bat, the possibility of their presence – principally as a result of seasonal migration through the Project Area – cannot be completely ruled out.

This HCP, therefore, serves the purpose of documenting the steps taken by Hoopeston Wind to avoid and minimize the impact of the Project on Indiana and northern long-eared bats and to provide mitigation for the Project's projected impacts.

4.2 Project Description

The Project is a state-of-the-art wind energy facility located in Vermilion County, Illinois, southwest of the city of Hoopeston and west of the village of Rossville. The Project is designed to generate up to 98 MW of electricity and interconnects with a 138-kilovolt (kV) transmission line owned by the Illinois utility subsidiary of Ameren Illinois Corporation. The Project also includes underground power collection lines, a substation, an O&M building, access roads, and a permanent met tower (see Figure 1).

4.2.1 Site Selection

The Project site was first identified through a review of available wind resource mapping. As a renewable resource, wind is classified according to wind power classes, which are based on typical wind speeds. These classes range from Class 1 (the lowest) to Class 7 (the highest). Strong wind resources were indicated in the Vermilion County area.

In addition to a strong, reliable wind resource, a wind project requires interconnection to the overall electrical grid via an existing transmission line with sufficient capacity to accommodate the full output of the wind turbines. Hoopeston Wind identified an existing 138 kV high voltage transmission line near the Project Area early on, and this, combined with the robust wind resource, led Hoopeston Wind to continue its development efforts in Vermilion County.

At this site, significant agricultural land use occurs throughout the Project Area, comprising over 95% of the area within the Project Area (see Section 3.6 and Figure 2). Except for the immediate Project footprint, this use would be expected to continue. The character of the overall landscape, therefore, will be minimally changed.

Avoiding negative natural resource and community impacts is a priority for all Apex projects. Of the total approximately 8,884 acres (3,595 ha) within the Project boundary, only a small percentage was affected by project infrastructure. Throughout development of the Project layout, the focus of turbine placement and permanent Project infrastructure was optimized to minimize the Project footprint, resulting in a total permanent impact of approximately 34 acres.

4.2.2 Project Characteristics

The Project Area is located southwest of the city of Hoopeston and west of the village of Rossville in Illinois (see Figure 1). Land use throughout much of the Project Area is dominated by agriculture (i.e., row crops and pasture), interspersed with creeks and drainages.

The Project is located on land leased from participating landowners. As a leaseholder, Hoopeston Wind's rights are limited to those incorporated in the lease agreement to allow for safe and effective construction,

operation, maintenance and decommissioning of the Project. Hoopeston Wind has no control over landowner activities on the property within which the Project will be located to the extent not covered in specific lease provisions.

Additional detail of various Project components is provided in the following sections.

4.2.2.1 Turbines

There are 49 Vestas V100 2.0 MW turbines associated with the Project. Each wind turbine consists of three major components: the tower, the nacelle, and the rotor. The height of the tower, or "hub height" (height from foundation to top of tower) is approximately 312 ft (95 m). The nacelle sits atop the tower, and the rotor hub is mounted to the front of the nacelle. The total turbine height (i.e., height at the highest blade tip position) is approximately 476 ft (145 m). Descriptions of each of the turbine components are provided below.

Tower: The tubular towers used for this Project are conical steel structures manufactured in multiple sections. Each tower has an access door, internal lighting, and an internal ladder to access the nacelle. The towers are painted light gray to make the structure visible to aircraft (viewing against the ground) but decrease visibility against the sky. Steel reinforced concrete foundations were constructed to anchor each tower.

Nacelle: The main mechanical components of the wind turbine are housed in the nacelle. These components include the drive train, gearbox, and generator. The nacelle is housed in a steel reinforced fiberglass shell that protects internal machinery from the environment and dampens noise emissions. The housing is designed to allow for adequate ventilation to cool internal machinery. The nacelle is equipped with an external anemometer and a wind vane that signals wind speed and direction information to an electronic controller. The nacelle is mounted on a bearing that allows it to rotate (yaw) into the wind to maximize energy capture. Attached to the top of each nacelle located on the outside perimeter of the Project Area and some additional locations within the Project Area, per specifications of the Federal Aviation Administration (FAA), is a single, medium intensity aviation warning light. These lights are flashing red strobes (L-864) and operate only at night. Transformers are located in the nacelle.

Rotor: A rotor assembly is mounted to the nacelle to operate upwind of the tower. Each rotor consists of three composite blades with a rotor diameter of 328 ft (100 m). The rotor attaches to the drive train at the front of the nacelle. Hydraulic motors within the rotor hub feather each blade according to wind conditions, which enables the turbine to operate efficiently at varying wind speeds. The rotor can spin at varying speeds to operate more efficiently at lower wind speeds. The wind turbines begin generating energy (i.e., cut in) at wind speeds as low as 6.7 miles per hour (mph; 3.0 meters/second [m/s]) and cut out when wind speeds reach 44.7 mph (20 m/s) for 10 minutes, or with a gust of 60 mph (25 m/s) or higher.

4.2.2.2 Access Roads

The Project includes new or improved roads to provide access to the turbines and substation site, including a ring-road around each turbine. The location of Project access roads is shown in Figures 1 and

2. The roads are gravel-surfaced and approximately 16 ft (4.9 m) in width, though areas up to 90 ft (27.4 m) in width were disturbed during the spreading of topsoil.

4.2.2.3 Collection System and Substation

The Project includes an underground power collection system between the pad mounted transformers and a collector substation. All collector lines are buried a minimum of 4 ft (1.2 m) or 1 ft (0.3 m) below existing drain tile. A substation is located approximately 0.2 mi (0.3 km) southwest of Rossville.

4.2.2.4 Transmission Line

Approximately 270 ft (82.3 m) of overhead 138 kV transmission line extends from the substation to the switchyard. A pad-mounted transformer was installed at the base of each wind turbine and collects electricity generated by each turbine through cables routed down the inside of the tower.

4.2.2.5 Meteorological Towers

One 312 ft (95 m) tall permanent met tower has been installed to collect wind data and support performance testing of the Project (shown on Figures 1 and 2). The tower is a self-supporting, lattice steel structure and is unguyed.

4.2.2.6 Operations and Maintenance Building

An O&M building is located on site approximately 5.6 mi (9 km) west of Rossville on N 750 East Road. This site houses operations personnel, equipment, and materials, and provides staff parking.

4.3 Covered Activities

4.3.1 Operations and Maintenance

The potential for incidental take of Covered Species exists during the operational life of the Project. Due to the absence of Indiana and northern long-eared bat habitat within the Project Area, and the fact that maintenance activities will be taking place during daylight hours, no measurable take is anticipated to occur as a result of Project maintenance activities.

The potential for take arises from the operation of the turbines at times when Indiana and northern long-eared bats may be present in the Project Area, as the potential exists for individuals to be injured or killed through interactions with rotating turbine blades. The potential impacts of Project operation are fully described and evaluated in Section 6.

To avoid risk to these species during operations prior to issuance of an ITP for the Project, Hoopeston Wind developed and implemented a BBCS, in coordination with USFWS, providing for the curtailment of Project operations during periods of expected risk to Indiana bats and northern long-eared bats. The USFWS issued a TAL to Hoopeston Wind on March 4, 2014, indicating that, if the Project operates in accordance with the terms of the BBCS, it is presumed that take of Indiana bats and northern long-eared

bats will be avoided. At the time, the northern long-eared bat had only been proposed for listing, but the TAL and BBCS were designed to address the species in the event that it was listed. Hoopeston Wind operated under the terms of the TAL during the fall of 2015, and collected no *Myotis* or listed carcasses and a very low number other bat carcasses. During the fall of 2016 (August 1- October 15), the project operated with turbine blades feathered below a cut-in speed of 5.0 m/s, and again collected no *Myotis* or listed carcasses and a very low number of other bat carcasses. USFWS provided another TAL in 2017 (while the HCP was being finalized), based on pre-construction habitat surveys, bat acoustic monitoring, migration studies, and bat fatality monitoring at both 6.9 m/s and 5.0 m/s during the fall migration season. The TAL concluded that operating the project at 5.0 m/s during the 2017 fall migration season (August 1 through October 15) was unlikely to result in take of Indiana bats.

Upon issuance of an ITP, the ITP will authorize the take of Indiana bats and northern long-eared bats resulting from the operation of the Project with avoidance and minimization measures more fully described in Section 7.2, including:

- Operational adjustments that will feather the turbine blades below the cut-in speed of 6.7 mph (3.0 m/s), thereby reducing Indiana and northern long-eared bat mortality; and
- Monitoring the operational Project to allow for appropriate adaptive management.

4.3.2 Decommissioning

Commercial wind turbine generators typically have a life expectancy of 20 to 25 years, although their operational life may be extended through maintenance or repair. At the end of their useful life, or if turbines are non-operational for an extended period of time with no expectation of their returning to operation, the turbines will be decommissioned. Decommissioning consists of removal of Project components/improvements as well as site/land reclamation. Areas disturbed during decommissioning will be re-graded, reseeded, and restored. Because decommissioning activities do not involve the operation of wind turbines, Hoopeston Wind anticipates that these activities will not pose a risk of take to Indiana or northern long-eared bats.

4.3.3 Mitigation and Monitoring

This HCP includes mitigation actions (see Section 7.2.2) that will be conducted to offset the impacts of Indiana and northern long-eared bat take that may result from the Project. A range of mitigation actions were considered, including enhancement or protection activities at hibernacula, maternity colony and swarming habitat enhancement or protection, or funding contribution to other important research on threats to these species. The mitigation options selected are described in Section 7.2.2.

Post-construction monitoring will occur during the life of the ITP to ensure compliance with the ITP (see Section 7.3). During monitoring, injured or dead Indiana and/or northern long-eared bats may be collected. Dead Indiana or northern long-eared bats, if any, will be turned over to the USFWS.

4.4 Alternatives

Section 10(a)(2)(A) of the ESA and federal regulation 50 CFR 17.22(b)(1) and 17.32(b)(1) require an HCP to provide a description of alternative actions that were considered to reduce impacts to listed species, in this case, the Indiana and northern long-eared bats. Section 5.6 of the Habitat Conservation Planning Handbook (USFWS and National Marine Fisheries Service [NMFS] 2016d) states the HCP should describe "actions the applicant considered as alternatives to take that would result from the proposed action and the reasons why they are not using those alternatives". Alternatives typically include the following:

- A No-Action Alternative, which means that federal action (i.e., issuance of an ITP by the USFWS), will not occur because Covered Activities will not occur, and no HCP will be needed to minimize and mitigate impacts to the listed species, and

- Any alternative that will reduce incidental take below levels anticipated as a result of Covered Activities.

Each of the alternatives Hoopeston Wind considered is discussed below.

4.4.1 Take Avoidance Alternative

Under this alternative, take of Indiana and northern long-eared bats will be completely avoided by:

- Raising nighttime cut-in speeds to 15.4 mph (6.9 m/s) from sunset to sunrise, for the period from August 1 to October 15 each year for the life of the Project. The hub will not be locked, but blades will be feathered to the wind such that revolutions per minute (rpm) will be minimal during nighttime periods when wind speed is less than 15.4 mph (6.9 m/s).

- Conducting post-construction monitoring for the life of the Project, as described in the BBCS, to confirm avoidance of take.

Because take will be completely avoided, no HCP will be implemented, no mitigation will be implemented, and no ITP will be issued. This alternative was considered but rejected because it did not meet the Project's need (see Section 4.1), and because it was determined to be not practicable or economically sustainable over the projected operating life of the Project.

4.4.2 Reduced Cut-In Speed Alternative (Proposed Scenario)

The Reduced Cut-In Speed Alternative is the result of consideration of the range of alternatives to select a Project scenario that meets Project goals while minimizing potential threats to the Indiana and northern long-eared bat.

Under the Reduced Cut-In Speed Alternative:

- Cut-in speed will be 6.7 mph (3.0 m/s) year-round. The hub will not be locked, but blades will be feathered to the wind such that rpm will be minimal during periods when wind speed is less than 6.7 mph (3.0 m/s). The feathering/cut-in process will be computer-controlled and based on 10-minute interval wind speed data. Accordingly, turbines will cut in or feather throughout the night as the wind speed fluctuates above and below 6.7 mph (3.0 m/s).

- Post-construction monitoring will be conducted for the life of the Project, consisting of intensive monitoring in spring (April 1–May 15) and fall (July 15–October 15) migration with weekly monitoring in summer (May 16–July 14) during the first three years of operations under the permit, annual monitoring (April 1–October 15) during the life of the permit, and check-in monitoring (April 1–October 15) in years 15 and 16 of operations (for detailed description of the monitoring plan, see Section 7.3).

- Based on the results of the monitoring, adjustments to cut-in speeds will be addressed in accordance with Section 7.4, Adaptive Management.

- Although risk to both Indiana and northern long-eared bats is considered extremely low, mitigation measures have been incorporated into the Project to provide a long-term benefit to both species that will mitigate for the impacts of permitted take. As more specifically described in Section 7.2.2, initial mitigation will include coordinating with local land preservation entities in the vicinity of the Project to restore and/or enhance at least 165 acres of Indiana and northern long-eared bat summer maternity habitat. The mitigation plan will be implemented in close cooperation with USFWS and IDNR.

4.4.3 Increased Cut-In Speed Alternative

Under this alternative, cut-in speeds would be elevated to 11.0 mph (5.0 m/s) during the bat active period (April 1 to October 31). All other elements of the Proposed Scenario would be implemented as described above in Section 4.4.2. Hoopeston Wind rejected this alternative from detailed analysis because under this alternative, Hoopeston would forego the full benefits of Project construction and operation without materially improving species conservation. Hoopeston Wind determined the proposed action includes sufficient measures to minimize and monitor take, making it unnecessary to implement higher cut-in speeds at wind turbines that will result in lower energy production.

5.0 Covered Species

5.1 Indiana Bat

The Indiana bat was originally listed on March 11, 1967, as being in danger of extinction under the Endangered Species Preservation Act of 1966 (32 FR 4001). The species is currently listed as endangered under the ESA of 1973, as amended.

A USFWS Indiana Bat Recovery Plan was first developed and signed on October 14, 1983 (USFWS 1983). An agency draft of the Revised Recovery Plan was released in March 1999 (USFWS 1999) but was never finalized. The "Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision" (the "draft Revised Recovery Plan") was made available for public comment on April 16, 2007 (72 FR 19015-19016) (USFWS 2007). The draft Revised Recovery Plan describes three recovery objectives for reclassification of the species as threatened (USFWS 2007):

1. Permanent protection of 80% of Priority 1 hibernacula.

2. A minimum overall population number equal to the 2005 estimate (457,000).

3. Documentation of a positive population growth rate over five sequential survey periods.

In addition, the draft Revised Recovery Plan describes three recovery objectives for delisting of the species (USFWS 2007):

1. Permanent protection of 50% of Priority 2 hibernacula.

2. A minimum overall population number equal to the 2005 estimate.

3. Continued documentation of a positive population growth rate over an additional five sequential survey periods.

Information regarding the species' characteristics, habitat requirements, range and status in the vicinity of the Project is provided in the sections below.

5.1.1 Species Description

Indiana bats are medium-sized, grayish brown bats with a forearm length of 1.4 to 1.6 inches (3.6 to 4.1 centimeters [cm]) and a total length of 2.8 to 3.8 inches (7.1 to 9.6 cm). The tragus (a fleshy projection arising from the base of the inner ear that directs sound into the ear) is short and blunt and measures slightly less than half the height of the ear. The tail is approximately 80% of the length of the head and body. The skull has a small sagittal crest and a small, narrow braincase. Indiana bats may be distinguished from the similar little brown bat and the northern long-eared bat by the presence of a keeled calcar and toe hairs on the hind feet that are shorter than the claws.

5.1.2 Habitat Description

Indiana bats require specific hibernacula conditions (e.g., stable temperature, humidity and air movement), and typically hibernate in large, dense clusters that range from 300 individuals per square foot (Clawson et al. 1980) up to 100,000 individuals per cluster. Studies have found that over 90% of the range-wide population of Indiana bats hibernate in just five states: Indiana, Missouri, Kentucky, Illinois, and New York (USFWS 2007).

The summer habitat requirements of Indiana bats are not fully understood. Until recently, it was believed that floodplain and riparian forests were the preferred habitats for roosting and foraging (Humphrey et al. 1977); however, recent studies have shown that upland forests are also used by Indiana bats for roosting and that suitable foraging habitats may include upland forests, old fields (clearings with early successional vegetation), edges of croplands, wooded fencerows, and pastures with scattered trees and/or farm ponds (USFWS 2007).

The presence of Indiana bats in a particular area during the summer appears to be determined largely by the availability of suitable, natural roost structures. The suitability of a particular tree as a roost site is determined by its condition (live or dead), the amount of exfoliating bark, the tree's exposure to solar radiation, its relative location to other trees, as well as a permanent water source and foraging areas (USFWS 2007).

Thirty-three species of trees have been documented as roosts for female Indiana bats and their young, with 87% of documented roosts located in various ash (*Fraxinus*), elm (*Ulmus*), hickory (*Carya*), maple (*Acer*), poplar (*Populus*), and oak (*Quercus*) species (USFWS 2007). However, the species of the roost tree appears to be a less important factor than the tree's structure (i.e., the availability of exfoliating bark with roost space underneath) and local availability. Studies show that Indiana bats have strong fidelity to summer habitats. Females have been documented returning to the same roosts from one year to the next (Humphrey et al. 1977, Gardner et al. 1991, Callahan et al. 1997) and males have been recaptured when foraging in habitat occupied during previous summers (Gardner et al. 1991).

5.1.3 Reproduction and Maternity Roost Habitat Requirements

Indiana bats mate during the fall, just prior to hibernation. Male and female bats congregate near the opening of a cave (usually their hibernaculum), and swarm, a behavior in which large numbers of bats fly in and out of cave entrances from dusk to dawn, while relatively few roost in the caves during the day (Cope and Humphrey 1977). Swarming lasts over a period of several weeks, with mating occurring during the latter part of that period. Once females have mated, they enter the hibernacula and begin hibernation, whereas males will remain active longer, likely attempting to mate with additional females as they arrive at the hibernacula. Adult females store sperm during the winter with fertilization delayed until soon after they emerge from hibernation.

Females emerge from the hibernacula ahead of the males, usually by mid-to-late April, and migrate by the beginning of May to their summer roost habitats, where they form small maternity colonies (Whitaker and Hamilton 1998). Maternity colonies generally have several separate roost areas located near one another that collectively provide the colony with the necessary roosting resources (including cover and correct temperature provided by exfoliating bark) needed during different environmental conditions. These colonies typically utilize one to a few primary roost trees (Callahan et al. 1997), which provide the proper roosting conditions most of the time, and are normally large, dead trees with exfoliating bark that are exposed to abundant sunlight (Miller et al. 2002, Whitaker and Brack 2002).

The habitat in which the primary roosts have been found varies considerably. Roost trees have been found in dense or open woods, strips of riparian forest, small patches of woods, as well as open land;

however, the roosts are normally located in open areas subjected to prolonged sunlight (Whitaker and Brack 2002, Miller et al. 2002). During extreme environmental conditions, such as rain, wind, or temperature extremes, the maternity colony may use alternate roost trees, which likely provide the bats with microclimate conditions that the primary roost trees cannot during times of sub-optimal environmental conditions. The locations of these alternate roosts vary from open areas or in the interior of forest stands. A study of bats in northern Missouri revealed that usage of dead trees in the forest interior increased significantly in response to unusually warm temperatures, and the usage of both interior live and dead trees increased during periods of precipitation (Miller et al. 2002). The primary roosts are typically inhabited by many females and young throughout the summer, whereas alternate roost trees receive only intermittent use by individuals or a small number of bats. Females give birth to a single young in June or early July (USFWS 2007).

5.1.4 Foods and Feeding

Indiana bats are a nocturnal insectivore that feeds exclusively on flying insects, with both terrestrial and aquatic insects being consumed. Diet varies seasonally and variation is seen between different ages, sexes, reproductive status groups, and geographic regions (USFWS 2007). A number of studies conducted on the diet of Indiana bats have found the major prey groups to include moths (Lepidoptera), caddisflies (Trichoptera), flies, mosquitoes and midges (Diptera), bees, wasps, and flying ants (Hymenoptera), beetles (Coleoptera), stoneflies (Plecoptera), leafhoppers and treehoppers (Homoptera) and lacewings (Neuroptera) (USFWS 1999), with Coleoptera, Diptera, Lepidoptera and Trichoptera contributing most to the diet (USFWS 2007).

Studies indicate that Indiana bats typically forage from 6 to 100 ft (1.8 to 30 m) above the ground and hunt primarily around, not within, the canopy of trees (USFWS 2007). Foraging areas are most often located in closed to semi-open forested habitats and forest edges, with radio-telemetry data consistently indicating that wooded areas are preferred as foraging sites, although open habitats such as old fields and agricultural areas may also be used (USFWS 2007). Sparks et al. (2005) found that woodlands were used by foraging Indiana bats nearly twice as often as availability alone would suggest, supporting the idea that Indiana bats preferentially forage in woodlands.

5.1.5 Migration

The timing of spring emergence from hibernacula varies across the range of the species, but in general, females emerge first, from mid-to-late April, and males emerge later, from late April to mid-May (USFWS 2007). Females may leave for summer habitat immediately after emerging or shortly thereafter and often travel quickly to where they will spend the summer. Some individuals may travel several hundred miles from their hibernacula, but studies in Indiana and New York found Indiana bats using summer habitat only 30 to 50 mi (48 to 80 km) from their hibernacula (USFWS 2007). Maternity colonies begin breaking up in early August at which time females head back to their hibernacula (USFWS 2007).

5.1.6 Rangewide Status

A population decrease of 28% over the Indiana bat's total range was reported from 1960 to 1975 (Thomson 1982). The rangewide population estimate dropped 57% from 1965 to 2001 (USFWS 2007). As of 2006, the USFWS had records of extant winter populations at approximately 281 hibernacula in 19 states and 269 maternity colonies in 16 states (USFWS 2007). The estimated rangewide Indiana bat population in 2015 was at 523,636 bats (USFWS 2015b). The closest known occupied hibernaculum to the Project is Blackball Mine located in LaSalle County, Illinois, approximately 130 mi (209 km) to the northwest of the site (USFWS 2007). As of 2007, this hibernaculum was considered a Priority 2 site, containing a population of 1,804 Indiana bats. There is one closer known hibernaculum, Copperhead Mine, in Vermillion County, Indiana; however, Indiana bats were last documented at this site in 1992 (Whitaker and Rissler 1992).

Current threats to the Indiana bat include modifications to hibernacula that change airflow and alter the microclimate, human disturbance and vandalism during hibernation resulting in direct mortality, natural events during winter affecting large numbers of individuals, disease, and habitat degradation and loss (USFWS 2007).

A relatively recent, and potentially devastating, threat to Indiana bats is a disease known as white-nose syndrome. WNS is a fungal infection that was first identified in eastern New York during the winter of 2006–2007. It was named for the visible presence of a white fungus around the muzzles, ears, and wing membranes of affected bats. A previously unreported species of cold-loving fungus (*Pseudogymnoascus destructans*), which thrives in the darkness, low temperatures (40–50ºF), and high levels of humidity (>90%) characteristic of bat hibernacula, is now known to be the primary pathogen.[2] Bats afflicted with WNS wake more frequently from hibernation, causing them to lose fat reserves that are needed to survive hibernation.[3] It is thought that WNS is transmitted primarily from bat to bat; however, the possibility exists that it may also be transmitted by humans inadvertently carrying the fungus from cave to cave on their clothing and gear.

Since first being reported in New York, WNS has been confirmed to be present in 28 states.[4] WNS has been confirmed present in 11 counties in Illinois to date, including LaSalle, Carroll, Adams, Pike, Jackson, Union, Johnson, Pope, Hardin, Saline and Monroe counties. The nearest known hibernaculum, Copperhead Mine, is in a county with confirmed WNS and/or the causative fungus (USFWS 2016a).

Most species of bats that hibernate in the east are now known to be affected, with the little brown bat, northern long-eared bat, and Indiana bat particularly hard hit.[5] The USFWS estimates the Indiana bat population in the USFWS's Appalachian Region, where WNS has more recently spread, dropped 45.8% from 2011 to 2013 based on the 2013 count of Indiana bats (USFWS 2013a) and an additional 70.1% from 2013 to 2015 based on the 2015 count of Indiana bats (USFWS 2015b). Previously, between 2009 and 2011, the Northeast Region dropped 30% based on the 2011 count of Indiana bats (USFWS 2012b),

[2] http://www.fort.usgs.gov/WNS
[3] http://www.fws.gov/northeast/pdf/white-nosefaqs.pdf
[4] http://www.whitenosesyndrome.org/about/where-is-it-now
[5] http://www.fort.usgs.gov/WNS

dropped another 39.5% between 2011 and 2013 (USFWS 2013a), and an additional 13.9% between 2013 and 2015 (USFWS 2015b).

5.1.7 Ozark-Central Recovery Unit Status

The draft Revised Recovery Plan for the Indiana bat divides the species' range into four recovery units based on several factors such as traditional taxonomic studies, banding returns, and genetic variation (USFWS 2007). The Project Area is located within the Ozark-Central Recovery Unit (OCRU), which includes the range of Indiana bat within the states of Illinois, Missouri, Arkansas, and Oklahoma (USFWS 2007). According to the 2015 Rangewide Population Estimate (USFWS 2015b), the overall Indiana bat population in Illinois was approximately 58,840 in 2013 and 56,055 in 2015 (Table 5-1; USFWS 2015b). This represents approximately 10.7% of the overall 2015 population estimate for Indiana bats and 23% of the Indiana bat population in the OCRU (243,142) (USFWS 2015b). The overall population estimate for the OCRU decreased by approximately 0.3% between 2013 and 2015, and the population estimate for the state of Illinois decreased by approximately 4.7% over the two year period (Table 5-1; USFWS 2015b).

Table 5-1. Indiana Bat Population Estimates for the Ozark-Central Recovery Unit

State	2007	2009	2011	2013	2015
Illinois	53,824	53,342	61,239	58,840	56,055
Missouri[1]	183,304	181,097	182,852	184,245	185,693
Arkansas	1,821	1,480	1,206	856	1,389
Oklahoma	0	0	13	5	5
Total	**238,949**	**235,919**	**245,310**	**243,946**	**243,142**

[1]A previously unknown Indiana bat hibernaculum was discovered in Missouri in 2012, which contained 123,000 bats when surveyed in January 2013, and over 167,000 when more completely surveyed in 2015. This hibernaculum has been added to each previous survey year due to first-hand accounts of large clusters/numbers of hibernating bats for the past several decades prior to discovery by bat biologists.

Source: USFWS 2015b

5.1.8 Illinois Status

The Indiana bat is listed as state endangered in Illinois. State-listed species are protected under the Illinois Endangered Species Protection Act-520 ILCS 10/1, with regulatory authority under state law the responsibility of IDNR. Estimates of the size of hibernating populations of the Indiana bat vary across the state of Illinois. Within the southern portion of the state, estimates ranged from 14,700 in 1965 to 19,491 in 2001, with the most recent estimate (2005) at 42,539 (USFWS 2007). Within the northern portion of the state, estimates ranged from 100 in 1965 to 1,562 in 2001, with the most recent estimate (2005) at 1,804 (USFWS 2007). Recorded maternity colonies are known from 20 counties (USFWS 2007). Known hibernacula in Illinois include:

- 1 – Priority 1 (current and/or observed historic winter populations of ≥10,000 bats and currently have suitable and stable microclimates)
- 6 – Priority 2 (current or observed historic population of 1,000–10,000 bats)
- 7 – Priority 3 (current or observed historic population of 50–1,000 bats)
- 8 – Priority 4 (current or observed historic population of <50 bats)

Of the 22 previously recorded hibernacula, 16 sites have recorded at least one bat since 1995 (USFWS 2007). WNS was confirmed in the Illinois population in 2013 (IDNR 2015). The closest known occupied Illinois hibernaculum to the Project is Blackball Mine located in LaSalle County, Illinois, approximately 130 mi (209 km) to the northwest of the site (USFWS 2007). As of 2007, this hibernaculum was considered a Priority 2 site, containing a population of 1,804 Indiana bats. The other known hibernacula records in Illinois are located in the southern and western tier of counties (USFWS 2007).

The Illinois Natural Heritage Database includes 71 records of extant Indiana bat populations throughout the southern 75% of the state (IDNR 2015). Indiana bat maternity colonies are considered annually present along the upper Middle Fork of the Vermilion River, with captures of post-lactating females from as recent as 2014 (IDNR 2015). The IDNR has issued five previous Incidental Take Authorizations (ITAs) for Indiana bats in Illinois, including three wind farms (IDNR 2015).

5.1.9 Status within the Project Area

Maternity colonies are known to occur in Vermilion County, and other summer records are known from adjacent Ford County (USFWS 2007, IDNR 2015). Recent records include a July 2010 survey that identified an Indiana bat maternity colony on the Middle Fork of the Vermilion River in Ford and Champaign counties (IDNR 2010), with records from as recent as 2014 (IDNR 2015). No known hibernacula occur within the Project Area or within Vermilion County (USFWS 2007).

The majority of the Project Area consists of unsuitable tilled agriculture, non-forested shrubland, or areas with no suitable habitat connectivity. Fifteen forested areas within the Project boundary are considered suitable habitat for both the Indiana bat and northern long-eared bat; however, these areas are avoided by turbines by greater than 1,000 ft (305 m). These areas consist of nine shelterbelts, two areas of isolated roost trees, three riparian forested areas, and a 6-acre (2.4 ha) forest block. Additional suitable habitat is also present in areas surrounding the Project Area (Hale et al 2014).

Presence of Indiana bats was not confirmed within the Project Area by acoustic surveys conducted in 2009, 2010, and 2014 (Ecosystem Management Inc. 2011, Stantec 2015). Although several *Myotis* calls were recorded during acoustic surveys, positive identification to species was not possible because of the quality of the calls and the overlap in call characteristics (see Sections 3.9.1 and 3.10.2.3). Furthermore, a telemetry-based datalogger survey conducted in 2014 and 2015 did not confirm migratory use of the Project by Indiana bats radio-tagged in the nearby Middle Fork Forest Preserve (Boyles and McGuire 2014, J. Boyles, pers. comm. 2015). No Indiana bat fatalities have been discovered at the project since operations began in March 2015.

5.2 Northern Long-eared Bat

On April 2, 2015, the USFWS published a final rule in the Federal Register (80 FR 17974) designating the northern long-eared bat as a threatened species under the ESA throughout its geographic range. The listing and became effective on May 4, 2015, and the final 4(d) rule became effective on January 14, 2015. The northern long-eared bat is also listed as state threatened in Illinois.

5.2.1 Species Description

Northern long-eared bats are medium-sized yellowish brown bats with a forearm length of 1.3 to 1.5 inches (3.2 to 3.9 cm) and a total length of 3.0 to 3.4 inches (7.6 to 8.7 cm). The tragus is long, pointed, and measures more than one-half the height of the ear and is not obviously curved. Northern long-eared bats may be distinguished from the similar little brown bat and Indiana bat by longer ears and a longer, pointed tragus. The calcar is usually slightly keeled, and the toe hairs are medium-long and sparse.

5.2.2 Habitat Description

Suitable summer habitat for northern long-eared bats is quite variable. They will utilize a wide variety of forested habitats for roosting, foraging, and traveling and may also utilize some adjacent and interspersed non-forested habitat such as emergent wetlands and edges of fields. Males and non-reproductive females may utilize cooler roost spots such as caves or mines.

Winter habitat includes underground caves and cave-like structures such as mines and railroad tunnels. These hibernacula typically have high humidity, minimal air current, large passages with cracks and crevices for roosting, and maintain a relatively cool temperature (0–9 degrees Celsius) (USFWS 2014). The hibernation season in Illinois is November 1 through March 31 (USFWS 2014). Currently, 21 hibernacula sites with one or more winter records are known in Illinois, mostly in the southern portion of the state (USFWS 2015a).

5.2.3 Reproduction and Maternity Roost Habitat Requirements

Roosting habitat includes forested areas with live trees and/or snags with a diameter at breast height (DBH) of at least 3 inches (7.6 cm) with exfoliating bark, cracks, crevices, and/or other cavities. Trees are considered suitable if they meet those requirements and are located within 1,000 ft (305 m) of the nearest suitable roost tree, woodlot, or wooded fencerow (USFWS 2014). Maternity habitat is defined as suitable summer habitat that is used by juveniles and reproductive females. The summer maternity season in Illinois is April 1 through September 30 (USFWS 2014).

5.2.4 Foods and Feeding

Northern long-eared bats begin foraging at dusk, focusing on upland and lowland woodlots and tree-lined corridors, catching insects in flight. They will also feed by gleaning insects from vegetation and water surfaces (USFWS 2014). Prey includes moths, flies, leafhoppers, caddisflies, and beetles.

5.2.5 Migration

Northern long-eared bats migrate between their winter hibernacula and summer habitat, typically between mid-March and mid-May in the spring, and mid-August and mid-October in the fall. They are considered a short-distance migrant, with migration distances documented between 35 mi (56 km) and 55 mi (89 km; USFWS 2015a), and the IDNR considers them a short-distance migrant limited to approximately 60 mi (97 km; IDNR 2015).

5.2.6 Range-wide Status

The northern long-eared bat is a commonly encountered species throughout the majority of the Midwest, often commonly captured in mist-net surveys (USFWS 2013b). However, their distribution among hibernacula in the Midwest is not very well known. The northern long-eared bat is less common in the southern and western portions of its range than in the north, though they are considered abundant in the Black Hills National Forest of South Dakota. In Canada, the species occurs throughout a majority of the

forested regions, though, similar to the United States, it is more commonly encountered in the eastern portions of its range (USFWS 2013b).

Disease is the principal factor currently affecting the population status of northern long-eared bats throughout their range in the U.S. and Canada (Frick et al. 2010, USFWS 2013b). Currently, the transmission of WNS has affected approximately 40% of the bat's range. Within four years of initial WNS detection, northern long-eared bats have been documented to experience up to 100% decline at some hibernacula (Turner et al. 2011). Other factors such as habitat loss and modification, wind farm and urban development, and disturbance at hibernacula likely also impact this species, but no other single factor has had the profoundly devastating impact to northern long-eared bat populations as WNS. The USFWS (2013a) estimates that WNS will eventually spread throughout the entire known North American population of northern long-eared bats, and they estimate that impacts from WNS could lead to extinction of this species by 2026.

5.2.7 Illinois Status

The northern long-eared bat is currently listed as threatened within the state of Illinois. Northern long-eared bats are commonly captured in the Shawnee National Forest in southern Illinois (approximately 185 mi [298 km] south of the Project) and have been captured fairly consistently during surveys between 1999 and 2011 at Oakwood Bottoms in the Shawnee National Forest (USFWS 2013b). There are 21 known hibernacula (sites with one or more winter records) in the state (USFWS 2015a).

The Illinois Natural Heritage Databased includes 87 records for extant populations of northern long-eared bats, scattered throughout the state (IDNR 2015). The IDNR has issued only one previous ITA for northern long-eared bats due to their recent listing, and it was for a nearby wind farm (IDNR 2015).

5.2.8 Status within the Project Area

The Project Area falls within the known range of the northern long-eared bat, and the IDNR has records of annual maternity colonies of northern long-eared bats along the Middle Fork of the Vermilion River and its tributaries in Ford and Champaign counties, based on captures of post-lactating females as recently as 2014 (IDNR 2015). No known hibernacula occur within the Project Area.

The majority of the Project Area consists of unsuitable tilled agriculture, non-forested shrubland, or areas with no suitable habitat connectivity. Fifteen forested areas within the Project boundary are considered suitable habitat for both the Indiana bat and northern long-eared bat; however, these areas are avoided by turbines by greater than 1,000 ft (305 m). These areas consist of nine shelterbelts, two areas of isolated roost trees, three riparian forested areas, and a 6-acre (2.4 ha) forest block. Additional suitable habitat is also present in areas surrounding the Project Area (Hale et al. 2014).

Acoustic surveys conducted in 2009 and 2010 did not confirm the presence of the northern long-eared bat within the Project Area (Ecosystem Management Inc. 2011); although several *Myotis* calls were recorded during acoustic surveys, identification to species was not possible because of the quality of the calls and the overlap in call characteristics (see Sections 3.9.1 and 3.10.2.3). However, an additional

survey in fall 2014 (July 31 through October 31) did confirm the presence of northern long-eared bats with in the Project Area on October 20, 2014 (Stantec 2015). No radio-tagged northern long-eared bats were documented during migration via telemetry-based surveys conducted in 2014 and 2015 of radio-tagged bats in the nearby Middle Fork Forest Preserve (Boyles and McGuire 2014, J. Boyles, pers. comm. 2015), which is approximately 6 mi (9.7 km) from the Project. No northern long-eared bat fatalities have been discovered at the project since operations began in March 2015.

6.0 Effects of the Proposed Action

6.1 Direct Effects

6.1.1 Habitat Loss

No loss of summer maternity habitat will occur as a result of Project operation. Due to the limited amount of suitable habitat within the Project Area, the placement of turbines over 1,000 ft (304.8 m) away from suitable summer habitat per the TAL requirements, and the availability of suitable habitat outside of the Project Area, take of the Indiana bat or northern long-eared bat as a result of operation of the Project during the summer maternity season is not expected. The USFWS considers 1,000 ft to be the distance that northern long-eared bats and Indiana bats will travel from suitable habitat, and both species are unlikely to occur in areas located more than 1,000 ft from suitable habitat (USFWS 2014).

6.1.2 Mortality

Bat mortality has been documented at wind energy facilities worldwide (Arnett et al. 2008). The primary bat species affected by wind facilities are migratory, foliage- and tree-roosting lasiurine species that undergo long-distance migrations and do not hibernate. Arnett et al. (2008) compiled data from 21 studies at 19 wind facilities in the U.S. and Canada and found that mortality has been reported for 11 of the 45 bat species known to occur north of Mexico. Of the 11 species, the hoary bat, eastern red bat, and silver-haired bat have the highest mortality rates, with the hoary bat comprising 61.7% of all fatalities (Arnett et al. 2008).

Prior to September 2009, no mortality of species listed as threatened or endangered under the ESA had been reported in connection with wind energy facilities, including the Indiana bat (Arnett et al. 2008). In September 2009, the first documented take of an endangered Indiana bat occurred at BP Wind Energy's Fowler Ridge Wind Farm (FRWF) located in Benton County, Indiana (FRWF 2013); FRWF is approximately 12 mi (19.3 km) from the Project. Including this, a total of seven Indiana bats have been documented at five separate wind farms in the northeastern and Midwestern U.S. A summary of these publicly available fatalities is provided in Table 6-1.

Approximately 40 northern long-eared bat fatalities have been recorded from wind energy facilities located in North America (Table 6-1), representing less than 1 % of the total bat mortality (USFWS 2016b). The northern long-eared bat was not listed or proposed for listing when many of these fatalities occurred; however, these records do provide information on the rarity of northern long-eared bat fatalities,

given the large number of wind energy facilities operating within the species' range. A summary of publicly available northern long-eared bat fatalities is provided in Table 6-1 below.

Table 6-1. Summary of publicly available Indiana and northern long-eared bat fatalities at wind energy facilities in the U.S. and Canada by season.

(Spring = prior to June 1, Summer = June 1 to July 31, Fall = August 1 or after).

Species	Wind Farm	State/ Providence	Number Taken	Year(s)	Season	Source
Indiana Bat	Blue Creek	Ohio	1	2012	Fall	USFWS 2012c
	Fowler Ridge	Indiana	2	2009, 2010	Fall	FRWF 2013
	Laurel Mountain	West Virginia	1	2012	Summer	USFWS 2012d
	North Allegheny	Pennsylvania	1	2011	Fall	USFWS 2011a
	Undisclosed Location	Ohio	2	2013, 2014	Spring, Fall	USFWS, pers. comm.
Northern Long-eared Bat	Anonymous (Site 2-14)	Pennsylvania	1	2009	Fall	Taucher et al. 2012
	California Ridge	Illinois	2	2013, 2014	Fall	IDNR 2015, K.Shank pers. comm.
	Pittsfield, Pike County	Illinois	1	2014	Spring	IDNR 2015
	Cohocton and Dutch Hill	New York	1	2010	Summer	Stantec 2011
	Criterion	Maryland	1	2011	Summer	Young et al. 2013
	Erie Shores	Ontario	6	2007	Spring, Summer, Fall	James 2008
	Fowler Ridge	Indiana	2	2009, 2010	Fall	FRWF 2013
	Kingsbridge I	Ontario	1	2006	Fall	Stantec 2007
	Meyersdale	Pennsylvania	2	2004	Fall	Kerns et al. 2005
	Mountaineer	West Virginia	6	2003	Fall	Kerns and Kerlinger 2004
	Mount Storm	West Virginia	1	2008	Fall	Young et al. 2009
	Noble Ellenburg	New York	1	2008	Fall	Jain et al. 2009

	Noble Wethersfield	New York	6	2010, 2011	Summer, Fall	Jain et al. 2011, Kerlinger et al. 2011
	PGC unknown site[1]	Pennsylvania	1	Unknown	Summer	J. Taucher, PGC, pers. comm. with AWEA 2015
	PGC unknown site[1]	Pennsylvania	1	2012	Summer	J.Taucher, PGC, pers. comm. with AWEA 2015
	Ripley	Ontario	2	2008	Fall	Jacques Whitford 2009
	Steel Winds[2]	New York	6	2007	Unknown	Grehan 2008

[1] These sites were participating in the Pennsylvania Game Commission Wind Energy Voluntary Cooperation Agreement and were not identified by name.

[2] New York State Department of Environmental Conservation identified the bat species for this survey and provided the information to WEST; the species were not included in the original report.

Within the state of Illinois, no Indiana bats and only three northern long-eared bats have been found as fatalities at wind facilities (Table 6-1), representing 0.013% of estimated total bat mortality in the state as of 2014 (IDNR 2015). The three northern long-eared bat fatalities in Illinois occurred at two different projects, California Ridge in Vermilion and Champaign counties, and another project near Pittsfield in Pike County (K. Shank, pers. comm.). The project in Pike County has several known roosts of both Indiana and northern long-eared bats in the vicinity, but none closer than 2,000 ft (610 m) from the single turbine in the vicinity (K.Shank, pers. comm.). The northern long-eared bat fatality at that turbine occurred on May 28, 2014, at the 1.65 MW turbine built in 2005 (K. Shank, pers. comm.).

The two northern long-eared bat fatalities at California Ridge, located in the same county as Hoopeston, occurred in September of 2013 and 2014 (K. Shank, pers. comm.). Both fatalities occurred at 80 m turbines (1.6 MW) that are part of an acoustic deterrent study (under USFWS permit TE03502B-0), with one fatality occurring at a “control” turbine and one at a “treatment” turbine, though neither turbine was curtailed (K. Shank, pers. comm.).

Due to the absence of significant Indiana and northern long-eared bat records, it is instructive to consider general information regarding bat mortality to understand what type of mortality has been recorded and for what species. Bat mortality at wind facilities has been reported from direct impact with a spinning turbine blade or from barotrauma. Barotrauma involves tissue damage to air-containing structures (e.g., lungs) caused by rapid or excessive pressure change (Baerwald et al. 2008). As turbine blades spin, the blades create areas of low pressure. Bats flying through these areas may suffer barotrauma in as high as 90% of cases (Baerwald et al. 2008); however, more recent studies have concluded that traumatic injury is still the leading cause of death (Rollins et al. 2012, Grodsky et al. 2011).

The results of the acoustic bat survey conducted in 2009, 2010, and 2014 at the Project (Appendix A) had a limited number of potential *Myotis* calls, suggesting low levels of *Myotis* activity within the Project Area (see Section 3.10.2). A small number of *Myotis*, including Indiana and northern long-eared bats, may occur in the Project Area during the fall.

6.2 Indirect Effects

Indirect effects are those effects that are caused by or will result from the proposed action and are later in time but are still reasonably certain to occur. For the purposes of an HCP, the indirect effects in question must be reasonably foreseeable, a proximate consequence of the covered activities proposed under the HCP, and must rise to the level of take (USFWS and NOAA 1996) if they are to be included as a covered activity. None of the indirect effects associated with the operation or maintenance of the Project are likely to result in take of either Indiana or northern long-eared bats as explained below.

During maintenance, some limited tree clearing or trimming may need to occur. In the unlikely event that trees >3 inches (7.7 cm) DBH would require removal, such trees will be cleared from November 1 to March 31 or inspected by a qualified biologist to confirm no roosting bats are present prior to removal.

The Project is intended to supply electricity to the regional electrical grid to address existing and projected future energy needs. As such, significant local community growth is not anticipated as a consequence of the Project's energy contribution. The operation of the Project is not expected to result in significant local community growth. The Project will be staffed by approximately 10 personnel throughout the life of the Project. Agricultural, recreational, and other customary activities on the lands surrounding the turbines likely will continue to take place as they did prior to the construction of the wind farm.

A potentially positive indirect effect on Indiana and northern long-eared bats is the addition of the Project as a renewable energy source, offsetting the potential operation of fossil fuel–fired generating sources and with the potential to slow the effects of climate change on species including Indiana and northern long-eared bats. However, the specific level of such benefit attributable to the Project facility is not readily quantifiable.

The mitigation associated with the Project (increased restoration and protection of summer habitat) is not anticipated to result in an indirect negative effect to either species, but should directly enhance species viability.

6.3 Effects on Critical Habitat

A final rule designating critical habitat for the Indiana bat was published on September 24, 1976 (41 FR 41914). The critical habitat consists of 11 caves and two mines in six states:

- Illinois – Blackball Mine (LaSalle County)
- Indiana – Big Wyandotte Cave (Crawford County) and Ray's Cave (Greene County)
- Kentucky – Bat Cave (Carter County) and Coach Cave (Edmonson County)

- Missouri – Cave 021 (Crawford County), Capes 009 and 017 (Franklin County), Pilot Knob Mine (Iron County), Bat Cave (Shannon County) and Cave 029 (Washington County)
- Tennessee – White Oak Blowhole Cave (Blount County)
- West Virginia – Hellhole Cave (Pendleton County)

No critical habitat has been designated for the northern long-eared bat to date.

The Project Area does not occur within or in close proximity to, nor will it directly affect, designated Indiana bat critical habitat; therefore, none will be affected.

6.4 Incidental Take Permit

The USFWS will issue an ITP upon a finding that this HCP meets the permit issuance criteria set forth in 50 CFR § 17.32(b)(2), including that the actions proposed by Hoopeston Wind will not appreciably reduce the likelihood of the survival and recovery of the Indiana bat or northern long-eared bat in the wild, and that Hoopeston Wind has minimized and mitigated the effects of its activities to the maximum extent practicable. The minimization and mitigation measures that Hoopeston Wind will implement to meet this standard are described in the Conservation Plan in Section 7.0 of this HCP.

6.4.1 Scope of the Incidental Take Permit

6.4.1.1 Permit Period and Area

Hoopeston Wind is seeking a 30-year ITP for the Indiana and northern long-eared bat within the Project Area. This HCP identified the measures intended to assure that the effects of incidental take will be minimized and mitigated to the maximum extent practicable.

6.4.1.2 Type of Take

The Project has the potential to result in take of both the Indiana and northern long-eared bat during operation of the Project through mortality due to collision with turbine blades or as a result of barotrauma; however, take or temporary harm or harassment of individuals in the course of project maintenance and decommissioning, or the implementation of mitigation activities is not expected. Accordingly, the ITP will cover potential incidental take occurring in connection with otherwise lawful activities related to the operation of the Project and the implementation of mitigation activities pursuant to this HCP.

6.4.2 Take Estimate

6.4.2.1 Take Estimation Methodologies

In order to evaluate risk and predict levels of take of federally listed bats at the Project, Hoopeston Wind considered three take estimation methods that rely on regional, national and site-specific data. Hoopeston Wind used each of these methods to develop take estimates for the Project prior to implementing minimization measures (i.e., feathering below the 6.7 mph [3.0 m/s] cut-in speed during the active season). Each method is described in detail in the Sections below.

6.4.2.1.1 Fowler-based Approach

The Fowler-based Approach uses data from an operating wind farm located nearby in Indiana (approximately 12 mi [19.3 km] away) with known Indiana bat and northern long-eared bat take, and similar habitat to the Project Area (see Section 3.10.1). Based on data collected at the Fowler Wind Farm (FRWF) during 2010 and 2011 at turbines where no minimization measures were implemented, fall bat fatality at the facility was estimated to average 17.85 (90% CI = 14.56–21.97) bats/MW/fall season. Of the 1,246 total bat carcasses found during the three (2009–2011) fall search seasons at FRWF, two carcasses were Indiana bats and one carcass was a northern long-eared bat. The percent composition of Indiana bat fatality was therefore calculated to be 0.16% of the total bat fatality, and northern long-eared bats comprised 0.08% of all bat fatalities. Applying the FRWF average fatality estimate to the Project (17.85 bats/MW/season x 98 MW) produces an estimated bat fatality of 1,749 bats/fall season (90% CI = 1,423–2,153). Using the Fowler-based Approach, assuming that 0.16% of all bat fatalities are Indiana bats and 0.08% are northern long-eared bats, approximately 2.8 (90% CI = 2.3–3.4) Indiana bats and 1.4 (90% CI = 1.1–1.7) northern long-eared bats are estimated to be taken at the Project each year under no operational adjustments.

6.4.2.1.2 Arnett-Baerwald Approach

The Arnett-Baerwald Approach uses rates of Indiana and northern long-eared bat take from wind projects across the nation, including projects with no take of either species. Based on Arnett and Baerwald (2013), there were 13,361 installed MW of wind energy in the Midwestern Deciduous Forest-Agricultural Region (Southern Ontario, Minnesota, Wisconsin, Iowa, Michigan, Illinois, Missouri, Indiana and Ohio) as of September 30, 2011. This area had 23 studies at 14 sites with data on bat fatalities, resulting in a mean number of fatalities of 7.94 (95% CI = 4.92–10.96) bats/MW/yr. Across all regions, northern long-eared bats and Indiana bats comprised less than 0.01% of all fatalities, though this number was revised to 0.05% for northern long-eared bats by Western EcoSystem Technologies, Inc. in a presentation at the National Wind Coordinating Collaborative meeting in December 2014. Applying the average fatality estimate to the Project (7.94 bats/MW x 98 MW) produces an estimated bat fatality of 778 (95% CI = 482–1,074) bats. Considering that Indiana bats comprise <0.01% of all fatalities and northern long-eared bats comprise 0.5%, approximately 0.08 (95% CI = 0.05–0.1) Indiana bats and 3.9 (95% CI = 2.4–5.4) northern long-eared bats are estimated to be taken each year at the Project without any operational adjustments.

6.4.2.1.3 Acoustics Approach

The Acoustics Approach uses site-specific data from the pre-construction acoustic surveys described in Section 3.10. All data from the fall migratory season (July 31–October 31) were run through Kaleidoscope (Wildlife Acoustics, Maynard, MA) to identify calls to the species level, and then any *Myotis* call was qualitatively reviewed. Of the 2,365 calls identified by Kaleidoscope as *Myotis* (n = 100), 24 were determined potentially *Myotis* via qualitative analysis:

- 1 potential northern long-eared bat
- 1 potential Indiana bat
- 7 potential little brown bats
- 12 potential *Myotis* calls

- 3 potential *Myotis*, but not northern long-eared bats

Of the 24 *Myotis* calls detected, there are up to 13 potential northern long-eared bat calls (1 potential northern long-eared bat + 12 potential *Myotis*) and 16 potential Indiana bat calls (1 potential Indiana bat + 12 potential *Myotis* + 3 potential *Myotis*, but not northern long-eared bat). The 13 potential northern long-eared bat calls account for 0.6% of all calls identified to the species level recorded on-site during fall. The 16 potential Indiana bat calls account for 0.7% of all calls recorded on-site during fall. Given the average fatality estimate for the region from the Arnett-Baerwald Approach (7.94 bats/MW x 98 MW) produces an estimated bat fatality of 778 (95% CI = 482–1,074) bats. Considering that Indiana bats comprised up to 0.7% of fall bat activity at the site and northern long-eared bats comprised up to 0.6%, approximately 5.5 (95% CI = 3.4–7.5) Indiana bats and 4.7 (95% CI = 2.9–6.4) northern long-eared bats are estimated to be taken each year at the Project. It is likely that these estimates are high, given that bat data were collected at several “wooded sites” representing good bat habitat as opposed to areas representative of turbine locations, as well as at heights below the rotor-swept zone for 10 of the 12 recording locations. In addition, the potential *Myotis* calls were used to calculate both the Indiana and northern long-eared bat ratios, whereas each call can actually represent only one species.

6.4.2.2 Average Take Estimate

To estimate the amount of northern long-eared and Indiana bat take that would occur at the Project prior to implementing minimization measures (i.e., feathering below the 6.7 mph [3.0 m/s] cut-in speed), Hoopeston Wind averaged the take estimates resulting from the three approaches discussed above (Table 6-2). Because data from ground units was collected in nonrepresentative habitats, Hoopeston Wind also averaged only the Fowler and Arnett-Baerwald approaches to compare and consider the validity of the three-method average for predicting take at the Project. Table 6-2 presents the take estimates for the Project that result from each method.

Table 6-2. Indiana bat and northern long-eared bat take estimates at the Hoopeston Wind project, using three estimators.

Method	Total bats (per year)	Indiana bats (per year)	Northern long-eared bats (per year)
Fowler-based Approach	**1,768** (90% CI: 1,442–2,175)	**2.8** (2.3–3.5)	**1.4** (1.2–1.7)
Arnett-Baerwald Approach	**786** (95% CI: 487–1,085)	**0.08** (0.05–0.1)	**3.9** (2.4–5.4)
Average of above 2 approaches		**1.4**	**2.7**
Acoustics approach	**786** (95% CI: 487–1,085)	**5.5** (3.4–7.6)	**4.7** (2.9–6.5)
Average of all 3 approaches	N/A	**2.8**	**3.3**
Proposed Estimate	**N/A**	**2.0**	**3.0**

In summary, the average using only the Fowler and Arnett-Baerwald approaches is 1.4 Indiana bats and 2.7 northern long-eared bats per year, whereas the average of the three methods results in an overall take estimate of 2.8 Indiana bats and 3.3 northern long-eared bats per year at the Project. Due to the fact that all three estimates are coarse scale estimates, and the numbers are describing fractions of bats at very low numbers, Hoopeston Wind proposes to use intermediate values of estimated take of 2 Indiana bats and 3 northern long-eared bats per year.

6.4.2.3 Take Estimate Adjusted for Minimization Measures

Based on coordination with USFWS, Hoopeston Wind determined the expected risk period for potential take to be during the fall migration season. However, as an additional risk reduction measure, Hoopeston Wind proposes to operate the Project by feathering below the manufacturer's cut-in speed (6.7 mph [3.0 m/s]) during the spring (April 1–May 15), summer (May 16–July 31) and fall (August 1–October 15) periods. Research suggests that feathering below the manufacturer's cut-in speed can reduce fatalities by 35% to 57.5% (Baerwald et al. 2009, Young et al. 2011, Good et al. 2012). Using the conservative estimate of a 35% reduction in fatalities, the take estimates of 2 Indiana bats and 3 northern long-eared bats/year without minimization will be reduced to 1.3 Indiana bats and 1.9 northern long-eared bats/year if manufacturer's cut-in speed curtailment was implemented.

For the purpose of an ITP, Hoopeston Wind proposes to apply for a take limit of 2 Indiana bats and 2 northern long-eared bats per year, despite the conservative measure of feathering below manufacturer's cut-in speed to reduce risk. This will result in a total of 60 Indiana bats and 60 northern long-eared bats over the 30-year term of the ITP.

6.4.2.4 Proposed Take Limit

No Indiana or northern long-eared bat mortality is expected to occur during maintenance, decommissioning, or mitigation activities. The only Project activity that may potentially result in the take of

Indiana or northern long-eared bats is project operation. Hoopeston Wind proposes to apply for a take limit of 60 Indiana bats and 60 northern long-eared bats based on the cumulative estimated average over the 30-year ITP term (2 bats per year for both Covered Species, over the 30-year term of the permit).

Due to annual variation in environmental factors that may affect Indiana and northern long-eared bat population sizes and migration, annual take can be expected to vary from year to year. In an effort to be responsive to this variation, and to ensure that the 30-year take limits are not exceeded, this HCP includes post-construction monitoring and annual adaptive management take thresholds, which are described in detail in Sections 7.3 and 7.4. This expanded timeframe for measuring take compliance will allow for changes to be made to the operating plan to ensure authorized take is not exceeded. Cumulative records of calculated annual take will be kept throughout the 30-year life of the ITP.

6.4.3 Impacts of Estimated Take

The relatively low level of *Myotis* activity recorded within the Project Area during the fall migration period, and the limited number of potential Indiana and northern long-eared bat calls identified, support the conclusion that while both species may pass through the Project, concentrated migration of either species is not likely to occur. Given that migratory routes for Indiana bats and northern long-eared bats in the Midwest remain generally unknown, it cannot be predicted with certainty from which maternity colonies or hibernacula bats migrating through the Project Area may originate. Due to the location of the Project Area away from summer bat habitat or known hibernacula, take at the Project will likely originate from more than one maternity colony and more than one hibernacula. Based on the maximum known migration distance for Indiana bats (357 mi [574 km]) (USFWS 2011b) and the location of known hibernacula relative to the Project Area, it is expected that all or most of the Indiana bats taken by the Project will belong to the OCRU population. The size, status, and distribution of northern long-eared bat populations are not known; however, given the short maximum migration distance for the species (55 mi [89 km]; USFWS 2015a), it is expected that most of the northern long-eared bats taken by the Project will belong to the local population.

Therefore, take from the Project is not expected to significantly affect any single Indiana bat or northern long-eared bat maternity colony or hibernaculum and take is not expected to result in permanent loss of the reproductive potential of a maternity colony, or of the maternity colony itself. Additionally, loss of the anticipated small number of bats is unlikely to adversely impact any hibernating populations to which these individuals belong, since take is expected to be spread across multiple hibernacula.

Indiana and northern long-eared bats taken by the Project may include non-reproductive juveniles as well as adult female and male bats. Mortality statistics are skewed toward males of the four most commonly killed species at wind energy facilities: the hoary bat, eastern red bat, silver-haired bat, and tri-colored bat (Arnett et al. 2008). Behavioral-based risk factors have been hypothesized to increase the exposure potential for male tree bats at turbines (Cryan 2008). However, there are no data that suggest that male *Myotis* bats may be more vulnerable to wind turbine mortality (USFWS 2011b). Gruver et al. (2009) recorded an equal number of male and female *Myotis* fatalities at a wind energy facility in Wisconsin and BHE Environmental (2011) recorded more female *Myotis* fatalities than male *Myotis* fatalities at another wind energy facility in Wisconsin. Because the Project is expected to take migrating individuals originating

from a variety of unknown locations, it is currently most reasonable to assume equal risk for male and female bats within the Project Area.

6.4.3.1 Resource Equivalency Analysis (REA) of Proposed Take

To analyze the potential impacts of take, Hoopeston Wind ran the REA-based model developed by the USFWS for both Indiana bats and northern long-eared bats based on the proposed level of take (USFWS 2013c). The REA model uses the resource service of reproduction as the unit of measurement and evaluates the reproductive potential of females from the population. This is based on the assumption that when an adult female bat is prematurely taken at a wind energy facility, her and her offspring's reproductive potential is lost. This analysis for the Covered Species is presented below.

6.4.3.1.1 Indiana Bat

Although the overall ratio of females to males in the Indiana bat population within the OCRU is assumed to be 1:1, female Indiana bats are expected to occur more frequently than males in the population as distance from hibernacula increases. Female Indiana bats disperse from hibernacula to join summer maternity colonies, while male Indiana bats typically remain closer to hibernacula throughout the summer. Therefore, more female Indiana bats than male Indiana bats are expected to migrate through the Project Area, based on the distance of the Project Area to hibernacula. The USFWS estimates a 3:1 ratio of female to male Indiana bats migrating through the Project Area each fall (USFWS 2012e). Consequently, approximately 75% of the 60 Indiana bats taken at the Project are expected to be female, for an estimated take of 1.5 female bats/year, or 45 total female bats over the 30-year Project life. A stationary population (λ=1) within the REA model results in an estimated take of 45.0 adult female Indiana bats over the 30-year Project term, and a lost reproduction of 85.5 female pups, for a total potential impact of take of 130.5 female Indiana bats.

The potential impact of the proposed take over the 30-year life of the Project would be approximately 131 total Indiana bats, according to the REA model. This represents 0.07% of the estimated 2013 population of the OCRU (197,707 Indiana bats) and will be distributed over 30 years. Considering the overall low level of expected take and the compensatory mitigation measures Hoopeston Wind will implement to compensate for the take, it is highly unlikely that the impact of the Project will significantly impact this species. In the event that some of the bats taken at the Project belong to the Midwest Recovery Unit population, overall impacts to this population will be very minimal. In 2013, the Midwest Recovery Unit population was estimated to exceed the OCRU population by 102,968 individuals (USFWS 2013a).

6.4.3.1.2 Northern Long-eared Bat

Research into the sex ratios of northern long-eared bats has been limited. However, there is no evidence to suggest that a 1:1 sex ratio is improbable. Unlike Indiana bats, the northern long-eared bat shows less dispersal from hibernacula (USFWS 2014), suggesting that females and males may be expected to migrate through the Project Area in equal proportions. Consequently, of the 87 northern long-eared bats the REA model estimates could be taken at the Project over the term of the permit, 50% are estimated to be female, for an estimated take of 1 female bat per year.

A stationary population (λ=1) within the REA model results in an estimated take of 30 adult female northern long-eared bats over the 30-year Project term, and lost reproduction of 57 female pups, for a total estimated impact of 87 female bats. The northern long-eared bat population in Illinois has not yet seen the declines that have occurred in the eastern United States. Due to this, and the low level of estimated take, it is likely that overall impacts to the local population from take at the Project will be minimal. Due to the common occurrence of northern long-eared bats at mist-netting sites in the Midwest, it is generally assumed that the range-wide northern long-eared bat population is significantly larger than the range-wide Indiana bat population (534,239; USFWS 2013a). However, even if the northern long-eared bat population were this size, the take resulting from the Project would represent only 0.016% of the estimated population.

6.4.3.2 White-Nose Syndrome

As WNS spreads into and across the Midwest, it may significantly affect the OCRU Indiana bat population as well as the local northern long-eared bat population. WNS is causing severe declines in the populations of cave-hibernating bats throughout eastern North America. The USFWS has estimated that WNS caused a decline of approximately 36% in the Indiana bat Northeast Recovery Unit population between 2007 and 2009 (USFWS 2011c), a decline of approximately 54% between 2009 and 2011 (USFWS 2012b), but populations appear to have steadied between 2011 and 2013, with a 13.3% increase in the Northeast Recovery Unit Population (USFWS 2013a). In addition, there has been a sharp decline in the northern long-eared bat in the northeastern part of its range due to WNS, and WNS has been confirmed on northern long-eared bats (USFWS 2014), indicating that they are highly susceptible to the disease. The decline within surveyed hibernacula from eight states is approximately 99% for the northern long-eared bat (USFWS 2014).

If WNS becomes widespread across the Midwest, and specifically within Illinois, this level of take from the Project would represent a greater proportion of the local populations; however, the level of take experienced by the Project would be expected to decline proportionally. The amount of take that the Project will contribute in addition to losses from WNS would not cause the OCRU Indiana bat population or the local northern long-eared bat population to decline appreciably sooner than it would decline as a result of WNS alone.

7.0 Conservation Plan

In issuing an ITP, the USFWS must find, among other things, that the applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking.[6] The term “maximum extent practicable” is not defined in the ESA, nor is it defined in any agency regulations.[7] According to some courts, the maximum extent practicable standard does not mean that an applicant must implement all conservation measures that it can afford to implement while still going forward with development.[8] Rather, the “maximum extent practicable” standard means that the conservation measures proposed by the

[6] *See* 50 C.F.R. § 17.22(b)(2)(B).
[7] *See Nat’l Wildlife Fed’n v. Norton*, 306 F. Supp. 2d 920, 927 (E.D. Cal. 2004).
[8] *Id*.

applicant must be commensurate with the level of take under the plan. Stated differently, an applicant for an ITP must demonstrate that its avoidance, minimization, and mitigation measures are commensurate with the anticipated impacts of the take, are rationally based and supported by science, and are reasonably capable of being accomplished. It is only where certain constraints may preclude full minimization or full mitigation that the "practicability" issue needs to be addressed more thoroughly. Here, as will be described, Hoopeston's proposed minimization and mitigation are commensurate with the impact of the taking, and Hoopeston has provided funding assurances to ensure proper implementation of the HCP.

Steps taken to arrive at the conservation plan described herein included defining the biological goals, which include goals to minimize and mitigate impacts to listed species to the maximum extent practicable, and to reduce impacts to all bats by an amount based on best available science, which suggests that a 35% reduction can be attained using turbine operational protocols including raised cut-in speeds and blade feathering. Hoopeston agreed to meet this goal even though non-listed species are not protected under the ESA. Published literature and reviews by experts indicate that raising cut-in speeds is clearly effective at reducing impacts to all bats, although percent reduction is variable and effectiveness at reducing impacts to listed species is uncertain.

As described in Section 7.3.4 below, Hoopeston evaluated intensive monitoring programs using the USFWS Evidence of Absence (EofA) software (Dalthorp et al. 2017), with a goal of 90% confidence after the initial three years of monitoring to ensure that the Project is not exceeding the level of authorized take. The intensive monitoring program is designed to maximize the number of carcasses found by searching large areas frequently (see Section 7.3.4 for details), which will lead to both an increased chance of finding a Covered Species, should one be taken at the Project, as well as an increased level of confidence in the overall bat fatality information collected at the Project. In addition, using site-specific monitoring data in this manner is more consistent with the "No Surprises" rule, which is intended to reduce financial uncertainty and provide assurances to section 10 permit holders that, as long as the permittee is properly implementing the HCP, no additional commitments of resources will be required beyond those specified in the HCP.

7.1 Biological Goals and Objectives

The biological goals define the expected outcome of this conservation plan. These goals are broad, representing the guiding principles for operation of the conservation program described in this HCP and forming the basis for the minimization and mitigation strategies employed. The biological objectives represent the steps through which the biological goals will be achieved, and provide a basis for measuring progress towards and achievement of those goals. The biological goals and objectives of this conservation plan are:

1. To minimize Indiana and northern long-eared bat mortality in the Project Area. The objective of this goal is to implement an operational strategy that will decrease bat mortality by at least 35% from predicted uncurtailed levels, thereby decreasing actual mortality of all bats, and specifically Indiana and northern long-eared bats to no more than 60 individuals of each species over the 30-year permit term.

2. To increase survival and reproductive capacity of Indiana and northern long-eared bats on their summer range, thereby promoting population growth of maternity colonies for both species. The objective of this goal is to implement a mitigation project that will protect and restore habitat in blocks within the range of extant Indiana and northern long-eared bat maternity colonies.

7.2 Measures to Achieve Biological Goals and Objectives

7.2.1 Minimization of Direct Mortality

All publicly available curtailment studies to date show an inverse relationship between cut-in speeds and bat mortality. Feathering below the manufacturer's cut-in speed is expected to reduce overall bat mortality by a minimum of 35% (Good et al. 2012, Young et al. 2011, Baerwald et al. 2009).

Turbines will be feathered below the manufacturer's cut-in speed of 6.7 mph (3.0 m/s) every night during the bat activity season, from April 1 through October 15. After October 15, migrating Indiana and northern long-eared bats are not expected to occur within the Project Area due to the lack of hibernacula in the vicinity of the Project. Additionally, average nightly temperatures typically begin to decline throughout September, constraining bat activity and inducing bats to enter hibernation (USFWS 2007).

Curtailment actions effective at reducing the risk of collision for all bat species should be at least as effective for the smaller, weaker-flying Indiana and northern long-eared bats, in the event that these species do occur within the Project Area. Therefore, a nighttime cut-in speed of 6.7 mph (3.0 m/s) during the entire bat activity season is expected to minimize take of Indiana and northern long-eared bats. It is conservatively estimated that the proposed curtailment strategy will reduce overall bat fatality, Indiana bat mortality, and northern long-eared bat mortality by at least 35%, although the actual reduction in mortality may be greater.

7.2.2 Mitigation for the Impacts of the Take

To mitigate for anticipated Project impacts to Covered Species, Hoopeston Wind proposes to fund a specific conservation project or projects for Indiana bats and northern long-eared bats in consultation with the USFWS upon permit issuance. The goal of the mitigation project is to support recovery plan–based conservation projects on no less than 165 acres of mitigation land for Covered Species within the Project vicinity.

Over the ITP term, Hoopeston Wind estimates that 60 northern long-eared bats and 60 Indiana bats may be taken as a result of Project operations. Hoopeston Wind has developed and is implementing operational and construction protocols to avoid and minimize the majority of potential project impacts. Remaining, and likely minor, Project impacts will be mitigated through offsite conservation measures. The mitigation is based upon the impact of the take (see Section 6.4.36), specifically the lost reproduction of adult female bats.

During the development of this HCP, Hoopeston Wind worked with USFWS to evaluate options for conservation projects that could be undertaken as a part of this HCP. Hoopeston Wind identified

properties under the ownership and management of Grand Prairie Friends, a nonprofit conservation organization. The properties are located approximately 40-70 miles southwest of the Project, and consist of forested lands, wooded riparian areas, and agricultural lands. The properties are located about 46 miles from the nearest known northern long-eared bat record (near Newman, Illinois), and about 2 miles from the nearest known Indiana bat capture.

In consultation with the USFWS, Hoopeston Wind will work with Grand Prairie Friends or other appropriate conservation entities to implement mitigation projects consistent with this HCP. Hoopeston Wind has established a working relationship with Grand Prairie Friends, and has developed internal working agreements with this conservation entity to implement the terms of this HCP. Initially, Hoopeston Wind will develop a mitigation plan and conduct a bat habitat assessment on mitigation lands with Grand Prairie Friends to evaluate the quality and quantity of habitat, and to identify 165 acres of habitat that would benefit from enhancement/restoration activities. However, if within 60 days following issuance of the ITP Hoopeston Wind and USFWS mutually agree on a different conservation entity, then Hoopeston Wind will work with that conservation entity to develop internal agreements to implement the terms of this HCP. Hoopeston Wind will consider a combination of activities that enhance/restore summer habitat. Activities for enhancement/restoration could include, but may not be limited to, tree planting and management, installation of habitat features (e.g., BrandenBark©), native grass plantings, mowing around trees to reduce competition and impede weed growth, stand thinning, girdling to create roost trees, understory thinning, invasive species control, prescribed fire, selective harvesting, and/or supplemental plantings.

In arriving at the proposed amount of mitigation, Hoopeston Wind considered the results of the REA model developed by the USFWS (USFWS 2013c) to assess the impact of proposed take on listed bat species. The REA model provides useful information regarding potential benefits of different mitigation options, including summer habitat acquisition and protection, summer habitat restoration, and winter habitat acquisition and protection. Since wooded habitats in this area are limited, forest restoration efforts (which include permanent protection as well) are equal in value to preservation measures, so any combination of restoration or protection totaling 165 (150 + 10% addition for NLEB (15 acres)) acres (66.7 ha) will be sufficient based on the estimated impact of take (see Section 6.4.3) and the stacking of mitigation credits such that mitigating for the impact of take on Indiana bats is sufficient for the northern long-eared bats as well.

Based upon communications with Grand Prairie Friends, Hoopeston Wind estimates that it can enhance suitable habitat for the Covered Species on this privately owned land within the OCRU at a cost of about $3,000 per acre or less. This amount would cover the cost of implementing bat conservation actions on owned land, including, but not limited to, those described above. Based on these estimates, Hoopeston Wind concludes that at a cost of $495,000, it could restore or enhance at least 165 acres (66.7 ha) of bat habitat; therefore, conservation actions will be funded in an amount sufficient to enhance or restore at least 165 acres (66.7 ha) of habitat.

Hoopeston Wind will develop a mitigation implementation plan in consultation with the USFWS and Grand Prairie Friends, or another acceptable conservation entity identified by Hoopeston Wind and USFWS, and finalize this mitigation implementation plan within 5 months from issuance of an ITP . This implementation

will set forth the schedule and sequencing for specific habitat enhancement activities to be undertaken under the HCP.

The goal of the mitigation project is to contribute to the conservation of Covered Species by enhancing suitable habitat for the Covered Species. The following guidelines will be used to develop the mitigation plan:

- The proposed project will substantially reduce the threats to Covered Species;
- The mitigation plan will describe the recovery objectives and include anticipated dates for achieving those objectives, within the anticipated 12-month implementation period;
- The project will consist of enhancement and restoration activities that are not otherwise planned within the implementation area;
- The project will incorporate quantifiable, scientifically valid standards that will demonstrate achievement of recovery objectives;
- The project will provide benefit to the Covered Species for the life of the ITP by avoiding impacts associated with natural disasters, including disease, fires, blow downs, pests, and floods;
- The project will be monitored and reported to ensure implementation and effectiveness; and
- The project will be consistent with recovery plans or other pertinent scientific literature applicable to the Recovery Unit.

Other specific terms of the mitigation project include the following:

Payment Terms. Within 90 days following issuance of the ITP, Hoopeston Wind will make a payment of $495,000 to a segregated conservation fund administered by a third party selected by Hoopeston Wind and USFWS. Hoopeston Wind will work, in consultation with the USFWS, to secure a project (or projects) that achieve the expected biological benefits. If a project is implemented at a lower cost, the unused portion of the fund will be refunded to Hoopeston Wind. The conservation funds will be separate from the third party's day-to-day operations. Hoopeston Wind and the third party shall execute an agreement to ensure implementation of the mitigation projects consistent with this HCP.

Administration. The conservation fund will be administered by a USFWS-approved escrow agent or qualified conservation organization (such as Grand Prairie Friends). Fees associated with fund administration will not materially diminish the amount of the conservation fund.

Eligible Projects. Money will be disbursed from the conservation fund at the direction of Hoopeston Wind to fund projects that meet the goals, objectives, and criteria identified above. A mitigation plan will be developed in consultation with USFWS within 5 months of issuance of the ITP to enable prompt implementation of mitigation projects.

Reporting. Hoopeston Wind will submit to USFWS and IDNR by April 30 of each year an annual report detailing expenditures made during the preceding calendar year and the current balance of the funds until funds are fully expended. The conservation fund administrator and Hoopeston Wind will each certify the

accuracy of information contained in this report, which shall include details (i.e., photographs, maps, project targets and standards) about what projects are ongoing or have been completed. These reports are intended to help USFWS ensure that adequate funding will be provided to implement the HCP and that funding sources at the required annual levels are reliable and will meet the purposes of the HCP.

Basis for Bat Conservation Fund Amount. Hoopeston Wind estimates that up to 60 northern long-eared bats and 60 Indiana bats may be taken during the 30-year permit term. Monitoring conducted at the Project has not identified any priority bat habitats on Covered Lands (e.g., winter hibernation or summer maternity colonies), and disturbed agricultural habitat is common within the region. Therefore, permanent habitat disturbance associated with project construction is not expected to measurably increase the Project's estimated level of take of Covered Species. By focusing on a conservation project that protects or enhances priority habitat for reproductive females, the proposed conservation project will sufficiently mitigate the Project's permitted level of take.

7.3 Mortality Monitoring and Reporting

Hoopeston Wind is currently conducting post-construction monitoring under the protocols outlined in the Project's BBCS (Apex 2013) and in accordance with the requirements of the TALs issued for the Project on March 4, 2014 and July 27, 2017. This monitoring has included two springs of monitoring (2016 and 2017) under the spring operational protocols, which will not be changed under the HCP; however, post-construction monitoring under the ITP will involve "intensive monitoring" during the first three years of operations under the ITP, check-in monitoring during years 15 and 16 of operation under the ITP, and annual monitoring of roads and pads during the life of the permit. The goal of the intensive monitoring is to verify that allowable take levels have not been exceeded during the intensive monitoring period, and thus have a high degree of confidence that operation of the Project beyond the third year is compliant with the ITP.

7.3.1 Background and Goals

A detailed post-construction monitoring plan has been developed for the Project in coordination with USFWS to provide a means of monitoring and ensuring compliance with the take numbers estimated in this HCP and authorized in the ITP, and assessing the effectiveness of the HCP in meeting the biological objective of minimizing direct mortality to Indiana and northern long-eared bats set forth in Section 7.2.2 of this HCP. Included in the post-construction monitoring plan are standardized carcass searches, searcher efficiency trials, and carcass removal trials. The goals of the post-construction monitoring are to determine overall bat fatality rates from the Project, estimate Indiana and northern long-eared bat mortality at the species level, and evaluate the circumstances under which fatalities occur. Post-construction monitoring results will also provide triggers for adaptive management, as described in Section 7.4.

7.3.2 Species to be Monitored

The post-construction monitoring plan will address all bat fatalities observed within the Project Area. Based on the analysis provided in Section 6, Indiana and northern long-eared bat mortalities are expected to occur only rarely, if at all; therefore, the monitoring plan is designed to detect carcasses of all bird and bat species and calculate bat fatality estimates with enough precision to determine if the operational curtailment protocols are effective in reducing overall bat fatalities at the Project. The monitoring plan is also designed to enable comparison with other operating wind energy projects. Within the overall bat fatality estimates, estimates by species will be made, if possible, based on the number of carcasses detected.

7.3.3 Wildlife Handling Procedures

All potential state or federal-listed bat carcasses found will be labeled with a unique number, individually bagged, and retained in a freezer at the Project O&M building for identification to species. For *Myotis* specimens that cannot be confirmed, DNA sampling and analysis will be completed. A copy of the original data sheet for each carcass will be placed in the bag with each frozen carcass. The carcasses of non-listed species may be collected and used in searcher efficiency and carcass removal trials; however, mice purchased through a commercial source may be used as a surrogate. In the event that a carcass of an ESA- or state-listed species is found, Hoopeston Wind will notify the appropriate authorities within 48 hours of positive species identification. If an injured bat is found, the animal will be sent to a local wildlife rehabilitator, when possible.

7.3.4 Monitoring Protocols

7.3.4.1 Study Design

Hoopeston Wind will implement monitoring during the life of the Project that consists of intensive monitoring during the first three years of operations under the ITP, check-in monitoring during years 15 and 16 of operations under the ITP, and annual monitoring during the life of the Project. The intensive monitoring will include transect surveys of 40-m-radius circular plots (approximately 5,024 m^2 each) centered on the turbine and of road and pad areas (approximately 519 m^2 each), with the road portion extending out 95 m from the base of the turbine along a visible road surface that is 4.9 m wide and with the cleared pad around the base of the turbine extending 3.05 m. Larger plot sizes will be considered in year 2 of the ITP if the USFWS determines available information suggests the need to expand plot sizes.

Each monitoring period is summarized in Table 7-1 and described below.

Table 7-1. Summary of Proposed Monitoring Protocols and Schedule

Monitoring Type	Years	Season (Dates)	Frequency	Plots
Intensive Monitoring Years 1–3		Spring (Apr 1 to May 15)	1x/week	5 full plots (40 m radius) and 44 roads and pads (95 m radius from turbine)

		Fall (Aug 1 to Oct 15)	2x/week	15 full plots and 34 roads and pads
Annual Monitoring	Years 1–30	Spring, Summer, Fall (Apr 1 to Oct 15)	1x/week	49 roads and pads
Check-in Monitoring	Years 15 and 16	Spring (Apr 1 to May 15)	1x/week	5 full plots and 44 roads and pads
		Fall (Aug 1 to Oct 15)	2x/week	
Adaptive Management	Years 1-30	Season Triggered	3x/week	49 roads and pads

7.3.4.1.1 Intensive Monitoring (Fall and Spring)

Hoopeston Wind evaluated intensive monitoring programs using the USFWS EofA software (Dalthorp et al. 2014), with a goal of 90% confidence after the initial three years of monitoring to ensure that the Project is not exceeding the level of authorized take. Given the take estimate of 2 Indiana bats and 2 northern long-eared bats per year, this will be a limit of 6 estimated bats of each species over the three-year monitoring period.

To determine the survey effort required to achieve this level of confidence, Hoopeston Wind assumed that the fall monitoring period was the period of highest risk and applied the EofA concept during this period. The fall period is 91 days long (covering the 13-week period from August 1 through October 15), searcher efficiency was assumed to change (k) by 0.8 with each search, and carcass persistence was assumed to average 10 days using the exponential distribution. Additionally, a uniform prior distribution and uniform arrival function, both set to the EofA defaults, were used.

Based on studies conducted at the Fowler Ridge Wind Farm in Indiana, it was estimated that 70.6% of fatalities fall within 40 m of a turbine, giving an area adjustment for full plots of 0.706. Based on studies Stantec has conducted in similar landscapes, the area adjustment for roads and pads was estimated at 0.233. Searcher efficiency was assumed to be 0.9 for roads and pads, and 0.6 for full plots.

Scenarios were run through the EofA “Design Tradeoffs” function to determine detection probability (g) and then through the “Multi-year Total” function to determine the 90% credible maximum after three years of monitoring, assuming no listed bats are found.

Based on the EofA analysis, Hoopeston Wind will use a search protocol involving 70% roads and pads (34 turbines) and 30% full plots (15 turbines), with searches occurring twice weekly from July 15 through October 15. This will result in an overall detection probability of 0.292 and a 90% confidence that 6 or fewer Indiana bats and 6 or fewer northern long-eared bats were taken during the first three years of operation under the ITP assuming that no listed bats are found during the monitoring. If a Covered Species is found and the estimated fatality of either Covered Species is greater than 2 bats/year, adaptive management will be implemented as discussed in Section 7.4.

In addition to the fall monitoring, Hoopeston will also monitor during spring (April 1–May 15) during the first three years of operations as part of the intensive monitoring program. During the spring periods,

Hoopeston Wind will use a search protocol involving 90% roads and pads (44 turbines) and 10% full plots (5 turbines), with searches occurring once weekly during the first three years after permit issuance.

7.3.4.1.2 Annual Monitoring

Annual monitoring will be completed during the bat active season (April 1 to October 15) by operations staff that will be required to search for bat carcasses or a qualified consultant. A qualified party will collect carcasses for identification when required. All bat carcasses will be identified by a permitted bat biologist. Operations staff will be informed of the timing of spring/fall standardized searches and, in the event that they find a carcass or injured bat during these survey periods, these personnel will be trained to record and report the find without contact that might introduce bias to standardized searches and associated fatality rate estimates.

During years in which no intensive monitoring or check-in monitoring is occurring (i.e., years 4–14 and 17–30 of the ITP), annual monitoring will include weekly searches of all roads and pads during the bat active period. Mean searcher efficiency and carcass removal trial data from years 1-3 will be used to determine the total estimated site mortality, as described in Section 7.3.4.3; however, if annual variability is considered high, bias trials will be completed every two years or as recommended by USFWS to improve accuracy of fatality estimates. The results of these surveys will be used to determine whether any adaptive management changes (Section 7.4) are necessary.

7.3.4.1.3 Check-in Monitoring

After the initial intensive monitoring, period to be determined by adaptive management (see Section 7.4), and in addition to the annual monitoring completed during all years, the Project will implement check-in monitoring during years 15 and 16 of operations. Check-in monitoring will consist of weekly searches of 5 (10%) of the turbines with cleared 40-m-radius plots and 44 (90%) of turbine roads and pads out to 95 m during spring (Apr 1-May 15) and twice weekly searches during fall (August 1-October 15). Check-in monitoring will be undertaken by a qualified environmental consulting firm.

7.3.4.1.4 Adaptive Management Monitoring

In the event adaptive management actions are triggered as described in Section 7.4 or 8.1.2.5, the Project will implement Adaptive Management monitoring (see Tables 7-2, 7-3 and 8-1). Adaptive Management monitoring will consist of three times weekly searches of turbine roads and pads out to 95 m during the season in which the adaptive management action is triggered.

Hoopeston evaluated various monitoring approaches in arriving at the Adaptive Management monitoring plan described above using several tools, including currently available Evidence of Absence software. Hoopeston determined that Adaptive Management monitoring produced similar detection probabilities compared with check-in monitoring described in Table 7-1, across a range of carcass persistence assumptions. Detection probabilities were actually slightly higher under Adaptive Management monitoring than for intensive monitoring at low carcass persistence levels.

7.3.4.2 Field Methods

7.3.4.2.1 Standardized Carcass Searches

At 40-m-radius cleared-plot turbines, 7 transects will be spaced at approximately 16.4 ft (5 m) intervals. Observers will walk at a rate of approximately 2 mph (45 to 60 m per minute), scanning the ground for carcasses within 10 ft (3 m) of each transects. The observer will start at one side of the circular plot and systematically search in a north/south or east/west direction, switching the search pattern on a weekly basis. At road/pad turbines, the observer will walk the access road starting at 312 ft (95 m) from the turbine and walk toward the turbine, around the turbine, and back towards their vehicle searching the 16-ft (4.09-m)-wide unvegetated road surface until the entire road/access pad is searched.

Hull and Muir (2010) analyzed carcass finds and modeled the ballistics from similar turbines (312 ft or 95 m in height) and showed that 99% of all bat carcasses were found within 218 ft (66.5 m) of the turbine base; therefore, Hoopeston Wind will initially survey roads out to a conservative 312 ft (95 m) from the turbine base to evaluate the area correction factor assumed in Section 7.3.4.1.1 and potentially adjust it to become a site-specific area adjustment factor used in estimating facility-wide fatality rates if results indicate adjustment is appropriate. Information on carcass distributions will be discussed with USFWS and IDNR to determine how far from the turbine base future road and pad searches should be after the three years of intensive monitoring, or once enough carcasses have been collected to calculate an accurate site-specific area adjustment.

Carcass searches during intensive monitoring and check-in monitoring will be conducted by qualified biologists, under applicable permits and experienced in conducting fatality search methods, including proper handling and reporting of carcasses. Searchers will be familiar with and able to accurately identify bat species likely to be found in the Project Area. Carcass searches during annual monitoring will be conducted by operations staff trained in these methods, under applicable permits. Any unknown bats or suspected Indiana or northern long-eared bats discovered during fatality searches will be sent to a qualified USFWS-approved bat expert for positive identification, or DNA analysis will be completed.

For all carcasses found, data recorded will include:

- Date and time,
- Initial species identification,
- Sex, age, and reproductive condition (when possible),
- Global positioning system (GPS) location,
- Distance and bearing to turbine,
- Substrate/ground cover conditions,
- Condition (intact, scavenged),
- Any notes on presumed cause of death, and
- Wind speeds and direction and general weather conditions for nights preceding search.

A digital picture of each detected carcass will be taken before the carcass is handled and removed. Bird carcasses will be documented in place and not removed unless identity cannot be confirmed. Digital photographs and location information of all bird carcasses will be taken and used for confirming identification when necessary. As previously mentioned, all bat carcasses will be labeled with a unique number, bagged, and stored frozen as needed for future studies (with a copy of the original data sheet) at the Project O&M building.

Bat carcasses found in non-search areas or time periods will be coded as “incidental finds” and documented as much as possible in a similar fashion to those found during standard searches. Maintenance personnel will be informed of the timing of standardized searches and, in the event that maintenance personnel find a carcass or injured animal, these personnel will be trained on the collision event reporting protocol. Any carcasses found by maintenance personnel will also be considered incidental finds. Incidental finds will be included in survey summary totals but will not be included in the corrected mortality estimates because the lack of standardized search effort and search area as well as the lack of searcher efficiency and carcass removal trials prohibits calculations to account for bias and extrapolate incidental carcasses found to estimated fatalities.

7.3.4.2.2 Searcher Efficiency and Carcass Removal Trials

To assess carcass persistence, approximately 40 bat carcasses will be randomly placed within survey areas at varying times during the intensive monitoring, annual monitoring, and check-in monitoring periods. Hoopeston Wind and its contractors will rely on contacts with veterinary labs and universities that can provide bat carcasses and/or use of bat carcasses collected on-site during monitoring studies; however, in the event that 40 are not available, brown mice or small black rats will be used as surrogates for bat carcasses. The carcasses will be placed on a minimum of two dates during each season, thereby spreading the trials throughout the survey period to incorporate the effects of varying weather, climatic and vegetation conditions, and scavenger types and densities. Carcasses will be dropped from waist high or higher and allowed to land in a random posture. Each trial carcass will be discreetly marked (with tape or thread) prior to placement so that it can be identified as a study carcass if it is found by observers or wind facility personnel, or moved by a scavenger.

Observers conducting carcass searches will monitor the trial bats over a 14-day period according to the following schedule as closely as possible. Carcasses will be checked every day for the first 4 days, and then on days 7, 10 and 14. This schedule may vary slightly depending on weather and coordination with the other survey work. At each visit, the observer will note the condition of the carcass (e.g., intact, scavenged, complete). Trial carcasses will be left at the location until the end of the 14-day trial or until the carcass is removed entirely by scavengers. After 14 days, any remaining evidence of the carcasses will be removed.

Searcher efficiency trials will be completed concurrent with scavenger trials using the same test subjects as used in carcass persistence trials. Searchers will be unaware of the placement of the test subjects done on the morning of turbine searches. Test subjects will be checked after searcher efficiency trials to ensure the subjects were present at the time of the trial. These carcass removal and searcher efficiency trials will be used to adjust estimates of bat fatalities using contemporary equations for estimating fatality.

7.3.4.3 Statistical Methods for Estimating Overall Bat Fatality Rates

The currently proposed methodology for estimating overall bat fatality rates (other than covered species) largely follows the estimator proposed by Erickson et al. (2003), as modified by Young et al. (2009), which is also comparable to the Shoenfeld (2004) estimator; however, if more appropriate estimators are available at the time the monitoring work is completed, such as Huso (2011), or others to be developed in the future, they will be used if agreed upon with USFWS.

The proposed estimation technique would follow Erickson et al. (2003), in which the estimate of the total number of wind turbine-related casualties will be based on four components: (1) observed number of casualties, (2) searcher efficiency, (3) scavenger removal rates, and (4) estimated percent of casualties that likely fall in non-searched areas, based on percent of area searched around each turbine. Variance and 90% confidence intervals will be calculated using bootstrapping methods (Erickson et al. 2003 and Manly 1997 as presented in Young et al. 2009).

Mean Number of Observed Casualties (c)
The estimated mean observed number of bat casualties (c) per turbine per study period will be calculated as:

$$c = \frac{\sum_{j=1}^{n} c_j}{n}$$

where n is the number of turbines searched, and c_j is the number of casualties found at a turbine. Incidental mortalities (those found outside of the searched area or by maintenance personnel) will not be included in this calculation, nor in the estimated fatality rate.

7.3.4.3.1 Estimation of Searcher Efficiency Rate (p)

Searcher efficiency (p) will represent the average probability that a carcass was detected by searchers. The searcher efficiency rates will be calculated by dividing the number of trial carcasses observers found by the total number that remained available during the trial (non-scavenged). Searcher efficiency will be calculated for each season and for all search methods (i.e., roads and pads, full plots).

7.3.4.3.2 Estimation of Carcass Removal Rate (t)

Carcass removal rates will be estimated to adjust the observed number of casualties to account for scavenger activity at the Project Area. Mean carcass removal time (t) will represent the average length of time a planted carcass remained at the Project Area before it was removed by scavengers. Mean carcass removal time will be calculated as:

$$t = \frac{\sum_{i=1}^{s} t_i}{s - s_c}$$

where s is the number of carcasses placed in the carcass removal trials and s_c is the number of carcasses censored. This estimator is the maximum likelihood (conservative) estimator assuming the removal times follow an exponential distribution, and there is right-censoring of the data. Any trial carcasses still remaining at 30 days will be collected, yielding censored observations at 30 days. If all trial

carcasses are removed before the end of the search period, then s_c will be zero and the carcass removal rate will be calculated as the arithmetic average of the removal times. Carcass removal rate will be calculated for each season and for all search methods (i.e., roads and pads, full plots).

7.3.4.3.3 Search Area Adjustment

Approximation of *A*, the adjustment for areas that were not searched, will be adapted from the Erickson et al. (2003) estimator, as modified by Young et al. (2009), to accommodate differences in carcass search study design. For the Project fatality estimates, *A* will represent the adjustment for the proportion of carcasses that likely fell outside of the area searched. The value for *A* will be approximated using the following formula, or a variation thereof:

$$A = \frac{\left(\frac{C_{RP}}{P_{RP} * S_{RP}}\right) + \left(\frac{C_{FP}}{P_{FP} * S_{FP}}\right)}{\left(\frac{C_{RP}}{P_{RP}}\right) + \left(\frac{C_{FP}}{P_{FP}}\right)}$$

where C_{RP} is the number of observed casualties on roads and pads, C_{FP} is the number of observed casualties on full plots, P_{RP} is the searcher efficiency on roads and pads, P_{FP} is the searcher efficiency on full plots, S_{RP} is the proportion of roads and pads searched across all study turbines, and S_{FP} is the proportion of full plots searched across all study turbines. For intensive monitoring, S_{RP} = 0.7 and S_{FP} = 0.3, as roads and pads will be searched at 70% of the study turbines and full plot searches will be conducted at the remaining 30% of the study turbines. For spring monitoring and check-in monitoring, S_{RP} = 0.9 and S_{FP} = 0.1, as roads and pads will be searched at 90% of the study turbines and full plot searches will be conducted at the remaining 10% of the study turbines. For the annual monitoring, area adjustments for roads and pads will utilize the most recent area adjustments calculated for the Project (i.e., in years 4–14 the area adjustment factors from intensive monitoring and spring monitoring will be utilized, in years 17–30 the area adjustment factors from check-in monitoring will be utilized).

To adjust for the carcasses that fall outside of the 40-m full plots, a distance-based carcass density model for carcasses found on the roads and pads will be used to calculate a site-specific area adjustment (Huso and Dalthorp et al. 2014). This will use data from the first three years of intensive monitoring, when roads and pads are searched out to 312 ft (95 m; see Section 7.3.4.2.1).

7.3.4.3.4 Estimation of the Probability of Carcass Availability and Detection (π)

Searcher efficiency and carcass removal rates will be combined to represent the overall probability (π) that a casualty incurred at a turbine would be reflected in the post-construction mortality study results. This probability will be calculated as:

$$\pi = \frac{t \cdot p}{I} \cdot \left[\frac{\exp\left(I/t\right) - 1}{exp\left(I/t\right) - 1 + p}\right]$$

where I is the interval between searches. For this study, I=3.5 for intensive monitoring carcass searches and I=7 for annual monitoring, check-in monitoring, and spring monitoring carcass searches.

7.3.4.3.5 Estimation of Facility-Related Mortality (m)

Mortality estimates will be calculated using the estimator proposed by Erickson et al. (2003), as modified by Young et al. (2009), or others as discussed in Section 7.3.4.3 above. The estimated mean number of casualties/turbine/study period (m) will be calculated by dividing the estimated mean observed number of casualties/turbine/study period (c) by π, an estimate of the probability a carcass was not removed and was detected, and then multiplying by A, the adjustment for the area within the search plots which was not searched:

$$m = A \cdot \frac{c}{\pi}$$

7.3.5 Data Analysis, Reporting, and Consultation

7.3.5.1 Data Analysis

Species Composition Approach: Analysis of data collected during the post-construction mortality monitoring will include season fatality estimates for all bats. Based on the three take estimation methods used (see Section 6.4.2) and the species composition for the Covered Species under each method, Indiana bat fatality is expected to represent 0.29% of all bat fatalities and northern long-eared bat fatality is expected to represent 0.24% of all bat fatalities. This will be considered the starting point for estimating take of Indiana and northern long-eared bats using the Species Composition Approach. The species composition approach is most applicable when the composition ratio is derived from actual species fatalities within the project area. Therefore, a facility-specific percent composition value will be established using monitoring data from the Hoopeston wind project. If a facility-specific composition cannot be calculated, species composition from adjacent or nearby operating projects will be utilized. As such, Hoopeston and FWS will evaluate monitoring data from the project area and nearby wind facilities periodically and update the species composition rate, provided sufficient data is available and applicable.

Evidence of Absence Approach: The tools in the Evidence of Absence (EoA) software (Dalthorp et al. 2017) will also be used to estimate bat fatality rates (lambda) and cumulative bat fatalities (M*). More specifically, the average annual fatality rate, short term rate, projection of future mortality, and total mortality estimate tools in the Multiple Years Module will be used. Because incidental finds cannot be corrected for search effort, they will not be used to calculate take estimates for compliance except if the number of incidental finds in any given year exceeds the permitted take rate.

The Species Composition and EoA methods of fatality estimation will be analyzed throughout the permit period and the most scientifically defensible approach will be utilized to determine if adaptive management (see Tables 7-2, 7-3 and 8-1) is triggered in coordination with USFWS. As appropriate, and if necessary, Hoopeston and the USFWS will meet and discuss available data and attempt to informally resolve any disagreements regarding the need for adaptive management, with USFWS making the final determination.

7.3.5.2 Reporting

Hoopeston Wind will provide an annual mortality monitoring report to the USFWS by April 1 of each year of the permit summarizing the results of post-construction monitoring occurring during the prior calendar year. The report will include fatality estimates, data summaries, and assessment of correlations between fatality rates and potentially influential variables such as weather, location, turbine operation, etc. Fatalities will be expressed both in terms of fatalities/turbine/season and in terms of fatalities/MW/season, as recommended by the USFWS's LWEG (USFWS 2012a) to facilitate comparison with other studies. The reports will include all data analyses, including correlation analyses and overall fatality estimates, and a discussion of monitoring results and their implications.

In addition to the mortality monitoring reports, Hoopeston Wind will promptly report fatalities of ESA-listed species or eagles to the USFWS. Hoopeston Wind will report the discovery of any actual Indiana bat or northern long-eared bat fatalities to the USFWS within 48 hours of discovery. In the event that estimated Indiana or northern long-eared bat mortality exceeds the thresholds set forth in Table 7-2 and 7-3 (or 8-1 if applicable), adaptive management measures will be implemented as specified, informed by the relevant variables identified in the fatality monitoring report.

The proposed take limit has been established at no more than 60 Indiana bats and no more than 60 northern long-eared bats over the 30-year life of the permit, based on an expected average take of 2 Indiana bats and 2 northern long-eared bats per calendar year. Hoopeston Wind will implement adaptive management measures based on these annual expected take averages to provide assurance that total authorized levels of take will not be exceeded. Any adaptive management measures implemented shall be described in the annual fatality monitoring report.

7.4 Adaptive Management

Adaptive management is a process through which Hoopeston Wind can modify operational protocols outlined in this HCP to reflect new information or changing conditions in order to minimize take and ensure conservation of Indiana and northern long-eared bats, while minimizing effects on the operation of the Project. Hoopeston Wind will use adaptive management to minimize take associated with the operation of the Project, and to promote the long-term survival of both the Indiana and northern long-eared bats. Impacts will be analyzed using the best available science at that time, including scientific advancements made since issuance of the ITP. Analysis may include items such as timing of fatalities, location of fatalities, other circumstances (e.g., weather) as well as the actual take estimate. In addition to the conservation measures proposed below, additional conservation measures may be implemented if research suggests that they may be successful in reducing the level of take at the Project.

Adaptive management will allow Hoopeston Wind to minimize the uncertainty associated with gaps in scientific information or biological requirements. Information used in the adaptive management process will come from the post-construction mortality monitoring activities described in Section 7.3. Monitoring data will be analyzed to determine if the objectives of this HCP are being met. If the conservation measures are not producing the desired results, adjustments will be made to the HCP as necessary and in consultation with the USFWS to achieve the biological objectives of this HCP.

If no Covered Species (i.e., Indiana bat and northern long-eared bat) are detected during the first three years of monitoring (intensive monitoring period) and estimated fatalities of Covered Species are at or below 2.0 per year of each species (see Section 7.3.5.1 for methodology), then Hoopeston Wind will continue this operational program during the remaining term of the ITP unless specified adaptive management triggers are met.

7.4.1 Adaptive Management Triggers and Responses

If Covered Species are discovered during the first three years of monitoring, or if Covered Species are discovered during annual check-in monitoring, then Hoopeston Wind will notify USFWS within 48 hours of positive species identification (or if a suspect carcass is found) to evaluate available data concerning the discovery, potential cause of the fatality, and appropriate additional adaptive management actions if necessary. If no Covered Species are observed, the estimated total bat mortality will be evaluated to determine the estimated take of both Covered Species (see Section 7.3.5.1 for methodology), and these estimates will be evaluated to determine whether it is in compliance with the ITP. Tables 7-2, 7-3, and 8-1 outline specific adaptive management triggers and responses in view of carcass discoveries and associated Indiana and northern long-eared bat fatality estimates.

On January 14, 2016, the USFWS published a final ESA 4(d) rule for NLEB exempting incidental take occurring at wind projects from Section 9 take prohibitions with minor exceptions (81 Fed. Reg. 1900; USFWS 2016c). The USFWS concluded this 4(d) rule was necessary and advisable due to the infrequent and insignificant impact of wind energy operations on NLEB. In view of this development, the Applicant proposes to implement NLEB-specific adaptive management triggers as described in Table 7-3 until such time that take of this species is prohibited at wind energy projects, at which time measures proposed in Table 8-1 would be applicable.

In order to account for the annual variability of take, and to avoid making decisions based on an annual outlier result and given the rarity of incidental take, the adaptive management triggers are based on the a three-year rolling time period when using the Species Composition Approach and a combination of a three year estimation term and average fatality rates over completed permit years in the EofA approach. The three year assessment period accounts for annual variability and helps ensure that decisions are made based on the expected normal conditions at the Project. In addition, it also identifies if changes in the trend in bat mortality are occurring over time, for example increasing or decreasing, that a single year estimate would not account for. Using a three-year assessment period accounts for annual variability in incidental take and changes in trends in the take over time before triggering an adaptive management response. In this manner, decisions are made at an appropriate time scale, while still allowing Hoopeston Wind sufficient time over the Permit term to make adjustments to the minimization measures to maintain permit compliance.

Table 7-2. Indiana Bat Adaptive Management[1] Triggers and Responses.

Trigger for Adaptive Management[1]	Immediate Response	Adaptive Management Response
During the first three years of monitoring, the average take rate (estimated via Species Composition and/or using EoA with lambda at alpha = 0.5) is between 2 and 4 bats/year. OR In any given year, the Indiana bat fatality rate over the past three years (average rate estimated via Species Composition and/or using the short term rate test in EoA with lambda>tau at alpha=0.1) is between 2 and 4. OR Following the check-in monitoring period in Year 16, the average annual fatality rate (estimated via Species Composition and/or using EoA with lambda at 1- alpha = 0.5) over years 1-16 is between 2 and 4 bats per year	• Meet and confer with USFWS in advance of next monitoring period to evaluate available project-specific and/or other data on the potential cause of the fatalities, and determine the appropriate scope of additional adaptive management actions.	• Increase cut-in speed by increments of 1.1 mph (0.5 m/s) with the intent of bringing take down to expected annual levels (2 per year) at all Project turbines 7 days on either side of the mortality event(s). If take exceedance is calculated and no actual carcasses are in-hand, cut-in speed adjustments will occur during the two-week period in which all bat fatalities are the highest. Cut-in speeds will be raised at all Project turbines by 0.5 m/s unless the Applicant demonstrates with available data that raising cut-in speeds at fewer turbines will be at least as effective. • Implement Adaptive Management Monitoring[2] during the appropriate season for 2 additional years. Such monitoring will be project-wide unless the applicant demonstrates with available data that monitoring at fewer turbines will be at least as effective. • Review and update, as necessary, monitoring protocols to assess the conservation value of blade feathering. • Implement other appropriate measures to address the identified issue based on the best available science.

AND The projection of future mortality of Indiana bats (estimated via Species Composition and using EoA with alpha = 0.5), based on the remaining term of the permit, is likely to exceed the authorized amount.		
During the first three years of monitoring, the average take rate (estimated via Species Composition and/or using EoA with lambda at alpha=0.5) is greater than 4 bats/year. OR In any given year, the Indiana bat fatality rate over the past three years (estimated via Species Composition and/or using the short term rate test in EoA with lambda>tau at alpha=0.1) is greater than 4. OR Following the check-in monitoring period in Year 16, the average	• Meet and confer with USFWS in advance of next monitoring period to evaluate available project-specific and/or other data concerning the potential cause of the fatalities, and determine the appropriate scope of additional adaptive management actions.	• Increase cut-in speed by increments of 1.0 m/s with the intent of bringing take down to expected annual levels (2 per year) at all Project turbines, 7 days on either side of the mortality event(s). If take exceedance is calculated and no actual carcasses are in-hand, cut-in speed adjustments will occur during the two-week period in which all bat fatalities are the highest. • Cut-in speeds will be raised at all Project turbines by 1.0 m/s unless the applicant demonstrates with available data that raising cut-in speeds at fewer turbines will be at least as effective. • Implement Adaptive Management Monitoring[1] during the appropriate season for 2 additional years. Such monitoring will be project-wide unless the applicant demonstrates with available data that monitoring at fewer turbines will be at least as effective. • Review and update, as necessary, monitoring protocols to assess the conservation value of blade feathering. • Implement other appropriate measures to address the identified issue based on the best

annual fatality rate (estimated via Species Composition and using EoA with lambda at 1- alpha = 0.5) is greater than 4. AND The projection of future mortality of Indiana bats (estimated via Species Composition and using EoA with alpha = 0.5), based on the remaining term of the permit, is likely to exceed the authorized amount.		available science.
The projection of future mortality of Indiana bats (estimated via Species Composition and/or using EoA with alpha = 0.5), based on the remaining term of the permit, is likely to exceed the authorized amount.	• Meet and confer with USFWS in advance of next monitoring period to evaluate available project-specific and/or other data concerning the potential cause of the fatalities, and determine the appropriate scope of additional adaptive management actions.	• Evaluate with the USFWS adjusting operational protocols to further increase cut-in speeds during the appropriate period to stay within authorized levels of permitted take. Cut-in speeds will be adjusted to a level such that predicted future take does not exceed authorized amount as demonstrated by the Applicant and approved by the Service. • Evaluate with USFWS the installation of proven, cost-effective bat deterrent devices at the turbine or group of turbines implicated in the find, should that technology become commercially available. • Implement additional Adaptive Management

		Monitoring[1] at all or the adjusted turbines during the adjusted period for 2 additional years.

[1] Calculations of take rates for covered species will be done using the Species Composition method and EofA software (Dalthorp et al. 2017). Both take estimation methods will be used to assess whether adaptive management triggers have been met.

[2] Adaptive Management Monitoring consists of three times weekly monitoring at 49 roads and pads (95 m radius from turbine) during the appropriate season.

Table 7-3. Northern Long-eared Bat Adaptive Management Triggers and Responses.

(Note: Adaptive management responses in this table will apply to NLEB until the species becomes subject to section 9 take prohibitions in the future.)

Trigger for Adaptive Management[1]	Immediate Response	Adaptive Management Response
During the first three years of monitoring, the average take rate (estimated via Species Composition and/or using EoA with lambda at alpha=0.5) is between 4 and 6 bats/year. OR In any given year, the northern long-eared bat fatality rate over the past three years (estimated via Species Composition and/or using the short term rate test in EoA with lambda>tau at alpha=0.1) is between 4 and 6. OR Following the check-in monitoring period in Year 16, the average annual fatality rate (estimated via Species Composition and/or using EoA with lambda at 1- alpha = 0.5) is between 4 and 6 bats per year AND The projection of future mortality of northern long-eared bats (estimated via Species	• Meet and confer with the USFWS in advance of next monitoring period to evaluate available project-specific and/or other data concerning the potential cause of the fatalities, and determine the appropriate scope of additional adaptive management actions.	• Increase cut-in speed by increments of 1.1 mph (0.5 m/s) with the intent of bringing take down to expected annual levels (2 per year) at all Project turbines 7 days on either side of the mortality event(s). If take exceedance is calculated and no actual carcasses are in-hand, cut-in speed adjustments will occur during the two-week period in which all bat fatalities are the highest. Cut-in speeds will be raised at all Project turbines by 0.5 m/s unless the Applicant demonstrates with available data that raising cut-in speeds at fewer turbines will be at least as effective. • Implement Adaptive Management Monitoring[2] during the appropriate season for 2 additional years. Such monitoring will be project-wide unless the applicant demonstrates with available data that monitoring at fewer turbines will be at least as effective. • Review and update, as necessary, monitoring protocols to assess the conservation value of blade feathering. • Implement other appropriate measures to address the identified issue based on

Composition and/or using EoA with alpha = 0.5), based on the remaining term of the permit, is likely to exceed the authorized amount.		the best available science..
During the first three years of monitoring, the average take rate (estimated via Species Composition and/or using EoA with lambda at alpha=0.5) is greater than 6 bats/year. OR In any given year, the northern long-eared bat fatality rate over the past three years (estimated via Species Composition and/or using the short term rate test in EoA with lambda>tau at alpha=0.1) is greater than 6. OR Following the check-in monitoring period in Year 16, the average annual fatality rate (estimated via Species Composition and/or using EoA with lambda at 1- alpha = 0.5) is greater than 6. AND The projection of future mortality of northern long-eared bats, based on the remaining term of the permit, is likely (estimated via Species Composition and/or using EoA with	• Meet and confer with the USFWS in advance of next monitoring period to evaluate available project-specific and/or other data concerning the potential cause of the fatalities, and determine the appropriate scope of additional adaptive management actions.	• Increase cut-in speed by increments of 1.0 m/s with the intent of bringing take down to expected annual levels (2 per year) at all Project turbines, 7 days on either side of the mortality event(s). If take exceedance is calculated and no actual carcasses are in-hand, cut-in speed adjustments will occur during the two-week period in which all bat fatalities are the highest. • If take exceedance is calculated and no actual carcasses are in-hand, cut-in speed adjustments will occur during the two-week period in which all bat fatalities are the highest. • Cut-in speeds will be raised at all Project turbines by 1.0 m/s unless the applicant demonstrates with available data that raising cut-in speeds at fewer turbines will be at least as effective. • Implement Adaptive Management Monitoring[1] during the appropriate season for 2 additional years. Such monitoring will be project-wide unless the applicant demonstrates with available data that monitoring at fewer turbines will be at least as effective. • Review and update, as necessary, monitoring protocols to assess the

alpha = 0.5) to exceed the authorized amount.		conservation value of blade feathering. • Implement other appropriate measures to address the identified issue based on the best available science.
The projection of future mortality (estimated via Species Composition and/or using EoA with alpha = 0.5), based on the remaining term of the permit, appears likely to exceed the authorized amount.	• Meet and confer with the USFWS in advance of next monitoring period to evaluate available project-specific and/or other data concerning the potential cause of the fatalities, and determine the appropriate scope of additional adaptive management actions.	• Evaluate with the USFWS adjusting operational protocols to further increase cut-in speeds during the appropriate period to stay within authorized levels of permitted take. Cut-in speeds will be adjusted to a level such that predicted future take does not exceed authorized amount as demonstrated by the Applicant and approved by the Service. • Evaluate with USFWS the installation of proven, cost-effective bat deterrent devices at the turbine or group of turbines implicated in the find, should that technology become commercially available. • Implement Adaptive Management[1] monitoring at all or the adjusted turbines during the adjusted period for 2 additional years.

[1] Calculations of take rates for covered species will be done using the Species Composition method and EofA software (Dalthorp et al. 2017). Both take estimation methods will be used to assess whether adaptive management triggers have been met.
[2] Adaptive Management Monitoring consists of three times weekly monitoring at 49 roads and pads (95 m radius from turbine) during the appropriate season.

7.4.2 Reductions in Cut-in Speeds

In the event that fatality trajectory indicates that permitted take levels of either species will be exceeded in five years or less, Hoopeston will raise cut in speeds during fall to 5 m/s and implement 3 additional years of adaptive management monitoring to confirm effectiveness of the response.

7.4.3 Reductions in Cut-in Speeds

Reductions in cut-in speed may be justified if adaptive management triggers to raise the cut-in speed (see Section 7.4.1) are met, and the increased cut-in speed results in a greater-than-expected reduction in fatalities. If mortality rates decrease below the level of permitted take, then Hoopeston Wind will coordinate with USFWS if reductions in the cut-in speed are desired to determine appropriate monitoring and cut-in speed adjustments. Prior to such coordination, Hoopeston Wind will develop a report analyzing the amount of take that has occurred and assess the likelihood of exceeding authorized take over the remaining permit term. The parties will then meet and confer to agree up on cut-in speed adjustments at Project turbines and final approval for such reduction would be at the discretion of the Service.

7.4.4 Reporting and Notification

Hoopeston Wind shall provide written notification to the USFWS prior to the implementation of any adaptive management response measures set forth in this section. Annual mortality monitoring reports submitted in accordance with Section 7.3.5 of this HCP shall include a discussion of the effectiveness of the measures implemented.

8.0 Implementation and Funding Assurances

8.1.1 Plan Implementation

The HCP is a mandatory element of the permit application and its implementation will be a condition of the permit. The HCP is designed to be self-implementing, providing the requirements for covered activities, as well as required avoidance, minimization, and mitigation measures.

The applicant requests the benefits of the Federal No Surprises Rule, 63 Fed. Reg. 8859 (Feb. 23, 1998) (codified at 50 C.F.R. §§ 17.3, 17.22(b)(5), 17.32(b)(5)). It generally provides assurances to section 10 permit holders that, as long as the permittee is properly implementing the HCP, and the ITP, no additional commitment of land, water, or financial compensation will be required with respect to Covered Species, and no restrictions on the use of land, water, or other natural resources will be imposed beyond those specified in the HCP without the consent of the permittee. The “No Surprises” Rule has two major components: changed circumstances and unforeseen circumstances.

8.1.2 Changed Circumstances

The term “changed circumstances” means changes in circumstances affecting a species or geographic area covered by an HCP that can reasonably be anticipated and that can be planned for (e.g., the listing of new species or a fire or other natural catastrophic event in areas prone to such events).

As discussed in Section 9.6 of the HCP Handbook (USFWS and NMFS 2016d) with respect to foreseeable changed circumstances, the HCP should discuss measures developed by the applicant to meet such changes over time, possibly by incorporating adaptive management measures for Covered Species in the HCP. HCP planners should identify potential problems in advance and identify specific strategies or protocols in the HCP for dealing with them, so that adjustments can be made as necessary without having to amend the HCP. Hoopeston has identified impacts of WNS on Covered Species, elevated annual take due to changing environmental conditions, the listing of new species, and changed technologies/techniques.

8.1.2.1 Impacts of WNS on Covered Species

The occurrence of WNS and population declines constitute foreseeable changed circumstances that warrant consideration in this HCP. WNS has been confirmed in the Indiana bat OCRU; however, it is difficult to predict at this time what the long-term effects of the disease will be on the Covered Species.

By establishing a biological objective to reduce *Myotis* fatalities by turbine operational restrictions, and by lowering its take estimate over the Permit term (see Section 7.2.1), Hoopeston anticipates that incidental take will not constitute a material negative effect to the population declines that are already occurring due to WNS impacts; i.e., the WNS response has been incorporated into the development of the plan through the biological objectives and the take assessment. Given the uncertainty surrounding WNS and its effects on local bat populations, however, WNS is acknowledged as a changed circumstance that might require an additional response.

The changed circumstance trigger for the Covered Species is a 70% or greater reduction in the Indiana bat OCRU or northern long-eared bat local population based on USFWS data after 2015. Seventy percent is the approximate population reduction for Indiana bats in the Northeast Recovery Unit from 2007-2011, the period that reflects declining populations from WNS effects for that recovery unit (based on best scientific data currently available). That recovery unit has been experiencing effects from WNS since 2006, and we anticipate other recovery units will follow the same trend as WNS continues to spread. This trend is incorporated into the Indiana bat population model being used by USFWS in its biological opinion to analyze effects of the incidental take permit to Hoopeston on the Indiana bat. If, however, at any time the Indiana bat OCRU or local population of northern long-eared bat decreases by 70% or greater than the 2015 level, this will constitute a changed circumstance, as a key assumption of the Indiana bat population model will have been violated.

Upon receipt of the biennial population estimates for the OCRU or northern long-eared bat population, the USFWS will immediately evaluate whether this trigger has been met and will inform Hoopeston if that is the case. In the event that the WNS changed circumstance has been triggered, Hoopeston will conduct

an analysis, in coordination with the USFWS, to determine whether the level of Indiana bat take at the Project is having a material negative effect (after accounting for benefits of mitigation) to the remaining Indiana bat populations in the OCRU or northern long-eared bat population. If the analysis demonstrates that a 35% take reduction is no longer sufficient to prevent material negative effects with the declining population, Hoopeston will implement additional operational restrictions or minimization measures by the next bat spring emergence season (April). These additional measures will be determined through consultation with the USFWS, which will determine what level of take reduction prevents material negative effects. A written plan will be provided by Hoopeston to the USFWS by December, with formal concurrence reached by February 1. In addition, the effectiveness of these additional measures will be evaluated by additional monitoring, which will be detailed in the written plan.

Examples of different turbine operational protocols that will be considered include changes in the turbine cut-in speed; changes in timing of turbine operating regimes (if timing of Indiana bat or northern long-eared bat fatalities suggests a specific period when these species are at greatest risk); selected turbine curtailment (if evidence indicates specific turbines are causing significantly greater mortality of bats); making operational adjustments based in part on other environmental factors such as temperature; and deployment and testing of bat deterrent technology if suitable technology is available.

8.1.2.2 Elevated Annual Take Due to Changing Environmental Conditions

A primary biological goal of this HCP is to minimize potential take of Covered Species from the Project through on-site minimization measures. Available scientific information indicates that potential take of Indiana bats and northern long-eared bats at the Project as a result of turbine operations could range up to 2.0 bats per year of each Covered Species.

Given uncertainties about the presence of Covered Species in the Project Area, the potential expansion of the species' range, and local population size over time as a result of recovery actions implemented for Indiana bat or possible changes in habitat utilization as a result of climate change, the distribution and occurrence of Covered Species in or near the Project could change (e.g., establishment of a maternity colony near the Project). If the estimated annual take exceeds 2.0 bats per year of each Covered Species after the full adaptive management program has been implemented, Hoopeston assumes that there may have been an increase in the local abundance of Indiana bats or northern long-eared bats, thus triggering this changed circumstance, and Hoopeston will implement the following measure to address this changed circumstance.

Hoopeston and USFWS will meet to agree on potential adjustments to the conservation plan for subsequent years. Adjustments related to the changed circumstance may include focusing on those specific areas of the Project or time of year demonstrating the highest likelihood of take based on the new information. Through this process, Hoopeston will intensively evaluate geographic areas of the site containing the species, including seasonal and temporal presence of the species, and it will develop and implement turbine-specific operational protocols to reduce take in these areas to help ensure the amount of authorized take is not exceeded. Adjustments may also include different turbine operational protocols, including changes in the turbine cut-in speed; changes in timing (duration of night, length of season) of turbine operating regimes (if timing of Indiana or northern long-eared bat fatalities suggests a specific

period when these species are at greatest risk); selected turbine curtailment (if evidence indicates specific turbines are causing significantly greater mortality of bats); making operational adjustments based in part on other environmental factors such as temperature if evidence indicates these adjustments can substantially reduce fatality); and testing and deployment of bat deterrent technology if suitable technology is available.

Measures as described in this change circumstance will be an addition to the adaptive management actions as described in Section 7.4.

8.1.2.3 Listing of New Species

In the event of any future listing of bats or other species as threatened or endangered, Hoopeston will confer with USFWS over the need to pursue an amendment to the HCP and ITP. In the event of a future candidate species designation, Hoopeston will similarly confer with USFWS over the need to pursue an amendment of this HCP to include these as Covered Species and incorporate appropriate conservation measures.

Populations of cave-dwelling bats in the eastern and central U.S. may be declining due to WNS or other factors. In particular, little brown bat has experienced declines in recent years due to a variety of factors.

This species and others may occur in the Project Area. If one or more of these species become listed during the permit term, Hoopeston will comply with the ESA, and Hoopeston may seek to include such newly listed species as Covered Species in the ITP via a permit amendment...

8.1.2.4 Changed Technology/Techniques

Over the 30-year life of the permit, it is reasonably foreseeable that advances in wind turbine technology and techniques to avoid or minimize the mortality of bats will be made. This could include items such as bat deterrents, increased knowledge of the relationship between weather conditions and fatalities, and turbine design changes, as well as other advancements. These examples are described in detail below.

The use of acoustic deterrents is being studied for reducing bat mortality at wind turbines; however, this technology is currently not available on a large scale for use in wind energy facilities. Over time, other techniques that otherwise deter bats from collisions with turbines may prove effective in reducing bat mortality (e.g., changes in turbine colors, habitat modifications, etc.). Hoopeston may implement bat deterrents if approved by the USFWS and provided that this technique is proven and cost effective and meets the biological goals of this HCP.

A growing body of evidence suggests that bat activity is low at low temperatures, and particularly that nightly Indiana bat activity is correlated with temperature (USFWS 2007). Several studies have shown that bats and their prey become constrained by falling temperatures as autumn progresses (USFWS 2007). USFWS guidance states that mist-netting is unlikely to be successful when ambient temperatures are below 50° F (10° C) due to a sharp decrease in bat activity (USFWS 2007). This temperature is also understood to be the general threshold for hibernation by Indiana bats (USFWS 2007).

A study of the relationship between weather conditions and bat mortality at the Fowler Ridge wind energy facility in Indiana found that bat casualty rates were highest on nights with higher mean temperature and increasing variance in temperature (Good et al. 2011). Specifically, 91% of all bat fatalities during the fall migration period occurred on nights with mean nightly temperatures above 68° F (20° C). Regression analysis indicated that bat mortalities increased by 15% for every 1.8° F (1.0° C) increase in average nightly temperature at the Fowler site (Good et al. 2011). These data indicate that it may be possible to allow greater turbine operation at temperatures below 50° F (10° C), or other temperature to be determined based on future research, and avoid risk to Indiana bats as well as greatly reduce risk to all bats in general. Hoopeston may implement greater turbine operations at lower temperatures; if approved by the USFWS, this technique is proven and cost effective and meets the biological goals of this HCP.

Changes in turbine configuration, technology such as new turbine and/or blade designs, or automated changes in turbine operation triggered by monitoring parameters correlated to high risk to bats (such as weather variables or detection of high bat activity near the turbines) may also prove useful in reducing bat mortality at wind turbines. If new techniques or technology become available that cost less to implement than the currently proposed minimization measures, Hoopeston will evaluate whether to replace the measures detailed in the HCP and then take action if Hoopeston determines that the new measures are cost-effective, feasible to implement, and meet the biological objectives of the HCP. Although some technologies may be cost-effective, other factors may render them infeasible (e.g., topography, site constraints, safety, legal constraints). Additionally, although some measures may cost less to implement, timing may play a factor in whether such technologies are cost-effective to implement (i.e., it may not be financially prudent to change approaches in the latter years of the permit, especially if recorded take is negligible).

Any changes in techniques or technologies will only be considered if it has been demonstrated in an acceptable scientifically-based study, and has been approved by the USFWS as the best available science, compliant with the HCP biological goals and objectives, and will not require an increase in the take authorized for the Project.

8.1.2.5 Post 4(d) Adaptive Management for Northern Long-Eared Bat

Should the final ESA 4(d) rule for NLEB exempting incidental take occurring at wind projects from Section 9 take prohibitions (81 Fed. Reg. 1900; USFWS 2016c) be overturned or reversed, resulting NLEB take prohibition, the following NLEB-specific adaptive management triggers and responses as described in Table 8-1 will be implemented.

Table 8-1. Northern Long-eared Bat Adaptive Management[1] Triggers and Responses if the species becomes subject to Section 9 Take Prohibitions in the Future.

Trigger for Adaptive Management[1]	Immediate Response	Adaptive Management Response
During the first three years of monitoring, the average take rate (estimated via Species Composition and/or using EoA with lambda at alpha=0.5) is between 2 and 4 bats/year. OR In any given year, the northern long-eared bat fatality rate over the past three years (estimated via Species Composition and/or using the short term rate test in EoA with lambda>tau at alpha=0.1) is between 2 and 4. OR Following the check-in monitoring period in Year 16, the average annual fatality rate (estimated via Species Composition and/or using EoA with lambda at 1- alpha = 0.5) over years 1-16 is between 2 and 4 bats per year	• Meet and confer with USFWS in advance of next monitoring period to evaluate available project-specific and/or other data on the potential cause of the fatalities, and determine the appropriate scope of additional adaptive management actions.	• Increase cut-in speed by increments of 1.1 mph (0.5 m/s) with the intent of bringing take down to expected annual levels (2 per year) at all Project turbines 7 days on either side of the mortality event(s). If take exceedance is calculated and no actual carcasses are in-hand, cut-in speed adjustments will occur during the two-week period in which all bat fatalities are the highest. Cut-in speeds will be raised at all Project turbines by 0.5 m/s unless the Applicant demonstrates with available data that raising cut-in speeds at fewer turbines will be at least as effective. • Implement Adaptive Management monitoring[2] during the appropriate season for 2 additional years. Such monitoring will be project-wide unless the applicant demonstrates with available data that monitoring at fewer turbines will be at least as effective. • Review and update, as necessary, monitoring protocols to assess the conservation value of blade feathering. • Implement other appropriate measures to address the identified issue based on the best available science.

AND The projection of future mortality of northern long-eared bats, based on the remaining term of the permit, is likely (estimated via Species Composition and/or using EoA with alpha = 0.5) to exceed the authorized amount.		
During the first three years of monitoring, the average take rate (estimated via Species Composition and/or using EoA with lambda at alpha=0.5) is greater than 4 bats/year. OR In any given year, the northern long-eared bat fatality rate over the past three years (estimated via Species Composition and/or using the short term rate test in EoA with lambda>tau at alpha=0.1) is greater than 4. OR Following the check-in monitoring period in Year 16, the average	• Meet and confer with USFWS in advance of next monitoring period to evaluate available project-specific and/or other data concerning the potential cause of the fatalities, and determine the appropriate scope of additional adaptive management actions.	• Increase cut-in speed by increments of 1.0 m/s with the intent of bringing take down to expected annual levels (2 per year) at all Project turbines, 7 days on either side of the mortality event(s). If take exceedance is calculated and no actual carcasses are in-hand, cut-in speed adjustments will occur during the two-week period in which all bat fatalities are the highest. • If take exceedance is calculated and no actual carcasses are in-hand, cut-in speed adjustments will occur during the two-week period in which all bat fatalities are the highest. • Cut-in speeds will be raised at all Project turbines by 1.0 m/s unless the applicant demonstrates with available data that raising cut-in speeds at fewer turbines will be at least as effective. • Implement Adaptive Management monitoring[1] during the appropriate season for 2 additional years. Such monitoring will be project-wide unless the applicant demonstrates with available data that monitoring at fewer turbines will be at least as effective. • Review and update, as necessary, monitoring

annual fatality rate (estimated via Species Composition and/or using EoA with lambda at 1- alpha = 0.5) greater than 4 AND The projection of future mortality of northern long-eared bats, based on the remaining term of the permit, is likely (estimated via Species Composition and/or using EoA with alpha = 0.5) to exceed the authorized amount.		protocols to assess the conservation value of blade feathering. • Implement other appropriate measures to address the identified issue based on the best available science.
The projection of future mortality of northern long-eared bats, based on the remaining term of the permit, is likely to exceed (estimated via Species Composition and/or using EoA with alpha = 0.5) the authorized amount.	• Meet and confer with USFWS in advance of next monitoring period to evaluate available project-specific and/or other data concerning the potential cause of the fatalities, and determine the appropriate scope of additional adaptive management actions.	• Evaluate with the USFWS adjusting operational protocols to further increase cut-in speeds during the appropriate period to stay within authorized levels of permitted take. Cut-in speeds will be adjusted to a level such that predicted future take does not exceed authorized amount as demonstrated by the Applicant and approved by the Service. • Evaluate with USFWS the installation of proven, cost-effective bat deterrent devices at the turbine or group of turbines implicated in the find, should that technology become commercially available.

		• Implement additional Adaptive Management Monitoring[1] at all or the adjusted turbines during the adjusted period for 2 additional years.

[1] Calculations of take rates for covered species will be done using the Species Composition method and EofA software (Dalthorp et al. 2017). Both take estimation methods will be used to assess whether adaptive management triggers have been met.

[2] Adaptive Management Monitoring consists of three times weekly monitoring at 49 roads and pads (95 m radius from turbine) during the appropriate season.

8.1.3 Unforeseen Circumstances

Unforeseen circumstances are defined as changes in circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by plan developers and the USFWS at the time of the negotiation and development of the plan and that result in a substantial and adverse change in the status of the Covered Species (50 C.F.R. § 17.3).

The USFWS bears the burden of demonstrating that unforeseen circumstances exist using the best available scientific and commercial data available while considering certain factors (50 C.F.R. §§ 17.22(b)(5)(iii)(C)). In deciding whether unforeseen circumstances exist, the USFWS will consider, but not be limited to, the following factors (50 C.F.R. §§ 17.22(b)(5)(iii)(C)):

1. The size of the current range of the affected species;

2. The percentage of range adversely affected by the HCP;

3. The percentage of range conserved by the HCP;

4. The ecological significance of that portion of the range affected by the HCP;

5. The level of knowledge about the affected species and the degree of specificity of the species conservation program under the HCP; and

6. Whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

In negotiating unforeseen circumstances, the USFWS will not require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed upon for the species covered by the HCP without the consent of the permittee (50 C.F.R. §§ 17.22(b)(5)(iii)(A)). If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, the USFWS may require additional measures of the permittee where the HCP is being properly implemented only if such measures are limited to modifications within conserved habitat areas, if any, or to the HCP's operating conservation program for the affected species, and maintain the original terms of the plan to the maximum extent possible (50 C.F.R. §§ 17.22(b)(5)(iii)(B)). Additional conservation and mitigation measures will not involve the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the conservation plan without the consent of the permittee. Notwithstanding these assurances, nothing in the No Surprises Rule "will be construed to limit or constrain the USFWS, any federal agency, or a private entity, from taking additional actions, at its own expense, to protect or conserve a species included in a conservation plan" (50 C.F.R. §§ 17.22(b)(6)).

8.1.4 Funding Assurances

The ESA implementing regulations provide that an applicant for an ITP must establish that sufficient funding will be available to implement the HCP, including the requirements to monitor, minimize, and mitigate the impacts from the taking.

Measures requiring funding in an HCP typically include on-site measures during project implementation or construction (e.g., monitoring, surveys, research), as well as on-site and off-site measures required after completion of the Project or activity (e.g., revegetation of disturbed areas and acquisition of mitigation lands). For relatively small to medium-size projects involving only one or two applicants, the funding source is usually the permittee, and funding is provided immediately before project activities commence, immediately after, or in stages.

Hoopeston will provide such funds as may be necessary to carry out its obligation under the HCP. Hoopeston, and any successor in interest, should notify the Service if the Permittee's funding resources have materially changed, including a discussion of the nature of the change. To achieve this requirement, Hoopeston will provide two separate assurances that it will carry out all of its obligations under the HCP. First, concurrent with permit issuance, Hoopeston will provide USFWS with evidence that it has signed a contract for the first year of monitoring and reporting. Additionally, within one year of ITP issuance, Hoopeston will provide one or more irrevocable, non-transferable standby letters of credit issued by (i) a U.S. commercial bank or (ii) a U.S. branch of a foreign commercial bank with sufficient assets in the U.S., as determined by USFWS, with either such bank having a credit rating of at least A- from S&P or A3 from Moody's, or other equivalent form that is mutually agreeable to both Hoopeston and USFWS in the amount of $2,500,000. Hoopeston will maintain this financial assurance for the duration of the ITP and provide USFWS with evidence of its establishment. The amount of financial assurance is based on the estimated HCP implementation costs for Years 1-30 of the ITP, including the intensive monitoring effort, spring monitoring, check-in monitoring, annual monitoring, mowing, and reporting (see Table 8.2 for details). The amount of the financial assurance may be reduced over time commensurate with remaining financial obligations in the HCP by mutual agreement of the parties.

Hoopeston will fund an escrow account in the amount of $495,000 to facilitate off-site conservation actions (i.e., 165 acres for mitigation projects) during the term of the ITP. Hoopeston has entered into an agreement with a local nonprofit to undertake mitigation on its land (Apex 2016). Hoopeston will deposit one hundred percent of the $495,000 in a segregated escrow account within ninety (90) days after issuance of the ITP, so no ongoing financial security will be required to guarantee its fulfillment of this obligation. The Parties may agree in writing to extend the deadline for Hoopeston Wind to make a payment of $495,000 by up to an additional 90 days. In requesting the extension, Hoopeston Wind will outline the reasons for the extension. As described above, Hoopeston Wind will consult with USFWS over selected project(s) that satisfy the requirements of Section 7.2 before Hoopeston directs that money be disbursed (see Section 2.2.2).

Money from the conservation fund will be used by Hoopeston Wind to implement mitigation activities for the Covered Species, initial mitigation project documentation and monitoring efforts, and contingencies needed through adaptive management and changed circumstances.

The HCP and all of the obligations contained herein shall be binding on and shall inure to the benefit of the Parties hereto and their respective successors and assigns.

Table 8-2. Funding Assurances Budget.

(Note: All costs are in 2016 dollars, not adjusted for inflation.)

Task	Estimated Cost		Major Assumptions/Cost Basis
	Per year	Total	
Intensive monitoring Years 1-3 (fall)	$95,000[1,2]	$285,000	Fall searches include 15 full plot turbines and 34 roads and pads, searches twice per week.
Intensive monitoring Year 1-3 (spring)	$80,000[1,2]	$240,000	Spring searches include weekly searches of 5 full plots and 44 roads and pads for one year
Adaptive Management Monitoring	$45,000	$TBD	Three times weekly roads and pads during season triggered, based on changed circumstances or adaptive management
Annual monitoring Years 1-30	$45,000[1,2]	$1,170,000	Road and pad weekly searches, 6.5 months per year; performed by O&M personnel
Check-in Monitoring Years 15-16 (fall and spring periods)	$140,000[1,2]	$420,000	Monitoring of 5 full plots and 44 roads and pads, weekly during the spring and twice weekly during the fall season
Annual meetings Years 1-30	$6,000	$180,000	Conducted by consultant Years 1-3 and 15-16, conducted by Hoopeston all other years
Annual reports[1, 3]	Included above		Prepared by consultant Years 1-3 and 15-16, prepared by Hoopeston all other years
Vegetation clearing Years 1-3	$20,000	$60,000	5 spring, 15 fall plots
Vegetation clearing Years 15-16	$12,700	$38,100	5 plots in spring and fall
Annual O&M training[3]	Included above		
Land Restoration Costs for Off-site Habitat Conservation[4]		$495,000	165 acres, $3,000/acre
Administrative costs		$70,500	Consultant expenses; contracting
Long-term management costs		$67,500	Up-front contribution of up to 13.64% of restoration costs

[1] Searcher efficiency and carcass removal trial costs included in monitoring costs.
[2] Reporting costs included in monitoring costs.
[3] Search and data entry training for O&M personnel included in intensive monitoring costs (Hoopeston and consultant searchers trained concurrently).
[4] One-time payment to be made within 90 days of the issuance of the ITP.

9.0 List of Preparers

This document was prepared in consultation with the USFWS. The following companies and key individuals contributed to its preparation.

Company	Key Preparers
Apex Clean Energy, Inc.	Dave Phillips
K&L Gates LLP	Jim Lynch
Stantec Consulting Services Inc.	Terry VanDeWalle, Molly Stephenson

10.0 Literature Cited

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Appendix A

FINAL REPORT

Habitat Assessment for Indiana and Northern Long-eared Bats
Hoopeston Wind Energy Facility
Vermilion County, Illinois
January 23 - 24, 2014

Prepared for:

APEX Clean Energy, Inc.
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April 23, 2014

EXECUTIVE SUMMARY

APEX Clean Energy, Inc. (APEX) requested that Western EcoSystems Technology, Inc. (WEST) conduct an Indiana bat (*Myotis sodalis*; IBAT) and Northern long-eared bat (*Myotis septentrionalis;* NLEB) habitat assessment survey for the development of the planned Hoopeston Wind Farm in Vermilion County near Hoopeston, Illinois. The purpose of this assessment was to assist Apex in preliminary siting of wind turbines for the project in a manner that would minimize risk of impacts to these species, as well as inform the U.S. Fish and Wildlife Service (USFWS) Rock Island, Illinois, Ecological Services Field Office, which was providing technical assistance to Apex for these species. The field component of this assessment was completed on January 23 and 24, 2014, and data were used by USFWS to prepare a Technical Assistance Letter for IBAT and NLEB (USFWS 2014a).

Potential habitat was assessed using a two stage process. The first stage included desktop review of aerial photography to map treed areas within a minimum of 1,000 feet of the project boundary. The second stage included a field survey to assess the accuracy of the desktop work and identify additional treed areas that may have been missed for evaluation, and then assess the habitat potential for the species in all of these treed areas.

A total of 73 locations were surveyed from several vantage points along public roads. Binoculars, a high-powered spotting scope, and a telephoto lens were utilized to observe and record these potential habitats. Each delineated area was classified into four habitat types including non-habitat, shrubland, immature forest, or mature forest. Any dead or dying trees (snags) and any visible characteristics of these trees (e.g., exfoliating bark, cavities, crack) were also recorded when possible.

The majority of the proposed project is dominated by tilled agriculture and lacks suitable summer habitat for IBAT and NLEB. Several mature shelterbelts were identified within the project boundary that warrant siting consideration; however, most areas of suitable habitat were identified outside the project boundary. The results of the habitat assessment can be used by APEX to locate turbines away from suitable summer habitat for protected bat species.

STUDY PARTICIPANTS

Western EcoSystems Technology

Rhett E. Good	Senior Ecologist
Kevin L. Murray	Project Manager/Bat Biologist
Benjamin T. Hale	Bat Biologist

REPORT REFERENCE

Hale, B., K. Murray and R. Good. 2014. Habitat Assessment for Indiana and Northern Long-eared Bats, Hoopeston Wind Energy Facility, Vermilion County, Illinois. Prepared for APEX Clean Energy Charlottesville, VA. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana.

Table of Contents

BACKGROUND AND PROJECT OVERVIEW

APEX Clean Energy, Inc. (APEX) requested that Western EcoSystems Technology, Inc. (WEST) conduct an Indiana bat (*Myotis sodalis*; IBAT) and northern long-eared bat (*Myotis septentrionalis;* NLEB) habitat assessment for the planned Hoopeston Wind Farm in Vermilion County near Hoopeston, Illinois. The purpose of this assessment was to assist Apex in preliminary siting of wind turbines for the project in a manner that would minimize risk of impacts to these species, as well as inform the U.S. Fish and Wildlife Service (USFWS) Rock Island, Illinois, Ecological Services Field Office, which was providing technical assistance to Apex for these species. The field component of this assessment was completed on January 23 and 24, 2014, and data were used by USFWS to prepare a Technical Assistance Letter for IBAT and NLEB (USFWS 2014a).

TECHNICAL APPROACH

Indiana and Northern Long-eared Bat Habitat Assessment Surveys

The objectives of the bat habitat assessment were to: 1) classify habitat within or adjacent to the project boundary as non-habitat (no forest), shrubland, immature forest, or mature forest and 2) to assess forest habitat as suitable or unsuitable for both IBAT and NLEB. Methods used to assess potential habitat followed recommendations within the latest USFWS guidance documents for assessing potential IBAT and NLEB habitat (USFWS 2014b, USFWS 2014c).

Potential habitat was assessed using a two stage process. The first stage included desktop review of aerial photography to map trees, forested areas and potential shelterbelts within a minimum of 1,000 feet of the project boundary. The second stage included a ground truthing of the desktop work and identification of any additional treed areas that may have been missed during the desktop review, and assessment of habitat potential for the species for all habitat areas. The field survey was completed from the extensive public road network in the survey area. Binoculars and a high-powered spotting scope were utilized when necessary to enable careful visual inspection of the habitat patches under evaluation, and a camera with a telephoto lens was used to record these areas. In most cases, these areas were evaluated from several different vantage points along public roads. All delineated forested areas were characterized into four primary habitat categories; non-habitat, shrubland, immature forest, and mature forest. Non-habitat was defined as areas appearing as forest, hedge or fencerow in aerial images that were actually not treed habitat. Shrubland consisted of an area dominated by shrubs or trees with a DBH less than 3 in. and less than 7 meters tall. Immature forest consisted of trees with a DBH greater than 3 in. but generally less than 5 in. DBH, and would generally have few visible snags. Mature habitat consisted of trees with a DBH greater than 5 in. usually contain some visible snags.

Per current USFWS interim guidance (2014c), suitable habitat for NLEB was defined as forest stands with trees ≥ 3 in. diameter at breast height (DBH). In addition, shelterbelts ≤ 1,000 ft. from suitable habitat (e.g. riparian areas, continuous forest, and forested ponds) was considered suitable (USFWS, 2014c). Suitable habitat for IBATs was similarly defined except that trees must be at least 5 in. DBH to be considered suitable for this species (USFWS, 2014b). For NLEB, individual trees were considered to be potentially suitable roost trees if they have a DBH ≥ 3 in., contained crevices, cracks and/or exfoliating bark, and were located within 1,000 ft. of other

suitable roosting habitat. For the IBAT, individual trees with a DBH ≥ 5 in., containing crevices, cavities and/or exfoliating bark that were located within 1,000 ft. of suitable habitat, were considered suitable roosting habitat.

Isolated shelterbelts or isolated trees that were not connected to larger forest blocks or riparian areas (defined by gaps greater than 1,000 ft.) were considered unsuitable and unlikely to provide potential habitat for IBAT or NLEB. Conversely, shelterbelts, forest fragments, or isolated trees located near (within 1,000 ft.) of other mature shelterbelts, riparian forests, or upland forested areas were considered suitable habitat.

Field surveys were completed by Benjamin T. Hale, a federally permitted bat biologist for work with endangered species including the Indiana bat. He has been conducting research and surveys on bats with a focus on the *Myotis* genus for eight years (IBAT, NLEB, and little brown bat). His graduate thesis research focused on mist-netting, radio-tracking, habitat use, and home range delineation of IBAT, NLEB, and little brown bats in association with a pre-construction wind facility in Northeast Missouri. He has experience netting, tracking, and/or conducting habitat assessments of individuals of the *Myotis* genus in Missouri, Illinois, Indiana, Ohio, and West Virginia.

RESULTS

Habitat Assessment Surveys

A total of 73 forested areas and potential shelterbelts were assessed during the site visit (Appendix A). Fourteen areas were classified as shrubland (19%), and thus were considered unsuitable. Of the remaining forested areas and shelterbelts (n=59), 54% were immature trees (n=32) and 46% were mature trees (n=27).

A total of 15 forested areas were determined suitable for both IBAT and NLEB. Suitable habitat consisted of 9 shelterbelts, 2 areas of isolated roost trees, 3 riparian forested areas and one 6 acre forest block. Areas surveyed and results are presented in Figure 1. Representative photographs are presented in in Appendix A and described in the following sections.

Unsuitable Habitat

The majority (79%) of the habitat areas delineated were characterized as unsuitable habitat due to the age structure of the habitat (shrubland, non-habitat) and/or lack of connectivity to other suitable habitat (≥1,000 ft.). Several forested areas or shelterbelts identified from aerial photographs consisted of shrubs or isolating groupings of trees around a residential area (Figure 1). Shelterbelts that were labeled as unsuitable consisted primarily of shrubs or immature trees with some mature trees present; all of which were greater than 1,000 ft from suitable habitat (A-2 through A-6). Although some snags were present (A-1, 3, & 6), the isolation of these trees indicate they are unsuitable for use by IBAT and NLEB. Isolated shelterbelts with shrubs or immature trees are not likely to provide enough suitable roosting or foraging habitat to support IBAT or NLEB maternity colonies.

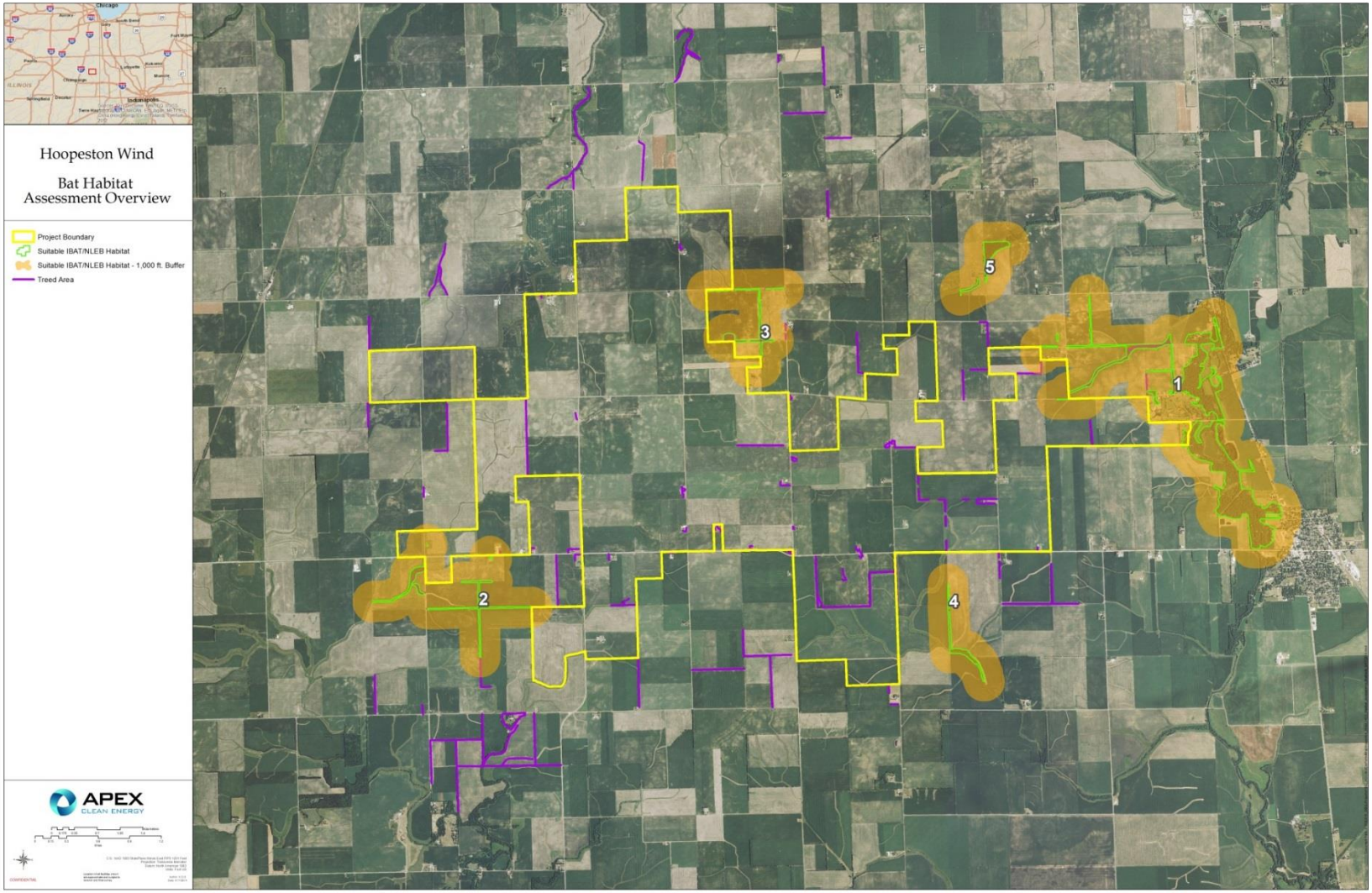

Figure 1. Areas surveyed and areas of suitable habitat identified for Indiana and northern long-eared bats at the Hoopeston Wind Farm.

Suitable Habitat

Fifteen areas were characterized as suitable habitat for both species, which occurred in 5 distinct "regions" throughout the project and vicinity as shown in Figure 1. Region 1 is located in the northeast region of the project and includes a few mature shelterbelts identified in the project boundary that were connected to suitable IBAT and NLEB habitat in the form of a forested riparian area (A-7). Suitable habitat was also identified outside the southwest project boundary (Region 2). This area includes mostly mature shelterbelts and some mature riparian habitat (A-8), with some snags just outside the project's border (A-9). A third region of suitability was identified bordering the north-central edge of the project (Region 3). This area is characterized primarily by a mature 6 acre forest block and mature shelterbelts (A-10). Some snags were present in the 6 acre forest block. Connectivity to other areas of suitable habitat was highly limited; however, the immediate proximity to a water source (70 m x 40 m man-made pond) indicates the potential for foraging for both bat species. A fourth area of suitable habitat was identified outside of the southeast part of the project area (Region 4). It primarily consisted of mature trees in a shelterbelt that was connected to a forested riparian area (A-11). Region 5 consisted of suitable habitat northeast of Region 1. This riparian area consisted of mostly immature trees with some mature trees present (A-12). Additionally, this area demonstrated direct connectivity to suitable riparian habitat.

DISCUSSION

The majority of the project and vicinity is dominated by tilled agriculture and lacks suitable habitat for IBAT and NLEB. A few mature shelterbelts were identified within the project boundary, with most areas of identified suitable habitat occurring outside of the project boundary. Current USFWS guidelines suggest that siting turbines over 1,000' from potential habitat will remove the potential for impacts to IBAT and NLEB during the summer (USFWS 2014d). The results of the habitat assessment can be used by APEX to locate turbines away from potentially suitable summer habitat for protected bat species.

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Appendix A. Representative Site Photos

A-1. Unsuitable habitat – isolated shelterbelts and treed areas in the central portion of the project

A-2. Unsuitable habitat – isolated shelterbelts in the southeast region of the project area

A-3. Unsuitable habitat – isolated shelterbelts within the eastern project boundary

A-4. Unsuitable habitat – isolated treed areas in the north central portion of the project

A-5. Unsuitable habitat – isolated shelterbelts and treed areas in the west central portion of the project

A-6. Unsuitable habitat – isolated shelterbelts and treed areas in the southwest portion of the project

A-7. Suitable habitat – Region 1

A-8. Suitable habitat – Region 2

A-9. Suitable habitat – Region 2

A-10. Suitable habitat – Region 3

A-11. Suitable habitat – Region 4

A-12. Suitable habitat – Region 5

Fall 2014 Acoustic Bat Survey

Hoopeston Wind Energy Project
Vermilion County, Illinois

Prepared for:
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Prepared by:
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January 14, 2015

Table of Contents

LIST OF TABLES

LIST OF FIGURE

1.0 INTRODUCTION

Stantec Consulting Services, Inc. (Stantec) was retained by Hoopeston Wind, LLC (Hoopeston) to perform a fall acoustic bat survey at the Hoopeston Wind Energy Project (Project) in accordance with U.S. Fish and Wildlife (USFWS) recommendations. The purpose of the study was to collect additional bat data to inform development of a Habitat Conservation Plan to be developed for Indiana and Northern long-eared bats that are potentially at risk during operation of the Project.

1.1 PROJECT DESCRIPTION

The Project will consist of 49-turbines and associated roads and infrastructure located in Vermilion County, Illinois (Figure 1). The project began construction in spring 2014 and is expected to be operational in January 2015.

1.2 OBJECTIVES

The primary objective of this study was to improve understanding of bat species composition and activity patterns at the project site during the fall migration season. The findings are intended to be used in developing appropriate conservation measures to reduce potential impact of federally protected bat species. Specific measures evaluated included the following:

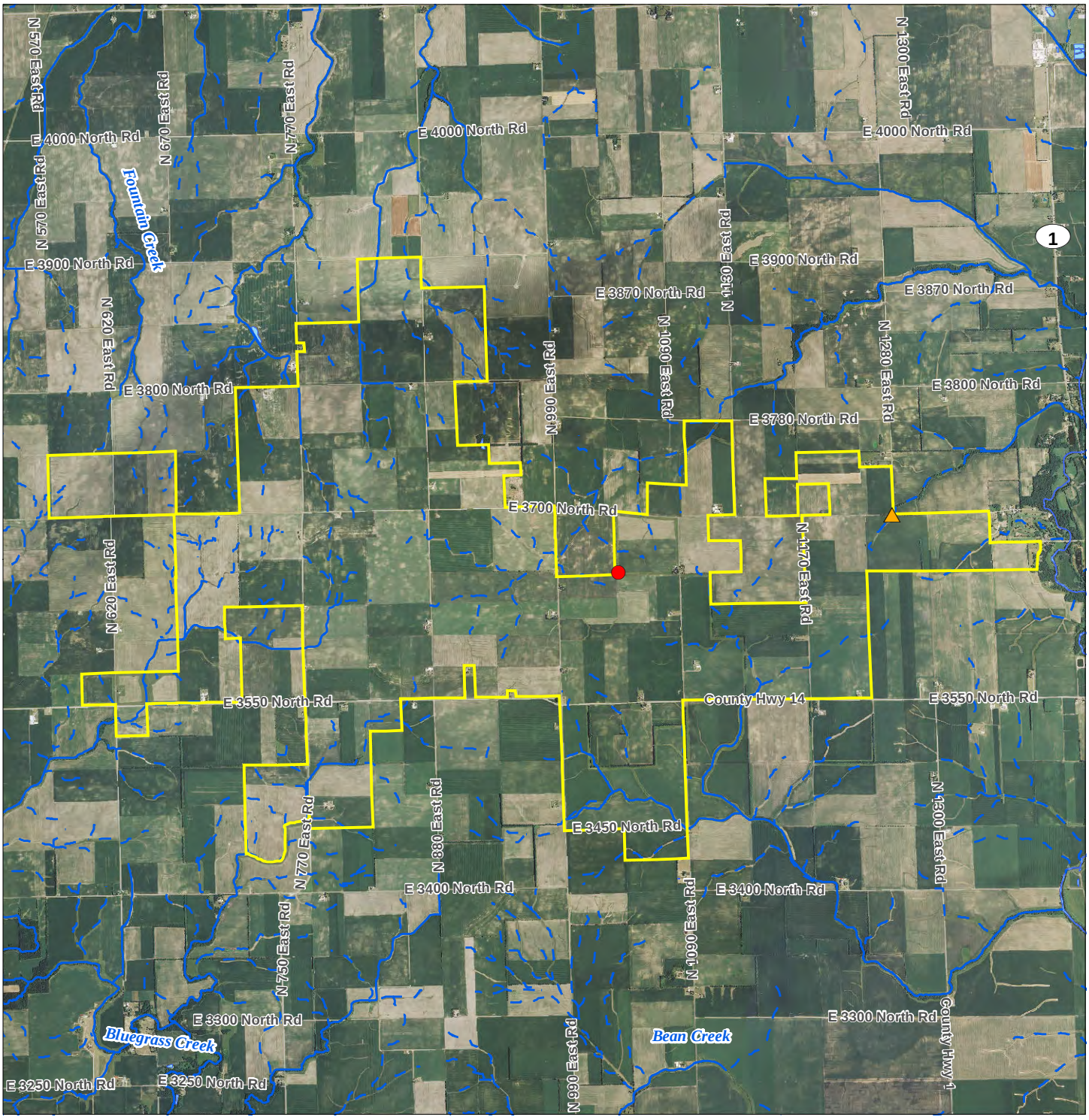
- Species composition
- Bat activity (as measured in passes/detector night)
- Seasonal, temporal and spatial (ground vs. 50 m above ground level [agl], two detector locations) patterns of activity

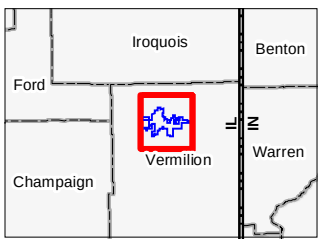
2.0 METHODS

2.1 ACOUSTIC DATA CAPTURE

The process used to evaluate the Project area generally follows recommended project siting guidelines of the USFWS Land-based Wind Energy Guidelines (USFWS 2012). Methods and sampling approaches were approved by the USFWS Rock Island Ecological Services Office prior to implementing the study.

Bat activity surveys within the Project area were completed using stationary (i.e. passive) echolocation detectors, which have been proven to be an acceptable methodology for bat/wind farm screening (Redell et al. 2006, Kunz et al. 2007). These detectors record the real-time ultrasonic calls emitted by echolocating bats, which can then be downloaded for filtering and visual analysis. From these files, the number of "bat passes", or times in which a bat was





Notes
1. Coordinate System: NAD 1983 StatePlane Illinois East FIPS 1201 Feet
2. Data Sources Include: Stantec, Apex, USGS, and Esri
3. Orthophotography: 2012 NAIP

Legend
- Ground Detector
- MET Tower
- Project Boundary

National Hydrography Data
- Perennial Stream
- Intermittent Stream
- Waterbody

Figure No.
1

Title
Project Location

Client/ Project
Apex Clean Energy, Inc.
Hoopeston Wind Project

Project Location
T22N/T23N, R12W/R13W
Vermilion Co., IL

19373166
Prepared by AB on 2014-12-12
Technical Review by MG on 2015-01-14
Independent Review by TV on 2015-01-14

0 3,000 6,000 Feet
1:72,000 (at original document size of 8.5x11)

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Stantec

recorded by the receiver, can be determined and used to calculate an index of bat activity or bat use in the area being sampled.

Bat activity surveys were conducted from 31 July through 31 October 2014. Surveys were focused on the fall migratory period since most bat fatalities occur in late summer and fall, coinciding with fall migration (Arnett et al. 2008).

Stationary detectors were used to determine the relative activity levels of bats at ground level (2 m agl) and near the rotor swept area (50 m agl). Bats were surveyed using Wildlife Acoustic SM3Bat full-spectrum recorders (Wildlife Acoustics, Maynard, Massachusetts). Stantec biologists deployed two detectors within the Project area: one on the Project's meteorological (MET) tower with a recording microphone at 2 m agl and one mounted at 50 m agl, and one unit located within a narrow band of trees adjacent to a local road, with a microphone at 2 m agl. The MET tower units evaluated activity in an open agricultural field, while the tree based unit sampled an area representative of the limited amount of summer bat habitat found within the Project area (Figure 1).

The tree-based detector was moved on 29 September 2014 to an alternate location within the same band of trees approximately 10 m to the west of the original location due to vandalism at the original location (the microphone cable had been cut). The detectors were programmed to record bat acoustic data nightly from sunset to sunrise.

2.2 ACOUSTIC DATA ANALYSIS

Bat calls were identified to species using Kaleidoscope Pro (Wildlife Acoustics, Inc.), a candidate acoustic identification program approved by USFWS. Calls were processed in both Analook Software (Titley Electronics, Australia) and Kaleidoscope to filter out files containing only noise. If Kaleidoscope identified a call as a *Myotis* species, qualitative analysis was conducted by Stantec biologists to determine if a positive or negative *Myotis* identification could be made. Characteristics of calls identified as *Myotis* were evaluated qualitatively to determine species if possible. Probable absence was assumed for any species not identified by the program, or if qualitative analysis determined that the automated identification was inaccurate.

The number of "bat passes", or times in which a bat was recorded by the receiver, was used as the basis for calculating an index to bat activity. A "bat pass" was defined as any file which passed the Kaleidoscope and Analook noise filters, regardless of whether it was identified to the species level or not. The total number of bat passes divided by the number of detector nights (one detector for one night = one detector night) was used as an index of bat activity.

3.0 RESULTS

A total of 1,189 bat passes were recorded over 184 detector nights at the Project area. Of these, a total of 1,020 passes (86%) were identified to the species level. The results by detector, species detected, temporal analysis and spatial analysis are discussed in detail below.

3.1 HIGH MET TOWER DETECTOR

The high MET tower detector had a total of 62 detector nights with a total of 194 bat passes (mean = 3.1 passes/detector night) recorded.

3.1.1 Species Detected

Of the 194 bat passes recorded at the high MET tower detector, a total of 179 bat passes (92%) were identified to the species level by Kaleidoscope, including:

- Silver-haired bat (*Lasionycteris noctivagans*) – 167 calls (86%)
- Hoary bat (*Lasiurus cinereus*) – 4 calls (2%)
- Big brown bat (*Eptesicus fuscus*) – 4 calls (2%)
- Evening bat (*Nycticeius humeralis*) – 1 call (<1%)
- Eastern red bat (*Lasiurus borealis*) – 1 call (<1%)
- Northern long-eared bat (*Myotis septentrionalis*) – 1 call (<1%)
- Tri-colored bat (*Perimyotis subflavus*) – 1 call (<1%)
- No Species Identification – 15 calls (8%)

A qualitative analysis of the Kaleidoscope identified northern long-eared bat call conducted by Stantec biologists determined that based upon call characteristics the call was not a *Myotis* call, and instead was in the big brown bat/silver-haired bat guild.

3.2 LOW MET TOWER DETECTOR

The low MET tower detector had a total of 62 detector nights with a total of 419 bat passes (mean = 6.8 passes/detector night) recorded.

3.2.1 Species Detected

Of the 419 bat passes recorded at the low MET tower detector, a total of 396 bat passes (95%) were identified to the species level by Kaleidoscope, including:

- Silver-haired bat – 343 calls (82%)
- Hoary bat – 41 calls (10%)
- Big brown bat – 9 calls (2%)
- Evening bat – 2 calls (<1%)
- Eastern red bat – 1 calls (<1%)
- No Species Identification – 23 calls (5%)

No *Myotis* species were detected at the low MET tower detector.

3.3 TREE-BASED DETECTOR

The tree-based detector had a total of 60 detector nights, and bats were recorded on 44 of these nights (73%). A total of 576 bat passes (mean=9.6 passes/detector night) were recorded at the ground-based detector.

3.3.1 Species Detected

Of the 576 bat passes recorded at the ground-based detector, a total of 445 bat passes (77%) were identified to the species level by Kaleidoscope, including:

- Silver-haired bat – 251 calls (44%)
- Big brown bat – 115 calls (20%)
- Evening bat – 27 calls (5%)
- Eastern red bat – 20 calls (3%)
- Hoary bat – 15 calls (3%)
- Northern long-eared bat – 6 calls (1%)
- Tri-colored bat – 5 calls (1%)
- Small-footed Bat (*Myotis leibii*) – 4 calls (1%)
- Indiana bat (*Myotis sodalis*) – 2 calls (<1%)
- No Species Identification – 131 calls (23%)

Qualitative analysis was conducted on the 12 Kaleidoscope identified *Myotis* species' calls (northern long-eared bat, small-footed bat, and Indiana bat) by Stantec biologists. Of the six northern long-eared bat calls, three were determined to be big brown bat/silver-haired guild, two were determined to be eastern red bat, and one was noise. Of the four small-footed bat calls, three were confirmed to be *Myotis* in origin, though positive species identification within that group was not possible due to the quality of the calls (note: the project area is located outside the known range of the small-footed bat in Illinois), and one was determined to be an eastern red bat. The two Indiana bat calls were determined to be one little brown bat and one northern long-eared bat.

3.4 TEMPORAL AND SPATIAL DISTRIBUTION OF BAT ACTIVITY

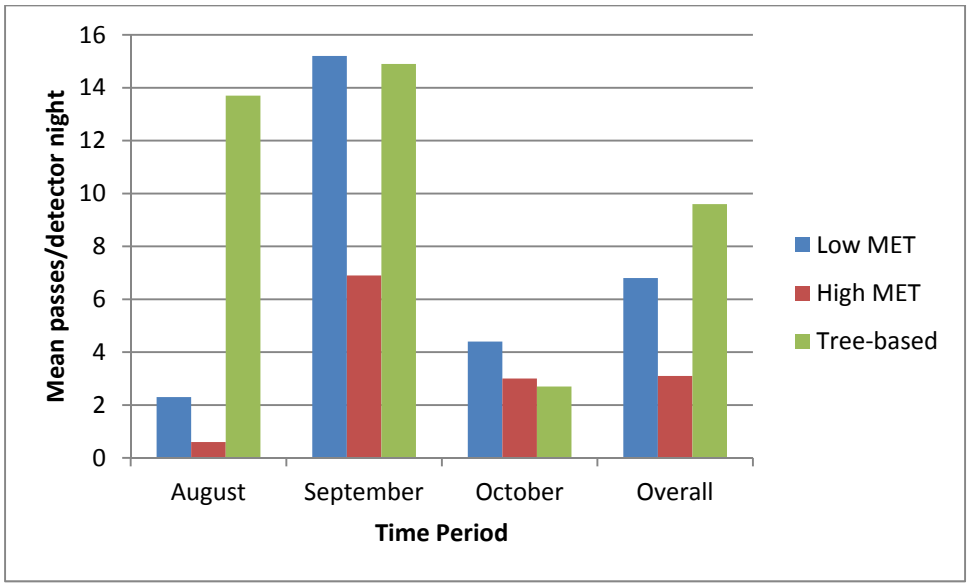
Of the 1,189 bat passes recorded during the survey, 16% (194 passes) were at the high MET tower detector, 35% (419 passes) were at the low MET tower detector, and 48% (576 passes) were at the tree-based detector. The overall bat activity rate was highest at the tree-based detector (9.6 passes/detector night), compared to the low MET tower detector (6.8 passes/detector night) and the high MET tower detector (3.1 passes/detector night; Table 1).

Table 1. Average bat activity per night, measured as passes/detector night, at the Hoopeston Wind Energy Project in Vermilion County, Illinois, as measured from 31 July through 31 October 2014.

		Bat Passes/Detector Night		
	Detector	**Low MET**	**High MET**	**Tree-based**
Month	August	2.3	0.6	13.7
	September	15.2	6.9	14.9
	October	4.4	3.0	2.7
Overall		6.8	3.1	9.6

At all three detectors, bat activity peaked in September (Table 1, Figure 2). Bat activity was lowest in October at the tree-based detector, and lowest in August at both MET tower detectors.

Figure 2. Mean bat passes/detector night by month and detector at the Hoopeston Wind Energy Project in Vermilion County, Illinois, as measured from 31 July through 31 October 2014.



4.0 SUMMARY AND LIMITATIONS

4.1 SUMMARY

- A total of 1,189 bat passes were detected during the survey; 194 (16%) at the high MET tower detector, 419 (35%) at the low MET tower detector and 576 (48%) at the tree-based detector.
- Overall bat activity rate was highest at the tree-based detector (natural habitat, 9.6 passes/detector night), compared to the low MET tower detector (agricultural field, 6.8 passes/detector night) and the high MET tower detector (agricultural field, 3.1 passes/detector night; Table 1).
- Of the 613 bat passes at the MET tower detectors, the majority (68%; 419 passes) were recorded at the low detector with the remaining 194 passes (32%) at the high detector (within the rotor-swept zone).
- Bat activity peaked in September at all three detector locations.
- Silver-haired bats were the most commonly recorded species at all detectors; 86% of all passes at the high MET tower detector, 84% of all passes at the low MET tower detector, and 44% of all passes at the tree-based detector.
- No *Myotis* calls were recorded at either MET tower detector; five *Myotis* calls were recorded at the tree-based detector, including one northern long-eared bat call on 20 October.

4.2 RISKS TO BATS

Of the 1,189 bat passes recorded during the survey, 16% (194 passes) were recorded at the high MET tower detector located within the proposed rotor-swept zone. Most bat mortality (>50%) at wind farms occurs in the late summer and early fall during migration (Erickson et al. 2002), which corresponds with the highest level of activity observed during this survey. Based on mortality data from other wind farms in the U.S., hoary bats comprised over 67% of all bat fatalities, followed by eastern red bats (17%) and silver-haired bats (7%; Erickson et al. 2002). Silver-haired bats comprised 86% of the passes detected at the high MET tower detector during this survey, suggesting potential risk to these species due to the location of this detector within the rotor-swept zone.

Little is known about the migration patterns of bats, specifically how they disperse across the landscape while migrating. Therefore, it is not possible to accurately predict an individual bat's route during migration. Based on this, migratory risk could occur anywhere within a species' geographic range, and the potential does exist for bats to migrate through the Hoopeston Wind

Energy Project area. While the Project is located in a highly agricultural setting away from large tracts of habitat, the results of this survey do show activity during the fall migratory season, including activity within the rotor-swept area. Yet previous studies have suggested that only a small fraction of detected bat passes near turbines result in collision mortality, and that there appears to be little correlation between bat activity at turbines and subsequent mortality (Erickson et al. 2002).

4.3 THREATENED AND ENDANGERED BAT SPECIES

The only species of bat currently listed as state or federally threatened or endangered in Vermilion County, Illinois is the Indiana bat. On October 2, 2013, the USFWS announced a 12-month finding on a petition to list the northern long-eared bat as endangered or threatened under the Endangered Species Act of 1973, as amended, and to designate critical habitat (78 FR 61046 – 61080). After review of the best available scientific and commercial information, the USFWS proposes to list the northern long-eared bat as endangered throughout its range. No critical habitat is designated at this time. An Interim Conference and Planning Guidance document on the northern long-eared bat was published on January 6, 2014 (USFWS 2014) to address how the USFWS will handle consultations and assessments concerning the northern long-eared bat prior to the final listing ruling. The USFWS anticipates a final ruling on whether to list the northern long-eared bat as endangered in April 2015. Additionally, the USFWS is voluntarily undertaking a status review of the little brown bat, due to significant population declines from White Nose Syndrome (reviewed in Kunz and Reichard 2010). The ranges of the Indiana bat, the northern long-eared bat and the little brown bat include the Project area (BCI 2014). A single call each of the northern long-eared bat and little brown bat was recorded during the survey, though neither species was detected at either MET tower detector.

Previous studies at various wind farms across the U.S. have found populations of little brown bats and northern long-eared bats living in close proximity to wind farms, yet the species do not appear to be as susceptible to collision mortality as hoary bats, silver-haired bats and red bats (reviewed in Erickson et al. 2002). The one northern long-eared bat call recorded during this study suggest the species is locally present, possibly at very low density, and may be at risk of collision with turbines during migration.

4.4 COMPARISON TO OTHER PRE-CONSTRUCTION DATA

Bat activity at the high MET tower microphone, when measured as an average number of bat passes/detector night, was relatively low when compared to other wind farm sites surveyed by Stantec in Iowa, Illinois, Indiana and Wisconsin. Table 2 provides a comparison of the bat activity at the high microphone at the MET tower within the Project area with activity at other wind farm sites surveyed at stationary locations by Stantec in the Midwest. Surveys may differ in the survey length and the number of detector nights.

Table 2. Comparison of bat activity at wind farms in the Midwest surveyed by Stantec.

Wind Farm Site Location	Mean Passes/Detector Night
Northeast Iowa	6.0
Central Indiana	5.4
Southwest Illinois	5.1
Northwest Illinois	4.8
East Central Wisconsin	3.9
Eastern Illinois	3.2
Hoopeston	**3.1**
Eastern Illinois	1.2
Northwestern Iowa	1.2
Northwestern Iowa	1.0
Central Iowa	0.4

Pre-construction acoustic data may not fully predict post-construction fatality risks (Cryan 2008). Currently, there are no published reports linking pre-construction activity rates to post-construction fatality rates, and therefore, it is not possible to accurately predict post-construction fatality rates. However, the results from this survey suggest that the project area has relatively low bat activity when compared to other wind farm locations in the Midwest. In addition, the presence of endangered, threatened or proposed bat species appears to be low in the Project area; however, this is based on a single season of acoustic data, and may not be reflective of migratory risk.

4.5 LIMITATIONS OF PRE-CONSTRUCTION BAT ACTIVITY SURVEYS

The results of the pre-construction bat activity survey should be viewed with the following limitations in mind:

1. Duration of the study – The survey included nightly passive survey events in two locations during the fall of one activity season. Because annual bat activity can vary due to weather and other factors, the results of one season may not be representative of the full range of bat activity in the Project area.
2. Spatial Limitations of Vertical Transects – Due to resource limitations, vertical transects, which survey bat activity at the height of the rotor-swept zone, were only conducted in one location. This pre-construction survey has only assessed bat activity in a small fraction of the overall rotor-swept zones that will be occupied by wind turbines, and was only compared to one alternative ground-based location.

The results of this survey should be used as baseline information regarding bat activity in the area and cannot be used to accurately predict what, if any, bat mortality would occur as a result of operation of the project. Though attempts have been made to correlate activity rates with mortality rates, there are currently no studies which have found a statistically significant correlation (reviewed in Erickson et al. 2002).

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Avian and Bat Studies for the Hoopeston Wind Farm
Vermilion County, Illinois

March 2011

Prepared For:
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Table of Contents **Page**

List of Figures

List of Tables

1.0 Introduction

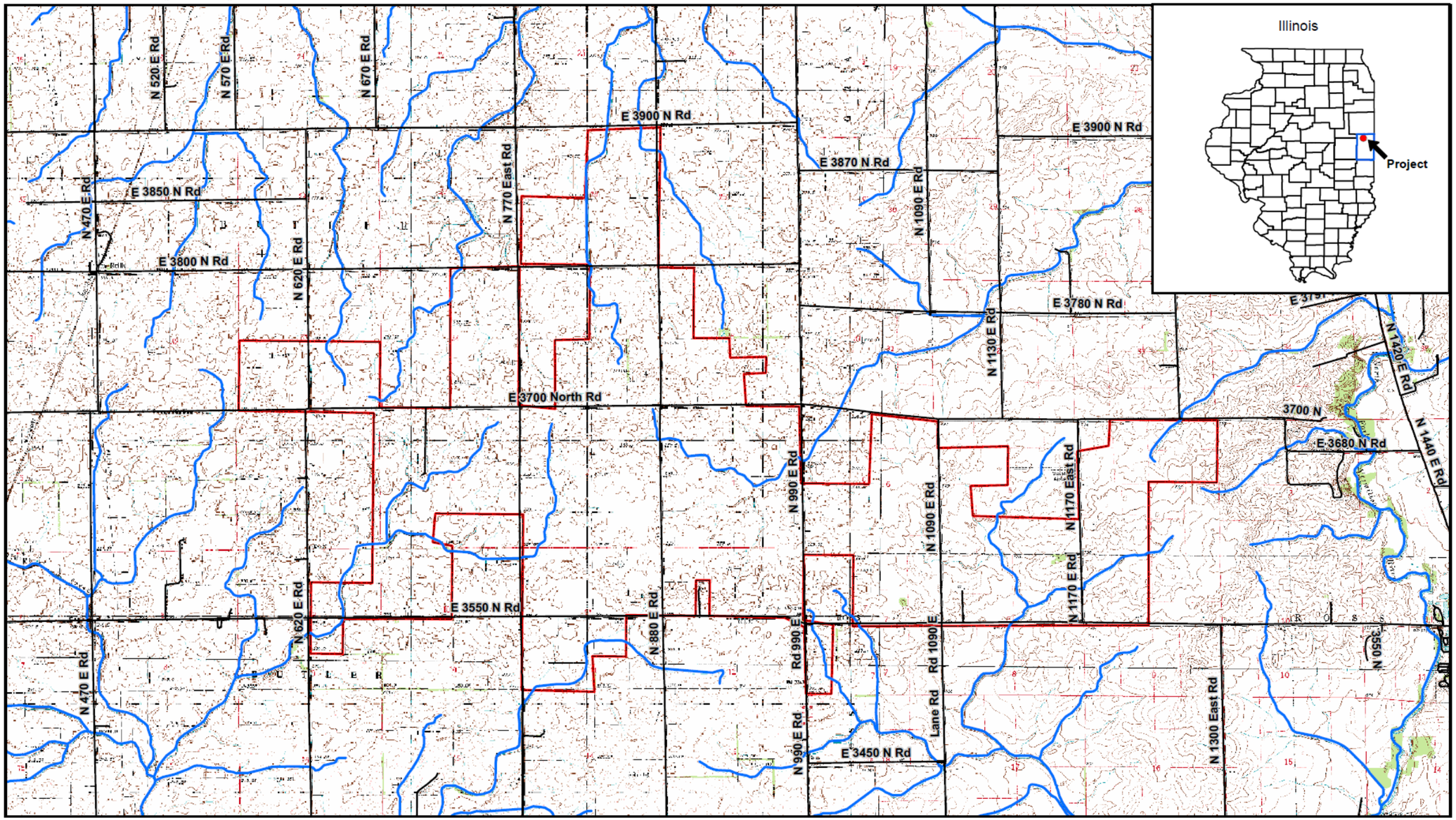
Hoopeston Wind, LLC. is proposing to develop a potential wind power project in Vermilion County, Illinois. The proposed wind farm site is 6,582 acres and located on private land approximately 4 miles west of Rossville, Illinois (Figure 1). The exact location and size of the proposed wind farm site depends on a number of factors including economics, transmission constraints, power purchase agreements, permitting, and results of the site surveys.

Prior to field surveys, informal consultation was conducted with the Illinois DNR (Department of Natural Resources) and US-FWS (Fish and Wildlife Service) to identify potential species of concern that had the potential to occur within Vermilion County, IL and specifically within the Hoopeston Wind Farm site. The concerns and recommendations by both agencies were taken into account when designing the monitoring which allows for the use of adaptive management with regard to data and studies on going in the field. This included but was not limited to potential project impacts to avian and bat resources, specifically the potential for bird and bat mortality from collisions with turbines and associated transmission lines, and species of concern that may be using the proposed wind farm site. To address these concerns, the agencies requested that data be collected which may be used to describe these resources in the context of the proposed development, assist in addressing potential impacts from the development, and to the extent possible, assist in the wind farm design/layout and siting that minimizes risk to avian and bat resources (i.e. wetland impacts/avoidance). This report presents the results of the avian point counts, acoustic bat surveys, and sensitive species surveys conducted at the proposed wind farm site in March 2009 – November 2010.

A field study was initiated in March 2009 to address agency concerns and to provide site specific data on resources of concern. The objectives of the field study were the following:

- Document current avian and bat use of the proposed project area that is useful in evaluating potential impacts from wind power development;
- Identify the bat species likely to occur in the proposed project area, particularly during the spring and fall migration periods;
- Identify potential bat roost sites and hibernacula in the proposed project area as well as adjacent to the project site;
- Monitor bat activity in the proposed project area during spring and fall migration periods and identify the species present; and
- Provide current avian, bat, and sensitive species use information for the proposed wind farm site to aide in designing/siting a wind farm in the proposed location. Also to identify site usage or lack of usage by all species identified for habitat and travel corridors associated with the proposed wind farm site.

Figure 1. Vicinity Map of Hoopeston Wind Farm Site in Vermilion County, Illinois.



2.0 Study Area

The proposed wind farm site is located in the Central Corn Belt Plains Illinois/Indiana Prairies ecoregion of Illinois. This ecoregion is characterized by glaciated, flat to rolling plains with glacial moraines that form elongated ridges, prairie potholes, and old lake beds. Historically, the predominant vegetation type was a mosaic of bluestem prairie and oak-hickory forests. The dominant vegetation for the mesic prairie included big bluestem, Indian grass, prairie dropseed, switch grass, and little bluestem; wet prairie included prairie cord grass, sedges, and bluejoint grass; and upland prairie included little bluestem and side-oats grama. Oak–hickory forest dominant vegetation included black oak, white oak, and shagbark hickory. Currently, the natural vegetation has been converted to cropland. Extensive parts of the land have been tiled, ditched, and tied into the drainage system to make the land suitable for agriculture and settlement. The mean precipitation is approximately 35 to 41 inches annually and the mean high temperature in July is 88° (NCDC 2010).

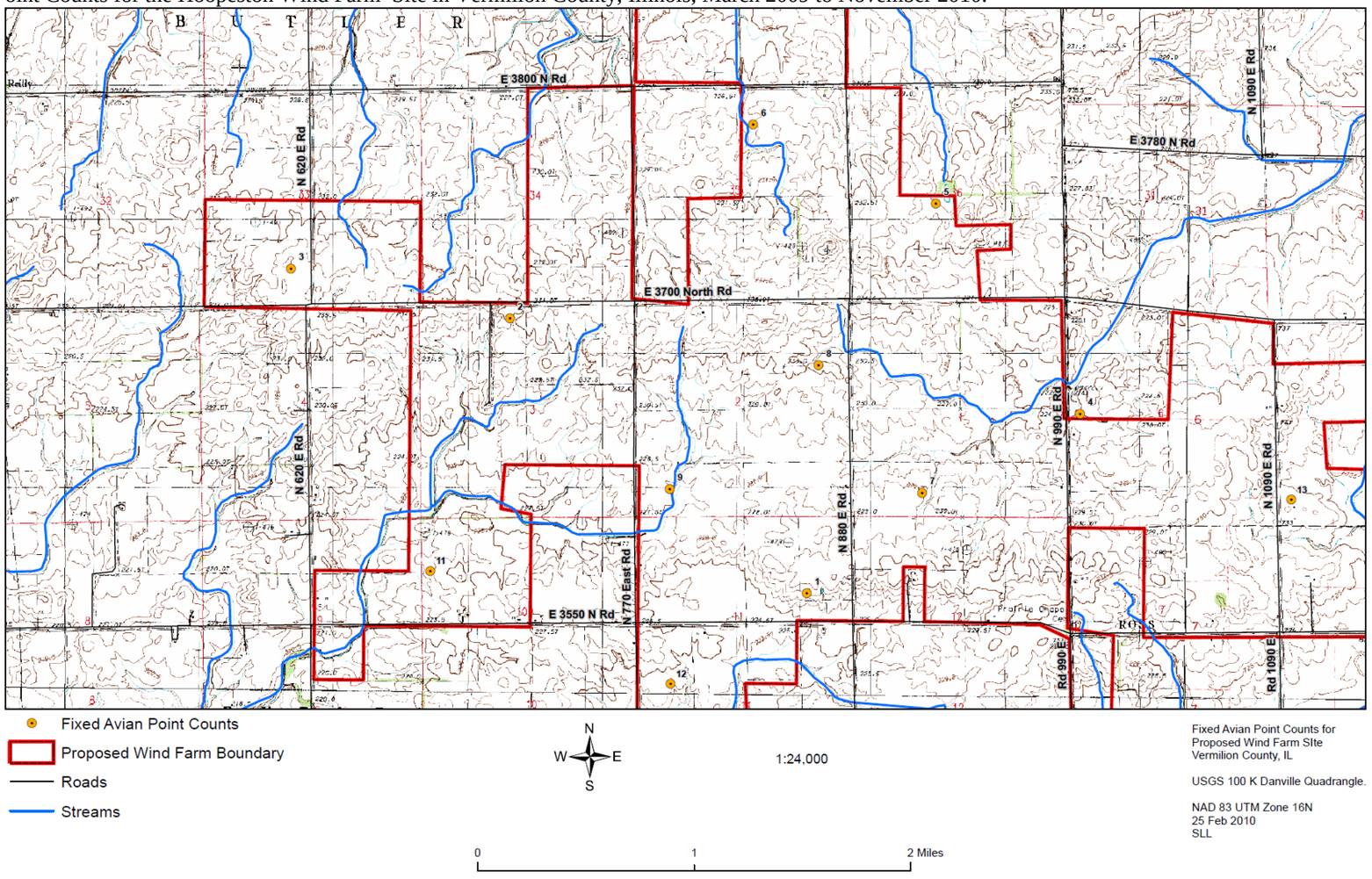
The land within the project area is privately owned farms, which produce mainly cash-grain crops and livestock. Approximately 80 percent of the area is cropland and approximately 5 percent supports native and introduced grasses. The project area infrastructure includes local paved and graveled roads, existing power lines, windmills that provide water to cattle tanks, and residential homes. The boundaries for the proposed wind farm site are as follows; north bordering road E3900 N Road, east bordering road N1170 E RD, south bordering road E3550 N Road, and the west bordering N620 E Road.

Landcover in the proposed wind farm site is classified as agricultural land for soybeans and corn, and rural grassland with scattered urban and built-up land with high density. The topographic relief is fairly level throughout the area. Formal wetland delineation was conducted by a third party company (Grimmenger and Associates, Inc (GIA)) for the client. The delineation conducted by GIA stated that the project site contains three (3) potentially jurisdictional waters and three (3) areas that meet adjacent wetland criteria or that have the potential to naturalize to an adjacent wetland condition. Per the client all six (6) site were avoided so there would not be impact the jurisdictional resources.

3.0 Methods

The surveys consisted of fixed point surveys conducive to observing raptors and other large birds, Anabat monitoring locations throughout the project area during spring and fall migration periods, and listed/sensitive species surveys for both federal and state listed species.

Figure 2. Fixed Avian Point Counts for the Hoopeston Wind Farm Site in Vermilion County, Illinois, March 2009 to November 2010.



3.1 Avian Fixed Point Surveys

The primary objective of the avian fixed point surveys was to estimate spatial and temporal use of the site by migrant raptors and other large birds. Point counts were conducted using the variable circular plot method (Reynolds et al. 1980). The point counts were selected to survey as much of the project area as possible. All birds observed were recorded, however the emphasis of the surveys were raptors and other large birds, which are thought to be more at risk for collisions with turbines. Avian use is considered an index to the density (number of individuals per unit area) of species using the proposed wind farm site. Use was measured by counting birds observed within sample plots.

A total of 15 observation stations were located within the proposed wind farm site with nine observation stations for the 2009 field season and six observation stations for the 2010 field season (Figures 2 and 3) (Appendix D). Observation points were randomly selected using the random points tool from Hawth's Analysis Tools (Beyer 2004). Each station is an 800 meter radius circle centered on an observation point. Landmarks and topographic features were used to identify the 800 meter boundary of each point when possible. Observations of birds beyond the 800 meter radius were recorded, but were not included in the analysis so that results were standardized among points as well as with similar wind farm studies.

All points were surveyed every two weeks for the 2009 and 2010 field seasons from mid-March to July (spring migration), and from mid-September to mid-November (fall migration), and once a month in December 2009 to February 2010 for winter residents. Each station was visited twice during each sampling time; once during the morning (6 a.m. – 12 p.m.) and once during the afternoon (12 p.m. – 6 p.m.). Efforts were made to ensure each station was surveyed about the same number of times during each period of the day.

Each survey lasted for 10 minutes at each point. The observer allowed one minute before beginning the survey, to allow birds to acclimatize to their presence. During the survey, the observer made a 360 degree visual scan of the survey plot using binoculars. All birds observed were recorded on data sheets, and flight or movement patterns of raptors and other large birds were recorded on a map of the plot. The date, start and end time of the observation period, species or best possible identification, number of individuals, distance from plot center when first observed, behavior, and flight angle were recorded. Behavior categories included, but not limited to, were perched, soaring, flying, circling, hunting, and gliding. The distance from the plot center was recorded using a laser rangefinder and the flight angle was recorded using a clinometer. Weather information such as temperature, wind speed, and cloud cover was also recorded for each survey. Any comments or unusual behavior were also recorded.

3.2 Anabat Surveys

In an initial survey of the study site, a search was made for potential hibernacula and roost sites and the most suitable locations for installation of ANABAT monitoring equipment were selected. In addition, Illinois DNR (Joseph Kath) and USFWS (Kris Lah) were contacted to identify any known roost sites or hibernacula in the proposed project area. There were no known hibernacula nearby. The closest hibernacula were Blackball Mine in Lasalle County in

northwestern Illinois and Copperhead Cave, a mine in Vermillion County Indiana, which are approximately 76 miles northwest and 44 miles southeast of the site, respectively. In addition, the closest known Indiana bat colonies and suitable bat habitat is Middle Fork of the Vermilion River, which is approximately 10 miles northeast of the site.

Suitable bat habitat was based on previous studies conducted by Hoffmeister, 1989; Walters and Whitaker 2007; Whitaker and Hamilton, 1998; and Whitaker 2008. A habitat description for individual species that may occur on the proposed wind farm site can be found in Appendix A.

3.2.1 Passive Acoustic Surveys

To ensure adequate data collection ANABAT II and CF Z-CAIM or ANABAT SD 1 monitoring systems were placed in the field at three sites in 2009 and at six sites in 2010. The number of sites was increased in 2010 due to two Indian bats found at the Fowler Ridge Wind Farm, which is approximately 30 mile northeast of the proposed wind farm site (personal communication Keith Shank, Illinois Department of Natural Resources, Environmental Review, 2-3-11).

Monitoring took place for two weeks during both the spring and fall migration periods. Every fourth day the acoustic monitoring equipment was checked, data were retrieved, and the flashcards and batteries were replaced. The study design was based on the request of the client, Hoopeston Wind, LLC. (personal communication Brianne Walters, Center for North American Bat Research and Conservation, Assistant Director, 2-10-11).

The three sites monitored in 2009 (Figure 3) were as follows:

Site 1: A tiny woodlot (perhaps 3 acres) located ½ mile N of Road 3700N and ½ mile east of 880 East is the only woodlot in the study area. Monitoring equipment was placed at the SW corner of this woodlot. There were a few large trees on this woodlot that could provide roosts for any of the possible bats in the area with the exception of little and big brown bats as they normally roost in buildings.

Site 2: Located just south of 3800N and on the west side of 770E. It was just west of the tower used in this project to collect information on wind. The monitoring system was placed on the west side of the tree row near the tower.

Site 3: This site was about ½ mile west of 770E on 3700N. The monitoring equipment was placed along a hedgerow just south of 3700N.

The 2009 monitoring sites are illustrated in Figure 3, which can be found on page 9 of this document.

The six sites monitored in 2010 (Figure 4) were as follows:

Site 1: This site was located at the southwest corner of a small woodlot located north of CR 3700N and East of CR 880E. There were a few large trees on this woodlot that could provide roosts for any of the possible bats in the area with the exception of little and big brown bats as they normally roost in buildings. It was a site that was sampled last year

but we chose to sample it again this year as it was the most productive site last year and one of the best locations on the property for potential bat activity.

Site 2: This Anabat was placed on the MET tower located north of CR 3550N and West of CR 770E. This was a new location that was requested by the client. The microphone for the Anabat is located roughly 58 meters above the ground.

Site 3: This site was located along a tree line near the MET tower located north of CR 3550N and West of CR 770E. This location is near an Anabat location used last year. The area was sampled again because it is one of the better habitat locations for bats. We can compare these data to last years to get a better understanding of how bats use the project area. We can also get a comparison of this data to the unit on the MET tower to see if height of the unit matters.

Site 4: This site was located along the north side of a woodlot located just north of CR 3550N and just West of CR 990E. It is across the road from a small cemetery. It is located in the original project boundary, but was established as a new Anabat sampling location. This location was chosen because it is next to a woodlot which is decent habitat as bats forage and move along woodlots and tree lines.

Site 5: This site was located along a tree line located just south of CR 3700N and East of CR 1170E. This location is in the new project boundary and was requested by the client as it is in the eastern portion of the project area. Bats typically fly along tree lines and this was the best habitat in the eastern portion of the project area.

Site 6: This site was located along a tree line and stream (the only standing water on the property) located south of CR 3550N and East of CR 770E. This location is in the new project boundary and chosen because it appeared to be good habitat for bats as it was along a tree line and water source.

The 2010 monitoring sites are illustrated in Figure 4, which can be found on page 10 of this document.

3.2.2 Active Acoustic Surveys

Active monitoring for intervals of 1 hour was conducted during the spring and fall migration periods. The study design was based on the request of the client, Hoopeston Wind, LLC. (personal communication Brianne Walters, Center for North American Bat Research and Conservation, Assistant Director, 2-10-11). On each of 2 days during the migration periods monitoring sessions began at dusk and 1 hour before sunrise. Thus 4 hours of active monitoring data were collected in both the spring and fall study periods. Active monitoring involved walking slowly around site #1 and the hedge row to the east of the break with a hand held ANABAT SD1. An attempt was made to visually document any bats detected during the active monitoring sessions.

ANABAT data files were inspected and all "non-bat" calls (insects, wind, etc.) were removed. As bat call sonograms are extremely variable and key attributes are often shared across multiple species, it is difficult to identify some calls to species. Also, in many instances only a fragment of a bat call is recorded and such calls are difficult to identify. All calls deemed acceptable for analysis were separated based on frequency range before an attempt was made to identify each call to species. Calls were identified visually. Some examples of typical bat calls recorded during this study can be found in Appendix B. The analysis was conducted by Justin Boyles and Jared Helms. Mr. Boyles has a PhD, has extensive experience working with acoustical analysis, has conducted and attended Anabat training workshops, and has over 10 years of experience working with bats. Mr. Helms has a MS, has attended Anabat training workshops, and has 8 years of experience working with bats.

Frequency groups were categorized as follows:

40k (40-50 kHz calls) - *Lasiurus borealis, Myotis sp,* and *Perimyotis subflavus*
25k (25-35 kHz calls) - *Eptesicus fuscus* and *Lasionycteris noctivagans*
20k (20 kHz and less) - *Lasiurus cinereus*

3.3 Sensitive Species Surveys

Based on a review of the vegetative, geographical, and topographical characteristics of the proposed wind farm site and the life requisites for the 39 Illinois state listed species for Vermilion County, the Indiana bat could potentially occur in the proposed wind farm site. In addition, the ornate box turtle was added to the Endangered and Threatened Species list for Illinois on February 20, 2009 and was identified by the Illinois DNR as a species that could potentially occur within the proposed wind farm site (personal communication, Keith Shank, Illinois Department of Natural Resources, Environmental Review, 8-19-09).

The Indiana bat is discussed in the Anabat surveys section. The method employed for determining presence/absence of the ornate box turtle was systematic searching of the project area in suitable habitat following the Visual Encounter Survey (VES) protocols (Heyer et al. 1994). Suitable habitat within the proposed wind farm site was narrowed down based on the primary habitat preference for open grasslands as well as wooded areas with leaf litter, and areas associated with water. Potential habitat areas were heads-up digitized based on the Illinois Natural History Survey (INHS) Illinois Gap Analysis Land Cover Classification (i.e., rural grassland).

VES surveys were conducted between May to June 2010 after ornate box turtles emerge from hibernation. Transects were walked within an agricultural field, which served as a representative control plot, and suitable habitat plots based on the criteria listed above (i.e., wooded areas, grasslands, areas associated with water) (Figure 5). The transect location and direction were chosen using a random number chart to select the compass direction. In addition, soil pits approximately 18 inches deep were taken at three different locations to determine if the soils had been altered (e.g., compaction, presence of fill material) due to agricultural practices. Photos were taken of the potential habitat areas surveyed (Appendix C).

Figure 3. Anabat Monitoring Locations for the Vermillion County Hoopeston Wind Farm Project, April and September 2009.

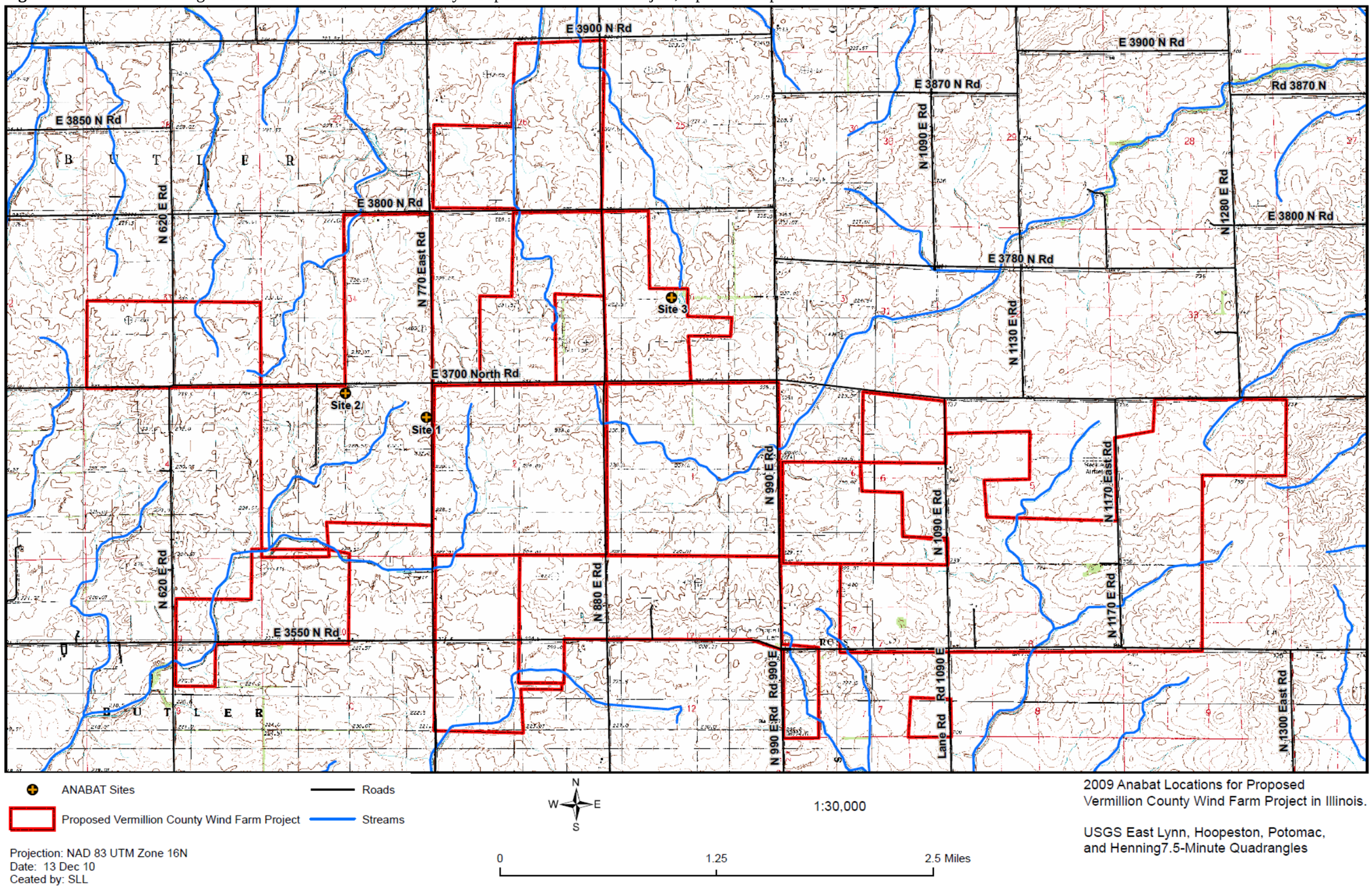


Figure 4. Anabat Monitoring Locations for the Vermillion County Hoopeston Wind Farm, April and September 2010.

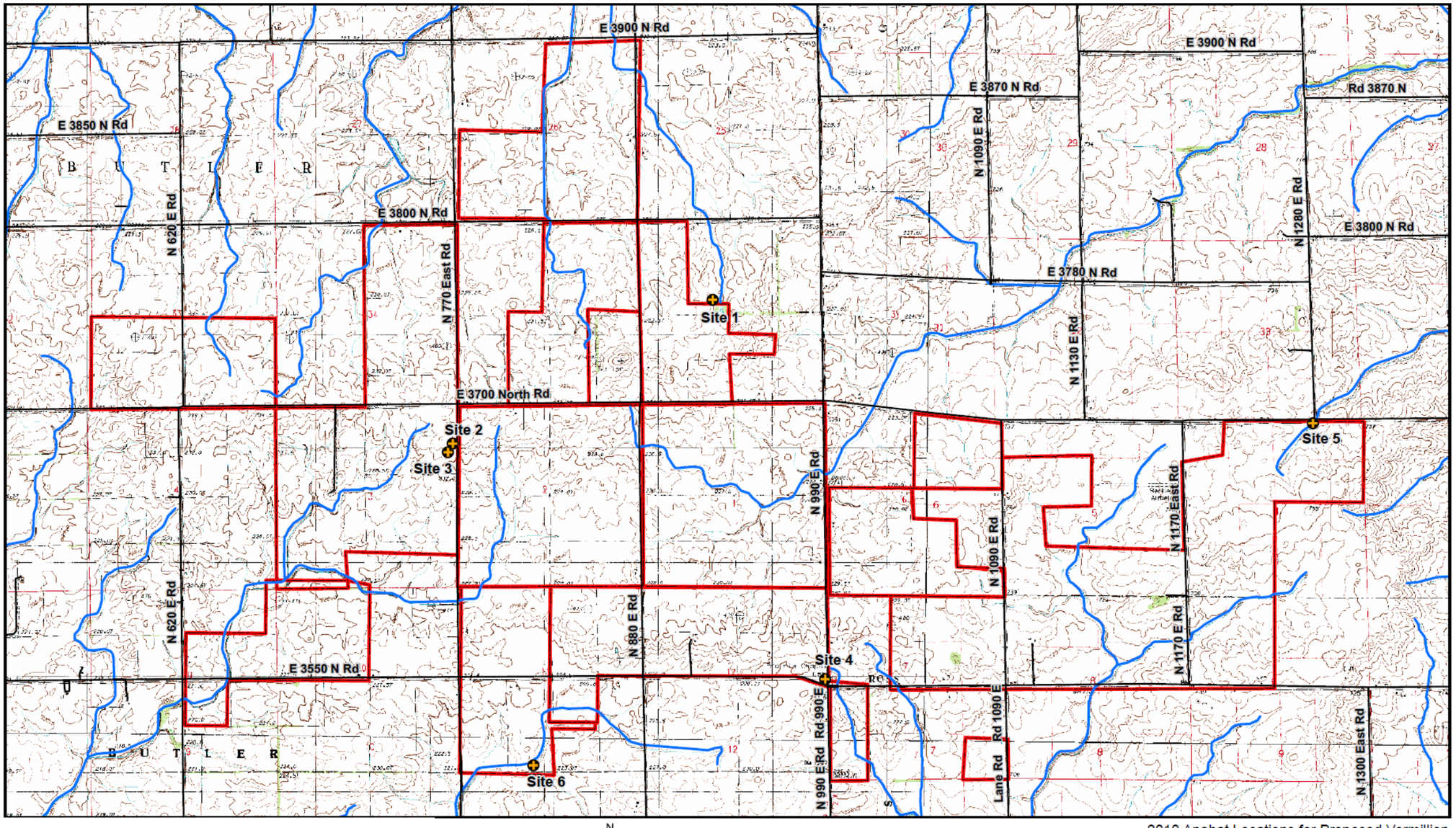
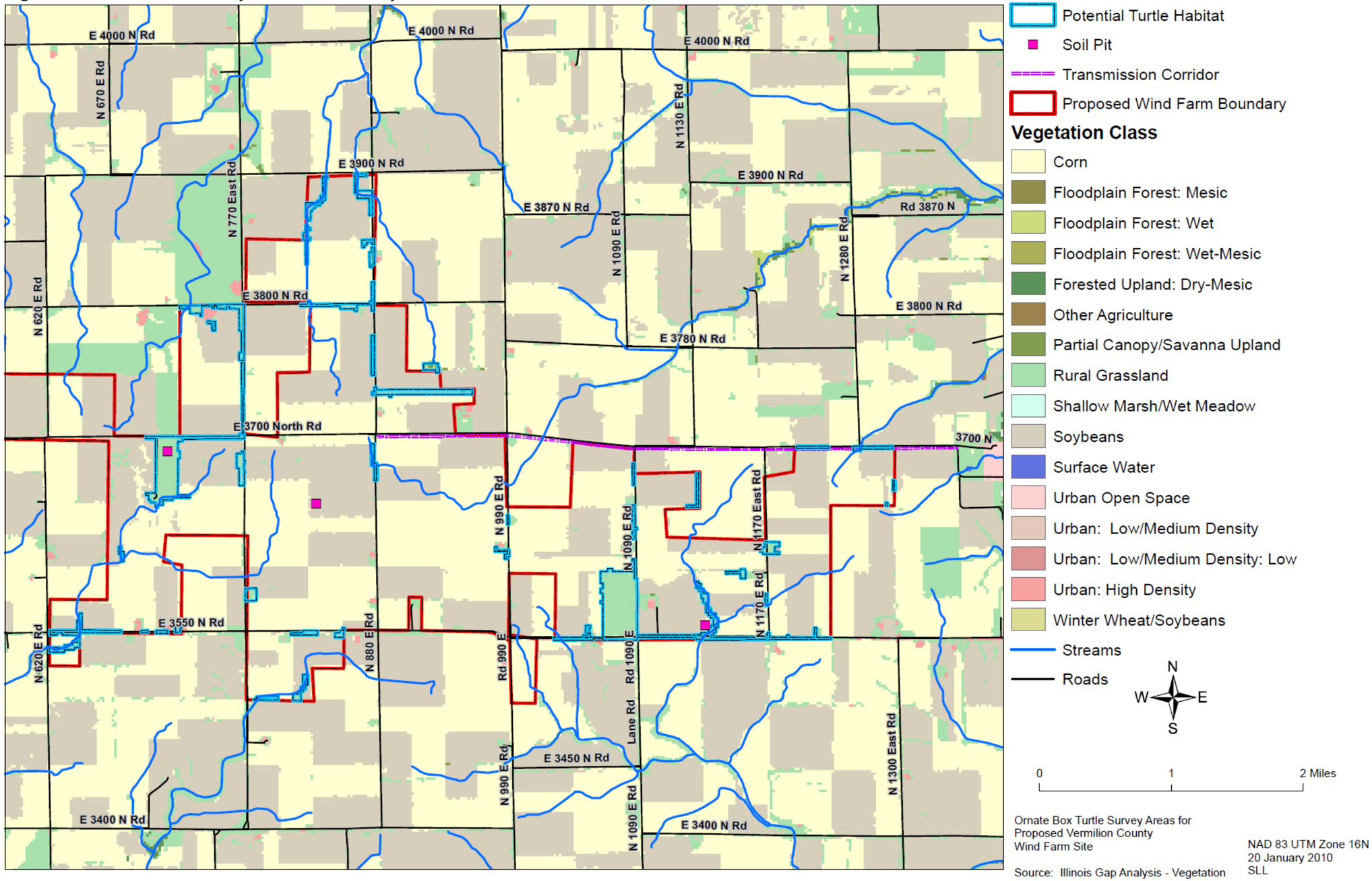


Figure 5. Ornate box turtle Surveyed Areas for the Hoopeston Wind Farm.



In 2009, presence/absence surveys were conducted for the proposed transmission corridor by walking the proposed corridor and searching for target species (ornate box turtle). The proposed transmission corridor parallels the existing E3700 N Road and is located within the existing right-of-way.

3.4 Data Analysis

3.4.1 Avian Surveys

Species lists were generated by season. The number of raptors and other species observed during each point count survey was standardized to a unit area and unit time searched. For example, if 2 raptors were seen during a survey at a point with a viewing area of 2.01 km^2, then these data were standardized to 0.99 raptors/ 30-minute survey. Mean use is reported as the number of individuals observed per 30-minute survey. Mean use is tabulated for species and groups.

The frequency of occurrence by species is calculated as the percent of surveys where a particular species was observed. Species composition will be represented by the mean use for a species divided by the total use for all species and multiplied by 100 to provide percent composition. Frequency of occurrence and percent composition provide relative estimates of the avian diversity of the project area.

A relative index to collision exposure was calculated for bird species observed during the fixed point count surveys using the following formula: $R = A*P_f*P_t$

Where A = mean use of species (i) averaged across all surveys; P_f = proportion of all observations where species (i) activity was recorded as flying; and Pt = proportion of all flight height observations of species (i) within the rotor-swept height (RSH). The RSH height is 49.5 – 150.5 meters based on the Siemens 2.3 MW 101m turbine model (information provided by client). This exposure index provides a relative measure of the risk each species observed during the avian point count surveys has colliding with a turbine on the proposed wind farm site. This analysis may provide insight into what species may be the most likely turbine casualties at the proposed wind farm site. However, this index does not account for differences in behavior besides flight characteristics (i.e., flight height, proportion of time spent flying).

4.0 Results

4.1 Avian Fixed Point Surveys

Surveys were conducted at 15 fixed point count stations located within the study area (Figures 2 and 3) approximately every two weeks from mid-March to July 2009 and 2010 (spring migration) and mid-September to mid-November 2009 and 2010 (fall migration), and once a month from December 2009 to February 2010 (winter residents). A total of 354, 10-minute point count surveys were conducted.

A total of 59 avian species with 6,323 total observations in 1,223 different groups were observed during the fixed point count surveys (Table 1). Table 1 provides the raw numbers of

observations, which are not standardized, but provide an overall list of birds observed. These counts may contain duplicate counts of the same individuals.

Passerines were the most common group observed with Red-winged Blackbirds (*Agelaius phoeniceus*) as the most commonly observed passerine species (14% of all passerine observations). Passerines comprised 66% of all birds observed and 77% of all groups observed. Raptors comprised 2% of all birds observed and 9% of all groups observed. Corvids (American Crows) comprised 1% of all birds observed and 2% of all groups observed. Shorebirds comprised 29% of all birds observed and 6% of all groups observed due to large flocks of American Golden Plovers((*Pluvialis dominica*) observed during spring migration. Other birds (waterfowl, upland game birds, doves, swifts, and woodpeckers) comprised 2% of all birds observed and 6% of all groups observed due mainly to Mourning Dove (*Zenaida macroura*) coveys observed. Upland game birds on the proposed wind farm site included Ring-necked Pheasants (*Phasianus colchicus*) an introduced species.

Observations varied by season with spring having the most individuals and groups observed (Table 1). Fall had the most individual and groups observed for raptors. Observations for all individuals and groups declined in winter. Raw data is in Appendix D.

Table 1. Avian Species /Groups Observed During the Avian Fixed Point Count Surveys on the Hoopeston Wind Farm, March 2009 – November 2010.

Species/Group	Spring		Fall		Winter		Total	
	obs.	groups	obs.	groups	obs.	groups	obs.	groups
Waterfowl								
Canada Geese	5	2			11	1	16	3
Mallard	2	1					2	1
Subtotal	7	3	0	0	11	1	18	4
Shorebirds								
American Golden-Plover	1710	24					1710	24
Common Snipe			1	1			1	1
Great Blue Heron	7	5					7	5
Killdeer	34	27	20	7			54	34
Pectoral Sandpiper	81	4					81	4
Solitary Sandpiper	1	1					1	1
Subtotal	1833	61	21	8	0	0	1854	69
Raptors								
American Kestrel			5	5	2	2	7	7
Broad-winged Hawk	1	1					1	1
Cooper's Hawk	1	1	1	1			2	2
Merlin			1	1			1	1
Northern Harrier	4	4	13	13	1	1	18	18
Osprey	1	1					1	1
Red-shouldered Hawk	1	1					1	1

Species/Group	Spring		Fall		Winter		Total	
	obs.	groups	obs.	groups	obs.	groups	obs.	groups
Red-Tailed Hawk	16	16	18	16	4	4	38	36
Rough-legged Hawk	1	1	2	2	3	3	6	6
Turkey Vulture	32	21	20	19			52	40
Subtotal	57	46	60	57	10	10	127	113
Corvids								
American Crow	15	11	18	12	6	3	39	24
Subtotal	15	11	18	12	6	3	39	26
Upland Game Birds								
Ring-necked Pheasant	6	6					6	6
Subtotal	6	6					6	6
Doves								
Mourning Dove	33	28	27	18	3	2	63	48
Rock Pigeon			10	2			10	2
Subtotal	33	28	37	20	3	2	73	50
Swifts								
Chimney Swift	6	5					6	5
Subtotal	6	5					6	5
Woodpeckers								
Northern Flicker	2	2	3	3			5	5
Red-bellied Woodpecker	3	3	1	1	1	1	5	5
Subtotal	5	5	4	4	1	1	10	10
Passerines								
American Goldfinch	18	14	29	25			47	39
American Pipit	50	5					50	5
American Robin	121	81	30	12			151	93
American Tree Sparrow					1	1	1	1
Barn Swallow	28	21	33	15			61	36
Blue Jay	9	6	10	6	1	1	20	13
Brown-headed Cowbird	175	80	761	9			936	89
Brown Thrasher	8	8					8	8
Cerulean Warbler	5	3	1	1			6	4
Chipping Sparrow	13	12	4	2			17	14
Common Grackle	225	62	6	1			231	63
Common Yellowthroat	1	1					1	1
Dickcissel	18	13					18	13
Eastern Meadowlark	55	48	8	7			63	55
Eastern Towhee	1	1					1	1
European Starling	81	26	994	39	36	2	1111	67

Species/Group	Spring		Fall		Winter		Total	
	obs.	groups	obs.	groups	obs.	groups	obs.	groups
Golden-crowned Kinglet	2	1					2	1
Horned Lark	76	71	290	31	56	18	489	120
House Finch	2	2					2	2
House Sparrow	26	16	135	20	35	7	196	43
House Wren	7	7					7	7
Indigo Bunting	9	9					9	9
Lapland Longspur	41	6			3	2	44	8
Northern Cardinal	15	15					15	15
Northern Rough-winged Swallow	2	1	1	1			3	2
Purple Martin			5	2			5	2
Red-eyed Vireo	1	1					1	1
Red-winged Blackbird	228	120	369	10			597	130
Song Sparrow	35	35	31	19	1	1	67	55
Summer Tanager	1	1					1	1
Tree Swallow	11	9	38	6			49	15
Vesper Sparrow	22	22	1	1			23	23
Yellow-rumped Warbler			25	4			25	4
Subtotal	1286	697	2771	211	133	32	4190	940
Grand Total	**3248**	**862**	**2911**	**312**	**164**	**49**	**6323**	**1223**

4.1.1 Avian Use

To allow for comparisons to other studies and between points, the number of raptors and other species observed during each point count survey was standardized to a unit area and unit time searched and species composition was calculated using only observations within 800 meters of the observation point. The point counts do not distinguish between individuals, but provide avian use of the study area. Abundance refers to mean use of the study area not absolute density or numbers of individuals.

The three most abundant species in the proposed wind farm site were American Golden Plovers (4.83 detections/10-minute survey), European Starlings (*Sturnus vulgaris*) (3.14 detections/ 10-minute survey), and Brown-headed Cowbird (*Molothrus ater*) (2.64 detections/10-minute survey). Together these species comprised more than 59% of the total bird use observed during the fixed point counts. Passerines were the most abundant group observed with approximately 12 individuals observed during each survey (Table 2). The most abundant raptors observed were Turkey Vulture (*Cathartes aura*) (0.15 detections/10-minute survey), Red-tailed Hawk (0.11 detections/10-minute survey), and Northern Harrier (*Circus cyaneus*) (0.05 detections/10-minute survey) (Table 2).

Passerine use was highest in the fall (18.45 detections/10-minute survey) and lowest in winter (2.46 detections/10-minute survey) (Table 2). Larger flocks of Brown-headed Cowbirds, European Starlings, Horned Larks (*Eremophila alpestris*), and House Sparrows (*Passer*

domesticus) were observed in fall. Raptor use was similar in the spring (0.38 detections/10-minute survey) and fall (0.40/10-minute survey), and decreased in winter (0.19 detections/10-minute survey) (Table 2). Northern Harrier use was highest in fall (0.09 detections /10-minute survey) and lowest in winter (0.02 detections/10-minute survey) (Table 2). Shorebird use was highest in the spring (12.22 detections/10-minute survey) due to several large flocks of American Golden Plovers (Table 2).

The Great Backyard Bird Count for the state of Illinois reported 128 species and 254,537 individuals observed from the 2010 surveys (Audubon Society 2010) compared to the 15 species and 164 individual observed during the winter surveys at the proposed wind farm site. The Illinois Spring Bird Count reported 276 species and 528,615 individuals observed during the 2010 spring survey compared to the 51 species and the 3,248 individuals observed during the spring surveys at the proposed wind farm site (personal communication Tara Beveroth, Illinois Spring Bird Count, State Compiler, 2-23-11).

Table 2. Estimated Mean Use for Species/Groups Observed Within 800 m of the Point During Avian Fixed Point Count Surveys on the Hoopeston Wind Farm, March 2009 – November 2010.

Species/Group	Spring Use		Fall Use		Winter Use		Total Use	
	Mean	St dev	Mean	St dev	Mean	St dev	Mean	St dev
Waterfowl	**0.05**	**0.07**	**0.00**	**0.00**	**0.20**	**0.61**	**0.06**	**0.21**
Canada Geese	0.03	0.09	0.00	0.00	0.20	0.61	0.05	0.30
Mallard	0.01	0.05	0.00	0.00	0.00	0.00	0.01	0.03
Shorebirds	**12.22**	**8.23**	**0.14**	**0.16**	**0.00**	**0.00**	**5.23**	**4.78**
American Golden-Plover	11.40	15.79	0.00	0.00	0.00	0.00	4.83	11.11
Common Snipe			0.01	0.03	0.00	0.00	0.00	0.02
Great Blue Heron	0.05	0.09	0.00	0.00	0.00	0.00	0.02	0.06
Killdeer	0.23	0.23	0.13	0.21	0.00	0.00	0.15	0.21
Pectoral Sandpiper	0.54	1.16	0.00	0.00	0.00	0.00	0.23	0.75
Solitary Sandpiper	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.02
Raptors	**0.38**	**0.13**	**0.40**	**0.13**	**0.19**	**0.09**	**0.36**	**0.10**
American Kestrel	0.00	0.00	0.03	0.06	0.04	0.07	0.02	0.05
Broad-winged Hawk	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.02
Cooper's Hawk	0.01	0.03	0.01	0.03	0.00	0.00	0.01	0.02
Merlin	0.00	0.00	0.01	0.06	0.00	0.00	0.00	0.04
Northern Harrier	0.03	0.06	0.09	0.11	0.02	0.06	0.05	0.08
Osprey	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.02
Red-shouldered Hawk	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.02
Red-Tailed Hawk	0.11	0.15	0.12	0.16	0.07	0.12	0.11	0.15
Rough-legged Hawk	0.01	0.03	0.01	0.04	0.06	0.08	0.02	0.05
Turkey Vulture	0.21	0.26	0.13	0.23	0.00	0.00	0.15	0.23

Species/Group	Spring Use		Fall Use		Winter Use		Total Use	
	Mean	St dev	Mean	St dev	Mean	St dev	Mean	St dev
Corvids	**0.10**	**0.15**	**0.12**	**0.14**	**0.11**	**0.24**	**0.11**	**0.17**
American Crow	0.10	0.15	0.12	0.14	0.11	0.24	0.11	0.17
Upland Game Birds	**0.04**	**0.07**	**0.00**	**0.00**	**0.00**	**0.00**	**0.02**	**0.05**
Ring-necked Pheasant	0.04	0.07	0.00	0.00	0.00	0.00	0.02	0.05
Doves	**0.22**	**0.20**	**0.25**	**0.19**	**0.06**	**0.12**	**0.21**	**0.17**
Mourning Dove	0.22	0.20	0.18	0.20	0.06	0.12	0.18	0.19
Rock Pigeon	0.00	0.00	0.07	0.18	0.00	0.00	0.03	0.11
Swifts	**0.04**	**0.06**	**0.03**	**0.08**	**0.00**	**0.00**	**0.03**	**0.06**
Chimney Swift	0.04	0.06	0.03	0.08	0.00	0.00	0.03	0.06
Woodpeckers	**0.03**	**0.05**	**0.03**	**0.03**	**0.02**	**0.06**	**0.02**	**0.04**
Northern Flicker	0.01	0.05	0.02	0.04	0.00	0.00	0.01	0.04
Red-bellied Woodpecker	0.02	0.06	0.01	0.03	0.02	0.06	0.01	0.05
Passerines	**8.57**	**0.67**	**18.45**	**4.48**	**2.46**	**0.98**	**11.81**	**2.18**
American Goldfinch	0.12	0.14	0.19	0.20	0.00	0.00	0.13	0.16
American Pipit	0.33	1.18	0.00	0.00	0.00	0.00	0.14	0.74
American Robin	0.81	0.60	0.20	0.44	0.00	0.00	0.43	0.57
American Tree Sparrow	0.00	0.00	0.00	0.00	0.02	0.06	0.00	0.03
Barn Swallow	0.19	0.18	0.22	0.55	0.00	0.00	0.17	0.38
Blue Jay	0.06	0.10	0.07	0.21	0.02	0.06	0.06	0.14
Brown-Headed Cowbird	1.17	0.99	5.07	12.40	0.00	0.00	2.64	7.87
Brown Thrasher	0.05	0.07	0.00	0.00	0.00	0.00	0.02	0.05
Cerulean Warbler	0.03	0.07	0.01	0.03	0.00	0.00	0.02	0.05
Chipping Sparrow	0.09	0.21	0.00	0.00	0.00	0.00	0.04	0.13
Common Grackle	1.50	1.58	0.04	0.15	0.00	0.00	0.65	1.21
Common Yellowthroat	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.02
Dickcissel	0.12	0.25	0.00	0.00	0.00	0.00	0.05	0.16
Eastern Meadowlark	0.37	0.45	0.05	0.12	0.00	0.00	0.18	0.33
Eastern Towhee	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.02
European Starling	0.54	0.84	6.63	10.74	0.67	1.94	3.14	7.24
Golden-crowned Kinglet	0.01	0.05	0.00	0.00	0.00	0.00	0.01	0.03
Horned Lark	0.05	0.35	1.93	3.67	1.04	1.22	1.19	2.41
House Finch	0.01	0.07	0.00	0.00	0.00	0.00	0.01	0.04
House Sparrow	0.17	0.32	0.90	2.53	0.65	0.94	0.55	1.63
House Wren	0.05	0.11	0.00	0.00	0.00	0.00	0.02	0.07
Indigo Bunting	0.06	0.10	0.00	0.00	0.00	0.00	0.03	0.07
Lapland Longspur	0.27	0.69	0.00	0.00	0.06	0.12	0.12	0.44
Northern Cardinal	0.10	0.12	0.00	0.00	0.00	0.00	0.04	0.09
Northern Rough-winged Swallow	0.01	0.05	0.01	0.03	0.00	0.00	0.01	0.04

Species/Group	Spring Use		Fall Use		Winter Use		Total Use	
	Mean	St dev	Mean	St dev	Mean	St dev	Mean	St dev
Purple Martin	0.00	0.00	0.03	0.10	0.00	0.00	0.01	0.07
Red-eyed Vireo	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.02
Red-winged Blackbird	1.52	1.22	2.46	7.05	0.00	0.00	1.69	4.44
Song Sparrow	0.23	0.30	0.21	0.30	0.02	0.06	0.19	0.27
Summer Tanager	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.02
Tree Swallow	0.73	0.13	0.25	0.65	0.00	0.00	0.14	0.42
Vesper Sparrow	0.15	0.16	0.01	0.03	0.00	0.00	0.06	0.12
Yellow-rumped Warbler	0.00	0.00	0.17	0.41	0.00	0.00	0.07	0.26
All Birds	**21.65**	**1.61**	**19.41**	**1.47**	**3.04**	**0.31**	**17.85**	**17.94**

4.1.2 Frequency of Occurrence and Species Composition

The frequency of occurrence was calculated as the percent of surveys a species was observed. Frequency of occurrence and species composition provide relative estimates of avian diversity of the proposed wind farm site. Based on frequency of occurrence only Horned Larks (33%) were observed in over one- third of all surveys. Most species were observed in less than 5% of all surveys (Table 3). The most frequently observed raptor was Red-tailed Hawks observed in 10% of all surveys with 0.6% of total avian use (Table 4). Turkey vultures were observed in approximately 10% of all surveys and comprised 0.8% of all avian use. Northern Harriers were observed in 5% of all surveys (Table 3) and comprised 0.28% of total avian use (Table 4). American Golden Plovers were observed in approximately 5% of all surveys and comprised 27% of all avian use. In contrast, Horned Larks were observed in approximately 33% of all surveys, and comprised 7% of all avian use (Table 4).

Passerines as a group were observed in 78% of all surveys and comprised 66% of all avian use (Table 4). As a group and due primarily to the abundance of American Golden Plovers, shorebirds comprised more than 29% of avian use and were observed in 12% of all surveys (Table 4). Raptor use of the proposed wind farm site was low with less than 1 raptor observed during each 10-minute survey (Table 2) and during 27% of all surveys (Table 3).

The three most abundant groups based on use were passerines, shorebirds, and raptors (Table 4). Passerine occurrence peaked in fall and was lowest in spring (40%). Shorebird occurrence was highest in spring (56%) and was less than 1% in fall (Table 4). Overall, raptor occurrence was low with a 6% peak use in winter and comprised 2% of overall avian use (Table 4).

An additional species diversity index is the mean number of species observed per survey. The mean number of species per survey was highest in the spring (4.95) followed by fall (1.99) and winter (0.88) (Table 5).

Table 3. Estimated Frequency for Species/Groups Observed Within 800 m of the Point During Avian Fixed Point Count Surveys on the Hoopeston Wind Farm, March 2009 – November 2010.

Species/Group	Spring Freq (%)	Fall Freq (%)	Winter Freq (%)	Overall Freq (%)
Waterfowl	**2.00**	**0.00**	**1.85**	**1.13**
Canada Geese	1.33	0.00	1.85	0.85
Mallard	0.67	0.00	0.00	0.28
Shorebirds	**24.00**	**4.67**	**0.00**	**12.15**
American Golden-Plover	10.67	0.00	0.00	4.52
Common Snipe		0.67	0.00	0.28
Great Blue Heron	3.33	0.00	0.00	1.41
Killdeer	17.33	4.67	0.00	9.89
Pectoral Sandpiper	2.67	0.00	0.00	1.13
Solitary Sandpiper	0.67	0.00	0.00	0.28
Raptors	**24.67**	**32.00**	**16.67**	**26.55**
American Kestrel		3.33	3.70	1.98
Broad-winged Hawk	0.67	0.00	0.00	0.28
Cooper's Hawk	0.67	0.67	0.00	0.56
Merlin	0.00	0.67	0.00	0.28
Northern Harrier	2.67	8.67	1.85	5.08
Osprey	0.67	0.00	0.00	0.28
Red-shouldered Hawk	0.67	0.00	0.00	0.28
Red-Tailed Hawk	10.67	10.67	7.41	10.17
Rough-legged Hawk	0.67	1.33	5.56	1.69
Turkey Vulture	12.00	10.67	0.00	9.60
Corvids	**7.33**	**8.00**	**5.56**	**7.34**
American Crow	7.33	8.00	5.56	7.34
Upland Game Birds	**4.00**	**0.00**	**0.00**	**1.69**
Ring-necked Pheasant	4.00	0.00	0.00	1.69
Doves	**17.33**	**12.67**	**3.70**	**13.28**
Mourning Dove	17.33	11.33	3.70	12.71
Rock Pigeon	0.00	1.33	0.00	0.56
Swifts	**3.33**	**1.33**	**0.00**	**1.98**
Chimney Swift	3.33	1.33	0.00	1.98
Woodpeckers	**3.33**	**2.67**	**1.85**	**2.82**
Northern Flicker	1.33	2.00	0.00	1.41
Red-bellied Woodpecker	2.00	0.67	1.85	1.41

Species/Group	Spring Freq (%)	Fall Freq (%)	Winter Freq (%)	Overall Freq (%)
Passerines	**98.67**	**70.67**	**42.59**	**78.25**
American Goldfinch	9.33	15.33	0.00	10.45
American Pipit	3.33	0.00	0.00	1.41
American Robin	41.33	8.00	0.00	20.90
American Tree Sparrow	0.00	0.00	1.85	0.28
Barn Swallow	10.00	10.00	0.00	8.47
Blue Jay	4.00	4.00	1.85	3.67
Brown-headed Cowbird	44.67	6.00	0.00	21.47
Brown Thrasher	4.67	0.00	0.00	1.98
Cerulean Warbler	2.00	0.67	0.00	1.13
Chipping Sparrow	8.00	0.00	0.00	3.39
Common Grackle	35.33	0.67	0.00	15.25
Common Yellowthroat	0.67	0.00	0.00	0.28
Dickcissel	6.00	0.00	0.00	2.54
Eastern Meadowlark	28.00	4.67	0.00	13.84
Eastern Towhee	0.67	0.00	0.00	0.28
European Starling	16.67	23.33	3.70	17.51
Golden-crowned Kinglet	0.67	0.00	0.00	0.28
Horned Lark	45.33	20.00	31.48	32.49
House Finch	1.33	0.00	0.00	0.56
House Sparrow	10.67	12.00	12.96	11.58
House Wren	4.00	0.00	0.00	1.69
Indigo Bunting	6.00	0.00	0.00	2.54
Lapland Longspur	3.33	0.00	3.70	1.41
Northern Cardinal	10.00	0.00	0.00	4.24
Northern Rough-winged Swallow	0.67	0.67	0.00	0.56
Purple Martin	0.00	1.33	0.00	0.56
Red-eyed Vireo	0.67	0.00	0.00	0.28
Red-winged Blackbird	57.00	6.67	0.00	27.40
Song Sparrow	22.00	12.67	1.85	14.97
Summer Tanager	0.67	0.00	0.00	0.28
Tree Swallow	6.00	3.33	0.00	3.95
Vesper Sparrow	14.00	0.67	0.00	6.21
Yellow-rumped Warbler	0.00	0.67	0.00	1.13

Table 4. Estimated Species Composition for Species/Groups Observed Within 800 m of the Point During Avian Fixed Point Count Surveys on the Hoopeston Wind Farm, March 2009 – November 2010.

Species/Group	Spring Comp (%)	Fall Comp (%)	Winter Comp (%)	Overall Comp (%)
Waterfowl	**0.23**	**0.00**	**6.70**	**0.34**
Canada Geese	0.15	0.00	6.70	0.25
Mallard	0.06	0.00	0.00	0.03
Shorebirds	**56.44**	**0.72**	**0.00**	**29.28**
American Golden-Plover	52.66	0.00	0.00	27.05
Common Snipe		0.03	0.00	0.02
Great Blue Heron	0.37	0.00	0.00	0.11
Killdeer	1.05	0.69	0.00	0.85
Pectoral Sandpiper	2.49	0.00	0.00	1.28
Solitary Sandpiper	0.03	0.00	0.00	0.02
Raptors	**1.76**	**2.06**	**6.09**	**2.02**
American Kestrel	0.00	0.17	1.22	0.11
Broad-winged Hawk	0.03	0.00	0.00	0.02
Cooper's Hawk	0.03	0.03	0.00	0.03
Merlin	0.00	0.03	0.00	0.02
Northern Harrier	0.12	0.45	0.61	0.28
Osprey	0.03	0.00	0.00	0.02
Red-shouldered Hawk	0.03	0.00	0.00	0.02
Red-Tailed Hawk	0.49	0.62	2.44	0.60
Rough-legged Hawk	0.03	0.07	1.83	0.09
Turkey Vulture	0.99	0.69	0.00	0.82
Corvids	**0.46**	**0.62**	**3.65**	**0.62**
American Crow	0.46	0.62	3.65	0.62
Upland Game Birds	**0.18**	**0.00**	**0.00**	**0.09**
Ring-necked Pheasant	0.18	0.00	0.00	0.09
Doves	**1.02**	**1.27**	**1.83**	**1.18**
Mourning Doves	1.02	0.93	1.83	1.00
Rock Pigeon	0.00	0.34	0.00	0.16
Swifts	**0.18**	**0.00**	**0.00**	**0.16**
Chimney Swift	0.18	0.00	0.00	0.16
Woodpeckers	**0.14**	**0.14**	**0.61**	**0.11**
Northern Flicker	0.06	0.10	0.00	0.08
Red-bellied Woodpecker	0.09	0.03	0.61	0.08

Species/Group	Spring Comp (%)	Fall Comp (%)	Winter Comp (%)	Overall Comp (%)
Passerines	**39.58**	**95.04**	**81.02**	**66.13**
American Goldfinch	0.55	1.00	0.00	0.74
American Pipit	1.54	0.00	0.00	0.79
American Robin	3.73	1.03	0.00	2.39
American Tree Sparrow	0.00	0.00	0.61	0.02
Barn Swallow	0.86	1.13	0.00	0.96
Blue Jay	0.28	0.34	0.61	0.32
Brown-headed Cowbird	5.39	26.14	0.00	14.80
Brown Thrasher	0.00	0.00	0.00	0.13
Cerulean Warbler	0.15	0.03	0.00	0.09
Chipping Sparrow	0.40	0.14	0.00	0.21
Common Grackle	6.93	0.21	0.00	3.65
Common Yellowthroat	0.03	0.00	0.00	0.02
Dickcissel	0.55	0.00	0.00	0.28
Eastern Meadowlark	1.69	0.27	0.00	1.00
Eastern Towhee	0.03	0.00	0.00	0.02
European Starling	2.49	34.14	21.93	17.57
Golden-crowned Kinglet	0.06	0.00	0.00	0.03
Horned Lark	0.23	9.96	34.11	6.67
House Finch	0.06	0.00	0.00	0.03
House Sparrow	0.80	4.64	21.32	3.10
House Wren	0.22	0.00	0.00	0.11
Indigo Bunting	0.28	0.00	0.00	0.14
Lapland Longspur	1.26	0.00	1.83	0.70
Northern Cardinal	0.46	0.00	0.00	0.24
Northern Rough-winged Swallow	0.06	0.03	0.00	0.05
Purple Martin	0.00	0.17	0.00	0.08
Red-eyed Vireo	0.03	0.00	0.00	0.02
Red-winged Blackbird	7.02	12.67	0.00	9.44
Song Sparrow	1.08	1.06	0.61	1.06
Summer Tanager	0.03	0.00	0.00	0.02
Tree Swallow	3.39	1.31	0.00	0.78
Vesper Sparrow	0.68	0.03	0.00	0.36
Yellow-rumped Warbler	0.00	0.86	0.00	0.40

Table 5. Overall Mean Bird Use and Diversity by Season on the Hoopeston Wind Farm, March 2009 – November 2010.

Season	No. of Surveys	No. of Species	Mean Use[a]	No. of Species per Survey[b]
Spring	150	51	21.65	4.95
Fall	150	33	19.41	1.99
Winter	54	15	3.04	0.88
Overall	354	59	17.85	3.07

[a] Mean number of bird observations per 10-minute survey
[b] Mean number of bird species observed per 10-minute survey

4.1.3 Flight Height Characteristics

The proportion of observations of bird species flying within the rotor swept area provides a rough estimate for the likelihood of that species to fly within the area occupied by the turbine rotors (Table 6). The turbine size will be a Siemens 2.3MW 101 m model with a "zone of risk[1]" from 49.5 m above ground level (AGL) to 150.5 m AGL (information provided by client). All passerine birds were observed perched or on the ground. The larger birds (i.e., raptors, corvids, shorebirds, waterfowl) tend to fly higher than 25 meters within the primary zone of influence for turbine blades for most newer generation turbines. As a group, 72% of waterfowl were observed within the zone of risk followed by shorebirds (50%), and raptors (38%) (Table 7). All Northern Harriers observed were flying below the zone of risk (Table 6). Although, waterfowl had the highest percent of individuals observed within the zone of risk, there were only 4 groups observed (Table 6).

[1] Zone of risk is the rotor swept area from 49.5 m to 150.5 m.

Table 6. Flight Height Characteristics by Species Observed During Avian Fixed Point Count Surveys at the Hoopeston Wind Farm, March 2009 – November 2010.

Species/Group	No. Observed Flying		Birds Flying	Relation to Rotor Swept Area (25 – 125 m)		
	Individual	Group	(%)	below	within	above
Waterfowl						
Canada Geese	16	3	100.00	31.25	68.75	0.00
Mallard	2	1	100.00	0.00	100.00	0.00
Shorebirds						
American Golden-Plover	999	20	58.42	44.34	48.35	7.31
Common Snipe	0	0	0.00	–	–	–
Great Blue Heron	7	5	100.00	28.57	71.43	0.00
Killdeer	29	15	53.70	68.97	31.03	0.00
Pectoral Sandpiper	35	1	43.21	0.00	100.00	0.00
Solitary Sandpiper	0	0	0.00	–	–	–
Raptors						
American Kestrel	2	2	28.57	50.00	50.00	0.00
Broad-winged Hawk	1	1	100.00	0.00	0.00	100.00
Cooper's Hawk	2	2	100.00	50.00	0.00	50.00
Merlin	1	1	100.00	0.00	100.00	0.00
Northern Harrier	18	18	100.00	88.89	11.11	0.00
Osprey	1	1	100.00	0.00	0.00	100.00
Red-shouldered Hawk	1	1	100.00	0.00	100.00	0.00
Red-Tailed Hawk	32	30	84.21	46.88	43.75	9.38
Rough-legged Hawk	6	6	100.00	83.33	16.67	0.00
Turkey Vulture	52	40	100.00	42.31	50.00	7.69
Corvids						
American Crow	0	0	0.00	–	–	–
Upland Game Birds						
Ring-necked Pheasant	0	0	0.00	–	–	–
Doves						
Mourning Doves	0	0	0.00	–	–	–
Rock Pigeon	0	0	0.00	–	–	–
Swifts						
Chimney Swifts	0	0	0.00	–	–	–
Woodpeckers						
Northern Flicker	0	0	0.00	–	–	–
Red-bellied Woodpecker	0	0	0.00	–	–	–

Species/Group	No. Observed Flying		Birds Flying (%)	Relation to Rotor Swept Area (25 – 125 m)		
	Individual	Group		below	within	above
Passerines						
American Goldfinch	0	0	0.00	–	–	–
American Pipit	0	0	0.00	–	–	–
American Robin	0	0	0.00	–	–	–
American Tree Sparrow	0	0	0.00	–	–	–
Barn Swallow	0	0	0.00	–	–	–
Blue Jay	0	0	0.00	–	–	–
Brown-Headed Cowbird	0	0	0.00	–	–	–
Brown Thrasher	0	0	0.00	–	–	–
Cerulean Warbler	0	0	0.00	–	–	–
Chipping Sparrow	0	0	0.00	–	–	–
Common Grackle	0	0	0.00	–	–	–
Common Yellowthroat	0	0	0.00	–	–	–
Dickcissel	0	0	0.00	–	–	–
Eastern Meadowlark	0	0	0.00	–	–	–
Eastern Towhee	0	0	0.00	–	–	–
European Starling	0	0	0.00	–	–	–
Golden-crowned Kinglet	0	0	0.00	–	–	–
Horned Lark	0	0	0.00	–	–	–
House Finch	0	0	0.00	–	–	–
House Sparrow	0	0	0.00	–	–	–
House Wren	0	0	0.00	–	–	–
Indigo Bunting	0	0	0.00	–	–	–
Lapland Longspur	0	0	0.00	–	–	–
Northern Cardinal	0	0	0.00	–	–	–
Northern Rough-winged Swallow	0	0	0.00	–	–	–
Purple Martin	0	0	0.00	–	–	–
Red-eyed Vireo	0	0	0.00	–	–	–
Red-Winged Blackbird	0	0	0.00	–	–	–
Song Sparrow	0	0	0.00	–	–	–
Summer Tanager	0	0	0.00	–	–	–
Tree Swallow	0	0	0.00	–	–	–
Vesper Sparrow	0	0	0.00	–	–	–
Yellow-Rumped Warbler	0	0	0.00	–	–	–
ALL Birds	**1204**	**147**	**19.03**	**44.19**	**48.92**	**6.89**

Table 7. Percent of Avian Groups Observed Flying Below, Within, and Above the Rotor Swept Area of Turbines.

Groups	No. Observed Flying		Birds	Relation to Rotor Swept Area		
	Individual	Flock	Flying (%)	Below	Within	Above
Waterfowl	18	4	100.00	27.78	72.22	0.00
Shorebirds	1070	41	57.71	43.46	49.72	6.82
Raptors	116	102	91.34	53.45	37.93	8.62
Passerines	0	0	0.00	–	–	–

4.1.4 Exposure Index

Exposure index provides a relative measure of the risk each species observed during the point count surveys has colliding with a turbine. This index is based on mean use of the study area by the species and the flight characteristics observed of the species. American Golden Plovers, Pectoral Sandpiper, and Turkey Vultures had the highest exposure indices (Table 8). Raptor species with the highest exposure index were Turkey Vulture and Red-tailed Hawk. Northern Harriers had an exposure index of 0.00 because all birds observed were flying below the zone of risk (Table 8). Overall, raptors had lower use of the proposed wind farm site, which reduced their exposure index.

Table 8. Mean Exposure Index by Species Observed During Avian Fixed Point Count Surveys at the Hoopeston Wind Farm, March 2009 – November 2010.

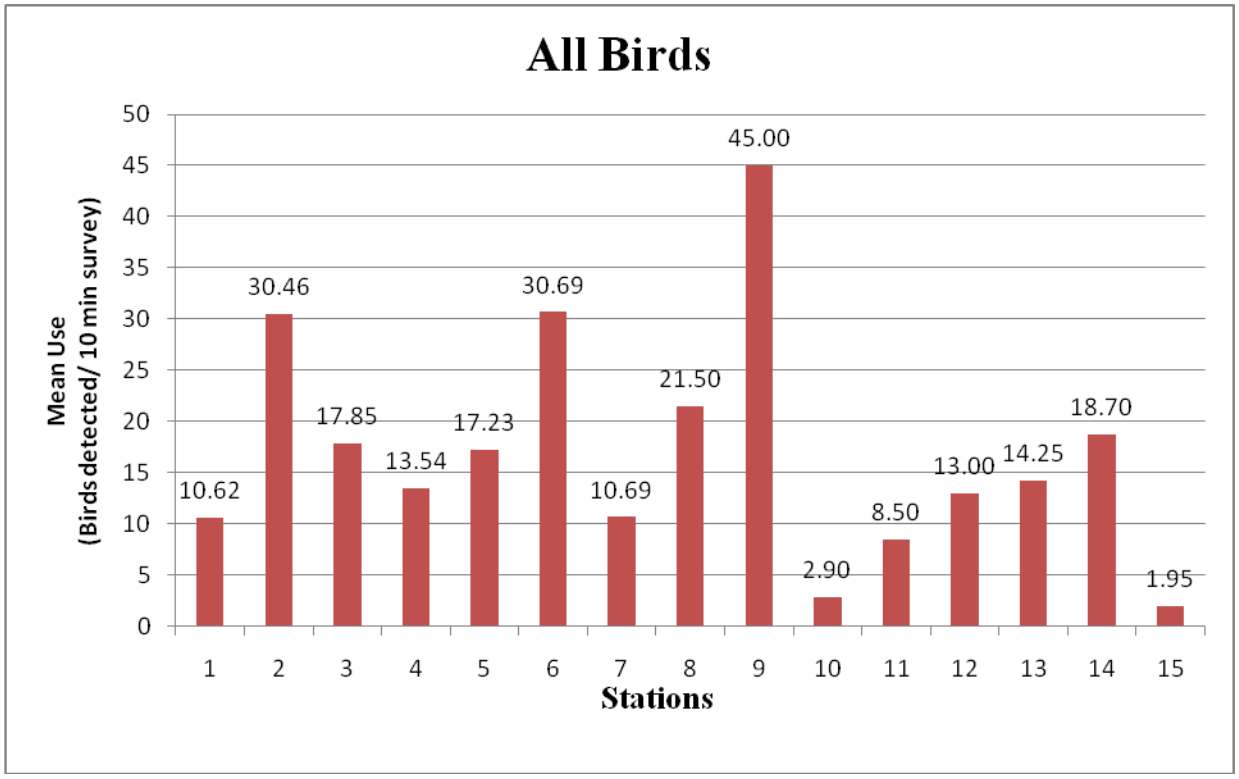
Species/Group	Mean Use	Birds Flying (%)	Flying within RSHA (%)	Exposure Index
Waterfowl				
Canada Geese	0.05	100.00	68.75	0.03
Mallard	0.01	100.00	100.00	0.01
Shorebirds				
American Golden-Plover	4.83	58.42	48.35	1.36
Common Snipe	0.00	0.00	–	
Great Blue Heron	0.02	100.00	71.43	0.01
Killdeer	0.15	53.70	31.03	0.02
Pectoral Sandpiper	0.23	43.21	100.00	0.10
Solitary Sandpiper	0.00	0.00	–	
Raptors				
American Kestrel	0.02	28.57	50.00	0.00
Broad-winged Hawk	0.00	100.00	0.00	0.00
Cooper's Hawk	0.01	100.00	0.00	0.00
Merlin	0.00	100.00	100.00	0.00
Northern Harrier	0.05	100.00	0.00	0.00
Osprey	0.00	100.00	0.00	0.00
Red-shouldered Hawk	0.00	100.00	100.00	0.00

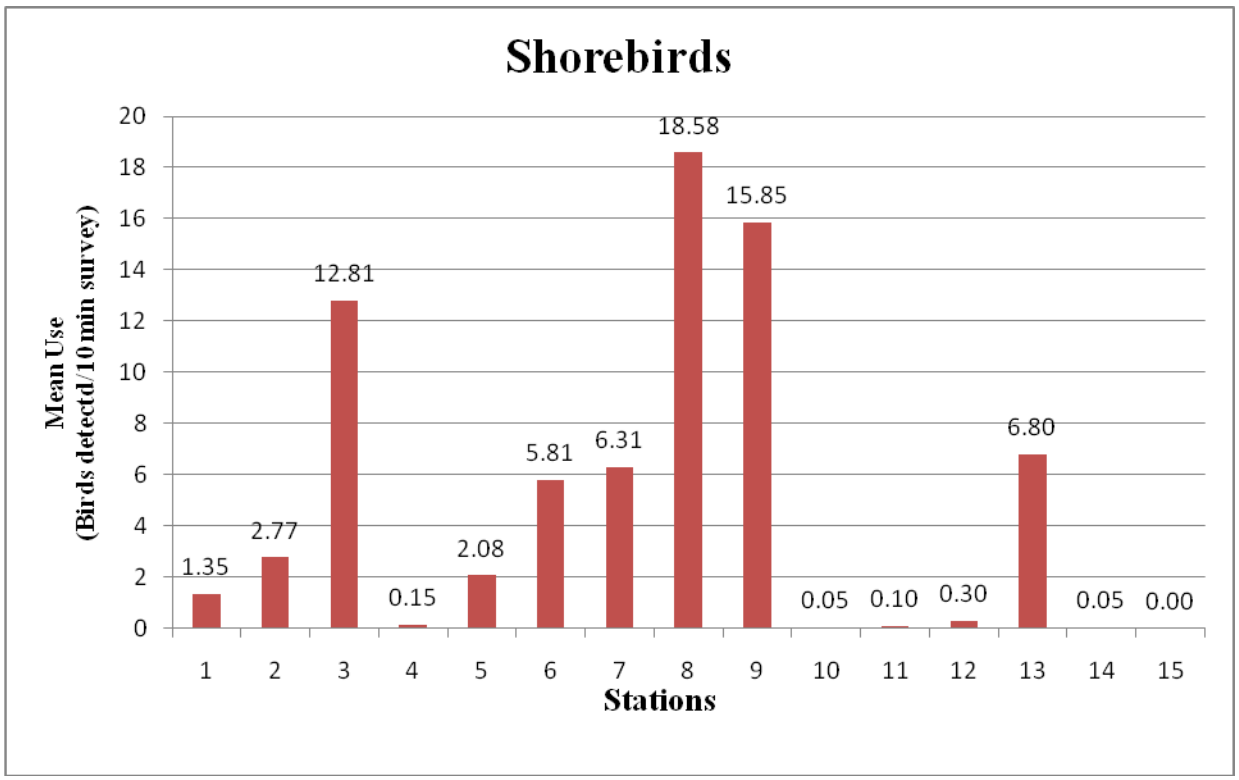
Species/Group	Mean Use	Birds Flying (%)	Flying within RSHA (%)	Exposure Index
Red-Tailed Hawk	0.11	84.21	43.75	0.04
Rough-legged Hawk	0.02	100.00	16.67	0.00
Turkey Vulture	0.15	100.00	50.00	0.08
Corvids				
American Crow	0.11	0.00	–	0.00
Upland Game Birds				
Ring-necked Pheasant	0.02	0.00	–	0.00
Doves				
Mourning Dove	0.18	0.00	–	0.00
Rock Pigeon	0.03	0.00	–	0.00
Swifts				
Chimney Swift	0.03	0.00	–	0.00
Woodpeckers				
Northern Flicker	0.01	0.00	–	0.00
Red-bellied Woodpecker	0.01	0.00	–	0.00
Passerines				
American Goldfinch	0.13	0.00	–	0.00
American Pipit	0.14	0.00	–	0.00
American Robin	0.43	0.00	–	0.00
American Tree Sparrow	0.00	0.00	–	0.00
Barn Swallow	0.17	0.00	–	0.00
Blue Jay	0.06	0.00	–	0.00
Brown-headed Cowbird	2.64	0.00	–	0.00
Brown Thrasher	0.02	0.00	–	0.00
Cerulean Warbler	0.02	0.00	–	0.00
Chipping Sparrow	0.04	0.00	–	0.00
Common Grackle	0.65	0.00	–	0.00
Common Yellowthroat	0.00	0.00	–	0.00
Dickcissel	0.05	0.00	–	0.00
Eastern Meadowlark	0.18	0.00	–	0.00
Eastern Towhee	0.00	0.00	–	0.00
European Starling	3.14	0.00	–	0.00
Golden-crowned Kinglet	0.01	0.00	–	0.00
Horned Lark	1.19	0.00	–	0.00
House Finch	0.01	0.00	–	0.00
House Sparrow	0.55	0.00	–	0.00
House Wren	0.02	0.00	–	0.00

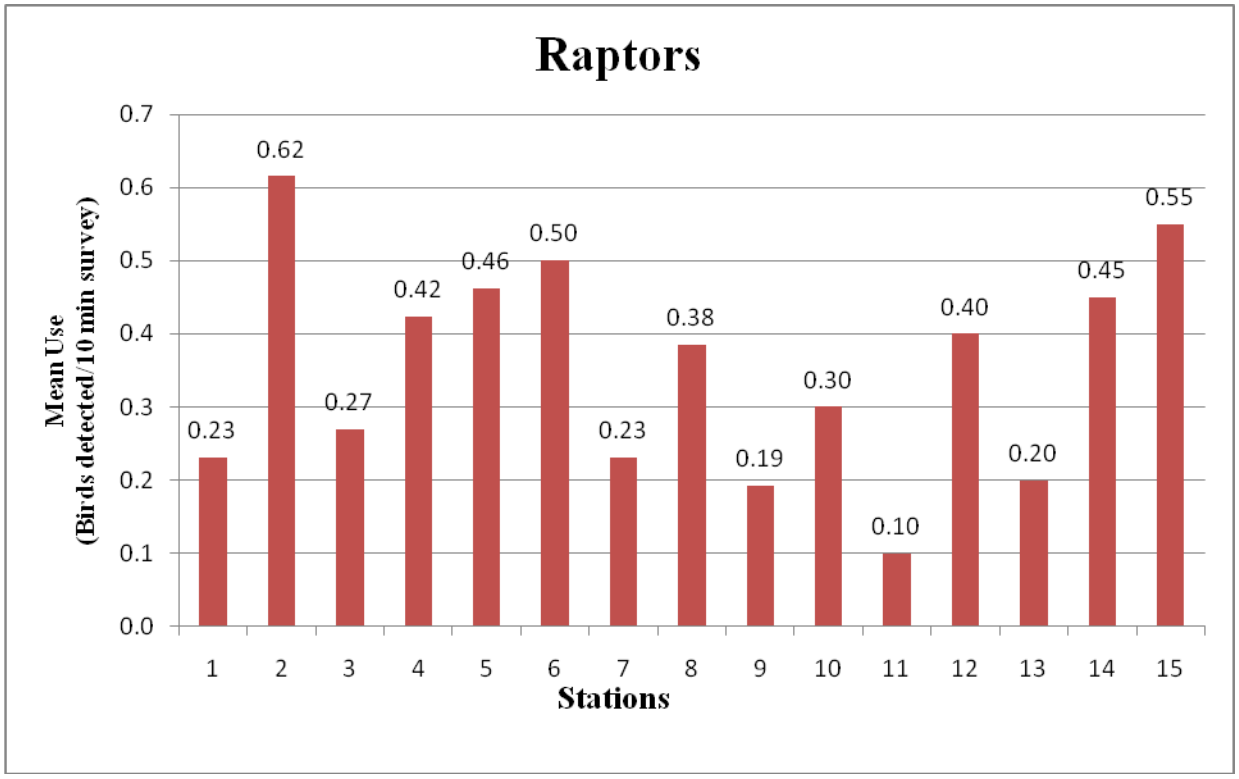
Species/Group	Mean Use	Birds Flying (%)	Flying within RSHA (%)	Exposure Index
Indigo Bunting	0.03	0.00	–	0.00
Lapland Longspur	0.12	0.00	–	0.00
Northern Cardinal	0.04	0.00	–	0.00
Northern Rough-winged Swallow	0.01	0.00	–	0.00
Purple Martin	0.01	0.00	–	0.00
Red-eyed Vireo	0.00	0.00	–	0.00
Red-winged Blackbird	1.69	0.00	–	0.00
Song Sparrow	0.19	0.00	–	0.00
Summer Tanager	0.00	0.00	–	0.00
Tree Swallow	0.14	0.00	–	0.00
Vesper Sparrow	0.06	0.00	–	0.00
Yellow-rumped Warbler	0.07	0.00	–	0.00

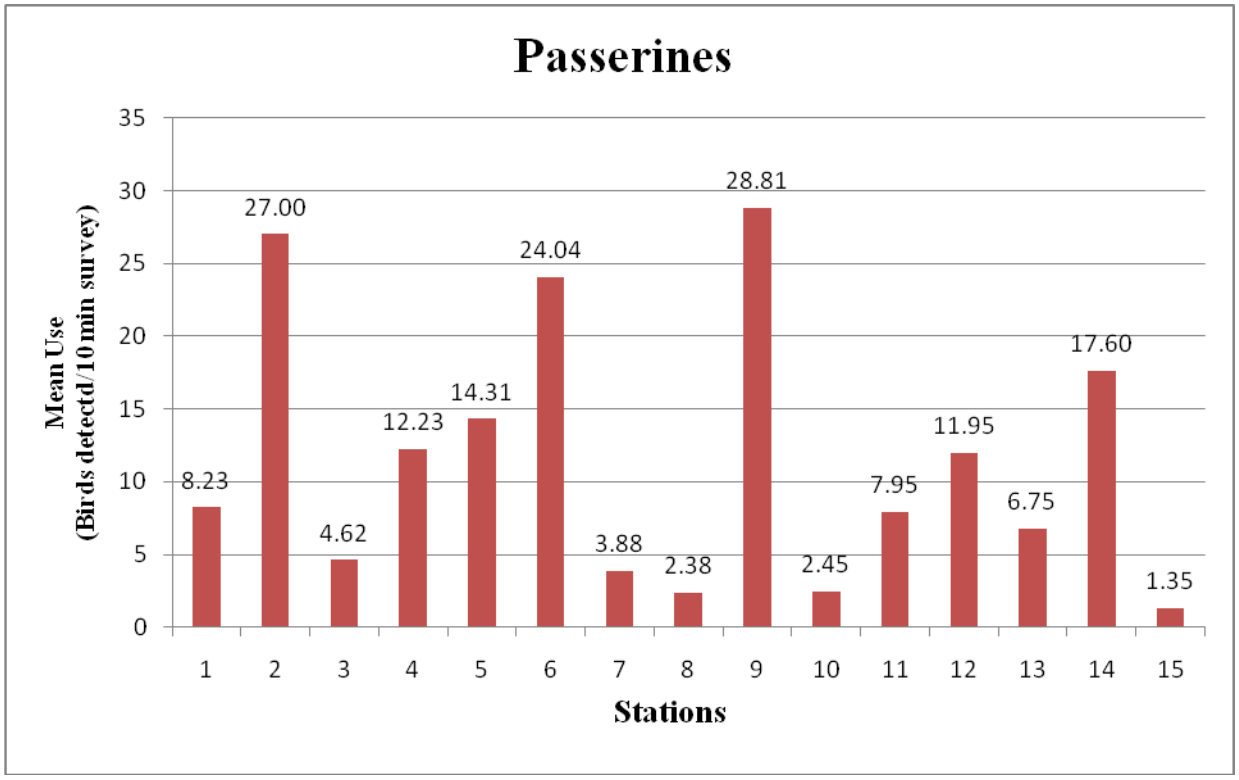
4.1.5 Spatial Use

Use by station was plotted to look for concentrations or differences in avian use across the study area (Figure 6). Overall bird use was highest at station 9 followed by stations 6 and 2 (Figure 6). The higher use at station 9 was due to large American Golden Plover and Brown-headed Cowbird flocks observed. The higher use at station 6 was due to large flocks of American Golden Plovers, European Starlings, Brown-headed Cowbirds, and Horned Larks observed. Overall raptor use was low across the study area and was similar across all stations; the highest use was observed at stations 2 and 15 (Figure 6). The higher raptor use was due to Turkey Vultures, Northern Harriers, and Red-tailed Hawks observed at these stations. Northern Harrier use was highest at station 2 (Figure 6) with 6 out of 18 individuals observed here (Table 1). Station 2 was located within and adjacent to rural grassland vegetation (Figure 7).


All Birds
Mean Use
(Birds detected/ 10 min survey)
50
45
40
35
30
25
20
15
10
5
0
10.62
30.46
17.85
13.54
17.23
30.69
10.69
21.50
45.00
2.90
8.50
13.00
14.25
18.70
1.95
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Stations


Shorebirds
Mean Use
(Birds detectd/10 min survey)
20
18
16
14
12
10
8
6
4
2
0
1.35
2.77
12.81
0.15
2.08
5.81
6.31
18.58
15.85
0.05
0.10
0.30
6.80
0.05
0.00
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Stations


Raptors
Mean Use
(Birds detected/10 min survey)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.23
0.62
0.27
0.42
0.46
0.50
0.23
0.38
0.19
0.30
0.10
0.40
0.20
0.45
0.55
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Stations


Passerines
Mean Use
(Birds detectd/10 min survey)
35
30
25
20
15
10
5
0
8.23
27.00
4.62
12.23
14.31
24.04
3.88
2.38
28.81
2.45
7.95
11.95
6.75
17.60
1.35
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Stations

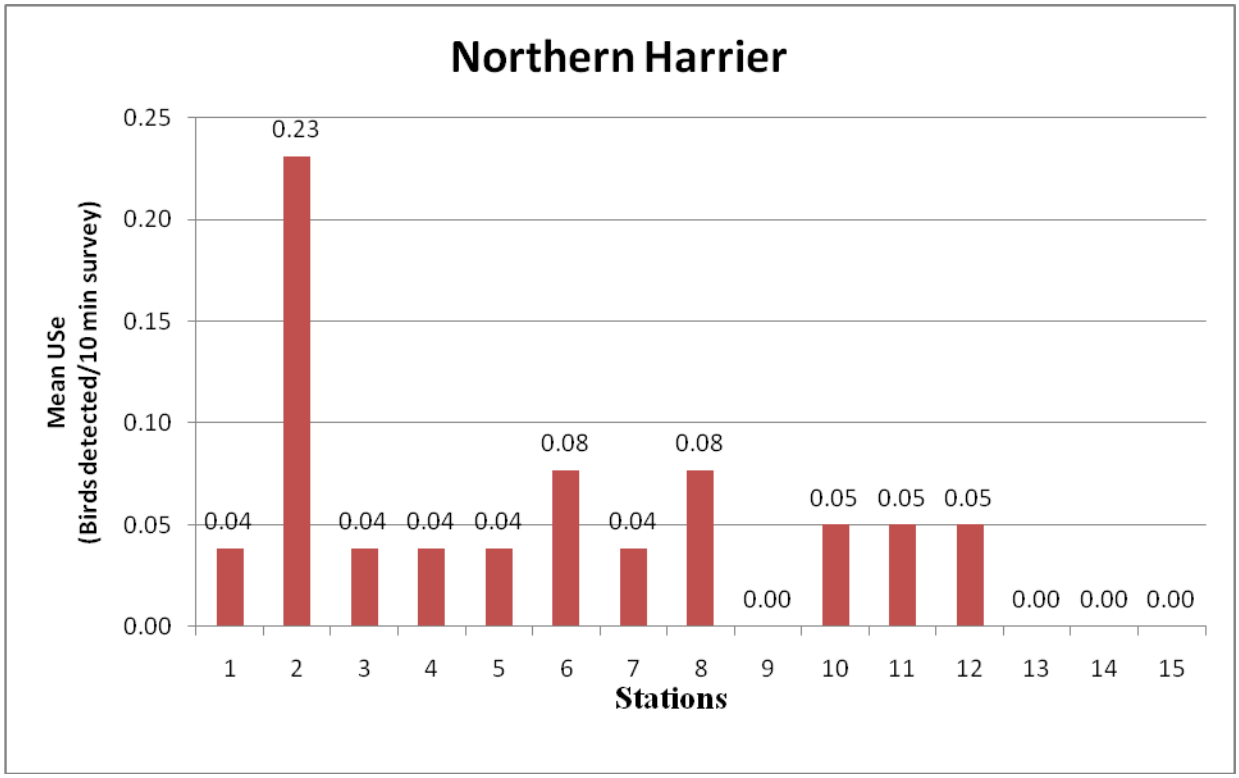


Figure 6. Mean use for all birds, shorebirds, raptors, passerines, and Northern Harriers by station, March 2009 – November 2010.

4.2 Anabat Surveys

4.2.1 Passive Monitoring

The total number of calls and calls per night recorded varied by season and monitoring site (Table 9). Each Anabat unit was programmed to record for 12 hours each day. In spring 2009, technical difficulties due to rain reduced the useable data to 216 hours. Spring sampling began on April 16, 2009 and recorded until May 3, 2009. A total of 110 bat calls (0.51 calls per hour) were recorded with the highest number of calls at monitoring site 1. For 52 of the calls, the acoustic data could not be identified to species. The remaining 58 calls were identified to 5 species. 2 of the calls could not be distinguished between *Myotis lucifugus* or *M. septentrionalis;* thus were identified as *Myotis* spp.

In fall 2009, 372 hours of useable data were obtained between September 14, 2009 and September 28, 2009. A total of 408 bat calls (1.10 calls per hour) were recorded with the highest number of calls at monitoring site 1 (Table 9). For 268 of the calls, the acoustic data could not be identified to species. 140 of the calls were reasonably identified to species. 12 of the calls could not be distinguished between *Myotis lucifugus, M. septentrionalis,* or *M. sodalis*.

In spring 2010, 1,236 hours of usable data were obtained between April 12, 2010 and May 3, 2010. A total of 1,003 bat calls (0.81 calls per hour) were recorded with the highest number of calls at monitoring sites 4 and 1 (Table 9). For 859 of the calls, the acoustic data could not be identified to species. 144 of the calls were reasonably identified to species.

In fall 2010, 1,764 hours of usable data were obtained between August 31, 2010 and September 29, 2010. A total of 1,690 bat calls (0.96 per hour) were recorded with similar recorded number of calls across monitoring sites 1 and 4-6 (Table 9). For 1,418 of the calls, the acoustic data could not be identified to species. 272 calls were reasonably identified to species. The one Myotis call could not be determined whether it was *M. lucifugus, M. septentrionalis,* or *M. sodalis*.

Table 9. Number of Sampling Days, total number of calls recorded, and calls/night recorded by each Anabat unit at the Hoopeston Wind Farm for spring and fall migration sampling periods, 2009–2010.

Year	Season	Anabat Site	No. of sampling days used in analysis	Total no. of calls	No. calls/night
2009	Spring	1	8	90	11.3
		2	5	11	2.2
		3	5	9	1.8
	Overall		18	110	**6.1**
	Fall	1	11	190	17.3
		2	10	101	10.1
		3	10	117	11.7
	Overall		31	408	**13.2**
2010	Spring	1	15	336	22.4
		2	18	22	1.2
		3	21	72	3.4
		4	14	414	29.6
		5	21	106	5.0
		6	14	53	3.8
	Overall		103	1,003	**9.7**
	Fall	1	30	346	11.5
		2	19	20	1.1
		3	22	107	4.9
		4	24	350	14.6
		5	22	391	17.8
		6	30	429	14.3
	Overall		147	1,643	**11.2**

Six bat species were positively identified during the spring and fall migration sampling periods (Table 10). The majority of calls could not be identified to species either because they contained too few pulses or the call characteristics overlapped more than two species. Relative call frequency was calculated by dividing the number of calls recorded for each species by the total number of calls for each sampling period.

On the basis of acoustic data alone, *Eptesicus fuscus* and *Lasionycteris noctivagans* are notoriously difficult to differentiate. Data gathered in this study confirms the likely presence of both species. While *Eptesicus fuscus* occurs much more frequently enough evidence was gathered to indicate low numbers of *Lasionycteris noctivagans* were also present.

Of the calls that were identified to species, red bat accounted for the majority of vocalizations recorded in the spring and fall of 2009, and big brown bat accounted for the majority of vocalizations recorded in the fall of 2009 and in the spring and fall of 2010. The lowest species diversity was recorded in fall 2009 with 3 species identified. The highest species diversity was recorded in spring and fall 2010 with 6 species identified. Currently, data is not available from other Illinois wind farm projects to compare the overall call identification results (personal communication Keith Shank, Illinois Department of Natural Resources, Environmental Review, 2-3-11).

Table 10. Relative call frequency of species recorded during the spring and fall migration sampling periods, 2009–2010.

Species		Relative Call Frequency			
		2009		2010	
Common Name	Scientific Name	Spring	Fall	Spring	Fall
Big brown bat	*Eptesicus fuscus*	0.14	0.14	0.09	0.11
Red bat	*Lasiurus borealis*	0.32	0.13	0.01	0.02
Hoary bat	*Lasiurus cinereus*	0.03	0.00	0.02	0.001
Silver-haired bat	*Lasionycteris noctivagans*	0.02	0.05	0.01	0.007
Eastern pipistrelle	*Perimyotis subflavus*	0.00	0.00	0.005	0.01
Evening bat	*Nycticeius humeralis*	0.00	0.00	0.003	0.00
Myotis species	*Myotis* spp.	0.02	0.03	0.000	0.01
No identification		0.47	0.66	0.86	0.84

4.2.2 Active monitoring

No bats were detected during the spring migration active monitoring periods in 2009 or 2010. In 2009, fall migration mobile surveys occurred on 3 nights and recorded 22 bat calls (Table 11). In 2010, fall migration mobile surveys occurred on 2 nights and recorded 47 bat calls (Table 11). No new bat species were recorded during the active monitoring surveys that were not recorded at the monitoring sites. Big brown bat was the most common species identified (Table 11). Similar to the passive monitoring, the majority of bat calls could not be identified to species. Currently, data is not available from other Illinois wind farm projects to compare the overall active call identification results (personal communication Keith Shank, Illinois Department of Natural Resources, Environmental Review, 2-3-11).

4.2.3 Habitat Comparison Study to the Fowler Ridge Site in Benton County, Indiana that have had known Indiana bat interactions

The habitats of the proposed wind farm site and the operating wind farm (Fowler Ridge) were found to be very similar in that neither contains much water or forest- both of which are important for bats (Whitaker 2010). Neither the proposed wind farm site nor Fowler Ridge was found to provide good Indiana bat habitat (Whitaker 2010). Both sites have at least adequate nearby habitat for Indiana and other bats, although there is more adjacent to the proposed wind farm site than at Fowler Ridge. In terms of migration, both sites are slightly elevated resulting in

all streams running away in all directions. There are streams containing good bat habitat east, south, and west of the proposed wind farm site, which could serve as migratory pathways. At Fowler Ridge it would appear that there are less major streams and less nearby habitat than at the proposed wind farm site. Whether there are defined flyways or not, it is clear that numerous bats do migrate over open areas such as occur at the proposed wind farm site and Fowler Ridge.

Table 11. Fall survey nights and number of detections by species during mobile Anabt surveys, 2009 and 2010.

Species		Date and Year Sampled				
		2009			2010	
Common Name	Scientific Name	9/21	9/22	9/28	8/31	9/1
Big brown bat	*Eptesicus fuscus*	3	4	3	17	0
Red bat	*Lasiurus borealis*	0	3	0	0	0
Hoary bat	*Lasiurus cinereus*				0	0
Silver-haired bat	*Lasionycteris noctivagans*	0	0	0	0	0
Eastern pipistrelle	*Perimyotis subflavus*	0	0	0	0	0
Evening bat	*Nycticeius humeralis*	0	0	0	0	0
	Myotis spp.	0	1	0	0	0
No Species ID		0	6	2	29	1
Total Detections/Night		3	14	5	46	1

4.3 Sensitive Species Surveys

No ornate box turtles or habitat was observed. The three soil pits showed no visible horizons and were compacted (Appendix C). In addition, the ornate box turtle is not listed as a threatened or endangered species for Vermilion County (INHS December 2010).

As of December 31, 1977, the Northern Harrier (NOHA) was listed as a state endangered species for Vermilion County (INHS 2010). The Northern Harrier was observed on the proposed wind farm site at 11 of the 15 stations during avian fixed point counts. Eighteen observations were made during the fixed avian point count surveys (Figure 7).

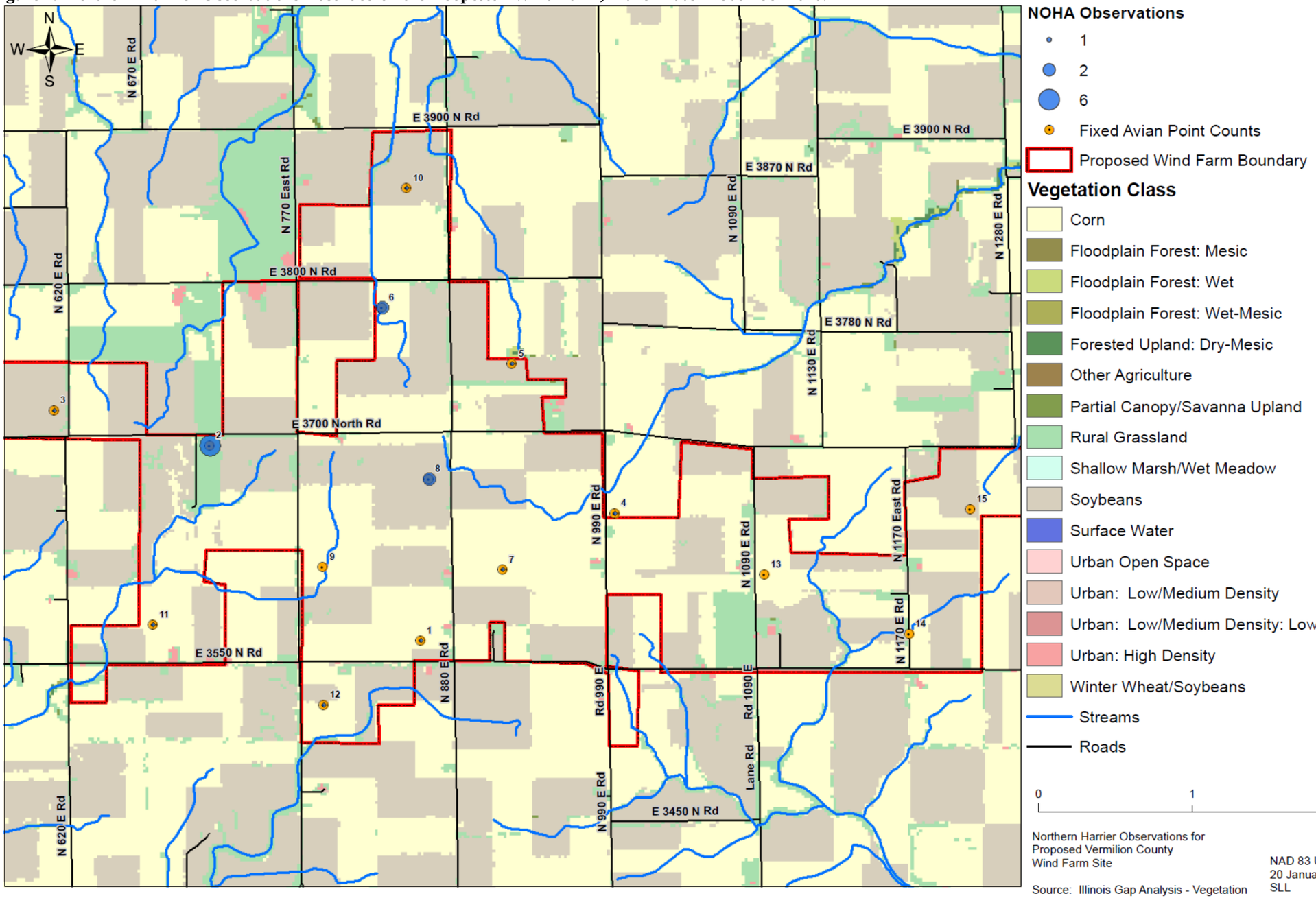
The Northern Harrier has recorded populations that have bred in Vermilion county in the past, and likely continues to do so. Most pre-construction avian use studies associated with wind farms in Illinois have noted migratory Northern Harriers passing through the project area, usually at altitudes well-below rotor height, so there may not be much in the way of collision risk (Per Keith Shank, IDNR 02/28/2011).

Of wind farms that have completed post-construction avian use studies, Northern Harriers are conspicuously absent. This suggests that migratory Northern Harriers avoid wind farms (and wind turbines).

"At this time, we have only one wind farm in close proximity to a known Harrier nesting site in Livingston County, and the nest actually lies outside the footprint. We are curious to see how construction and operation of the wind farm affects this pair's activities, but we have not recommended ITA in that case and the developer has not sought it." Keith Shank, IDNR (email: 02/28/2011, 10:09am).

No T&E species or suitable habitat was observed within or adjacent to the proposed transmission corridor during the survey. However, based on bird movement there is a probability the Northern Harrier may fly over the transmission corridor area or use the adjacent areas to forage. The proposed transmission corridor is within the public right-of-way with fescue grass (*Festuca* spp.), corn, and soybeans as the dominant vegetation.

Figure 7. Northern Harrier Observations Recorded on the Hoopeston Wind Farm, March 2009–November 2010.



5.0 Summary and Conclusions

5.1 Avian Use and Diversity

Based on the fixed point count surveys, the most abundant species were American Golden Plovers, European Starlings, and Brown-headed Cowbirds. Together these species comprised more than half of the total bird use observed during the fixed point counts. Passerines were the most abundant group observed with approximately 12 individuals observed during each survey. Highest passerine uses occurred during the fall due primarily to large flocks of Brown-headed Cowbirds, European Starlings, Horned Larks, and House Sparrows observed. Shorebird use was highest in the spring due to several large flocks of American Golden Plovers.

Overall, raptor use was not high with 127 raptors observed in 113 groups. Over all three seasons, the most abundant raptors observed in order were Turkey Vulture, Red-tailed Hawk, Northern Harrier, and American Kestrel. The most abundant raptor varied by season, however, raptor use and raptor species observed were similar in spring and fall (Table 2). As a group, raptors comprised approximately 2% of all avian use on the proposed wind farm site. Raptor use of the proposed wind farm site dropped substantially during the winter (0.09 detections per 10-minute survey).

Northern Harrier use was highest in fall (0.09 detections /10-minute survey) and lowest in winter (0.02 detections/10-minute survey) (Table 2). Northern Harriers typically forage over open habitats (e.g., short vegetated areas) like the agricultural fields at the proposed wind farm site. Northern Harrier have been reported to under use areas of short vegetation (i.e., overgrazed pastures, harvested agricultural fields), while idle or abandoned fields (often wet) with vegetative cover have been documented to be used more than expected (Linner 1980, Bildstein 1987, Preston 1990, Macwhirter et al. 1996). Northern harrier use was low on the proposed wind farm site (0.05 detections/10-minute survey) (Table 2), which consists mainly of agricultural fields.

Frequency of occurrence and percent composition were calculated to provide a relative estimate of the avian diversity of the proposed wind farm site. These statistics reflect the results of the use calculations in that there is relatively low species diversity on the site with three species (American Golden Plover, Brown-headed Cowbird, European Starling) making up the vast majority of the observations. Based on frequency of occurrence one species was observed in over one- third of all surveys, Horned Lark (33%) and comprised 7% of all avian use. In contrast, American Golden Plovers were observed in approximately 5% of all surveys and comprised 27% of all avian use. Most species were observed in less than 5% of all surveys (Table 3).

The most frequently observed raptor was Red-tailed Hawk with 0.6% of total avian use (Table 4). Turkey vultures were observed in approximately 10% of all surveys and comprised 0.8% of all avian use. Northern Harriers were observed in 5% of all surveys (Table 3) and comprised 0.28% of total avian use (Table 4). As a group, raptors comprised only 2% of all avian use with less than 1 raptor observed during each 10-minute survey (0.36 per 10-minute survey). In contrast, passerines comprised 66% of all avian use (Table 3) and approximately 12 passerines were observed during each 10-minute survey (Table 2).

5.2 Bat Use and Diversity

No evidence of any caves or mines which might serve as suitable hibernacula was found. The only bat that might hibernate in the area would be the big brown bat, with most individuals hibernating in buildings (Whitaker, 2009), and possibly the red bat which might hibernate in leaf litter in the woodlot (site #1) plus other small areas of trees that occurred.

In 2009, acoustic monitoring data indicated that relatively few bats used this area for roosting or foraging at least in fall and spring. Levels of 0.51 calls per hour in the spring and 1.10 per hour in the fall are very low[2].

In 2010, acoustic monitoring data indicated that relatively few bats used this area for roosting or foraging at least in fall and spring. Levels of 0.25 calls per hour in the spring and 0.96 per hour in the fall are very low.

More bat species were documented in 2010 (n=7) versus 2009 (n=5) at this project site. However, fewer calls/hour were recorded in 2010 (0.25 calls/hour spring, 0.96 calls/hour fall) than in 2009 (0.51 calls/hour spring, 1.10 calls/hour fall). No bats were recorded during spring active monitoring for either 2009 or 2010 and only low numbers were recorded during fall active monitoring for both years.

No Indiana bats were observed during the active or passive monitoring surveys at the proposed wind farm site.

However, other studies at wind farm sites have shown mortality is greatest during fall migration and peaks in August and September (Johnson 2005, Arnett et al. 2008). In reality, very little is known about migration routes and behavior of bats. Preliminary observations suggest that migratory bats fly, at least generally, north and south using streams and woods when available, but that they fly across open country when necessary, as evidenced by the numbers that get killed at turbines. The Big Four Ditch, the Middle Fork of the Vermilion River, and the North Fork of the Vermilion River are all good bat habitat and could all serve as migratory routes near the proposed wind farm site. Birds are known to follow flyways, but these flyways are rather broad tracts along the stream, rather than just over the stream. If bats do the same thing, then they could migrate along these same three streams but branch out over the proposed Vermilion wind farm site, if they don't follow such streams then they could migrate over the proposed wind farm site. Therefore, there is a probability the proposed wind farm site may have bat mortalities, but until more is known about the migration of bats- the direction they fly, how factors on the ground affect how they fly, how much open ground they will pass over, etc., and probably several others, it will be very difficult to estimate the number of bats that might be killed at various proposed wind farm sites.

[2] The reference to high and low bat call numbers is based on the 30 – 40 years of bat research experience of the Indian State University for North American Bat Research and Conservation research team.

5.3 Sensitive Species Surveys

Northern Harriers, a state listed species for Vermilion County as of December 2010 (INHS 2010), was observed in the proposed wind farm site. Northern Harriers have been recorded as fatalities at two wind projects in the U.S. (Erickson et al. 2001, Whitfield and Madders 2006a); 3 individuals were documented at Altamont Pass, California (Smallwood and Thelander 2004, Theander et al. 2003), and 1 individual was documented at Foote Creek Rim Wind Farm, Wyoming (Johnson et al. 2000a). Both of these studies include different habitat types and topographical relief than the proposed wind farm site. The Altamont Pass study area exhibits a variety of topographical relief with ridge tops and swales (Small and Thelander 2004, Theander et al. 2003); and the Foote Creek Rim study area is located along a large mesa ranging from 2,435 m to 2,315 meters in elevation (Johnson et al. 2001). Seven other wind farm sites in the U.S. have not documented any Northern Harrier fatalities (Erickson et al. 2000, Johnson et al. 2000b, Erickson et al. 2003, Johnson et al. 2003, Schmidt et al. 2003, Young et al. 2003, Erickson et al. 2004). The overall use by this species was low on the proposed wind farm site (0.05 observed per 10-minute survey) and would not be expected to be at great risk.

"At this time, we have only one wind farm in close proximity to a known Harrier nesting site in Livingston County, and the nest actually lies outside the footprint. We are curious to see how construction and operation of the wind farm affects this pair's activities, but we have not recommended ITA in that case and the developer has not sought it." Keith Shank, IDNR (email: 02/28/2011, 10:09am).

Northern Harriers tend to fly at low altitudes with the majority of flight altitudes occurring within 10 or 20 meters of the ground (Whitfield and Madders 2006b). This species flies at lower altitudes while foraging for prey species (Schipper 1977, Watson 1977). For the proposed wind farm site, 100% (18 out of 18 individuals) of Northern Harriers were observed flying below the zone of risk (Table 6) with the highest flight altitude of 27 meters. The turbine size will be a Siemens 2.3MW 101 m model with a "zone of risk" from 49.5 m above ground level (AGL) to 150.5 m AGL (information provided by client). The nine studies in the U.S. have examined wind turbine collision risk of Northern Harriers and mortality was documented at two of the studies (Whitfield and Madders 2006a). The low mortality rate in modern wind farms (e.g., tubular pole design) suggest that higher rotor swept areas may reduce collision risk in Northern Harriers due to their typically low flight altitude (Whitfield and Madders 2006a).

5.4 Risk of Turbine Collisions

Exposure Index

Waterfowl, shorebirds, and raptors were the only groups observed flying during the avian fixed point count surveys (Table 6). The species with the highest exposure indices were Mallards, Pectoral Sandpiper, Merlin, and Red-shouldered Hawks (Table 6). However, the Mallard and Pectoral Sandpiper had one group observed; and the Merlin and Red-shouldered Hawk had one individual/group observed. American Golden Plovers were the most abundant species observed with 48% observed flying within the zone of risk. American Kestrel, Merlin, Red-shouldered Hawk, and Turkey Vulture had ≥50% observed flying within the zone of risk. While the

exposure index is not a measure of absolute risk, it does provide a relative estimate of the chance a species may come in contact with turbine blades. An exposure index of zero does not necessarily mean that a species is not at risk, but it does indicate that based on the observations made of that species on the proposed wind farm site, it is unlikely to be in the area of the turbine blades for much of the time.

Passerines (perching birds) have been the most abundant avian fatality at other projects studied in the U.S. (Erickson et al. 2001), often comprising more than 80% of the avian fatalities. Both migrant and resident passerine fatalities have been observed. Given that passerines make up the vast majority of the avian observations on the proposed wind farm site, passerines would likely make up the largest proportion of potential fatalities. Common species such as Horned Larks would be most at risk for turbine interactions based on abundance at the proposed wind farm site.

Based on the relative low use of the proposed wind farm site by raptors, potential raptor mortality for this project is expected to be low. The raptors expected to be most at risk of collision are the species most abundant in the proposed wind farm site, Turkey Vultures, Red-tailed Hawks, and Northern Harriers. All three species have also been casualties at other studied wind plants in the U.S. (Erickson et al. 2001).

Northern Harriers were observed with 100% (18 out of 18 individuals) (Table 6) flying below the zone of risk and the highest recorded flight altitude of 27 meters. The "zone of risk" for the proposed wind farm site will be from 49.5 m above ground level (AGL) to 150.5 m AGL (information provided by client). Northern Harriers tend to fly at low altitudes with the majority of flight altitudes occurring within 10 or 20 meters of the ground (Whitfield and Madders 2006b). This species flies at lower altitudes while foraging for prey species (Schipper 1977, Watson 1977). Nine studies in the U.S. have examined wind turbine collision risk of Northern Harriers and mortality was documented at two of the studies (Whitfield and Madders 2006a). The low mortality rate in modern wind farms (e.g., tubular pole design) suggest that higher rotor swept areas may reduce collision risk in Northern Harriers due to their typically low flight altitude (Whitfield and Madders 2006a).

Wind farm sites across the U.S. have reported low rates of shorebird collisions (Everaert 2003; Kingsley and Whittam 2007) with mortality generally occurring when water was near the wind farm site, attracting large flocks (Erickson et al. 2001). American Golden Plovers were the most abundant species on the proposed wind farm site due to several large flocks observed during spring migration. Based on the results of this study, American Golden Plovers had an exposure index of 1.36 (Table 8) with 48% observed flying within the zone of risk. American Golden Plovers may use a variety of habitats during migration which includes tilled farmland and harvested crop lands found on the proposed wind farm site (Clay et al. 2010). American Golden Plovers have been displaced up to 0.5 miles from wind farms (Manes et al. 2004); and could be displaced by the proposed wind farm site.

Use by other groups of birds such as waterfowl, doves, woodpeckers, and other non-passerine species was so low that trends or concentration areas could not be distinguished easily. These groups are not expected to be at risk from the proposed development.

5.5 Turbine Siting Issues

The proposed wind farm site consists of privately owned farms, which produce mainly cash-grain crops and livestock. Historically, the predominant vegetation type was a mosaic of bluestem prairie and oak-hickory forests. Currently, the natural vegetation has been converted to cropland (i.e., approximately 80 percent). Extensive parts of the land have been tiled, ditched, and tied into the drainage system to make the land suitable for agriculture and settlement. The primary crops are soybeans and corn, which are harvested annually. A common land management practice for these agricultural operations is herbicide and pesticide use, which will continue to be implemented. Common land management practices associated with agriculture in general include but are not limited to crop rotation, field resting (no crops), and use of large equipment throughout the year. These agriculture practices are known to produce large amounts of noise and other high disturbances which can cause avoidance by native wildlife populations and deaths in some cases.

Overall the results of the avian surveys were typical of converted cropland areas with monotypic vegetation type and topography. The site is generally flat and the dominant vegetation type is agricultural fields. Based on the fixed avian point count survey results there were greater shorebird (i.e., American Golden Plover) use at stations 8 and 9 (Figure 7). American Golden Plovers are not a state or federal listed species, but are protected under the Migratory Bird Treaty Act (MBTA). Migratory birds are protected under the MBTA of 1918 (16 USC 703-711). The MBTA protects all migratory birds listed in 50 CFR Part 10, and makes it unlawful to take, possess, buy, sell, purchase, or barter for them including feathers, eggs, nests.

The Northern Harrier is a state listed species and protected by the MBTA. However, based on the typical low flight altitude for Northern Harriers; the wind turbine design information provided by the client (i.e., tubular pole design, RSA 49.5 m to 150.5 m); there should be no turbine siting issues due to the Northern Harrier. It is recommended that the client consider other avian programs that would involve the implementation of avian predator perch deterrents (e.g., cover nacelle platforms with screen, apply deterrents to some horizontal structures in the RSA) that would help decrease potential avian risks associated with wind turbines and their operation. Furthermore, historically and currently the MBTA has not been used as an enforcement or curtailment of any wind farm projects. Based on the acoustical bat surveys there were no marked concentrations or areas that would appear to pose a greater risk from development. No results were found that might suggest some further investigation or detailed analysis to look for variable trends.

5.6 Future Study Issues

Based on the avian fixed point counts and sensitive species surveys, raptor use on the proposed wind farm site is low. American Golden Plovers were the most abundant species on the proposed wind farm site due to several large flocks observed during spring migration. This species is not a state or federal listed species, but is protected under the MBTA. The Northern Harrier is a state listed species and is protected under the MBTA. However, historically and currently the MBTA has not been used as an enforcement or curtailment of any wind farm projects.

Based on the bat acoustical surveys, bat use is low on the proposed wind farm site. Furthermore, no evidence of any caves or mines which might serve as suitable hibernacula was found within the proposed wind farm site.

Future studies, if needed are recommended for post construction monitoring. A post construction study is recommended for the project to quantify impacts to avian and bat species to determine if or what extent mortality occurs. A monitoring plan for the project should consider the following components: 1) fatality monitoring involving standardized carcass searches, scavenger removal trials, searcher efficiency trials, and reporting of incidental fatalities by maintenance personnel and others; and 2) a minimum of one breeding season of post construction point count surveys. The protocol for the fatality monitoring study should be similar to protocols used at other wind farms and take in account Federal and State recommendations.

It is recommended that USFWS guidelines for wind park siting and development are investigated and implemented if feasible. Although voluntary implementation of the USFWS guidelines for wind park siting and development and consultation with the agency cannot absolve a company of liability under the Migratory Bird Treaty Act (MBTA), a company that has adopted USFWS recommendations, e.g., orienting turbine arrays parallel to avian flight pathways, constructing meteorological towers with no guy lines, minimizing lighting or using slow-blinking strobe lights where aviation lighting is required, and building electric transmission lines underground to reduce avian mortality, may be afforded some protection from full enforcement. The MBTA provides no recourse or permit for incidental or accidental take of avian species. The USFWS guidelines for wind park siting and development are all voluntary recommendations and are not required by law at this point in time.

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APPENDIX A: Habitat Descriptions of Individual Bat Species that May Occur on the Hoopeston Wind Farm

Species of bats that have been recorded from Vermilion County, IL are:

***Eptesicus fuscus* (Big Brown Bat):** Is probably the most common bat in Illinois. In summer, maternity colonies are normally found in buildings, bridges, or other man-made structures. During winter a few hibernate in caves or mines, but most are found in human structures. In Illinois, this is the only species known to hibernate in buildings.

***Lasiurus borealis* (Red Bat):** The red bat is probably the second most common bat in Illinois. The red bat is a solitary bat which lives during summer among the foliage of tress. It could easily occur in the study area but is not likely to be abundant because of the paucity of trees. Most migrate southward in fall, and those over-wintering in the north hibernate in ground litter.

***Myotis lucifugus* (Little Brown Myotis):** The little brown bat is common in Illinois. In summer, most colonies occur in man-made structures (attics, barns, church belfries). In winter it hibernates in caves and mines.

***Myotis septentrionalis* (Northern Myotis):** Recorded in Danville, Illinois. In summer, colonies are most often in cavities, cracks, or sometimes under the sloughing bark of trees in wooded areas, and occasionally in buildings. They winter in crevices in caves or mines.

***Lasiurus cinereus* (Hoary Bat):** Like the red bat, this species is solitary and in summer roosts among the foliage in trees. Although a few may remain in northern areas, most individuals migrate far south and west where they winter.

Species of bats that have been recorded in adjacent counties, but not in Vermilion County, IL:

***Lasionycteris noctivagans* (Silver-Haired Bat):** Has been recorded in Champaign County. This species migrates northward in spring, has its young to the north of Illinois, and migrates back to the south in fall. Spring migration is mostly from April through early June and fall migration occurs mostly in September and October. It hibernates in southern Illinois and south, mostly in caves and mines.

***Perimyotis subflavus* (Eastern Pipistrelle or Tri-color Bat):** This is the smallest bat found in Illinois. During the summer, this species sometimes forms small colonies in buildings, but most often lives in clusters of leaves in wooded areas. In the winter it hibernates in caves and mines.

***Nycticeius humeralis* (Evening Bat):** The evening bat has been found in buildings and woods in Illinois, including Champaign County. In Indiana we no longer know of any in buildings, where they may have been outcompeted by big brown bats. The same could be true for Illinois. This species in Indiana is now apparently restricted to big woods and

is not likely to be found at this study site. It is not known where this species hibernates, but we suspect it may be in hollow trees along larger streams to the south.

Species occurring in Illinois, but unlikely to occur at the study site:

***Myotis sodalis* (Indiana Bat):** This species has not been reported in east central Illinois. The Indiana bat spends the winter in large numbers in a few caves; in the summer it forms maternity colonies under loose bark of trees- often in riparian locations. This bat normally forages in open areas around upland and bottomland forest. Because of distribution and habitat preference it is unlikely to occur at the study site.

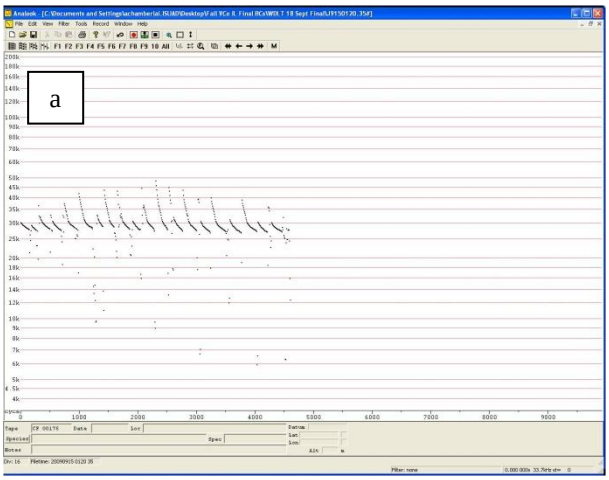
Species occurring in Illinois, but highly unlikely to occur at study site:

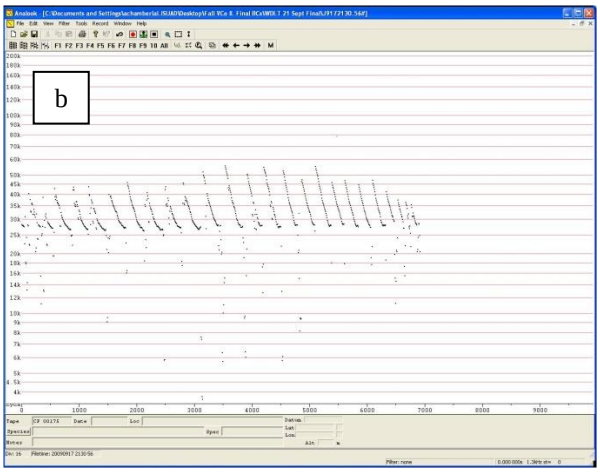
***Myotis grisescens* (Gray Bat):** The gray bat is an uncommon inhabitant of Illinois with sporadic reported occurrences, although there is a summer colony in Cave Spring Cave in Hardin County. In both summer and winter it lives in caves. Maternity colonies typically occur in warm caves close to permanent water sources. In winter, this species hibernates in huge numbers in a few "cold" caves.

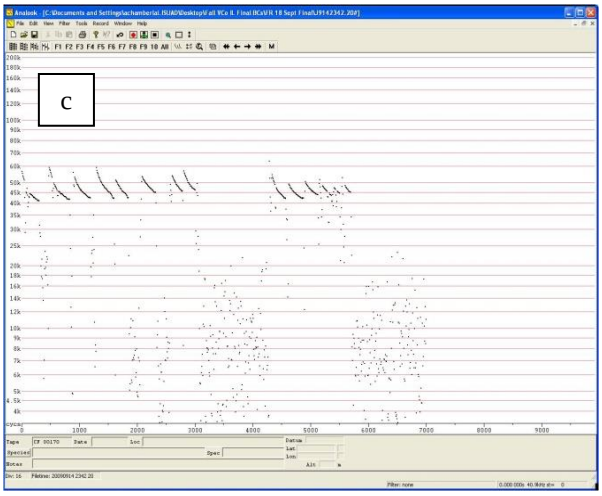
***Corynorhinus rafinesquii* (Rafinesques's Big Eared Bat):** Most of the big-eared bats reported from Illinois were hibernating in caves and mines in the far southern part of the state.

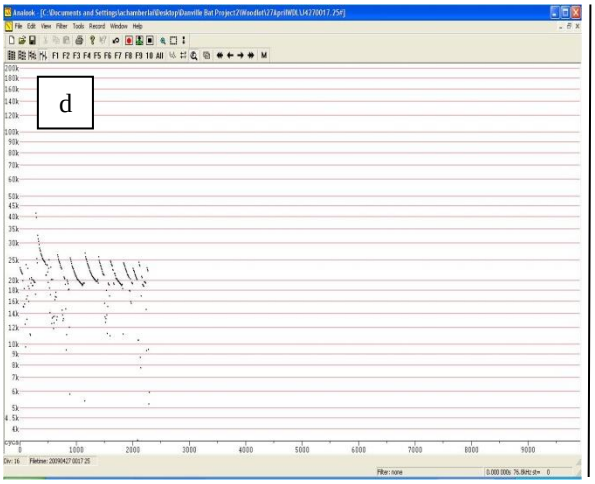
APPENDIX B: Anabat Raw Data

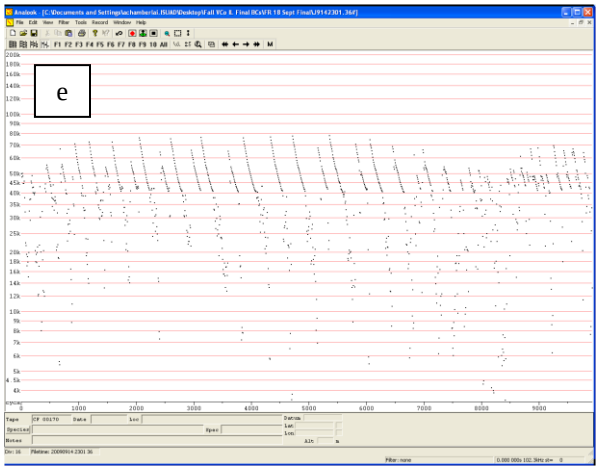
Typical bat calls of the big brown bat (a), the silver-haired bat (b), the red bat (c), the hoary bat (d), and Myotis species (e).











APPENDIX C: Photographs of Habitat Areas located within the VES Surveys.

Photo 1. Rural grassland within right-of-way adjacent to agricultural crop.

Photo 2. Agricultural crop land.

Photo 3. Rural grassland within and adjacent to residential areas.

Photo 4. Rural grassland located between agricultural crops.

Photo 5. Rural grassland adjacent to treeline.

Photo 6. Fragmented rural grassland right-of-way.

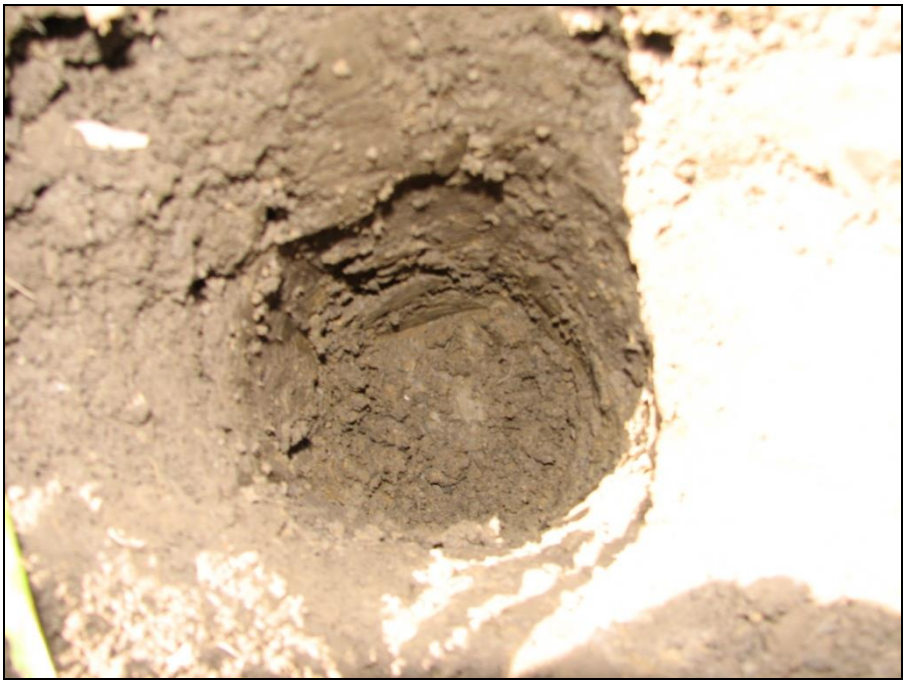


Photo 7. Soil Pit with compacted soils from proposed wind farm site.

Photo 8. Soil Pit with compacted soils from proposed wind farm site.

Photo 9. Soil Pit with compacted soils from proposed wind farm site.

APPENDIX D: Raw Avian Fixed Point Count Survey Data by Season.

Spring Data

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
26-Mar-09	8:15	8:25	SOSP	1		80			
			RWBL	11		75			
			BHCO	1		700			
			AMRO	1		400			
			AMRO	1		350			
			AMRO	1		550			
			SOSP	1		375			
			MODO	1		250			
			COGR	3		60			
			COGR	1		20			
	15:34	15:44	SOSP	1		41			
			AMRO	1		214			
			AMRO	1		45			
12-Apr-09	10:11	10:21	MODO	1		269			
			SOSP	1		165			
			HOSP	2		269			
			TREE	1		10			
			RWBL	1		300			
	13:46	13:56	SOSP	1		190			
26-Apr-09	7:59	8:09	AMRO	4		266			
			BHCO	1		10			
			COGR	3		266			
			RWBL	1		311			
			EAME	1		365			
			HOSP	2		266			
			MODO	1		45			
			TREE	1		35			
			AMGO	1		40			
			KILL	1	2	20	1	FLYING & CALIING	
			RWBL	2		15			
			AMGP	20	8	400	56	FLYING	
	15:00	15:10	TREE	1		15			
			EUST	1		92			
			EUST	2		40			
10-May-09	8:05	8:15	MODO	1		277			
			RWBL	2		61			
			AMGO	1		213			
			BHCO	1		143			
			COGR	1		236			
			AMRO	3		600			
			AMRO	2		61			
			SOSP	1		61			
			EAME	1		675			
			BASW	1		58			
			AMGP	6	4	458	32	FLYING	
			GBHE	2	4	765	55		
	14:52	15:02	AMRO	1		257			
			COGR	1		12			
			AMRO	1		56			
			RWBL	2		15			
			BASW	1		5			
			COGR	3		98			
			BHCO	2		83			
29-May-09	8:16	8:26	COGR	2		45			
			RWBL	1		60			
			MODO	1		80			
			INBU	1		126			
			RICL	2	4	22	2	Flying & Calling	
			BHCO	2		180			
			AMRO	4		66			
			VESP	1		215			
			HOSP	1		57			
			SOSP	1		75			
			CEWA	2		20			
			TREE	1		38			
	14:41	14:51	COGR	2		65			
			RWBL	1		65			
			INBU	1		65			
			CHSW	1		32			
			RWBL	1		145			
			AMRO	1		70			

Point 1

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
26-Mar-09	9:24	9:34	SOSP	1		120			
			KILL	1		90			
			AMRO	1		150			
			BHCO	2		90			
			RWBL	1		400			
			VESP	1		400			
			BHCO	3		125			
			EAME	1		650			
			BHCO	2		125			
			RWBL	1		500			
			NOHA	1	2	750	26	HUNTING	
			COGR	1		150			
	14:49	14:59	HOLA	1		80			
			EAME	1		540			
12-Apr-09	11:07	11:17	RWBL	1		200			
			BHCO	12		115			
			AMRO	2		150			
			VESP	1		163			
			SOSP	1		187			
			RWBL	1		115			
	13:05	13:15	RWBL	6		90			
			BHCO	3		95			
			EAME	1		230			
			COGR	3		103			
			BHCO	7		115			
			VESP	1		318			
			AMRO	1		305			
			VESP	1		420			
26-Apr-09	8:42	8:52	BHCO	1		145			
			SOSP	1		380			
			AMGO	1		45			
			HOLA	1		60			
			COGR	2		134			
			KILL	1		35		FORAGING IN WET AREA	
			AMRO	1		121			
			AMGP	35	12	300			
	14:16	14:26	BHCO	2		146			
			AMGP	30	2	178	6	FLYING	
			TREE	1		72			
			BHCO	1		42			
10-May-09	8:50	9:00	HOLA	2		74			
			NOCA	1		129			
			BHCO	4		150			
			AMGO	1		44			
			RWBL	1		165			
			AMRO	2		127			
			BASW	4		18			
			BLJA	2		363			
			KILL	1		195		WALKINH 7 CALLING	SE OF POINT
			NOHA	1	3	515	27	HUNTING	
			TUVU	1	9	480	76	SOARING	
			EAME	1		215			
			SOSP	1		182			
	14:08	14:18	TUVU	1	3	457	24	SOARING	
			BASW	1		68			
			BHCO	1		152			
			RWBL	1		129			

29-May-09	8:59	9:09	REVI	1		155		
			TUVU	1	40	74	48	SOARING
			DICK	1		120		
			BHCO	1		137		
			COGR	3		32		
			SOSP	1		111		
			KILL	1		42		CALLING
			HOWR	1		287		
			RWBL	1		515		
			MODO	1		178		
			EUST	2		145		
			BARS	2		63		
	14:03	14:13	DICK	1		167		
			DICK	1		280		
			HOWR	1		125		
			SOSP	1		10		
			VESP	1		231		
			COGR	1		105		
			BRTH	1		143		
			AMRO	1		142		
			BHCO	2		115		

Point 2

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
26-Mar-09	9:45	9:55	EAME	1		400			
			EAME	1		450			
			LALO	3		50			
			AMRO	1		200			
			SOSP	1		600			
			GBHE	2	10	700	123	FLYING	
			LALO	9		60			
			HOLA	1		100			
			NOHA	1	2	450	16	FLYING	
			RWBL	1		550			
	14:31	14:41	RTHA	1	60	150	260	SOARING	
			RWBL	1		115			
			HOLA	1		200			
12-Apr-09	11:25	11:35	RTHA	1	70	85	233	GLIDING	
			BHCO	1		115			
			HOLA	1		207			
	12:47	12:57	VESP	1		365			
			HOLA	1		47			
26-Apr-09	9:04	9:14	VESP	1		410			
			BHCO	2		125			
			EAME	1		300			
			BHCO	4		83			
			AMGO	1		70			
			CHSW	1		35			
	13:56	14:06	RTHA	1	60	33	57	SOARING	
			EAME	1		258			
			BHCO	3		62			
10-May-09	9:31	9:23	RTHA	1	10	611	108	SOARING	
			AMGP	250	75	15	56	FLYING	APPEAR TO BE MIGRATING
			RWBL	2		141			
			BHCO	3		15			
			BASW	2		80			
			AMGP	80	35	171	120	FLYING	
	13:47	13:57	EAME	1		411			
			HOLA	1		82			
			GBHE	1	20	163	59	FLYING	
29-May-09	9:18	9:28	HOLA	1		48			
			AMRO	1		480			
			EAME	1		215			
			BHCO	1		104			
			SOSP	1		495			
			HOLA	1		54			
	13:47	13:57	EAME	1		215			
			HOLA	1		105			

Point 3

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
26-Mar-09	11:45	11:59	TUVU	2	10	600	106	SOARING	
			RWBL	2		165			
			AMRO	3		165			
			COGR	8		160			
			MODO	1		185			
			SOSP	1		600			
			AMCR	1		700		CALLING ON TREE	
			SOSP	1		90			
			TUVU	1	80	30	170	GLIDING OVER	
	12:05	12:15	COGR	3		160			
			MODO	1		450			
			EUST	2		90			
			SOSP	1		180			
			HOLA	1		100			
			RBWO	1		500			
			AMCR	2		700		SUNNING IN TREE	
			RWBL	5		165			
			BHCO	15		140			
			MODO	1		15			
			COGR	15		140			
			HOSP	1		160			
12-Apr-09	8:10	8:20	COGR	4		115			
			MODO	1		115			
			RWBL	5		115			
			AMGO	2		85			
			SOSP	1		140			
			BHCO	2		160			
			HOSP	2		85			
			CAGO	2	3	670	35		
			NOCA	1		415			
			VESP	1		400			
	15:38	15:48	RWBL	1		140			
			TUVU	4	10	425	75		
26-Apr-09	11:02	11:12	CHSP	1		160			
			RWBL	1		103			
			AMRO	2		160			
			HOSP	2		160			
			SOSP	1		133			
			BHCO	4		17			
			COGR	1		10			
			KILL	1	1	94	2	FLYING & LANDED	
			VESP	1		147			
			EUST	1		66			
			AMGO	2		3			
			RWSW	2		15			
	15:18	15:28	HOSP	2		192			
			RWBL	2		192			
			CHSP	1		192			
			COGR	2		178			
			EUST	1		39			
			CHSW	1		2			
			SOSP	1		208			
			KILL	1	15	48	13	FLYING & LANDED	
10-May-09	7:45	7:55	RWBL	1		103			
			AMGO	1		20			
			HOSP	1		160			
			MODO	1		88			
			AMRO	2		650			
			SOSP	1		220			
			COGR	5		161			
			BHCO	2		65			
			CHSP	1		160			
			RNPH	1		520		CALLING	MALE
			BRTH	1		365			
	15:10	15:20	CHSP	1		177			
			RWBL	1		103			
			HOSP	2		177			
			EUST	1		177			
			COGR	1		25			
			SOSP	1		177			
			AMRO	1		161			
			HOLA	1		23			
			RWBL	1		116			

29-May-09	7:50	8:00	MODO	1		143		
			GBHE	1	2	280	10	FLYING
			INBU	1		140		
			CHSP	1		93		
			SOSP	1		100		
			AMRO	5		95		
			COGR	2		40		
			EUST	6		140		
			RWBL	2		165		
			HOLA	1		82		
			KILL	1		130		CALLING
			BARS	1		10		
			COGR	4		140		
	15:05	15:15	COGR	1		34		
			EUST	4		145		
			CHSP	1		145		
			HOSP	2		145		
			NOCA	1		130		
			RWBL	1		250		
			COGR	2		15		
			INBU	1		145		
			BARS	1		20		
			AMRO	1		195		
			HOLA	1		40		

Point 4

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior
26-Mar-09	10:48	10:58	RTHA	1	25	180	84	SOARING
			RBWO	1		200		
			AMRO	4		225		
			EUST	20		200		
			RWBL	1		200		
			KILL	1		20	20	FLYING
			COGR	20		200		
	13:38	13:48	RWBL	1		110		
			AMRO	1		120		
			EATO	1		450		
			EUST	1		85		
			HOLA	1		90		
12-Apr-09	8:43	8:53	VESP					
			RWBL					
			BRTH					
			EAME					
			BRTH					
			SOSP					
			BHCO					
			EUST					
			RWBL					
			AMGP	18	13	775	179	FLYING
			PESA	35	10	700	123	FLYING
			COGR					
			NOFL					
			AMRO					
			GCKI					
	15:03	15:13	RWBL	13		215		
			NOFL	1		160		
			AMPI	30		15		
26-Apr-09	10:15	10:25	RWBL	1		22		
			EAME	1		330		
			HOLA	1		63		
			BHCO	1		118		
			RWBL	1		240		
			AMPI	16		15		
			RTHA	1	28	138	73	SOARING
			EUST	1		80		
			NOCA	1		195		
	13:05	13:15	RWBL	1		160		
			BASW	1		22		
			EUST	1		43		
10-May-09	10:13	10:23	VESP	1		260		
			BLJA	2		135		
			HOWR	1		117		
			BASW	1		19		
			AMRO	1		142		
			INBU	1		105		
			SOSP	1		169		
			AMGO	1		32		
			RTHA	1	12	660	140	SOARING
			RSHA	1	55	80	114	SOARING
	12:49	12:59	VESP	1		110		
			RBWO	1		117		
			BHCO	5		181		
			SOSP	1		238		

29-May-09	10:25	10:35	HOWR	1		87		
			AMRO	4		73		
			MODO	2		103		
			VESP	1		295		
			BARS	1		60		
			SOSP	1		105		
			INBU	1		160		
			AMRO	1		550		
			BHCO	1		126		
			BHCO	2		17		
			BLJA	1		109		
			HOLA	1		44		
			RTHA	1	3	78	4	FLYING THEN LANDED
			NOCA	1		112		
			AMGO	1		20		
			SUTA	1		162		
	12:50	13:00	HOWR	1		95		
			AMRO	1		115		
			NOCA	1		133		
			INBU	1		170		
			RTHA	1		104		PERCHED
			COGR	1		126		
			CEWA	2		40		
			HOWR	1		142		
			SOSP	1		215		
Point 5								

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
26-Mar-09	10:23	10:33	BHCO	1		20			
			RWBL	1		60			
			EAME	1		300			
			RWBL	1		275			
			BHCO	1		200			
			NOHA	1	1	300	5	HUNTING	FEMALE
			RWBL	1		175			
			BHCO	3		20			
			KILL	1	21	150	58	FLYING	WEST TO EAST
			TREE	1		20			
	14:05	14:15	HOLA	1		60			
			EAME	1		550			
			EAME	1		275			
			RWBL	1		300			
			TUVU	1	45	90	90	Soaring	
12-Apr-09	11:46	11:56	TUVU	2	45	92	92	Soaring	
			BHCO	3		80			
			LALO	1		5			
			RWBL	1		275			
	12:01	12:11	VESP	1		93			
			COGR	2		275			
			EAME	1		380			
			TUVU	2	85	15	171	Soaring	
26-Apr-09	9:37	9:47	AMGP	22	3	620	32	FLYING	
			KILL	2	10	15	3	FLYING & CALLING	
			EAME	3		33			
			RWBL	6		272			
			RWBL	2		48			
			TREE	2		18			
			KILL	3	10	66	12	FLYING	
	13:33	13:43	RWBL	1		30			
			RWBL	1		74			
			EAME	2		85			
			RWBL	3		270			
10-May-09			RWBL	1		53			
			PESA	2		55		FORAGING	
			RWBL	1		72			
			RWBL	2		300			
			HOLA	1		110			
			EAME	1		280			
			AMGO	1		30			
			TUVU	2	40	111	93	SOARING	
			BHCO	1		22			
			BASW	1		8			
	13:18	13:28	RWBL	1		80			
			RWBL	1		39			
			RWBL	1		104			
			MODO	1		10			
			HOLA	1		93			
			MALL	2	2	730	25	FLYING	
			AMGP	120	3	680	36	FLYING & LANDED	
29-May-09	9:45	9:55	RWBL	2		32			
			DICK	2		270			
			AMRO	1		380			
			RWBL	4		265			
			HOLA	1		51			
			EAME	1		290			
			BARS	1		30			
			DICK	2		74			
			MODO	2		19			
			COGR	1		10			
			KILL	1		123		CALLING	
	13:20	13:30	DICK	2		76			
			DICK	2		259			
			RWBL	3		35			
			EAME	1		276			
			BHCO	1		10			
			HOLA	1		30			

Point 6

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
26-Mar-09	11:32	11:42	SOSP	1		580			
			LALO	2		80			
			COGR	1		115			
			NOCA	1		550			
	12:46	12:56	COGR	2		315			
			HOLA	1		240			
			RWBL	1		560			
			NOCA	1		560			
12-Apr-09	9:41	9:51	HOLA	1					
			VESP	1					
			RWBL	1					
			AMRO	1					
			PESA	30	45	80			
	14:10	14:20	BWHA	1	85	15	171	GLIDING	
			OSPR	1	89	5	286	GLIDING	
			TUVU	1	5	388	34	GLIDING	
			TUVU	1	5	720	63	GLIDING	
26-Apr-09	11:44	11:54	BHCO	1		153			
			RWBL	1		184			
			RWBL	1		565			
	12:01	12:11	BHCO	1		163			
			HOLA	1		109			
			RWBL	1		330			
10-May-09	11:41	11:51	GBHE	1	3	700	37	FLYING	
			AMGP	35	8	661	93	FLYING	
			BHCO	1		41			
			AMGP	40	1	280	5	LANDING	
			VESP	1		175			
			AMGP	55	85	15	171	FLYING	MIGRATING IN V FORMATION
	12:01	12:11	HOLA	1		48			
			AMRO	1		610			
			VESP	1		116			
			RWBL	1		35			
29-May-09	12:01	12:11	AMRO	1		475			
			RWBL	1		560			
			KILL	1		90		CALLING ON GROUND	
			MODO	1		700			
			MODO	1		10			
			BHCO	1		115			
	11:40	11:50	BHCO	2		60			
			RWBL	2		315			
			KILL	2		33		CALLING ON GROUND	
			AMRO	1		350			
			COGR	2		41			

Point 7

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
26-Mar-09	11:11	11:21	KILL	1	1	250	4	CALLING & FLYING	
			COHA	1	40	450	386	GLIDING	
			TUVU	1	40	460	386	GLIDING	
			HOLA	1		100			
	13:11	13:21	RWBL	1		400			
			LALO	1		215			
			HOLA	1		90			
12-Apr-09	9:14	9:24	HOLA	1		65			
			BHCO	1		60			
			AMGP	15	11	500	97	FLYING	
			RTHA	1	20	650	237	SOARING	
			AMGP	20	20	315	115	FLYING	
	14:37	14:47	HOLA	1		95			
26-Apr-09	10:40	10:50	AMGP	325		75		FORAGING	Center ~ 75 M West of Point
			HOLA	1		38			
			AMGP	60	1	460	8	FLYING & LANDED	
			BHCO	2		26			
	12:38	12:48	HOLA	1		34			
			KILL	1	2	32	1	FLYING & CALLING	
			HOSP	2		38			
10-May-09	10:52	11:02	AMGP	30	22	98	40	FLYING	
			HOLA	1		41			
			COGR	1		231			
			BASW	1		32			
			AMGP	28	11	517	100	FLYING	
	12:24	12:34	BASW	1		135			
			BLJA	2		340			
			CHSW	2		199			
			BHCO	1		85			
			HOLA	1		106			
29-May-09	11:03	11:13	RWBL	1		370			
			TREE	1		15			
			COGR	4		283			
			BHCO	1		60			
	12:27	12:37	HOLA	1		75			
			RWBL	1		280			

Point 8

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
26-Mar-09	8:41	8:51	AMCR	2		750		calling in tree	
			HOLA	2		40			
			RWBL	1		275			
			RWBL	1		600			
			BHCO	1		300			
			HOSP	1		275			
			RWBL	2		40			
			AMRO	1		600			
	15:12	15:22	HOLA	1		170			
			LALO	25		40			
12-Apr-09	10:43	10:53	HOLA	1		55			
			HOLA	1		32			
			RTHA	1	35	100	70	SOARING	
			TUVU	1	30	90	52	SOARING	
	13:25	13:35	HOLA	1		20			
			KILL	1		48		ON GROUND	
26-Apr-09	8:23	8:33	BHCO	10		65			
			RWBL	2		273			
			BHCO	2		35			
			HOLA	1		40			
			AMGP	2		10		FORAGING	ON GROUND SW OF POINT
			AMRO	1		560			
			COGR	8		45			
			COGR	3		25			
			AMPI	2		40			
	14:38	14:48	PESA	14		20		FORAGING	
			AMGP	380		90		FORAGING	90 M TO CENTER OF FLOCK
			BHCO	2		34			
10-May-09	8:29	8:39	HOLA	2		49			
			BLJA	1		680			
			BHCO	3		15			
			KILL	1		60			
			AMRO	3		300		WALKING & CALLING	SE OF POINT
			CHSP	1		300			
			RWBL	1		269			
			AMGO	1		30			
	14:29	14:39	SOSA	1		88		FORAGING	
			KILL	2		71		WALKING & CALLING	
			HOLA	1		40			
29-May-09	8:40	8:50	HOLA	1		20			
			KILL	2		50		CALLING ON GROUND	
			AMRO	2		295			
			BHCO	1		295			
			RWBL	1		450			
			EUST	2		290			
			VESP	1		260			
	14:22	14:32	KILL	1		53		CALLING ON GROUND	
			HOLA	1		32			
			CHSW	1		74			
			COGR	1		15			

Point 9

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
14-Mar-10	10:24	10:34	RWBL	12		300			
			EAME	1		300			
	13:16	13:26	EAME	1		200			
4-Apr-10	11:50	12:00	RWBL	1		65			
			TUVU	1	3	475	25	SOARING	
			HOLA	1		40			
	12:01	12:11							
26-Apr-10	11:50	12:00	AMRO	1		300			
			TUVU	1	8	250	35	SOARING	
	12:01	12:11	MODO	1		80			
			EAME	1		250			
14-May-10	11:27	11:37	AMRO	1		300			
			RWBL	1		100			
			AMRO	1		110			
			RNPH	1		300			
			EAME	2		350			
			COGR	2		175			
			RTHA	1	2	450	16	SOARING	
			BHCO	1		20			
	12:01	12:11	HOLA	2		40			
			AMRO	2		300			
			AMCR	2		650			
			BHCO	1		30			
			EAME	1		350			
28-May-10	11:35	11:45	RWBL	1		200			
			EAME	1		150			
			DICK	1		150			
			BHCO	1		75			
			EAME	1		250			
			CEWA	1		10			
			BRTH	1		500			
	12:01	12:11	RTHA	1	3	550	29	SOARING	
			RWBL	1		50			
			EAME	1		150			
Point 10									

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
14-Mar-10	10:47	10:57	RWBL	8		300			
			EAME	1		350			
			HOLA	1		40			
			AMCR	1		500			
			EUST	3		150			
	13:37	13:47	HOLA	1		35			
4-Apr-10	9:43	9:53	COGR	1		50			
			RWBL	3		50			
			EAME	1		150			
			NOCA	1		500			
			AMRO	1		50			
			EAME	1		300			
			RWBL	3		170			
			HOLA	1		20			
			EUST	6		350			
			BHCO	2		25			
	13:38	13:48	EAME	1		85			
			AMRO	1		110			
26-Apr-10	9:31	9:41	AMRO	2		65			
			EAME	2		115			
			RWBL	6		300			
			BHCO	2		225			
			RWBL	4		150			
			EUST	1		300			
	13:43	13:53	RWBL	1		75			
			RWBL	2		125			
			RWBL	2		275			
			EAME	2		100			
			EUST	2		200			

14-May-10	9:37	9:47	NOCA	1	350
			DICK	1	100
			AMGO	3	50
			EAME	2	75
			RWBL	1	65
			RWBL	3	80
			RWBL	1	300
			AMRO	1	500
			EAME	1	500
			BHCO	1	45
			BHCO	1	80
			VESP	1	250
			EUST	1	350
			MODO	1	100
			RNPH	1	300
	13:32	13:42	DICK	2	140
			RWBL	1	150
			EAME	1	300
			EAME	1	450
			RWBL	1	200
			RNPH	1	300
			NOCA	1	225
			TRES	2	40
			SOSP	1	200
			BARS	1	50
			COGR	1	175
28-May-10	9:33	9:43	RWBL	2	80
			RWBL	1	125
			RWBL	1	60
			DICK	1	80
			DICK	1	175
			SOSP	1	150
			AMRO	1	125
			RWBL	3	200
			HOSP	1	5
			INBU	1	50
			COGR	12	20
	13:30	13:40	DICK	1	75
			COGR	1	50
			RWBL	2	125
			RWBL	1	50

Point 11

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
14-Mar-10	11:06	11:16	COGR	2		45			
			COGR	3		200			
			HOLA	1		50			
			MODO	1		250			
			RWBL	5		100			
	12:53	13:03	RLHA	1	1	175	3	HOVERING	Caught Small Mammal
			HOLA	1		60			
4-Apr-10	10:05	10:15	VESP	1		15			Chorus Frogs
			BHCO	1		5			
			BHCO	2		20			
			AMRO	1		25			
			AMGP	4		50			
			AMPI	1		50			
	13:19	13:29	HOLA	1		35			
			EAME	1		115			
26-Apr-10	9:52	10:02	BHCO	1		30			
			RWBL	1		80			
			TUVU	1	2	600	21	SOARING	
			BHCO	3		75			
			AMPI	1		40			
			HOLA	1		60			
			AMRO	1		325			
			MODO	1		75			
			EAME	1		400			
	13:26	13:36	MODO	1		300			
			VESP	1		5			
			COGR	1		275			
			AMRO	2		300			
			KILL	1		125		CALLING ON GROUND	

14-May-10	9:57	10:07	HOLA	1		55		
			HOLA	1		30		
			AMRO	1		250		
			COGR	2		100		
			RWBL	2		500		
			AMRO	1		35		
			EUST	1		80		
			COGR	25		60		
	13:14	13:24	RWBL	1		150		
			HOSP	2		250		
			COGR	2		40		
			BHCO	1		40		
			RWBL	1		200		
			AMRO	1		50		
			RWBL	1		100		
			EAME	1		300		
			TUVU	1	60	80	69	SOARING
			TUVU	1	8	200	28	SOARING
			KILL	1		45		CALLING ON GROUND
28-May-10	9:52	10:02	HOLA	1		35		
			RWBL	1		30		
			BHCO	2		75		
			AMRO	1		300		
			BHCO	1		50		
			COGR	1		75		
			AMRO	1		50		
			RTHA	1	5	350	30	SOARING
	13:12	13:22	COGR	1		50		
			HOLA	1		25		
			RWBL	2		200		

Point 12

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
14-Mar-10	11:23	11:33	AMCR	1		100			
			RWBL	1		80			
			EAME	1		50			
	12:35	12:45	RWBL	1		200			
			COGR	13		250			
			AMCR	1		100			
			AMRO	1		50			
			KILL	1	12	250	52	FLYING & CALLING	
4-Apr-10	10:29	10:39	BHCO	1		250			
			AMRO	1		300			
			AMGP	35	1	800	14		
			RWBL	1		300			
			COGR	5		35			
			AMCR	1		375			
			CAGO	3	2	275	10	FLYING	
			AMGP	25	1	650	11		
			AMGP	75	1	700	12		
			AMRO	1		30			
	13:00	13:10	EUST	7		115			Chorus Frogs
			RTHA	1	4	675	47	SOARING	
			AMCR	1		250			
26-Apr-10	10:17	10:27	COGR	11		175			
			RWBL	2		150			
			AMRO	2		275			
			CHSP	2		250			
			MODO	2		400			
	13:07	13:17	AMRO	1		129			
			COGR	3		200			
			MODO	2		160			
			HOSP	2		175			

14-May-10	10:17	10:27	CHSP	1	200
			AMRO	1	30
			BHCO	1	20
			COGR	1	70
			NOCA	1	215
			RNPH	1	325
			BARS	2	10
			SOSP	1	225
	12:55	13:05	BARS	1	40
			EAME	1	100
			COGR	3	100
			AMRO	1	80
			RWBL	2	115
			NOCA	1	300
			BHCO	1	65
			CHSP	1	125
28-May-10	10:12	10:22	AMRO	1	250
			CHSP	1	150
			COYE	1	250
			SOSP	1	250
			RWBL	1	250
			AMCR	1	600
			BRTH	1	300
			AMRO	1	215
			COGR	2	15
	12:52	13:02	AMRO	2	225
			RWBL	1	300
			CHSP	1	100
			AMRO	1	75
			COGR	1	250
			BRTH	1	300
			COGR	3	10
			MODO	1	125
			SOSP	1	200
			RNPH	1	175
			HOSP	1	200
			HOLA	1	75

Point 13

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
14-Mar-10	11:36	11:46	COGR	4		100			
			HOFI	1		150			
			AMRO	3		40			
			EUST	5		150			
	12:19	12:29	AMRO	2		100			
			KILL	1		125		CALLING ON GROUND	
			HOLA	1		30			
4-Apr-10	10:48	10:58	EAME	1		215			
			BRTH	1		400			
			MODO	1		400			
			BHCO	5		175			
			HOLA	1		125			
			HOFI	1		400			
	12:45	12:55	EUST	1		110			
26-Apr-10	10:31	10:41	EUST	1		15			
			BHCO	2		60			
			RWBL	1		30			
			AMRO	2		15			
			MODO	1		300			
			HOLA	1		50			
			TUVU	1	2	700	24	SOARING	
	12:52	13:02	AMRO	1		50			
			HOLA	1		40			
			BHCO	1		50			
			TUVU	5	12	200	42	SOARING TOGETHER	
14-May-10	10:38	10:48	RWBL	2		95			
			AMRO	1		350			
			EUST	1		50			
			NOCA	1		200			
			RWBL	1		20			
			BLJA	1		550			
			MODO	2		10			
	12:40	12:50	RWBL	2		35			
			BHCO	1		45			
28-May-10	10:30	10:40	AMCR	2		400			
			AMRO	2		300			
			NOCA	1		300			
			AMRO	1		75			
	12:38	12:48	BARS	2		50			
			AMRO	1		250			
			INBU	1		35			
			HOWR	1		250			
			RWBL	1		100			
			AMRO	1		5			

Point 14

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
14-Mar-10	11:51	12:01	HOLA	1		50			
			RTHA	1	10	500	87	SOARING	
	12:02	12:12	HOLA	2		60			
4-Apr-10	11:12	11:22	RWBL	1		50			
			BHCO	1		25			
			AMRO	2		90			
	12:30	12:40	HOLA	1		50			
26-Apr-10	11:00	11:10	BHCO	1		125			
	12:34	12:44	HOLA	1		25			
14-May-10	10:55	11:05	HOLA	1		40			
			COGR	1		85			
			BHCO	1		100			
	12:24	12:34	BHCO	1		40			
28-May-10	10:47	10:57	AMGO	1		25			
			BARS	1		125			
			BARS	1		25			
			AMRO	1		50			
			HOLA	1		50			
	12:23	12:33	HOLA	1		25			
			BHCO	1		35			
Point 15									

Fall Data

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
29-Aug-09	9:43	9:53	TRES	1		30			
			AMRO	1		85			
			American kestrel	1	30	123	61	HOVERING & CALLING	
			MODO	1		94			
			BARS	2		71			
			KILL	2	14	140	34	FLYING	
	12:15	12:25	AMRO	1		60			
10-Sep-09	9:28	9:38	MODO	1		375			
			AMCR	1		700			
			AMGO	1		50			
			EUST	33		95			
	12:14	12:24	American kestrel	1		280		PERCHED ON POWER LINE	
			AMGO	1		43			
			BARS	3		10			
3-Oct-09	9:12	9:22	HOLA	4		25			
			BLJA	1		550			
			EUST	12		10			
	12:20	12:30							
13-Oct-09	8:51	9:01	EUST	1		40			
			EUST	6		20			
			KILL	2		215		CALLING ON GROUND	S OF POINT
			AMRO	1		68			
			RWBL	1		45			
			RTHA	1	1	425	7	FLYING TO PERCH	
	12:16	12:26	EUST	2		115			
			RTHA	1	5	110	10	FLAPPING	
			BLJA	1		70			
			SOSP	2		12			
			EUST	21		265			
21-Nov-09	9:11	9:21	RTHA	1		215		PERCHED	SE OF POINT
			HOLA	1		40			
			EUST	3		260			
			RBWO	1		210			
			BLJA	5		210			
			HOSP	4		260			
	12:20	12:30	HOLA	1		25			
			BLJA	1		200			
			HOSP	2		200			
Point 1									

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
29-Aug-09	10:15	10:25	NOHA	1	2	550	19	GLIDING	
			HOLA	1		23			
			BARS	1		36			
			TUVU	1	5	650	57	SOARING	
			SOSP	1		60			
	12:42	12:52	RTHA	1	9	205	32	FLAPPING	
			CHSW	1		28			
			SOSP	1		64			
			BARS	11		4			
			NOHA	1	2	625	22	GLIDING	FEMALE
10-Sep-09	10:05	10:15	AMRO	1		60			
			RTHA	1	80	15	15	SOARING	IMMATURE
	12:42	12:52	AMGO	1		25			
			NOHA	1	2	350	12	FLAPPING	FEMALE
3-Oct-09	9:40	9:50	SOSP	2		15			
	12:53	13:03	HOLA	1		64			
			American Kestrel	1		198			
13-Oct-09	9:25	9:35	AMCR	3		175			
			SOSP	2		5			
			AMRO	15		150			
			EAME	1		115			
			HOLA	45		175			
			BHCO	25		400			
			EUST	155		240			
			NOHA	1	1	335	6	HUNTING	FEMALE
	12:57	13:07	RWBL	35		24			
			BHCO	30		24			
			AMGO	1		30			
			SOSP	2		21			
			AMRO	1		40			
			EUST	250		300			
			KILL	3		10		WALKING & FEEDING	
21-Nov-09	9:45	9:55	HOLA	1		50			
	12:51	13:01	RTHA	1	4	575	40	SOARING	
Point 2									

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
29-Aug-09	10:30	10:40	EUST	1		38			
			MODO	3		25			
			AMGO	1		51			
	13:00	13:10	AMGO	1		15			
10-Sep-09	10:24	10:34	VESP	1		20			
	12:55	13:05							
3-Oct-09	9:57	10:07	AMCR	1		150			
	13:09	13:19							
13-Oct-09	9:46	9:56	HOLA	2		5			
			RWBL	10		85			
			TRES	25		5			
	13:02	13:12							
21-Nov-09	10:00	10:10	RLHA	1	8	725	101	HOVERING	
	13:09	13:19	HOLA	1		30			
Point 3									

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
29-Aug-09	9:18	9:28	AMGO	1			50		
			EUST	20			65		
			MODO	1			65		
	14:01	14:11	PUMA	1			60		
			HOSP	2			8		
10-Sep-09	9:02	9:12	AMGO	1			60		
			MODO	5			55		
			AMRO	5			79		
			EUST	34			96		
			COGR	6			80		
			HOSP	2			15		
	13:57	14:07	MODO	1			28		
3-Oct-09	8:50	9:00	RWBL	2			25		
			BARS	1			5		
			EUST	17			45		
	14:17	14:27							
13-Oct-09	8:30	8:40	AMRO	1			35		
			EUST	1			5		
			BHCO	1			15		
			YRWA	2			15		
	14:07	14:17	YRWA	3			5		
			NOHA	1		6	62	6	FLAPPING
21-Nov-09	8:54	9:04	EUST	4			115		
			HOSP	11			95		
			BHCO	1			110		
	14:23	14:33	HOSP	4			105		
			EUST	5			80		

Point 4

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
29-Aug-09	11:08	11:18	TRES	1		85			
			TUVU	1	3	370	19	SOARING	
			BARS	3		75			
	13:35	13:45	MODO	1		20			
			RTHA	3	12	400	83	SOARING	2 ADULTS; 1 JUVENILE
			AMGO	1		25			
10-Sep-09	11:20	11:30	RTHA	1	11	420	80	SOARING	OVER WOODLOT
	13:28	13:38	AMGO	1		30			
3-Oct-09	11:01	11:11	EUST	8		210			
	13:44	13:54	AMCR	1		750			
13-Oct-09	10:42	10:52	NOHA	1	1	560	10	GLIDING	MALE
			NOFL	1		350			
	13:36	13:46	EUST	75		300			
21-Nov-09	10:50	11:00	HOLA	65		40			
	13:48	13:58	HOLA	14		25			

Point 5

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
29-Aug-09	10:50	11:00	EUST	2		70			
			BARS	1		30			
			TUVU	1	62	95	84	SOARING	
	13:21	13:31	CHSW	3		29			
			BARS	1		30			
10-Sep-09	11:00	11:10	AMGO	1		25			
			EUST	12		215			
	13:12	13:22	AMCR	1		650			
3-Oct-09	10:25	10:35	SOSP	2		48			
			RWBL	1		42			
			EUST	18		575			
			EAME	1		250			
			HOLA	4		17			
			AMGO	1		20			
	13:27	13:37	BHCO	16		101			
			HOLA	1		54			
13-Oct-09	10:16	10:26	AMGO	2		25			
			RTHA	1	2	240	8	FLAPPING	
			SOSP	5		30			
			EAME	1		450			
			HOLA	2		228			
			NOFL	1		575			
			BHCO	250		315			
			YRWA	15		10			
	13:18	13:28	AMGO	1		45			
			SOSP	2		110			
			RTHA	1	4	324	23	FLAPPING	
			EAME	1		200			
			EUST	45		130			
			AMGO	2		22			
21-Nov-09	10:32	10:42	HOLA	120		60			
			NOHA	1	2	375	13	FLAPPING	FEMALE
	13:31	13:41	RTHA	1		280		PERCHED	
			AMCR	1		600			

Point 6

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
29-Aug-09	11:50	12:00	TRES	7		54			
			AMGO	1		15			
			BARS	3		15			
			EUST	1		10			
	12:02	12:12	RWBL	1		10			
			BARS	1		60			
			AMGO	1		10			
10-Sep-09	11:50	12:00							
	12:01	12:11	AMGO	1		45			
			MODO	1		20			
3-Oct-09	11:50	12:00	SOSP	1		10			
	12:02	12:12	ROPI	4		235			
13-Oct-09	11:32	11:42	AMRO	1		183			
			YRWA	5		5			
			AMCR	1		550			
	12:02	12:12	NOHA	1	1	415	7	FLAPPING	MALE
			BLJA	1		95			
			SOSP	1		5			
			AMCR	1		725			
			EUST	3		10			
21-Nov-09	11:40	11:50	HOSP	1		45			
			EUST	15		70			
	12:01	12:11	HOSP	1		60			
Point 7									

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
29-Aug-09	11:24	11:34	KILL	3	1	168	3	FLAPPING	
			MODO	2		28			
			EUST	8		22			
			NOHA	1	1	488	9	HUNTING	MALE
	13:48	13:58	BARS	2		12			
10-Sep-09	11:37	11:47							
	13:41	13:51	NOHA	1	2	175	6	FLAPPING	MALE
3-Oct-09	11:35	11:45	RTHA	1	35	150	86	SOARING	
	13:59	14:09							
13-Oct-09	11:09	11:19	AMCR	1		600			
	13:51	14:01	RTHA	1		400		PERCHED	N OF POLE
			SOSP	1		62			
			AMCR	4		350			
21-Nov-09	11:15	11:25	RTHA	1	11	675	129	SOARING	
			HOLA	8		20			
	14:06	14:16	HOLA	2		45			

Point 8

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
29-Aug-09	10:00	10:10	BARS	1		24			
			TUVU	1	21	115	41	SOARING	
			EUST	2		33			
			MODO	2		245			
	12:30	12:40	PUMA	4		115			
			EUST	23		45			
10-Sep-09	9:49	9:59	EUST	30		15			
			AMGO	1		35			
			RWBL	1		20			
			BARS	1		35			
	12:27	12:37							
3-Oct-09	9:25	9:35	EUST	20		25			
			TUVU	1	5	600	52		
			RWBL	3		55			
	12:35	12:45	NOFL	1		30			
			SOSP	1		8			
			American Kestrel	1		410			
13-Oct-09	9:07	9:17	EUST	16		10			
			KILL	7	11	310	59		
			CEWA	1		25			
			AMRO	1		5			
			BHCO	425		130			
			EUST	75		130			
			SOSP	2		5			
			EUST	25		45			
			COSN	1		270			
	12:33	12:43	SOSP	2		12			
21-Nov-09	9:28	9:38	HOLA	1		30			
			HOSP	3		55			
	12:36	12:46	HOLA	4		60			
Point 9									

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
5-Sep-10	11:35	11:45	BARS	1		38			
			KILL	1		62		Walking on Road	
	12:01	12:11	BARS	1		27			
19-Sep-10	11:46	11:56	TUVU	1	2	800	28	SOARING	Beans Up
	12:01	12:11							
2-Oct-10	11:45	11:55	AMGO	1		5			
			HOLA	1		7			
	12:01	12:11	NOHA	1	1	175	3	SOARING	Over Waterway
16-Oct-10	11:27	11:37	HOLA	1		36			
	12:01	12:11							
13-Nov-10	11:30	11:40	HOLA	1		180			
	12:01	12:11							
Point 10									

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
5-Sep-10	9:47	9:57	MODO	1		70			
			TRES	1		115			
			MODO	2		350			
			EUST	1		50			
			TRES	3		20			
			NRWS	1		30			
	13:36	13:46							
19-Sep-10	9:54	10:04	COHA	1	8	210	29	Flapping	Corn Down
			AMGO	1		45			
			AMGO	3		60			
			EAME	2		72			
			BLJA	1		450			
			AMCR	2		775			
	13:22	13:32	EAME	1		52			
2-Oct-10	9:50	10:00	EUST	1		310			
			AMGO	1		40			
	13:31	13:41	EUST	1		215			
			EAME	1		90			
16-Oct-10	9:52	10:02	KILL	2	82	20	3	Flying	
			HOLA	1		31			
	13:27	13:37							
13-Nov-10	9:55	10:05	EUST	15		275			
			NOHA	1	2	184	6	Flapping	
	13:31	13:41	HOLA	1		61			
Point 11									

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
5-Sep-10	10:02	10:12	HOSP	2		20			
			BHCO	7		275			
			HOSP	3		30			
			AMGO	1		185			
	13:20	13:30	HOSP	7		28			
			MODO	1		7			
19-Sep-10	10:11	10:21	HOSP	25		30			Beans Up
			MODO	1		21			
			RWBL	40		32			
	13:04	13:14	HOSP	45		25			
			MODO	1		33			
2-Oct-10	10:13	10:23	AMRO	1		20			
	13:12	13:22							
16-Oct-10	10:10	10:20	HOLA	1		3			
	13:10	13:20	TUVU	1	4	700	49	Soaring	
			MODO	1		113			
			SOSP	1		222			
13-Nov-10	10:12	10:22	RLHA	1	1	650	11	Flapping	
			NOHA	1	1	667	12	Soaring	
	13:13	13:23	HOSP	17		133			
Point 12									

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
5-Sep-10	10:20	10:30	RTHA	1		542		Perched	
			TUVU	1	90	0	45	Soaring	
	13:03	13:13	HOSP	1		62			
19-Sep-10	10:29	10:39	HOSP	1		270			Corn Up
			HOSP	1		33			
	12:50	13:00	AMRO	1		35			
2-Oct-10	10:34	10:44	EUST	25		265			
	12:52	13:02							
16-Oct-10	10:30	10:40	RTHA	1	8	320	45	Soaring	
			HOLA	1		42			
	12:54	13:04	HOSP	2		64			
13-Nov-10	10:33	10:43	AMCR	1		700			
	12:55	13:05							

Point 13

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
5-Sep-10	10:35	10:45	EUST	8		10			
			BHCO	6		23			
			ROPI	6		421			
	12:46	12:56	TUVU	1	86	15	15	SOARING	
			TUVU	1	52	112	88	SOARING	
			HOSP	1		22			
			MODO	1		127			
19-Sep-10	10:43	10:53	TUVU	1	11	282	54	SOARING	
			RWBL	275		400			
			SOSP	1		8			
	12:36	12:46							
2-Oct-10	10:50	11:00	SOSP	1		7			
	12:38	12:48							
16-Oct-10	10:47	10:57	SOSP	1		23			
	12:38	12:48	MODO	1		320			
13-Nov-10	10:48	10:58							
	12:38	12:48							
Point 14									

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
5-Sep-10	11:02	11:12	HOLA	1		34			
			TUVU	1	12	268	58	SOARING	
	12:28	12:38	TUVU	1	4	590	41	SOARING	
			TUVU	1	5	750	65	SOARING	
19-Sep-10	11:06	11:16	MERL	1	7	525		Flapping	Prey in Mouth
	12:18	12:28	AMGO	1		38	85		
			TUVU	1	24	210		SOARING	
2-Oct-10	11:08	11:18	HOLA	1		20			
	12:20	12:30	American Kestrel	1	2	240	8	Flapping/Landing	
			TUVU	1	3	650	34	Soaring	
16-Oct-10	11:05	11:15	HOLA	1		44			
			TUVU	1	6	665	69	Soaring	
	12:21	12:31	TUVU	1	6	515	54	SOARING	
			TUVU	2	3	750	39	SOARING	
13-Nov-10	11:04	11:14	HOLA	1		45			
	12:23	12:33	HOLA	1		44			

Point 15

Winter Data

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
18-Dec-09	9:15	9:25	RBWO	1		170			
			CAGO	11	11	425	81	FLYING	
	12:30	12:40	NOHA	1	3	175	9	FLAPPING	
16-Jan-10	9:33	9:43							
	12:28	12:38							
12-Feb-10	9:24	9:34	SOSP	1		10			
			AMTS	1		25			
			HOSP	2		100			
	12:20	12:30	BLJA	1		300			

Point 1

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
18-Dec-09	9:55	10:05							
	13:11	13:21	RTHA	1	3	700	37	FLAPPING	
16-Jan-10	10:07	10:17							
	13:04	13:14	HOLA	3		175			
12-Feb-10	9:59	10:09							
	12:52	13:02	RLHA	1	5	100	9	FLAPPING	DARK MORPH

Point 2

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
18-Dec-09	10:12	10:22	HOLA	1		40			
			HOLA	20		115			
	13:27	13:37	HOLA	1		35			
16-Jan-10	10:25	10:35	RLHA	1	2	450	18	PERCHED	DARK MORPH
	13:21	13:31							
12-Feb-10	10:15	10:25	HOLA	1		80			
	13:06	13:16							

Point 3

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
18-Dec-09	9:00	9:10	AMCR	3		0:00			
			RTHA	1	1	215	4	FLAPPING	
			American Kestrel	1		300			
	14:43	14:53							
16-Jan-10	9:15	9:25	EUST	1		125			
			MODO	1		90			
	14:48	14:58	RTHA	1		60		PERCHED	
			HOLA	1		30			
12-Feb-10	9:06	9:16	HOSP	2		30			
			HOLA	2		15			
			AMCR	1		700			
			LALO	1		15			
	14:19	14:29	HOSP	8		95			
			HOLA	2		40			

Point 4

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
18-Dec-09	11:05	11:15							
	14:07	14:17	HOLA	7		80			
16-Jan-10	11:11	11:21							
	14:06	14:16	MODO	2		275			
12-Feb-10	10:59	11:09	HOLA	1		45			
			HOSP	5		500			
	13:45	13:55	HOLA	2		125			

Point 5

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
18-Dec-09	10:38	10:48							
	13:48	13:58							
16-Jan-10	10:47	10:57							
	13:41	13:51	EUST	35		600			
12-Feb-10	10:40	10:50							
	13:21	13:31							

Point 6

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
18-Dec-09	11:55	12:05	AMCR	2		515			
	12:05	12:15	HOSP	5		400			
16-Jan-10	11:50	12:00	RTHA	1	22	215	80	SOARING	
	12:01	12:11	HOSP	11		375			
12-Feb-10	11:49	11:59							
	12:01	12:11							

Point 7

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
18-Dec-09	11:32	11:42	RLHA	1	1	250	4	FLYING	
	14:25	14:35	American Kestrel	1		175			
16-Jan-10	11:30	11:40	HOLA	1		100			
	14:29	14:39							
12-Feb-10	11:16	11:26	HOLA	1		125			
	14:03	14:13	HOLA	4		60			

Point 8

Date	Start	End	Species Code	No.	Flight Angle (0-90)	Distance (M)	Flight Height (M)	Behavior	Comment
18-Dec-09	9:31	9:41							
	12:52	13:02							
16-Jan-10	9:50	10:00	HOLA	5		45			
			LALO	2		45			
	12:45	12:56	HOLA	2		200			
12-Feb-10	9:43	9:53	HOSP	2		160			
			HOLA	1		40			
	12:37	12:47	HOLA	1		60			

Point 9

Autumn migration of Indiana bats (*Myotis sodalis*) and northern myotis (*Myotis septentrionalis*) in eastern Illinois – potential implications for the Hoopeston and Ford Ridge wind energy projects

Interim Report

Submitted by:
Cooperative Wildlife Research Laboratory, SIUC

Presented to:
Apex Clean Energy

Principal Investigators

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December 2014

PROJECT SUMMARY

Migration may account for a substantial proportion of annual mortality (50% in some models) so it is critical that migration is incorporated into conservation efforts for threatened species. White-nose Syndrome (WNS) already threatens extinction of several species, including Indiana bats and northern myotis. Therefore, it is critical to understand and mitigate any additional threats to these species. Although neither species currently comprises a large proportion of known wind-turbine fatalities, the expansion of wind energy combined with the threat of WNS may be insurmountable. Consequently, the lack of understanding of migration by both species is a critical obstacle to effective conservation and management.

We propose a regional-scale, automated radio-telemetry array to study potential migratory movements of the Indiana bat (*Myotis sodalis*) and northern myotis (*Myotis septentrionalis*). The project will provide novel insight into colony dynamics at the initiation of migration, the use of habitat corridors as bats migrate across the landscape, potential risk of mortality from the wind energy facility, and connectivity with the nearest hibernacula to the summer roost. The result of these findings may inform risk of collision related fatality to fall migrant bats posed by the project and help focus potential curtailment periods to the appropriate season for these bat species.

Migration is a vital period that links, both spatially and temporally, summer and winter habitats of many bat species, yet we have only a superficial understanding of bat migration. The current gold standard for studies of bat migration involves using aircraft and vehicles to radiotrack intensively a small number of bats. This technique is inefficient and provides haphazard data on only part of the total migration route for a small number of bats.

The radio-telemetry array we propose consists of telemetry towers equipped with recently developed open-source receivers and multiple directional antennas capable of detecting transmitters in a 14-km radius. We will place telemetry towers at: 1) a summer roost site located near the project where we capture bats, 2) along a riparian corridor connected to the roost area, 3) at the Hoopeston and Ford Ridge wind energy sites, and 4) at the three most likely hibernacula for these bats given the geographic location (Figure 1). We will attach radiotransmitters to 20 bats at a known maternity site in Middle Fork Forest Preserve, prior to autumn migration. This design will provide information on when bats leave maternity colonies, synchrony of maternity colony departure, direction of migratory departure from the maternity colony, movement across the landscape and the use of habitat corridors, the likelihood of bats migrating through the area of the wind energy facility, the duration of migration, and connectivity to the most likely hibernacula.

The specific objectives of our research are:

Objective 1: *Wind Project Risk.* What proportion of bats migrate across the area of the Hoopeston or Ford Ridge wind energy sites? Or, do bats follow riparian corridors during migration?

Objective 2: *Migratory Timing*. When do bats in central Illinois disperse from summer maternity colonies towards winter hibernacula? Can this information be used to define fall migration curtailment periods for wind projects in the region?

Objective 3: *Colony breakup dynamics*. Does the entire colony leave for migration in a synchronized manner, or does breakup occur slowly? Do all bats in this colony depart in

a similar direction? What proportions depart in the direction of and/or move across the Hoopeston or Ford Ridge wind energy projects?

Objective 4: *Migratory connectivity*. Do bats migrate to the nearest known hibernacula? To what extent do bats from the same summer colony migrate to the same hibernacula?

Objective 5: *Migration Rate*. What is the total duration of migration? Does migration rate correspond to model predictions or do multi-day stopovers delay movement? Can this information be used to define fall migration curtailment periods for wind projects in the region?

PROGRESS

Datalogger Deployment

We deployed eight Sensorgnome dataloggers on the landscape at seven locations (Figure 1, Figure 2). Two dataloggers were deployed on a 30 ft tower at Middle Fork Forest Preserve to track bats while they remained within summer range, and as they departed for fall migration. We constructed additional datalogger and tower setups on the southeastern corner of the proposed Ford Ridge wind energy site and the southwestern corner of the Hoopeston wind energy site. Finally, for biological interest, we also deployed one datalogger on a tower at Kickapoo State Park to determine if bats used the Middle Fork River corridor as a migration pathway, and placed three dataloggers, without towers, at known hibernacula in the region. All dataloggers were confirmed to be working during the study.

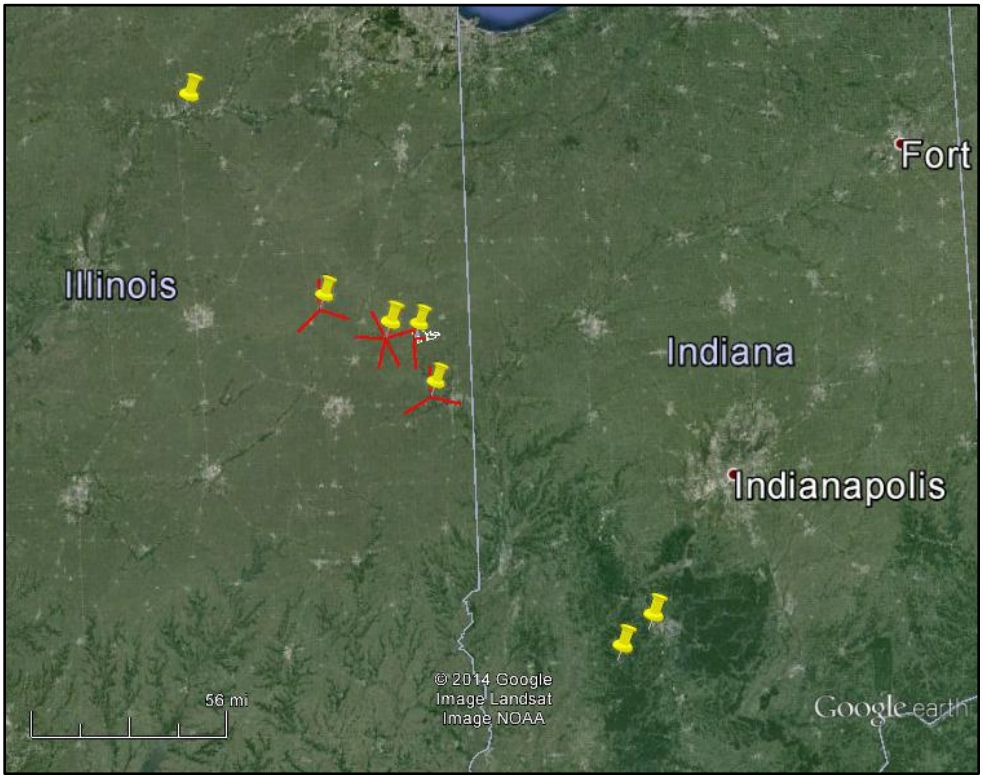


Figure 1. Sensorgnome datalogger deployment locations. Yellow pins indicate datalogger locations, and red lines indicate the direction and approximate range of antennas. Pins without

antennas indicated represent dataloggers placed at hibernacula. See Figure 2 for a closer view of the locations surrounding the focal Apex sites.

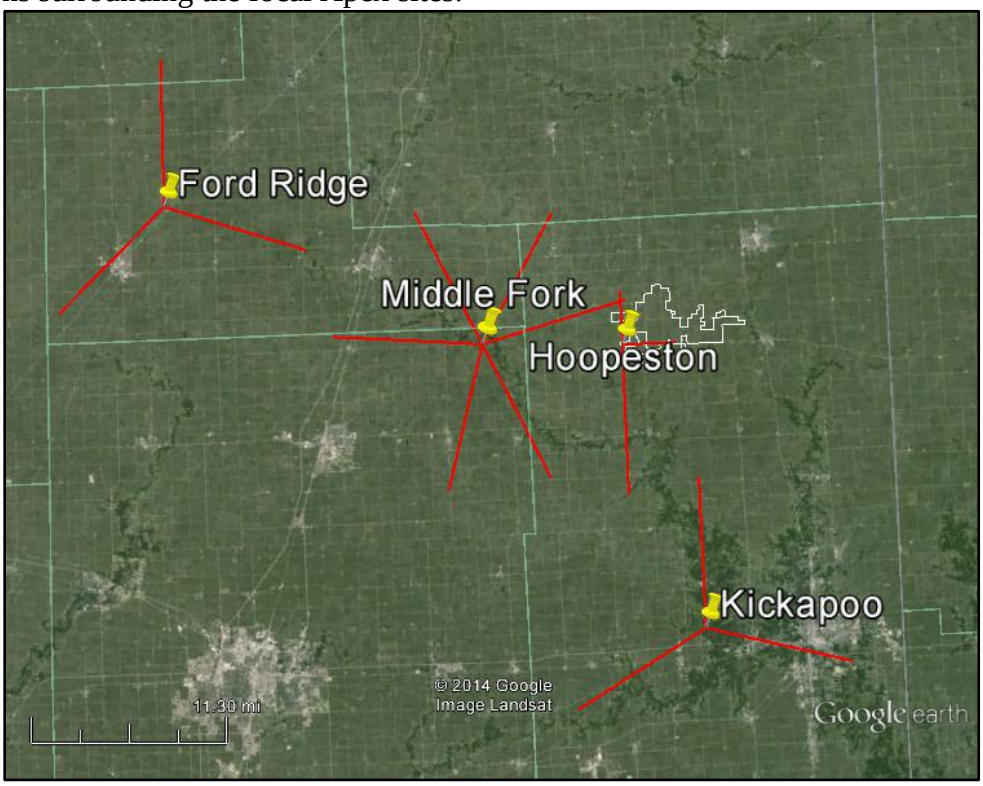


Figure 2. Location of dataloggers around focal Apex sites. Yellow pins indicate datalogger locations, and red lines indicate the direction and approximate range of antennas. A tower with 6 antennas was placed at Middle Fork Forest Preserve, where bats were captured and tagged. Additional towers were placed at the Hoopeston and Ford Ridge sites, and at Kickapoo State Park.

Bat Capture

We conducted 11 nights of netting at Middle Fork Forest Preserve between 8-24 August. We captured 26 bats of 5 species, including both Indiana bats and northern bats. We attached transmitters to 3 northern bats (1 adult male, 2 adult females) and 5 Indiana bats (2 adult males, 3 adult females) (Table 1). All bats were released at the point of capture.

Telemetry Observations

The number of detections for each transmitter varied from 281 – 25,651 (Table 1), and transmitters were only detected at the Middle Fork tower (see Appendix 1: Data plots). **No bats were detected at either the Hoopeston or Ford Ridge wind energy sites.** All receivers were confirmed to be functioning properly at the time the towers were erected, and diagnostics provided from the receivers indicate they operated properly throughout the deployment. The only exceptions were the receivers at Ray's Cave and Coon Cave where late season sun and forest cover limited power availability later in the tracking period.

One noteworthy finding is that the **Indiana bats departed from Middle Fork over a relatively narrow period of time.** The final detection for the Indiana bats we tagged ranged

from August 22 -27th (Table 1). The narrow window suggests the colony does not travel together during migration, nor is the initiation of migration highly synchronized, but there is not a large amount of variation in the individual decisions to begin migration. The timeframe of last detections for northern myotis was more varied (Table 1).

It is difficult to infer a departure direction with a high degree of confidence for several of the bats. However, a consistent pattern may be emerging even from few bats with relatively good tracking data. For the three bats with the greatest number of detections, the final contact is strongest on the 30° antenna, and somewhat weaker on the 335° and 75° antennas. **The pattern of final signal detections suggests a northeast departure direction** for these bats. Although based on fewer detections, 3 additional transmitters were last detected with indications of a northeastern signal direction. This pattern is consistent with the lack of detections at other towers. There are no towers to the northeast of the capture site (Figure 1), so bats departing in this direction would likely avoid detection on all towers. Further investigation and departure patterns are required for confirm this general pattern.

The relatively low number of detections for several of the transmitters suggests that the location of the Middle Fork tower was not within close proximity of the day roosting area used during the project. For several of the bats we only detected the transmitter briefly each night, with weak signal strength. This suggests these bats spent the majority of their active period beyond the range of the Middle Fork tower, only periodically coming within range.

DISCUSSION

This project has given us an interesting look into the migration dynamics of Indiana bats and northern myotis in the Midwest and suggests great potential for using this type of automated tower system for tracking migrating bats. With delays in finalizing funding agreements and initiating the research, we started the project several weeks later than would have been ideal. This resulted in difficulty capturing the proposed number of bats, so our sample size is smaller than we had hoped. However, even with the eight bats we were able to track, we see two patterns of note:

1) Indiana bats depart the site in a relatively narrow timeframe, while northern myotis departure dates are less synchronized.
2) The last detection of most of the bats was to the northeast, where there are no known hibernacula.

In addition to these interesting biological findings, we learned several logistical lessons that should greatly increase the success of the project in year two. Specifically, it is clear that better knowledge of the roosting areas actually being used during the year of study will increase the likelihood of success, so we will make a concerted effort to find roosts using standard radiotelemetry before we begin tracking with the broader telemetry array. It is also clear that a different configuration of towers at the Middle Fork site, specifically 3 antennas on each of 2 towers instead of 6 antennas on 1 tower, will be advantageous for increasing coverage of the site. We have also discovered the limits of the solar systems for powering the Sensorgnomes into the autumn when sunlight is limited and can adjust positioning and battery banks for several of the sites.

Finally, year two holds immense potential and we are optimistic about the project for two reasons. First, we have coordinated with the Sensorgnome developers and they will provide a software release in spring 2015 which will provide updates for power optimization and increased detection range. The software update will increase the area we can cover with each tower, and

the functionality of towers in areas of obscured sunlight. Second, and more importantly, we will begin another, much larger project using the same towers to track these species throughout the Midwest. The towers erected for the larger scale project be complementary to the towers erected for the Apex project and will greatly increase our ability to track bats across large distances and will increase our chances of detecting bats after they leave the Middle Fork site.

Table 1. Capture details for target species. Tagged bats were detected between 281 – 25,651 times.

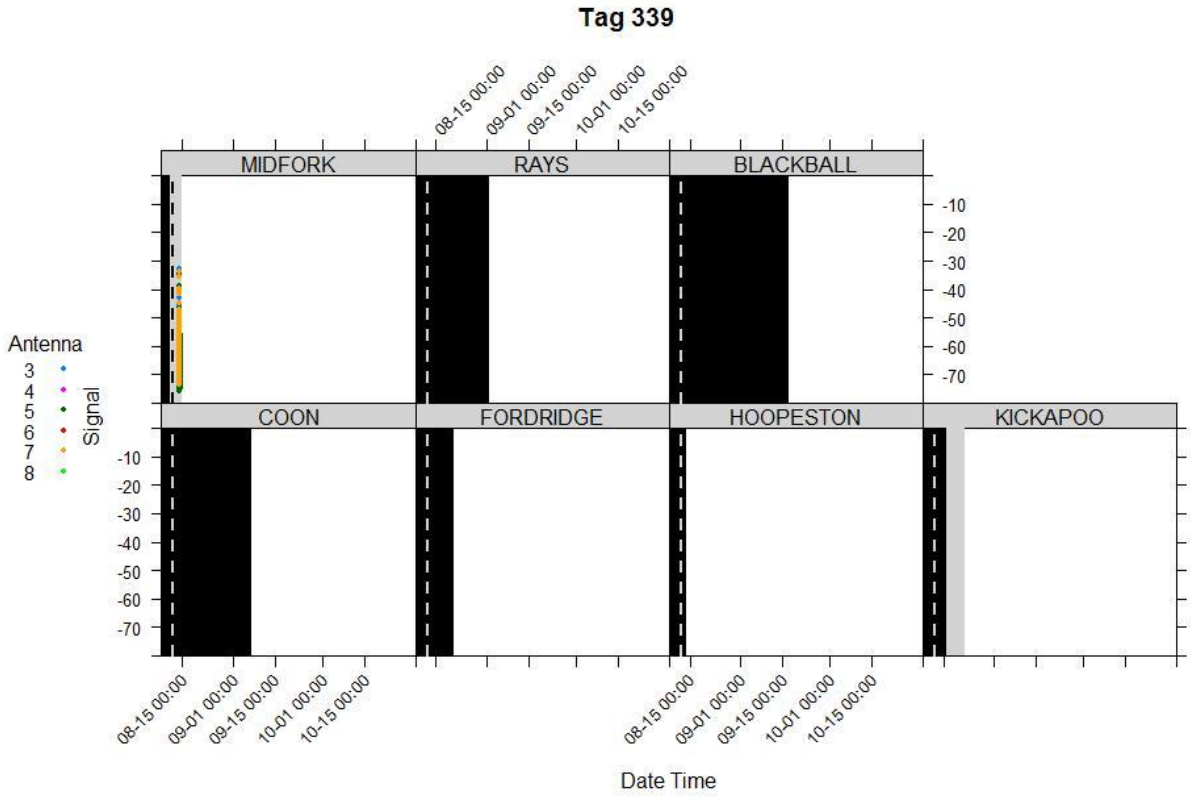
Transmitter ID	Capture Date	Last Detection	Species	Sex	Age	Reproductive Condition	Forearm Length (mm)	Mass (g)	WNS Wing Score	# Detections
339	11-Aug-2014	14-Aug-2014	*Myotis septentrionalis*	male	adult	non-reproductive	35.0	6.5	0	1958
341	13-Aug-2014	20-Aug-2014	*Myotis septentrionalis*	female	adult	post-lactating/non-reproductive	35.9	8.5	0	5101
345	21-Aug-2014	29-Aug-2014	*Myotis septentrionalis*	female	adult	post-lactating	33.6	7.5	0	25651
342	13-Aug-2014	22-Aug-2014	*Myotis sodalis*	female	adult	post-lactating/non-reproductive	38.4	8.0	0	858
343	13-Aug-2014	24-Aug-2014	*Myotis sodalis*	male	adult	non-reproductive	39.6	7.5	0	4569
340	16-Aug-2014	24-Aug-2014	*Myotis sodalis*	male	adult	non-reproductive	35.8	6.5	0	281
344	22-Aug-2014	27-Aug-2014	*Myotis sodalis*	female	adult	post-lactating	38.3	8.0	0	1392
352	23-Aug-2014	27-Aug-2014	*Myotis sodalis*	female	adult	post-lactating/non-reproductive	41.3	7.5	0	375

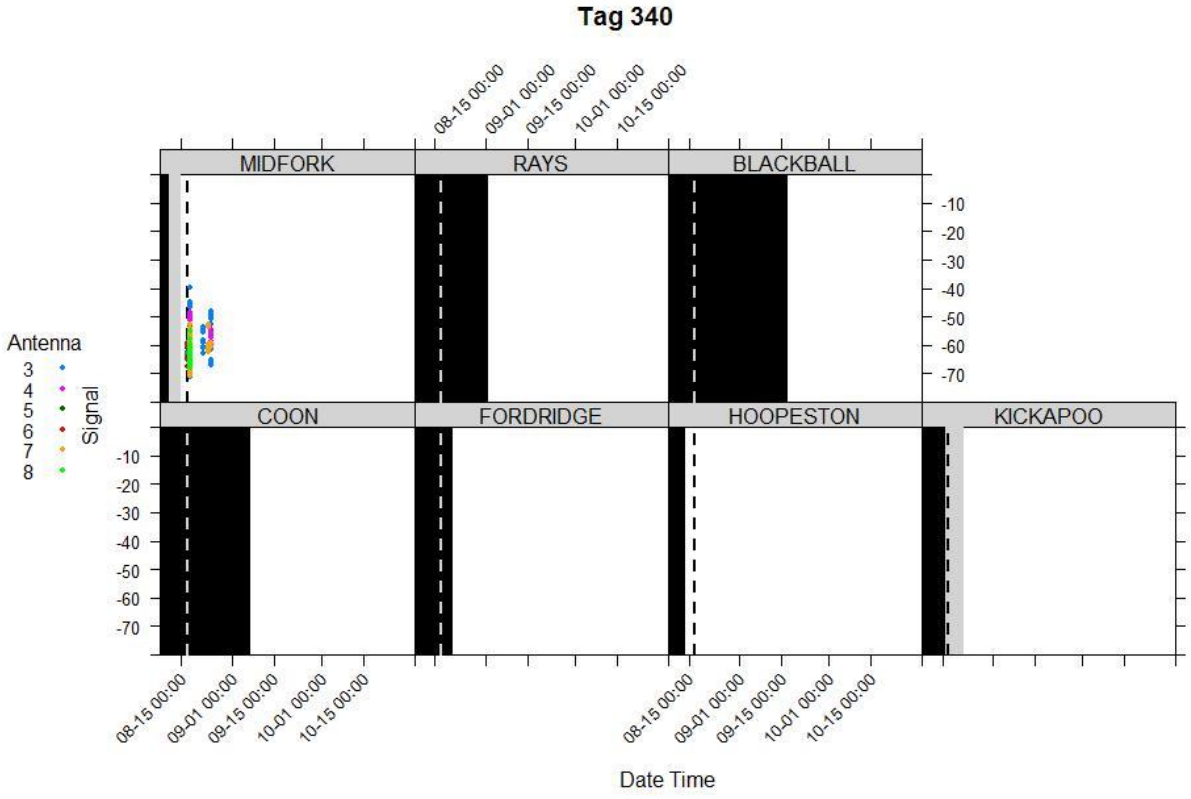
Appendix 1: Data Plots

Full Data Plots

Full dataplots for each transmitter are included below. Refer to Table 1 for details of the individual bats. In each figure there are 7 panels, one for each tower location. Bats were captured at Middle Fork Forest Preserve (MIDFORK). Towers were placed at the Hoopeston (HOOPESTON) and Ford Ridge (FORDRIDGE) wind energy sites, as well as along the Middle Fork River in nearby Kickapoo State Park (KICKAPOO). The final three dataloggers were placed at hibernacula (RAYS, BLACKBALL, COON). The layout of the panels is arbitrary and does not represent geographic proximity.

Within each panel, the x-axis indicates that date and time (August 8 – November 6, 2014) and the y-axis indicates the signal strength. Greater signal strength indicates closer proximity to the tower. Colored points indicate each individual detection of the transmitter (many points are obscured at longer time scales), with the color of the point indicating which antenna detected the transmitter. The time of capture is indicated with a vertical dashed line. Periods prior to the erection of the towers are shaded black, and periods where the tower was not fully operational (3 of 6 antennas at Middle Fork, 1 of 3 antennas at Kickapoo) are shaded grey.

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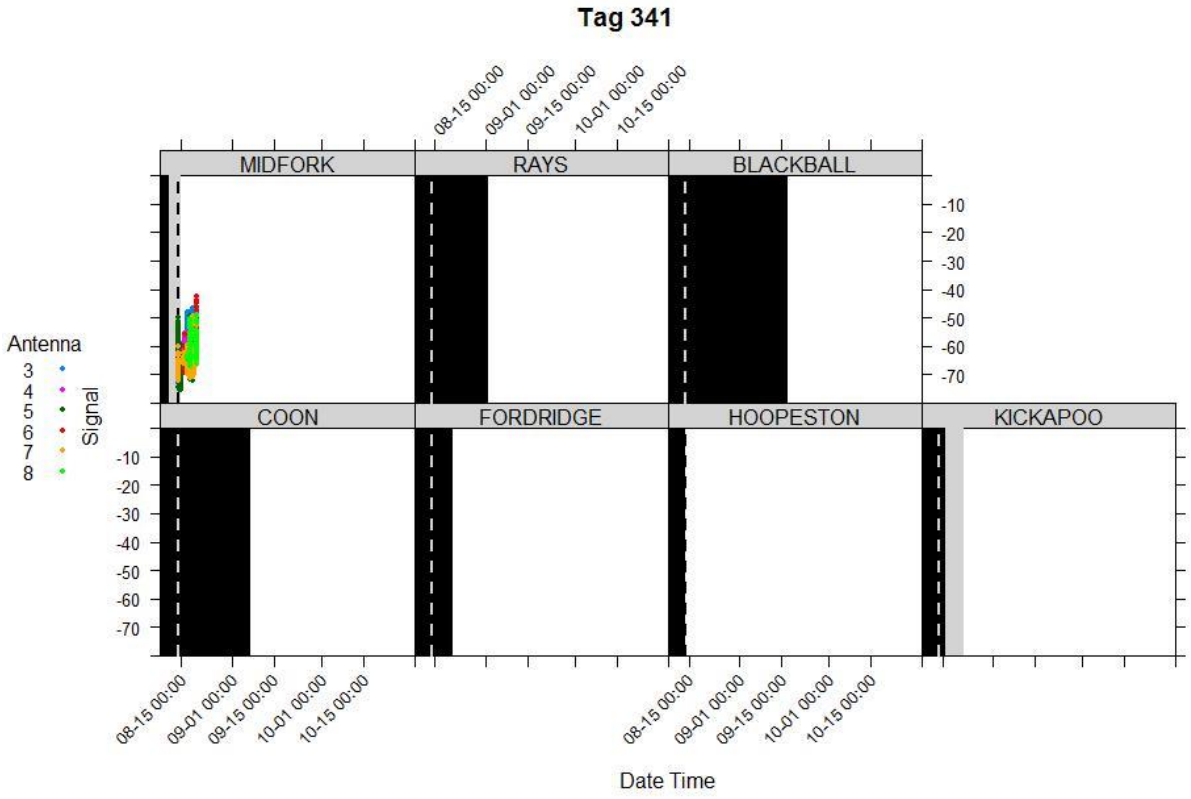
RAYS
BLACKBALL
COON
FORDRIDGE
HOOPESTON
KICKAPOO
Antenna
3
4
5
6
7
8
Signal
-10
-20
-30
-40
-50
-60
-70
08-15 00:00
09-01 00:00
09-15 00:00
10-01 00:00
10-15 00:00
Date Time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RAYS
BLACKBALL
COON
FORDRIDGE
HOOPESTON
KICKAPOO
Antenna
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4
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6
7
8
Signal
-10
-20
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09-01 00:00
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10-15 00:00
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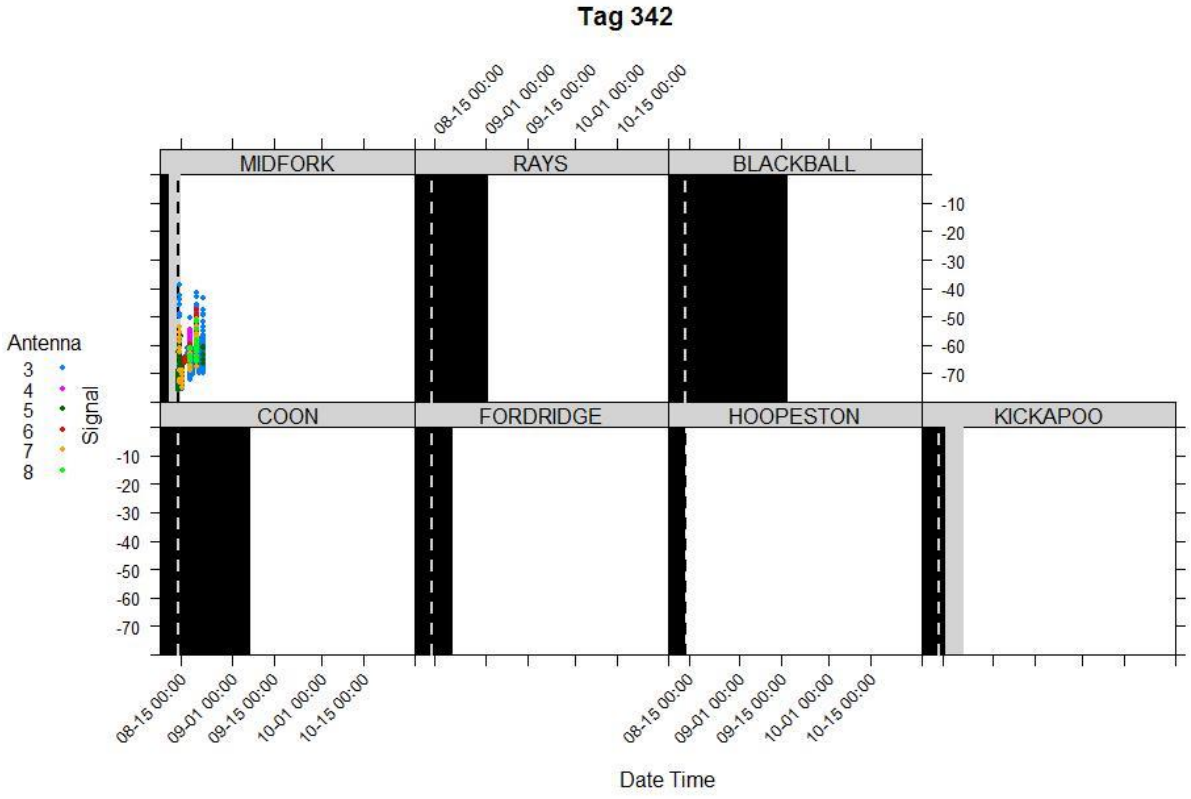
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RAYS
BLACKBALL
COON
FORDRIDGE
HOOPESTON
KICKAPOO
Antenna
3
4
5
6
7
8
Signal
-10
-20
-30
-40
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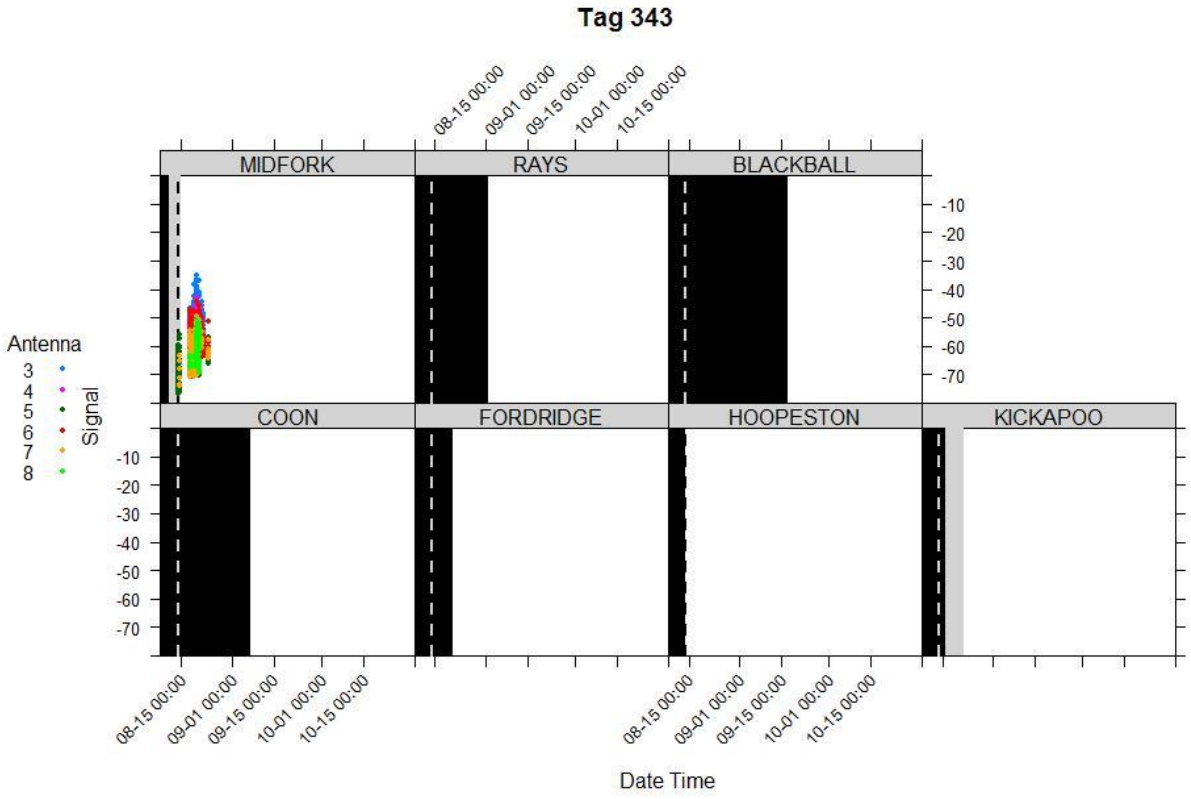
-70
08-15 00:00
09-01 00:00
09-15 00:00
10-01 00:00
10-15 00:00
Date Time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BLACKBALL
COON
FORDRIDGE
HOOPESTON
KICKAPOO
Antenna
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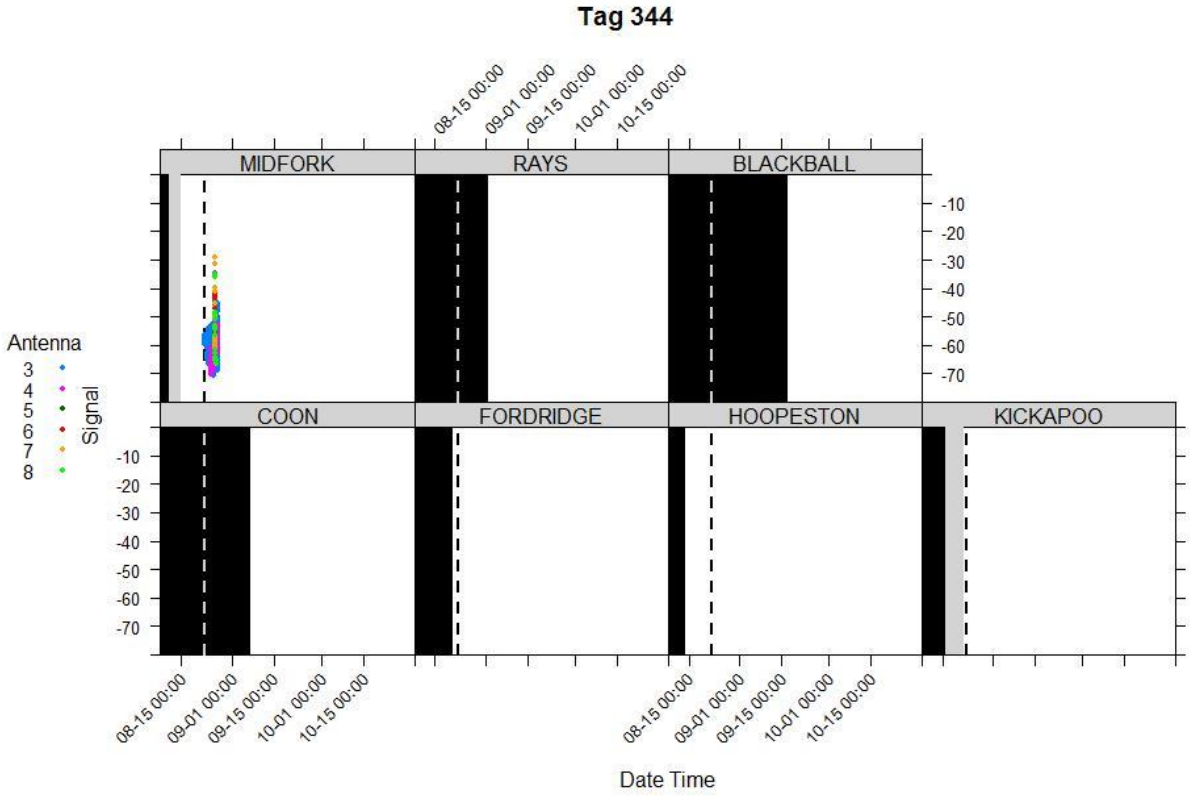
4
5
6
7
8
Signal
-10
-20
-30
-40
-50
-60
-70
08-15 00:00
09-01 00:00
09-15 00:00
10-01 00:00
10-15 00:00
Date Time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BLACKBALL
COON
FORDRIDGE
HOOPESTON
KICKAPOO
Antenna
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Signal
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09-01 00:00
09-15 00:00
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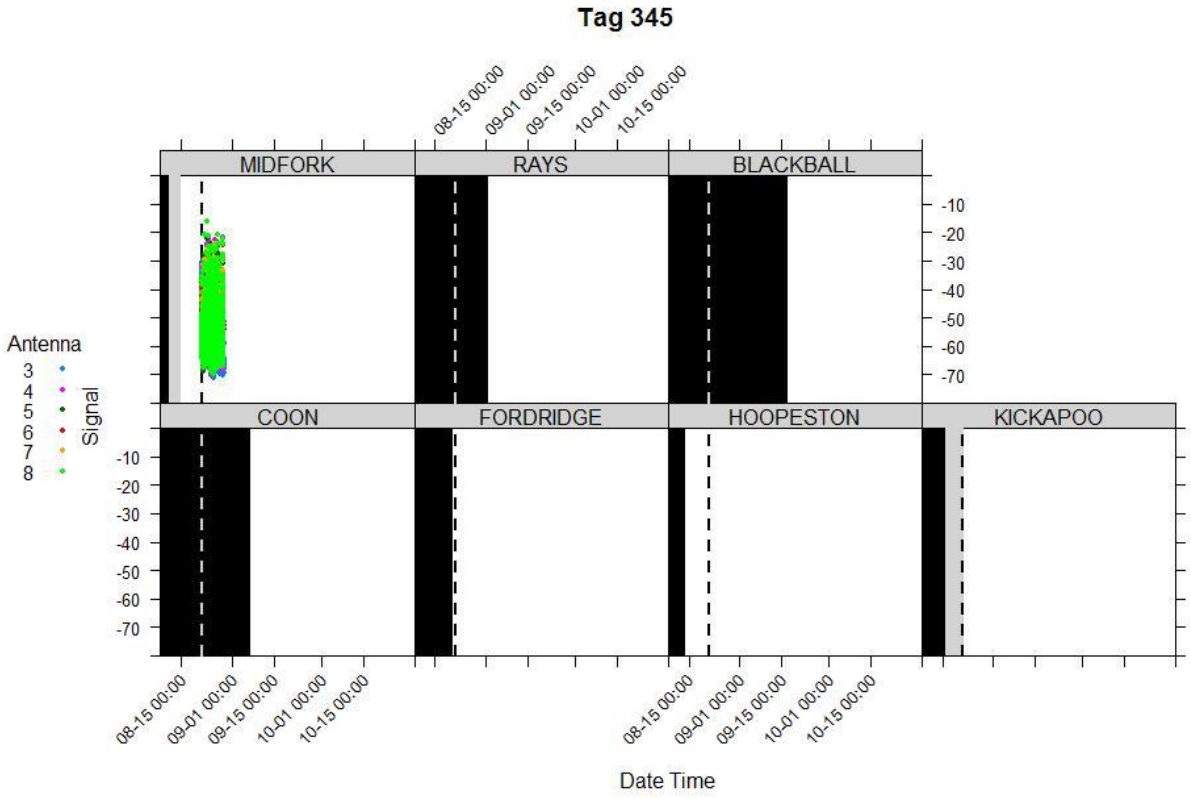
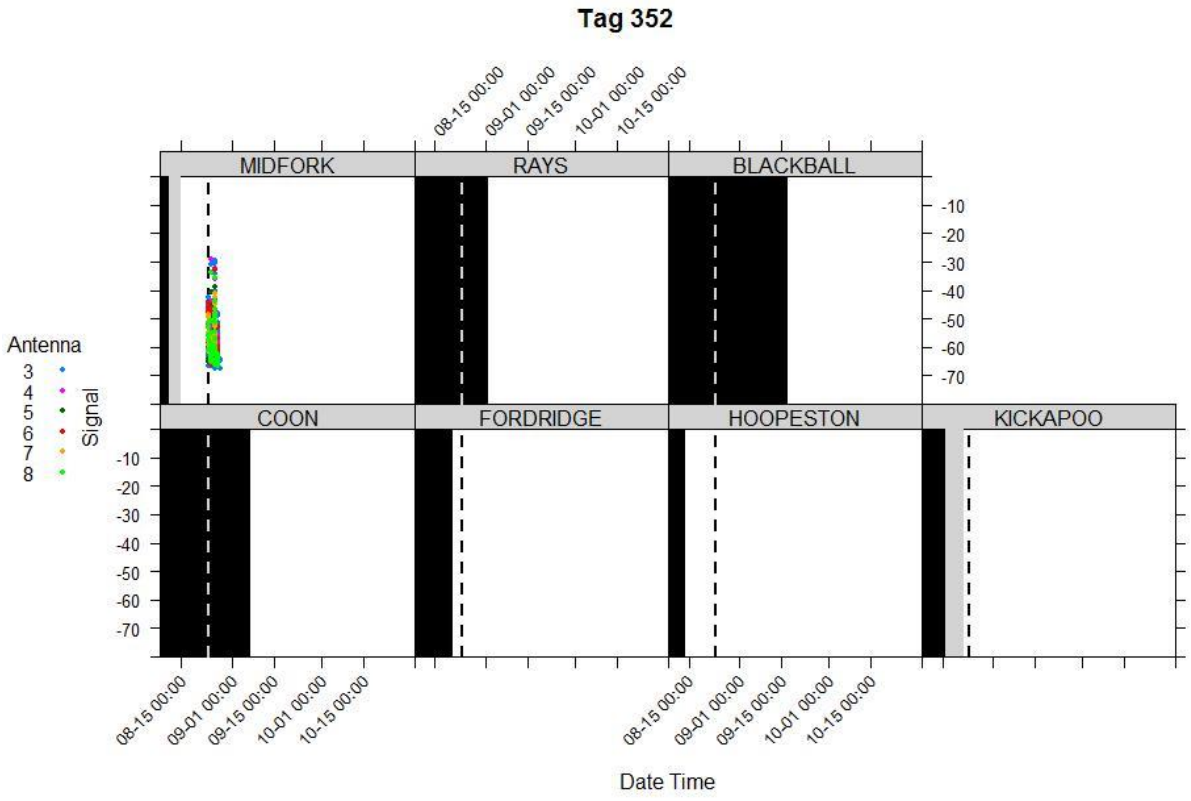
10-15 00:00
Date Time


Tag 345
MIDFORK
RAYS
BLACKBALL
COON
FORDRIDGE
HOOPESTON
KICKAPOO
Antenna
3
4
5
6
7
8
Signal
-10
-20
-30
-40
-50
-60
-70
08-15 00:00
09-01 00:00
09-15 00:00
10-01 00:00
10-15 00:00
Date Time

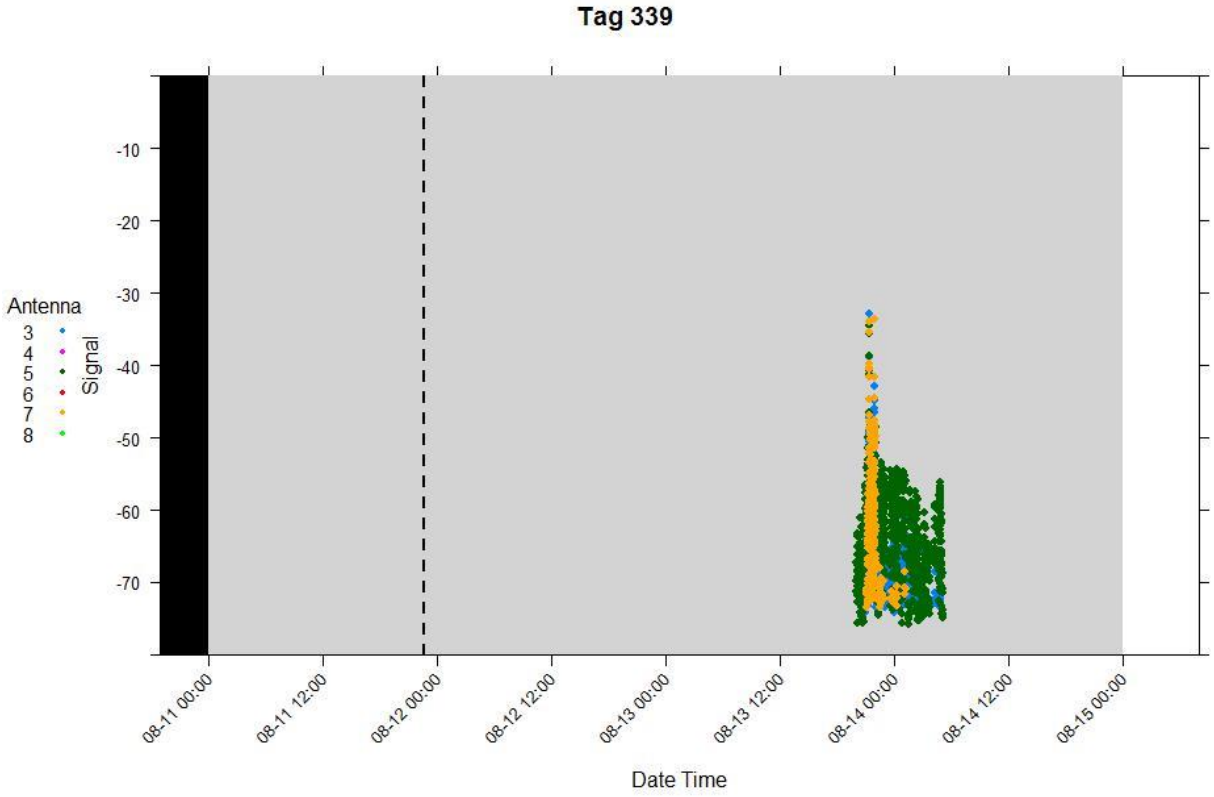


Focused Data Plots

The following data plots focus on the period of contact with each bat. Figure layout is as for the full data plots above. As bats were only detected at the Middle Fork tower, only a single panel is shown in these plots. As before, the color of the data point indicates the antenna. The antenna numbering system (3-8 rather than 1-6) derives from a software configuration in the Sensorgnome receivers. For reference with Figure 2, the direction of the numbered antennas on the Middle Fork tower is as follows:

Antenna 3: 30°
Antenna 4: 335°
Antenna 5: 155°
Antenna 6: 75°
Antenna 7: 275°
Antenna 8: 195°

Note the relatively weak signal strength and small number of data points for many of the transmitters. This suggests the day roosts, and area of primary activity was likely beyond the range of the Middle Fork tower. If day roosts and primary foraging areas were adjacent to the tower, we would expect stronger signal strength and many more detections throughout the night. Compare, for example, Tag 340 and Tag 345.


Tag 339
Antenna
3
4
5
6
7
8
Signal
-10
-20
-30
-40
-50
-60
-70
08-11 00:00
08-11 12:00
08-12 00:00
08-12 12:00
08-13 00:00
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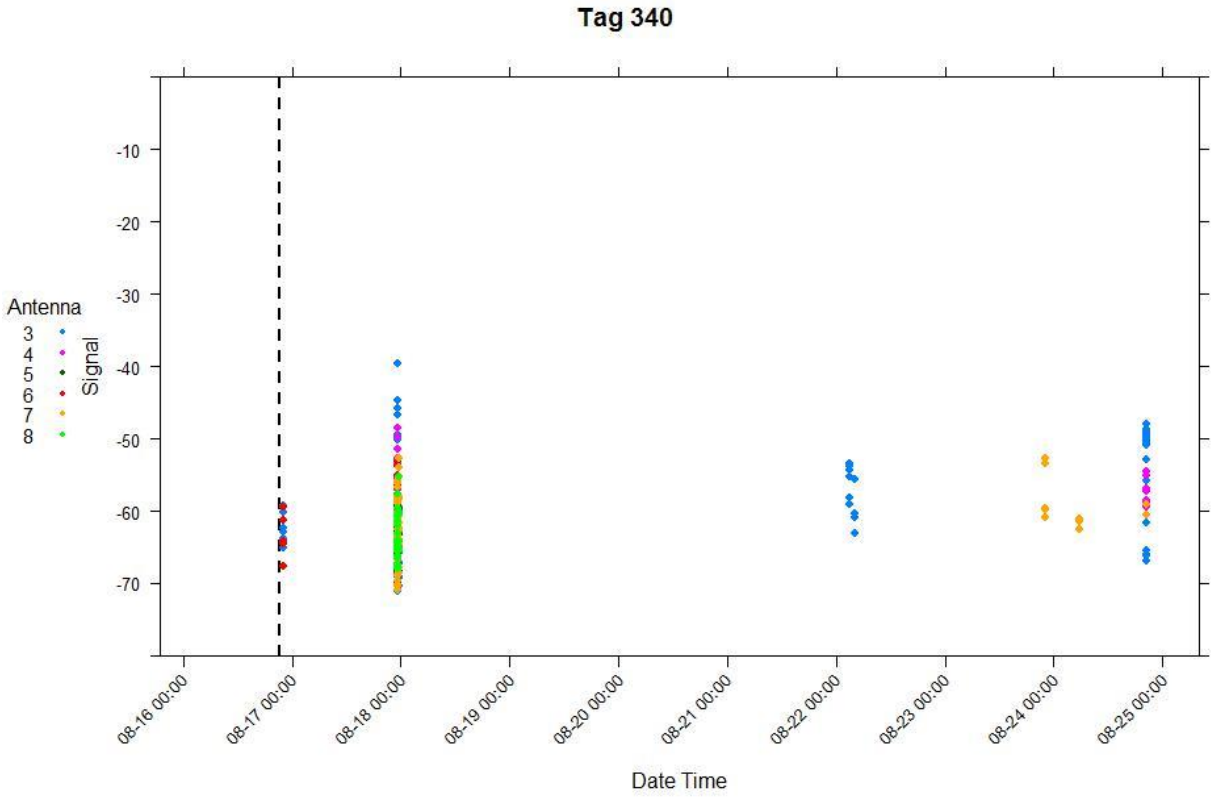
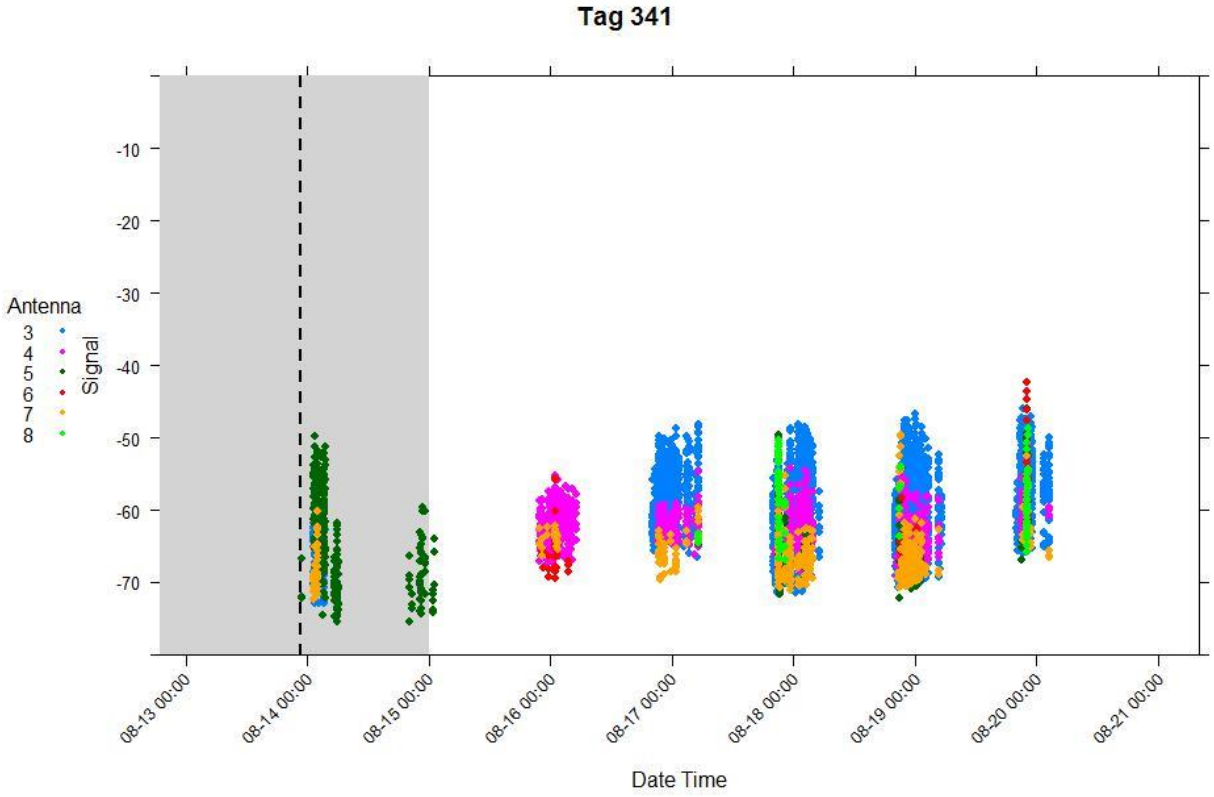
08-14 00:00
08-14 12:00
08-15 00:00
Date Time


Tag 340
Antenna
3
4
5
6
7
8
Signal
-10
-20
-30
-40
-50
-60
-70
08-16 00:00
08-17 00:00
08-18 00:00
08-19 00:00
08-20 00:00
08-21 00:00
08-22 00:00
08-23 00:00
08-24 00:00
08-25 00:00
Date Time


Tag 341
Antenna
3
4
5
6
7
8
Signal
-10
-20
-30
-40
-50
-60
-70
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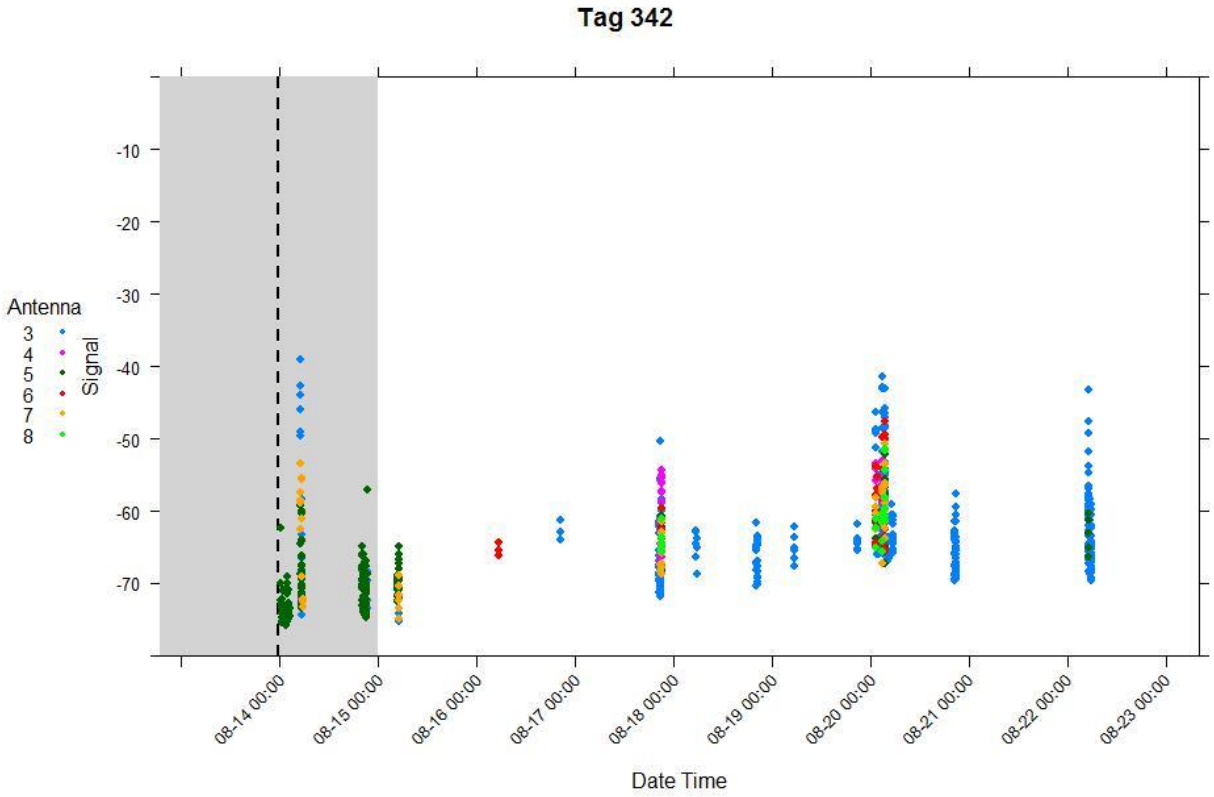
08-14 00:00
08-15 00:00
08-16 00:00
08-17 00:00
08-18 00:00
08-19 00:00
08-20 00:00
08-21 00:00
Date Time


Tag 342
Antenna
3
4
5
6
7
8
Signal
-10
-20
-30
-40
-50
-60
-70
08-14 00:00
08-15 00:00
08-16 00:00
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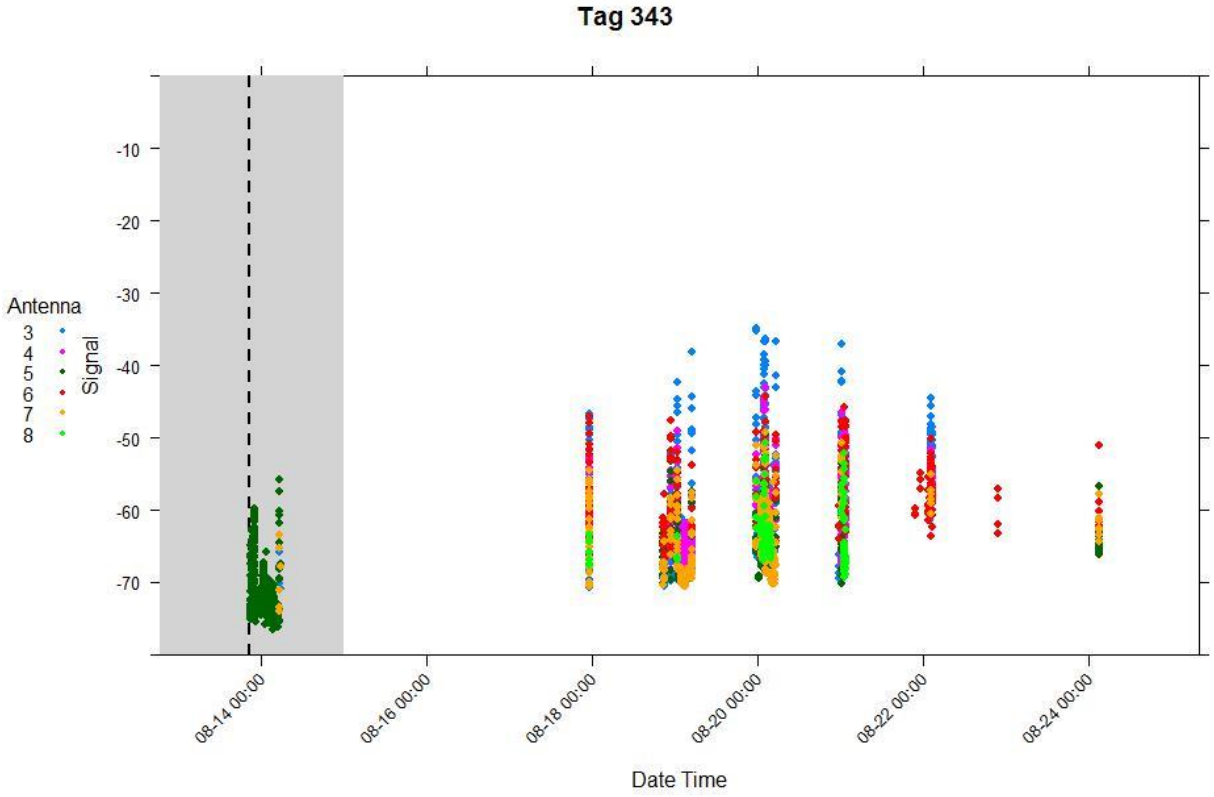
08-22 00:00
08-23 00:00
Date Time


Tag 343
Antenna
3
4
5
6
7
8
Signal
-10
-20
-30
-40
-50
-60
-70
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08-16 00:00
08-18 00:00
08-20 00:00
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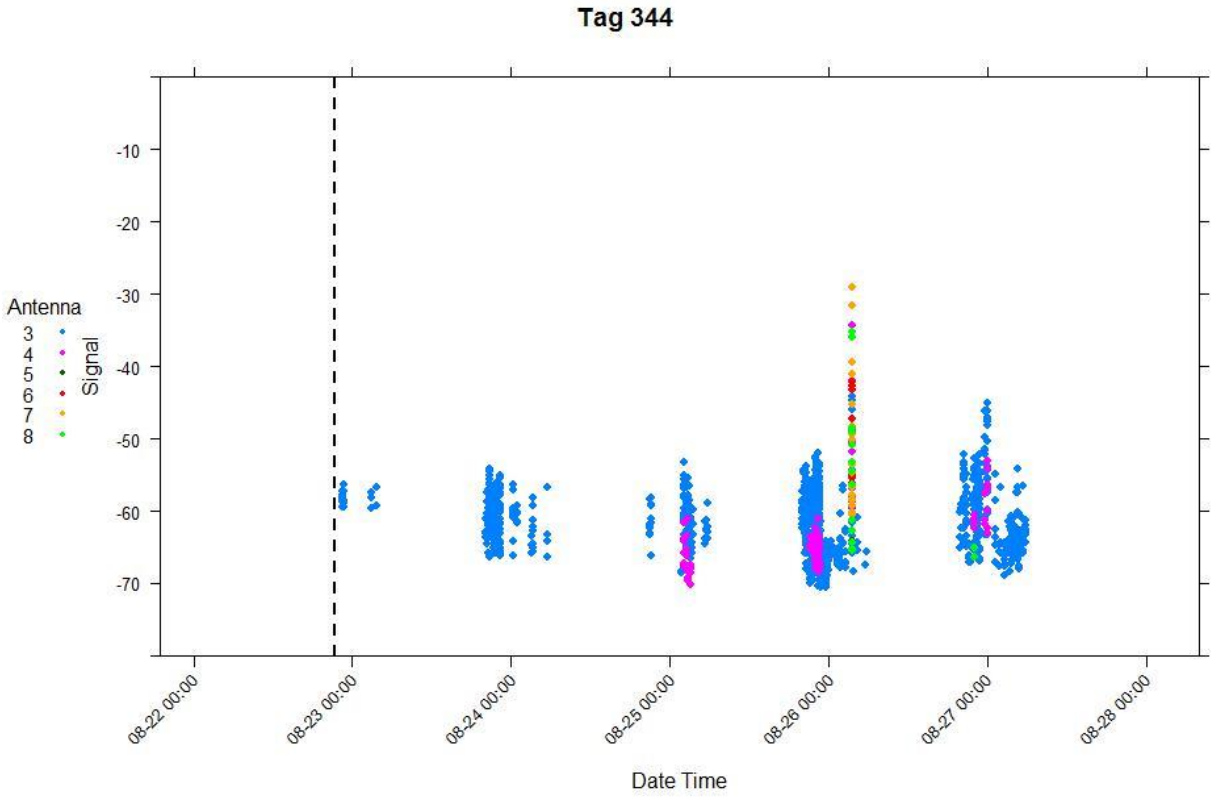
08-24 00:00
Date Time


Tag 344
Antenna
3
4
5
6
7
8
Signal
-10
-20
-30
-40
-50
-60
-70
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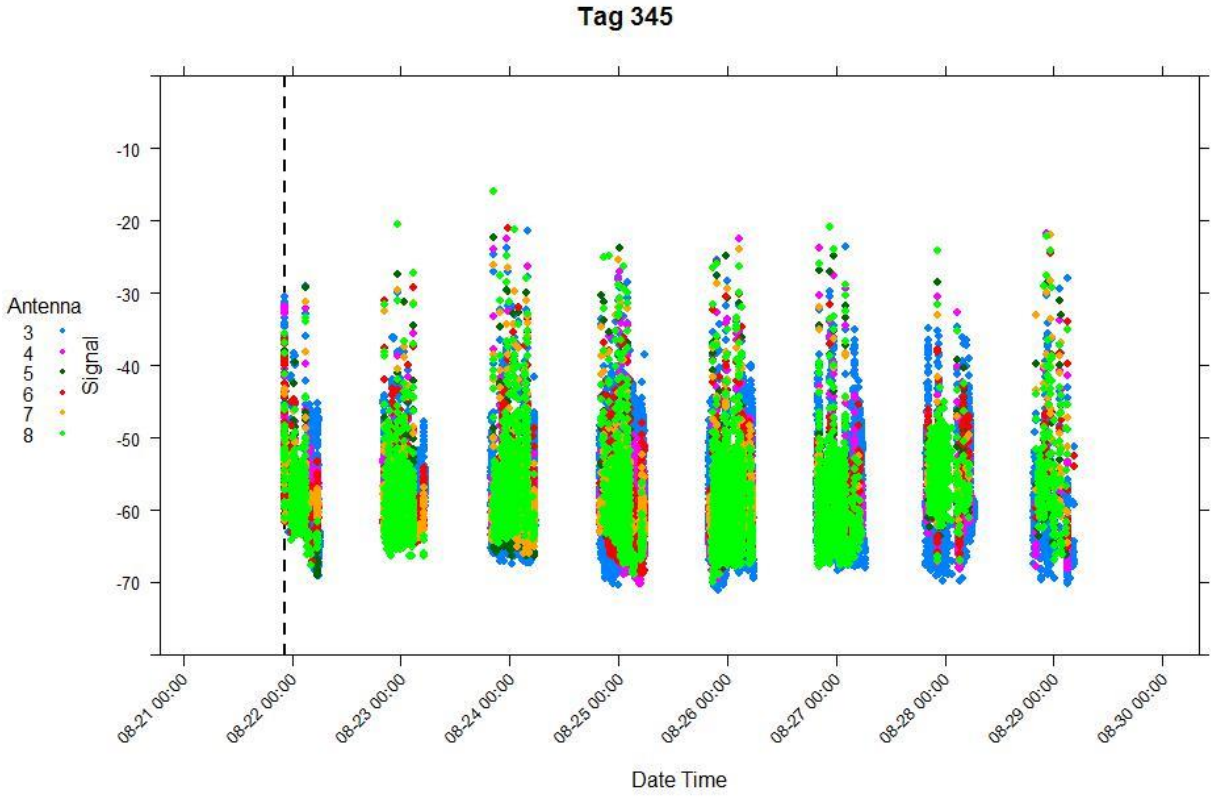
08-26 00:00
08-27 00:00
08-28 00:00
Date Time


Tag 345
Antenna
3
4
5
6
7
8
Signal
-10
-20
-30
-40
-50
-60
-70
08-21 00:00
08-22 00:00
08-23 00:00
08-24 00:00
08-25 00:00
08-26 00:00
08-27 00:00
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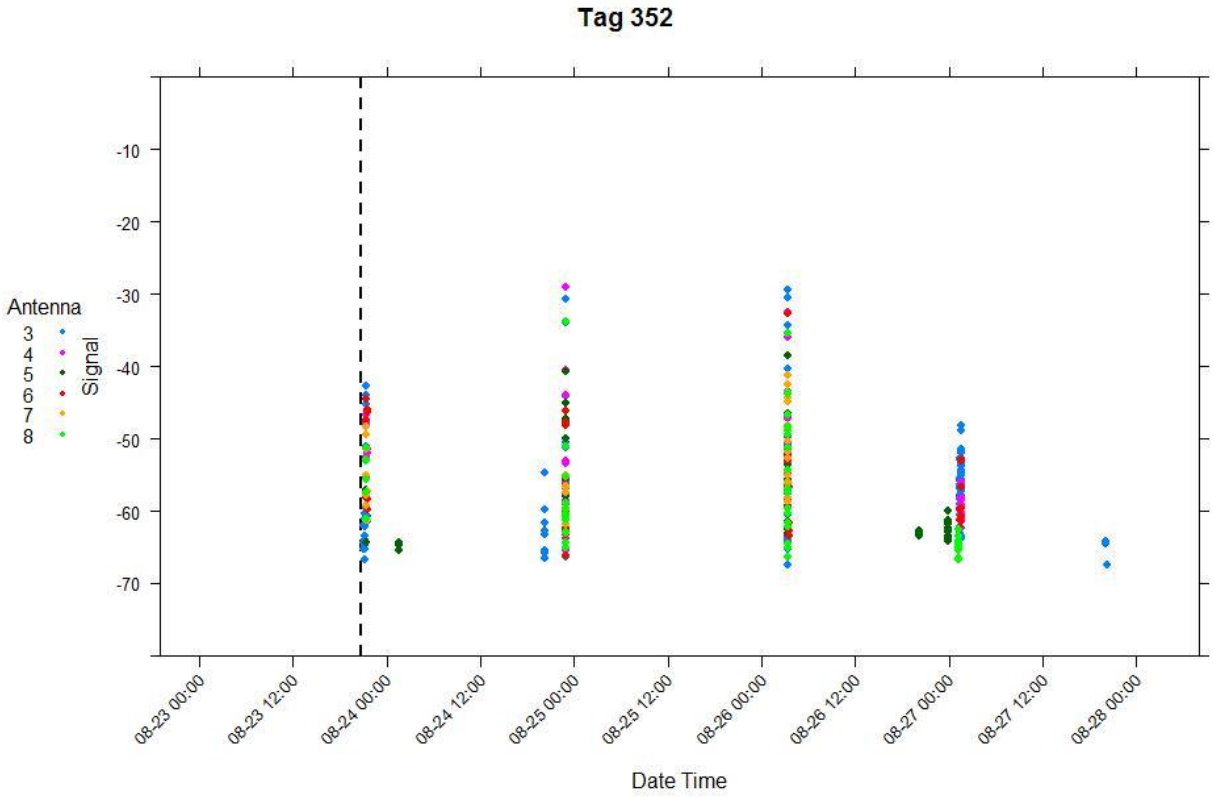
08-29 00:00
08-30 00:00
Date Time


Tag 352
Antenna
3
4
5
6
7
8
Signal
-10
-20
-30
-40
-50
-60
-70
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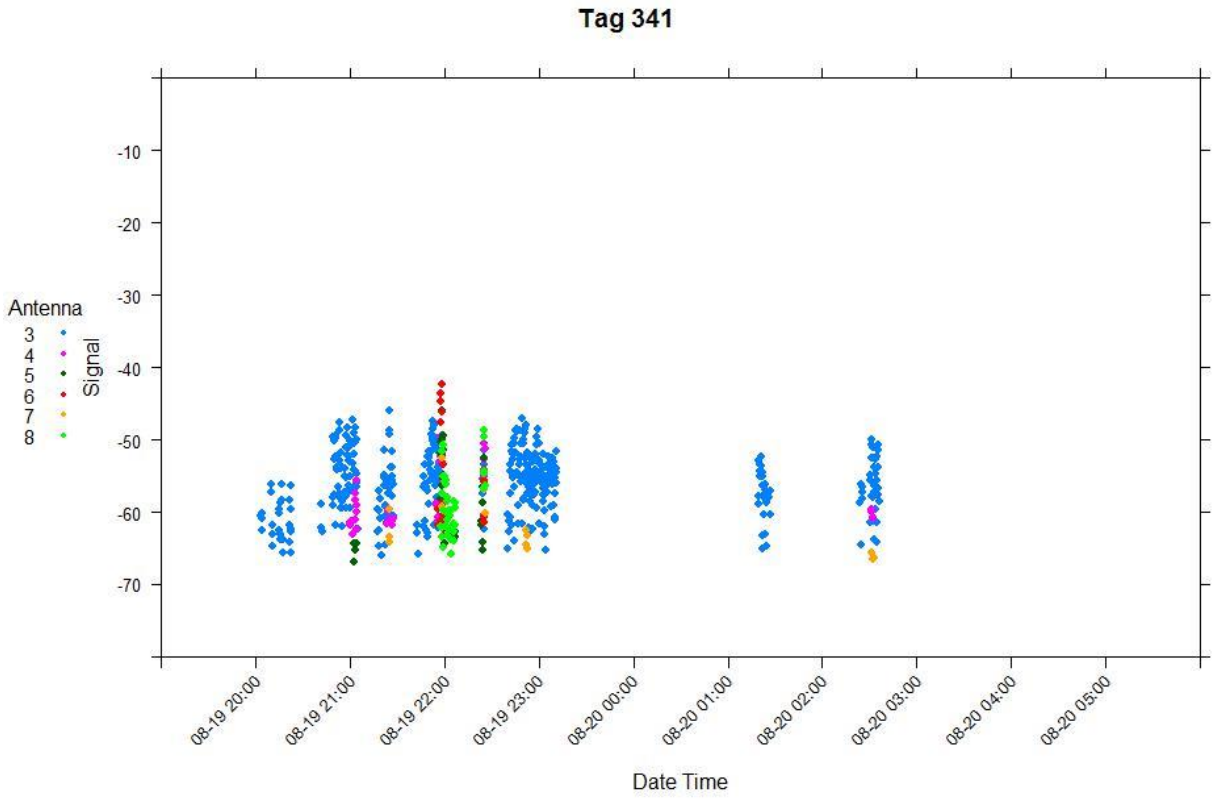
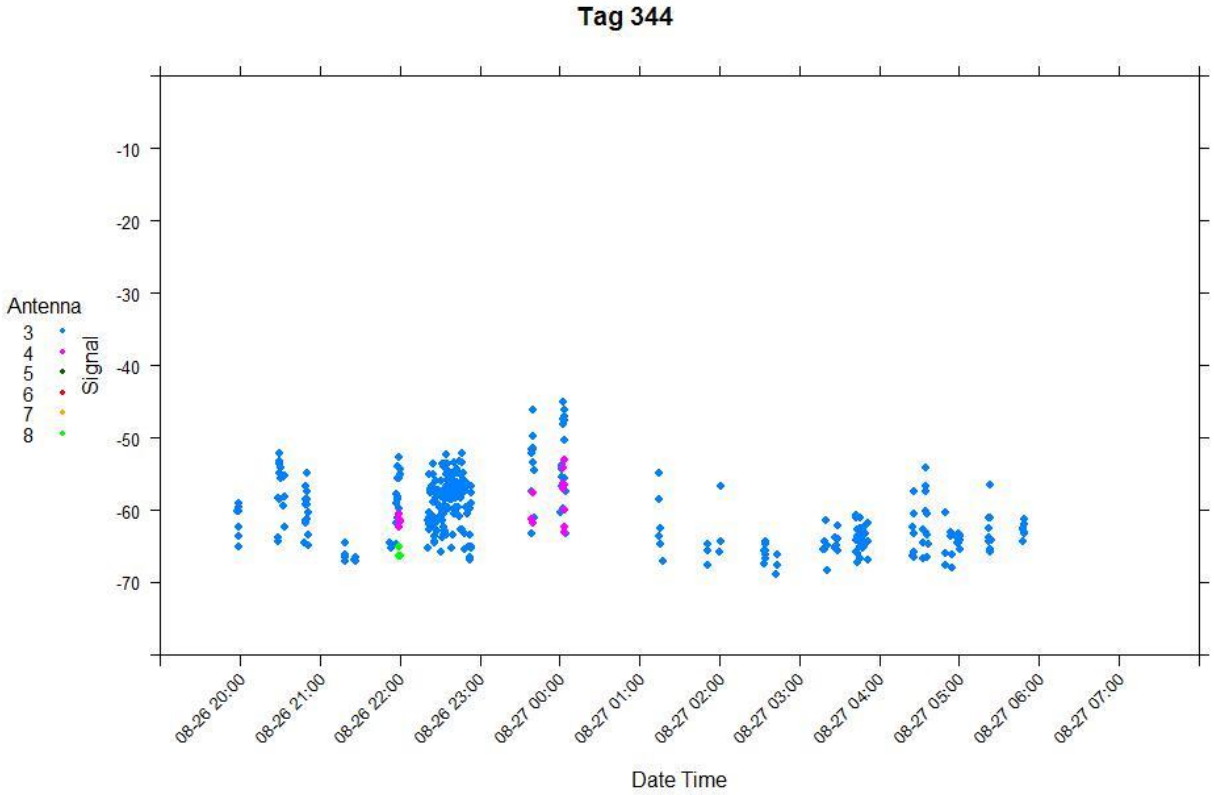
08-23 12:00
08-24 00:00
08-24 12:00
08-25 00:00
08-25 12:00
08-26 00:00
08-26 12:00
08-27 00:00
08-27 12:00
08-28 00:00
Date Time

Selected Final Contact Plots

Below are selected plots of the final night of contact for bats with a greater number of detections. Note that for all three bats (Tag 345 in particular), final contact is most prevalent on Antenna 3 (blue, 30°), and to a lesser extent antenna 4 (pink, 335°) and antenna 6 (red, 75°). This indicates that the final direction these bats were detected from was approximately to the northeast. Although there are fewer data points from other transmitters (lower degree of confidence), antenna 3 (blue, 30°) is associated with the final detections of 3 additional transmitters (340, 342, 352). A northeasterly departure direction is consistent with the lack of detections on any of our other towers. There were no towers deployed to the northeast of Middle Fork. Bats departing in this direction would not be detected on any other towers unless they followed a very indirect route.




Tag 344
Antenna
3
4
5
6
7
8
Signal
-10
-20
-30
-40
-50
-60
-70
08-26 20:00
08-26 21:00
08-26 22:00
08-26 23:00
08-27 00:00
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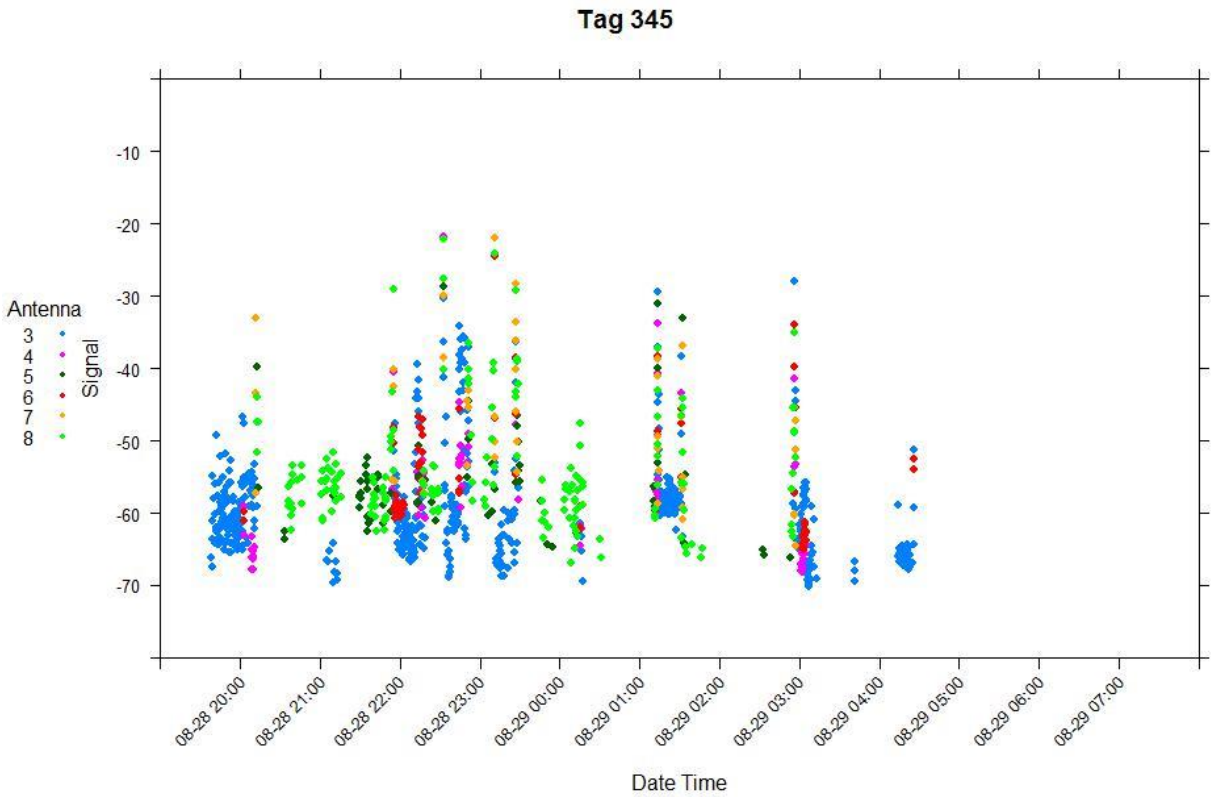
08-27 07:00
Date Time


Tag 345
Antenna
3
4
5
6
7
8
Signal
-10
-20
-30
-40
-50
-60
-70
08-28 20:00
08-28 21:00
08-28 22:00
08-28 23:00
08-29 00:00
08-29 01:00
08-29 02:00
08-29 03:00
08-29 04:00
08-29 05:00
08-29 06:00
08-29 07:00
Date Time

Appendix B. Mitigation Project Criteria

I. <u>Location of Projects</u>. Projects will be undertaken in the Embarras River Watershed or other occupied watershed in proximity to the Hoopeston Wind Project. The Embarras River Watershed consists of approximately 1,558,063 acres (2,435 square miles) of mixed land use, and encompasses portions of Champaign, Clark, Coles, Crawford, Cumberland, Douglas, Edgar, Effingham, Jasper, Lawrence, Richland, and Vermilion Counties. The Embarras River watershed remains primarily rural and agricultural. About 81.8% of the watershed is covered by agriculture and forest.

Two specific parcels of land in fee ownership of Grand Prairie Friends have been identified for specific, near term restoration and enhancement activities (Figure 1). These areas consist of a 154-acre parcel (Embarras Ridge) and a 20-acre parcel (Burnett), which are both located in close proximity to habitat occupied by covered species. Embarrass Ridge includes a mix of open field (~8.3 acres), early successional field with low density of 7-15 year old trees (~35.1 acres) and relatively mature forest (~110.6 acres). The Burnett parcel consists of open field, a narrow band of riparian hardwood along the river, and a small area with planted oak and hickory trees (~7-10 yrs old).

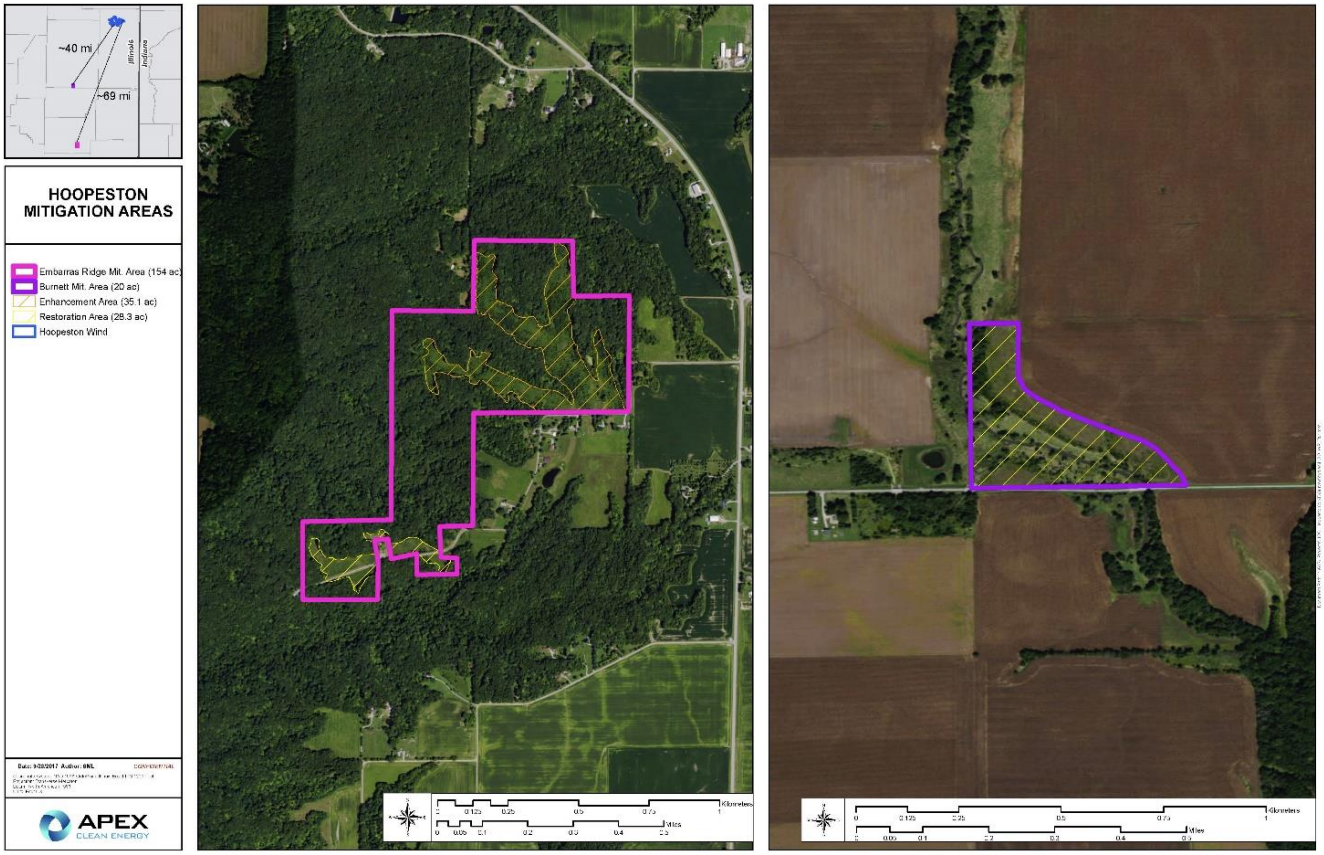


Figure 1. Hoopeston Wind Project mitigation areas.

Restoration actions are planned for implementation in spring/summer 2018 in the 20-acre Burnett Parcel and in 8.3 acres of the Embarras Ridge parcel as shown in Figure 1. Restoration actions include, but are not limited to, invasive plant species management, vegetation management through mowing and selective burning, and native tree planting. Density and species of native trees to be planted would be based on soil type throughout the project area, and determined in coordination with USFWS. The planned activities will be described in detail in the Mitigation Plan.

Enhancement actions are planned for implementation in 2018 and 2019 in an approximately 35.1-acre area of the Embarras Ridge parcel as shown in Figure 1. Enhancement actions would include, but are not limited to mowing, burning, invasive species control, native tree planting to reach desired stem density and species composition as described above, and installing Brandenbark™ or other similar bat habitat structures in suitable habitat areas.

The remainder of the Embarrass Ridge parcel will be evaluated in 2018, based on criteria described in Section II below, to determine if additional enhancement activities (i.e., tree removal, girdling, Brandenbark™, surface water development, etc.), would provide mitigation benefit to the covered species in areas that lack snags or roost trees or other optimal habitat features. If sufficient acreage is not available to achieve the 165-acre mitigation requirement of the HCP, the remaining portion of the mitigation funds will be directed towards future fee or easement acquisitions and/or restoration and enhancement activities on similar lands in areas near the Embarras Ridge or Burnett parcels as described in Section II.

II. Project Evaluation Criteria

a. Protected Lands. Protected lands are lands that have been acquired in fee simple with no underlying easements, permitted uses, or mineral reservations that will materially diminish the conservation value of the land for covered bats during the term of the ITP. Land areas may qualify as protected land if a conservation easement has been recorded on the land in a manner that protects bat habitat for the term of the ITP, or if the land has been enrolled in a state program that serves to protect the land in a manner equivalent to a conservation easement for the term of the ITP.

i. Criteria for evaluation. Protected lands will be evaluated to determine if they contain existing wooded habitat that will provide adequate covered bat species habitat for the term of the ITP. If such habitat does exist, and the land is already adequately protected, the land will be excluded from consideration as mitigation land. If such habitat does not exist or the land is not adequately protected, the land will then qualify as potential mitigation land so long as specific management actions can be implemented on the land to enhance its value as covered bat habitat. Lands would be evaluated with input from

qualified professionals (e.g., Illinois Department of Natural Resources Biologist or consulting bat biologist), with USFWS making the final decision on whether habitat is sufficient or not.

ii. Specific actions for improvement. Management actions that may be undertaken on protected land include removing non-native tree species, and planting native tree species that provide roosting and foraging habitat for bats. Additional snags within the forested acres will be created by girdling/killing live trees (NRCS 2017). Also, active management of existing native forested areas to enhance tree growth through thinning of understory and planting of native plant species may encourage bat habitat enhancement.

iii. Mechanism to secure ("additionality") improvements. Prior to undertaking enhancement actions, habitat surveys will be completed on protected lands to establish baseline habitat conditions. Thereafter, enhancement actions will occur, and habitat quality will be assessed over the term of the ITP to demonstrate habitat quality improvements over baseline conditions.

b. Unprotected Lands. Unprotected lands are lands that do not meet the criteria of II.a. above. Such lands do not have the requisite ownership interests to protect them for the term of the ITP.

i. Criteria for evaluation. Ownership interests in unprotected lands will be evaluated to determine if the land contains easements or mineral reservations that may permit uses that will materially diminish covered bat conservation during the term of the ITP. If such ownership interests do not exist, or can be acquired, then conservation easements may be placed on the unprotected lands limiting potential uses of the land during the term of the ITP. Alternatively, lands may be purchased and enrolled in a state program that will provide an equivalent level of protection to that provided by a conservation easement. Lands would be evaluated with input from qualified professionals (e.g., Illinois Department of Natural Resources Biologist or consulting bat biologist), with USFWS making the final decision on whether habitat is sufficient or not.

Unprotected lands will also be evaluated to determine if they contain habitat features that will provide mitigation value for covered bat species habitat over the term of the ITP. If such lands do contain such features, protection as discussed above would be viewed as additive mitigation with regard to conservation of covered species. If such lands do not contain such habitat features, the lands will be evaluated to determine the cost of acquisition along with the cost of management actions required to enhance the land to provide conservation benefits to covered bat species. If the cost of acquisition and management actions taken together exceeds $3,000 per acre, then alternative

mitigation sites will be evaluated unless such lands are a part of a larger conservation program that will provide mitigation value for covered species over the term of the ITP.

ii. Mechanism for protection. The mechanism to protect unprotected land includes acquiring a conservation easement or other ownership interest in the land which restricts the use of the land in a manner that could materially diminish the conservation value of the land for covered bat species during the term of the ITP.

iii. Criteria/specific actions for ("additionality") improvement. Prior to the acquisition of an ownership interest in land, ownership interests in the land will be evaluated to verify the land can be acquired and protected for the term of the ITP. In addition, prior to acquiring the land, a habitat assessment will be completed to verify the land contains habitat features that will provide mitigation value for covered bat species.

Implementing Agreement for the Hoopeston Wind Farm Habitat Conservation Plan

1.0 PARTIES

This IMPLEMENTING AGREEMENT ("IA") for the Hoopeston Wind Habitat Conservation Plan ("HCP"), is entered into as of the 26th day of April, 2018, by Hoopeston Wind Energy, LLC ("Hoopeston"). Hoopeston will implement the HCP in coordination with the Illinois Department of Natural Resources ("IDNR").
Hoopeston's Renewable Energy Portfolio Manager will be designated as the Officer of Record for the HCP and this IA. Should the Officer of Record leave his or her position for any reason, an appropriate replacement will be determined in coordination with IDNR.

Officer of Record:

John Harris
Renewable Energy Portfolio Manager
Hoopeston Wind Energy, LLC
c/o 420 Alan Wood Road, 19428 Conshohocken, PA
Phone: +31 683 444 863
Email: john.harris@ikea.com

2.0 OBLIGATIONS AND SCHEDULE

Hoopeston will implement the HCP upon approval and issuance of the ITA by IDNR. Hoopeston will allocate sufficient personnel and resources to ensure effective implementation of the HCP and will fully and faithfully perform all obligations assigned to it under this IA, the ITA, and the HCP. Table 1 provides a schedule for implementation of the various conservation, mitigation, and reporting measures. Note that additional conservation measures may be implemented or the measures may be modified through adaptive management as set forth in Section 7.4 of the HCP. Copies of all monitoring and program review reports required under the HCP will be submitted to IDNR concurrent with their submission to the U.S. Fish & Wildlife Service as required under Hoopeston's federal incidental take permit.

Conservation Measures as discussed in the HCP, ITP and Mitigation Plan have been completed to date and will be completed in accordance with schedules outlined in the respective documents. Annual reports will be provided to IDNR on January 31 covering the wind project operational compliance (e.g., fatality study results), and annual reports will be provided April 30 of each year regarding mitigation plan compliance (expenditures), following each year this ITA is in effect.

3.0 FEDERAL TAKE AUTHORIZATION

Hoopeston possesses an Incidental Take Permit under Section l0(a)(l)(B) of the federal

Endangered Species Act (Permit No. TE54252C-0). The permit's effective date is October 16, 2017, with an expiration date of October 16, 2047. Hoopeston is in compliance with all other federal, State and local regulations pertinent to the proposed action and to execution of the HCP.

4.0 AUTHORITY

As an Officer of Hoopeston Wind Energy, LLC, I, John Harris, am authorized to execute this IA on behalf of Hoopeston and have the legal authority to carry out my obligations and responsibilities under this IA, the ITA, and the HCP.

Signature: _____ Date: 26 APRIL 2018

John Harris
Renewable Energy Portfolio Manager
Hoopeston Wind Energy, LLC

NATIVE ENDANGERED & THREATENED SP. HABITAT CONSERVATION PLAN
ENDANGERED & THREATENED WILDLIFE

Permit Number: TE54252C-0

Effective: 10/16/2017 Expires: 10/16/2047

Issuing Office:

Department of the Interior
U.S. FISH & WILDLIFE SERVICE
Endangered Species Permit Office
5600 American Boulevard, West, Suite 990
Bloomington, MN 55437-1458
permitsR3ES@fws.gov

DEPUTY REGIONAL DIRECTOR

Permittee:

HOOPESTON WIND, LLC
246 E. HIGH STREET
CHARLOTTESVILLE, VA 22902
U.S.A.

Name and Title of Principal Officer:
FREDERIK DE JONG - CORPORATE FINANCE MANAGER

Authority: Statutes and Regulations: 16 USC 1539(a), 16 USC 1533(d); 50 CFR 17.22, 50 CFR 17.32, 50 CFR 13.

Location where authorized activity may be conducted:
Vermilion County, Illinois

Reporting requirements:
ANNUAL REPORT DUE: 01/31
See permit conditions for reporting requirements

Authorizations and Conditions:

A. The validity of this permit is conditioned upon the prerequisite of U.S. Fish and Wildlife Service (Service) approval of the mitigation plan to be developed by Hoopeston Wind, LLC, as discussed in Section 7.2.2. of the Final Habitat Conservation Plan for the Indiana Bat and the Northern Long-Eared Bat, Hoopeston Wind Project, Vermilion County, Illinois (HCP), dated September 3, 2017. In accordance with section 7.2.2 and Appendix B of the HCP, Hoopeston Wind, LLC (Permittee) shall submit a mitigation plan to the Service within 5 months from permit issuance for review and approval by the Service.

B. General permit conditions, set out in Subpart D of 50 CFR 13, and specific conditions contained in Federal Regulations cited in Block #2 above, are hereby made a part of this permit. All activities authorized herein must be carried out in accordance with and for the purpose described in the application submitted. Continued validity, or renewal, of this permit is subject to complete and timely compliance with all applicable conditions, including the filing of all required information and reports.

C. The validity of this permit is also conditioned upon strict observance of all applicable foreign, state, local, tribal, or other federal law.

D. Valid for use by Permittee named above.

D1. Valid for use by Hoopeston Wind, LLC

E. The authorization granted by this permit is subject to full and complete compliance with, and implementation of the HCP, including the mitigation plan required in section 7.2.2 and Appendix B of the HCP, and all specific conditions in this permit. This permit, the Service-approved mitigation plan, and the HCP are binding upon the Permittee, and any authorized officer, employee, contractor, or agent conducting permitted activities. The permit terms and conditions supersede and take precedence over any inconsistent provisions in the HCP or other program documents.

F. Terms and conditions of the permit are inclusive; take resulting from any activity not specifically covered is prohibited. Please read through these conditions carefully as violations of permit terms and conditions could result in your permit being suspended or revoked. Violations of your permit terms and conditions that contribute to a violation of the Endangered Species Act of 1973, as amended (ESA) could also subject you to criminal or civil penalties.

G. Acceptance of this permit serves as evidence that the Permittee and their authorized agents understand and agree to abide by all of the terms of the permit and all sections of title 50 Code of Federal Regulations, parts 13 and 17, pertinent to issuance of incidental take permits. Section 11 of the ESA, provides for civil and criminal penalties for failure to comply with permit conditions.

H. The Permittee is responsible for implementing the terms and conditions of the HCP and the incidental take permit which includes the mitigation plan to be submitted by the Permittee in accordance with section 7.2.2 of the HCP. Failure of the Permittee to fully implement the HCP, the permit and/or the mitigation plan will result in permit revocation and/or suspension.

I. Upon locating one or more dead, injured, or sick Indiana bats or northern long-eared bats, the Permittee must apply care and disposition instructions as described in section 7.3.3 of the HCP. For circumstances not described in the HCP, or upon locating a dead, injured, or sick individual of any other endangered or threatened species, the Permittee must contact the Service's Illinois and Iowa Ecological Services Field Office for care and disposition instructions. Use extreme care when handling sick or injured individuals to ensure effective and proper treatment. Also take care in handling dead specimens to preserve biological materials in the best possible state for an analysis of cause of death. Along with the care of sick or injured endangered/threatened species, or preservation of biological materials from a dead specimen, the Permittee is responsible for ensuring that evidence intrinsic to the specimen is not unnecessarily disturbed.

J. The authority issued to the Permittee applies to all officers, directors, employees, agents, subsidiaries, contractors, and subcontractors. The Permittee is liable for any permit violations that occur by any of the persons and/or entities referenced in this paragraph or by any other persons and/or entities under the direct control of the Permittee. The Permittee shall inform all such persons and entities of the commitments and provisions in the HCP, the incidental take permit, the mitigation plan and the BBCS. The Permittee shall be responsible for supervising their compliance with those provisions and terms and conditions, and all applicable contracts between Permittee and such persons and entities, where relevant, shall require their compliance with the HCP, the mitigation plan and this permit.

K. The Permittee will be authorized under the ESA to incidentally take the federally endangered Indiana bat (*Myotis sodalis*) and federally threatened northern long-eared bat (*Myotis septentrionalis*), to the extent that such take of these species would otherwise be prohibited under section 9 of the ESA, and its implementing regulations, or pursuant to a rule promulgated under section 4(d) of the ESA. Take must occur incidental to otherwise lawful activities associated with operation of the Hoopeston Wind LLC Project as described in the HCP, and as conditioned in this permit. Activities associated with mitigation lands will also be authorized pursuant to the mitigation plan once the mitigation plan receives approval by the Service (Illinois and Iowa Ecological Services Field Office).

L. As provided in Section 7.2.2 of the HCP, the Permittee shall provide a mitigation plan for Service approval that describes the restoration, enhancement, protection and/or maintenance of mitigation lands in accordance with the Mitigation Project Criteria enclosed as Appendix B to the HCP on no less than 165 acres of land (the quantity of land identified in the HCP.)

M. A copy of this permit must be in possession of the Permittee and designated agents while conducting covered activities.

N. Unless the permit is amended, suspended, revoked, or terminated, the permit duration is 30 years from the date it becomes effective. The permit must be amended prior to the Permittee making changes to any component of the original HCP or the forthcoming mitigation plan.

O. This permit authorizes the Permittee to take up to 60 Indiana bats and 60 northern long-eared bats over the 30-year permit term, as described in section 6.4.2.3 of the HCP.

P. The Permittee shall ensure that all minimization measures and mitigation activities are carried out, as described in section 7 of the HCP.

Q. The Permittee shall ensure that all monitoring activities and reporting requirements are carried out, as described in section 7.3 of the HCP.

R. The Permittee will comply with the adaptive management processes designed for the minimization measures, as described in Section 7.4 of the HCP.

S. The Federal "No Surprises" Rule, 63 FR 8859 (February 23, 1998; codified at 50 CFR §§ 17.3, 17.22(b)(5), 17.32(b)(5)) provides assurances to the Permittee, provided that the Permittee has received final approval of the mitigation plan, and properly implemented the HCP and the permit as described in section 8 of the HCP.

T. The Permittee, within one year of permit issuance, will assure the funding needed to implement the HCP, as described in section 8.1.4 of the HCP, in a form acceptable to the Service (e.g., letter of credit, escrow account). The financial assurance will provide funds for monitoring, annual meetings, reporting, and contingencies for adaptive management and changed circumstances. The Permittee will fund an escrow account in the amount of $495,000 within 90 days after issuance of the permit to fund off-site mitigation actions. All funds deposited into the escrow account shall be used for mitigation projects identified in the

HCP and mitigation plan as outlined in Appendix B. Funds deposited into the Escrow account shall not be refunded to the Permittee unless the Permit is terminated by the Service or relinquished by the Permittee prior to the expenditure of such funds for mitigation purposes. Upon termination or relinquishment, unspent funds shall be refunded to the Permittee less any outstanding mitigation requirements for take that has already occurred. This permit condition supersedes any agreement to the contrary contained in the HCP.

U. The Permittee will enter information into the Service's Injury and Mortality Reporting System (when it becomes available) for the duration of the permit. This data entry will be additional to all other reporting requirements of the HCP and permit.

V. For the purposes of monitoring, compliance, reporting, and administration of the terms of this permit, except where otherwise specified in the HCP, the contact office for the Service shall be the Illinois and Iowa Ecological Services Field Office (see W.2. below).

W. Reports are due on January 31 following each year this permit is in effect. Copies of reports required by the HCP shall be sent to the offices listed below. When possible, electronic copies shall be submitted in lieu of hard copies in MS Word, Portable Document Format, Rich Text Format, or other file format that is compatible with the receiving office.

W.1. Regional Permits Coordinator

U.S. Fish and Wildlife Service - Region 3

Division of Ecological Services
5600 American Blvd. W., Suite 990
Bloomington, Minnesota 55437-1458 (612/713-5343;
fax 612/713-5292)
permitsR3ES@fws.gov <mailto:permitsR3ES@fws.gov>

W.2 Field Supervisor

U.S. Fish and Wildlife Service

Illinois and Iowa Ecological Services Field Office
1511 47th Ave.
Moline, Illinois 61265
(309/757-5800, x215; fax 309/757-5807)

W.3. Endangered Species Coordinator

Illinois Department of Natural Resources

Division of Natural Heritage
One Natural Resource Way Springfield, Illinois
62702-1271 (217/785-8764; fax 217/785-2438)

Mitigation Plan (USFWS Incidental Take Permit No. TE54252C-0)

Hoopeston Wind

March 1, 2018

Prepared by:

Hoopeston Wind, LLC

Contents

1 Introduction

1.1 Purpose of this Mitigation Plan

This Mitigation Plan (Plan) is proposed in order to satisfy Condition A of U.S. Fish and Wildlife Service (USFWS) Incidental Take Permit (ITP) No. TE54252C-0 (Effective 10/16/2017). The goal of the mitigation plan (Plan) is to support recovery plan-based conservation projects on approximately 165 acres of mitigation land for the Covered Species (Indiana bat and Northern long-eared bat).

In consultation with USFWS, Hoopeston Wind (Hoopeston) will work with Grand Prairie Friends (GPF), a nonprofit conservation organization, to implement the mitigation efforts described herein on the parcels shown in Figure 1. Similar measures may be implemented on additional lands for the purposes of ITP compliance, at which time the Plan will be updated.

The objectives of this Plan are to protect, enhance or restore summer habitat for Indiana and northern long-eared bats for at least the duration of the ITP.

1.2 Description of Mitigation Area

The area under consideration includes approximately 165 acres of land located in Coles County, Illinois, comprised of 4 distinct parcels owned or to be owned in fee by GPF (Figure 1). Three parcels are are located in the northern portion of the the Warbler Ridge Conservation Area, part of an extensive woodland corridor running along the Embarras River River and in the same restoration corridor. The 165 acres is comprised of current agricultural fields that will be restored to suitable habitat for the Covered Species through implementation of this Plan. Some forested areas located along the permiter of these parcels (especially field 4) could be considered if necessary. The soil types within the Plan area include Lawson silt loam (27.53%), fincastle silt loam (19.54%), Camden silt loam (18.10%), lands fine sandy loam (15.06%), ross silt loam (9.00%), xenia silt loam (6.71%), tice silty clay loam (3.56%), martinsville silt loam (0.38%), and senachwine silt loam (0.12%). The topography of the properties is flat to gently sloping. Each parcel is shown in more detail in Figures 2 and 3.

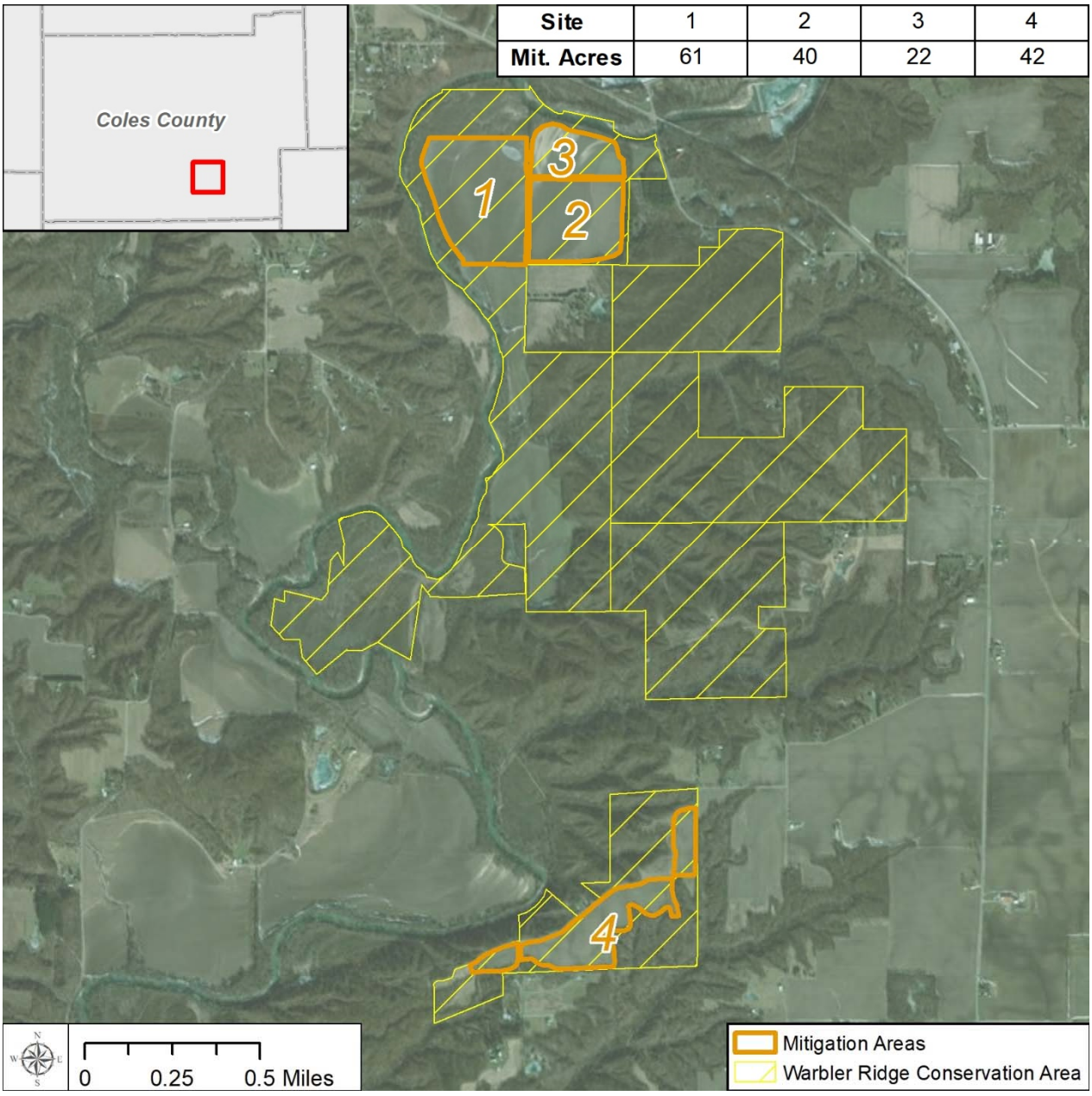


Figure 1. Mitigation Areas

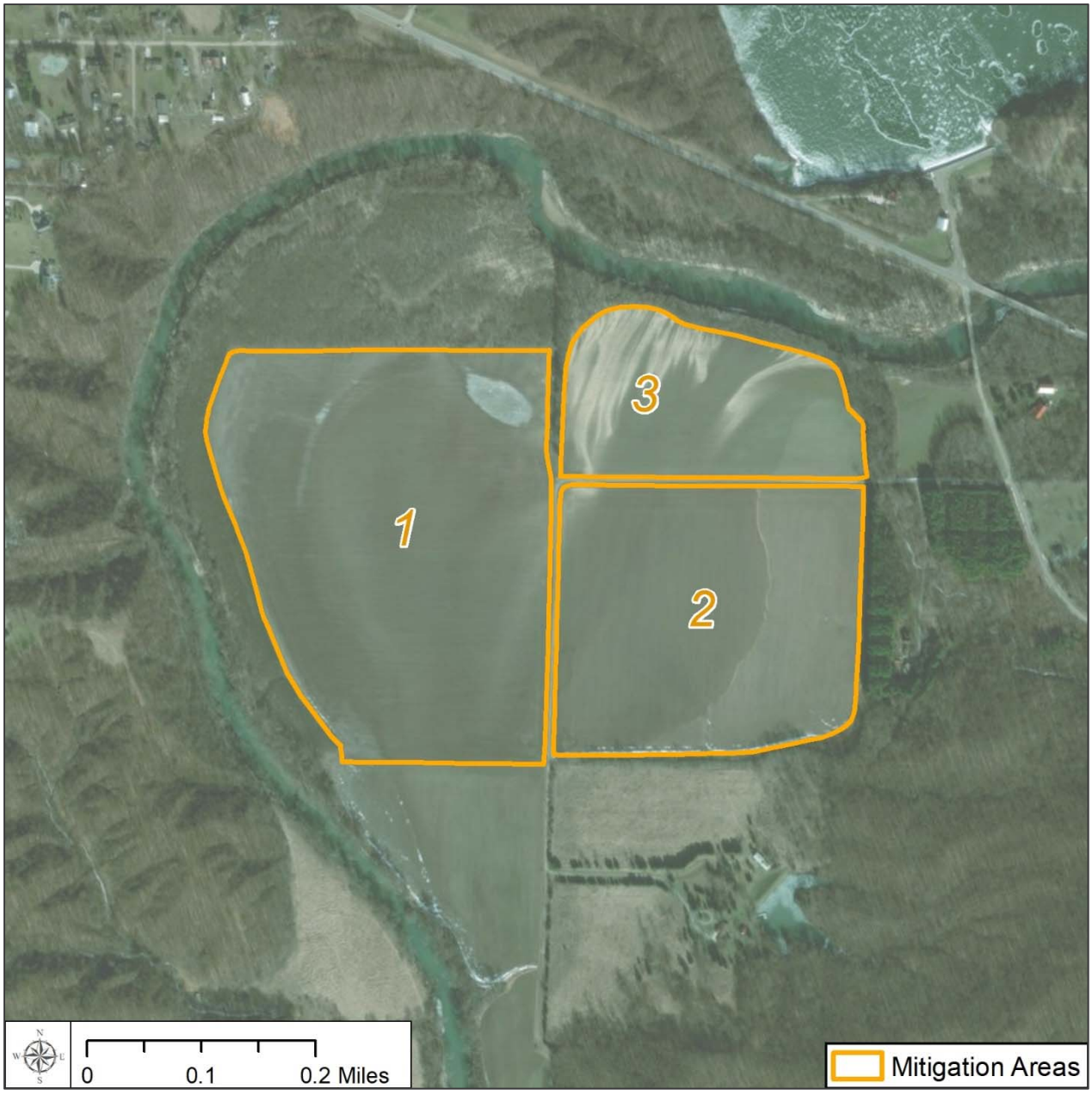


Figure 2. Mitigation Areas 1-3

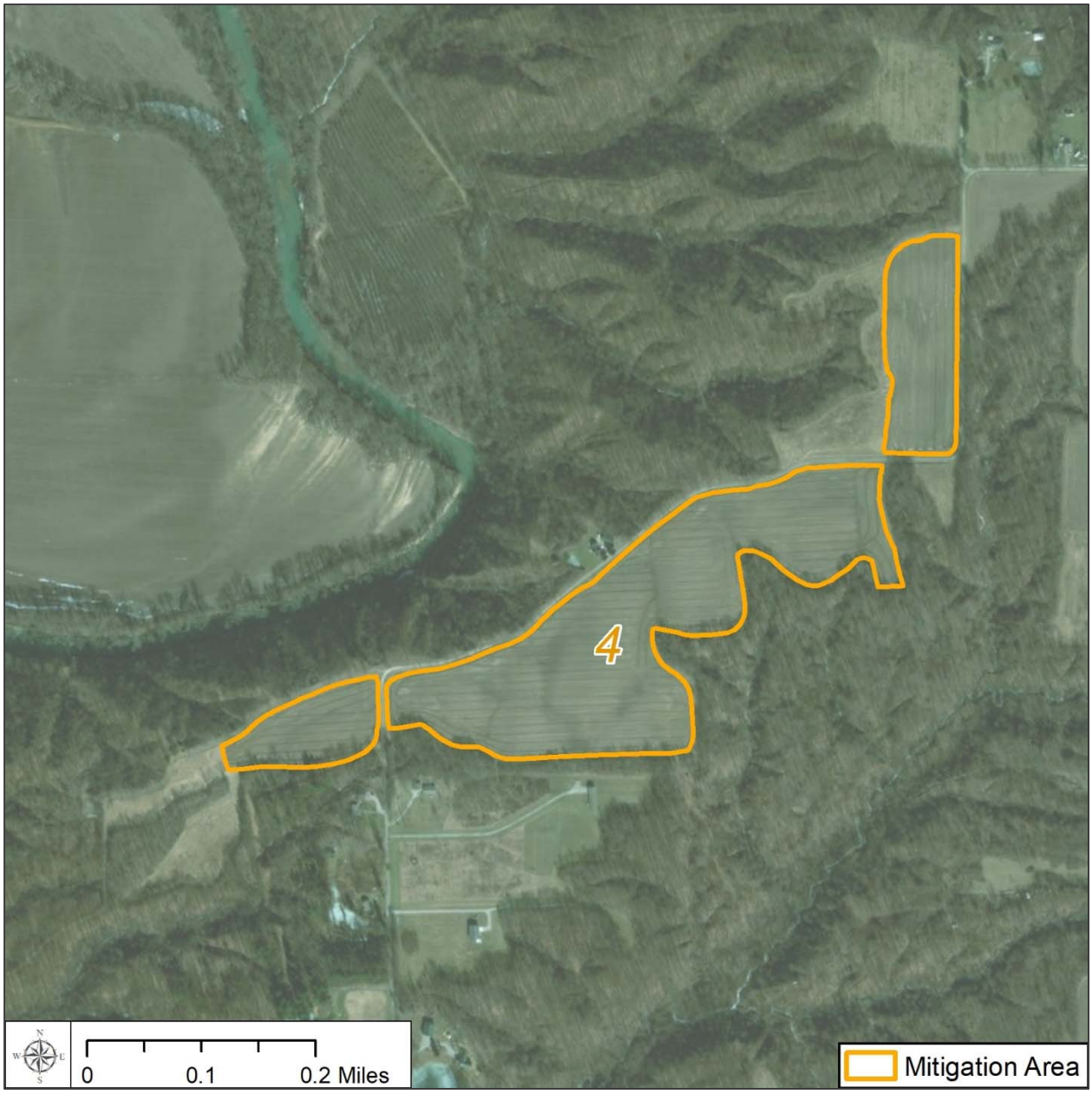


Figure 3. Mitigation Area 4

Based on the 2011 National Land Cover Dataset (NLCD; U.S. Geological Survey [USGS], 2011), habitats within the mitigation parcels include cultivated crops (90.31%), developed open space (7.52%), deciduous forest (2.16%), and woody wetlands (0.004). (Figure 4); therefore, protection and enhancement of the forested habitats and protection, restoration and enhancement of the currently tilled agricultural lands, will substantially improve the lands for summer use and productivity by the Covered Species and meet the requirements for compliance with the ITP.

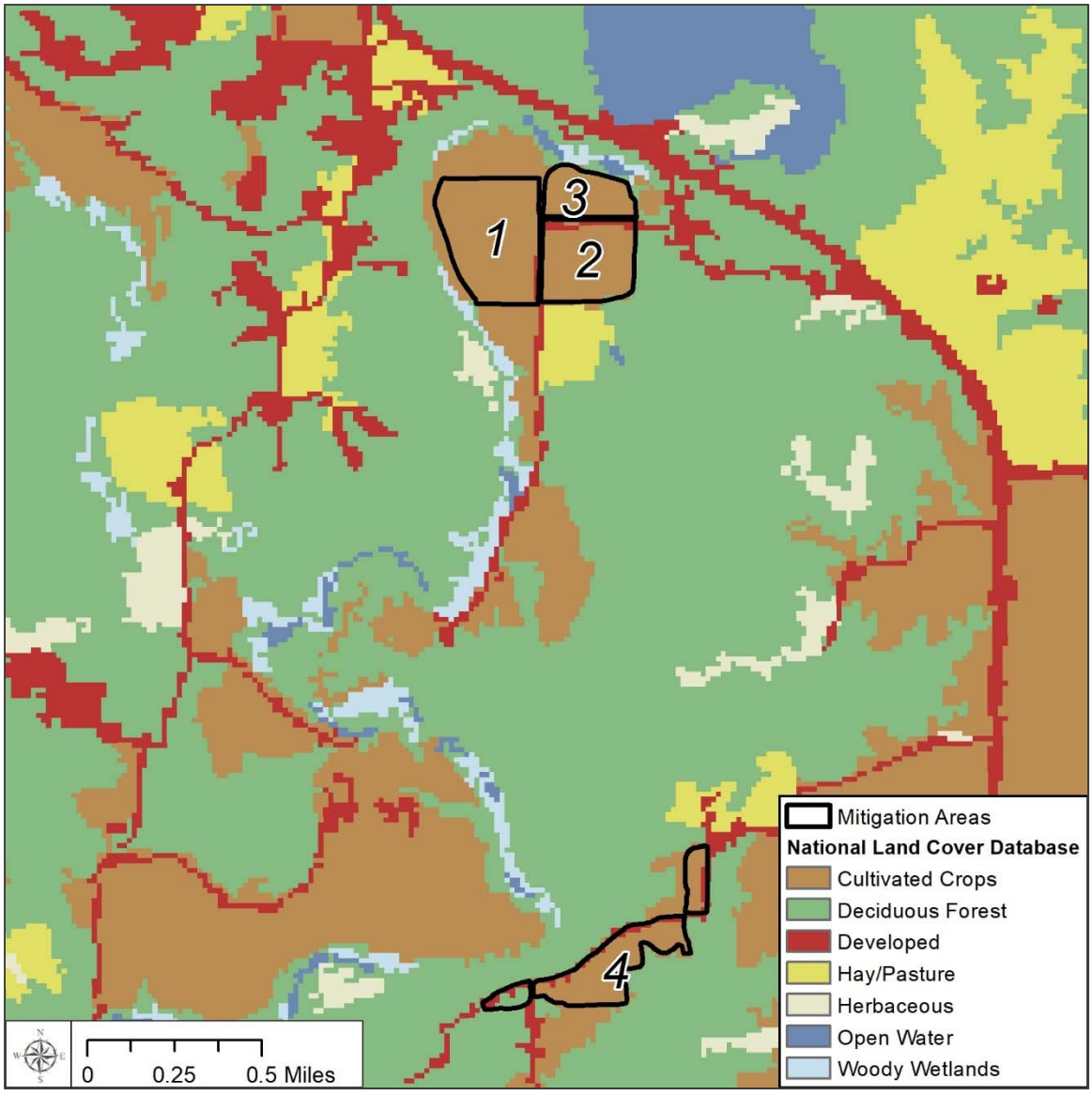


Figure 4. National Land Cover Database (2011)

1.3 Contractor Selection

Hoopeston will work with GPF to identify potential contractors capable of completing the work outlined in this Plan once it is approved by USFWS. GPF will manage the contractor chosen to implement land management actions. A site visit will be conducted with potential contractors prior to selection of a final contractor, if necessary. This Plan may be revised pending information provided by the chosen contractor and with approval from the USFWS.

1.4 Land Protection

The mitigation lands are or will be owned by GPF in fee simple. Project mitigation funds may be used for GPF to enroll the lands in the Land and Water Reserve (LWR) with the Nature Preserve Commission[1] for protection in perpetuity, or to implement other mechanisms to ensure protection and management of the lands in accordance with this Plan for the duration of the ITP. It is GPF's intention to enroll these parcels in LWR. GPF will work with Illinois Nature Preserves Commission and USFWS to determine timing for enrollment.

2 Planting Plan

Hoopeston consulted with Shane McDearmon, Illinois Department of Natural Resources District Forester, to evaluate soil types and suitable tree species and planting plans that will allow planted trees to grow into suitable habitat for the Covered Species. Additionally, GPF provided input on tree species that are suitable to generate habitat for the Covered Species. Such trees will be planted and managed in accordance with this Plan. Some species may be added and not all species listed may be planted, but the vast majority of the planting will come from these species and any modifications to the species list would be developed in coordination with and approved by USFWS (Table 1).

Before trees are planted, Virginia Wild Rye will be planted at a density of 20 pounds/acre. The purpose of this planting is to prevent erosion, improve soil's physical and biological properties, supply nutrients, suppress weeds, improve the availability of soil water, and break pest cycles[2]. Seedlings and saplings will be planted as described in Table 1. To give the area a more natural appearance, all tree species will be randomly mixed together prior to planting. Each agricultural field has been assigned a number for reference and reporting (Figure 1).

Table 1. Trees proposed for planting in each soil type.

Site #	Acres Avail. For Mitigation	Soil Types	Soil Names	Tree Species	Trees/acre
1	61	3304A 3451A 3073A 7373B	Landes fine sandy loam Lawson silt loam Ross silt loam Camden silt loam	Overcup oak (*Quercus lyrata*) Pecan (*Carya illinoinensis*) Pin oak (*Q.palustris*) Swamp white oak (*Q. bicolor*) Bur oak (*Q. macrocarpa*)	450 bare root or 150 rpm

[1] Illinois Department of Natural Resources, https://www.dnr.illinois.gov/inpc/pages/default.aspx
[2] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/climatechange/?cid=stelprdb1077238

2	40	3304A 3451A 7373B	Landes fine sandy loam Lawson silt loam Camden silt loam	Swamp white oak Bur oak Shumard's oak (*Q. shumardii*) Shagbark hickory (*C. ovata*) Pecan Overcup oak Pin oak	450 bare root or150 rpm
3	22	3304A 3451A 7373B 3284A 7570B 618C2	Landes fine sandy loam Lawson silt loam Camden silt loam Tice silty clay loam Martinsville silt loam Senachwine silt loam	Chinquapin oak (*Q. muehlenbergii*) Bur oak Cherrybark oak (*Q .pagoda*) Northern red oak (*Q. rubra*) Bitternut hickory (*C. cordiformis*) Shagbark hickory American basswood (*Tilia americana*) Persimmon (*Diospyros virginiana*)	450 bare root or150 rpm
4	42	291B 496A	Xenia silt loam Fincastle silt loam	Swamp white oak Bur oak Shumard's oak Cherrybark oak Shagbark hickory Pecan Overcup oak	450 bare root or150 rpm

2.1 Seedling and Sapling Stock Sources

GPF will coordinate with the chosen contractor to procure seedlings and saplings based on cost and availability. GPF may elect to include saplings grown using the Root Production Method® (RPM), developed by Forest Keeling Nursery in Missouri. RPM is a multistep production system of container tree production that places primary emphasis on the root system[3]. GPF intends to use Forest Keeling or an equivalent nursery for RPM trees.

2.2 Care of Seedlings and Saplings

Seedlings and saplings will be cared for as follows prior to planting:

- Containers will not be opened until time for planting.
- Seedlings may be stored in package for up to one week, if kept unopened, and in a cool dry place.
- If planting is delayed for more than one week, cold storage (32-40 degrees F) will be used for the seedlings until they are planted.
- Seedlings will not be watered until just before planting. Too much water (or heat) will encourage mold.

[3] https://www.fs.fed.us/rm/pubs/rmrs_p024/rmrs_p024_020_021.pdf

- While planting, roots will be kept moist and out of direct sunlight.
- RPM trees come as potted plants and may be stored longer prior to planting.
- Seedlings should be in the ground by May 15th.

RPM® saplings will be cared for as specified by Forest Keeling.

2.3 Planting Method

This project can be planted using a planting machine on loan from the Coles County Natural Resources Conservation Service office or District Forestry Office. Other planting options proposed by the contractor will also be evaluated.

RPM® seedlings will be planted as specified by the developer's specifications, typical of root ball type of plantings..

2.3.1 Planting Standards and Specifications

PLANTING

Depth: Seedlings and saplings are to be planted at the same depth as grown at the nursery. In soils rated moderately well drained or better, plant trees up to 1" deeper than the nursery soil line. The nursery soil line can be distinguished by a color change on the root collar. Seedlings and saplings should not be sunk in a hole or raised in a mound. At no time should a seedling or sapling be planted with its roots exposed.

Root Pruning: Field pruning of hardwood stock must leave a minimum 8" root length. Field pruning of conifer stock must leave a minimum 6" root length. No root pruning is required for RPM trees.

Firmness: Soil around a seedling or sapling's roots must be packed firmly to eliminate air pockets. A properly planted seedling or sapling should be able to withstand a moderate tug with the thumb and index finger while remaining firmly in place.

Root Position: During planting, seedling or sapling roots must not be bunched, curled, doubled (formed into a "J"), twisted, or flatted into a plane (formed into an "L"). All roots should be pointing in a downwards direction.

Crown Position: The seedling or sapling should be planted and managed in such a way that the top (crown/stem) is in an upright position. This position should be nearly perpendicular to the ground below. Hardwoods are not to lean greater than 20 degrees off center.

PLANTING STOCK SPECIFICATIONS

At least 80% of the hardwood stock must be in the 12 to 18 inch size range for bare root trees. The minimum acceptable root length must be 8". The height requirement can be waived if the seedlings meet or exceed a caliper of 7/32". RPM trees are typically available in 5 gallon pots and may be specified as conservation grade. Any variations must be approved in writing by the USFWS. A minimum of 25% RPM trees will be planted in certain soil types that are prone to flooding as a means of trying to improve survivability if flooding occurs, with such areas identified as agreed upon with USFWS.

IMPLEMENTATION SCHEDULE

March-December 2018; Year 1:

- Spring-Fall: Farm all fields in 2018 season
- June 1: GPF Initial Scope of Work and Budget due to Hoopeston
- April-June: Contractor on-site interview, research, obtain quotes
- April-September: Plant/Tree/Branden bark/ tree accessory vendor research, quotes, order
- April-September: Install Branden bark, locations tbd
- April-September: Consultation NRCS/ DNR Forestry Seed & Tree Species Consultation
- April 30: GPF Conservation Report due to U.S. FWS and IDNR (progress, plans, finance)
- April-October: Fields #1, #2, #3, #4: Invasive removal in perimeter of all fields
- May-September: Fields #1, #2, #3: Mow/manage perimeter access corridor
- October: Field #1: Post- harvest, plant cover crop (60 acres; Rye spp.)
- November: Field #1: Post- harvest, install wetland (10 acres)
- December 31: GPF Annual Report of Mitigation Work submitted to Hoopeston for Review
- December 31: GPF Annual Hoopeston Account Activity Report to Hoopeston for Review
- December 31: 2019 GPF Proposed Project, Scope of Work and Budget submitted to Hoopeston for Review

- **January-December 2019; Year 2:**
- January 31: Hoopeston Comments Due to GPF on Annual Report Modifications
- February 28: Hoopeston Comments Due to GPF on 2019 Projects/ Scope of Work
- Spring-Fall: Fields #2, #3, #4: Farm fields
- Spring: Field #1: RPM Tree Planting
- Spring: Field #1: Wetland seeding
- April-June: Contractor on-site interview, research, obtain quotes
- April-September: Plant/ Tree/Branden bark/ tree accessory vendor research, quotes, order
- April-September: Install/maintain Branden bark, (locations TBD)
- April-September: Consultation NRCS/ DNR Forestry Seed & Tree Species Consultation
- April 30: GPF Conservation Report due to U.S. FWS and IDNR (progress, plans, finance)
- Spring-Fall: Field #1: Maintenance/spray/mowing
- Fall: Fields #2 & #3: Plant cover crop
- December 31: GPF Annual Report of Mitigation Work submitted to Hoopeston for Review
- December 31: GPF Annual Hoopeston Account Activity Report to Hoopeston for Review
- December 31: 2019 GPF Proposed Project, Scope of Work and Budget submitted to Hoopeston for Review

January-December 2020; Year 3:

- Spring: Fields #2 & #3: RPM tree Planting
- Spring: Fields #2 & #3: Plant pollinator strips along perimeter
- April-June: Contractor on-site interview, research, obtain quotes
- April-September: Plant/ Tree/Branden bark/ tree accessory vendor research, quotes, order

- April-September: Install/maintain Branden bark, (locations TBD)
- April-September: Consultation NRCS/ DNR Forestry Seed & Tree Species Consultation
- April 30: GPF Conservation Report due to U.S. FWS and IDNR (progress, plans, finance)
- Spring- Fall: Field #1:Maintenance of previous RPM tree planting/spray/mowing/ replant as necessary
- Spring-Fall: Field #2 & #3: Invasive/spraying/mowing maintenance
- Spring-Fall: Field #4: Continue to actively farm
- Fall: Field #4: Plant cover crop
- December 31: GPF Annual Report of Mitigation Work submitted to Hoopeston for Review
- December 31: GPF Annual Hoopeston Account Activity Report to Hoopeston for Review
- December 31: 2019 GPF Proposed Project, Scope of Work and Budget submitted to Hoopeston for Review

January-December 2021; Year 4:

RPM tree planting will have been accomplished at all four sites; 165 acres in this year

- Spring: Field #4: RPM tree planting
- Spring: Field #4: Plant pollinator strips along perimeter
- April-June: Contractor on-site interview, research, obtain quotes
- April-September: Plant/ Tree/Branden bark/ tree accessory vendor research, quotes, order
- April-September: Install/maintain Branden bark, (locations TBD)
- April-September: Consultation NRCS/ DNR Forestry Seed & Tree Species Consultation
- April 30: GPF Conservation Report due to U.S. FWS and IDNR (progress, plans, finance
- Spring-Fall: Field #1, #2, #3: Previous RPM tree planting maintenance/spray/mowing/ replants necessary
- Spring-Fall: Field #4: Invasive/spraying/mowing maintenance of new RPMs
- Spring-Fall: All Fields: Invasive management
- December 31: GPF Annual Report of Mitigation Work submitted to Hoopeston for Review
- December 31: GPF Annual Hoopeston Account Activity Report to Hoopeston for Review
- December 31: 2019 GPF Proposed Project, Scope of Work and Budget submitted to Hoopeston for Review

2022-Forward; Year 5-30; All Fields

- Spring-Fall: Replant as necessary
- Spring-Fall: Maintenance in all fields (mowing, spraying, etc.)oSpring-Fall: All Fields: Invasive management
- Spring-Fall: Plantings will be pruned and thinned as appropriate
- April-June: Contractor on-site interview, research, obtain quotes
- April-September: Plant/ Tree/Branden bark/ tree accessory vendor research, quotes, order
- April-September: Install/maintain Branden bark, (locations TBD)
- April-September: Consultation NRCS/ DNR Forestry Seed & Tree Species Consultation
- April 30: GPF Conservation Report due to U.S. FWS and IDNR (progress, plans, finance
- December 31: GPF Annual Report of Mitigation Work submitted to Hoopeston for

Review
- December 31: GPF Annual Hoopeston Account Activity Report to Hoopeston for Review
- December 31: 2019 GPF Proposed Project, Scope of Work and Budget submitted to Hoopeston for Review

2.5 Ongoing Management

It may be necessary to thin trees from the tree planting area to ensure and promote the growth of the planted seedlings. Information specific to thinning and other ongoing management will be provided for USFWS consideration and approval in the annual report as required by Condition Q of the ITP, as described in section 7.3 of the Habitat Conservation Plan for the mitigation lands.

2.6 Protection

Reasonable precautions will be taken to protect planted trees from browsing damage from wildlife, insects and disease attacks. If damage is detected during routine monitoring, more aggressive techniques may be implemented to enhance probability of survival.

3 Bat Habitat Enhancement

The installation of habitat enhancement features may be implemented in the existing forested areas near the perimeter of all mitigation sites. GPF may consider placing and maintaining habitat enhancement features such as BrandenBark©[4], an artificial bark, throughout the Warbler Ridge Conservation Area in areas deemed acceptable to USFWS. Placement of habitat enhancement features in existing forested areas would allow mitigation activities within 2018 while the agricultural lands continue to be farmed.

Per recommendations from the developer of BrandenBark©, these artificial roosts will be installed on untreated utility poles approximately 25 feet tall with 12 inch diameter butts. Installation procedures will follow the guidance provided by the developer. The artificial roosts will be installed in areas with high levels of solar exposure, close to the forest edge (approximately 20 feet), and in areas in close proximity to water, if possible. The artificial roosts will be installed in clusters of three to four at a density of 1 cluster per 40 acres.

Invasive tree species, such as amur honesuckle (*Lonicera maackii*), Japanese honeysuckle (*Lonicera japonica*), and autumn olive (*Elaeagnus umbellate*) will be controlled in these areas via girdling or removal so as to promote growth of species likely to be used for roosting by the covered species in the future.

4 Wetland Restoration & Pollinator Planting

In order to integrate the mitigation area into GPF's overall Warbler Ridge Conservation Area, GPF also seeks to implement wetland restoration and pollinator planting practices in small areas of these mitigation lands as a part of mitigation activities. A several acre wetland area is proposed in the northeast corner of Field 1 generally where standing water is shown in Figure 2,

[4] http://copperheadconsulting.com/brandenbark/

and narrow areas of pollinator habitats are proposed along the northern edge of Field 2 and southern edge of Field 3. These practices will promote a healthy and diverse local ecosystem for Covered Species.

5 Success Criteria and Reporting

5.1 Reporting

GPF will provide conservation reports on an annual basis that summarize work completed to date, describe the results of monitoring to evaluate Plan success, and propose planned actions for future years to be considered and approved by USFWS prior to implementation. This report will be prepared and submitted to USFWS and IDNR by April 30 of each year and will include detailed expenditures made for mitigation purposes during the preceding calendar year, the current balance of Mitigation Funds, and the planned spend to be used in the forthcoming year.

5.2 Success Criteria

Initial planting and forest management will be completed during the first 3 years as described above for sufficient acreage to meet the requirements of the ITP. Success for all areas will be considered achieved if in Year Ten, the following criteria are met:

- ~50% survival of bare root plantings
- ~85% survival (or replanting) of RPM® plantings

Additional trees will be planted when necessary to maintain a minimum of 100 trees per acre of desired species in order to provide adequate suitable habitat for covered species.

7 Mitigation Fund Information

A percentage of funds from the Mitigation Fund may be reserved for use in the case of a natural disaster such as flood or drought. Approval for the use of such funds will be requested from USFWS on a case-by-case basis if an unforeseen event occurs during the duration of the ITP.

8 Document Approval

This Mitigation Plan has been reviewed by and the information presented herein is acceptable to:

Signature: _____ Date: 16-03-2018

Full Name: William Molda

On behalf of Hoopeston Wind LLC

AND

Signature: _____ Date: 3-16-2018

Full Name: David Easter

On behalf of Grand Prairie Friends

AND

Signature: _____ Date: 3/13/18

Full Name: Craig McPeek

On behalf of the U.S. Fish and Wildlife Service