Appendix D Bird and Bat Conservation Strategy – Fowler Ridge Wind Farm

FINAL

BIRD AND BAT CONSERVATION STRATEGY
FOWLER RIDGE WIND FARM

Benton County, Indiana

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1.0 INTRODUCTION

Fowler Ridge Wind Farm LLC, Fowler Ridge Wind Farm II LLC, Fowler Ridge Wind Farm III LLC, and Fowler Ridge Wind Farm IV LLC are collectively called Fowler Ridge Wind Farm (FRWF). FRWF is developing, constructing, and operating the Fowler Ridge Wind Farm (Project) in Benton County, Indiana (Figure 1). The Project is planned to have a total build out capacity of 750 MW. The first three phases of the Project are currently operational, with a total capacity of 600 MW. Construction on Phase IV is expected to begin in 2013 and include an additional 150 MW of clean, renewable energy.

1.1 PURPOSE OF THE AVIAN AND BAT PROTECTION PLAN

Wind energy is one of the fastest growing sources of renewable energy in the United States and is the most economically competitive form of renewable energy (AWEA 2008). However, construction, operation, and decommissioning of wind energy projects has the potential to impact bird and bat populations through habitat fragmentation, displacement, and mortality due to collisions with Wind Turbine Generator (WTG) blades (NWCC 2010). FRWF has developed this Bird and Bat Conservation Strategy (BBCS) in a good faith effort to avoid and reduce potential impacts to birds and bats at the Project. The FRWF BBCS is based on the July 2010 draft "Considerations for Avian and Bat Protection Plans, U.S. Fish and Wildlife Service White Paper" prepared by the U.S. Fish and Wildlife Service (USFWS or the Service) (USFWS 2010) and demonstrates FRWF's adherence to the USFWS Land-Based Wind Energy Guidelines (USFWS 2012a). This BBCS will be in effect through the life of the Project as a working document.

The main goals of the FRWF BBCS are to:

- Describe measures to avoid and reduce potential impacts to birds and bats during development, construction, operations and maintenance, and decommissioning of the Project;
- Ensure the potential for impacts to protected and sensitive bird and bat species is reduced; and
- Develop effective post-construction monitoring and adaptive management procedures to guide management actions for the life of the Project.

1.2 REGULATORY FRAMEWORK

1.2.1 Federal

Endangered Species Act

The federal Endangered Species Act (ESA) of 1973 (16 U.S.C. §§ 1531 *et seq*.) provides for the listing, conservation, and recovery of endangered species. Section 9 of the ESA prohibits the take of any endangered or threatened species of fish or wildlife listed under the ESA. Under the ESA, the term "take" is defined to mean "*…to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect*" species listed as endangered or threatened, or to attempt to engage in any such conduct. The siting, design, and operation components of the Project incorporate measures to ensure the potential for impacts to ESA-listed bird species is reduced; these measures are described in this BBCS.

FRWF is currently developing a Habitat Conservation Plan (HCP; FRWF 2013) and working to obtain an Incidental Take (Section 10(a)1(B)) Permit (ITP) for the Indiana bat (*Myotis sodalis*), based on the recommendations of Region 3 of the Service (Pruitt 2011, February 24, 2010 meeting minutes summary). FRWF was issued a two-year Scientific Research and Recovery

Permit for the Indiana bat (TE 15075A) by USFWS Region 3 to help build a better scientific basis for the potential minimization measures for HCP development.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA, 16 U.S.C. §§ 703-712) prohibits the taking, killing, injuring, or capture of listed migratory birds. Neither the MBTA nor its implementing regulations found in 50 Code of Federal Regulations [CFR] Part 21 provide for the permitting of "incidental take" of migratory birds that may be killed or injured by wind turbines. To avoid and reduce potential impacts to species protected under the MBTA at the Project, FRWF will implement this BBCS throughout the life of the Project. This BBCS incorporates the results of pre-construction avian habitat and use surveys within the Project area, patterns of bird mortality reported at other wind energy facilities in the Midwest, and recommendations obtained through consultation with the Service and the Indiana Department of Natural Resources (IDNR) for reducing impacts to birds. Avoidance and minimization measures for reducing impacts to MBTA-listed species at FRWF were developed based on these data and are described in this BBCS.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act of 1940 (50 CFR 22.26), and its implementing regulations, provides 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, or 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."

The Service published a final rule (Eagle Permit Rule) on September 11, 2009 under BGEPA authorizing limited issuance of permits to take bald eagles and golden eagles ''for the protection of . . .other interests in any particular locality'' where the take is compatible with the preservation of the bald eagle and the golden eagle, is associated with and not the purpose of an otherwise lawful activity, and cannot practicably be avoided (FR 46836-46879).

On May 2nd, 2013, the Service announced the availability of the Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2[1] (FR 10387) (the "Guidance"). The Guidance provides a means of compliance with the BGEPA by providing recommendations and in-depth guidance for:

- Conducting early pre-construction assessments to identify important eagle use areas;
- Avoiding, minimizing, and/or compensating for potential adverse effects to eagles; and
- Monitoring for impacts to eagles during construction and operation.

The Guidance interprets and clarifies the permit requirements in the regulations at 50 CFR 22.26 and 22.27, and does not impose any binding requirements beyond those specified in the regulations. As for other MBTA-listed species, this BBCS incorporates site-specific, regional, and agency information and measures developed based on this information to avoid and reduce impacts to bald and golden eagles at the Project.

[1] http://www.fws.gov/windenergy/PDF/Eagle%20Conservation%20Plan%20Guidance-Module%201.pdf

1.2.2 State

The IDNR maintains a list of state endangered, threatened, rare, extirpated, special concern, significant, and watch-list wildlife and plant species. Under IC 14-22-34, the Wildlife Diversity Section of the IDNR is responsible for developing "programs designed to ensure the continued ability of nongame species in need of management to self-perpetuate successfully." The Indiana Nongame Fund was established by state legislature in 1982 to support these programs. This BBCS addresses measures to reduce impacts to state-listed bird and bat species from the Project.

FRWF has received a State Endangered Species ITP (Appendix A) from the IDNR Division of Fish and Wildlife for the evening bat (*Nycticeius humeralis*). The renewable permit was issued June 18, 2011 and will expire June 30, 2016. FRWF is required to monitor wind turbine sites for bat fatalities for the duration of the permit, and report any mortalities or suspected mortalities of evening bats to the IDNR within 24 hours of discovery.

1.3 COORDINATION WITH USFWS AND IDNR

Prior to Project construction, FRWF informally consulted with the Service and IDNR to discuss potential wildlife concerns. FRWF initiated agency consultation in 2006 by submitting data requests to the Service and IDNR regarding protected and high-quality biological resources within the Project area. In a response letter dated October 13, 2006, the Service identified the Project as within the range of a non-essential, experimental population of whooping cranes (*Grus americana*). A risk assessment for whooping cranes conducted in 2007 found the risk of impacts to the population to be low (Johnson and Tidhar 2007). The Service also noted that while there are no records for bald eagles in Benton County, two bald eagle nests are present in Tippecanoe County and one nest is present in Newton County; the Service did not indicate concern that the Project transmission line would impact either eagle nest in Tippecanoe County (USFWS letter addressed to Victoria Poulton, WEST, Inc., dated October 13, 2006).

Consultation with the Service identified the American golden-plover (*Pluvialis dominica*; AMGP), a migratory shorebird and U.S. Shorebird Conservation Plan species of high concern, as the primary avian concern for FRWF due to the proximity of the Project to the Benton County IBA and heavy use of the IBA as a staging ground by migrating AMGP (Pruitt 2007). FRWF attended and participated in a meeting with representatives of the Service, IDNR, the National Audubon Society, and Western EcoSystems Technologies (WEST) on June 13, 2007. The main focus of this meeting was to discuss the AMGP. The Service prepared a follow-up letter after this meeting, which stated that the major concerns for golden-plovers within the Project area are avoidance of tall structures, habitat loss and fragmentation, and strike mortality. The letter included a list of recommendations, developed during a conference call between the Service, IDNR, Illinois Natural History Survey, and the National Audubon Society on August 3, 2007, which were intended to provide a range of options for protection of the migrating golden-plover population within the Project area. The Service stated that as many of these recommendations as possible should be implemented (USFWS letter addressed to Rene Braud, BP Alternative Energy, dated September 10, 2007). These recommendations discussed timing, geography, design, monitoring, and mitigation.. In addition to phased Project development, AMGP concerns were addressed through three years of AMGP use and behavior surveys, described in Section 3.2.2. These surveys determined that AMGP may not be at significant risk of collisions with turbines, due to the majority of observed flying time being below the rotor-swept area and the lack of AMGP observed near newly-constructed turbines in 2009 (Johnson et al. 2009). Additionally, no AMGP fatalities have been found during the intensive post-construction mortality studies at Phase I, II, or III turbines.

The Service also documented in their September 2007 letter (Pruitt 2007) that there were no anticipated impacts to the bald eagle from the Project, based on the location of the Project site and the distribution of eagles in the area (USFWS letter addressed to Rene Braud, BP Alternative Energy). An eagle use assessment conducted in summer 2011 also concluded that risk to eagles at the FRWF is low, based on very limited foraging and nesting opportunities for eagles within the Project area, known eagle distributions, and survey results indicating low use of the Project area by eagles (Good and Simon 2011). Although the Service has mapped a spring and fall raptor migration route along the Indiana and Illinois border, the Service does not specify if the corridor is utilized by eagles. Survey results indicate low use of the Project area by migrating eagles and moderate use by other raptors (Good and Simon 2011).

IDNR responded to FRWF's data request in a letter dated September 22, 2006. IDNR listed records of occurrence in or near the Project area for six of the seven bird species listed by IDNR as endangered, threatened, or rare in Benton County. Each of these species was assessed for impacts from the Project; habitat for these species was found to be of marginal quality in the Project area (see Table 3.2 in Section 3.1). None of these species were found during carcass searches in 2009, 2010, or 2011 (see Section 3.3). IDNR also identified five Gamebird Habitat Areas (GHA) within the Project area (IDNR letter addressed to Victoria Poulton, WEST, Inc., dated September 22, 2006). IDNR staff originally recommended that no turbines be constructed within one mile (1.6 km) of any GHA (IDNR Early Coordination/Environmental Assessment dated December 11, 2006); follow-up conversations with IDNR identified that the one-mile (1.6-km) setback recommendation was drafted by a staff member who was no longer with the agency and the rationale for the recommendation was not readily apparent to IDNR representatives at a June 2007 meeting (Fowler Ridge II Wind Farm, LLC 2009). IDNR also recommended that Project siting avoid placing infrastructure within Parish Grove, the last intact pre-settlement forest grove in Benton County (IDNR Early Coordination/Environmental Assessment dated December 11, 2006). These areas were avoided during siting of Phase I-III turbines, and will be avoided during siting of Phase IV turbines as well.

Finally, the Service stated in their September 2007 letter (Pruitt 2007), that there was very little habitat for the Indiana bat within the Project area. However, the Service stated that there may be more extensive habitat along the power line transmission route, as there are several summer records of Indiana bats in Tippecanoe and Warren Counties, along Mud Pine Creek, Big Pine Creek, and Little Pine Creek. Of these areas, the Service was most concerned about Big Pine Creek (Pruitt 2007). Additionally, it was noted in an October 13, 2006 letter from the Service that spring and fall migration routes for Indiana bats could include areas of Benton County (Pruitt 2006).

The closest known Indiana bat hibernacula are located in Greene and Monroe Counties in southern Indiana and in LaSalle County, Illinois (USFWS 2007). Based on known migration distances, it is possible that Indiana bats from caves within a 350-mile (560-km) radius could travel through the Project area. Although there are no known maternity colonies in Benton County, maternity colonies have been documented in five of the seven counties which border Benton County (USFWS 2007). There is therefore a potential for migrating/dispersing Indiana bats to occur at the Project area. However, pre-and post-construction acoustic and mortality surveys conducted within the Project area indicate that late summer mating, seasonal swarming, and concentrated fall migration events do not occur in the Project area. There is no designated critical habitat for the Indiana bat in the Project area (USFWS 2007).

The Service has concluded, based on spring bat mortality studies conducted at FRWF in 2009, 2010, and 2011, that operation of the Project during spring migration is not likely to result in the mortality of Indiana bats. Consequently, the Service indicated that an ITP is not necessary for operation of the Project during the spring bat migration period (Pruitt 2011). Fall bat mortality

studies at the FRWF verified that Indiana bats are taken at the Project during the fall migration period and the Service recommended that FRWF complete an HCP and obtain an ITP for Indiana bats to provide ESA coverage for Project operation during the fall (Pruitt 2011).

Fall bat mortality studies at the FRWF also verified that state-listed evening bats are taken at the Project during the fall migration period. FRWF has obtained a State Endangered Species ITP from the IDNR to provide coverage for Project operation during the fall.

All USFWS and IDNR recommendations incorporated into the siting, design, and operation processes of the Project are described in Section 4.3 of this BBCS.

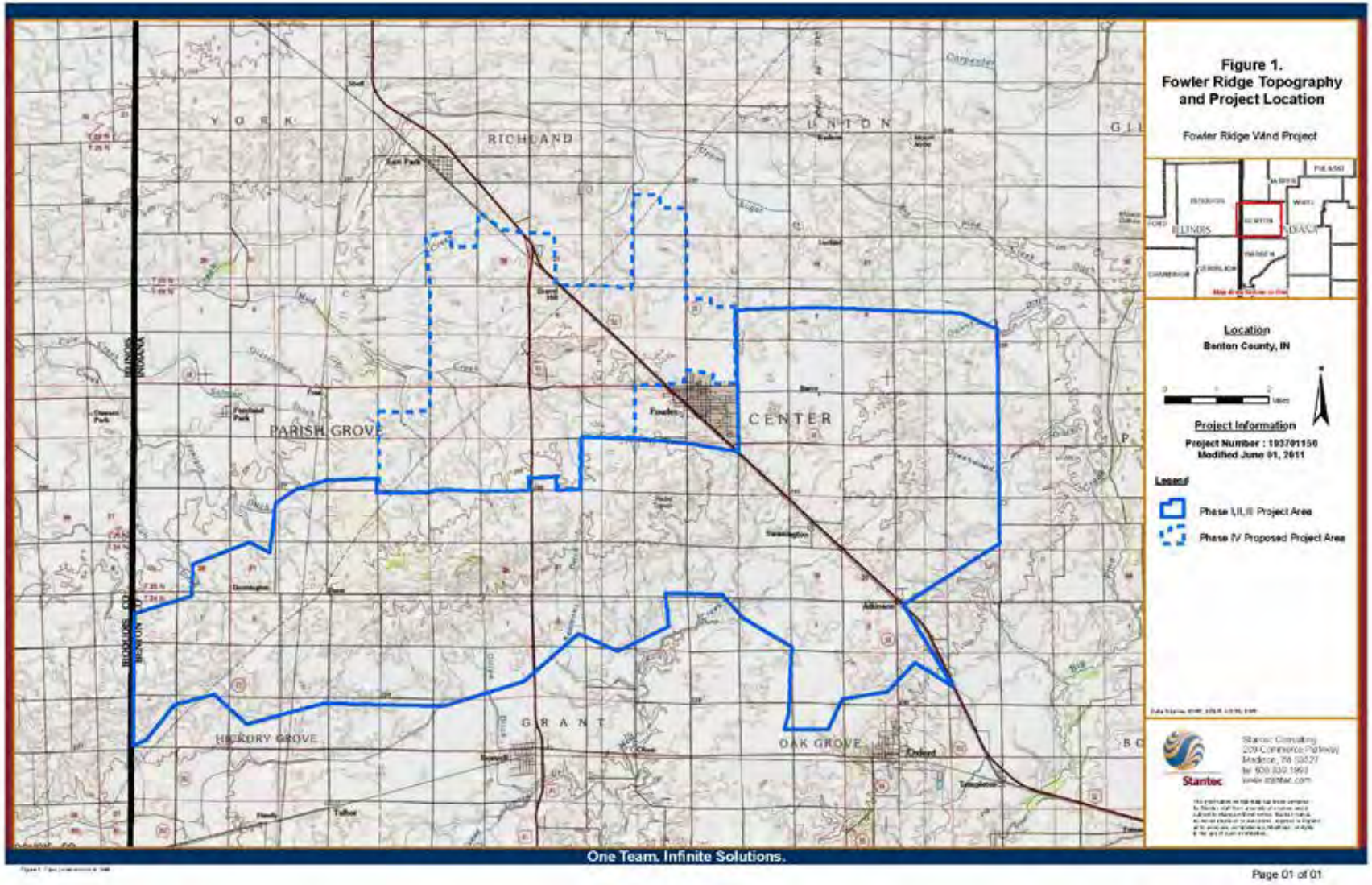

Figure 1 FRWF Topography and Project Location

2.0 PROJECT DESCRIPTION

2.1 PROJECT AREA

The Project is located in Benton County, Indiana, in the vicinity of the Town of Fowler and adjacent to the Illinois state line (Figure 1). An interconnect line for the Project extends into Tippecanoe County. The Project area encompasses approximately 72,947 acres (29,521 ha), only a portion of which is, or will, actually be occupied by Project facilities. All Project facilities are located or sited on private land.

The Project area is bisected and paralleled by improved roads, fence lines, buried pipelines, gates, residential structures, ephemeral drainages, earthen berms, drainage culverts, and two railroads. Land use within the Project area is dominated by tilled agriculture; of the approximately 72,947 acres (29,521 ha) within the Project area, row crops comprise about 93 percent. Corn (*Zea mays*) and soybeans (*Glycine max*) are the most abundant crops.

2.2 PROJECT COMPONENTS

The Project is being constructed in phases, as recommended by USFWS (Pruitt 2007; Figure 2). The facility is designed to have a total build-out capacity of approximately 750 MW. The first three phases of the Project are currently operational, with a total capacity of 600 MW. Construction on Phase IV is expected to begin in 2013. Each phase's minimum lifespan is expected to be about 20 years.

Table 2.1 Project Phases

Phase	Ownership	No. of Turbines	Turbine Type	Capacity	Status
I	Fowler Ridge Wind Farm	122 40	Vestas V82 1.65 MW Clipper C96 2.5 MW	301 MW	Operational (2009)
II	Fowler Ridge II Wind Farm	133	GE 1.5 MW	200 MW	Operational (2009)
III	Fowler Ridge III Wind Farm	60	Vestas V82 1.65 MW	99 MW	Operational (2009)
IV	Fowler Ridge IV Wind Farm	Up to 94	GE TC3+ 1.6 MW	149 MW	Construction expected in 2015

In addition to the wind turbine generators, each Project phase includes access roads and collection and transmission lines. Components of the Project also include three substations, a switchyard, and an Operations and Maintenance (O&M) Facility. Substation facilities were constructed in the Phase I, II, and III Project areas; transmission lines currently connect the substations to the interconnect switchyard. The Project O&M Facility was constructed with Phase I of the Project. This building will serve as the O&M Facility for the entire FRWF.

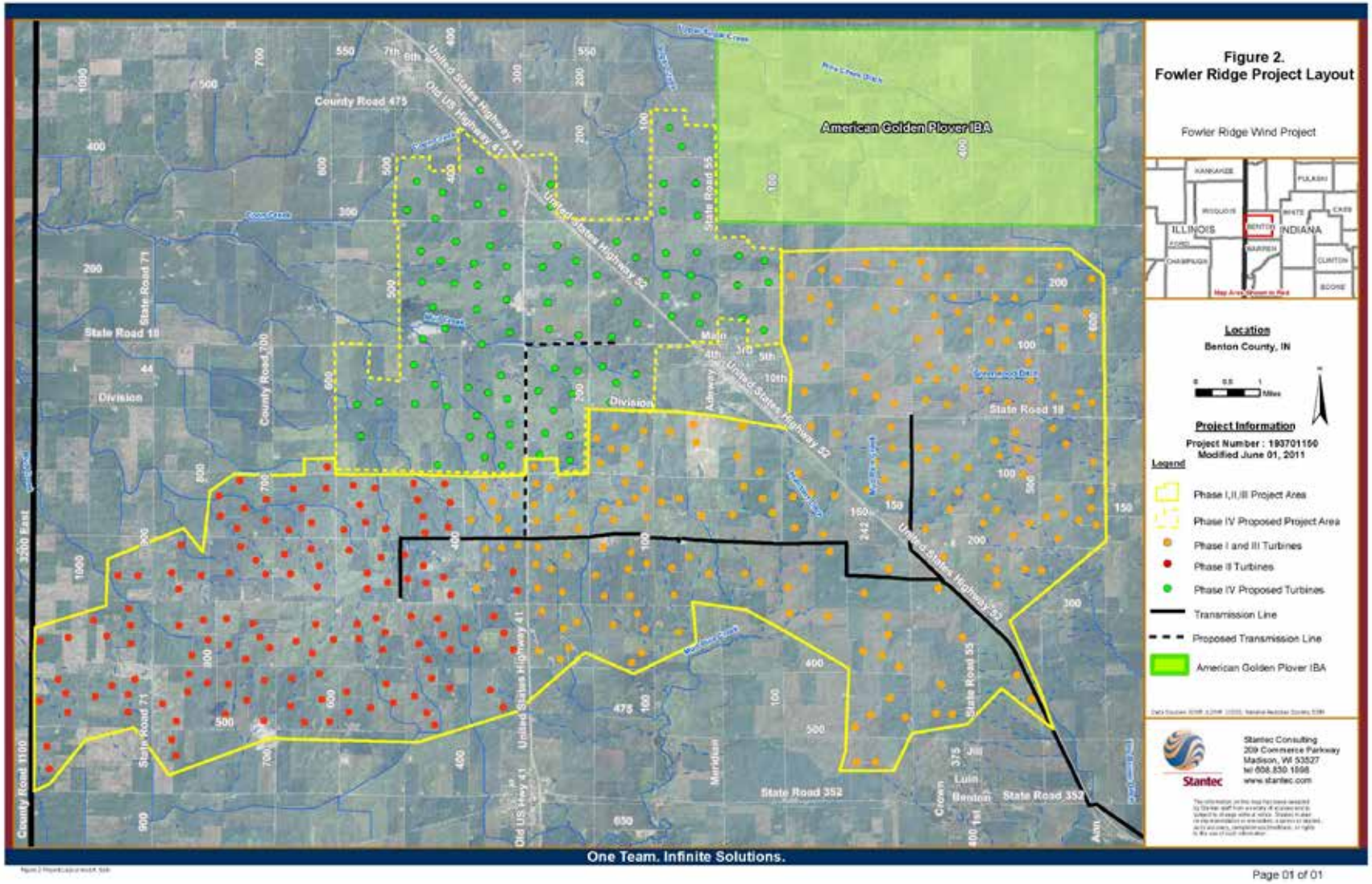

Figure 2 FRWF Project Layout

3.0 AVIAN AND BAT RESOURCES

3.1 HABITAT DESCRIPTION

The Project area is within the Tipton Tall Plain physiographic region that includes much of central Indiana. The topography of the Project area is mostly flat to slightly rolling. There are no hills, ridges, or other areas of starkly elevated topography (Figure 1). Elevations in the Project area range from 700 to 800 ft (213 to 244 m) above sea level, approximately. Annual precipitation in the Project area averages 40 inches (102 cm); average temperatures range from 19°F to 45°F (-7.2°C to 7.3°C) in January to 65°F to 86°F (18°C to 30 °C) in July. Soils in the region are various combinations of silt loam, clay loam, loam, silty clay loam, sandy loams, and sandy clays. Much of the area is classified as prime farmland based on soil type.

The Project area is dominated by tilled agriculture, with corn and soybeans being the dominant crops. Of the roughly 72,947 acres (29,521 ha) within 0.5 mile (0.80 km) of Phase I, II, III and IV turbine locations, row crops compose about 93 percent of the land use (Table 3.1, Homer et al. 2004). Developed areas (e.g., houses and buildings) comprise 5.2 percent of the Project area and pasture/hay fields constitute approximately 1.5 percent. The remaining area consists mostly of isolated patches of forested habitat and herbaceous habitat (i.e., grasslands). Forested areas are rare within the study area based on 2001 data (Homer et al. 2004), and the 286 acres (116 ha) of forest compose 0.4 percent of the total Project area. Trees in the study area occur at homesteads, along some of the drainages and fencerows, and within some small, isolated woodlots. Parish Grove, the largest contiguous tract of forest, is approximately 640 acres (259 hectares) in size, located in the southwest portion of the Project area. Grasslands in the Project area are limited primarily to strips along drainages, railroad rights-of-way, and rights-of-way along county and state roads. There are also a few grass-lined waterways within cultivated fields in the area. Small amounts of barren ground, open water, and woody wetlands are also present. The primary waterway is Sugar Creek in the northern part of the Project; there are several tributaries of this creek and other drainages in the area.

A total of 53 wetlands covering approximately 94.6 acres (38.2 ha) were identified and delineated in the vicinity of the Project area. Approximately 42 streams were also identified in the vicinity of the Project area (CBBEL 2007a and 2008). Additionally, small ephemeral pools of water may form in tilled fields following periods of rain.

Table 3.1 Land Cover Types, Coverage, and Composition within the FRWF Project Area

Habitat	Acres [Hectares]	Percent Composition
Row Crops	67,616 [27,363]	92.69%
Developed, Low Intensity	2,101 [850]	2.88%
Developed, Open Space	1,643 [665]	2.25%
Pasture/Hay Fields	1,100 [445]	1.51%
Deciduous Forest	286 [116]	0.39%
Developed, Medium Intensity	102 [41]	0.14%
Open Water	38 [15]	0.05%
Herbaceous (Grassland)	30 [12]	0.04%
Developed, High Intensity	17 [7]	0.02%
Barren Land	11 [4]	0.02%
Woody Wetlands	3 [1]	<0.01%
Total	**72,947 [29,521]**	**100.00**

3.1.1 Birds

Suitable avian habitat within the Project area is limited, as land use within the Project area is dominated by tilled agriculture. Due to high levels of disturbance and lack of native vegetation, agricultural habitats are of limited quality for birds. The many improved roads, fencelines, buried pipelines, gates, residential structures, and other disturbances which bisect and parallel the Project area also detract from the quality of the habitat within the Project area for many bird species.

Passerines and Waterbirds/Waterfowl

Cultivated agriculture is rarely used as nesting habitat by birds, although certain, disturbance-tolerant species may forage in crops. Agricultural fields may attract large flocks of birds, such as blackbirds and Canada Geese (*Branta canadensis*), during the fall migration and winter seasons (Erickson et al. 2002). Isolated patches of pasture and grassland habitat within the Project area may support sensitive or nesting grassland and prairie birds; however, these patches are small and comprised primarily of edge habitat. Similarly, the Project area contains only limited amounts of forested habitat (tree rows, drainage ditches, homesteads). Forest fragments such as those found within the Project area are typically not considered high-quality nesting habitat due to their limited size and abundance of edge habitat, which is associated with higher incidence of nest predation and parasitism (USGS 2011). These small patches of forest habitat may receive higher levels of bird use during migration, as forest fragments often provide stopover habitat for migrating passerines and other birds (Wallheimer 2009). In addition to the limited amount of stopover habitat, there is little discernible topography in the Project area and surrounding areas that would funnel migrating songbirds through the Project area. Songbirds migrating through the Project area likely do so in broad fronts moving in north-south or south-north directions (Johnson and Poulton 2007).

Small wetlands and streams throughout the Project vicinity may provide suitable habitat for certain bird species, although most wetlands and many streams in the area are ephemeral. Two ponds located to the north of the Project area were occupied by waterbirds and waterfowl during an October 2006 site visit by WEST staff (Johnson and Poulton 2007).

Raptors

Nesting habitat for raptors, with the exception of ground-nesting species, was found to be rare within the Project area, as less than one percent of the Project area is covered by forested habitat (Johnson and Bay 2008 and Carder et al. 2010). Consequently, habitat for raptors within the Project area is limited to foraging habitat. Prey densities and prey availability of species such as deer mice may be high in agricultural fields immediately after harvest, as mice forage on leftover grain. Densities of small mammals such as deer mice, voles, and shrews may also be higher along un-mowed ROW of county roads, highways, and railroads. However, overall, prey densities were expected to be low in the Project area based on the large amount of tilled agriculture present. Raptor use is not expected to be heavily influenced by topography within the Project area because of its general lack of defined ridges and rim edges. In addition, the Project area is not located on or near any major ridgelines, rivers, or other features which might funnel raptors through the Project area. Although site characteristics suggest that the Project area should not concentrate migrating raptors, information compiled by Region 3 of the USFWS indicates there may be a minor fall raptor migration route along the Illinois/Indiana border, which is near the Project area (Johnson and Poulton 2007).

Whooping Cranes

WEST staff determined during the October 2006 site characterization visit that the Project area contains little roosting habitat which could draw migrating ESA-listed whooping cranes to the area (Johnson and Poulton 2007). The most likely roosting area in Benton County is the Pine Creek GHA, located approximately 3.2 miles (5.1 km) east of the Project area (Johnson and Poulton 2007). Regarding habitat for IDNR-listed bird species, WEST determined that the Project area contained limited suitable habitat for most species (Johnson and Poulton 2007) (Table 3.2); a threatened and endangered species review of the Project area supported this conclusion of limited habitat (CBBEL 2007b).

Table 3.2 Habitat and Potential for Occurrence for IDNR-Listed Bird Species in the FRWF Project Area

Species	IDNR Status	Habitat	Potential for Occurrence
Short-eared owl *Asio flammeus*	Endangered	Wetlands, grasslands, agricultural areas	No suitable nesting habitat; could possibly forage over Project area; one record in area.
Upland sandpiper *Bartramia longicauda*	Endangered	Native grasslands, croplands, pastures and hayfields	Marginal habitat in Project area; recorded in area.
Northern harrier *Circus cyaneus*	Endangered	Nests in large grasslands and marshes, may hunt over agricultural fields	No suitable nesting habitat; suitable foraging habitat; one individual observed in Project area during October 18, 2006 site visit.
Least bittern *Ixobrychus exilis*	Endangered	Wetlands, especially those with dense cattails and reeds	Little suitable habitat in Project area; one record in area.
King rail *Rallus elegans*	Endangered	Freshwater marshes and marsh-shrub swamps, sedge and cattail marshes	Little suitable habitat in Project area; one record in area.
Barn owl *Tyto alba*	Endangered	Open areas such as grasslands, agricultural fields, and marshes	No recent records in Benton County; could possibly nest in abandoned barns and forage over Project area.
Western meadowlark *Sturnella neglecta*	Species of concern	Open grasslands, pastures, hayfields, weedy areas	At eastern limit of species range; some habitat available; one record in area.

American Golden Plover

An Important Bird Area (IBA) was established for AMGP in 2006 in the two southern-most quadrants of Union Township in Benton County. This area of approximately 11,520 acres (4,662 hectares) supports exceptionally high concentrations of golden-plovers during the spring migration season (late March and early April). The IBA is adjacent to Phase I, III, and IV of the Project area (Johnson and Poulton 2007; Figure 2). The Benton County IBA is located on private lands and is currently afforded no legal conservation protections (Fowler Ridge II Wind Farm, LLC 2009).

Gamebirds

Also within the Project area are five INDR GHAs and one Indiana Department of Transportation and IDNR Natural Preserves Highway Management Area (HMA): Hawkins GHA, Knob View

GHA, Watland GHA, Falwell GHA, Kirsch GHA, and Fowler HMA (IDNR letter addressed to Victoria Poulton, WEST, Inc., dated September 22, 2006; Figure 4).

3.1.2 Bats

A total of 12 species of bats occur in Indiana. Nine species, all members of the family Vespertilionidae, have geographic distributions that include Benton County: Indiana bat, evening bat, little brown bat (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), silver-haired bat (*Lasionycetris noctivagans*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), tri-colored bat (*Perimyotis subflavus*), and big brown bat (*Eptesicus fuscus*)(Simon et al. 2002; Whitaker and Mumford 2008). All nine of those bat species use woodland habitat for feeding or roosting at some time during the year. In addition, many of the species feed along stream corridors or over water. A limited number of narrow, linear tracts of woodland associated with stream corridors and small woodlots associated with farmsteads are found within the Project area. These areas may, at times, provide potentially suitable foraging and roosting habitat for bats. The Project area is not located in a karst region of Indiana and there are no known bat hibernacula in Benton County.

Limited information is available on how bats use agricultural areas in the Midwest; however, species such as the big brown bat and little brown bat will roost, and even overwinter, in attics or large buildings. The farmsteads located in the Project area, with their farmhouses and large outbuildings, likely provide suitable roosting locations for species such as these. Likewise, buildings in the towns of Fowler, Oxford, Boswell and Earl Park also likely provide suitable roosting and possibly overwintering sites for species such as the big brown bat and little brown bat.

A threatened and endangered species review of the Project area concluded that the woodlots within the Project area and the Big Pine Creek floodplain did not contain suitable roosting trees for Indiana bats (CBBEL 2007b). As described in Section 1.3 Coordination with USFWS and IDNR, the Service concurred that there was very little summer habitat for Indiana bats within the Project area.

Although habitat requirements for migrating bats are not well understood, based on the Project's location within the ranges of nine bat species and the dispersed and transitory patterns believed to characterize migration movements of most of those bat species (Cryan 2003, USFWS 2007), it is likely that common species of both tree bats and cave-roosting bats pass through the Project area during the spring and fall migration seasons. The results of post-construction monitoring studies conducted at FRWF to-date are reported in Section 3.5, Post-Construction Bat Mortality Studies; impacts to bats are further discussed in Section 4.2.2, Potential Impacts from the Fowler Ridge Wind Farm.

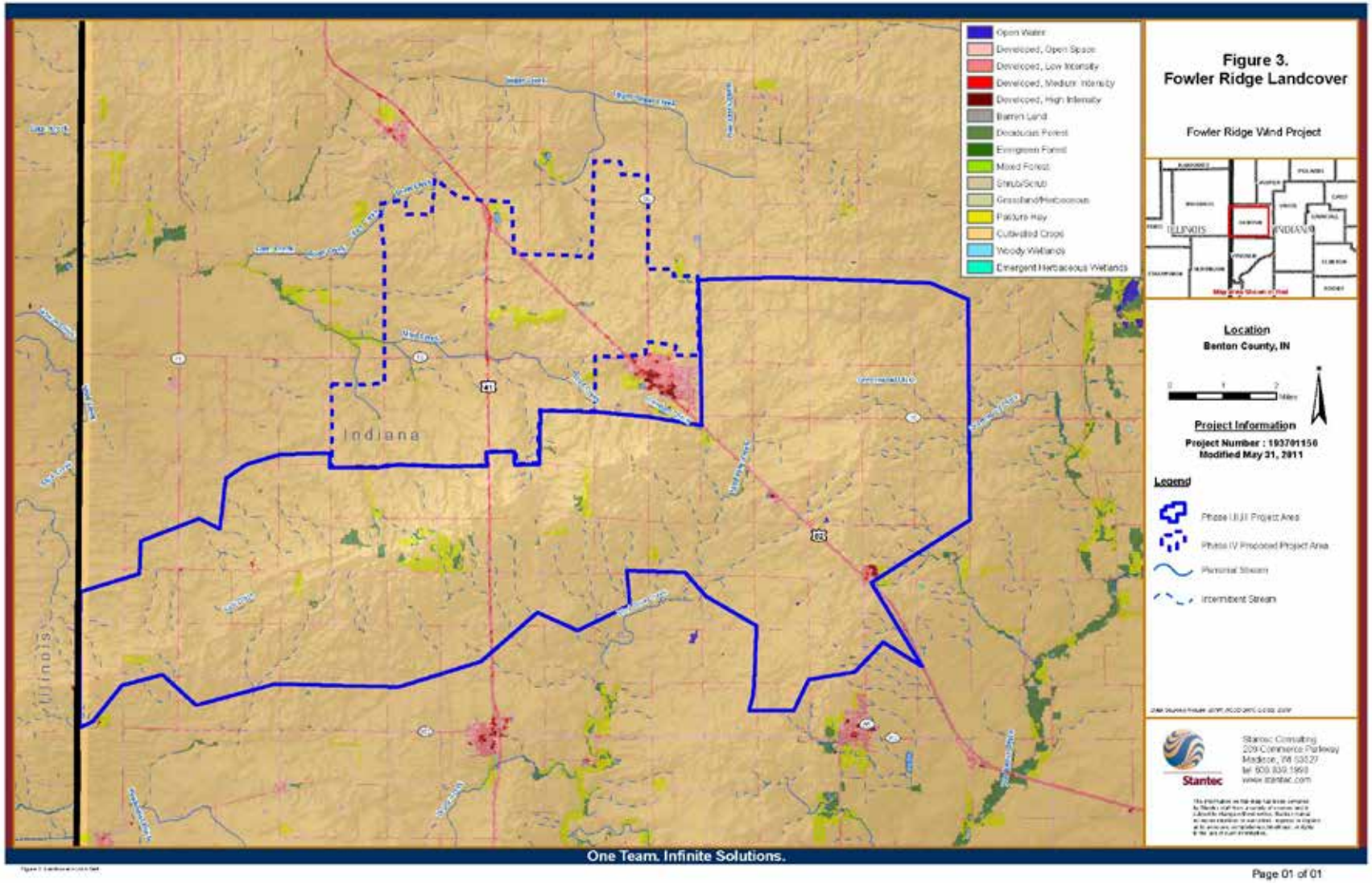

Figure 3 FRWF Landcover

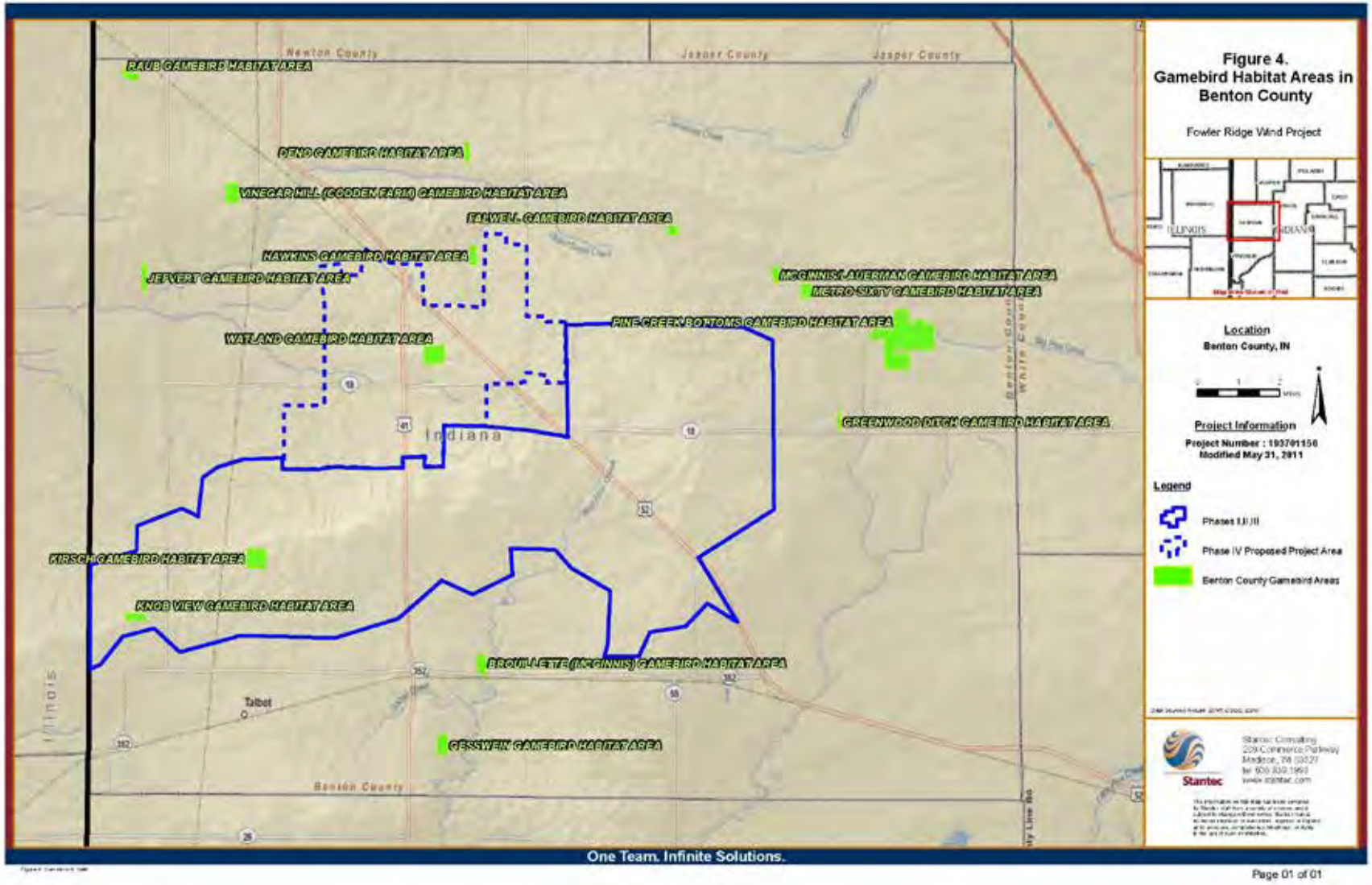

Figure 4 Gamebird Habitat Areas in Benton County

3.2 PRE-CONSTRUCTION AVIAN USE STUDIES

3.2.1 Fixed-Point Bird Use Surveys

WEST conducted fixed-point bird use surveys at 20 points distributed throughout the Project area from March 31, 2007 through April 9, 2009 (Johnson and Bay 2008 and Carder et al. 2010). Ten of the points were surveyed during studies in 2007; the other ten points were surveyed during studies in 2008 and 2009. In 2007, surveys were conducted approximately once a week during the spring (March 31 to April 28, 2007) and fall (September 20 to November 16, 2007). In 2008 and 2009, surveys were conducted approximately once a week during spring (March 15 to May 31, 2008) and fall (September 15 to November 15, 2008), and bi-weekly during summer (June 1 to September 14, 2008) and winter (November 16, 2008 to March 14, 2009). Results of these surveys are summarized below.

2007 Surveys

During the 2007 surveys, 7,738 individual birds within 507 separate groups were observed; 161 of which were raptors. Although forty-five unique species were recorded, six species (13.3% of all species) comprised 74.4 percent of all observations: unidentified blackbird, AMGP, European starling (*Sturnus vulgaris*), unidentified swallow, tree swallow (*Tachycineta bicolor*), and unidentified shorebird. All other species individually comprised less than five percent of the observations.

Overall bird use was higher in the spring (78.80 birds/plot/20 min survey) than in the fall (46.40 birds/plot/ 20 min survey). The higher use in spring was partly due to large numbers of shorebirds that were not observed during the fall surveys. For all bird species combined, use was highest at the survey points in the northern section of the Project area; these points were nearest to the plover IBA. High overall bird use in these areas was largely due to high use by shorebirds and passerines. Raptor use was consistent across all survey points.

A total of 5,484 individual birds were observed flying during the surveys; overall, 20.8 percent of the birds observed flying were within the rotor-swept area for collision with turbine blades of 82 to 410 ft (25 to 125 m) above ground level. The remaining birds observed flying were mostly below the rotor-swept area (79.0%); few birds (0.2%) were observed flying above the rotor-swept area. Raptors were observed at all flight height categories (50.8% below, 40.3% within, and 8.9% above the rotor-swept area). Waterbirds had the highest percentage (100%; 2 total birds) of flying birds within the rotor-swept area. Table 3.3 provides the observed flight characteristics for each bird type and raptor subtype observed flying within the rotor-swept area.

No ESA-listed bird species were observed within the Project area. Two species were recorded which were on the IDNR endangered species list at the time (2007): northern harrier (*Circus cyaneus*) and upland sandpiper (*Bartramia longicauda*). Six additional species which have since become listed (endangered or species of concern) by IDNR were also observed: osprey (*Pandion haliaetus*), sharp-shinned hawk (*Accipiter striatus*), AMGP, greater yellowlegs (*Tringa melanoleuca*; incidental observation), sandhill crane (*Grus canadensis*), and solitary sandpiper (*Tringa solitaria*; incidental observation). Most of these species, with the exception of northern harrier and AMGP, were observed in low numbers. AMGP were investigated further during a 2007-2009 AMGP survey effort, discussed below (Johnson et al. 2009). Northern harriers were observed to primarily fly below the rotor-swept area within the Project area; presumably because of this low flight pattern, the species has rarely been found as fatalities at wind energy facilities (Erickson et al. 2001).

2008-2009 Surveys

During the 2008-2009 surveys, 4,721 individual birds within 1,259 separate groups were observed; 64 of which were raptors. Fifty-eight unique species were recorded, but three species (5.2% of all species) comprised 39.7 percent of all observations: European starling, common grackle (*Quiscalus quiscula*), and brown-headed cowbird (*Molothrus ater*). All other species individually comprised less than 10 percent of the observations. Species richness was highest in the spring and lower in the summer, fall, and winter. Passerines were the most abundant bird type across all seasons during the 2008-2009 surveys.

Overall bird use was highest in the spring (19.89 birds/plot/20 min survey), followed by fall (9.81 birds/plot/20 min survey), winter (8.35 birds/plot/20 min survey), and summer (7.85 birds/plot/20 min survey). Bird types exhibited different and varying use across the survey points, likely due to differences in habitat between the points. Unlike the 2007 survey, survey results in 2008-09 were not dominated by shorebirds, and overall use was therefore influenced by many bird types and more evenly distributed throughout the Project area. Raptor use was again relatively uniform across all survey points.

A total of 3,634 individual birds were observed flying during the surveys; overall, 0.8 percent of the birds observed flying were within the rotor-swept area for collision with turbine blades of 115 to 427 ft (35 to 130 m) above ground level. The remaining birds observed flying were below the rotor-swept area; no birds were observed flying above the rotor-swept area. The majority (95.7%) of flying raptors were observed below the rotor-swept area. Vultures had the highest percentage (20.4%) of flying birds within the rotor-swept area. Table 3.3 provides the observed flight characteristics for each bird type and raptor subtype observed flying within the rotor-swept area.

No ESA-listed bird species were observed within the Project area. Nine bird species listed (endangered or species of concern) by the IDNR were observed during surveys. These species include: AMGP, sandhill crane, northern harrier, sharp-shinned hawk, greater yellowlegs (incidental observation), bald eagle, broad-winged hawk (*Buteo platypterus*; incidental observation), western meadowlark (*Sturnella neglecta*; incidental observation), and upland sandpiper. Data collected did not suggest that listed species are numerous within the study area, with the exception of AMGP, sandhill crane, and northern harrier. AMGP were investigated further during the 2007-2009 AMGP survey effort, discussed below (Johnson et al. 2009). The number of sandhill cranes observed within the Project area was much lower than the number observed at well-known stopover sites. Northern harriers are not considered to have especially high risks of colliding with turbines due to the tendency of this species to hunt close to the ground, thus avoiding the rotor-swept area of the turbines (Carder et al. 2010). Other sensitive species were observed in relatively low numbers, and were likely individuals migrating through the Project area.

Table 3.3 Flight Height Characteristics for All Bird Types and Raptor Subtypes Observed during Fixed-Point Bird Use Surveys at the FRWF Project Area, March 31, 2007-April 9, 2009

	#Gps Flying		# Ind Flying		Mean Flight Height (m)		% Obs Flying		% within Flight Height Categories					
									2007			2008-2009		
Group	2007	2008-2009	2007	2008-2009	2007	2008-2009	2007	2008-2009	0-82 ft (0-25m)	82-410 ft* (25-125m)	>410 ft (>125m)	0-114 ft (0-35m)	114-427 ft* (35-130m)	>427 ft (>130m)
Waterbirds	2	10	2	18	60.00	9.60	100	94.7	0	100	0	100	0	0
Waterfowl	3	11	6	112	16.00	12.18	24.0	93.3	100	0	0	100	0	0
Shorebirds	39	54	863	540	14.31	7.28	47.5	91.5	69.4	30.6	0	100	0	0
Coots	0	-	0	-	0	-	0	-	0	0	0	-	-	-
Raptors	106	47	124	47	38.04	12.04	96.9	82.5	50.8	40.3	8.9	95.7	4.3	0
Accipiters	6	-	6	-	80.83	-	100	-	50.0	33.3	16.7	-	-	-
Buteos	42	26	42	26	30.43	15.23	95.5	86.7	61.9	35.7	2.4	92.3	7.7	0
Northern Harrier	10	10	11	10	26.30	6.90	100	100	63.6	18.2	18.2	100	0	0
Eagles	-	1	-	1	-	15.00	-	100	-	-	-	100	0	0
Falcons	13	6	14	6	7.46	2.67	87.5	50.0	100	0	0	100	0	0
Other Raptors	4	4	4	4	80.25	17.50	100	100	25.0	50.0	25.0	100	0	0
Vultures	31	33	47	54	51.23	24.79	100	98.2	25.5	61.7	12.8	79.6	20.4	0
Upland Gamebirds	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Doves/Pigeons	30	45	337	99	8.03	4.64	98.5	66.9	77.7	22.3	0	100	0	0
Passerines	212	632	4145	2759	9.86	5.45	98.3	78.5	81.9	18.1	0	99.5	0.5	0
Other Birds	7	4	7	5	7.57	5.25	100	83.3	100	0	0	100	0	0
Overall	**399**	**836**	**5484**	**3634**	**17.90**	**6.80**	**83.9**	**80.6**	**79.0**	**20.8**	**0.2**	**99.2**	**0.8**	**0**

* Rotor-swept area

3.2.2 Raptor Nest Surveys

Raptor nest surveys were conducted within the Project area by WEST during spring 2007 and spring 2008 prior to leaf-out (Johnson and Bay 2008 and Carder et al. 2010). The objectives of the raptor nest surveys were to locate and record raptor nests which may be subject to disturbance and/or displacement effects by Project construction and/or operation. Surveys were completed by walking and driving along public roads and accessible private roads and searching for raptor nest structures within areas of suitable habitat (trees, rock outcrops, powerline poles, etc.). No raptor nests were observed in the Project area in 2007 or 2008.

3.2.3 American Golden-Plover Surveys

AMGP occur in sizable congregations in many areas in west-central Indiana and eastern Illinois in late March and early April. AMGP have been observed to be especially concentrated in the two southern-most quadrants of Union Township in Benton County. An IBA was established in 2006 by the Indiana State Chapter of the Audubon Society in close proximity to the Project area (Figure 2). The Service, with input from IDNR and Indiana Audubon, recommended that a three year monitoring study be conducted to study AMGP use of the Project area (USFWS letter addressed to Rene Braud, BP Alternative Energy, dated September 10, 2007). While the AMGP is not listed as threatened or endangered under the ESA or by the state of Indiana, it is protected by the MBTA and listed as a species of special interest by the IDNR. Surveys were conducted in the springs of 2007, 2008, and 2009 to determine use of the Project area by AMGP (Johnson et al. 2009). Surveys were designed to be consistent with those conducted in previous AMGP studies in the region. Surveys were conducted twice a week during the spring season; surveyors drove public roads and searched for plovers. Twice each survey day, surveyors spent a minimum of 30 minutes recording detailed observations, including plover behavior and flight height.

During all three years of study, active farming operations were occurring throughout the Project area. In 2007, there was no construction activity occurring in the Project area during the study period. In 2008, Project construction activity was relatively light during the spring study period, involving some sporadic earth work with no tower deliveries or erected turbines. Between the spring of 2008 and December 2008, turbines were erected in the Phase I and III areas. In 2009, there was little construction activity during the study period, but road cleanup and restoration activities were conducted in the Phase I area (Johnson et al. 2009).

In 2007, a total of 58,943 AMGP in 184 groups were observed in the IBA and Project area. AMGP use of the Project area and IBA decreased during 2008 to 8,919 AMGP in 71 groups (the spring migration in 2008 was unusual for AMGP, with other observers also noting possible changes in plover distribution due to a wet and cold spring). In 2009, overall use was similar to that of 2008, with 8,981 AMGP in 38 groups observed. However, AMGP sightings in 2009 were located away from the newly erected turbines. AMGP sightings had been recorded in the turbines locations in 2007 and 2008, prior to erection of the turbines. It is possible that AMGP could have shown an especially pronounced avoidance of wind turbines in 2009 as this was the first year that turbines were encountered within areas historically used by AMGP. Crop type may also have influenced plover distribution, as 90 percent of plover sightings in 2009 were made in soybean fields, but soybean crops comprised only 35 percent of the turbine areas. Differences in AMGP used between 2007 and 2008 also show that weather can greatly influence use of the Project area between years, regardless of the presence of turbines (Johnson et al. 2009).

AMGP spent the majority of time flying below blade height during all three years of survey. Approximately 10 percent of observations of flying plovers were within blade height, while 90

percent of observations of flying plovers were below blade height. No plovers were found during a concurrent fatality study in 2009 (Johnson et al. 2009).

3.3 POST-CONSTRUCTION AVIAN MORTALITY STUDIES

Mortality monitoring studies were conducted at FRWF over three years from 2009 to 2011. In 2009, carcass searches occurred from April 2 to June 10 at Phase III and from April 6 to October 30 at Phase I. In 2010, carcass searches occurred at Phases I, II, and III from April 13 through May 15 and from August 1 through October 15. In 2011, carcasses searches occurred at Phases I, II, and III from April 1 to May 15 and July 15 to October 29. No Indiana state-listed or federally listed bird species were found during these searches.

During the study at Phase III in 2009, three birds were found. All three of the fatalities were comprised only of a few bones without any feathers or fleshy parts remaining. Two of the fatalities were identifiable only as ducks, based on skull characteristics. The remaining casualty was only identifiable as a large bird because no skull was present; that casualty was determined to also likely be a species of waterfowl. No AMGP fatalities were found during this survey. Because all three birds found during the study were estimated to have died well before (> 2 weeks-1 month) the study was initiated, no estimate of overall avian mortality could be made for the Phase III turbines.

A total of 28 birds comprised of 11 species were found during the searches at Phase I in 2009. The most common bird species found as a casualty was killdeer (four fatalities), followed by tree swallow (three), red-tailed hawk (three), and unidentified large bird (three); two unidentified ducks were also found as fatalities. The three unidentified large birds and two unidentified ducks found during the study consisted entirely of a few large bones with no feathers or flesh remaining. The estimated fatality rate and 90 percent confidence interval (CI) for the entire study period was 5.26 birds/turbine (90% CI=3.52, 10.25). Given the 301-MW nameplate capacity of Phase I, the overall fatality estimate for the entire study period (three seasons) was 2.83 birds/MW. This estimated fatality rate is lower than average compared to other wind energy facilities located in the Midwest. Overall bird fatality estimates at seven Midwest facilities in Nebraska, Wisconsin, Minnesota, Iowa, and Illinois have ranged from 0.6 to 7.2 and average 4.28 birds/MW/year (Johnson et al. 2010b).

A total of 60 bird carcasses comprised of 22 species were found during the 2010 monitoring (Good et al. 2011). The majority of carcasses were passerines. The most common bird species found was killdeer (nine fatalities), followed by European starling, golden-crowned kinglet, and unidentified birds (five each). No waterbirds or waterfowl fatalities were recorded. Three red-tailed hawk carcasses and one rough-legged hawk carcass were found. This monitoring effort was focused on detecting actual bat mortalities and estimating bat fatality rates for the Project. Consequently, bird carcasses were recorded but no estimate of bird fatality was developed for 2010.

A total of 77 bird carcasses comprised of 24 species were found during the 2011 monitoring (Good et al. 2012). The majority of carcasses were passerines. As in 2010, the most common bird species found was killdeer (21 fatalities), followed by European starling (seven carcasses), and mourning dove (six carcasses). Four unidentified large bird carcasses and three unidentified waterfowl carcasses were found. The unidentified large bird carcasses were determined not to be eagle carcasses based on bone and feather measurements. As in 2010, three red-tailed hawk carcasses and one rough-legged hawk carcass were found in 2011. The monitoring effort was again focused on detecting and estimating bat mortality, so no estimate of bird fatality was developed for 2011.

The results of these post-construction surveys were used to assess the relative impacts to birds at FRWF in the context of impacts reported for other wind energy projects; this discussion is provided in Section 4.1.2, Potential Impacts from the Fowler Ridge Wind Farm. Section 4.3, Avoidance and Minimization Measures, provides a description of the conservation measures developed for birds based on the results of the pre- and post-construction studies and the impacts assessment.

3.4 PRE-CONSTRUCTION BAT ACTIVITY STUDIES

Pre-construction ground-based bat acoustical surveys were conducted at the Project from August 15 through October 19, 2007 and from July 17 through October 15, 2008, time periods that cover the time frame during which most bat mortality occurs at wind energy facilities throughout North America (Arnett et al. 2008). Three AnaBat® II bat detectors (Titley Electronics Pty Ltd., NSW, Australia) were established approximately 3.2 ft (1 m) above the ground in habitat in the Project area similar to that at the turbine locations, and programmed to record from 0.5 hour before sunset to 0.5 hour after sunrise.

A total of 648 bat calls were recorded in 2007, averaging 4.7 bat calls per detector-night across the entire study period (Gruver et al. 2007). Bat activity peaked in late September and early October. Approximately equal numbers of high frequency (≥ 35 kHz) calls (which may include *Myotis* species) and low frequency (<35 kHz) calls were recorded. High frequency calls averaged 2.3 calls per detector night, while low frequency calls averaged 2.4 calls per detector night. In general, high frequency calls per detector night exceeded low frequency calls on a weekly basis, except between September 19 and October 2, when bat activity was highest and nearly twice as many low frequency calls were recorded than high frequency calls.

A total of 851 bat calls were recorded in 2008, averaging 6.45 bat calls per detector night across the entire study period (Carder et al. 2009). Bat activity was highest in early August, and then peaked again from mid-August through early September. Just under half (47.4%) of the calls were low (<30 kHz) frequency, while mid-frequency (30-40 kHz) and high frequency (>40 kHz) calls comprised 18.4 percent and 34.2 percent of the total, respectively. The high frequency calls were likely attributable to tri-colored bats and several *Myotis* bat species.

3.5 POST-CONSTRUCTION BAT MORTALITY STUDIES

Over three years of post-construction mortality studies at FRWF from 2009 to 2011, a total of 1,543 bat carcasses of 10 different species were found. Table 3.4 gives a breakdown of the total recorded mortality by species.

Table 3.4 Bat Carcasses Found at the FWRF Project during Post-Construction Mortality Studies from 2009 to 2011, by Species

Species	Total Carcasses
Eastern red bat	877
Hoary bat	355
Silver-haired bat	235
Big brown bat	52
Little brown bat	5
Evening bat	4
Seminole bat	3
Tri-colored bat	3
Indiana bat	2
Northern Myotis	1
Unknown	6
Total	**1,543**

Adjusted fatality estimates for the FRWF ranged from 0.56 bats/turbine (90% CI=0.32, 0.82) for the 2010 spring survey to 30.54 bats/turbine (90% CI=25.40, 37.45) for the 2011 fall survey (Good et al. 2011 and 2012). The level of effort, study design, and results of the post-construction monitoring surveys varied across the three years, as described in the survey reports.

During the mortality study conducted at Phase III from April 2 to June 10, 2009, five bat fatalities comprised of four species were found, including two hoary bats and one each of the following species: eastern red bat, silver-haired bat, and big brown bat (Johnson et al. 2010a). Bat fatalities were evenly distributed throughout the study season. The estimated number of bat fatalities and associated 90 percent CI for the study period from April 2 to June 10 was 3.03 bats/turbine (90% CI=0.71, 6.58). Based on the 1.65-MW capacity of Phase III, the estimated number of bat fatalities was 1.84 bats/MW from April 2 to June 10, or a total of 182 estimated bat fatalities.

Mortality monitoring at Phase I conducted from April 6 through October 30, 2009 documented a total of 156 bat fatalities comprised of six species. Most (94.2%) of the bat fatalities were migratory tree bats, including 56 eastern red bats (35.9%), 48 hoary bats (30.8%), 42 silver-haired bats (26.9%), and one unidentified *Lasiurus* species (either hoary or eastern red bat). The other bat fatalities included four big brown bats, three little brown bats, one northern myotis, and one Indiana bat. The Indiana bat casualty was collected as an incidental casualty on September 11, 2009. Based on the lack of Indiana bat summer habitat in or near the Project area, and the date of the casualty (estimated to be September 9, 2009), the fatality was assumed to be a migrant through the area. Most (73.7%; n=115) of the bat fatalities occurred from August 1 to September 15, with an additional 12.8 percent (n=20) of fatalities found between September 16 and October 30. The estimated fatality rate and 90 percent CI for the entire study period was 15.03 bats/turbine (90% CI=10.89, 20.52). Given the 301-MW nameplate capacity of Phase I, the overall fatality estimate for the entire study period (three seasons) was 8.09 bats/MW (2,435 bats total for Phase I). This estimated fatality rate is moderate when compared to other wind energy facilities in North America and is somewhat below the regional average in the Midwest. Reported bat fatality estimates at seven other wind energy facilities in the Midwest (located in Nebraska, Wisconsin, Minnesota, Iowa, and Illinois) ranged from 0.8 to 30.6 bats/MW/year and averaged 9.8 bats/MW/year (Johnson et al. 2010b).

As a result of the discovery of the Indiana bat carcass during the fall 2009 monitoring at Phase I, the Service recommended that FRWF complete an HCP and obtain an ITP from the Region 3 USFWS office. FRWF was issued a two-year Scientific Research and Recovery Permit for the Indiana bat (TE 15075A) by USFWS Region 3 to help build a better scientific basis for the potential minimization and mitigation measures for HCP development. As part of the research conducted under the permit, daily carcass searches were conducted in 2010 and 2011 at Phases I, II, and III.

The 2010 carcass searches were conducted during the spring (April 13-May 15) and fall (August 1-October 15) migration seasons (Good et al. 2011). Overall, 36 bat casualties (18 silver-haired bats, 15 eastern red bats, two hoary bats, and one big brown bat) were found during the spring. During the fall, a total of 773 bats of seven species were found; most fatalities were found during the month of August. The majority (64.68%; 500 carcasses) of bat fatalities found during the fall were eastern red bats, followed by hoary bats (18.63%; 144 carcasses), silver-haired bats (12.03%; 93 carcasses), and big brown bats (3.88%; 30 carcasses). Three tri-colored bats, two little brown bats, and one Indiana bat were also found. The estimated fatality rates for the spring season were 0.56 bats/turbine (90% CI=0.32, 0.82) using the Shoenfeld estimator and 0.74 bats/turbine (90% CI=0.44, 1.14) using the empirical estimator. These estimates increased during the fall season, with 16.03 bats/turbine (90% CI=13.95, 18.33) based on the Shoenfeld

estimator and 21.45 bats/turbine (90% CI=18.50, 29.34) using the empirical estimator. Bat casualty rates were lower at turbines which were operated at higher cut-in speed treatments. Observed fatality rates during the fall season were 14.0 bats/turbine (90% CI=11.6, 16.5), 7.0 bats/turbine (90% CI=5.1, 9.1), and 3.0 bats/turbine (90% CI=1.8, 4.2) for control (3.5 m/s), 5.0 m/s, and 6.5 m/s treatment conditions, respectively. An approximate 50 percent reduction in observed bat mortality was realized by raising the cut-in speed from the control to 5.0 m/s and an approximate 78 percent reduction in observed bat mortality was realized by raising the cut-in speed from the control to 6.5 m/s.

In 2011, 573 bat carcasses were discovered, 465 of which were found during the fall monitoring period (July 15 – October 15). Only one carcass was found during the late fall monitoring period (October 16 – October 29). Most bat fatalities were again found in August, however more bat fatalities were found in September 2011 compared to 2010. Similar to 2010, the most commonly found bat species was eastern red bat (53.2%, 305 fatalities), followed by hoary bat (27.8%, 159 fatalities), silver-haired bat (14.1%, 81 fatalities), and big brown bat (2.8%). Two new species were found in 2011: the Seminole bat (*Lasiurus seminolus*, three carcasses) and the Indiana state-endangered evening bat (four carcasses). Seasonal adjusted fatality estimates based on the Shoenfeld estimator were 0.61 (90% CI=0.32, 1.06) bats/turbine from April 1 to May 15, 2.18 (90% CI=1.32, 3.26) bats/turbine from July 15 to July 31, and 22.99 (90% CI=19.21, 29.35) bats/turbine from August 1 to October 15, for an overall estimate of 25.78 (90% CI= 22.51, 32.37) bats/turbine. Empirical fatality estimates were higher: 0.66 (90% CI=0.32, 1.17) bats/turbine from April 1 to May 15, 2.90 (90% CI=1.57, 4.22) bats/turbine from July 15 to July 31, and 30.54 (90% CI= 25.40, 37.45) bats/turbine from August 1 to October 15, for an overall estimate of 34.10 (90% CI= 28.64, 41.37) bats/turbine. Bat casualty rates were lower at turbines which were feathered until higher cut-in wind speeds were reached. Bat casualty rates were decreased by about 36 percent, 57 percent, and 73 percent, compared to control turbines, when turbines were feathered at 3.5 m/s, 4.5 m/s, and 5.5 m/s, respectively.

Of the ten bat species found as fatalities at the FRWF, the Indiana bat is listed as Indiana state- and federally endangered and the evening bat is listed as Indiana state-endangered. Six species, the little brown bat, northern myotis, silver-haired bat, red bat, hoary bat, and tri-colored bat, are listed as special concern species by the IDNR. The big brown bat and the Seminole bat are the only two of the ten bat species found in the Project area that are not listed as either endangered or special concern. The big brown bat is widespread and common throughout its range. The FRWF is outside of the known range of the Seminole bat, which is typically a resident of the southern U.S. While few records of Seminole bat exist in Indiana, the species has occasionally been found outside of its range in other states, as well.

Acoustic monitoring was conducted simultaneously with carcass searches in 2010 and 2011 to research bat use rates at the Project area and the relationship of bat use levels to mortality levels (Good et al. 2011 and 2012). The average bat activity in 2010 was 1.34 $\pm$ 0.29 bat passes per detector-night at ground stations in the spring, and 11.46 $\pm$1.29 at ground stations and 3.10 $\pm$ 0.42 at nacelle stations in the fall. In 2011, the average spring bat activity was 2.57 $\pm$ 0.06 and 0.56 $\pm$ 0.02 bat passes per detector-night at the ground and raised stations, respectively. The average fall bat activity was 16.72 $\pm$ 1.52 and 5.19 $\pm$ 0.59 bat passes per detector-night at the ground and raised stations, respectively. The highest periods of bat use occurred during the first two weeks of August in 2010 and during mid to late August in 2011. Passes by high-frequency bats were outnumbered by passes by mid-frequency and low-frequency bats during the spring study period both years and during the fall study period in 2011. In fall 2010, high-frequency passes were outnumbered by low-frequency passes, but slightly exceeded the number of mid-frequency passes.

Very few *Myotis* calls (15.6% and 0.2% of identifiable calls in 2010 and 2011, respectively) were recorded during the course of the studies. Most of the 30 calls potentially resembling Indiana bat calls were recorded on August 9-10, 2010, at a reference station located away from the turbines. Bat casualty rates were found to be positively correlated with higher bat activity, although other factors were also associated with increases in observed casualty rates, including lower mean wind speeds, higher mean temperatures, increasing variance in temperature, and increasing barometric pressure. Data collected in 2011 showed that 77 percent of all bat fatalities and 73 percent of all bat activity recorded by detectors on nacelles occurred when wind speeds were below 5.5 m/s. These data suggest that wind speeds above certain thresholds greatly reduce the ability of bats to fly near nacelle height. The results of these post-construction surveys were used to assess the relative impacts to bats at FRWF in the context of impacts reported for other wind energy projects; this discussion is provided in Section 4.2.2, Potential Impacts from the Fowler Ridge Wind Farm. Section 4.3, Avoidance and Minimization Measures, provides a description of the conservation measures developed for bats based on the results of the pre- and post-construction studies and the impacts assessment.

4.0 POTENTIAL IMPACTS TO BIRDS AND BATS

4.1 BIRDS

4.1.1 Overview of Potential Impacts

Nationally, wind turbines are responsible for 0.01-0.02 percent of all avian fatalities due to human structures (Erickson et al. 2002). Fatality rates ranged from 0.00 birds/turbine/year to 9.33 birds/turbine/year and averaged 2.08 birds/turbine/year in 22 studies conducted at wind energy facilities across North America (Barclay et al. 2007). Mortality rates at sites in the west and Midwest, particularly agricultural ones, have typically been at the low end of the national range. Recent studies at the Blue Sky Green Field and Crescent Ridge sites in Wisconsin recorded unusually high bird fatality rates which increased the upper limit of the Midwest bird fatality range (Poulton 2010). Publicly-available estimates for the Midwest now range from 0.00 to 11.83 birds/turbine/year (Barclay et al. 2007 and Poulton 2010). The number of avian fatalities at wind energy facilities is generally low when compared to the total number of birds detected at these sites (Erickson et al. 2002). No particular species or family has been identified as incurring greater numbers of fatalities at wind energy facilities. However, likely due to differences in abundance and use of habitat, bird groups have experienced varied impacts from wind turbines. Passerines, both resident and migrant, represent the majority (approximately 75%) of mortalities at wind turbines nation-wide (Erickson et al. 2001 and Johnson et al. 2002) and result in spring and fall peaks of bird mortality rates at most wind energy facilities (Johnson et al. 2002). Although waterbird (waterfowl, shorebirds, and seabirds) mortality at wind energy facilities has been highly variable, national research has demonstrated that waterbirds rarely collide with inland turbines (Everaert 2003 and Kingsley and Whittam 2005). The only sites experiencing regular waterfowl fatalities have been those located on the shores of large, open expanses of water (Erickson et al. 2002). Raptor mortality rates at Midwest sites have been very low; generally one or two carcasses are found per study (Poulton 2010).

Episodic events involving large numbers of one or a few bird species during migration have been recorded at multiple wind energy projects, and are associated with lighting that attracts or disorients birds. The first documented episodic mortality event at a wind facility occurred in heavy fog during spring migration in May 2003 at Mountaineer Wind Energy Center in West Virginia and consisted of 33 passerine fatalities. Weather conditions and the location of the carcasses suggested that the birds were attracted to bright sodium vapor lights present at a substation located adjacent to three turbines. After these lights were extinguished, no other episodic events occurred at the substation or adjacent turbines (Kerns and Kerlinger 2004). Two additional episodic mortality events were observed in West Virginia during 2011. In October 2011, a total of 484 bird carcasses were found at the Laurel Mountain Substation, near a wind facility, after several days of fog, cold weather, and winds. Eight 250-watt high pressure sodium lamps were on at night during the event and were assumed to have attracted birds during adverse weather conditions. Similarly in September 2011 at the Mount Storm Wind Energy Facility in WV, 59 bird carcasses were found on one day, 31 of which were found at one turbine whose internal nacelle light had been inadvertently left on overnight. The previous night's weather had been foggy, and the nacelle light was thought to have attracted the birds to the turbine.

4.1.2 Potential Impacts from the Fowler Ridge Wind Farm

Pre-construction avian surveys and a review of other available site-specific bird use data have indicated that use by most bird species within the Project area is moderate when compared to other Midwest wind energy sites. AMGP and whooping crane are species of concern for the Project; impacts to these species are addressed specifically in Sections 4.2.1 and 4.2.2, below.

Over a total of 40 survey hours conducted during the spring and fall of 2007 at the Project area, a total of 7,738 birds comprised of 45 unique species were observed. This number was inflated by the high numbers of AMGP observed during surveys. Over a total of 112.67 survey hours conducted during all four seasons from spring 2008 to spring 2009, a total of 4,721 birds of 58 unique species were observed. During four years (March 15, 1996 - November 15, 1999) and approximately 325 hours of avian point count surveys at Buffalo Ridge, MN, a total of 70,727 birds of 164 species were recorded (Johnson et al. 2000). At Black Fork, OH, a total of 362 birds of 27 species were detected during approximately six hours of surveys in fall 2008. At the same facility in spring 2009, a total of 1,733 birds of 67 species were detected over approximately 18 hours of surveys (Ecology and Environment 2009).

Raptor use rates were also moderate at the Project area when compared to those recorded at similar Midwest sites. Plot sizes varied slightly across studies, but the results of other pre-construction surveys provide a relative comparison of raptor use per 20 minutes of survey effort. During the Fowler Ridge avian surveys, a total of 161 raptors of six species were observed in 2007 and a total of 64 raptors of 5 species were observed in 2008-2009. Raptor use at the Project averaged 0.60 and 1.22 raptors/plot/20 min survey in the spring and fall, respectively, at the Project area in 2007. During the 2008-2009 surveys, raptor use averaged 0.15, 0.13, 0.17, and 0.24 raptors/plot/20 min survey, in the spring, summer, fall, and winter, respectively. At Buffalo Ridge, MN, raptor use averaged 0.78, 0.22, 0.64, and 0.60 raptors/plot/20 min survey in the fall, winter, spring, and summer, respectively (Johnson et al. 2000). At Black Fork, OH, raptor use averaged 0.13 and 0.26 raptors/plot/20 min survey in the fall and spring, respectively (Ecology and Environment 2009). At Buckeye Wind, OH, raptor use averaged 0.11 and 0.20 raptors/plot/20 min survey in the fall and spring, respectively (Stantec Consulting Services, Inc. 2009). The number of raptor species detected has been similar across Midwest sites, ranging from 4 to 13 species (Kerlinger et al. 2007; Derby et al 2010; Guarnaccia and Kerlinger 2008; Cutright 2006 and 2009).

Potential Impacts from Construction of Phase IV

Potential impacts to birds during construction of Phase IV and Project decommissioning are likely to be minimal. Certain bird species may be temporarily displaced due to noise and increased human presence during these stages of the Project. Grassland birds may be particularly susceptible to displacement, although grassland and pasture habitat within the Project area is comprised of small fragments, with much edge habitat. The large majority of birds detected during surveys within and near the Project area were common species adapted to human disturbance (Johnson and Bay 2008 and Carder et al. 2010); these species are less likely to be displaced due to Project activities (Shaffer and Johnson 2008 and Kerlinger 2002). Mortality of juvenile birds may occur if construction or decommissioning actions occur in non-tilled areas during the breeding season. However, nesting habitat for ground- and shrub-nesting birds is limited within the Project area, due to the predominance of active agriculture (>90%).

Potential Impacts from Operation of Phases I-IV

Displacement

Although Project operation has the potential to cause displacement of birds from the Project area, bird species sensitive to disturbance currently exhibit low use of the Project area and minimal suitable habitat for these species is present, as discussed above. The majority of birds occurring within the Project area are members of common, disturbance-tolerant species; it is therefore unlikely that displacement impacts from the turbines would greatly alter the composition of the area's avian community. It is unclear if displacement impacts to more disturbance-sensitive species would persist for the life of the Project; certain species may adapt to the presence of the turbines (The Ornithological Council 2007).

Collision Risk

The operating turbines will also pose a risk of mortalities from collisions for avian resources within the Project area. Although the Project area does not exhibit any environmental characteristics indicating a high level of collision risk, the turbines are expected to regularly strike a small number of birds each year, based on the results of post-construction mortality studies at FRWF and similar facilities. Mortality rates over the life of the Project are expected to be within the 0.00 to 11.83 birds/turbine/year range reported from other Midwestern sites. Given the moderate levels of avian abundance and species richness, the lack of native habitats, and the low observed flight patterns of most birds in the Project area (Table 3.3), mortality rates are likely to be at the lower end of this range[2]. Initial post-construction monitoring studies estimated the bird mortality rate at 5.26 birds/turbine over spring, summer, and fall for Phase I of the FRWF (Johnson et al. 2010b). Given the 301-MW nameplate capacity of Phase I, the overall fatality estimate for the entire study period (three seasons) at FRWF was 2.83 birds/MW. This estimated fatality rate is lower than average compared to other wind energy facilities located in the Midwest. Overall bird fatality estimates at seven Midwest facilities in Nebraska, Wisconsin, Minnesota, Iowa, and Illinois have ranged from 0.6 to 7.2 and averaged 4.28 birds/MW/year (Johnson et al. 2010b).

Bird fatality rates have been observed to peak during the spring and fall migration seasons at most wind energy facilities (Johnson et al. 2002). The results of initial post-construction monitoring studies indicated that bird mortality at the Project area follows the same pattern of seasonality, though mortality rates are lower than the Midwest average (Johnson et al. 2010b). Passerines, both resident and migrant, are likely to constitute the greatest number of fatalities in the Project area, as this avian group represents the majority (75%) of mortalities at wind turbines nation-wide and was by far the group most frequently observed during surveys within and near the Project area (Johnson and Bay 2008 and Carder et al. 2010). Night-migrating passerines may be at a higher risk than other bird types, as this group has accounted for over 50 percent of avian fatalities at certain sites, but no particular species or group of species has been identified as incurring greater numbers of fatalities (Erickson et al. 2002). As a group, passerines constituted the majority of bird fatalities recorded at FRWF (Johnson et al. 2010b and Good et al. 2011). Birds taking off at dusk or landing at dawn, or birds traveling in low cloud or fog conditions (which lower the flight altitude of most migrants) are likely at the greatest risk of collision (Kerlinger 1995). Nationally, these mortalities have not been known to result in a significant population level impact to any one species, mainly because the migratory species with relatively high collision mortality are regionally abundant. Additionally, no large-scale night migration-related mortality events have been observed at turbines as have been seen at communications towers (Erickson et al. 2002).

Collision risk is likely to be much lower for other bird groups in the Project area. Very few waterbirds or waterfowl were observed during the pre-construction avian surveys; the high numbers of shorebirds (AMGP) observed are discussed under Section 4.2.1 below. National research has demonstrated that waterbirds rarely collide with inland turbines (Everaert 2003 and Kingsley and Whittam 2005), perhaps because of the consistently high (150-1500m)

[2] Recent post-construction studies at the Blue Sky Green Field (Gruver et al. 2009) and Cedar Ridge (BHE Environmental, Inc. 2010) facilities in Wisconsin have demonstrated that avian mortality rates at the high end of this range may result at facilities sited in agricultural habitats.

altitudes at which waterbirds migrate over land (Kerlinger 1995). Initial post-construction mortality studies recorded seven waterbird or waterfowl fatalities over two study seasons at both Phase I and Phase III and one study season at Phase II of the Project (Johnson et al. 2010a and b, Good et al. 2011). Risk to waterfowl may be increased on the Project area during the winter months if the croplands within the Project area attract large flocks of Canada Geese (Erickson et al. 2002). Raptor use of the Project area was observed to be moderate during the pre-construction surveys. The most frequently-observed raptor species were red-tailed hawk, American kestrel, and northern harrier (Johnson and Bay 2008 and Carder et al. 2010). Given the lack of major raptor migration lines through the Project area, low expected prey densities, and lack of raptor nests or nesting habitat observed during surveys (Johnson and Poulton 2007), raptor fatality rates at the Project site are expected to be similar to those at other Midwest sites. Initial post-construction monitoring studies recorded seven raptor fatalities over two seasons of studies at both Phase I and Phase III and one study season at Phase II of the Project, six of which were red-tailed hawks (Johnson et al. 2010b and Good et al. 2011). Fatality estimates were not calculated for birds in the Phase III or Phase II studies; however, the moderate avian fatality rate estimated from the Phase I 2009 study and the majority composition of red-tailed hawks, a widespread and common species in the Midwest, indicates these raptor fatalities are unlikely to represent an appreciable impact.

Section 4.3, Avoidance and Minimization Measures, provides a description of the conservation measures developed for birds based on the results of the pre- and post-construction studies and the impacts assessment. Although the potential for impacts is expected to be low and effectively minimized by the conservation measures, Section 5.2.2 includes adaptive management developed to address any unexpected impacts to birds.

Sensitive Species

Concerns expressed by the Service and IDNR regarding avian resources within the Project area focused primarily on collision risks during the migration season to listed species and certain other migratory birds. The Service and IDNR both expressed concern for migrating AMGP, a migratory bird and species of concern on the federal priority species lists and whooping cranes, a federally-endangered species with a population (listed under the ESA only as experimental) which migrates across Indiana. The IDNR also expressed concern for several state-listed species which are known or have the potential to occur near or within the Project area: least bittern, northern harrier, barn owl, short-eared owl, upland sandpiper, king rail, and western meadowlark. Four of these species: AMGP, upland sandpiper, northern harrier, and western meadowlark, were observed within the Project area during pre-construction surveys (Johnson and Bay 2008 and Carder et al. 2010). Several other IDNR-listed species were also observed during surveys (see Section 3.2). With the exception of AMGP and northern harrier, all sensitive species were observed in low numbers. A threatened and endangered species review of the Project area concluded that although construction activities will disturb a small percentage of available foraging habitats, in the form of grasslands and agricultural fields, for sensitive avian species, plenty of foraging areas will remain following Project construction. Additionally, all wetland areas, preferred habitat for many of the IDNR-listed bird species with potential for occurrence within the Project area, will be avoided by land-disturbing activities (CBBEL 2007b). Given the low numbers observed and limited available habitat, many of these species are therefore considered to be at low collision risk except during aerial mating displays or migration. Initial post-construction surveys in 2009, 2010, and 2011 recorded no fatalities of state or federally threatened or endangered bird species (Johnson et al. 2010a and b, Good et al. 2011).

American Golden-Plovers

Displacement and disturbance impacts to AMGP from the Project may be likely, as AMGP were not sighted near turbines during AMGP surveys conducted in 2007, 2008, and 2009 by WEST (Johnson et al. 2009). No AMGP were observed near the newly-erected turbines during the 2009 surveys, despite using these areas in 2007 and 2008 prior to the erection of the turbines. It is possible that AMGP could have shown an especially pronounced avoidance of wind turbines in 2009, as this was the first year that turbines were encountered within areas historically used by AMGP. Also, differences in AMGP used between 2007 and 2008, before turbines were constructed, showed that weather can greatly influence use of the Project area between years, regardless of the presence of turbines (Johnson et al. 2009). However, if AMGP continue to avoid areas near Project turbines, they may be displaced from much of the Project area (Figure 2). Displacement impacts are not expected to extend into the IBA, as neither erected nor proposed turbines are located immediately adjacent to the border of the IBA (Figure 2).

Given the high numbers of AMGP which occur within the Project area and adjacent IBA during the spring migration period (58,943 individuals were observed during the 2007 AMGP surveys), it is likely that some AMGP will collide with Project turbines or the Project transmission line. Flocks of AMGP will fly at altitudes within the rotor-swept area as they migrate into and out of the IBA and Project area, which may increase the risk of turbine collision. However, AMGP mortality at the Project is expected to be low relative to the number of individuals present and unlikely to have significant population-level impacts, considering the flight patterns and turbine avoidance observed during the surveys. During all three years of AMGP surveys within the Project area, AMGP were observed to spend the majority of time flying at their typical foraging altitudes, below blade height (Johnson et al. 2009). Based on these flight patterns and the lack of AMGP observed near newly-erected turbines during the 2009 surveys, despite previous observations in these areas in 2007 and 2008, it was concluded that AMGP may not be especially susceptible to collisions with wind turbines (Johnson et al. 2009). Initial post-construction monitoring studies conducted during the spring migration season for two years at both Phase I and Phase III and one year at Phase II of the Project did not detect any AMGP carcasses (Johnson et al. 2010a and b, Good et al. 2011).

Although impacts to AMGP have not been recorded at FRWF, Section 5.2.2 includes adaptive management developed for AMGP to address any unexpected impacts.

Whooping Crane Risk Assessment

In a response to a data request from FRWF dated October 13, 2006, the Service identified the Project as within the range of a non-essential, experimental population of whooping cranes (*Grus americana*). A risk assessment of potential impacts of the Fowler Wind Farm on the eastern experimental population of whooping cranes was undertaken in June 2007 (Johnson and Tidhar 2007). The eastern population of whooping cranes was reintroduced to the Midwest in 2001 and is listed as a non-essential, experimental population. This designation relaxes the restrictions of the ESA and lessens possible conflicts between people and whooping crane conservation. The flock is still protected under the MBTA. An ultra-light aircraft was used to imprint birds of this population to migrate between breeding grounds in Wisconsin and wintering grounds in Florida. One of the stopover sites on this route was in Benton County until 2008. Although juvenile cranes are no longer being led through Indiana during migration, whooping cranes that were trained to fly through the state may continue to maintain their route. Whooping cranes migrating on their own have the potential to occur anywhere in Indiana and eastern Illinois.

Within the 72,947 acres (29,521 ha) that comprise the FRWF, very few wetlands are present. However, approximately 94.6 acres (38.2 ha) of wetlands were identified in the vicinity of the

Project area. Habitat quality within these wetlands was found to be marginal for whooping cranes. There are also 38 acres (15 ha) of open water, primarily small ponds, within the Project area. It is possible that migrating whooping cranes may occasionally stopover in Benton County. The risk assessment determined that direct mortality during Project construction is very unlikely, especially when construction occurs outside of the spring and fall migration periods. Direct mortality was also determined to be unlikely during the steady migratory flight, since whooping cranes migrate at an altitude much higher (1,000 to 6,000 ft [305 to 1,829 m]) than the rotor-swept area of the Project turbines (approximately 82 to 427 ft [25 to 130 m]). The risk assessment identified greater potential for collision with turbines and/or the Project's transmission line during stopover periods when whooping cranes fly between foraging and rooting sites at sunset and sunrise under low-light conditions. Inclement weather was also determined to increase the chance of collision. Marking powerlines reduces collision rates; however, it was determined that the potential for adverse effects to whooping cranes, particularly from turbines, cannot be reduced to discountable or insignificant levels at the Project. The risk assessment concluded that for this reason, if the flock was protected under the ESA, the appropriate determination would be that operation of the Project is likely to adversely affect whooping cranes. Due to the presence of marginal stopover habitat in the Project area, the risk assessment considered the potential for disturbance and displacement of whooping cranes to be possible. However, based on the small total population size of the flock (~100 cranes) and the marginal quality of the habitat within the Project area, the overall risk to whooping cranes at the Project was determined to be low (Johnson and Tidhar 2007).

Although impacts to whooping cranes are not expected to occur at FRWF, Section 5.2.4 includes adaptive management developed for whooping cranes to address any unexpected impacts.

Eagle Use Assessment

The Service also documented in their September 2007 letter (Pruitt 2007) that there were no anticipated impacts to the bald eagle from the Project, based on the location of the Project site and the distribution of eagles in the area (USFWS letter addressed to Rene Braud, BP Alternative Energy).

An assessment of bald and golden eagle use at the FRWF was conducted in summer 2011 to summarize existing information and assess which risk category is most appropriate for the FRWF based on the latest guidance from the Service regarding eagle conservation plans (USFWS 2011a). Phases I-IV were found to lack primary bald eagle habitat in the form of mature forest and large, fish-bearing waters. Phases I-IV were also found to lack primary golden eagle habitat in the form of grasslands and other native habitat. Because over 98 percent of the Project area is composed of flat corn and soybean fields and developed areas, foraging and nesting opportunities were considered very low for bald and golden eagles. More suitable nesting habitat for bald eagles was found to exist outside of the FRWF along the forested corridors of the Tippecanoe and Wabash Rivers and associated woodlots over 10 miles (16 km) from the FRWF. Lower quality, but potentially suitable nesting habitat for bald eagles was also identified along Pine Creek, approximately two miles (3.2 km) east of the FRWF (Good and Simon 2011).

Correspondence provided by Matt Stuber, USFWS, on March 4, 2011, stated that there is one known bald eagle nest in Indiana within the 10-mile (16-km) buffer search zone, located approximately 6.5 miles (10.5 km) southeast of the southeast corner of the FRWF along Cranberry Marsh. The nest was recorded as active in 2009 and 2010, with two fledged young documented in 2009. Correspondence received on April 25, 2011, from Matt Sailor, USFWS, states that there are no records of bald or golden eagle use within the FRWF or the 10-mile (16-

km) buffer in Illinois, as of the most current dataset for Illinois (2009 nesting season). No records of nesting golden eagles exist for Indiana and the FRWF is located outside of the breeding range of the golden eagle. The Service also has records of additional bald eagle nests located along the Wabash River within 20 miles (32 km) of the FRWF, with the closest nest reported as 12 miles (19 km) away from the FRWF boundary. The Indiana nest information provided by the Service was current as of the end of the 2010 nesting season (Good and Simon 2011).

Over the course of four years of pre-construction bird surveys and post-construction carcass surveys at the FRWF, a total of three bald eagles and zero golden eagles were observed flying over the Project area. A single bald eagle was observed during regular point count surveys conducted in 2008. In addition, two bald eagles were incidentally observed during post-construction surveys conducted at the Project area in 2011. This low number of eagle observations was determined to indicate that although bald eagle nesting activity occurs within 6.5 miles of the FRWF, and although some lower-quality potential habitat is located as close as two miles (3.2 km) from the FRWF, eagles are not utilizing the FRWF for foraging or nesting due to the lack of habitat present, and are rarely observed flying over the FRWF. The low number of eagle observations was also interpreted to indicate that the Project area is rarely utilized by migrating bald eagles. The complete lack of golden eagle observations during wildlife studies and lack of known golden eagle use areas in Benton County suggested a very low probability of turbine collision for the species. No eagle fatalities were found at the FRWF over the course of 2.5 years of both formal fatality studies and implementation of the FRWF self-reporting, wildlife incident reporting system (Good and Simon 2011).

USFWS (2011) guidance, as currently written, states that any wind energy facility with important eagle use areas (e.g. nests) within 10 miles (16 km) of turbines should fall within Category 2—moderate to high risk to eagles. However, the eagle use assessment contends that the FRWF should be considered a Category 3—minimal risk site for eagles, due to site characteristics, known eagle distributions, and survey results indicating low use of the Project area by eagles and consequently low risk to eagles from the FRWF. In a letter dated September 10, 2007, the Service came to a similar conclusion, and stated “the distribution of eagle nests with respect to the project study area has not changed since our previous review of the project, and there are currently no anticipated impacts on eagles.” The Service documented in their September 2007 letter (Pruitt 2007) that there were no anticipated impacts to the bald eagle from the Project, based on the location of the Project area and the distribution of eagles in the area (Good and Simon 2011).

In February, 2012, the Service provided additional comments regarding eagle risk at the Project area in accordance with BGEPA and the MBTA, based on the eagle use assessment conducted and other data. The Initial Assessment of Eagle Risk, as outlined in the Draft ECP Guidance, for the Fowler Ridge Wind Energy Development (included as Appendix B) concluded that risk to eagles from the Project may be relatively low. This was determined based on data indicating that the FRWF a.) does not appear to overlap with any “important eagle use areas,” b.) appears to overlap only limited amounts of suitable eagle habitat, c.) may have low risk to eagles during the breeding and winter seasons, and d.) may have relatively limited eagle use during spring and fall migration (based on 2007-2009 survey results). However, based on sources of uncertainty associated with eagle use of the Project area and the relatively large size of the Project, the Service noted that risk to eagles is difficult to predict for the FRWF and may be underestimated. The Service’s predictive model arrived at a fatality estimate of 0.201 bald eagles per year for the Project, with a 95 percent confidence interval between 0 and 0.604 bald eagles per year. Extrapolated over the 25-year life of the Project, the fatality estimate adds up to 5 bald eagles; however, actual eagle fatality could be as low as zero, given the confidence intervals associated with the calculation of risk. The Service recommended that FRWF develop

an eagle management plan for the Project to consider risk to eagles and outline a management strategy. The Project's eagle management plan is included in Section 5.2.3.

4.2 BATS

4.2.1 Overview of Potential Impacts

Commercial wind facilities have been found to affect many bat species (Arnett et al. 2008). These impacts may include displacement of individuals, fragmentation of habitat, and direct mortality from collisions with or proximity to wind turbines (Kunz et al. 2007a). Mortality or loss of reproductive fitness may also occur due to habitat destruction or increased noise, vibration, human activity, or traffic associated with wind facility construction and maintenance. Direct mortality at wind turbines is currently the greatest concern for bats in general at wind facilities (Cryan 2008a). Whether bats are attracted to wind turbines and the exact mechanisms by which wind turbines cause mortality are unclear (reviewed in Kunz et al. 2007b); however, several hypotheses have recently been put forth and tested, including the role of land cover and environmental conditions in attracting bats to wind turbine locations, behavioral factors that might make wind turbines attractive to bats, pressure changes from rotating blades causing "barotrauma", or direct impact of unsuspecting migrant bats (Baerwald et al. 2008; Horn et al. 2008; Johnson et al. 2004; Kerns et al. 2005; reviewed in Kunz et al. 2007b).

The influence of landcover on bat mortality at wind turbine sites is unclear (Arnett et al. 2008). Johnson et al. (2004), for example, found no significant relationship between bat fatalities and landcover type within 328 ft (100 m) of wind turbines. They also found no significant relationship between bat mortality and distance to wetlands or woodlands (Johnson et al. 2004). Weather conditions, such as wind speed, rainfall, and temperature, have been found to have a significant impact on bat mortalities (Arnett et al. 2008). Bat mortality and insect activity are both high on nights with low wind speed (Kerns et al. 2005). Bat fatalities decrease with increases in wind speed and precipitation intensity (Kerns et al. 2005).

The primary bat species affected by wind facilities are believed to be migratory, foliage- and tree-roosting species that mostly emit low frequency calls (Johnson et al. 2004; reviewed by Kunz et al. 2007b). Arnett et al. (2008) compiled data from 21 studies at 19 wind facilities in the United States 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, nearly 75 percent were the migratory, foliage-roosting hoary bat, eastern red bat, and silver-haired bat (Kunz 2007a).

Some researchers have suggested that bats that roost in foliage of trees for most of the year may be attracted to wind turbines because of their migratory and mating behavior patterns (e.g. Kunz et al. 2007b; Cryan 2008b). At dawn, these tree bats may mistake wind turbines for roost trees, thereby increasing the risk of mortality (Kunz et al. 2007b). Cryan (2008) suggested that male tree bats may be using tall trees as lekking sites, calling from these sites to passing females. If this is the case, then tree bats may be more attracted to wind turbine sites after the turbines are erected. Migrating tree bats are also thought to navigate across large landscapes using vision rather than echolocation, possibly resulting in the bats being attracted to visual landscape features, such as wind turbines, during migration (Cryan and Brown 2007). As further support for these hypotheses, the majority of bat fatalities occur mid-summer through fall, during approximately the same time frame as southward migration of tree bats (Arnett et al. 2008). Tree bats tend to be larger species that emit low frequency calls. Bats that use low frequency calls may be more inclined to forage above tree tops where there are few obstructions. Migratory bats may also fly higher to maximize efficiency. Thus, tree bats may be more likely to fly in the rotor-swept area of wind turbines when compared to smaller bat species that have different foraging and migration strategies.

Although the number of bat fatalities recorded at wind energy facilities varies regionally, reports of mortality have been highest along forested ridge tops in the eastern U.S. and lowest in open landscapes of Midwestern and western states (Kunz et al. 2007b). However, it is difficult to make direct comparisons among projects due to differences in study length, metrics used for searches, and calculations for compensating for study biases (Arnett et al. 2008). Fatality rates ranged from 0.00 bats/turbine/year to 42.7 bats/turbine/year and averaged 7.12 bats/turbine/year in 21 studies conducted at wind energy facilities across North America (Barclay et al. 2007). In the Midwest, bat fatalities range from 0.1 to 40.5 bats/turbine/year (Poulton 2010), but higher fatality rates (up to 69.6 fatalities/turbine/year) have been reported in the eastern U.S. (Arnett et al. 2008). Estimates based on mortality studies conducted within USFWS Region 3 (Ohio, Michigan, Indiana, Illinois, Wisconsin, Missouri, Iowa, and Minnesota) suggest that fatalities range from 0.76 to 30.61 bats/MW/year (mean= 6.81) (USFWS data).

4.2.2 Potential Impacts from the Fowler Ridge Wind Farm

Bat mortality or loss of reproductive fitness is not expected to result from construction of the remaining phase of the FRWF (i.e., Phase IV), or associated increases in noise, vibration, human activity, and/or traffic, due to the lack of suitable maternity habitat or hibernacula for bats in the nearly 100 percent agricultural Project area.

Pre-construction acoustic bat use surveys indicated that use of the Project area by bats was moderate. Compared to the 4.7 and 6.45 mean bat passes per detector-night recorded in 2007 and 2008, respectively, at FRWF (Gruver et al. 2007 and Carder et al. 2009), 2.2 and 1.9 mean bat passes per detector-night were recorded in 2001 and 2002, respectively, at the Buffalo Ridge site in Minnesota (Johnson et al. 2004), 2.8 and 7.7 mean bat passes per detector-night were recorded at elevated and ground detectors, respectively, at the Blue Sky Green Field site in Wisconsin (Gruver 2008a), 5.7 mean bat passes per detector-night were recorded at the Glacier Hills site in Wisconsin (Gruver 2008b), 12.4 mean bat passes per detector-night were recorded at the Buckeye Wind site in Ohio (Stantec Consulting Services, Inc. 2009), and 34.9 mean bat passes per detector-night were recorded at the Top of Iowa site in Iowa (Jain et al. 2011).

Bat mortality monitoring studies conducted at FRWF have resulted in overall bat mortality rates that are within the range (0.1-40.5 fatalities/turbine/year) reported by studies at other Midwest wind energy facilities. The overall estimated fatality rate from all three seasons of mortality monitoring at Phase I was 15.03 fatalities/turbine/year (90% CI=10.89, 20.52) (Johnson et al. 2010b). The overall (spring and fall combined) estimated fatality rate from the mortality monitoring in 2010 at Phases I, II, and III was 16.59 fatalities/turbine/year (90% CI=14.36, 18.92) based on the Shoenfeld estimator and 22.20 fatalities/turbine/year (90% CI=19.32, 29.17) based on the empirical estimator (Good et al. 2011).

All nine bat species whose geographic ranges overlap with the Project area have been documented as fatalities at the FRWF; the Seminole bat has also been recorded as a fatality, although the species' range does not include the Project area (Johnson et al. 2010a and b, Good et al. 2011 and 2012). However, the majority of fatalities have consisted of migratory tree bat species. This pattern has been consistent at wind energy facilities throughout North America (Arnett et al. 2008) and it is expected that migratory tree bats will comprise the majority of the bat fatalities over the life of the Project. A separate HCP is being prepared to identify and address impacts specific to the ESA-listed Indiana bat at the FRWF (FRWF 2013). The majority of bat fatalities over the life of the Project are expected to occur during the fall migration period, as has been the pattern at wind energy facilities throughout North America (Arnett et al. 2008) and at the FRWF (Johnson et al. 2010b, Good et al. 2011).

A small number of bat fatalities were documented at the FRWF during spring monitoring (0.56 bats/turbine Shoenfeld estimate, 0.74 bats/turbine empirical estimate in 2010; 0.61 bats/turbine Shoenfeld estimate, 0.66 bats/turbine empirical estimate in 2011). Data collected at the FRWF show much lower overall bat activity in spring than in fall and the great majority of bat mortality at FRWF to-date has occurred during the fall migration season (see Sections 3.4 and 3.5), indicating that risk to bats at FRWF occurs mostly during the fall. It is not possible to compare the level of mortality observed at the FRWF to other wind facilities in the region. Relatively few post-construction monitoring studies have been conducted at wind facilities in the Midwest; only 12 wind power projects have publicly available post-construction monitoring data and among these, only six conducted monitoring during the spring. None of these six projects conducted spring monitoring with the same intensity as was done at the FRWF, and are therefore not comparable. However, bat fatalities that occurred during the spring at the FRWF comprised an extremely small percentage of the total bat fatalities; fall mortality constituted approximately 97 percent to 98 percent of the estimated annual bat fatality (Table 4.1).

Table 4.1 Seasonal Distribution of Bat Fatalities at FRWF, Benton County, Indiana

		Spring Bat Fatalities			Fall Bat Fatalities		
Study[1]	**Method**	**Dates**	**Estimate[2]**	**% of Combined Spring & Fall Estimate**	**Dates**	**Estimate[2]**	**% of Combined Spring & Fall Estimate**
Fowler I-III (Good et al. 2011)	Shoenfeld	4/13-5/15, 2010	0.56	3.4	8/1-10/15, 2010	16.03	96.6
	Empirical		0.74	3.3		21.45	96.7
Fowler I-III (Good et al. 2012)	Shoenfeld	4/1-5/15, 2011	0.61	2.6	8/1-10/15, 2011	22.99	97.4
	Empirical		0.66	2.1		30.54	97.9

[1] Note that monitoring conducted during the spring at the FRWF during 2009 was not included because the study period included spring and part of the summer (Apr 6, - Jul 3, 2009).
[2] Bats/turbine

Conservation measures that were implemented based on the results of the pre-construction studies to reduce the general impacts to bats at FRWF are described in Section 4.3, Avoidance and Minimization Measures. However, based on the post-construction monitoring results, FRWF also developed targeted conservation measures to reduce the impacts to bats during the period of highest risk in the fall, as described in Section 4.3.5, Operational Changes. Although the potential for impacts is expected to be effectively minimized by these conservation measures, Section 5.2.2 includes adaptive management developed to address any unexpected impacts to bats.

4.3 AVOIDANCE AND MINIMIZATION MEASURES

FRWF has taken several initial steps to reduce the impacts to avian and bat resources from the Project. The planning, development, and completed construction stages of the Project have incorporated guidance from the Wind Turbine Guidelines Federal Advisory Committee, APLIC, U.S. Fish and Wildlife Service, and the IDNR. These measures have long-term conservation benefits by having avoided potential impacts during Project development and construction.

The minimization measures presented below, particularly the operational protocol (Section 4.3.5), are expected to reduce potential direct impacts resulting from operation of the Project. The minimization measures are intended to protect all bird and bat species that may occur within the Project area, including the ESA-listed Indiana bat and the Indiana state-listed evening bat. Mortality monitoring (Section 5.1) will evaluate the effectiveness of the Project's minimization measures at protecting birds and bats at the FRWF and the Project's adaptive management plan (Section 5.3) will allow for adjustments to the minimization measures, if necessary.

A separate HCP is being prepared to address specific impacts to the Indiana bat from the FRWF; it is proposed that the ITP associated with the HCP authorize the incidental take of 193 Indiana bats over the 21-year permit term (FRWF 2013). The HCP includes the minimization measures presented below to ensure that the level of authorized take will not be exceeded. The HCP also includes additional conservation measures to mitigate for the take of Indiana bats at the FRWF. FRWF has received a State Endangered Species ITP from the IDNR Division of Fish and Wildlife authorizing take of evening bats as the result of operation of the wind turbines at the FRWF. Although the permit does not limit the number of evening bat takes that may occur at the FRWF, it is expected that the avoidance and minimization measures implemented at the Project to reduce Indiana bat mortality may also reduce evening bat mortality, as a subset of all bat mortality.

4.3.1 Pre-Construction Studies

Pre-construction studies were conducted for Phases I-IV to assess potential impacts to avian and bat resources and assist in micrositing of turbines and associated facilities to avoid and minimize the identified potential impacts. These studies, described in Sections 3.1, 3.2, and 3.4, include:

- Fixed-point bird use surveys
- Raptor nest surveys
- AMGP surveys
- Whooping crane risk assessment
- Eagle use assessment
- Acoustic bat surveys
- Wetland surveys
- Landcover mapping
- Threatened and endangered species review

4.3.2 Siting and Design

The Project has been developed in phases, beginning in the southwest portion of the overall Project area, per USFWS recommendations (Figure 2). This has provided the opportunity to observe the effect of the Project on AMGP use of the area prior to development closer to the AMGP IBA. Results of the AMGP surveys have influenced the siting and design of Project Phase IV, located closer to the IBA. All Phase IV turbines will be sited at least 1,760 ft (536 m) from the IBA border to avoid creating areas within the IBA which may not be used by plovers, as observed near turbines in 2009. Additionally, WEST determined that based on the flight patterns observed during three years of surveys, AMGP may not be especially susceptible to collisions with wind turbines (Johnson et al. 2009), indicating that construction of turbines closer to the IBA may not greatly increase the risk to AMGP.

The siting processes for all phases of the Project incorporated considerations to avoid or minimize impacts to avian and bat resources and habitat. During the micro-siting processes, pre-construction avian and bat use and habitat mapping study results were used to avoid locating turbines or access roads in areas of potentially suitable habitat for sensitive species and areas of higher use (riparian, grassland, woodlot habitats and gamebird areas). No turbines were placed within GHA's. Approximately 1,000 ft (305 m) of transmission line was routed within a right-of-way (ROW) easement granted by the IDNR which runs along the frontage road of the Hawkin's GHA. The design of the transmission line follows spacing recommendations included in the 2006 Avian Power Line Interaction Committee (APLIC) *Suggested Practices for Avian Protection on Power Lines, the State of the Art in 2006* (APLIC 2006). Project facilities and infrastructure were sited to avoid impacting the remaining forest stands in Parish Grove. As a best practice, the amount of aboveground collection and transmission lines were minimized across all Project sites. Six miles (9.7 km) of 345 kV overhead transmission line connect Phase II turbines to the Phase I substation. This line was built to the spacing guidelines recommended in the Avian Power line Interaction Committee's *Suggested Practices for Avian Protection on Power Lines, the State of the Art in 2006* (APLIC 2006). Sixty-two miles (99.8 km) of 34.5 kV collection line were buried within the Phase II site. There is no aboveground collection within the Phase I, II, and III Project areas. Collection lines crossing streams were directionally bored to minimize impact to streambeds. These best practices will also be utilized in designing and constructing the collection and transmission lines for Phases IV.

The Project substation is equipped with downward facing shields on all lights. The lights are equipped with light-sensors set to come on at night for security purposes. All operators and technicians on site are required to turn off internal lights in turbines at night unless staff is conducting repair work or maintenance on that turbine. Facility staff will be trained on the importance of light management to minimize impacts to birds.

Through engineering and micro-siting, county roads were utilized to the maximum extent possible during construction of Phases I-III. New roads were designed to cover the shortest distances, where possible, while also minimizing impacts to wetlands, jurisdictional waters, and sensitive habitat. Construction of Phases IV will exercise these same measures, as it is both environmentally and economically preferable to minimize the footprint of roads within the Project area.

Following the useful life of the Project facilities and infrastructure, the FRWF owners have the option to decommission the assets. Decommissioning of the Project will minimize the long term impacts (when compared with re-commissioning or re-powering the Project) by removing turbines from the Project area and restoring the area to the pre-existing land use and vegetation communities.

4.3.3 Construction Sensitive Species Awareness Training

Sensitive species training practices have been developed to teach all workers on the Project to be aware of sensitive wildlife. This training has been integrated into the standard construction orientation at FRWF. Training materials include laminated pamphlets detailing the potential sensitive species within the Project area, to serve as a convenient reference to be maintained in Project vehicles. Additionally, large sensitive-species posters are provided for display in construction trailers. Training includes an emphasis on reviewing the posters and instructions for reporting any suspected sensitive species observations to construction supervisors. Sensitive species identification training has been given to Phase I, II, and III staff. Training will also be provided to Phase IV staff.

4.3.4 Biomonitor

The construction schedule and location of proposed construction activities was evaluated against habitat mapping results for Phase II to determine the potential for construction to occur within areas of potentially-suitable habitat for state-listed bird species or nesting raptors. Where necessary, biological monitoring services were contracted for construction of Phase II of the Project. The biological monitor was present on-site three days per week, from April 22 to July 10, 2009. Surveys were conducted within the proposed construction footprint at least once per week during this time period in order to identify newly established bird nests. After June 15, it was expected that all birds should have established nesting territories, and no new nests would be established. Construction schedule and location plans will be evaluated for Phases IV prior to initiation of construction activities; if necessary, biological monitoring services will be contracted for construction of this Phase.

4.3.5 Operational Changes

Birds

Low bird mortality rates were observed during the post-construction mortality studies for Phases I and III (discussed in detail in Section 3.3) verifying the effectiveness of the avoidance and minimization measures incorporated in the development, siting, and design of the Project at reducing impacts to avian resources. The AMGP surveys indicate that construction of Phase IV turbines, in adherence with recommendations of the Service (Pruitt 2007), is unlikely to greatly increase impacts to AMGP in the Project area and IBA. Therefore, no operational minimization measures for birds are proposed by FRWF at this time. This determination will be re-evaluated throughout the life of the Project, through the adaptive management framework described in Section 5.3.2, below. Although the operational adjustments discussed below will reduce the amount of time that turbines are in operation at night during the fall season, this measure is not expected to noticeably affect bird mortality. Curtailment studies at FRWF in 2010 and 2011 did not detect a relationship between turbine operation and observed bird mortality (Good et al. 2011, Good et al. 2012).

Bats

Spring bat mortality rates have been low at FRWF to-date, comprising approximately 2 percent to 3 percent of bat fatalities documented during spring and fall monitoring (see Section 4.2.2). This pattern has been prevalent at wind energy facilities in North America (Arnett et al. 2008) and it is currently understood that bats behave differently during spring migration, making shorter, more direct flights that put them at much lower risk than during the fall, when mating behavior coincides with migration (Kunz et al. 2007b, Cryan 2008b). Therefore, no operational minimization measures for bats during spring are being proposed.

Fall bat mortality rates were moderate during the post-construction mortality studies for Phases I and III (discussed in detail in Section 3.5). However, two Indiana bat fatalities and four evening bat fatalities have been found at the FRWF to-date. In response to these unexpected impacts to federal and state-endangered species, FRWF implemented operational minimization measures at the Project, obtained a state ITP for evening bat from the IDNR, and is in the process of developing an HCP for Indiana bat and obtaining an ESA Section 10 ITP for Indiana bat from the USFWS Region 3 office (FRWF 2013). Implementation of operational minimization measures at FRWF has been shown to reduce overall bat mortality rates, comprised primarily of tree bat species, from moderate levels to low levels.

FWRF will minimize overall bat mortality and potential take of Indiana bats and evening bats from operations of the Project by implementing seasonal turbine operational adjustments. For the term of the ITP, FRWF will

1) Raise the turbine cut-in speed to 5.0 m/s during the fall migration season at the FRWF; and
2) Adjust the turbine operations parameters so that the rotation of the turbine rotors below cut-in wind speed is minimized (the blades are "feathered").

Raised cut-in speeds and feathering of turbine blades below cut-in wind speed will be implemented on a nightly basis from sunset to sunrise, adjusted for sunset/sunrise times weekly, from August 1 to October 15 annually. Under this turbine operational protocol, FRWF has committed to reducing mortality of all bat species by at least 50 percent. This turbine operational protocol represents the maximum extent to which FRWF can reduce turbine operations and maintain Project viability, as demonstrated in the confidential financial document associated with the HCP (FRWF 2013, Appendix J).

In concurrence with other studies demonstrating an inverse relationship between bat mortality and increased turbine cut-in speeds and/or turbine feathering (Arnett et al. 2009 and Baerwald et al. 2009), bat fatalities at the FRWF were reduced by a mean of 50 percent (90% CI = 38%-60%) when cut-in speeds were increased to 5.0 m/s during the 2010 fall migration season (Good et al. 2011). However, turbines were not feathered below this cut-in speed in 2010. In 2011, turbines at the FRWF were feathered until cut-in wind speeds of 4.5 m/s and 5.5 m/s were reached. The results of this study indicated that feathering turbines below a cut-in speed of 5.0 m/s would have achieved between 57 percent (mean at 4.5 m/s; 90% CI = 39%-70%) and 73 percent (mean at 5.5 m/s; 90% CI = 60%-83%) reduction in mortality (Good et al. 2012). Tree bats comprised more than 90 percent of the fatalities recorded for each cut-in speed in the study; this consistent species composition indicates that the great majority of fatalities avoided at the higher cut-in speeds were also tree bats. Therefore, feathering of turbines during the fall migration season is expected to greatly reduce overall bat mortality as well as reduce potential take of listed bat species. Tree bat species, including red bat, hoary bat, and silver-haired bat, are particularly likely to benefit from this turbine operation measure, as these species have comprised the majority of bat mortality at the FRWF and consequently will comprise the majority of the reduction in mortality due to modified turbine operations. Fatality of bat species that are not federally listed is estimated to be reduced from 33.68 bats/turbine/year to 18.63 bats/turbine/year as a result of implementing operational changes at FRWF.

The only exception to feathering turbines below a cut-in speed of 5.0 m/s would occur on nights when temperatures are below 50˚ F (10.0°C) from August 1 to October 15. Turbines will be allowed to operate at full capacity below these temperatures. Turbines will be monitored and controlled based on temperature on an individual basis (i.e., the entire facility will not alter cut-in speed at the same time, rather operational changes will be based on temperature conditions specific to each turbine). Turbines will begin operating under normal conditions when the 5 to 10 minute rolling average temperature drops below 50˚ F (10.0 ˚C); raised cut-in speeds will be resumed if the 5 to 10 minute rolling average temperature goes to 50˚ F (10.0 ˚C) or above during the course of the night.

The 50˚F (10.0 ˚C) temperature threshold is based on results from post-construction mortality monitoring at FRWF and nightly temperatures measured at 10-minute increments derived from turbine Supervisory Control and Data Acquisition (SCADA) data between the hours of 20:00 and 08:00 from August 1 to October 15, 2010-2012. These data show that the proportion of fresh bat fatalities that occurred when average nightly temperatures were above 50˚ F (10.0 ˚C) was 99.7 percent (285 fatalities out of 286; range in nightly temperatures in this group of fatalities was

42.8˚F to 88.9˚F [6.0˚C to 31.6˚C]) in 2010, 99.0 percent (307 fatalities out of 310; range in nightly temperatures in this group of fatalities was 44.4˚F to 85.6˚F [6.9 ˚C to 29.8˚C]) in 2011, and 98.2 percent (55 fatalities out of 56; range in nightly temperatures in this group of fatalities was 44.1˚F to 100.4˚F [6.7˚C to 38.0˚C]) in 2012. Average nightly temperatures were below 50˚ F (10.0 ˚C) 4.1 percent of the time in 2010, 2.7 percent of the time in 2011, and 9.5 percent of the time in 2012.

Given the relatively small proportion of time temperatures are expected to be below 50˚ F (10.0˚C), and the large proportion of fatalities that occurred above 50˚ F (10.0˚C) during both years of study, feathering turbine blades below 5.0 m/s above this temperature threshold is expected to adequately minimize risk to bats and achieve at least a 50 percent reduction in all bat mortality from 2010/2011 levels. However, if greater than 10% of documented fatalities occur on nights when temperatures are below 10.0˚ C in any given year, as determined through analysis of mortality data at the conclusion of the fall monitoring period, then turbine operational adjustments (i.e., turbines feathered up to a cut-in speed of 5.0 m/s) will be resumed for the entire night during the fall, regardless of temperature, in future years. Should the FRWF be required to disable the temperature-controlled cut-in speed adjustment parameter, the turbine control software would be reconfigured remotely and rolled out to each individual turbine. Currently this task would require one to three days to implement, but user interfaces are improving which could accelerate implementation time in the future.

In addition raising cut-in speeds to 5.0 m/s and feathering turbines below this cut-in speed, FRWF will implement an adaptive management plan that includes raising cut-in speeds in 0.5 m/s increments, if needed, to assure that bat mortality does not exceed acceptable limits. The adaptive management plan is described in detail in Section 5.3.

5.0 ADAPTIVE MANAGEMENT AND MONITORING PLAN

5.1 FALL POST-CONSTRUCTION MONITORING

Post-construction monitoring has been conducted at Phases I, II, and III during each year of Project operation. Based on the results of past monitoring, fall post-construction monitoring will continue to be conducted at all Project phases (including Phase IV, once operational) throughout the life of the Project. Because bird mortality rates were found to be moderate (compared to other Midwest wind energy facilities; see Section 3.3), the monitoring protocol is focused on providing an accurate estimate of all bat mortality and enabling the detection of changing trends in bat mortality over time. However, the protocol will provide for the detection of unusual bird fatalities or mass mortality events, as all birds found during surveys will be recorded and included in survey reports. Monitoring will ensure that for all bird and bat casualties found, data recorded will include species, sex and age determination (when possible), turbine identification number, date and time collected, global positioning system (GPS) location, condition (live, injured, intact, scavenged, feather spot), and distance from turbine, as well as any comments that may indicate cause of death for fatalities. Monitoring will also ensure that take of all bat species is reduced by at least 50 percent throughout the life of the Project. Monitoring will also provide the information necessary to calculate the incidental take of Indiana bats by the FRWF and ensure compliance with the take limit established in the ITP. This is described in the HCP (FRWF 2013). Results of the monitoring efforts will serve as the basis for adaptive management decisions related to turbine operational changes, the primary bat mortality minimization measure for the Project.

5.1.1 Monitoring Phases and Schedule

Fall post-construction monitoring (referred to as take compliance monitoring in the HCP due to its focus on estimating Indiana bat fatality) will be conducted in two phases: the Evaluation Phase and the Implementation Phase. There are two main objectives for the post-construction monitoring: (1) to conduct monitoring that provides data to accurately determine if a 50 percent reduction in bat mortality from 2010/2011 levels has been achieved; and (2) to detect changing trends in bat mortality over time. Because risk to Indiana bats (and bats in general) and the effectiveness of minimization measures is uncertain, monitoring will be most intensive at the beginning of the ITP term. During the first fall migration period following issuance of the ITP, Evaluation Phase mortality monitoring will be conducted. It is expected that the Evaluation Phase, along with the four years of post-construction mortality monitoring conducted from 2009 to 2012, will provide sufficient information to accurately assess the level of risk to Indiana bats and bats in general by confirming the effectiveness of the operational curtailment.

After the completion of the first year of Evaluation Phase mortality monitoring, provided the results confirm at least the estimated 50 percent reduction in mortality calculated from the fall 2010-2011 data, FRWF will implement the less intensive Implementation Phase monitoring every year for the duration of the ITP. A stepped-down approach to monitoring will be adopted during the Implementation Phase that will nevertheless be sufficient to continue monitoring bat mortality and to detect year to year changes in bat mortality that may occur. The Implementation Phase monitoring will remain in effect for the remainder of the operational life of the Project, unless a less than 50 percent reduction in bat mortality (indicating less than a 50% reduction in Indiana bat mortality, which equates to the adaptive management threshold) from 2010/2011 levels is observed. If this occurs, operational changes in accordance with the adaptive management framework described in Section 5.3 would be made and two years of Evaluation Phase monitoring would be conducted following the operational change to confirm its effectiveness at reducing bat mortality by at least 50 percent from 2010/2011 levels. Table 5.1

summarizes the differences in sampling intensity for each phase of monitoring. During all phases of monitoring, searches will be conducted from August 1 to October 15, which encompasses the period of highest overall bat mortality at the FRWF during 2009, 2010, and 2011 (Good et al. 2011 and 2012), the fall migration period for Indiana bats (USFWS 2007), and the period in which both Indiana bat fatalities occurred at the FRWF.

5.1.2 Sample Size and Search Interval

Table 5.1 Permit Year and Sample Size for Each Phase of Monitoring at the FRWF, Conducted Annually from August 1 to October 15

Fall Monitoring Phase	Permit Year	Number of Turbines Searched		
		Phase I, II, III (355 turbines)	Phase I, II, III, IV (449 turbines)	Phase IV (94 turbines)
Evaluation Phase	Year 1	118	N/A	N/A
Implementation Phase	Years 2-21, with the exception of 2 years following any operational change	75	90	20
Evaluation Phase	2 Years following any operational change	118	150	31

To provide sufficient statistical power and spatial coverage to detect potential differences in mortality rates among years and avoid spatial biases, 33 percent of turbines will be searched for Evaluation Phase monitoring and 20 percent of turbines will be searched for Implementation Phase monitoring. To further minimize potential for bias due to search location, efforts will be made to ensure sampling locations are representative of the entire FRWF and are relatively equally distributed through the Project area. Search turbines will be distributed among turbine types in proportion to their relative occurrence in the Project area.

The search interval for each year of fall monitoring will be based on the average carcass removal length determined during the previous year's monitoring effort as follows:

- Weekly (i.e., each turbine will be searched once per week), if mean carcass removal is > 7 days;
- Semiweekly (i.e., each turbine will be searched twice per week), if mean carcass removal is > 3 days; or
- Daily (i.e., each turbine will be searched once per day), if carcass removal is < 3 days.

During the first year of fall mortality monitoring following issuance of the ITP, a weekly search interval will be used, based on mean carcass removal times of 9.93, 10.34, and 13.02 days observed during monitoring at FRWF in 2009, 2010, and 2011, respectively (WEST unpublished data, Good et al. 2011 and 2012). Searches on any given monitoring day will begin after 7:00

AM and will be completed by sunset. Most searches will be completed by mid-afternoon on any given search day.

5.1.3 Search Area

To develop reliable estimates of bat mortality, only roads and pads will be searched during monitoring. There are numerous benefits of roads and pads searches:

1) Searcher efficiency estimates are significantly higher on the roads and pads (about 85%) compared to cleared plots containing areas away from roads and pads (about 32%) (Good et al. 2011). Higher searcher efficiency results in more precise estimates of mortality.
2) A more randomized and representative sample can be acquired when only searching roads and pads. Logistics for clearing plots are significant and the location of plots is limited to landowners willing to cooperate with the study. Increased randomization strengthens model assumptions for fatality estimation.
3) A much larger sample of individual turbines can be searched, providing larger spatial coverage. Increased spatial coverage provides additional information regarding possible flyways. Additional spatial representation also allows for testing and evaluation of a larger number of factors that may influence mortality, including proximity to landscape features (e.g., distance to water, shelterbelts, or surrounding crop types).

The results of the 2010 FWRF study support the use of road and pad searches for generating comparable and unbiased overall bat fatality estimates (Good et al. 2011). The 2010 study determined, through a double sampling approach, that overall bat fatality estimates using only road and pad searches were comparable to bat fatality estimates generated from cleared plot searches. The study also confirmed that fatality density (fatalities per square meter) decreased as distance to turbine increased.

5.1.4 Data Collection

Observers trained in proper search techniques will conduct the carcass searches. All bat (and bird) carcasses will be recorded, although casualty rates will only be calculated for bats[3]. Searches will occur within all roads and pads located within 263 feet (80 m) of turbines selected for the study. Observers will walk at a rate of approximately 148 to 197 feet per minute (about 45 to 60 m per minute) scanning the ground out to 7-10 feet (2-3 m) either side of the transect for casualties. Transects will be spaced at a maximum of 16-foot (5-meter) intervals, allowing for some visual overlap of search area between transects to help maximize carcass detection.

The condition of each casualty found will be recorded using the following categories:

- Live/Injured – a live or injured bat or bird.
- Intact - a carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger.

[3] Given the very low numbers of bird fatalities documented during mortality monitoring at the FRWF (HCP [FRWF 2013], Appendix A), and the likelihood for low bird fatality rates in the future, it is not possible to develop a road/pad correction factor specifically for birds that could be used to derive an adjusted bird fatality estimate. However, since bird carcasses will be collected, it will be possible to monitor for changes in patterns of bird mortality or to document large fatality events, if they were to occur.

- Scavenged - an entire carcass, which shows signs of being fed upon by a predator or scavenger, or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, portion of a carcass, etc.), or a carcass that has been heavily infested by insects.
- Feather Spot (for bird carcasses only) - 10 or more feathers at one location indicating predation or scavenging.

Fresh bat carcasses found, except for *Myotis* species, will be collected, identified, and utilized during searcher efficiency and carcass removal trials (see below for more details). Tissue and hair samples will be collected from all dead bats throughout the life of the Project. Older or scavenged bat carcasses, except those already positively identified as non-Myotis, will be identified, labeled with a unique number, and then bagged and frozen for future reference and species identification testing (e.g. deoxyribonucleic acid [DNA] analysis). A copy of the data sheet for each casualty will be maintained, bagged with the carcass, and kept with the carcass at all times. For all casualties found, data recorded will include species, sex and age determination (when possible), turbine identification number, date and time collected, Global Positioning System (GPS) location, condition (live, intact, scavenged, feather spot), and distance from turbine, as well as any comments that may indicate cause of death. For casualties where the cause of death is not apparent, the assumption that the casualty is due to wind turbine collision will be made for the analysis. All casualties located will be photographed as found and plotted on a detailed map of the Project area showing the location of the wind turbines and associated facilities.

All *Myotis* carcasses will be identified within seven days of collection by biologists trained in the identification of *Myotis* species, including Indiana bat, and approved by the Service. In order to verify field identifications, skin samples from carcasses too decomposed for positive identification will be sent to Jan Zink at the Portland State University or other suitable laboratories for identification via deoxyribonucleic acid (DNA) analysis. All *Myotis* carcasses will be delivered to the Service within seven days of collection, for concurrence on species identification.

Casualties found outside the formal search area by observers or by FRWF personnel will be treated following the above protocol as closely as possible. Casualties found in non-search areas (e.g., near a turbine not included in the sample of search turbines) will be coded as incidental discoveries and will be documented in a similar fashion as those found during standard searches.

In addition to carcasses found, all injured bats and birds observed will be recorded and treated as a casualty. Appropriate wildlife salvage permits will be obtained from the IDNR. Dissemination of data (e.g., to the USFWS Special Agent and/or other agency representatives) will be as needed or according to permit condition (see Disposition of Data section below).

5.1.5 Field Bias Trials

The efficiency rates of observers and removal rates of carcasses by scavengers will be quantified to adjust the estimate of total bat fatalities for detection bias. Bias trials will be conducted throughout the entire monitoring period each year. Only freshly killed bats conclusively identified as non-*Myotis* bat species will be used for carcass removal trials and searcher efficiency trials. The field crew leader will gather all bat carcasses and redistribute bat carcasses that are intact at the predetermined random points within any given turbine's searchable area prior to that day's searches. Data recorded for each trial carcass prior to placement will include date of placement, species, turbine number, and the distance to and the direction from the turbine. Small, black zip ties will be placed on the wing or legs of each bat to distinguish it from other fatalities landing nearby or if scavengers move the trial bat away from its original random location. For the scavenger removal trial, each trial bat will be left in place

and checked by the field crew leader or an observer not involved with carcass searches for up to 24 days, or until the carcass is removed by scavengers. Trial bats will be checked on days one, two, four, six, eight, 10, 12, 18, and 24.

Trial bats will also be used for estimating searcher efficiency bias. Observers conducting carcass searches will not know when or where the bat carcasses will be placed for bias trials. Carcasses placed by the field crew leader will be available and may potentially be found multiple times unless the carcasses are previously removed by a scavenger. The day that each bat was found by an observer will be recorded to determine the amount of time the carcass remained in the scavenger removal trial. When a bat carcass is found, the observer will inspect the carcass to determine if a bias trial carcass had been found. If so, the observer will contact the field crew leader and the bat will be left in place for the carcass removal trial as described above.

5.1.6 Statistical Methods for Bat Mortality Estimation

Statistical methods for estimating all bat mortality will be the same for all phases of monitoring. Estimates of facility-related bat mortality will be calculated based on:

1) Observed number of bat carcasses found during standardized searches during the monitoring period;
2) Non-removal rates expressed as the estimated average probability a bat carcass is expected to remain in search areas and be available for detection by the observers during removal trials; and
3) The area adjustment factor for bat carcasses landing outside of searched roads and pads.

Upon completion of each monitoring year, data will be analyzed using the same statistical methods for calculating overall bat mortality (casualty rate) employed during the 2010 and 2011 FRWF studies, namely the empirical measure of carcass availability. This empirical estimate is based on the overall ratio of trial carcasses found by searches to the number placed and does not separate out the influence of scavenging versus searcher detection. As described in the HCP, a correction factor of 6.56 will be used to adjust for fatalities that likely occurred outside of searched roads and pads, to determine total estimated bat mortality during the fall migration period (FRWF 2013).

5.1.7 Disposition of Data and Reporting

FRWF will prepare data sheets and report templates for monitoring that will be reviewed and approved by the Service prior to initiation of the first year of monitoring. During active monitoring, raw data forms will be stored on site and at the offices of the independent monitoring contractor. Raw data forms will be made available to the Service upon request. The following information will be maintained for each fatality in a database that will be provided to the Service annually or upon request: date and time of collection, species, UTM coordinate, closest turbine number, and, if available, temperature and wind speed for the night preceding *a Myotis* fatality.

All *Myotis* and unknown bat carcasses will be delivered to the Service within seven days of collection, for concurrence or determination of species identification. The final disposition of individual casualties will be based on direction from the appropriate salvage permits, the legal status of individual casualties, and the direction of the USFWS Law Enforcement Agent in Charge. In addition, the Service and IDNR will be notified (by email and/or phone) within 24 hours if a species protected under BGEPA, ESA, or the Indiana state endangered species list is discovered as a casualty.

An annual report describing methods and results of take compliance monitoring will be prepared following completion of the field surveys and data analysis for each year of monitoring. Annual reports will include:

- Results from monitoring, including results of bias corrections (i.e., searcher efficiency trials, scavenger removal trials, and searchable area adjustments) and estimates of total bat and Indiana bat mortality;
- Adaptive management changes that were implemented in response to observed and/or estimated bat mortality, if necessary;
- Raw data sheets from take compliance monitoring, including bird fatalities; and
- Spreadsheets showing the timing and actual speeds at which the turbines were operational and feathered during the minimization period.

The annual report will be prepared and submitted to the Service by January 31 following completion of the field surveys. A weekly summary of bats and birds found during fall monitoring will also be provided to the Service, which will be used to evaluate whether a trigger has been met that would require an adaptive management response, as described in detail in the HCP (FRWF 2013).

5.1.8 Wildlife Incident Reporting System

At the start of operation, each Phase of the FRWF began participating in the Wildlife Incident Reporting System (WIRS), which will be implemented for the life of the Project. The WIRS is currently in use at Phases I, II, and III. The WIRS is a protocol designed to provide a means of recording avian and bat species found in the Project area by Project staff, thereby increasing the understanding of wind turbine and wildlife interactions. WIRS provides a set of standardized instructions for FRWF personnel to follow in response to wildlife incidents in the Project area. Each incident will be documented on a data sheet and reported to the designated environmental affairs contact. The data will be logged in a tracking spreadsheet maintained by the environmental affairs team. A quarterly review of the reported incidents will be undertaken by environmental affairs. This review frequency may be modified based on the results of the reporting.

Training: Site personnel will be trained to follow WIRS procedure and fill out the WIRS reporting form (Appendix C). Additionally, posters identifying sensitive species have been prepared and are posted at the O&M Facility.

Reporting: Any incident, defined as an injury or fatality, involving a threatened or endangered species or a bald or golden eagle will be reported to the Service and/or IDNR within 24 hours of finding an identified or suspected member of one of these species.

Bird and bat casualties discovered by Project staff will be documented and recorded as part of the WIRS. This information will be used as a means of tracking impacts to all bats and birds from the Project.

5.2 ADAPTIVE MANAGEMENT

The FRWF BBCS represents a process through which FRWF plans to reduce impacts to birds and bats at the wind energy facility while maintaining optimal Project operation and generating electricity from the renewable, non-polluting wind energy resource. FRWF has sited the Project and incorporated measures into the proposed action to avoid and minimize impacts to birds and bats.

Based on best available science, it is assumed that minimization measures (i.e., raising cut-in speeds to 5.0 m/s and feathering turbines below the cut-in speed) will result in at least a 50

percent reduction in all bat mortality, especially mortality of the three tree bat species (red bat, hoary bat, and silver-haired bat) that have comprised the great majority of bat mortalities at FRWF thus far. Based on curtailment studies at FRWF in 2010 and 2011, the turbine operational adjustments are not expected to noticeably affect bird mortality from the Project (Good et al.2011, Good et al. 2012)). The Project will be managed under an adaptive management framework to enable the results of post-construction monitoring and research to influence the minimization measures implemented at the Project and ensure the goals of the HCP (FRWF 2013) and BBCS (Section 1.0) are being met. Adaptive management thresholds, defined below and in Table 5.3, are focused on Indiana bat mortality because the ESA-listed Indiana bat is the primary species of concern at the FRWF and management actions that reduce impacts to Indiana bats are expected to also reduce impacts to bats in general. Indeed, Indiana bat protection measures may confer even greater protection for tree bat species (red bat, hoary bat, and silver-haired bat) at the FRWF, given that the majority of bat mortality reduction is likely to consist of these high-fatality species. Adaptive management thresholds have also been established to address unexpected mortality of birds and increased risk to eagles during the life of the Project. Adaptive management will apply throughout the life of the Project; on-going evaluation of Project impacts and subsequent adaptation of Project management will provide effective measures for avoiding and reducing impacts to birds and bats.

5.2.1 Bats

The general adaptive management approach includes raising cut-in speeds in 0.5 m/s increments if fall bat mortality thresholds are met during, or at the conclusion of, the monitoring year. Adaptive management thresholds for any given year are based on the upper 90 percent confidence interval (or upper 95th percentile) for estimated fall bat mortality in 2010 and 2011 at turbines with minimization measures in place. This is based on Monte Carlo simulations that showed that over 1,000 22-year periods using the adaptive management strategy described below, the mean number of Indiana bat fatalities was 178 with a 90 percent confidence interval of 166 to 191 fatalities, assuming a conservative 50 percent reduction in fatality when feathering blades below a 5.0 m/s cut-in speed. Based on the calculated Indiana bat species composition for FRWF (0.16%), this level of Indiana bat mortality corresponds to 111,250 overall bat fatalities with a 90 percent confidence interval of 103,750 to 119,375 overall fatalities. Given that a 57 percent (90% CI = 39% - 70%) reduction in bat fatality was achieved by feathering blades below a 4.5 m/s cut-in speed in the 2011 FRWF study, a more realistic reduction in bat mortality of 60 percent by feathering blades below 5.0 m/s was also simulated. Using the same simulation methods (i.e., 1,000 22-year periods that assumed the adaptive management described herein), an average of 152 Indiana bat fatalities occurred over a 22-year period with a 90 percent confidence interval of 136 to 168 total Indiana bat fatalities, corresponding to 95,000 overall bat fatalities with a 90 percent confidence interval of 85,000 to 105,000 overall fatalities, under the assumption of a 60 percent reduction in all bat mortality when blades are feathered below 5.0 m/s (see Chapter 5.4.2 of the HCP [FRWF 2013] for full description).

The actual adaptive management threshold will depend on the number of turbines that are in operation in a given year: 6,625, 8,375, or 1,750 estimated bat fatalities per year for the 355-, 449-, or 94-turbine Project, respectively (Table 5.2)[4]. If take exceeding these levels is estimated,

[4] Estimated annual overall bat mortality and bat fall adaptive management thresholds are based on Table 4.6 of the HCP (FRWF 2013).

based on total bat mortality, at the end of the monitoring year, cut-in speeds will be increased by 0.5 m/s to ensure that overall bat mortality and estimated Indiana bat take is reduced in the following years. Conversely, if estimated bat mortality is equal to or less than the lower 90 percent confidence interval (or 5th percentile) at the end of a given monitoring year (see Table 5.2), cut-in speeds will be reduced by 0.5 m/s, but only if cut-in speeds have been increased above 5.0 m/s as a result of previous adaptive management decisions (i.e., cut-in speeds will not go below 5.0 m/s under any circumstance).

Table 5.2 Estimated Annual Overall Bat Mortality with Minimization of each Operational Phase of the FRWF

Phase	Turbines	Estimated Annual Overall Bat Mortality		
		Lower 90% CI	Mean	Upper 90% CI
Phase I, II, III	355	4,375	5,375	6,625
Phase I, II, III, IV	449	5,500	6,813	8,375
Phase IV	94	1,188	1,438	1,750

If an operational change was made in response to either the 95th percentile (or upper bound of the 90% CI) being exceeded or 5th percentile (or lower bound of the 90% CI) being met or exceeded, two years of Evaluation Phase monitoring (i.e., 33% of turbines searched weekly from August 1 to October 15) will be conducted to ensure that operational adjustments were sufficient to minimize overall bat mortality and comply with the terms of the Indiana bat ITP.

Within-Season Adaptive Management

Within-season adaptive management thresholds will be calculated to serve as an early indicator that adjustments to minimization efforts are necessary before the conclusion of the monitoring year. Within-season adaptive management thresholds will be based on the predicted number of bat carcasses that would be found[5] that would equal the upper quartile (i.e., 75th percentile) of estimated fall bat mortality in 2010 and 2011 at control turbines with minimization measures in place: 5,938, 7,500, or 1,563 estimated bat fatalities per year for the 355-, 449-, or 94-turbine Project, respectively. The 75th percentile was used instead of the 95th percentile (which is the adaptive management threshold at the end of the year) as a conservative way to ensure that the adaptive management threshold is not reached at the end of the year. To determine the number of bat carcasses of all species found that would equate to this level of estimated bat mortality, bias correction factors (i.e., unsearched areas, scavenger removal, and carcass removal) from the previous year's monitoring results will be applied. If this number of bats is found at any point during monitoring, FRWF will increase cut-in speeds by 0.5 m/s[6]. If an additional number of bat carcasses (of any species) are found during compliance monitoring within the same season that equate to one additional estimated Indiana bat fatality[7] after cut-in speeds have been increased, cut-in speeds will again be increased by 0.5 m/s. Cut-in speeds will be increased by 0.5 m/s each time a number of bat carcasses that equates to one additional estimated Indiana bat

[5] Cumulative counts of bat carcasses found during each fall monitoring period will be tallied on a weekly basis.
[6] Note that if within-year operational changes are needed based on adaptive management criteria, FRWF will require up to 1 business day to make the necessary cut-in speed changes to the turbine SCADA systems.
[7] The number of found bat carcasses equating to one estimated Indiana bat fatality will be established for each monitoring year based on the results of the searcher efficiency and carcass removal bias trials of the previous monitoring year.

fatality are found within the same season. This will effectively limit the number of all bat fatalities that would occur before adaptive management action is taken.

Note that any operational changes made based on within-season numbers of carcasses found may be adjusted before the start of the next fall season based on the final estimated all bat mortality for full fall season. Because within-season triggers are conservatively based on the 75th percentile rather than the 95th percentile, the end of the year mortality may in fact be below the 95th percentile adaptive management trigger. Also, because the within-season adaptive management thresholds are based on the previous year's bias correction results, the actual annual mortality estimate determined at the conclusion of the monitoring year (based on that year's bias correction trials) may be lower than the 95th percentile.

A set of control turbines will be used to determine whether or not the adaptive management trigger was reached at the end of the monitoring period. If the within-season adaptive management trigger is met, cut-in speeds will not be raised at 20 turbines among those selected for monitoring (cut-in speeds will be raised at all other turbines in the wind facility). A sample size of 20 was determined to have adequate power based on power modeling done to determine minimum sample size for monitoring (see Section 5.4.1.2 and Table 5.1). Control turbines allow for an accurate assessment of the effectiveness of the initial cut-in speed when a within-season adaptive management threshold results in raising the cut-in speed for the remainder of the monitoring period. If no turbines remain at the initial cut-in level, there is no way to evaluate whether or not mortality was below the 95th percentile as a result of raising cut-in speeds, or whether it would have been below the 95th percentile even if cut-in speeds had not been raised.

End-of-Year Adaptive Management

At the end of each monitoring year, if overall bat mortality estimated from the 20 control turbines is lower than or equal to the 95th percentile, the cut-in speed increase implemented in response to the within-season trigger will not be maintained in the following year and cut-in speeds will be resumed at 5.0 m/s (or as determined at the end of year response in the previous year) at the beginning of the subsequent fall monitoring season. Conversely, if at the end of the year, overall bat mortality estimated from the 20 control turbines is higher than the 95th percentile, the raised cut-in speed that was implemented within-season will be maintained in the subsequent year. If within-season thresholds are not triggered, total mortality estimated from the entire facility will be used to make adaptive management decisions for the following year (i.e., there will be no control turbines).

Table 5.3 Bat Adaptive Management Thresholds and Responses for the FRWF

Monitoring Year	Project Operations Action	Adaptive Management Thresholds and Responses	
		Within-year (August 1 – October 15)	End of Year
Year 1 (355 Turbines)	Cut-in speed of 5.0 m/s with blades feathered below cut-in (sunset to sunrise, August 1 – October 15) AND Monitoring of 33% of turbines weekly, roads and pads only, August 1 – October 15	If cumulative count of bat carcasses found suggest overall bat fatality is greater than the 75th percentile based on previously collected carcass removal and searcher efficiency data at any point during the monitoring period, cut-in speeds will be increased to 5.5 m/s and blades feathered below cut-in (sunset to sunrise, thru October 15) at all but 20 control turbines AND If a number of bat carcasses equal to 1 additional estimated Indiana bat fatality is found[8] after the initial cut-in speed increase, cut-in speed will again be increased by 0.5 m/s with blades feathered below cut-in (sunset to sunrise, thru October 15); each time this occurs within season, cut-in speed will be increased by 0.5 m/s with blades feathered below cut-in (sunset to sunrise, thru October 15)	If annual overall bat mortality estimated from fall searches at all searched turbines or from control turbines (if within-season AM trigger was met) is ≤6,625, continue feathering turbines below 5.0m/s in Year 2 OR If annual overall bat mortality estimated from fall searches at all searched turbines or from control turbines (if within-season AM trigger was met) is >6,625, increase cut-in speed to 5.5 m/s in Year 2
Years 2-21 (355, 449, or 94 Turbines)	Cut-in speed of 5.0m/s with blades feathered below cut-in (sunset to sunrise, August 1 – October 15) OR As determined in previous year's end of year response	If cumulative count of bat carcasses found suggest overall bat fatality is greater than the 75th percentile based on previously collected carcass removal and searcher efficiency data at any point during the monitoring period, cut-in speed will be increased by 0.5 m/s higher than initial Year 2 cut-in speed, and blades feathered below cut-in (sunset to sunrise, thru October 15) at all but 20 control turbines	If annual overall bat mortality estimated from fall searches at all searched turbines or from control turbines (if within-season AM trigger was met) is ≤ the lower 90% confidence interval (i.e., 5th percentile), reduce cut-in speed by 0.5 m/s (but only if cut-in speeds have been increased above 5.0 m/s from a previous AM response) OR If annual overall bat mortality estimated from fall searches at all searched turbines or from control turbines (if within-season AM trigger was met) is ≤ 6,625 (355 turbines), ≤ 8,375 (449 turbines), or ≤ 1,750 (94 turbines), continue feathering turbines below the initial year cut-in speed in subsequent year

[8] The adaptive management trigger is based on finding a number of bat carcasses, of any species, that is calculated to equal one estimated Indiana bat fatality. The trigger number of found bats will be established for each monitoring year based on the results of the searcher efficiency and carcass removal bias trials of the previous monitoring year.

Monitoring Year	Project Operations Action	Adaptive Management Thresholds and Responses	
		Within-year (August 1 – October 15)	End of Year
	AND Monitoring of 20% of turbines weekly, roads and pads only, August 1 – October 15	AND If a number of bat carcasses equal to 1 additional estimated Indiana bat fatality is found after the initial cut-in speed increase, cut-in speed will again be increased by 0.5 m/s with blades feathered below cut-in (sunset to sunrise, thru October 15); each time this occurs within season, cut-in speed will be increased by 0.5 m/s with blades feathered below cut-in (sunset to sunrise, thru October 15)	OR If annual overall bat mortality estimated from fall searches at all searched turbines or from control turbines (if within-season AM trigger was met) is >6,625 (355 turbines), >8,375 (449 turbines), or >1,750 (94 turbines), increase cut-in speed by 0.5 m/s increment in subsequent year AND If cut-in speed adjustments are made, perform 2 years of Evaluation Phase monitoring of 33% of turbines weekly, roads and pads only, August 1 – October 15 during following 2 years

5.2.2 Birds

Avian mortality is expected to continue to be generally low at Fowler, based on the assessment of potential impacts presented in Section 4.1. However, should post-construction monitoring or wildlife incident reporting detect avian mortality exceeding established adaptive management triggers, FRWF will take remedial actions.

Triggers for adaptive management will include[9]:

I. A mass avian mortality event (>100 birds killed in one night) is documented.
II. Observed raptor fatality exceeds six (6) individuals in one monitoring year.
III. Observed American golden-plover fatality exceeds 20 individuals in one monitoring year.

Remedial actions to be taken in response to adaptive management triggers will include:

I. FRWF will promptly notify the Service of the discovery and investigate, based on the available data, the circumstances under which the mass mortality event occurred. FRWF will coordinate with the Service to discuss the implementation of potential mitigation and/or minimization measures, including modified turbine operations under specific weather conditions.
II. FRWF will implement an on-site carrion removal program to reduce the availability of raptor food sources near turbines. FRWF will conduct a subsequent year of monitoring to evaluate the effectiveness of the carrion removal program.
III. FRWF will promptly notify the Service of the discovery and investigate, based on the available data, the circumstances under which plover mortality has occurred. FRWF will coordinate with the Service to discuss the implementation of potential mitigation and/or minimization measures, including modified turbine operations at certain locations during the plover migration season.

FRWF will conduct a year of mortality monitoring following the implementation of any of the above-listed actions to evaluate the effectiveness of the adaptive management measures.

5.2.3 Eagles

Although risk to eagles at FRWF is considered low (Section 4.1.2), the estimated risk to eagles will be periodically re-evaluated through the life of the Project to consider new information. Information considered will include any incidental observations of eagles at FRWF and post-construction mortality monitoring data. A shift in current land use within the Project area to include areas of cattle-grazed pasture would also trigger re-evaluation of eagle risk. Additionally, if the Service updates the eagle risk model in use, FRWF will request that the Service re-calculate eagle risk at the Project using the new model. If a significant change in the model-estimated eagle risk becomes apparent during the life of the Project, FRWF will meet with the Service to identify mitigation strategies based on the best available science garnered from current research and eagle interactions at other wind energy facilities.

[9] The very low numbers of bird fatalities documented during mortality monitoring at the FRWF (HCP [FRWF 2013], Appendix A), and the likelihood for low bird fatality rates in the future, indicates that these triggers are unlikely and would be substantial events which should be detectable through the WIRS system or incidental recording of bird casualties during the bat mortality monitoring.

If an eagle fatality is discovered at the Project, FRWF will notify the Service of the discovery within 24 hours. FRWF will coordinate with the Service to identify potential mitigation measures based on the best available science; these measures could include marking above-ground powerlines with bird flight diverters or retro-fitting powerline poles to avian-safe standards (APLIC 2006). Additionally, FRWF will meet with the Service to apply for an eagle programmatic take permit.

5.2.4 Whooping Cranes

This addresses potential future impacts to the Eastern U.S. non-essential experimental population (NEP) of whooping cranes at FRWF in Benton County, Indiana, primarily, the impacts from collision with overhead generation tie-in lines, which is a known hazard to whooping cranes and secondarily impacts from collision with turbines.

The BBCS risk assessment concludes that the probability of impacts to whooping cranes is small. There has been no whooping crane fatalities found during four years of post-construction surveys at the FRWF turbines (considering these are very large birds, it is logical to conclude that the probability of finding a fatality during searches is high). Although no formal searches have been done, no whooping cranes have been reported killed or injured by overhead generation tie-in lines at FRWF.

Currently, the NEP numbers approximately 106 animals that migrate between breeding areas in Wisconsin and wintering areas from southern Indiana south to northern Florida. The migratory pathway of all of the birds is not known; however, the fact that whooping cranes have been observed in Benton County, and that a number of cranes pass through or winter in south-central Indiana suggests the need for an adaptive management strategy to address potential risks to whooping cranes should the following triggers indicate the probability of impacts have increased.

Triggers: occurrence of any of the following triggers will result in FRWF implementing the appropriate adaptive management response as detailed below.

Trigger 1 – The designation of the NEP changes and this population becomes listed under the ESA.

Trigger 2 – Annual data requests from FRWF to IDNR or the Service provide documented evidence that whooping cranes are regularly (i.e., any two years out of ten) using (i.e., landing, feeding, or roosting) within 10 miles (16 km) of FRWF.

Trigger 3 – a documented fatality or injury of a whooping crane from overhead generation tie-in lines at FRWF.

Trigger 4 - a documented fatality or injury of a whooping crane from turbines at FRWF.

Trigger 5 – a documented fatality of a whooping crane at a wind facility (or associated overhead generation tie-in line) in Benton County.

Responses:

Response 1 – should Trigger 1,2, or 3 occur, FRWF will, in consultation with the Service, prepare a methodology to conduct an assessment of the overhead generation tie-in line carrying electricity from FRWF Phases I-IV to identify portions of the line where bird diverters may be effective at reducing whooping crane collision risk. The methodology will be based on the best available scientific data available at the time of the trigger and will be approved by the Service. Installation of bird diverters will occur within one calendar year of assessment methodology approval by the Service.

Response 2 – should Trigger 4 occur, FRWF in coordination with the Service will identify an appropriate response designed to minimize the potential impacts to whooping cranes from collision with turbines prior to the next migratory season.

Response 3 –should Trigger 5 occur, FRWF will consult with the Service within 60 days of the trigger to discuss the circumstances of the event and the implications, if any, for FRWF. If the Service determines increased vulnerability of whooping cranes based on this consultation, the Service, in coordination with FRWF, will determine an appropriate response based on the circumstances of the event. For example, if the documented fatality is due to the overhead generation tie-in line, then Response 1 will be implemented.

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APPENDIX A: STATE ENDANGERED SPECIES INCIDENTAL TAKE PERMIT

INDIANA FISH AND WILDLIFE PERMIT

State Form 2404R

Agency DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
402 W. Washington St., Rm. W273
Indianapolis, IN 46204-2781
Telephone: (317) 233-6527
Fax: (317) 232-8150

Name of Permittee FOWLER RIDGE WIND FARM	Authority - status IC 14-22-2 IC 14-22-34-12 Regulations (attached)
Address 700 LOUISIANA STREET, 33RD FLOOR	
City, State and Zip code HOUSTON, TX 77002 PHONE: (713) 354-2178	

Number	Effective	Expires	Renewable	May Copy
N/A	06/18/11	06/30/16	☑ Yes ☐ No	☑ Yes ☐ No

Name and Title of Principal Officer (If Permittee is a business) MATTHEW SAKURADA	Type of permit **STATE ENDANGERED SPECIES INCIDENTAL TAKE PERMIT**

Location where authorized activity may be conducted

FOWLER WIND FARM IN FOWLER, INDIANA ONLY (Benton County)

Conditions and Authorizations:

1. All activities authorized herein must be carried out in accordance with and for the purposes described in the application submitted. Continued validity, or validity, of this permit is subject to complete and timely compliance with all applicable conditions, including the filling of all required information and reports.
2. The validity of this permit is also conditioned upon strict observance of all applicable foreign, state, local or other federal law.
3. Valid for use by permittee named above.

4. THE PERMIT HOLDER IS AUTHORIZED TO TAKE (KILL) EVENING BATS AS THE RESULT OF THE OPERATION OF THE WIND TURBINES AT THE FOWLER WIND FARM IN FOWLER, INDIANA.

5. REPORT ANY MORTALITIES OR SUSPECTED MORTALITIES OF EVENING BATS TO THE INDIANA DNR AT (317) 233-6527 (LINNEA PETERCHEFF) OR (317) 232-8160 (KATIE SMITH) WITHIN 24 HOURS OF DISCOVERY.

6. CONTINUE TO MONITOR WILD TURBINE SITES CONTROLLED BY THE PERMITTEE FOR BAT FATALITIES ASSOCIATED WITH THE TURBINES FOR THE DURATION OF THIS PERMIT.

6. SPECIMENS THAT ARE COLLECTED MUST BE STORED IN ACCORDANCE WITH THE SPECIAL PURPOSE SALVAGE PERMIT ISSUED BY THE INDIANA DNR.

6. THE PERMITTEE IS RESPONSIBLE FOR CARRYING OUT AND ABIDING BY ALL PERMIT CONDITIONS.

☐ Additional conditions and authorizations on a separate sheet.

Reporting requirements
PLEASE REPORT ANY ACCIDENTAL MORTALITY OF STATE ENDANGERED SPECIES TO LINNEA PETERCHEFF AT 317-233-6527 WITHIN 24 HOURS OF DISCOVERY.

Issued by	Title	Date
Linnea Petercheff	LINNEA PETERCHEFF OPERATION STAFF SPECIALIST DIVISION OF FISH AND WILDLIFE	6/18/11

APPENDIX B: INITIAL ASSESSMENT OF EAGLE RISK, USFWS 2012B

United States Department of the Interior
Fish and Wildlife Service

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

February 17, 20012

Ms. Blayne Gunderman
Environmental Manager
BP Wind Energy
700 Louisiana St. – 32nd Floor
Houston, TX 77002

Dear Ms. Gunderman:

Thank you for your previous correspondence with our office concerning eagle risk at your existing wind energy development, Fowler Ridge Wind Farm, located in Benton County, Indiana. Our records indicate that construction has been completed and turbines are operational in three phases of this development, which consists of 355 existing turbines. Additionally, we are aware that a fourth project phase is proposed adjacent to the existing turbines, which would add up to 93 additional turbines to the project.

We have reviewed your draft wildlife baseline study report from Feb 25, 2008 and your final wildlife baseline study report from July 27, 2011. Additionally, we have reviewed your Eagle Use Assessment from June, 2011. We are providing comments on your project in accordance with the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d, 54 Stat. 250; Eagle Act), and the Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA).

The Eagle Act is one of the primary federal laws protecting eagles and prohibits, among other things, the killing and disturbance of eagles. The Service published a Final Eagle Permit Rule on September 11, 2009 (50 CFR 22.26) authorizing limited issuance of permits to take bald and golden eagles where the take is associated with but not the purpose of an otherwise lawful activity (74 Fed. Reg. 46836, September 11, 2009). A permit is not required to conduct any particular activity, but is necessary to avoid potential liability for take caused by an otherwise lawful activity.

As you are aware through previous correspondence with the U.S. Fish and Wildlife Service (Service) and through your monitoring data, eagles may occur within your existing and proposed project area. The attached eagle risk analysis (Enclosure 1) discusses this office's assessment regarding eagle use of the project area and corresponding risk to eagles from turbine operation. This assessment is based on eagle-use and avian mortality data provided (from you) to our office as well as existing knowledge of eagle use areas within and in the vicinity of the project area.

As described in detail in the attached risk assessment, we have determined that the Fowler Ridge Wind Project a) does not appear to overlap with any "important eagle use areas" (definition in Enclosure 1), b) appears to overlap only limited amounts of suitable eagle habitat, c) may have low risk to eagles during the breeding and winter seasons, and d) may have relatively limited eagle use during spring and fall migration (based on 2007-2009 survey results). However, based on the sources of uncertainty outlined in Enclosure 1 and the relatively large size of your project, there is a possibility that we are underestimating risk and/or are incapable of predicting some risk with the

data we have been given. Lending support to this, as outlined in Enclosure 1, we arrived at a fatality estimate for this project of 0.201 bald eagles per year, with a 95% confidence interval between 0 and 0.604 bald eagles per year.

Based on the information available to us, we believe that the risk to eagles from your project may be relatively low. However, given the uncertainty and the fatality estimate outlined in Enclosure 1 and discussed above, it may be prudent for BP to adopt a conservative approach when considering risk to and developing management strategies for eagles at Fowler Ridge. To determine and outline a management strategy, we recommend that BP develop an Eagle Conservation Plan (ECP) or modify an existing Avian and Bat Protection Plan (ABPP) to be relevant to eagles. Completion and implementation of an ECP or ABPP will ensure that BP is aware of and prepared for changes in eagle use and movements in the vicinity of the project and prepared to address any current and future risk that may exist to eagles at this site.

The Service has prepared interpretive guidance, the *Draft Eagle Conservation Plan Guidance* (http://www.fws.gov/windenergy/; ECP Guidance), which provides detailed information on methods for data collection, risk assessment, examples of appropriate avoidance and minimization measures, and Advanced Conservation Practices (ACPs) for wind projects. Also, this document outlines when a permit may be recommended eagle take. Any eagle management plan for this project should be created using the ECP Guidance as a guide, should be shared with and reviewed by the Service, and should, at minimum, include the following:

1. A commitment to monitor for and report eagle mortality for the life of the project.
2. An operational plan to minimize, where appropriate, the likelihood that eagles will use the project site (i.e. carcass management, eagle prey management, etc.).
3. A plan to periodically update the predicted risk of the project to eagles utilizing the best available sources of information such as updated nest location information, post-construction fatality monitoring data, migration data, incidental observations, and other sources of information. This may also include new research, monitoring, and surveys if the above information is not available.
4. Adaptive management plans that initiate action (i.e. minimization or mitigation) if risk to eagles is found to increase in the future. Specifically, the management plan should identify methodologies and quantitative risk assessment methods that will be used to identify changing risk and describe criteria for adaptive management to take effect. ACPs that may be employed as a part of adaptive management should also be outlined.
5. A commitment to consider and incorporate, where appropriate, the latest research findings and minimization measures concerning eagle mortality at wind power projects.

Thank you for the opportunity to provide comments and conduct an eagle risk assessment for this proposed wind energy development. For further discussion on eagle risk, eagle management strategies, or for any questions you may have, please contact Matt Stuber at 517/351-8469 or at matthew_stuber@fws.gov.

Sincerely,

Scott Pruitt
Field Supervisor

Enclosure (1)

cc: USFWS, Matt Stuber – East Lansing, MI Field Office

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<u>Enclosure 1</u>: Initial Assessment of Eagle Risk, as outlined in the Draft ECP Guidance, for the Fowler Ridge Wind Energy Development

Summary of Monitoring Data Provided to the Service

Pre-construction point-count surveys were conducted at 10 stations throughout the project area between March 31, 2007 and April 9, 2009. Monitoring between these dates covered approximately two spring raptor migration seasons (2007 and 2008), two fall raptor migration seasons (2007 and 2008), one breeding season (summer 2008), and one winter/early spring season (2008/2009). A total of 458 20-minute, 800 meter radius, point count surveys were conducted during this time, for a total of 152 hours of raptor observation within the project area. The methods used during the point-counts were similar to the methods outlined in the ECP Guidance; however, the number of sample points used is notably less than recommended in this document (see discussion of fatality prediction, below).

Avian and bat carcass surveys were also conducted in certain portions of the project area at existing turbines. Carcass surveys began on April 6, 2009 and continue to date. These surveys were done within 160m x 160m plots in 2009, within 80m x 80m in 2010, and on roads and pads at other turbines during 2010. A total of 6,353 searches have been conducted on individual turbines up to October 15, 2010.

During pre-construction monitoring, one eagle was observed flying within the project area in the fall of 2008. This eagle was observed within the rotor swept zone. During carcass surveys, no eagle carcasses have been observed to date, although two observations were incidentally made of eagles in flight by carcass survey crews in the spring 2011. The flight height of these eagles was not recorded.

Initial Site Assessment and Site-Specific Surveys for Risk

Bald eagles and golden eagles associate with distinct geographic areas and landscape features throughout their respective ranges. The Service defines an "important eagle use area" as "an eagle nest, foraging area, or communal roost site that eagles rely on for breeding, sheltering, or feeding, and the landscape features surrounding such nest, foraging area, or roost site that are essential for the continued viability of the site for breeding, feeding, or sheltering eagles" (USFWS 2009). Because migration corridors and migration stopover sites provide important foraging areas for eagles during migration (e.g., Restani *et al*. 2000, Mojica 2008), the Service believes that these areas fall within the regulatory definition of important eagle-use areas and they have been included as such in the Draft ECP Guidance and in this assessment.
Since risk to eagles is more likely to exist where a project area overlaps an "important eagle use area" (hereafter "eagle use area"), the ECP Guidance recommends that, to begin an eagle risk assessment, a project proponent first identify the location and type of all eagle use areas on and within a 10-mile perimeter of a project footprint. We further recommend that proposed project locations that do overlap known eagle use areas be re-sited or re-designed in order to minimize their risk to eagles unless subsequent data collection provides evidence that site-specific eagle movements and behavior do not put eagles at risk.

Breeding Season
An analysis of the proposed site and surrounding area using 2010 nesting data provided by the Service has located one known bald eagle nest (an eagle use area) within 10 miles of the project area, approximately 6.5 miles southeast. Although the movements of breeding eagles may vary drastically among adults and among territories, at this distance there is likely no overlap between the project area and the established territory of this pair. Additionally, the limited amount of eagle habitat within the project area suggests a relatively low abundance of non-breeding eagles (juveniles, sub-adults, or adult "floaters") are likely to be using the project area during the breeding season. This is supported by the data collected by BP, as no eagles were observed during monitoring within the project area during the breeding season. Based on this initial assessment, it appears that risk to eagles during the breeding season may be relatively low at this site. Note, however, that monitoring efforts did not cover all times of the breeding season equally. Specifically, surveys efforts were reduced to bi-weekly during the early breeding/courtship and late nesting/early fledging periods and these efforts only spanned one breeding season. More certainty could have been or could be obtained with added monitoring effort during the early breeding/courtship and late breeding/early fledging periods.

Winter Season
A search for any available information on eagle movements or concentration areas during the winter has produced no known eagle winter concentration areas within or in the vicinity of the project area. Additionally, during BP's pre-construction monitoring during the winter of 2008/2009, zero eagles were observed using the project area. Based on this initial assessment, it appears that risk to eagles during the winter may be relatively low at this site. Note, however, that the knowledge and documentation of winter eagle concentration areas and winter eagle movements may be sparse in Indiana and Illinois. There is no comprehensive database that our office is aware of that maintains concentration area information and very few reports on the subject of winter movements and roost locations in and near your project area. Additionally, as with portions of the breeding season, BP's monitoring efforts were again slightly reduced during the winter. Specifically, survey efforts during this time were reduced to bi-weekly and these efforts only spanned one winter. More certainty could have been or could be obtained with added monitoring efforts during the winter months.

Migration Season
The Service has determined the existence of a raptor migration route along the Indiana and Illinois border (USFWS 2006). It is possible that raptors travelling along this migration route will pass very near or through/over the Fowler Ridge Wind Farm, especially as they enter the relatively open landscape of northern Indiana/Illinois and may begin to disperse as they continue south. Both bald and golden eagles may be present along this migration pathway, especially during fall migration.

BP's pre-construction monitoring efforts collected data from two spring (2007 and 2008), and two fall (2007 and 2008) raptor migration seasons. During this monitoring effort, one bald eagle and no golden eagles were observed passing through the project area. The bald eagle observation occurred in the fall of 2008. Considering monitoring efforts only during the fall, one bald eagle was observed within the project area over 60 hours of observation. Based on this data, it appears that the monitored portion of the project area does not overlap an eagle migration corridor during the spring or fall migration season. Note, however, that during spring 2011 carcass searches, two bald eagles were incidentally observed and documented within the project area. Note also that, while the spring monitoring occurred during the generally accepted raptor migration season, bald eagles may be returning and establishing territories as early as mid-January in Indiana. This monitoring data may have missed some of this movement, although some of it may be captured in the winter monitoring data (see below discussion). More certainty could have been or could be obtained with added survey points and an extended spring monitoring season during the spring and fall migration seasons.

Initial Fatality Prediction

As outlined in the ECP Guidance, the Service has developed a predictive model in collaboration with modeling experts from outside and within the Service. The purpose of the model is to predict the number of eagle fatalities for a particular siting and operational configuration at a wind facility. As of the date of this letter, the model is in its late stages of development and discussion.

Because this project was conceived and monitoring data for this proposed project was collected before the publication of any consistent monitoring recommendations from the Service, the monitoring method for this project, understandably, may not have collected and/or reported data in a manner optimal for inclusion into the aforementioned model. For example, the number of points monitored during pre-construction monitoring relative to the large project area and number of turbines creates uncertainty in the data, and thus, the model output. Specifically, only ten monitoring points were established each year throughout the existing and proposed project areas. As such, only approximately four percent of the total project area was visually observed each year during point count monitoring.

Running the model, we arrived at a fatality estimate for this project, based on data collected by BP, of 0.201 bald eagles per year, with a 95% confidence interval between 0 and 0.604 bald eagles per year. Stated another way, our model predicts that eagle fatality rates at the proposed project site are likely to equal one eagle every 4.97 years and may be as high as one bald eagle every 1.66 years. Note the relatively large confidence interval calculated by the model. Note also that a model output of zero eagles per year is within the calculated 95% confidence interval.

Risk Summary
Considering the above risk analysis, the following are noteworthy about this project's risk to eagles:

1) Existing data collected by BP suggests that the project area does not overlap a spring and/or fall eagle migration corridor, although one eagle was observed within the project area (and the rotor swept zone) during formal monitoring in the fall 2008, and two eagles were incidentally observed in flight during carcass searches in the spring 2011.
2) There are no known bald eagle nest sites or other eagle use areas in the vicinity of the project area. The closest known eagle use area is a bald eagle nest, which is approximately 6.5 miles southeast of the project boundary.
3) There is limited eagle habitat within the project, reducing the potential of an eagle being attracted to the project area.
4) During 152 hours of formal observation within the project area, one bald eagle was observed, although, as mentioned, two were subsequently observed during carcass searches in spring 2011.
5) Despite several years of fatality monitoring with the potential to observe and document eagle carcasses at existing turbines, including cleared plots at some turbines and roads and pads at others, no eagle mortalities have been observed to date.
6) We arrived at a fatality estimate for this project of 0.201 bald eagles per year, with a 95% confidence interval between 0 and 0.604 bald eagles per year.

Uncertainty Summary
Uncertainty in our assessment may be relatively high. This uncertainty may be contributing, in part, to the aforementioned take prediction and large 95% confidence interval calculated by the model. In particular, a relatively low sampling effort and seasonally reduced sampling intensity relative to project size and number of turbines has left a large percentage of your project area and turbine locations unmonitored during times when eagles may be present. Uncertainty in this area is understandable, as monitoring data used in our assessment was collected prior to publication of any consistent monitoring recommendations from the Service. Uncertainty may also exist because the eagle monitoring data used in the attached analysis was collected between 2007 and 2009, ending approximately two years prior to the date of this letter. As a result of this, conditions relative to eagles may have changed slightly since pre-construction monitoring was completed.

APPENDIX C: WIRS PROCEDURE AND REPORTING FORM

BP WIND ENERGY
POLICIES AND PROCEDURES

WILDLIFE INCIDENT REPORTING SYSTEM (WIRS)

Document Control Details

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Wildlife Incident Reporting System (WIRS)

1.0 Purpose/Scope

1.1 The purpose of this policy is to define the procedures that employees and contractors should take when they observe an injured animal or animal carcass (an "incident") at a wind operating asset.

- For the purposes of this reporting system, "incident" is a general term that refers to any bird, bat, or other animal, or evidence thereof, that is found either dead or injured within the wind project facility.
- An intact, carcass, carcass parts, bones, scattered feathers (10 or more feathers constitute a feather spot), or an injured bird or bat are all considered reportable incidences.

1.2 These procedures are intended to be in place for the life of the project.

1.3 These procedures are independent of any formal monitoring studies and should occur simultaneously to any formal monitoring studies.

1.4 Implementation of the WIRS will be part of the AE Power Services staff training program.

1.5 New or existing projects may from time to time have additional special requirements. Projects with special considerations are listed in Attachment 3. The VP - Operations and Asset Management, Director of HSSE and the Environmental Manager, Construction and Operations are authorized to periodically update Attachment 3 and communicate those requirements to Director of O&M, Facility Managers, and Deputy Facility Managers, where appropriate..

2.0 Reference

3.0 Responsibilities

3.1 Facility Manager (Facility/Project) or Deputy Facility Manager (if no Facility Manager on site)

A. Facility (or Deputy Facility) Managers have overall accountability to ensure that the requirements of this procedure are being followed by all facility employees and contractors within their respective organizations.

3.2 Employees and Contractors

A. Employees must take action when they observe a wildlife incident.

B. Employees must report, using the procedure herein, all wildlife incidents.

C. Contractors must take action when they observe a wildlife incident, as directed by the Facility (or Deputy Facility) Manager.

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3.3 Environmental Manager, Construction & Operations

A. Maintain completed WIRS reports and photos.

B. Answers questions as they arise, regarding the WIRS and wildlife interactions at the site.

C. Contacts agency(s) if an incident arises pertaining to threatened or endangered species.

4.0 Procedure

4.1 General

A. Prior to assuming a bird, bat, or other animal is injured, it should be observed to determine if it does not display normal behaviors.

- For example, raptors will occasionally walk on the ground, especially if they have captured a prey item. Raptors also "mantle" or hold their wings out and down covering a prey item. These types of behaviors may make the wings appear broken or the animal injured. Identification of specific behaviors typical to bird life cycles and distress behaviors will be part of the AE POWER SERVICES training program.

B. Always exercise caution before approaching or attempting to capture an injured bird. Typically, site personnel will not handle carcasses or injured animals on site, except with express approval from the HSSE Director.

C. Any incident involving a threatened or endangered species or a bald or golden eagle must be reported to BP Wind Environmental Manager, Construction & Operations immediately after identification.

4.2 Materials Needed to Complete a Report

- A copy of this WIRS procedure (unless already comfortable with the procedure)
- Wildlife Incident Report Form (see Attachment 1)
- Camera
- Pen/pencil

4.3 Incident Reporting Procedure

A. If the animal is injured:

- Move yourself to a distance far enough away that the animal is not further disturbed or uneasy due to your presence.
- Follow the procedure in Section 4.3B
- Call Environmental Manager, Construction & Operations, *immediately* to find out how the facility should handle getting the injured animal to a rehabilitation center. Leave a message if there is no answer.

B. If mortality occurs:

- Leave the animal in place.
- Photograph the incident, as it was found in the field. Take at least 2 pictures: a close-up shot of the animal as it lays in the field; and a broader view of the animal

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with a local feature (turbine, road) in view. For the close-up picture, lay a measuring object (radio, coin, pencil) next to the carcass so that there is a scale comparison.

- Prepare the Wildlife Incident Report Form (Attachment 2, for an example)
- Submit the report to the Facility (or Deputy Facility) Manager and the Environmental Manager, Construction & Operations within 24 hours.

NOTE:
Do not touch or pick up the dead animal. A Collection Permit is required in order to do this.

5.0 Training

5.1 Training on the content and requirements of the WIRS procedure shall be conducted upon hiring and/or assignment to a job with exposure to wildlife incidents, and new contractor orientation.

6.0 Auditing

6.1 The requirements called for in this procedure are subject to periodic inspection by the BP Facility (or Deputy Facility) Manager and annually during the BPWE site-specific HSSE audit.

6.2 This procedure shall be reviewed at least every three years.

7.0 Acronyms and Definitions

Acronyms Table

Acronym	Definition
HSSE	Health, Safety, Security and Environmental
WIRS	Wildlife Incident Reporting System

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Attachment 1
Wildlife Incident Reporting Form

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Wildlife Incident Reporting Form

Site:

Date: _____ Time: _____

Observer: _____

(Please list all observers in the close vicinity of the discovered animal)

Animals Observed:

Type of Animal: Bird, Bat, Other

Common Name (if known): _____

Color/Markings: _____

Sex: Male, Female, Unknown

Age: Adult, Juvenile, Unknown

Condition: Injured, Deceased

If injured what behavior is animal exhibiting? _____

If deceased what is the condition of the carcass? _____

Condition of remains		Age of remains	Was animal photographed?
Intact	Feather Spot	Fresh	Yes
Scavenged	Other	Aged	No
Dismembered		Unknown	Film roll/photo no. _____

Location of Animal:

Plot type: _____ Plot no. _____

Location if not on plot _____

UTM or long, lat coords (NAD27) _____

Distance and bearing from nearest tower/pole _____

Environmental conditions:

	Precipitation	Ambient Temperature	Wind Conditions	Other Weather Observations
Weather:	Clear	Cold	Calm	_____
	Fog	Cool	Gusty wind	_____
	Cloudy	Mild	Storm	_____
	Rain	Warm	Violent storm	_____
	Snow	Hot		_____
Habitat:	Bare ground	Forest	Other (describe)	_____
	Grassland	Tilled agriculture		_____
	Gravel road	Mix of above (check all that apply)		_____

Insect Pests: Mosquitos Fleas Ticks Flies None _____

Attachment 2
Wildlife Incident Reporting Form & Photos
(completed)

DRAFT

Wildlife Incident Reporting Form

Date: 6/22/11 Time: 1:35PM

Observer: Mark Hallowell

(Please list all observers in the close vicinity of the discovered animal)

Animals Observed:

Type of Animal: Bird / X Bat / Other

Common Name:

Color/Markings: Brown/Black

Is animal bagged or tagged? Yes / X No / Unknown

Does animal resemble a threatened or endangered species? Yes / No / X Unknown

Which species?

Sex: Male / Female / X Unknown

Age: Adult / Juvenile / X Unknown

Condition: Injured / Deceased X

If injured what behavior is animal exhibiting?

If deceased what is the condition of the carcass?

Condition of remains: Intact X / Scavenged / Dismembered / Feather Spot / Other

Age of remains: Fresh / Aged / Unknown

Was animal photographed? X Yes / No

Film roll/photo no.

Location of Animal:

Plot type: D4 Plot no. N/A

Location if not on plot Approximately 20 ft West of Turbine

UTM or long lat coords (NAD27) (hddd.mm.ss.s)

Distance and bearing from nearest tower/pole

Environmental conditions:

	Precipitation	Ambient Temperature	Wind Conditions	Other Weather Observations
Weather:	X Clear	Cold	X Calm	
	Fog	Cool	Gusty wind	
	Cloudy	X Mild	Storm	
	Rain	Warm	Violent storm	
	Snow	Hot		

Habitat:	X Bare ground	forest	Other (describe)	
	Grassland	Tilled agriculture		
	Gravel road	Mix of above (check all that apply)		

Insect Pests: Present:	mosquitos	Fleas	X None
	Ticks	Biting flies	

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Attachment 3
Projects with Special Conditions

Project	Special Condition	Date of Condition
Fowler Ridge WF	All reports of bat incidents must be made within 4 hours of the observance.	July 15, 2011

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DOCUMENT CONTROL DETAILS

			Document Name	Wildlife Incident Reporting System	
			Scope	BP Wind Energy	
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Authority	Matt Sakurada	VP Operations & Asset Management	**Custodian**	Blayne Gunderman	Environmental Manager

REV #	REV DATE	Revision Detail	Authority	Custodian
0.0	07-14-11	Wildlife Incident Reporting System procedure	Matt Sakurada	Blayne Gunderman