Final Environmental Impact Statement for Proposed Habitat Conservation Plan and Incidental Take Permit

Fowler Ridge Wind Farm
Benton County, Indiana

December 2013

U.S. Fish and Wildlife Service
Bloomington, Indiana Field Office
621 South Walker Street
Bloomington, Indiana 47403

COVER SHEET

a. Title: Proposed Habitat Conservation Plan and Incidental Take Permit for the Fowler Ridge Wind Farm, Benton County, Indiana

b. Subject: Final Environmental Impact Statement

c. Lead Agency: United States Fish and Wildlife Service (Service)

d. Abstract: The permit applicant, Fowler Ridge Wind Farm LLC; Fowler Ridge II Wind Farm LLC; Fowler Ridge III Wind Farm LLC; and Fowler Ridge IV Wind Farm LLC., collectively Fowler Ridge, is seeking an Incidental Take Permit (ITP) for the Fowler Ridge Wind Farm (FRWF or Project) in Benton County, Indiana.. The FRWF currently consists of 355 wind turbines and associated access roads and infrastructure constructed in three phases with a total energy capacity of 600 megawatts (MW). Construction of Phase IV, owned by Fowler Ridge IV Wind Farm LLC, is currently planned for 2014. Phase IV would consist of up to 94 turbines for a total capacity of 150.4 MW. The total build-out for all four phases of Fowler Ridge will be up to 449 turbines (750 MW)

The FRWF is located in an area through which the federally endangered Indiana bat (*Myotis sodalis*) migrates. Fowler Ridge has developed a Habitat Conservation Plan (HCP) to ensure that impacts to the federally listed Indiana bat are adequately minimized and mitigated in accordance with the requirements of Section 10 of the Endangered Species Act (ESA). The Service received an application for an ITP from Fowler Ridge for the FRWF on January 15, 2013.

On April 5, 2013, the Service published a notice in the Federal Register stating the availability of the Draft Environmental Impact Statement (DEIS), Draft Habitat Conservation Plan (DHCP), and Draft Implementing Agreement (DIA). The public comment period for the above mentioned documents expired on June 4, 2013. Comments received during the public comment period and Service responses to those comments are included in Appendix I of this Final Environmental Impact Statement (FEIS).

Since release of the DEIS, the ITP term length changed from 22 years to 21 years. Substantive changes to the DEIS resulting from the reduction in permit term length are included in Appendix J of this FEIS.

Key issues associated with the construction of Phase IV and the operation of the four phases of the FRWF include impacts to

wildlife (including migratory birds and bats) and impacts to the federally endangered Indiana bat.

The Service has selected the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action) as the preferred alternative. Of the alternatives evaluated in this FEIS, this alternative best fulfills the agency's statutory mission and responsibilities while meeting the purpose and need.

e. Contact:

Mr. Scott Pruitt
Field Supervisor
U.S. Fish and Wildlife Service
Bloomington Indiana Field Office
621 South Walker St.
Bloomington, IN, 47403
(812) 334-4261
scott_pruitt@fws.gov

f. Transmittal:

This FEIS prepared by Service staff on the proposed HCP and ITP for the Indiana Bat (*Myotis sodalis*) for the Fowler Ridge Wind Farm located in Benton County, Indiana is being made available to the public in January 2014.

The Service's decision on issuance of the permit will occur no sooner than 30 days after the publication of the Environmental Protection Agency notice of the FEIS in the Federal Register and will be documented in a Record of Decision.

You may obtain copies of the FEIS and related documents on the Internet at *http://www.regulations.gov* (**Docket Number FWS-R3-ES-2013-0032)**.

You may obtain the documents by mail from the Bloomington Indiana Field Office (see contact information above**)** or the Midwest Regional Office.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

ABC	American Bird Conservancy
AIRFA	American Indian Religious Freedom Act
ALTA	American Land Title Association
APE	Area of Potential Effect
BA	Biological Assessment
BBCS	Bird and Bat Conservation Strategy
BFO	Bloomington Field Office
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practice
BO	Biological Opinion
CAA	Clean Air Act
CEQ	Council for Environmental Quality
CFR	Code of Federal Regulations
CH_4	Methane
CO_2	Carbon dioxide
CRP	Conservation Reserve Program
CUP	Conditional Use Permit
CWA	Clean Water Act
CWS	Canadian Wildlife Service
dB	Decibel
dBA	A-weighted decibel
DEIS	Draft Environmental Impact Assessment
ECP	Eagle Conservation Plans
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
F	Fahrenheit
FAA	Federal Aviation Administration
FSA	Farm Service Agency
FEIS	Final Environmental Impact Statement
FEMA	Federal Environmental Management Agency
FPPA	Farmland Protection Policy Act
FRWF	Fowler Ridge Wind Farm
GHA	Gamebird Habitat Areas
GHG	Greenhouse gases
HCP	Habitat Conservation Plan
HFCs	Hydrofluorocarbons
Hz	Hertz
HUC	Hydrological Unit Codes
IBA	Important Bird Areas
IC	Indiana Code
IDEM	Indiana Department of Environmental Management
IDNR	Indian Department of Natural Resources
INDOT	Indiana Department of Transportation
ITP	Incidental Take Permit

kHz	Kilohertz
kV	Kilovolt
Leq	Equivalent Energy Sound Level
m/s	Meters per second
MBTA	Migratory Bird Treaty Act
MET	Meteorological Tower
MRU	Midwest Recovery Unit
MW	Megawatt
N_2O	Nitrous oxide
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NGO	Non-Governmental Organization
NHPA	National Historic Preservation Act
NLCD	National Landcover Data
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
O&M	Operations and Maintenance
PA	Programmatic Agreement
PFCs	Perfluorocarbons
PIF	Partners in Flight
RGP	Regional General Permit
ROW	Right-of-way
SCADA	Supervisory Control and Data Acquisition
SF_6	Sulfur hexafluoride
SHAARD	State Historic Architectural and Archaeological Research Database
SHPO	State Historic Preservation Office
SGCN	Species of Greatest Conservation Need
SWPPP	Storm Water Pollution Prevention Plan
T&E	Threatened and Endangered
TMDL	Total Maximum Daily Loads
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service
WECS	Wind Energy Conversion Systems
WEST	Western EcoSystems Technologies, Inc.
WNS	White Nose Syndrome
WTG	Wind Turbine Generators

1.0 PROJECT OVERVIEW AND BACKGROUND

1.1 INTRODUCTION

The U.S. Fish and Wildlife Service (Service or USFWS) received an application for an Incidental Take Permit (ITP), pursuant to the provisions of Section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (ESA or Act),16 U.S.C. 1531, *et seq*., 1539(a)(1)(B), for the Fowler Ridge Wind Farm (FRWF). The FRWF consists of four project phases owned by four separate Companies: Fowler Ridge Wind Farm LLC; Fowler Ridge II Wind Farm LLC; Fowler Ridge III Wind Farm LLC; and Fowler Ridge IV Wind Farm LLC. The four Companies, hereinafter referred to as Fowler Ridge or Applicant, will jointly serve as permittees under the ITP, and are jointly and severally liable for all obligations assigned to them under the ITP, Habitat Conservation Plan (HCP) and associated documents such as the Implementing Agreement (IA) and Programmatic Agreement (PA).

The ITP would authorize the incidental take of the federally-endangered Indiana bat (*Myotis sodalis)* during the operation of the FRWF Phases I, II, III and IV in Benton County, Indiana (Figure 1.1). This Final Environmental Impact Statement (FEIS) evaluates the effects of construction of Phase IV and operation and decommissioning of all four phases of FRWF.

The Indiana bat was listed as endangered by the Service on March 11, 1967 (32 Fed. Reg. 4001). An Indiana Bat Recovery Plan was first developed and signed on October 14, 1983 (USFWS 1983). An agency draft of the Revised Recovery Plan was released in March 1999 (USFWS 1999). The Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision was made available for public comment on April 16, 2007 (72 Fed. Reg. 19015-19016) (USFWS 2007).

1.2 FOWLER RIDGE WIND FARM PROJECT DESCRIPTION

1.2.1 Project Components

The FRWF currently consists of 355 wind turbines constructed in three phases with a total energy capacity of 600 megawatts (MW) (Table 1.1):

(1) The 301.3 MW Fowler Phase I was constructed in 2008 and consists of 40 Clipper Liberty wind turbine generators (WTG) with a capacity of 2.5 MW per turbine and 122 Vestas V82 WTGs with a capacity of 1.65 MW per turbine. The site is owned by Fowler Ridge Wind Farm LLC and began operating in 2009.

(2) The 199.5 MW Fowler Phase II was constructed in 2009 and began operating later that year. The site is owned by Fowler Ridge II Wind Farm LLC and consists of 133 GE WTGs, each with a 1.5 MW capacity.

(3) The 99 MW Fowler Phase III was constructed in 2008 and began operating in 2009. The site is owned by Fowler Ridge III Wind Farm LLC and consists of 60 Vestas V82 WTGs, each with a 1.65 MW capacity per turbine.

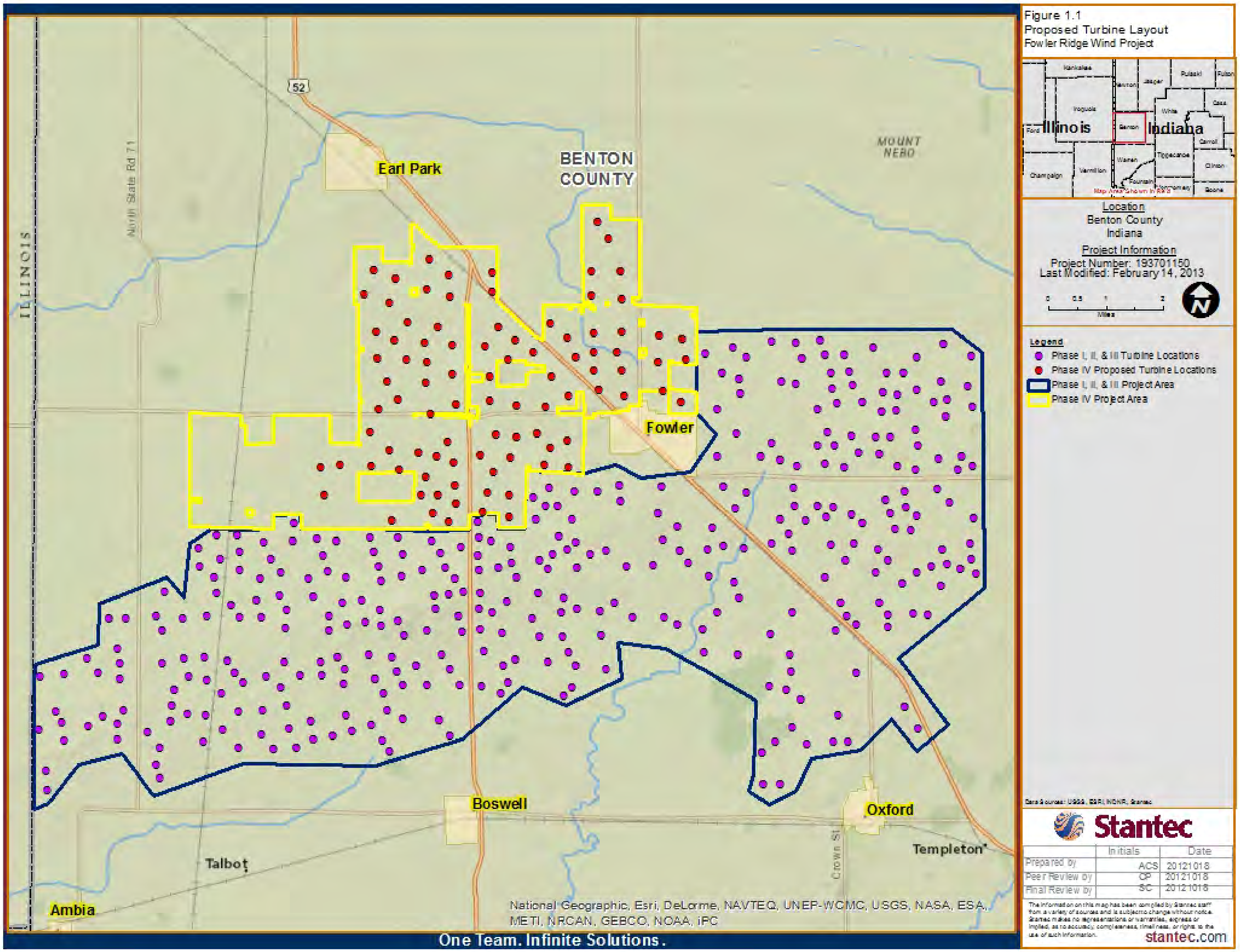


Figure 1.1
Proposed Turbine Layout
Fowler Ridge Wind Project
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: February 14, 2013
Legend
Phase I, II, & III Turbine Locations
Phase IV Proposed Turbine Locations
Phase I, II, & III Project Area
Phase IV Project Area
Earl Park
BENTON COUNTY
MOUNT NEBO
Fowler
Boswell
Oxford
Templeton
Talbot
Ambia
ILLINOIS
North State Rd 71
52
Crown St
National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC
One Team. Infinite Solutions.
Stantec
Initials
Date
Prepared by
ACS
20121018
Peer Review by
CP
20121018
Final Review by
SC
20121018
stantec.com

The turbine towers at the first three phases are approximately 262 feet in height with a rotor blade path ranging from 253 to 314 feet. Therefore, the maximum height of the turbines from tower base to highest blade tip (i.e., 12 o'clock position) is 416 feet. The turbines are arranged throughout the project area, which is bisected by U.S. Highway 52 running north and south (Figure 1.1).

Seven permanent, un-guyed meteorological (MET) towers, 262 feet tall, are located within the FRWF project area. Each permanent MET tower and associated electrical components are situated within a 46-foot by 46-foot chain link fence that is graveled and accessible from project roads.

The project currently includes three substations, one for each phase of the wind farm. One additional substation will be constructed for Phase IV of the project. The substations collectively contain six transformers that feed electricity into an existing 345 kilovolt (kV) electrical tie-in line. Electrical power generated by the WTGs is transformed and collected through a network of underground collection circuits. The underground collection cables total approximately 160 miles and are buried four feet deep.

Overhead generation tie-in lines were constructed as part of the first three phases. Tie-in and collection lines are owned and maintained by the Applicant. The tie-in line for the project consists of roughly 200 poles, and carries electricity approximately 31 miles within the project area and ultimately to the Dequine Substation, located in Tippecanoe County, near Lafayette, Indiana.

Construction of the first three phases was completed in December, 2009, and included 355 turbines, the generation tie-in lines, substations, operations and maintenance (O&M) building, access roads, and collection and communications lines.

Construction of Phase IV, owned by Fowler Ridge IV Wind Farm LLC, is currently planned for 2014. Phase IV would consist of up to 94 GE 1.6 MW turbines for a total capacity of 150.4 MW. The total build-out for all four phases of FRWF will be up to 449 turbines (750 MW) (Table 1.1).

Table 1.1 Fowler Ridge Wind Farm Turbines and Capacity

Phase	Operational Date	Capacity (MW)	Turbines	Number of Turbines
I	3/1/2009	301.3 MW	Vestas V82 1.65 MW	122
			Clipper C96 2.5 MW	40
II	12/16/2009	199.5 MW	GE SLE 1.5 MW	133
III	2/27/2009	99 MW	Vestas V82 1.65 MW	60
IV	expected 2014	150.4 MW	GE TC3+ 1.6 MW	94

1.2.2 Construction of Fowler IV

All of the alternatives described in Section 3.1.3 would include the construction of Phase IV. Phase IV will consist of up to 94 GE TC3+ 1.6 MW turbines for a total capacity of 150.4 MW. Currently, Phase IV is planned for construction in 2014. The turbine towers in Phase IV will be

262 feet in height with a rotor diameter 253 feet; the maximum height of the turbines from tower base to highest blade tip (12 o'clock position) is 389 feet.

Turbine construction may take up to 12 months to complete after issuance of applicable construction permits. Prior to construction of Phase IV, the Applicant will: 1) order all necessary components, including wind turbine generators, foundation materials, electrical cable, and transformers; 2) complete micrositing of final turbine locations[1]; 3) complete an American Land Title Association (ALTA) survey to establish locations of structures and roadways; and 4) complete soil borings, testing, and analysis for proper foundation design and materials.

Turbines will be constructed using standard wind farm construction procedures and equipment and will entail the following activities:

- Road and pad construction
- Generation tie-in line construction
- Foundation construction for turbine towers, MET towers, and transformers
- Trenching and placement of underground collection and communications cables
- Tower erection
- Nacelle and rotor installation
- Turbine commissioning
- Final road preparation, erosion control, and site restoration

A construction staging and laydown area, including project offices, equipment, and employee parking areas, will be developed and will be utilized throughout construction of Phase IV. A temporary concrete batch plant may be located adjacent to the staging area and laydown area.

1.2.2.1 *Road and Pad Construction*

Existing roads may be upgraded and new roads will be constructed in accordance with wind industry standards for roads and local building requirements. The roads will accommodate all-weather access by heavy equipment during construction and long-term use during operations and maintenance. New roads will be located in consultation with the landowner to minimize disturbance, maximize transportation efficiency, and avoid cropland to the extent feasible. All new roads will be constructed for the specific purpose of project construction, operation, and maintenance. Surface disturbance will be contained within road right-of-way (ROW), which will average a width of 36 feet along turbine/crane access roads. The permanent width of access roads will be approximately 16 feet. All roads will include road base, gravel surface materials, appropriate drainage, and culverts where necessary.

All FRWF wind turbines are anchored to an inverted tee concrete foundation that is approximately 50 feet in diameter at the base and 15 feet in diameter at the top and extends approximately 12 feet below the ground. Surrounding this concrete area at the surface is a circular area (the pad) that is approximately 50 feet in diameter. The pad is constructed much

---

[1] Although proposed locations of up to 94 turbines have been determined, minor modifications to their locations may occur prior to finalization of construction. Turbine locations will not change by more than 95 feet from their currently proposed locations (see Figure 1.1).

like the access roads with a base overlaid by gravel. The diameter of the constructed surface (foundation and pad) immediately around each turbine is approximately 50 feet.

Topsoil removed during road construction will be stockpiled in elongated rows within road ROWs. Topsoil will be re-spread on areas that will be re-vegetated as soon as possible after road construction is complete.

Construction of Phase IV will necessitate construction of temporary crane pads at each turbine site, temporary travel roads for the cranes, temporary turning areas for oversized equipment at certain county and local road intersections, temporary laydown areas around each turbine, trenches for the underground electrical collection and communication system, and temporary storage/stockpile areas. Construction of each turbine will result in temporary impacts of:

(1) Approximately 10 feet on either side of the permanent roadway width;

(2) A 60-foot by 80-foot gravel crane pad extending from the roadway to the turbine foundation; and

(3) A 150-foot radius rotor laydown area centered on the turbine foundation (i.e., turbine pad).

1.2.2.2 *Generation Tie-In Line Construction*

The 4.5-mile tie-in line will be constructed on approximately 34 poles spaced approximately 650 to 800 feet apart. The typical construction sequence includes pole erection, insulator installation, conductor installation, and testing.

1.2.2.3 *Foundation Construction*

Foundations for turbine towers, MET towers and transformers will be constructed by excavating the area, installing forms, and pouring concrete. Anchor bolts will be embedded in the concrete, and the foundations will be allowed to cure prior to tower erection.

Up to three additional permanent, unguyed MET towers will be erected for Phase IV. Permanent MET towers will be 262 feet tall and installed on a 3-foot diameter pier foundation.

Transformer foundations will be constructed using standard procedures by pouring concrete in a shallow slab or using a precast structure set on structural fill.

1.2.2.4 *Underground Electrical and Communication Cables*

Underground collection lines and communications cables will be placed in approximately 4-foot deep trenches located between turbines and along access roads. Electrical collection lines will be installed first, and the trench partially backfilled prior to placement of the communications cables. Trenches will be backfilled and the area revegetated with excess soil from other construction areas, if needed.

1.2.2.5 *Turbine Tower Erection*

Turbine towers will be anchor-bolted to the concrete foundations. Tower bottom sections will be lifted with a crane and bolted to the foundation. The middle and top sections will be lifted into place with a crane and bolted to the section below.

1.2.2.6 *Nacelle and Rotor Installation*

Rotor construction will occur within the laydown area at each turbine site. Once the tower has been erected, the nacelle is lifted into place and bolted to the top tower section. Following the nacelle, the rotor will be hoisted into place and bolted to the nacelle.

1.2.2.7 *Turbine Commissioning*

Turbine commissioning involves mechanical, electrical, and communications inspections to ensure systems are installed and functioning properly. Turbine testing will include checks of each wind turbine and the Supervisory Control and Data Acquisitions (SCADA) system prior to turbine commissioning. Electrical tests of the turbines, transformers, collection system, and transmission system will be performed by qualified electricians to ensure that all electrical equipment is installed in accordance to design specification and is operating within industry and manufacturer standards. Since turbines will be spinning during turbine testing, minimization measures will be taken to avoid take of Indiana bats, including conducting turbine testing during the period when Indiana bats are not expected to be in the project area (between October 16 and July 14); or conducting testing during daylight hours if testing needs to occur during the period from July 15 to October 15; or implementing other minimization measures approved for operations.

1.2.2.8 *Final Road Preparation, Erosion Control, and Reclamation*

The existing land use will be restored following construction. Once construction is complete, all disturbed areas will be graded to the approximate original contour. Areas disturbed during construction will be stabilized and restored using appropriate erosion control measures, including site-specific contouring, reseeding, or other measures agreed to by the landowner and designed and implemented in compliance with the project Storm Water Pollution Prevention Plan (SWPPP). As previously discussed an approximate 50 foot diameter circular area around each turbine (foundation and pad) is concrete and gravel. This is maintained throughout the period the turbines are in place. Outside of this 50 foot diameter area, land use is controlled by the landowner. In the case of FRWF, these areas will revert to the original land use, which is typically row crop agriculture.

Final road grading and preparation will include reducing the construction road width to the final 16 feet. Adjacent areas will be reclaimed to current landcover types and surface contours will be directed away from any cut-and-fill slopes and into ditches that discharge to natural drainages as necessary. Typically SWPPPs include standard sediment control devices to minimize soil erosion during and after construction. Following construction, all unused construction materials and waste will be picked up and removed from the project area and waste materials will be disposed of at approved and appropriate landfills. The Applicant has agreed that all materials from the construction process will be removed from the project site, recycled, or disposed of appropriately.

1.2.3 Operations and Maintenance (O&M)

The FRWF is designed to be operated both locally from the control room in the O&M building and remotely from Houston, Texas, through a remote operations center. A permanent staff of approximately 60 on-site personnel provides all O&M support activities to the FRWF. Each turbine includes a SCADA operations and communications system that allows automated independent and remote operation of the turbine. The SCADA data provide detailed operating and performance information for each turbine, allowing real-time control and continuous monitoring to ensure optimal operation and identification of potential problems. A local wind technician is either on-site or available on-call to respond in the event of an emergency or critical outage.

A preventative maintenance and inspection schedule has been implemented for the project. Typical O&M activities include WTG inspections and routine maintenance activities on WTGs, as required. Some repair activities may require the use of heavy equipment, such as cranes, to assist in the repairs of components such as the rotor, turbine blades, and nacelle components.

Maintenance activities consist of periodic mowing to maintain previously-cleared areas associated with project infrastructure (e.g., roads, transmission lines) and ROW. Mowing maintains cleared areas in an herbaceous or scrub-shrub condition. The need for mowing is evaluated by site operations staff periodically during the growing season and occurs on an as-needed basis during daytime hours.

Maintenance consists of building inspection and repairs, as needed; periodic grading of roads to restore the road surface or repair of culverts, as needed; and annual inspection and removal of hazards (e.g., downed trees or encroaching branches) on transmission lines.

The WTGs are lit with required Federal Aviation Administration (FAA) lighting on the nacelle of select WTGs. The O&M facility has outside safety lights that may be operated manually or via motion detectors.

1.2.4 Decommissioning

The projected operational life of each phase of the FRWF is 20 years. After the useful life of the turbines is complete, FRWF will assess the viability of either repowering the project by installing new or refurbished turbines, or completely decommissioning the project.

In the event that the FRWF will be decommissioned after 20 years, the turbines, infrastructure, and facilities will be removed. All turbines, concrete foundations, and other facilities, with the exception of the underground collection systems, will be removed to a depth of four feet below grade. In some instances, the landowners may wish to maintain certain facilities, such as access roads. The decommissioning process will be similar in scope and duration to the construction process. Most components and materials will be removed, recycled, or disposed of in an approved and appropriate waste management facility. Decommissioning activities for Phases I, II and III could begin as early as 2029 and decommissioning of Phase IV would begin as early as 2034 (see Table 1.1 in the HCP).

1.2.4.1 *Decommissioning Process*

The decommissioning process includes removal of above-ground structures and concrete foundations to a depth of four feet below the surface; removal of access roads if required by the landowner; restoration of topsoil, re-vegetation and seeding; and a three-year monitoring and remediation period. Turbine blades will be permanently pitched into the wind and braked to prevent spinning and the potential take of Indiana bats during the period between when the WTGs stop producing electricity and when the turbines are taken down.

Above-ground structures include the turbines, transformers, substations, maintenance buildings, MET towers, transmission lines, and communications equipment. Below-ground structures include turbine foundations, the collection and communication system, drainage structures, and access road sub-base material. The process of removing structures involves evaluating components and materials for reuse, salvage, recycling, and/or disposal. Components and material may be stored on-site in a pre-approved location until ready for transport to appropriate facilities for reconditioning, salvage, recycling or disposal.

Access roads will be widened as necessary to accommodate movement of cranes or other machinery required for the disassembly and removal of the turbines. Turbine components, control cabinets, electronic systems, and internal cables will be de-energized and removed. The blades, hub, and nacelle will be lowered to the ground for disassembly. The tower sections will be disconnected and lowered to the ground where they will be further disassembled as needed into transportable sections.

Foundations (e.g., turbines, transformers, MET towers) will be excavated to a depth sufficient to remove anchor bolts, rebar, conduits, cable, and concrete to a depth of four feet below grade. The excavation will be filled and compacted with clean sub-grade material of quality and density comparable to the surrounding area. All unexcavated areas compacted by equipment used in decommissioning will be de-compacted to adequately restore the topsoil and sub-grade material to the proper quality and density comparable to the surrounding area.

The collector and communications cables and conduits will be cut back to a depth no greater than four feet. All cable and conduit buried deeper than four feet will be left in place and abandoned.

Decommissioning of the substation will include removal of fencing, conductors, switches, transformers, and foundations. Substation material and equipment disposal, reconditioning, or reuse will be dependent on condition and market value. Foundations and underground components will be removed to a depth of four feet and the excavation filled, contoured, and re-vegetated.

After turbine decommissioning is completed, access roads and construction pads will be removed, unless the landowner requests that access roads remain in place. Gravel will be removed from access roads and turbine pads and transported to a disposal location or approved stockpile site, or as requested by the landowner. Drainage structures integrated with the access roads will be removed and backfilled with sub-grade material, the topsoil replaced, and the surface contoured and re-vegetated. Improvements to local and county roads that were not removed after construction at the request of Benton County will remain in place. The Applicant has agreed that all materials from the decommissioning process will be removed from the project site, recycled, or disposed of appropriately.

1.2.4.2 *Site Restoration*

Areas requiring restoration or reclamation will be leveled or re-contoured to match the surrounding area, covered with topsoil, and re-seeded, if needed. Other steps necessary to prevent soil erosion, ensure establishment of native vegetation cover, and/or control for noxious weeds and pests will be conducted as necessary. A monitoring and remediation period of approximately three years will follow completion of decommissioning and restoration activities.

1.3 REGULATORY AND LEGAL FRAMEWORK

The protection of federally-listed threatened and endangered species is the responsibility of numerous federal agencies that operate under various statutory and regulatory authorities. The following section provides information regarding the governing legal authorities and the overlap with this National Environmental Policy Act (NEPA) document and the HCP process.

1.3.1 National Environmental Policy Act (NEPA)

The National Environmental Policy Act of 1969, as amended (NEPA), 42 U.S.C. 4321, *et seq*., requires Federal agencies to evaluate and disclose the effects of their proposed actions on the natural and human environment. The NEPA process is intended to help federal agencies make decisions that are based on an understanding of potential environmental consequences, and take actions that protect, restore, and enhance the environment. NEPA regulations provide the direction to achieve that purpose.

NEPA and the Council for Environmental Quality (CEQ) *Regulations for Implementing NEPA* (40 C.F.R. Parts 1500 - 1508) contain "action-forcing" provisions to ensure that all federal agencies act according to the letter and spirit of NEPA.

NEPA procedures must ensure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA.

NEPA implementation requires that every federal agency prepare an Environmental Impact Statement (EIS) for proposed legislation or other federal actions “significantly affecting the quality of the human environment” (40 C.F.R. 1501). The Service, as the Lead Federal Agency, has determined that an EIS is appropriate to analyze the effects of the proposed action on the natural and human environment. This EIS addresses potential effects associated with the construction of Phase IV, operation of the Fowler Phases I – IV, and proposed issuance of an ITP. In accordance with NEPA, this EIS also addresses a “no-action” alternative, which provides an assessment of future conditions in the absence of the proposed federal action (i.e., issuance of the ITP).

1.3.2 Federal Endangered Species Act (ESA)

The purpose of the ESA is to provide a means whereby the ecosystems upon which threatened and endangered (T&E) species depend may be conserved, and to provide a program for the conservation of such T&E species.

Section 9 of the ESA prohibits the “take” of any fish or wildlife species listed under the ESA as endangered (16 U.S.C.1538). Under Federal regulation, take of fish or wildlife species listed as threatened is also prohibited unless otherwise specifically authorized by regulation (50 C.F.R.

17.31). “Take”, as defined by the ESA, means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” (16 U.S.C. 1532(19)).

Section 9 also prohibits the removal and reduction to possession of any listed plant species “under federal jurisdiction,” as well as the removal, damage, or destruction of such plants on any other areas in knowing violation of any state law or regulation or in violation of state trespass law (16 U.S.C. 1538). The Service’s implementing regulations further define the term “harm” to include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering” (50 C.F.R. 17.3.) They also define harass as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering” (50 C.F.R. 17.3.).

The 1982 amendments to the ESA established a provision in Section 10 that allows for “incidental take” of endangered and threatened species of wildlife by non-Federal entities (16 U.S.C. 1539.) Incidental take is defined by the ESA regulations as take that is “incidental to, and not the purpose of, the carrying out of an otherwise lawful activity” (50 C.F.R. 17.3.). Under Section 10 of the ESA, the Secretary of the Interior and Secretary of Commerce may, where appropriate, authorize the taking of federally-listed fish or wildlife if such taking occurs incidentally to otherwise legal activities. The Service is charged with regulating the incidental taking of listed species under its jurisdiction.

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

The submission of the ESA Section 10(a)(1)(B) permit application requires the development of a HCP (16 U.S.C. 1539(a)(1)(B) and 1539(a)(2)(A)) designed to ensure the continued existence and aid in the recovery of the listed species, while allowing for any limited, incidental take of the species that might occur during the construction and operation of the project, or during mitigation activities. The implementing regulations for Section 10(a)(1)(B) of the ESA, as provided in 50 C.F.R. 17.22, specify the requirements for obtaining a permit allowing the incidental take of listed species pursuant to otherwise lawful activities.

Since it was originally made available in December 1996, the Service also considers the *Habitat Conservation Planning Handbook* (USFWS and NMFS 1996) (Handbook) during HCP development, review, and implementation processes. Its purpose is to provide policy and guidance for Section 10(a)(1)(B) procedures to promote efficiency and nationwide consistency within and between the Service and National Marine Fisheries Service (NMFS). However, all species which would be the subject of the Proposed Action are under the sole jurisdiction of the Service.

An addendum to the Handbook was published in the Federal Register on June 1, 2000 (65 Fed. Reg. 35241-35257). This addendum, also known as the “Five Point Policy”, provides additional guidance on HCPs, specifically regarding: (1) biological goals; (2) adaptive management; (3) monitoring; (4) permit duration; and (5) public participation. The addendum was created to incorporate lessons learned, recommendations received, and methods the Service and NMFS were using to strengthen the HCP process since original issuance of the Handbook.

Section 7 of the ESA requires all federal agencies, in consultation with the Service, to ensure that any action "authorized, funded, or carried out" by any such agency "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification" of critical habitat (16 U.S.C. 1536.) Because the "action" in this case is issuance of an ITP, the action agency is the Service and the consultation is referred to as an intra-agency consultation, since the Service is essentially consulting on its own action. Before initiating an action, the federal action agency must determine whether or not the proposed project may affect listed or proposed species and/or their critical habitat. If so, further consultation is required.

Since in the case of the FRWF, issuance of an ITP for the take of Indiana bat is likely to adversely affect a listed species, the consultation cannot be concluded informally and formal consultation on the effects to the Indiana bat is required. During formal consultation, the Service prepares a biological opinion (BO) in response to the information in the form of a biological assessment (BA) typically provided by the federal agency. In the case of an intra-agency consultation on issuance of an ITP, this information is usually the HCP (in place of a BA).

The BO analyzes the implementation of the HCP and other relevant information for the effects on the listed species and analyzes whether the Proposed Action would be likely to jeopardize the continued existence of the species or destroy or adversely modify designated critical habitat. If the BO reaches a jeopardy or adverse modification conclusion, the opinion must suggest "reasonable and prudent alternatives" that would avoid that result (16 U.S.C. 1536(b)(3)(A)). If the BO concludes that the project as proposed would involve the take of a listed species, but not to an extent that would jeopardize the species' continued existence, the BO must include an incidental take statement and specify reasonable and prudent measures to minimize the impact of the take (16 U.S.C. 1536(b)(4)).

The incidental take statement specifies an amount of take that the Service believes may occur as a result of the action. The Service may also make conservation recommendations, which are non-binding suggestions, such as identifying additional discretionary measures to reduce take, identifying additional needed studies, monitoring or research, and recommending how the action agency may assist species conservation in furtherance of ESA Section 7(a)(1). If a proposed action is carried out in compliance with the BO and the incidental take statement, it may be implemented without violation of the ESA, and the take is thereby exempted. The resulting BO will encompass the issuance of the ITP and implementation of the HCP.

1.3.3 Migratory Bird Treaty Act (MBTA)

The Migratory Bird Treaty Act of 1918 (MBTA), 16 U.S.C. 703, *et seq*., prohibits the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts and nests, except when specifically authorized by the Department of the Interior. Although the MBTA has no provision for allowing unauthorized take of migratory bird species, the Service recognizes that some birds may be taken during the operation of a wind facility even if all reasonable measures to avoid take are implemented. .

1.3.4 Bald and Golden Eagle Protection Act (BGEPA)

The Bald and Golden Eagle Protection Act of 1940 (BGEPA), 16 U.S.C. 668, *et seq*., 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, molest, or disturb" (16 U.S.C. 668c.). On September 11, 2009, the Service published a final rule (Eagle Permit Rule) 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 (74 Fed. Reg. 46836-46879).

On May 2, 2013, the Service announced the availability of the Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2[2] (the "Guidance")(78 Fed. Reg. 25758). The Guidance provides a means of compliance with the BGEPA by providing recommendations and in-depth guidance for:

(1) Conducting early pre-construction assessments to identify important eagle use areas;

(2) Avoiding, minimizing, and/or compensating for potential adverse effects to eagles; and

(3) 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.

1.3.5 Clean Water Act (CWA)

Section 404 of the Clean Water Act (CWA), 33 U.S.C. 1251, *et seq*., 1344, which is administered by the U.S. Army Corps of Engineers (USACE), regulates the placement of fill or dredged material into wetlands and other Waters of the United States.

1.3.6 National Historic Preservation Act (NHPA)

According to the National Historic Preservation Act (NHPA) of 1966, as amended, 16 U.S.C. 470, *et seq*., "the historical and cultural foundations of the Nation should be preserved as a living part of our community life and development in order to give a sense of orientation to the American people"(16 U.S.C 470(b)(2)). Further, the Federal government has a responsibility to "foster conditions under which our modern society and our prehistoric and historic resources can exist in productive harmony" (16 U.S.C. 470-1(1)). As a result of Section 106 of the NHPA and its implementing regulations, federal agencies are required to take into account the impact of federal undertakings upon historic properties in the area of the undertaking (16 U.S.C. 470f; 36 C.F.R. Part 800) (Revised January 2001).

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

1.3.7 Clean Air Act

The Clean Air Act (CAA) 42 U.S.C. §7401 *et seq.* (1970) is a comprehensive federal law that regulates air emissions from stationary and mobile sources. Among other things, this law authorizes the U.S. Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and public welfare and to regulate emissions of hazardous air pollutants.

1.3.8 Farmland Protection Policy Act (FPPA)

The Farmland Protection Policy Act of 1981 (FPPA), 7 U.S.C. 4201, *et seq*., purpose is "to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses, and to assure that Federal programs are…compatible with…policies to protect farmland" (7 U.S.C. 4201(b)).

1.3.9 Executive Order 11990 – Wetlands Protection

The purpose of Executive Order 11990 is to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands." To meet these objectives, it requires federal agencies, in planning their actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided.

1.3.10 Executive Order 11988 – Floodplain Management

Executive Order 11988, signed on May 24, 1977, requires federal agencies to avoid, to the extent possible, the long-term and short-term adverse impacts associated with the occupancy and modifications of floodplains, and to avoid the direct or indirect support of floodplain development whenever there is a practicable alternative. The preferred method for satisfying this requirement is to avoid sites within the floodplain. If an action must be located within the floodplain, the executive order requires that agencies minimize potential harm to people and property and to natural and beneficial floodplain values by incorporating current floodplain management standards into the project.

1.3.11 Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, states that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority populations and low-income populations." It also requires that representatives of any low-income or minority populations that could be affected by the project be given the opportunity to be included in the impact assessment and public involvement process.

1.3.12 State Regulations

1.3.12.1 *Indiana Nongame and Endangered Species Conservation Act*

The Indiana Nongame and Endangered Species Conservation Act (IC 14-22-34) is maintained by the Office of Code Revision Indiana Legislative Services Agency. Any species or subspecies of wildlife whose survival or reproductive parameters are in jeopardy or are likely to be within the foreseeable future and any species or subspecies designated under the federal ESA are deemed endangered species under the Indiana Nongame and Endangered Species Conservation Act (IC 14-22-34-1).

According to 312 IAC 9-10-18, "(a) The department may issue a permit under this section to an individual, organization, corporation, or government agency to take a state endangered species. This permit may only be issued for state endangered species that are either federal proposed species or federal listed species. (b) The permit application under this section shall be made as follows: (1) The applicant must submit a Habitat Conservation Plan. (2) The division of fish and wildlife will supply an outline of information sections that must be included in the Habitat Conservation Plan. This outline will include, but not necessarily be limited to, the following sections: (A) Current status of the endangered species. (B) Description of area of impact. (C) Specific impacts to the species' habitat. (D) Conservation actions to be undertaken to ensure no detrimental effect to the endangered species. (E) Schedule for enacting the conservation actions. (F) Guarantees to ensure the enactment of conservation actions. (c) The permit application has to be available for a minimum of thirty (30) days for public review and comment. The director shall determine whether the permit will be issued after review of comments received during the review and comment period. (d) The permit may be revoked at any time if the provisions of the Habitat Conservation Plan are not enacted according to the schedule in the plan."

To be in compliance with IC 14-22-34, a limited take permit must be sought and obtained from the Indiana Department of Natural Resources (IDNR) for the proposed project. Under this law, the IDNR may issue a permit authorizing the take of a state-listed species that is either federally-proposed or federally-listed as threatened or endangered. This administrative rule was specifically designed to complement the federal HCP/limited-take-permit.

1.3.12.2 *Indiana Flood Control Act (IC 14-28-1)*

In 1945, the Indiana General Assembly determined that it was in the best interest of the citizens of the state to prevent and limit the damaging effects of floods by regulating, supervising, and coordinating the construction, operation, and design of flood control works and alteration of streams and by keeping floodways free and clear. The Natural Resources Commission has been given primary authority concerning flood control activities in the state.

This act provides that it is illegal to construct a permanent abode or place of residence in a floodway. Any other structure, obstruction, deposit, or excavation in the floodway of any stream in the state must first be approved by the Commission. The IDNR Division of Water has been given authority from the Commission to act on its behalf concerning flood control activities in the state. Proposed construction activities in a floodway are reviewed by the IDNR to determine if the work will:

(1) Adversely affect the efficiency of or unduly restrict the capacity of the floodway;

(2) Create an unreasonable hazard to the safety of life or property; or

(3) Result in unreasonably detrimental effects upon the fish, wildlife or botanical resources.

1.3.13 County Regulations

1.3.13.1 *Ordinance for Regulating Energy Generation Using Wind Power in Benton County, Indiana.*

Benton County, Indiana has prepared an extensive Wind Energy Siting Ordinance[3]. Prior to construction, the developer must obtain three permits, including:

(1) A Conditional Use Permit (CUP) for any Wind Energy Conversion Systems (WECS) in any Zone other than R-1, R-2, R-3 or R-4;

(2) A Request for Variance for any variances anticipated from the ordinance; and

(3) An Improvement Location Permit from the Benton County Building Commissioner.

Site plans to be submitted for the CUP must show location of recognized historic or heritage sites as noted by the Division of Historic Preservation and Archaeology of the IDNR and any wetlands based upon a delineation prepared in accordance with the applicable USACE requirements and guidelines.

For setbacks, no turbine may be installed within 350 feet, or 1.1 times the height of the turbine, whichever is greatest, from any property lines, dedicated roadway, railroad right-of-way, or overhead electrical transmission or distribution lines. In addition, turbines shall be at least 1,000 feet from any occupied residence and 1,500 feet from any platted community. The Wind Energy Siting Ordinance also includes several specifications for the turbines related to safety, color, lighting, and noise; requires that use of public roads be approved by the Benton County Highway Supervisor; requires several maintenance items; and requests a decommissioning plan[4].

1.3.14 Consultation and Regulatory Compliance History

Consultation with appropriate federal, state, and local agencies is being conducted as part of development of Phase IV and all applicable federal, state, and local permits will be obtained as required. Table 1.2 summarizes permits that may be needed prior to construction.

Table 1.2 Federal and State Permits

Permitting Agency	Permit Needed	Trigger
USACE	Clean Water Act §404 Permit for Impacts to Waters of the United States (Regional General Permit 1).	Impact less than 1 acre of wetlands or Waters of the U.S.
IDNR – Division of Water	Construction in a Floodway (if applicable)	Presence of streams/ floodplains on subject property

[3] http://www.in.gov/oed/files/Benton_County_Wind_Ordinance.pdf
[4] Ibid, Benton County

Permitting Agency	Permit Needed	Trigger
IDNR – Division of Fish and Wildlife	State endangered species incidental take permit	Presence of state listed endangered species on site with the possibility of incidental take.
Indiana Department of Environmental Management (IDEM)	Stormwater Runoff Permit (Rule 5)	Required for construction activities that disturb 1 acre or more of land (e.g., clearing, grading, and excavating)
IDEM – Office of Air Quality	Approval for Fugitive Dust emissions of more than 25 tons per year in a non-attainment area	Fugitive Dust emissions of more than 25 tons/year with a location in a "nonattainment" area.
IDEM – Office of Water Quality, Wetlands and TMDLs Program	Regional General Permit (RGP 1) Regulation of Discharges of Dredged or Fill Material to Waters of the State and State Isolated Wetlands.	Impact less than 1 acre of wetlands or Waters of the US.
Benton County Building Commissioner	Three Permit Approvals must be obtained before construction: 1) Conditional Use Permit 2) Request for Variances (where appropriate) 3) Improvement Location Permit	Construction of a wind farm in Benton County, Indiana.

1.4 SCOPING AND PUBLIC INTERACTION

Scoping is a crucial step in the early planning stage of an environmental document. The objectives of scoping are to identify issues and to translate these into the purpose of the action, the needs for the action, the action or actions to be taken, the alternatives to be considered in detail, the alternatives not to be considered in detail, and the impacts to be addressed. Scoping is used to design the EIS, and, if effective, should reduce paperwork, delays, and costs and improve the effectiveness of the NEPA process. Scoping is a public participation process that begins with the publication in the Federal Register of the Notice of Intent (NOI) to prepare an EIS.

On May 25, 2011, the Service published a NOI in the Federal Register to solicit feedback from potentially affected federal, state, and local agencies, tribes, and the public in determining the scope of this EIS (76 Fed. Reg. 30384-30386). Publication and distribution of the NOI initiated the process of public scoping for this EIS (Appendix A). A public scoping meeting was held on

June 7, 2011, in Benton County and a Service website[5] was created to provide agencies and the public with information related to the project. The scoping period extended until June 23, 2011.

On June 2, 2011, a letter was sent via e-mail to state and federal agencies and non-governmental organizations (NGOs) informing them that the Service was initiating scoping for development of this EIS. In addition, a public notice was published in the Indianapolis Star newspaper, press releases were issued to local radio stations, and flyers announcing the public meeting were posted at public gathering sites (e.g., grocery stores, gas stations/convenience stores, public library). Notification was given that comments could be submitted through the U.S. Postal Service, by facsimile, or on the Service website.

The scoping meeting provided an opportunity for the attendees to learn about the Proposed Action and comment on environmental issues of concern and the alternatives that should be discussed in the EIS. Scoping comments are summarized below.

1.4.1 Issues Raised During Public Scoping Period

Ten written responses were received during the scoping period, all of which were from the public or NGOs (Appendix B). No written comments were received from federal, state, or local agencies as part of the public scoping period.

Comments received generally fell into the following categories:

- Five comments indicated a preference for the maximally restrictive alternative.
- Two comments requested that the ITP be denied.
- One comment voiced opposition to the project in general.
- One comment outlined the legal considerations that must be taken into account as part of the NEPA process. Various comments from this letter are addressed in this FEIS.
- One written comment requested to be added to the project mailing list. This letter requested paper copies of project materials, including scoping documents.

1.5 DRAFT EIS (DEIS) PUBLIC REVIEW

The DEIS was published in the Federal Register for public review on April 5, 2013 (78 Fed. Reg. 20690-20692) in accordance with requirements set forth in the NEPA and its' implementing regulations (40 CFR 1500-1508). Public comments were accepted during a 60-day period following publication of the Federal Register Notice of Availability. One public information meeting was held during the comment period, on April 18, 2013 in Fowler, Indiana. Comments received during the comment period were taken into account in assessing Project impacts and potential mitigation and resulted in some modifications in this FEIS. Responses to substantive comments on the DEIS and Draft HCP can be found in Appendix I of this FEIS.

Following issuance of this FEIS, the Service will publish the Record of Decision (ROD) documenting its decision on whether to issue the ITP no earlier than 30 days after the FEIS is published. The Service does not have a formal administrative appeal procedure for NEPA decisions. Judicial review of a Service NEPA decision can be accomplished in Federal court under the Administrative Procedure Act (5 U.S.C. §500 *et seq*).

[5] http://www.fws.gov/midwest/Endangered/permits/hcp/r3hcps.html

2.0 PURPOSE AND NEED

2.1 PURPOSE OF THE EIS

The purpose for which this EIS is being prepared is to:

- Respond to an application from Fowler Ridge requesting an ITP for the incidental take of the federally endangered Indiana bat (*Myotis sodalis)*, pursuant to the ESA Section 10(a)(1)(B) and its implementing regulations and policies
- Protect, conserve, and enhance the Indiana bat and its habitat for the continuing benefit of the people of the United States
- Provide a means to conserve the ecosystems depended upon by the Indiana bat
- Ensure that FRWF will not appreciably reduce the likelihood of the survival and recovery of the Indiana bat in the wild through protection and management of the species and its habitat within the context of the project
- Ensure compliance with the ESA, NEPA and other applicable federal laws and regulations

2.2 PROPOSED ACTION

The proposed action is issuance of an ITP by the U.S. Fish and Wildlife Service (Service) pursuant to the provisions of Section 10(a)(1)(B) of the ESA, which would authorize the incidental take of the federally endangered Indiana bat resulting from the operation of Fowler Phases I, II, III and IV.

Under Section 10 of the ESA, applicants may be authorized, through issuance of an ITP, to conduct activities that may result in take of a listed species, as long as the take is incidental to, and not the purpose of, otherwise lawful activities.

The purpose of the section 10(a)(1)(B) permit is to ensure that any incidental taking that might occur will be minimized and mitigated to the maximum extent practicable and will not appreciably reduce the likelihood of the survival and recovery of this species in the wild. The proposed permit term is 22 years[6].

The submission of the ESA section 10(a)(1)(B) permit application requires the development of an HCP designed to ensure the continued existence and aid in the recovery of the listed species, while allowing for any limited, incidental take of the species that might occur during the operation of the project. The implementing regulations for section 10(a)(1)(B) of the ESA, as provided at 50 C.F.R. 17.22, specify the requirements and issuance criteria for obtaining an ITP.

The Service will analyze the impacts of the proposed covered activities on all elements of the natural and human environment that could be affected, including other wildlife species that occur within the covered lands. Consistent with Service guidance, it will also consider among

[6] Since release of the DEIS, the ITP term length changed from 22 years to 21 years. Substantive changes to the DEIS resulting from the reduction in permit term length are included in Appendix J of this FEIS.

other things, the effectiveness of the adaptive management strategy in reducing impacts to migratory birds and other bat species.

2.3 NEED FOR THE PROPOSED ACTION

Section 9 of the ESA prohibits the "take" of any fish or wildlife species listed under the ESA as endangered (16 U.S.C. 1538). Under Federal regulation, take of fish or wildlife species listed as threatened is also prohibited unless otherwise specifically authorized by regulation (50 C.F.R. 17.31). Take, as defined by the ESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S.C. 1532(19)).

The 1982 amendments to the ESA established a provision in Section 10 that allows for "incidental take" of endangered and threatened species or wildlife by non-Federal entities (16 U.S.C. 1539). Incidental take is defined by the ESA regulations as take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity" (50 CFR 17.3). Under Section 10 of the ESA, the Secretary of the Interior and Secretary of Commerce may, where appropriate, authorize the taking of federally listed fish or wildlife if such taking occurs incidentally to otherwise legal activities. The Service was charged with regulating the incidental taking of listed species under its jurisdiction.

The need for the proposed action (i.e., issuance of an ITP) is based on the finding of two dead Indiana bats at the facility in 2009 and 2010, and the potential that future operation of the FRWF could result in take of the Indiana bat.

2.4 DECISIONS TO BE MADE BY RESPONSIBLE OFFICIALS

The Service must decide whether to issue or deny the proposed ITP. The issuance criteria for an ITP are contained in Section 10(a)(2)(B) of the ESA and the implementing regulations for the ESA (50 C.F.R. 17.22(b)(2) and 17.32(b)(2)). The four Companies identified in Section 1.1 as the Applicant will jointly serve as permittees under the ITP, and are jointly and severally liable for all obligations assigned to them under the ITP, HCP and associated documents. An ITP shall be issued to Fowler Ridge if the Service makes the following determination with respect to Fowler Ridge's ITP application (USFWS and NMFS 1996):

(1) The take will be incidental to otherwise lawful activities.

(2) The Applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking.

(3) The Applicant will ensure that adequate funding for the HCP and procedures to deal with unforeseen circumstances will be provided.

(4) The taking will not appreciably reduce the likelihood of the survival and recovery of the Indiana bat in the wild.

(5) The Applicant will ensure that other measures that the Service may require as being necessary or appropriate will be provided.

(6) The Service has received such other assurances as may be required that the HCP will be implemented.

In addition to these necessary HCP elements, the Five-Point Policy (65 Fed. Reg. 35241-35257; June 1, 2000), an addendum to the *Habitat Conservation Planning Handbook* (USFWS and NMFS 1996), describes five clarifying components that should be included in an HCP:

(1) Biological Goals and Objectives – Biological goals are the broad guiding principles for the operating conservation program of the HCP and provide the rationale behind the minimization and mitigation strategies. Objectives describe the desired outcome of the plan and are described in terms of measurable targets for achieving the biological goals.

(2) Adaptive Management – Adaptive management is an integrated method of addressing uncertainty over time. Adaptive management provides flexibility in the conservation program to examine alternative strategies for achieving the goals and objectives.

(3) Monitoring – Monitoring is a mandatory element of an HCP under the Five-Point Policy. The monitoring plan must identify how compliance with the HCP will be evaluated, identify how biological goals and objectives will be met, and provide information that will inform the adaptive management strategy.

(4) Permit Duration – HCPs should clearly define the desired duration the permit will be in effect and discuss the factors considered in determining the length of the permit.

(5) Public Participation – The Five-Point Policy expanded the public comment period for most HCPs from 30 days to 60 days, with the exception of large-scale, regional, or exceptionally complex HCP's where the comment period was extended to 90 days.

Further, the Service's regulations require that, "Upon receiving an application completed in accordance with paragraph (a)(1) of this section, the Director will decide whether or not a permit should be issued. In making this decision, the Director shall consider, in addition to the general criteria in §13.21(b) of this subchapter, the following factors: (i) Whether the purpose for which the permit is required is adequate to justify removing from the wild or otherwise changing the status of the wildlife sought to be covered by the permit; (ii) The probable direct and indirect effect which issuing the permit would have on the wild populations of the wildlife sought to be covered by the permit; (iii) Whether the permit, if issued, would in any way, directly or indirectly, conflict with any known program intended to enhance the survival probabilities of the population from which the wildlife sought to be covered by the permit was or would be removed; (iv) Whether the purpose for which the permit is required would be likely to reduce the threat of extinction facing the species of wildlife sought to be covered by the permit; (v) The opinions or views of scientists or other persons or organizations having expertise concerning the wildlife or other matters germane to the application; and (vi) Whether the expertise, facilities, or other resources available to the applicant appear adequate to successfully accomplish the objectives stated in the application" (50 C.F.R. 17.22, 17.32).

3.0 ALTERNATIVES

NEPA requires that the environmental documents prepared for a proposed action discuss alternatives. Therefore, this chapter describes the alternatives considered in the EIS relevant to the proposed action (i.e., issuance of an ITP by the Service pursuant to the provisions of Section 10(a)(1)(B) of the ESA). The alternatives were developed to address the potential for take of Indiana bats, and as such, are primarily operational alternatives relating to the dates and times of operation and changes in cut-in speed (i.e., the wind speed at which turbines begin generating power and sending it to the grid). The alternatives do not address other aspects of Fowler Ridge Wind Farm (FRWF) Phase IV, such as turbine siting, because:

(1) No suitable Indiana bat summer habitat is found within the FRWF Phase IV project area; and,

(2) At present, the only proven mechanism to reduce mortality of migrating bats is operational adjustment of wind turbines.

3.1 ALTERNATIVES

3.1.1 Development of Alternatives

On May 25, 2011, the Service published a NOI to prepare a draft EIS for the Fowler Ridge Project in the Federal Register to solicit participation of responsible federal, state, and local agencies, Tribes, and the public in determining the scope of this EIS. Publication and distribution of the NOI initiated the process of public scoping for this EIS (Appendix A). A public scoping meeting was held on June 7, 2011, in Fowler, Indiana, and a Service website[7] was created to provide agencies and the public with information related to the project. The scoping period extended until June 23, 2011.

On June 2, 2011, a scoping letter was sent via e-mail to state and federal agencies and NGOs. In addition, a public notice was published in the Indianapolis Star newspaper, press releases were issued to local radio stations and flyers announcing the public scoping meeting were posted at public gathering sites in Benton County (e.g., grocery stores, gas stations/convenience stores, public library). Notification was given that comments could be submitted through the U.S. Postal Service, by facsimile, or through the Service website. No additional alternatives were developed as a result of comments received during the scoping period.

The Service developed eight action alternatives and a No Action Alternative. Five action alternatives were dismissed and not carried forward for detailed analysis. These alternatives, along with the reasons for dismissal, are discussed in Section 3.1.3. Four alternatives were carried forward for detailed analysis, including a 3.5 m/s Cut-in Speed (Feathered) Alternative, a 5.0 m/s Cut-in Speed Alternative (Applicant Proposed Action), a 6.5 m/s Cut-In Speed Alternative, and a No Action Alternative.

[7] http://www.fws.gov/midwest/Endangered/permits/hcp/r3hcps.html

Each alternative carried forward for detailed analysis is evaluated in the EIS to determine:

(1) If the alternative meets the purpose and need identified in Chapter 2 of this EIS;

(2) The impacts to the natural and human environment; and

(3) That implementation of the alternative is feasible from a legal, regulatory, and project financial standpoint.

3.1.2 Alternatives Carried Forward for Detailed Analysis

Each of the alternatives discussed below would include construction of Phase IV (see Section 1.2.2) and operation of Phases I through IV of the FRWF. Available land use and land cover indicate that the FRWF project area is more than 95% agriculture and rural development, and therefore does not contain winter or summer habitat for Indiana bats. Based on an assessment of the project by the Service (see Service letter dated August 5, 2011; Appendix C), the Indiana bat is considered absent from the project area during the winter and the project area has a very low potential for spring and summer occurrence of Indiana bat.

Following the useful life of project facilities and infrastructure under any of the four alternatives discussed below, Fowler Ridge has the option to decommission the assets (see Section 1.2.4). While decommissioning actions are not likely to affect the Indiana bat, decommissioning of the project minimizes long term impacts (when compared with re-commissioning or re-powering the project) by removing turbines from the site and restoring the site to the existing land use and vegetation communities.

The Applicant will generate sufficient income each year through its routine operations over the 22-year life of the ITP to ensure that all costs associated with funding the conservation plan are included in its annual budget. The Applicant will provide funding assurance for an HCP in the form of a Surety acceptable to the Service (e.g., an escrow account, bond, or cash). Although the Applicant will have the ability to directly undertake all required actions described in an HCP, FRWF will establish a Surety into which the Applicant has indicated that it will make scheduled payments to reflect the levels of assurance. According to the Applicant, the Surety will be funded through a reduction and/or expenditure of a portion of the Applicant's' earned revenue. The Surety will provide funds for monitoring, mitigation, annual meetings, reporting, and contingencies for adaptive management and changed circumstances in advance of the time at which they are needed. The Surety will be administered by an independent financial institution and will contain sufficient funds to assure the Applicant's performance under an HCP.

3.1.2.1 *No Action Alternative*

Under the No Action Alternative, the Applicant would construct Phase IV and all 449 turbines would be shut down (i.e., non-operational) from sunset to sunrise from August 1 through October 15, the primary fall migratory period of the Indiana bat, each year during the operational life (22 years) of the FRWF.

Implementation of this alternative would be expected to result in complete avoidance of impacts to Indiana bats; therefore, an ITP pursuant to Section 10(a)(1)(B) of the ESA would not be necessary and no permit would be issued for the existing phases of the FRWF or the future Fowler IV. In addition, no HCP would be prepared and the Indiana bat would not have the conservation benefits (e.g., mitigation) afforded to it through development and implementation of an HCP. Fowler Ridge would commit to implementing the FRWF Bird and Bat Conservation

Strategy (BBCS) as part of this alternative to reduce the potential for impacts to migratory birds and bat species (Appendix D).

3.1.2.2 *3.5 m/s Cut-In Speed (Feathered) Alternative*

Under the 3.5 m/s Cut-In Speed (Feathered)[8] Alternative, an HCP would be prepared and an ITP pursuant to Section 10(a)(1)(B) of the ESA would be issued for the take of Indiana bat during the fall season (August 1 to October 15) at the three existing phases of the FRWF and the future Fowler IV. Fowler Ridge would commit to implementing the FRWF BBCS as part of this alternative to reduce the potential for impacts to migratory birds and bat species (Appendix D).

The 3.5 m/s Cut-In Speed (Feathered) Alternative includes implementation of an HCP to avoid, minimize, mitigate, and monitor take of Indiana bats, in accordance with Section 10 of the ESA. The HCP would contain the following measures designed to avoid, minimize, mitigate, and monitor take of Indiana bats as a result of the FRWF project:

(1) Minimization through Project Operations – Fowler Ridge would minimize potential take of Indiana bats from operations of the project by adjusting the turbine operational parameters so that the rotation of the turbine rotors below the 3.5 m/s cut-in wind speed is minimized (i.e., the blades are "feathered"). Feathering of turbine blades below the 3.5 m/s cut-in wind speed would be implemented on a nightly basis from sunset to sunrise, adjusted for sunset/sunrise time weekly, from August 1 to October 15 annually.

In addition to feathering turbines below 3.5 m/s, Fowler Ridge would implement an adaptive management plan that includes adjusting cut-in speeds in 0.5 m/s increments, if needed, to assure compliance with authorized take limits.

(2) Measures to Mitigate the Impact of Taking – Although feathering blades below the 3.5 m/s cut-in speed is anticipated to reduce take of Indiana bats, some level of unavoidable, incidental take may still occur. Therefore, Fowler Ridge would mitigate for the unavoidable impacts of the taking of Indiana bats by coordinating, funding, and monitoring the protection and restoration of both summer habitat and winter habitat (USFWS 2012a).

Specifically, Fowler Ridge would:

a. Preserve and restore summer maternity habitat in the vicinity of existing maternity colonies in Putnam County, Tippecanoe County, Vermillion County, or Warren County;

b. Protect winter habitat by installing a new bat gate near the entrance of a Priority 1 hibernaculum, Wyandotte Cave, in Crawford County, Indiana.

All mitigation measures follow guidance outlined in the *Bloomington Field Office Draft Indiana Bat (Myotis sodalis) Mitigation Guidance for Wind Energy Habitat Conservation Plans* provided by the USFWS Bloomington Field Office (BFO) (hereafter USFWS BFO Draft Mitigation Framework; USFWS 2012a). All proposed

[8] Feathering reduces the blade angle to the wind in order to slow or stop the turbine from spinning during wind conditions below the cut-in wind speed.

mitigation measures can be found in Chapter 5 of the HCP prepared for the 5.0 m/s Alternative.

(3) Monitoring and Adaptive Management – The monitoring program that would be implemented as part of the HCP would provide the information necessary to:

a. Assess ITP compliance

b. Assess project impacts

The monitoring program consists of two components: take limit compliance monitoring and mitigation effectiveness monitoring. The goal of take limit compliance monitoring is to ensure compliance with the terms of the ITP; whereas, the goal of mitigation effectiveness monitoring is to ensure the success of mitigation efforts at offsetting the impacts of unavoidable take of Indiana bats from the FRWF. Based on information derived from monitoring, adaptive management would be used to make modifications to the proposed minimization and mitigation measures, if they have been ineffective at meeting the biological goals and objectives of the HCP.

Details of the monitoring program, including a detailed discussion of the monitoring program and adaptive management, are found in Chapter 5 of the HCP prepared for the 5.0 m/s Alternative.

3.1.2.3 *5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action)*

Under the 5.0 m/s Cut-In Speed Alternative, seasonal operational adjustments would be implemented, an HCP would be prepared, and an ITP pursuant to Section 10(a)(1)(B) of the ESA would be issued for the take of Indiana bat during the fall season (August 1 to October 15) at the three existing phases of the FRWF and the future Fowler IV. Fowler Ridge would commit to implementing the FRWF BBCS as part of this alternative to reduce the potential for impacts to migratory birds and bat species (Appendix D).

The 5.0 m/s Cut-In Speed Alternative includes implementation of an HCP to avoid, minimize, mitigate, and monitor take of Indiana bats, in accordance with Section 10 of the ESA. The HCP contains the following measures designed to avoid, minimize, mitigate, and monitor take of Indiana bats as a result of the FRWF project:

(1) Minimization through Project Operations – Fowler Ridge would minimize potential take of Indiana bats from operations of the project by implementing seasonal turbine operational adjustments. Based on the reduced number of overall bat fatalities and lack of Indiana bat fatalities found during the spring and summer compared to the fall during three years of monitoring, the Service has determined the risk to Indiana bats at the FRWF occurs during the fall. Because take of Indiana bats is expected to occur only during the fall migration season and Indiana bat fatalities are not expected during the spring migration, summer maternity, or winter seasons (see Section 4.1.1.2 in HCP), no operational adjustments would be made during the spring migration, the summer maternity season or after October 15.

For the term of the ITP (22 years), Fowler Ridge will:

a. Raise the turbine cut-in speed to 5.0 m/s on a nightly basis from sunset to sunrise, adjusted for sunset/sunrise times weekly, from August 1 to October 15 annually. As discussed in Chapter 4 of the HCP and documented in

Appendix A and D of the HCP, Indiana bat fatalities are not expected during spring migration, summer or after October 15.

b. Adjust the turbine operations parameters so that the rotation of the turbine rotors below cut-in wind speed is minimized (i.e., the blades are "feathered"). Feathering of turbine blades below cut-in wind speed would be implemented on a nightly basis from sunset to sunrise, adjusted for sunset/sunrise times weekly, from August 1 to October 15 annually. Turbines will be monitored and controlled based on wind speed 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 wind speed conditions specific to each turbine). It is expected that turbines will begin operating under normal conditions when the 5 to 10 minute rolling average wind speed is above 5.0 m/s; turbines will be feathered again if the 5 to 10 minute rolling average wind speed goes below 5.0 m/s during the course of the night.

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 from August 1 to October 15. Turbines would be allowed to operate at full capacity when temperatures are below 50˚ F. Turbines would be monitored and controlled based on temperature on an individual basis (i.e., the entire facility would not alter cut-in speed at the same time, rather operational changes would be based on temperature conditions specific to each turbine). It is expected that turbines would begin operating under normal conditions when the 5 to 10 minute rolling average temperature drops below 50˚ F; raised cut-in speeds would be resumed if the 5 to 10 minute rolling average temperature goes to 50˚ F or above during the course of the night.

In addition to raising cut-in speeds to 5.0 m/s and feathering turbines below this cut-in speed, Fowler Ridge would implement an adaptive management plan that includes adjusting cut-in speeds in 0.5 m/s increments, if needed, to assure compliance with authorized take limits. The adaptive management plan is described in detail in Section 5.5.1.1 of the HCP.

(2) Measures to Mitigate the Impact of Taking - As described above, Fowler Ridge would implement operational practices that are expected to reduce take of Indiana bats. However, some level of unavoidable, incidental take may still occur. Therefore, Fowler Ridge would mitigate for the unavoidable impacts of the taking of Indiana bats by coordinating, funding, and monitoring the protection and restoration of both summer habitat and winter habitat (USFWS 2012a).

Specifically, Fowler Ridge would:

a. Preserve and restore summer maternity habitat in the vicinity of existing maternity colonies in Putnam County, Tippecanoe County, Vermillion County, or Warren County;

b. Protect winter habitat by installing a new bat gate near the entrance of a Priority 1 hibernaculum, Wyandotte Cave, in Crawford County, Indiana.

Mitigation measures follow guidance outlined in the USFWS BFO Draft Mitigation Framework (USFWS 2012a). All proposed mitigation measures can be found in Chapter 5 of the HCP.

(3) Monitoring and Adaptive Management – The monitoring program that would be implemented as part of the HCP would provide the information necessary to:

a. Assess ITP compliance

b. Assess project impacts

c. Verify progress towards meeting the biological goals and objectives identified in Section 5.1 of the HCP.

The monitoring program consists of two components: take limit compliance monitoring and mitigation effectiveness monitoring. The goal of take limit compliance monitoring is to ensure compliance with the terms of the ITP; whereas, the goal of mitigation effectiveness monitoring is to ensure the success of mitigation efforts at offsetting the impacts of unavoidable take of Indiana bats from the FRWF. Based on information derived from monitoring, adaptive management would be used to make modifications to the proposed minimization and mitigation measures, if they have been ineffective at meeting the biological goals and objectives of the HCP.

Details of the monitoring program, including a detailed discussion of the monitoring program and adaptive management, are found in Chapter 5 of the HCP.

3.1.2.4 *6.5 m/s Cut-In Speed Alternative*

Under the 6.5 m/s Cut-In Speed Alternative, seasonal operational adjustments would be implemented, an HCP would be prepared, and an ITP pursuant to Section 10(a)(1)(B) of the ESA would be issued for the existing phases of the FRWF and the future Fowler IV. Fowler Ridge would commit to implementing the FRWF BBCS as part of this alternative to reduce the potential for impacts to migratory birds and bat species (Appendix D).

The 6.5 m/s Cut-In Speed Alternative includes implementation of an HCP to avoid, minimize, mitigate, and monitor take of Indiana bats, in accordance with Section 10 of the ESA. The HCP contains the following types of measures designed to avoid, minimize, mitigate, and monitor take of Indiana bats as a result of the FRWF project:

(1) Minimization through Project Operations – Fowler Ridge would minimize potential take of Indiana bats from operations of the project by implementing seasonal turbine operational adjustments. Based on the reduced number of overall bat fatalities and lack of Indiana bat fatalities found during the spring and summer compared to the fall during three years of monitoring, the Service has determined the risk to Indiana bats at the FRWF occurs during the fall. Because take of Indiana bats is expected to occur only during the fall migration season and Indiana bat fatalities are not expected during the spring migration, summer maternity, or winter seasons (see Section 4.1.1.2 in HCP), no operational adjustments would be made during the spring migration, the summer maternity season or after October 15.

For the term of the ITP (22 years), Fowler Ridge would:

a. Raise the turbine cut-in speed to 6.5 m/s on a nightly basis from sunset to sunrise, adjusted for sunset/sunrise times weekly, from August 1 to October 15 annually. As discussed in Chapter 4 of the HCP and documented in Appendix A and D of the HCP, Indiana bat fatalities are not expected during spring migration, summer or after October 15.

b. Adjust the turbine operations parameters so that the rotation of the turbine rotors below cut-in wind speed is minimized (i.e., the blades are "feathered"). Feathering of turbine blades below cut-in wind speed would be implemented on a nightly basis from sunset to sunrise, adjusted for sunset/sunrise times weekly, from August 1 to October 15 annually. Turbines would be monitored and controlled based on wind speed on an individual basis (i.e., the entire facility will not alter cut-in speed at the same time, rather operational changes would be based on wind speed conditions specific to each turbine). It is expected that turbines would begin operating under normal conditions when the 5 to 10 minute rolling average wind speed is above 6.5 m/s; turbines would be feathered again if the 5 to 10 minute rolling average wind speed goes below 6.5 m/s during the course of the night.

The only exception to feathering turbines below a cut-in speed of 6.5 m/s would occur on nights when temperatures are below 50˚ F from August 1 to October 15. Turbines would be allowed to operate at full capacity when temperatures are below 50˚ F. Turbines would be monitored and controlled based on temperature on an individual basis (i.e., the entire facility would not alter cut-in speed at the same time, rather operational changes would be based on temperature conditions specific to each turbine). It is expected that turbines would begin operating under normal conditions when the 5 to 10 minute rolling average temperature drops below 50˚ F; raised cut-in speeds would be resumed if the 5 to 10 minute rolling average temperature goes to 50˚ F or above during the course of the night.

In addition to raising cut-in speeds to 6.5 m/s and feathering turbines below this cut-in speed, FRWF would implement an adaptive management plan that includes adjusting cut-in speeds in 0.5 m/s increments, if needed, to assure compliance with authorized take limits.

(2) <u>Measures to Mitigate the Impact of Taking</u> - As described above, Fowler Ridge would implement operational practices that are expected to reduce take of Indiana bats. However, some level of unavoidable, incidental take may still occur. Therefore, Fowler Ridge would mitigate for the unavoidable impacts of the taking of Indiana bats by coordinating, funding, and monitoring the protection and restoration of both summer habitat and winter habitat (USFWS 2012a).

Specifically, Fowler Ridge would:

a. Preserve and restore summer maternity habitat in the vicinity of existing maternity colonies in Putnam County, Tippecanoe County, Vermillion County, or Warren County;

b. Protect winter habitat by installing a new bat gate near the entrance of a Priority 1 hibernaculum, Wyandotte Cave, in Crawford County, Indiana.

Mitigation measures follow guidance outlined in the USFWS BFO Draft Mitigation Framework (USFWS 2012a). All proposed mitigation measures can be found in Chapter 5 of the HCP prepared for the 5.0 m/s Alternative.

(3) Monitoring and Adaptive Management – The monitoring program that would be implemented as part of the HCP would provide the information necessary to:

   a. Assess ITP compliance

   b. Assess project impacts

The monitoring program consists of two components: take limit compliance monitoring and mitigation effectiveness monitoring. The goal of take limit compliance monitoring is to ensure compliance with the terms of the ITP; whereas, the goal of mitigation effectiveness monitoring is to ensure the success of mitigation efforts at offsetting the impacts of unavoidable take of Indiana bats from the FRWF. Based on information derived from monitoring, adaptive management would be used to make modifications to the proposed minimization and mitigation measures, if they have been ineffective at meeting the biological goals and objectives of the HCP.

Details of the monitoring program, including a detailed discussion of the monitoring program and adaptive management, are found in Chapter 5 of the HCP prepared for the 5.0 m/s Alternative.

3.1.3 Alternatives Considered and Dismissed

The following alternatives were considered but dismissed from consideration:

3.1.3.1 *No Operational Adjustment Alternative*

Under the No Operational Adjustment Alternative, all four phases of the FRWF project would operate year-round without restriction (i.e., no curtailment or time-of-year restrictions). An ITP would not be issued for the existing three phases of the FRWF or the future Fowler IV. Under this alternative, the Applicant would not have coverage for incidental take of the Indiana bat and would be at risk of violation of Section 9 of the ESA. No HCP would be prepared; therefore, the Indiana bat would not have the protections or the conservation benefits (e.g., mitigation) afforded to it through development and implementation of an HCP. In addition, the FRWF BBCS would not be implemented.

The No Operational Adjustment Alternative was dismissed from consideration because it does not meet the purpose and need identified in Chapter 2 for the following reasons:

(1) It would not protect, conserve, or enhance the Indiana bat and its habitat in the FRWF project area for the continuing benefit of the people of the United States.

(2) It would not provide a means, nor does it take steps, to conserve the ecosystems depended upon by the Indiana bat.

(3) Because the Indiana bat would not be protected under the measures set forth in an HCP, this alternative would not ensure that the project will not appreciably reduce the likelihood of the survival and recovery of the Indiana bat in the wild through protection and management of the species and its habitat within the context of the FRWF.

In addition, because take of two Indiana bats has already occurred at the FRWF and future take is likely to occur, the No Operational Adjustment Alternative was determined by the Service to not be a feasible alternative from a legal and regulatory standpoint for FRWF even though other commercial wind facilities in Indiana, which have not documented take of Indiana bats, continue to operate without an ITP.

3.1.3.2 *Reduced Incidental Take Permit Length Alternative*

Under the Reduced Incidental Take Permit Length Alternative, seasonal operational adjustments would be the same as described for the 5.0 m/s Cut-In Speed Alternative (see Section 3.1.2.3), an HCP would be prepared as described in Section 3.1.2.3, and an ITP pursuant to Section 10(a)(1)(B) of the ESA would be issued for the existing phases of the FRWF and the future Fowler IV. However, under this alternative, the ITP permit term would be reduced to five years to allow the Service to review the effectiveness of operational adjustments and mitigation measures at five year intervals and to make necessary changes if circumstances warrant.

This alternative was dismissed from consideration because the conservation benefits of a longer permit term length were determined by the Service in the case of FRWF to outweigh the additional certainty provided by shorter permit length. Specifically, those conservation benefits are more mitigation, and more certainty regarding the outcome of the mitigation because FRWF is committed to longer term monitoring of required mitigation projects.

The Service recognizes that there can be significant uncertainty, particularly with respect to the effects of White Nose Syndrome (WNS) and climate change on Indiana bats under longer term permits. In the case of FRWF, however, the requested permit term is 22 years, which is at the shorter end of the continuum of the life of wind development projects. More important, however, are the provisions built into the HCP that are based on data collected during three years of intensive on-site, post-construction monitoring and research at FRWF Phases I - III. During Years 2010 and 2011, this research was conducted in close cooperation with the Service under a scientific research permit. In cooperation with the Service, the Applicant tested and replicated multiple parameters at FRWF Phases I – III including various cut-in speed treatments, monitoring protocols, atmospheric variables, and others (see Appendix A of the HCP for post-construction monitoring reports). Data from post-construction monitoring in 2009, 2010, and 2011 were utilized during preparation of the HCP. The Service concluded that collection and analysis of these data have limited the uncertainty associated with a longer permit term.

Related to the collection of multiple years of post-construction data are the components built into the HCP using these data and designed specifically to address uncertainty over a longer permit term. These fall into three categories: the monitoring program (evaluated and refined between 2009 and 2011); adaptive management (informed by post-construction monitoring, particularly with respect to weather variables and their effect on migrating bats); and changed circumstances, which addresses both WNS and the potential effects of climate change on Indiana bats. The Service expects these aspects of the HCP to allow the Applicant and the Service to quickly identify when changes to the conservation program are needed, and to respond to new data that may become available regarding Indiana bat populations or new mechanisms for reducing bat mortality, should they be developed.

3.1.3.3 *Reduced Number of Turbines Alternative*

Under the Reduced Number of Turbines Alternative, an HCP would be prepared and an ITP would be issued for FRWF Phases I – III (355 turbines), but would not include the proposed Phase IV (up to 94 turbines). It is assumed that the Applicant would still construct FRWF Phase IV; however, a separate HCP would be prepared for Phase IV and a separate ITP would be issued.

This alternative was dismissed from consideration because the Service believes the effects of Phases I - III and Phase IV are most efficiently and effectively analyzed within the context of a single HCP. Phase IV has been planned since Fowler Ridge initiated the HCP process, so the Applicant and the Service have had adequate time to consider it as part of an HCP encompassing all four phases of the FRWF. Because the proposed FRWF Phase IV is immediately adjacent to Phases I - III (see Figure 1.1) and the turbine types and sizes overlap with Phases I - III, the analytical process used to assess impacts for both are the same. The Service believes that the aforementioned data collected during post-construction monitoring of Phases I - III are also directly applicable to Phase IV and the Service concluded that there would be no qualitative difference in the conservation program relative to Phase IV. Finally, the cost of preparing a separate HCP for Phase IV concurrent with preparation of an HCP covering Phases I – III (Phase IV is scheduled for construction in 2014) would be burdensome to the Applicant and the Service. The Service therefore made the decision to consider all four phases a single complete project.

3.1.3.4 *Migratory Season Shutdown Alternative*

Under the Migratory Season Shutdown Alternative, all 449 turbines would be shut down (or curtailed) from sunset to sunrise from April 1 through May 15 in addition to curtailment during the fall migratory period from August 1 through October 15.

The Migratory Season Shutdown Alternative was dismissed from consideration because the Service concluded, based on post-construction mortality monitoring studies conducted at Fowler Phases I – III from 2009 – 2011, that operational adjustments (i.e., complete shutdowns or changes in cut-in speed) during the spring migratory period (April 1 – May 15) were not necessary because Indiana bat fatalities are not expected to occur during spring migration (see Service letter dated August 5, 2011 in Appendix C of the EIS and post-construction monitoring reports found in Appendix A of the HCP).

3.1.3.5 *Complete Shutdown Alternative*

Under the Complete Shutdown Alternative all 449 turbines would be shut down from sunset to sunrise from April 1 through October 15.

The Complete Shutdown Alternative was dismissed from consideration because the Service concluded, based on post-construction mortality monitoring studies conducted at Fowler Phases I – III from 2009 – 2011, and the absence of suitable Indiana bat summer habitat within the Fowler Ridge project area, that operational adjustments (i.e., complete shutdowns or changes in cut-in speed) during the spring migratory period (April 1 – May 15) and summer breeding period (May 16 – July 31) were not necessary because Indiana bat fatalities are not expected to occur during spring migration (see Service letter dated August 5, 2011; Appendix C), or the summer maternity season.

4.0 AFFECTED ENVIRONMENT

This chapter describes the existing conditions within the FRWF project area (Phases I, II, III and IV) and within Benton County where applicable. For the purposes of this chapter and Chapter 5 (Environmental Consequences), resources were assessed using different spatial extents depending on the character of the resource and the extent to which construction of Phase IV and operation of FRWF Phases I through IV may potentially affect the resource. This approach is consistent with the Service's regulations for implementing NEPA, which indicate that the scope of analysis is dependent on the extent of reasonably foreseeable Project-related impacts (USFWS 2003). The spatial extent used for the analysis of each resource in this chapter is noted at the beginning of the discussion of each resource. For the purposes of this EIS, "Project Area" refers to FRWF Phases I – IV, and "Phase IV" refers only to the proposed FRWF Phase IV project.

4.1 GEOLOGY AND SOILS

4.1.1 Scope of Analysis

This section describes the existing soil and geologic resources in the Project Area, including topography, bedrock features, and seismicity. The soils and geology analysis is based on information from online databases and documents produced by the following federal and state agencies: United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), United States Geological Survey (USGS), and IDNR.

4.1.2 Existing Conditions

4.1.2.1 *Geographical Setting*

The Project Area is a relatively homogeneous region in terms of its geographic characteristics. The region is relatively flat with open agricultural land interspersed with occasional intermittent drainage features and small population centers. There are no significant hills, ridges, or other areas of prominently elevated topography (Figure 4.1.2.1). Elevations in the Project Area range from approximately 725 feet to 900 feet.

The physiography and geology of the Project Area is the result of the most recent glacial period known as the Wisconsin Age that began about 70,000 years ago. Prior to the Wisconsin Age, Indiana had been glaciated twice, though the Wisconsin glacier can be credited with building topography in the northern region of Indiana. During the main advance about 21,000 years ago, the Wisconsin glacier covered two-thirds of the state. Numerous glacial advances and retreats resulted in moraine deposition and the formation of Indiana topography as it is known today. Benton County is part of the Tipton Till Plain. This till plain is an almost completely flat to gently rolling glacial plain. Although most of the till plain is featureless, several low, poorly developed, end moraines cross it. The glacial topography of the area is underlain by shale bedrock formed during the Devonian and Mississippian Ages about 20 to 60 million years ago (Gutschick 1966). Before glaciers deposited drift over the area, the landscape consisted of shale, sandstone, limestone, and dolomite bedrock. This bedrock is now covered by glacial deposits that are as much as 260 feet thick in places (Barnes 1989). No karst features are located in the Project Area.

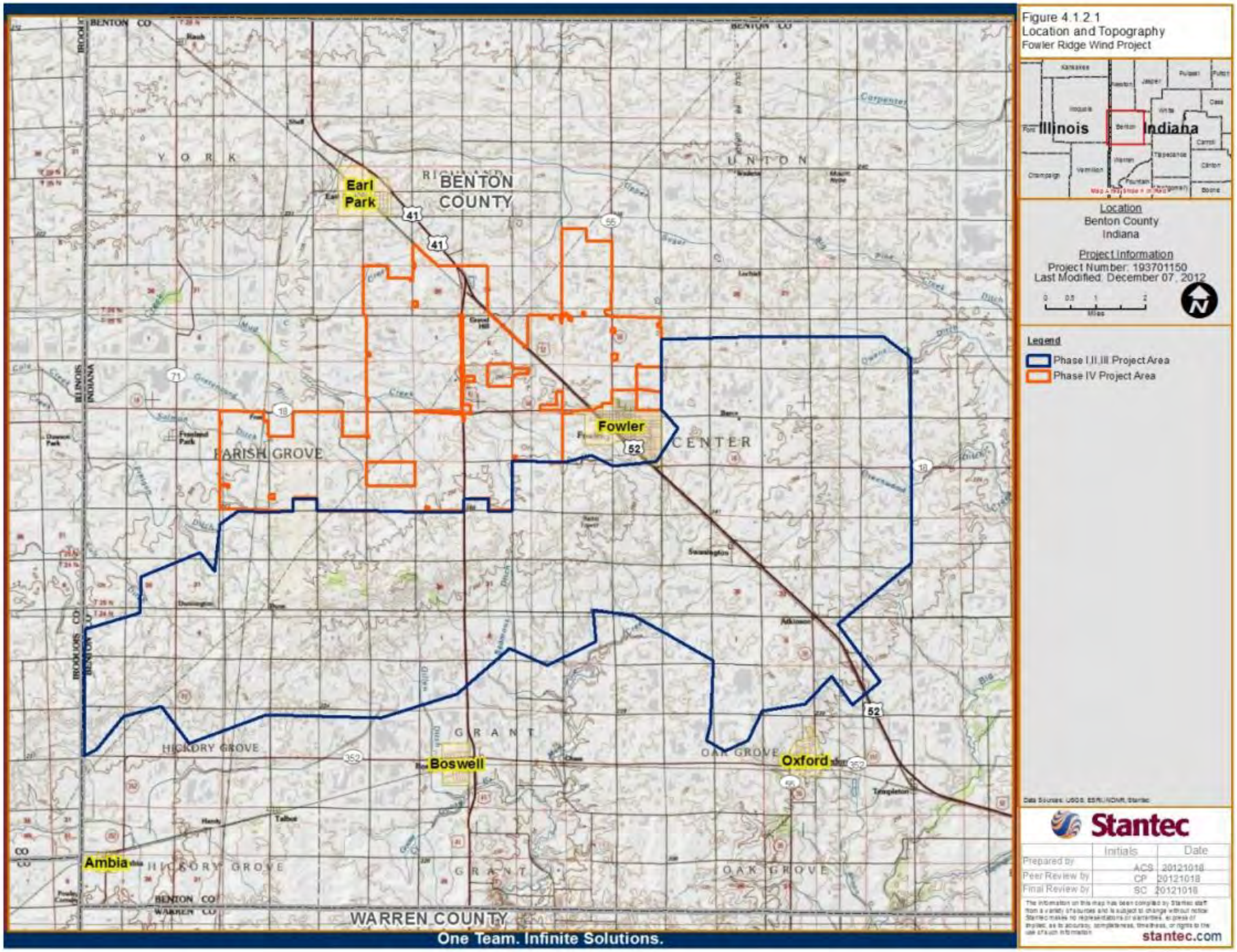


Figure 4.1.2.1
Location and Topography
Fowler Ridge Wind Project
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 07, 2012
Legend
Phase I,II,III Project Area
Phase IV Project Area
Earl Park
BENTON COUNTY
YORK
UNION
Fowler
CENTER
PARISH GROVE
HICKORY GROVE
GRANT
Boswell
OAK GROVE
Oxford
Ambia
WARREN COUNTY
One Team. Infinite Solutions.
Stantec
Initials
Date
Prepared by
ACS
20121018
Peer Review by
CP
20121018
Final Review by
SC
20121018
stantec.com

According to the 2007 U.S. Census of Agriculture (the most recent data available), total farmland area in Benton County is approximately 270,810 acres, an increase of 9% from the total farmland area estimated in 2002. Natural habitats (i.e., not farmed), including woodlands, wetlands, streams and ponds, are also present. National Landcover Data (NCLD 2006) indicate cropland comprises approximately 93% of landcover within Benton County. Table 4.1 summarizes landcover within Benton County in comparison to the FRWF.

Table 4.1 Landcover type and amount as determined through analysis of National Landcover Data (NLCD 2006)

Landcover Type	Total Acreage (% of Total)		
	Benton County	FRWF Phases I, II and III	FRWF Phase IV
Agriculture (Cultivated Crops)	238,059 (91.6)	44,887.8.8 (92.8)	15,453.6 (93.7)
Developed/Barren Land	13,658.3 (5.3)	2,515.5 (5.2)	794.9 (4.8)
Pasture/Hay	4.604.4 (1.8)	694 (1.4)	202.4 (1.2)
Deciduous Forest	3,046.7 (1.2)	243.8 (0.5)	24.4 (0.15)
Grassland/Herbaceous	170.5 (0.07)	16.9 (0.3)	2.48 (0.02)
Wetland/Open Water	322.4 (0.12)	18.3 (0.04)	21.65 (0.13)
Total	**259,861.1**	**48,276.2**	**16499.5**

Four incorporated communities, Fowler, Boswell, Earl Park, and Oxford, are located within close proximity to the FRWF.

4.1.2.2 *Soils*

Benton County is found within the Grand Prairie Region of Indiana. According to the Soil Survey of Benton County (Barnes 1989), there are six soil associations in Benton County: Gilboa-Chalmers-Selma, Chalmers-Lisbon-Drummer, Drummer-Comfrey-Tippecanoe, Corwin-Odell-Chalmers, Montmorenci-Miami-Chalmers, and Odell-Montmorenci-Chalmers.

The soil types found in the Project Area are a product of the original parent materials deposited by the glaciers that covered the area 15,000 to 20,000 years ago. The main parent materials found in the county are glacier outwash and till, lacustrine material, alluvium, and organic materials that were left as the glaciers receded. The soils are a result of the interaction of physical and mineralogical composition of the parent materials with the physical, chemical, and biological variables found in the area (climate, plant and animal life) over time.

Table 4.2 contains information on these general soil associations and where within the general topography they may be found.

Table 4.2 Characteristics of General Soil Association Found within Benton County

Association	Description	Texture	Formation Process	Location
Drummer-Comfrey-Tippecanoe	Silt loam, silty clay loam, and clay loam	Fine	In silty deposits, outwash, and alluvium	On floodplains, outwash terraces, and outwash plains
Corwin-Odell-Chalmers	Silt loam, silty clay loam, and clay loam	Fine	In glacial till and in silty deposits	On end moraines
Gilboa-Chalmers-Selma	Silt loam, silty clay loam, and clay loam	Fine	In silty deposits, outwash, and glacial till	On end moraines and ground moraines
Chalmers-Lisbon-Drummer	Silty clay loam, silt loam	Fine	In loess and the underlying till and outwash	On till plains, moraines, outwash plains and stream terraces
Montmorenci-Miami-Chalmers	Silty clay loam, silt loam	Fine	In loess, silty material and the underlying loam till	On till plains, moraines,
Odell-Montmorenci-Chalmers	Silty clay loam, silt loam	Fine	In loess, silty material and the underlying loam till	On till plains, swells, moraines,

Source: Soil Survey of Benton County, Indiana [Barnes 1989)

4.2 LAND USE

4.2.1 Scope of Analysis

This section provides a discussion of current and future land use; state, regional, county, and municipal comprehensive plans and regulations; residential structures; agricultural programming; and recreation within Phase IV and the immediate surrounding area. The land use analysis in this EIS is based on publicly available state, regional, county, and municipal-level planning documents, as well as U.S. Census Bureau and USDA data.

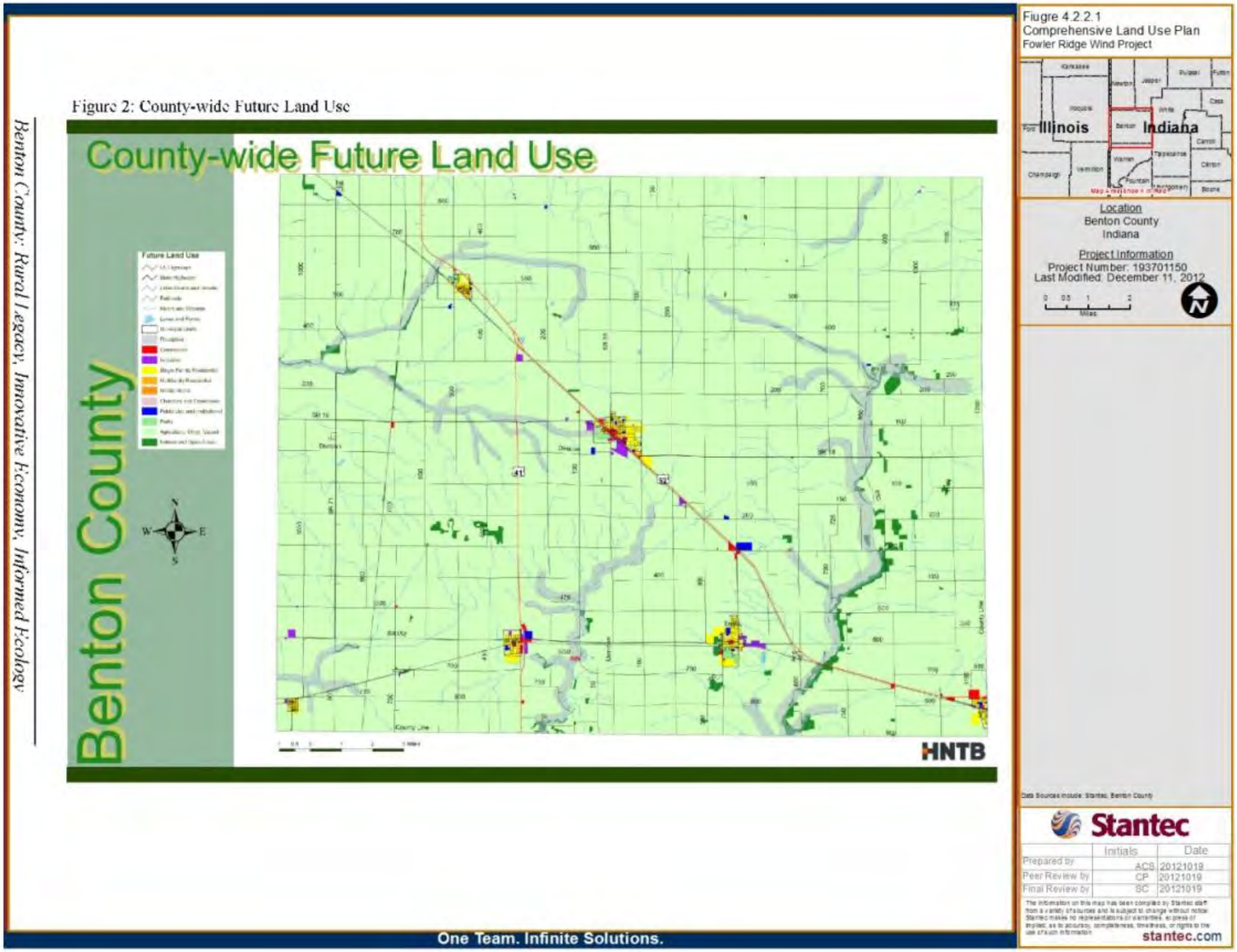
4.2.2 Existing Conditions

4.2.2.1 *Land Use Planning and Zoning*

Benton County has drafted a Comprehensive Land Use Plan dated December 2006[9]. The plan is advisory in nature and outlines a vision for the County and the incorporated communities as expressed by the citizens through its vision statement, goals and objectives. The land use plan ensures that development is planned and serves local goals and objectives and future land resources and needs. Additionally, the plan aims to promote the health, safety, and general welfare of its citizens. The existing Comprehensive Land Use Plan map is shown on Figure 4.2.2.1.

A CUP is required and will be obtained prior to construction of Phase IV per Benton County's Wind Energy Siting Ordinance (See Section 1.3.13.1). A CUP is given to those projects that are not likely to be injurious to the use and enjoyment of other property in the immediate vicinity or impede the normal and orderly development and improvement of surrounding property for permitted uses (Benton County Zoning Code § 8-10(d)).

[9] http://ldm.agriculture.purdue.edu/Pages/Resources/PlanIN.html#LinksAdams


Fiugre 4.2.2.1
Comprehensive Land Use Plan
Fowler Ridge Wind Project
Figure 2: County-wide Future Land Use
County-wide Future Land Use
Benton County
Benton County: Rural Legacy, Innovative Economy, Informed Ecology
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 11, 2012
HNTB
Stantec
Initials
Date
Prepared by
ACS
20121019
Peer Review by
CP
20121019
Final Review by
SC
20121019
stantec.com
One Team. Infinite Solutions.

4.2.2.2 *Agricultural Land Use*

Agricultural land use dominates the Project Area and is mainly comprised of corn and soybeans with minimal land devoted to large livestock (i.e., cattle and hogs). According to the 2007 U.S. Census of Agriculture[10], 97% of farm land in Benton County is used as cropland, with dominant crops being corn and soybeans.

Table 4.3 provides an agricultural profile of Benton County. From 2002 to 2007, the total number of farms remained relatively consistent, while the land in farms and the average farm size increased slightly. Substantial increases were seen with the estimated market value of the products sold and government payments received.

Prime farmland is one of several land types classified and recognized by the USDA. Prime farmland is land that is best suited for crops. The land is used for cultivation, pasture, woodland or other production, but it is not urban land or water areas. This type of land produces the highest yields with minimal inputs of energy and economic resources. Therefore, when possible, the optimal land use strategy places industrial and residential development on the marginal lands while keeping prime farmland available for production. Approximately 253,550 acres (greater than 97%) of farmland in Benton County meets prime farmland requirements (Barnes 1989).

Table 4.3 Benton County Agricultural Profile

	2002	2007	% Change
Number of Farms	394	399	+1
Land in Farms (acres)	247,998	270,810	+9
Average Size of Farm (acres)	629	679	+8
Crop Sales	N/A	$130,249,000 (94%)	--
Livestock Sales	N/A	$8,164,000 (6%)	--
Total Market Value of Products Sold	**$69,582,000**	**$138,413,000**	+99
Average Per Farm	$176,604	$346,900	+96
Government Payments	$3,236,000	$5,606,000	+73
Average Per Farm Receiving Payments	$10,858	$15,358	+41

Source: U.S. Census of Agriculture (2007)

Agricultural Preservation

Benton County contains land enrolled in the Conservation Reserve Program (CRP), managed by the Farm Service Agency (FSA) of the USDA. Farmers with land enrolled in the CRP can receive financial reimbursements for the withdrawal of farmland from production for conservation purposes. For Benton County, the average CRP rental payment was $174.94 per acre in fiscal year (FY) 2010, with 2,925 acres enrolled.[11]

[10] http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_ Level/Indiana/index.asp
[11] http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp-st

CRP's national policy allows the construction and operation of wind turbines on formally enrolled properties. County CRP Committees may approve up to 5 acres of wind-powered generation devices per CRP contract. Table 4.4 indicates the number of acres under contract in Benton County during the period from 2008 – 2011 and the average crop rental payments per acre for FY 2008 through 2010.[12]

Table 4.4 Conservation Reserve Program, Benton County, Indiana

	Acres within the Conservation Reserve Program[1]	Average Program Rental Payments ($ per Acre)[1]
FY 2008	2,956	163.24
FY 2009	2,850	170.12
FY 2010	2,925	173.94
FY 2011[2]	2,865	Not provided

[1] http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp-st
[2] Average Rental Payments for FY 2011 (ending September 2012) were not available as of October 2012.

4.2.2.3 *Institutional Land Use*

Institutional development is predominately located in Fowler and typically includes schools, police and fire stations, and county government offices.

Two elementary schools are located in Fowler. Sacred Heart Elementary is a private elementary school located on Washington Avenue. Fowler Elementary School is a public school located on East 2nd Street. Two facilities serve preschool aged children: Steps in Faith Preschool located at the Ministry of Hope Wesleyan Church on North Grant Avenue and Sacred Heart Elementary (see above).

No additional pre-kindergarten through high school facilities are located within the Project Area. Additional preschool and elementary schools are located in the adjacent towns of Oxford and Boswell. Middle school and high school aged children in the county attend Benton Central located in Oxford.

The Fowler/Center Township fire department is a volunteer force of 24 personnel. The fire department is located on North Washington Avenue. The Fowler/Center Township department works in cooperation with other area fire departments within Fowler and surrounding countryside. The Benton County Sheriff is located on South Lincoln Avenue in Fowler.

The Benton County Courthouse is located in Fowler, which has been the county seat of Benton County since 1874.

[12] http://www.fsa.usda.gov/Internet/FSA_File/su41county.pdf

The Purdue Cooperative Extension Service, which offers educational material and programs in agriculture, horticulture, consumer and family science, is located on East Second Street in Fowler. The Benton County Public Library is located on North Van Buren Avenue in Fowler.

No hospitals are located in Fowler or within the project boundaries. The closest hospitals include: St. Vincent Williamsport Hospital, Inc. located approximately 27 miles south of Fowler in Williamsport, Indiana and Hoopeston Community Memorial Hospital located approximately 30 miles southwest of Fowler in Hoopeston, Illinois.

4.2.2.4 *Commercial/Industrial Land Use*

Commercial and industrial development in Benton County is generally found concentrated in Fowler's downtown central business district and surrounded by established residential neighborhoods. Business types in the central business district and throughout Fowler are generally mixed and include retail stores, service stores, grocery stores, manufacturing companies, health care providers, gas stations and convenience stores, restaurants, and agricultural service shops.

Major manufacturing employers include: Altivity Packaging (150 employees), Holscher Products (35 employees), Powell Systems (30 employees) and Slon Inc. (10 employees). Fowler's economy is based largely on manufacturing, retail trade, and educational services[13].

In addition to the manufacturing employers in Fowler, three wind farms have been, or are being, constructed in Benton County[14] (.2.2.4):

(1) FRWF Phases I, II and III currently employ 44 fulltime staff and 10 part-time staff. Start of construction for Phase IV is planned for 2014 with an estimated completion during the last quarter of 2014.

(2) Located approximately 1 mile north of Phase IV, the Benton County Wind Farm, developed by Orion Energy, has been approved for construction of up to 130 turbines. As of May 2011, 87 turbines (130 megawatt (MW)) were constructed. Thirteen people are employed at this site. No ITP was issued for operation of the Benton County Wind Farm.

(3) Located approximately 3 miles northeast of the FRWF, the Hoosier Wind Farm, developed by enXco, has been approved for 63 turbines (106 MW). As of December 2011, 53 turbines had been constructed. Eight people are employed at this site. No ITP was issued for the operation of the Hoosier Wind Farm.

4.2.2.5 *Residential Land Use*

Residential development is found primarily within and surrounding the incorporated towns in the county. This development is primarily single-family residential with scattered pockets of multi-family residential. Rural residential developments are located in various parts of the Project Area.

[13] http://www.city-data.com/city/Fowler-Indiana.html
[14] http://www.bentoncounty.in.gov/windfacts.php

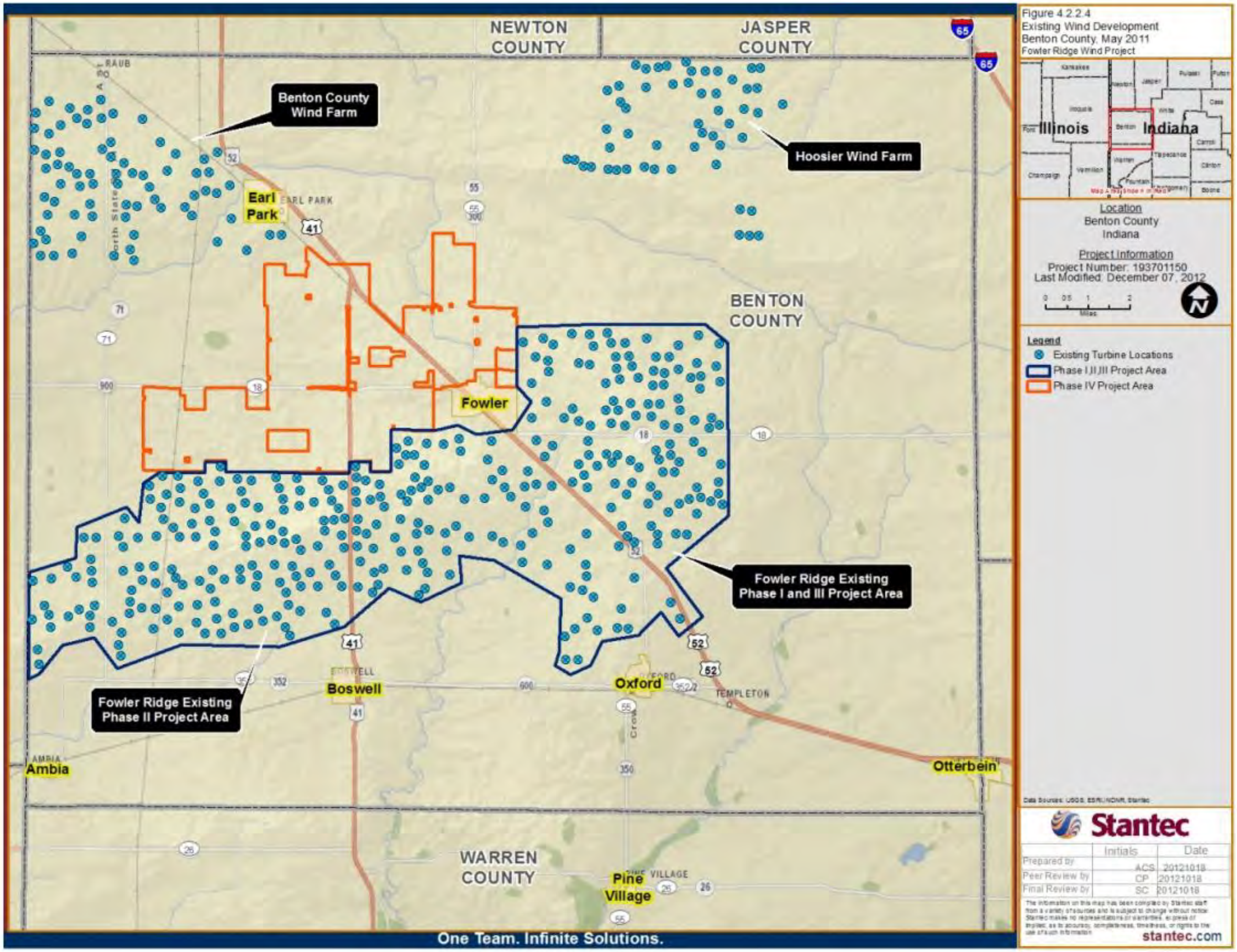


Figure 4.2.2.4
Existing Wind Development
Benton County, May 2011
Fowler Ridge Wind Project
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 07, 2012
0 0.5 1 2
Miles
Legend
Existing Turbine Locations
Phase I,II,III Project Area
Phase IV Project Area
NEWTON COUNTY
JASPER COUNTY
BENTON COUNTY
WARREN COUNTY
Benton County Wind Farm
Hoosier Wind Farm
Fowler Ridge Existing Phase I and III Project Area
Fowler Ridge Existing Phase II Project Area
Earl Park
Fowler
Boswell
Oxford
Ambia
Otterbein
Pine Village
TEMPLETON
One Team. Infinite Solutions.
Stantec
Initials
Date
Prepared by
ACS
20121018
Peer Review by
CP
20121018
Final Review by
SC
20121018
stantec.com

4.2.2.6 *Cemeteries*

There are no cemeteries within Phase IV; however, 3 cemeteries are located within one mile of the outermost project boundary. Two cemeteries are located within the town of Fowler, including: the Fowler Cemetery, located at 465 West Division Road and the Sacred Heart Cemetery, located at 480 West Division Road in Fowler. The Earl Park Cemetery is located south of the town of Earl Park and is approximately 1 mile north of the Phase IV Project Area.

4.2.2.7 *Public Use Lands*

Benton County offers a variety of recreational opportunities, including parks, golf courses, shopping and historic homes, buildings and small towns. Fowler Park, located within the city limits of Fowler, is owned by the town and managed by the Fowler Park Board. The 7.4 acre park is located on the west side of town and includes a four-acre man-made pond, park shelters, 250,000 gallon swimming pool, walking paths, sports fields, playground area and a skate park.

There are no federal, state, or county parks within the Project Area; however, other state lands are present (see Section 4.5.2.7).

4.2.2.8 *Wild and Scenic Rivers*

At present, no federally-designated Wild and Scenic Rivers are located in Indiana[15].

4.3 VEGETATION

4.3.1 Scope of Analysis

This section of the EIS describes vegetation within the Project Area. The description includes a spatial layout of cover types and details on botanical character and composition of habitats found in the Project Area. This section does not discuss rare, threatened, or endangered plant species: these species are discussed in Section 4.6 of this EIS. The vegetation analysis in this EIS is based on information from publicly available databases and documents through credible internet sources (e.g., USGS, USDA and IDNR).

4.3.2 Existing Conditions

A summary of landcover types within the Project Area is found in Table 4.1. North-central Indiana is within the mixed, mesophytic deciduous forest region of North America. In the 1800s, the forests in this area were predominantly oak/hickory and beech/maple associations. During the past century, most of the beech/maple associations have been converted to farmland because the soils that supported this forest community were among Indiana's better agricultural soils. In addition, when drainage lowered the water table, many lowland communities were cleared and cultivated.

Benton County is within the historic range of the Prairie Peninsula (Transeau 1935). Prior to 1860, prairies in the historic Peninsula were dominated by grass species such as big bluestem (*Andropogon gerardii)* and Indian grass (*Sorghastrum nutans)*, and included diverse layers of forbs, flowering shrubs, and other grasses (Williams 1981). Some grasses grew to more than 10

[15] http://www.rivers.gov/wildriverslist.html

feet (3 m) tall. The ecosystem was characterized by an annual fire regime, a thick topsoil layer rich in nitrogen, and sharp fluctuations in surface water and soil moisture content (Williams 1981). Farming and urban development, soil drainage, and introduction of non-native species have destroyed most of the historic tallgrass prairies in the Peninsula.

Common tree species in the region currently include white oak (*Quercus alba)*, shingle oak (*Quercus imbricaria)*, black oak (Quercus velutina), bur oak (*Quercus macrocarpa)*, northern red oak (*Quercus rubra)*, pignut hickory (*Carya glabra)*, shagbark hickory (*Carya ovate)*, shellbark hickory (*Carya laciniosa)*, mockernut hickory (*Carya tomentosa)*, American sycamore (*Platanus occidentalis)*, American elm (*Ulmus americana)*, hackberry (*Celtis occidentalis)*, green ash (*Fraxinus pennsylvanica)*, black gum (*Nyssa sylvatica)*, black cherry (*Prunus serotina)*, black walnut (*Juglans nigra)*, black willow (*Salix nigra)*, eastern cottonwood (*Populus deltoides)*, river birch (*Betula nigra)* and yellow-poplar (*Liriodendron tulipifera)*. Understory species found in the region include dogwood (*Cornus* sp.), sassafras (*Sassafras albidum)*, box elder (*Acer negundo)*, red mulberry (*Morus rubra*), and a variety of herbaceous species.

Some of the more common shrubs, herbaceous, weed and grass species found in the forest understory and along field edges and drainageways include the following: blackberry (*Rubus allegheniensis)*, honeysuckle (*Lonicera* sp.), clearweed (*Pilea pumila*), stinging nettle (*Urtica dioica*), foxtail (*Setaria* sp.), quackgrass (*Agropyron repens*), multiflora rose (*Rosa multiflora*), sedge species (*Carex* spp.), goldenrods (*Solidago* spp.), smartweed species (*Polygonum* spp.), buttonbush (*Cephalanthus occidentalis*), jewelweed (Impatiens pallida), ironweed (*Vernonia fasciculata*), annual and giant ragweed (*Ambrosia artemisiifolia* and *A. trifida*), bulrush (*Scirpus* sp.), rice cutgrass (*Leersia oryzoides*), moneywort (*Lysimachia nummularia*), cattail (*Typha* sp.), fescue (*Festuca* sp.), Joe-pye weed (*Eupatorium purpureum*), grape (*Vitis* sp.), boneset (*Eupatorium perfoliatum*), evening primrose (*Oenothera* sp), fleabane (*Erigeron* sp.), pokeweed (*Phytolacca americana*), Virginia creeper (*Parthenocissus quinquefolia*), poison-ivy (*Toxicodendron radicans*), broomsedge (*Andropogon virginicus*), Christmas fern (*Polystichum acrostichoides*), elderberry (*Sambucus canadensis*), and pawpaw (*Asimina triloba*).

4.4 WATER RESOURCES

4.4.1 Scope of Analysis

This section of the EIS describes the water resources within Phase IV; only construction of Phase IV would impact these resources. Water resources include groundwater and surface water. Groundwater is the subsurface hydrologic resource that is used for potable water consumption, agricultural irrigation, and industrial applications. Groundwater is described in terms of depth to aquifer, aquifer or well capacity, and surrounding geologic composition. Surface water resources include watersheds, streams, wetlands, and floodplains.

The water resources analysis is based on information from publicly available online databases and/or documents produced by the following federal, state, and local agencies: USGS, Federal Environmental Management Agency (FEMA), USFWS, IDNR, and IDEM.

4.4.2 Existing Conditions

4.4.2.1 *Surface Water Resources*

Rivers and Streams

The USGS classifies watersheds by Hydrological Unit Codes (HUC), which include both a name and a series of numbers that are standardized based on the size of the stream. The Project Area lies within three HUC 8 watersheds (Figure 4.4.2.1-1):

(1) Iroquois Watershed HUC 07120002
(2) Middle Wabash-Little Vermilion Watershed HUC 05120108; and
(3) Vermilion Watershed HUC 05120109

Land use within each of these watersheds is predominantly agriculture (i.e., rowcrops).

Gretencord Ditch, Salmon Ditch, Minier Lateral, Sugar Creek, Mud Creek, Coon Creek, and their tributaries are found within Phase IV (Figure 4.4.2.1-2).

The natural hydrology of Phase IV has been drastically altered by extensive drainage tile systems and the construction of large regulated ditches to quickly and efficiently transport water away from agricultural fields. Many of the perennial and intermittent waterways are channelized agricultural ditches with grassed banks and few meanders. Some of the mapped intermittent waterways contain water only during rain events and are classified as grassy swales with no defined bed or bank, or are directed into an underground field tile system. The dominant substrates within these channels are mud, silt, and sand with a small amount of gravel.

The IDEM has not identified any waterbodies in Benton County as those having outstanding ecological, recreational, or scenic importance, and this includes those waterbodies in Phase IV[16].

Sugar Creek, located within Phase IV, is identified as a Category 5B on the IDEM 2008 303(d) List of Impaired Waterbodies approved by the U.S. EPA in 2008[17] (Figure 4.4.2.1-2). Category 5B indicates the water quality standard set forth by the U.S. EPA has not been attained due to the presence of mercury or PCBs, or both, in the edible tissue of fish collected from them at levels exceeding Indiana's human health criteria for these contaminants and due to the presence of *E. coli*.

[16] http://www.in.gov/dnr/water/2452.htm
[17] http://www.in.gov/idem/nps/2647.htm

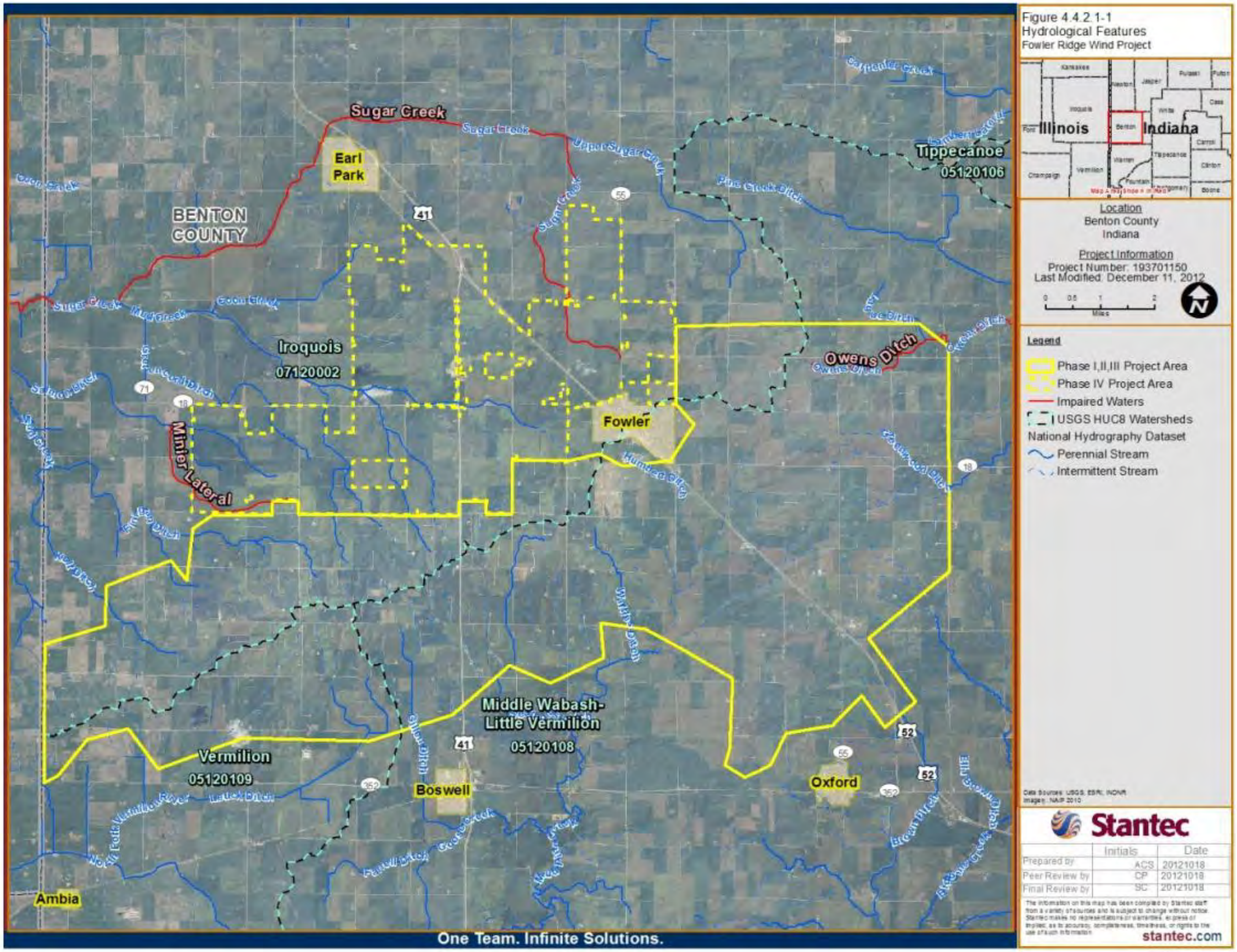


Figure 4.4.2.1-1
Hydrological Features
Fowler Ridge Wind Project
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 11, 2012
Legend
Phase I,II,III Project Area
Phase IV Project Area
Impaired Waters
USGS HUC8 Watersheds
National Hydrography Dataset
Perennial Stream
Intermittent Stream
Stantec
stantec.com
One Team. Infinite Solutions.
Sugar Creek
Earl Park
BENTON COUNTY
Tippecanoe
05120106
Iroquois
07120002
Owens Ditch
Fowler
Minier Lateral
Middle Wabash-Little Vermilion
05120108
Vermilion
05120109
Boswell
Oxford
Ambia

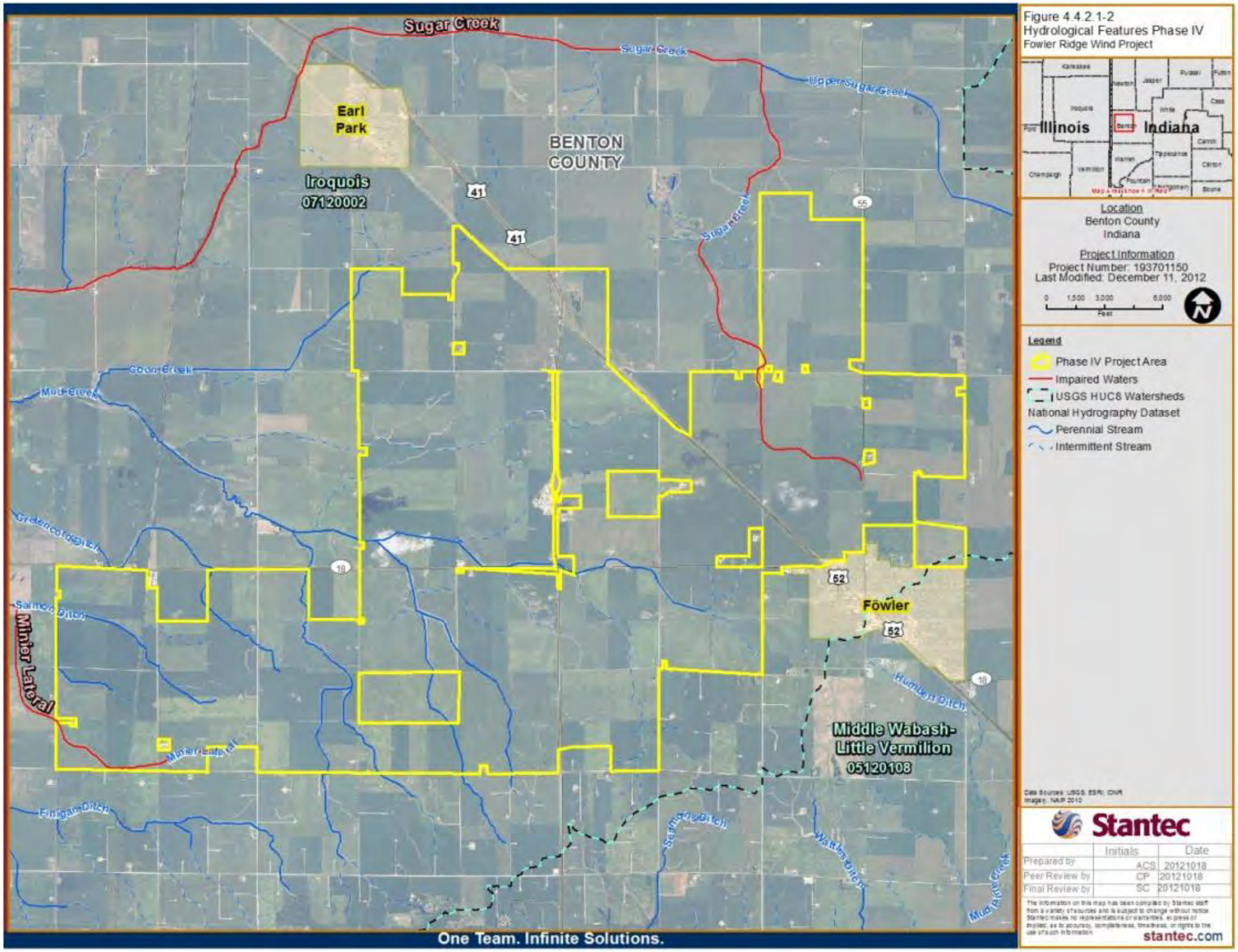


Figure 4.4.2.1-2
Hydrological Features Phase IV
Fowler Ridge Wind Project
Sugar Creek
Upper Sugar Creek
Earl Park
BENTON COUNTY
Iroquois
07120002
Coon Creek
Mud Creek
Minier Lateral
Salmon Ditch
Fowler
Humbert Ditch
Middle Wabash-Little Vermilion
05120108
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 11, 2012
Legend
Phase IV Project Area
Impaired Waters
USGS HUC8 Watersheds
National Hydrography Dataset
Perennial Stream
Intermittent Stream
Stantec
Prepared by ACS 20121018
Peer Review by CP 20121018
Final Review by SC 20121018
stantec.com
One Team. Infinite Solutions.

Lakes and Ponds

There are no named lakes or ponds within Phase IV. A large excavated pond, used for watershed management, is located east of the US Interstate 52/41 interchange. Fowler has a 4-acre man made pond located in Fowler Park on the west side of town. Farm ponds are found throughout Phase IV. These ponds are typically excavated, diked, or impounded shallow ponds used for livestock watering, recreational activities, or watershed management purposes, such as flood control and sediment retention. They occur in natural or excavated depressions, or as impoundments behind dikes near the headwaters of small streams, and may negatively impact these streams.

The ponds provide substantial watershed management functions both in and well beyond Phase IV. The ponds mitigate downstream flooding by catching and slowly releasing runoff from rainstorms. This controlled release also reduces soil erosion caused by high flows scouring drainageways. The ponds also improve water quality downstream by acting as retention ponds and settling basins for surface runoff from livestock operations and soil eroded from farmfields located upslope. In addition, they reduce nutrients, suspended solids and biological oxygen demand generated by livestock operations and agricultural runoff.

The ponds provide limited use for wildlife due to their highly managed condition and lack of vegetation for food and cover. The ponds may provide a drinking water source for upland species, such as white-tailed deer (*Odocoileus virginianus*), harbor fish populations, and provide habitat for certain common species of reptiles and amphibians.

4.4.2.2 *Wetlands*

Wetlands are found throughout Indiana. Historically, approximately 24% of the state was covered by wetlands[18]. Installation of subsurface tile drain networks, excavation of drainage channels, and straightening of streams has resulted in conversion of prairies and wetlands to agriculture. Today, only about 3.5% of wetlands remain[19]. Approximately 60 acres of wetland are identified on USFWS National Wetlands Inventory (NWI) maps within Phase IV ().

In 2011, Stantec Consulting Services conducted a desktop review and windshield survey to locate potential wetlands within Phase IV. This review and survey identified approximately 48.1 acres of potential wetland within the Phase IV area (Figure 4.4.2.2).

Classifications

A number of wetland classification systems exist. For regulatory purposes, the system most often used is the system developed by Cowardin et al. (1979) for the Service's NWI program. The typical wetland community types found within Phase IV include palustrine emergent, palustrine scrub-shrub/emergent, and palustrine forested wetlands. Cowardin et al. (1979) define these wetland plant communities as follows:

[18] http://www.in.gov/idem/4406.htm
[19] Ibid

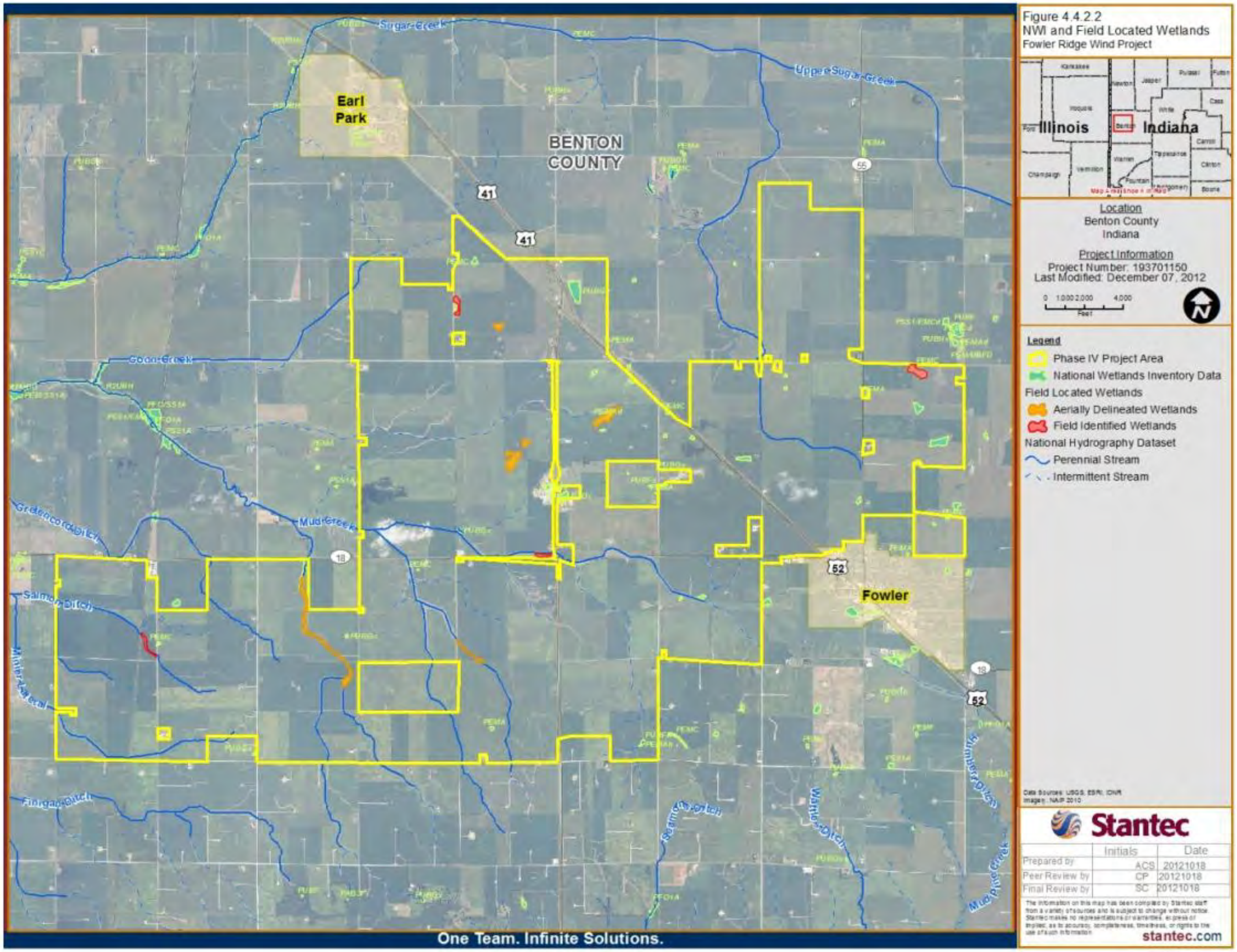


Figure 4.4.2.2
NWI and Field Located Wetlands
Fowler Ridge Wind Project
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 07, 2012
Legend
Phase IV Project Area
National Wetlands Inventory Data
Field Located Wetlands
Aerially Delineated Wetlands
Field Identified Wetlands
National Hydrography Dataset
Perennial Stream
Intermittent Stream
Earl Park
BENTON COUNTY
Fowler
Sugar Creek
Upper Sugar Creek
Coon Creek
Mud Creek
Salmon Ditch
Finigan Ditch
Stantec
Initials
Date
Prepared by
ACS
20121018
Peer Review by
CP
20121018
Final Review by
SC
20121018
stantec.com
One Team. Infinite Solutions.

Palustrine Emergent Wetlands – These wetlands are characterized by erect, rooted, herbaceous hydrophytic plants, such as cattails, bulrushes, and arrowhead (*Sagittaria latifolia).* The vegetation is present for most of the growing season in most years and dominated by perennial plants. Emergent wetlands may include shallow marshes, wet meadows, swales, and pond edges and are often found in the floodplain of larger streams and rivers. They provide water quality, erosion control, shoreline stability, wildlife habitat, recreation, hunting, food chain support, and ecosystem integrity functions.

Palustrine Scrub/Shrub Wetlands – These wetlands are dominated by woody vegetation less than 20 feet tall. Plants characteristic of scrub/shrub wetlands include: willows (*Salix* spp.), buttonbush, rose mallow (*Hibiscus laevis*), and spicebush (*Lindera benzoin)*. Scrub/shrub wetlands function primarily as wildlife habitat and are often associated with emergent wetlands.

Palustrine Forest Wetlands – Forested wetlands are dominated by trees that are more than 20 feet tall. Typically, forested wetlands include an understory of young trees or shrubs and an herbaceous layer. In Phase IV, these wetlands often are commonly located along the banks and within the floodplain of rivers and streams. These forested wetlands provide habitat and travel corridors for wildlife. In some areas, forested wetlands are the only remaining woodlands of substantial size. Forested wetlands primarily function as flood storage, bank stabilization, wildlife habitat and travel corridors, food chain support, recreation, and hunting.

Functions

Wetlands provide many important functions, including storm water retention, water quality improvement, aesthetics, recreation, shoreline protection, and habitat for wildlife. Specifically wetlands:

- Intercept runoff and store storm waters, thereby ameliorating sharp runoff peaks into slower discharges over a long period. In this way, wetlands reduce the damage that flooding may do to stream banks, farm fields and residences (Mitsch and Gosselink 2000).
- Remove organic and inorganic nutrients and toxic materials from the water that flows through them by reducing the velocity of runoff entering the wetland, allowing sediments to settle. This allows wetland vegetation to take up chemicals (e.g., fertilizer or livestock waste) from the sediments before the chemicals can enter the stream. When the wetland vegetation dies, the accumulated organic material may immobilize the chemicals (Mitsch and Gosselink 2000).
- Provide breeding and rearing grounds for fish, reptiles and amphibians; nesting areas for birds; and forage and cover for many species of wildlife.
- Provide protection for river and stream banks by reducing wave action produced by boat traffic, wind or currents.
- Serve as groundwater recharge and discharge locations.
- May be a valuable resource in meeting the demand for recreational uses such as hunting, camping, canoeing, hiking and nature study.

4.4.2.3 *Floodplain*

Phase IV consists of numerous small to large drainage basins. Large or small, every drainageway has a floodplain. However, not all floodplains are identified in available floodplain mapping for the local government. Where such studies have been completed, the focus of study and mapping efforts is generally on the larger watersheds that have greater flooding impacts. For the majority of the Phase IV project area, floodplains have been significantly disturbed and converted to agricultural use.

FEMA has sponsored Flood Hazard Boundary maps for Benton County. These maps provide approximate floodplain boundaries on select reaches of the county's rivers and streams. Approximate floodplain limits do not provide detail as to specific flood elevations or discharge values along the mapped reach. Approximate floodplain delineations generally are created using historical information or empirical discharge/channel capacity ratings. Channel elevations and measurements are taken from the USGS 7.5-minute quadrangle topographic mapping or the best available mapping.

Floodplain designation generally is regarded as the natural limits of runoff inundation resultant from a designated 100-year flood. This is the area around streams and rivers that will be under water whenever a 100-year storm event occurs. The 100-year flood event is used to map floodplains for regulatory purposes. For floodplain conditions and impacts references in the EIS, the 100-year flood event is the referenced flood. No mapped 100-year floodplain is located within the FRWF Phase IV boundary (Figure 4.4.2.3).

"Floodway" is defined as the channel of a river or stream and those portions of the floodplain adjoining the channel which are reasonably required to efficiently carry and discharge the peak flow of the regulatory flood of any river or stream. The floodway is the portion of the floodplain where the IDNR has jurisdiction based on the Indiana Flood Control Act. Many of these floodways have been delineated through studies performed for the National Flood Insurance Program. The floodway represents a part of the total floodplain or possibly the entire floodplain limit that must be kept free of encroachment so that the 100-year regulatory flood can be conveyed without substantial increase to flood heights. No mapped regulatory floodways are located within the FRWF Phase IV boundary (Figure 4.4.2.3).

4.4.2.4 *Groundwater and Drinking Water Supply*

Residents of Benton County are entirely dependent on groundwater for their water supply. The regional hydrogeology in the Project Area consists of two bedrock aquifer systems and five unconsolidated aquifer systems.

Bedrock wells represent approximately 50% of all wells completed in the county. The bedrock aquifer system consists of the Borden Group of Mississippian age and New Albany Shale of Devonian and Mississippian age. The Mississippian age Borden Group Aquifer System is composed mostly of siltstone and shale, but fine-grained sandstones are common. The New Albany Shale consists mostly of brownish-black carbon-rich shale, greenish-gray shale, and minor amounts of dolomite and dolomitic quartz sandstone.

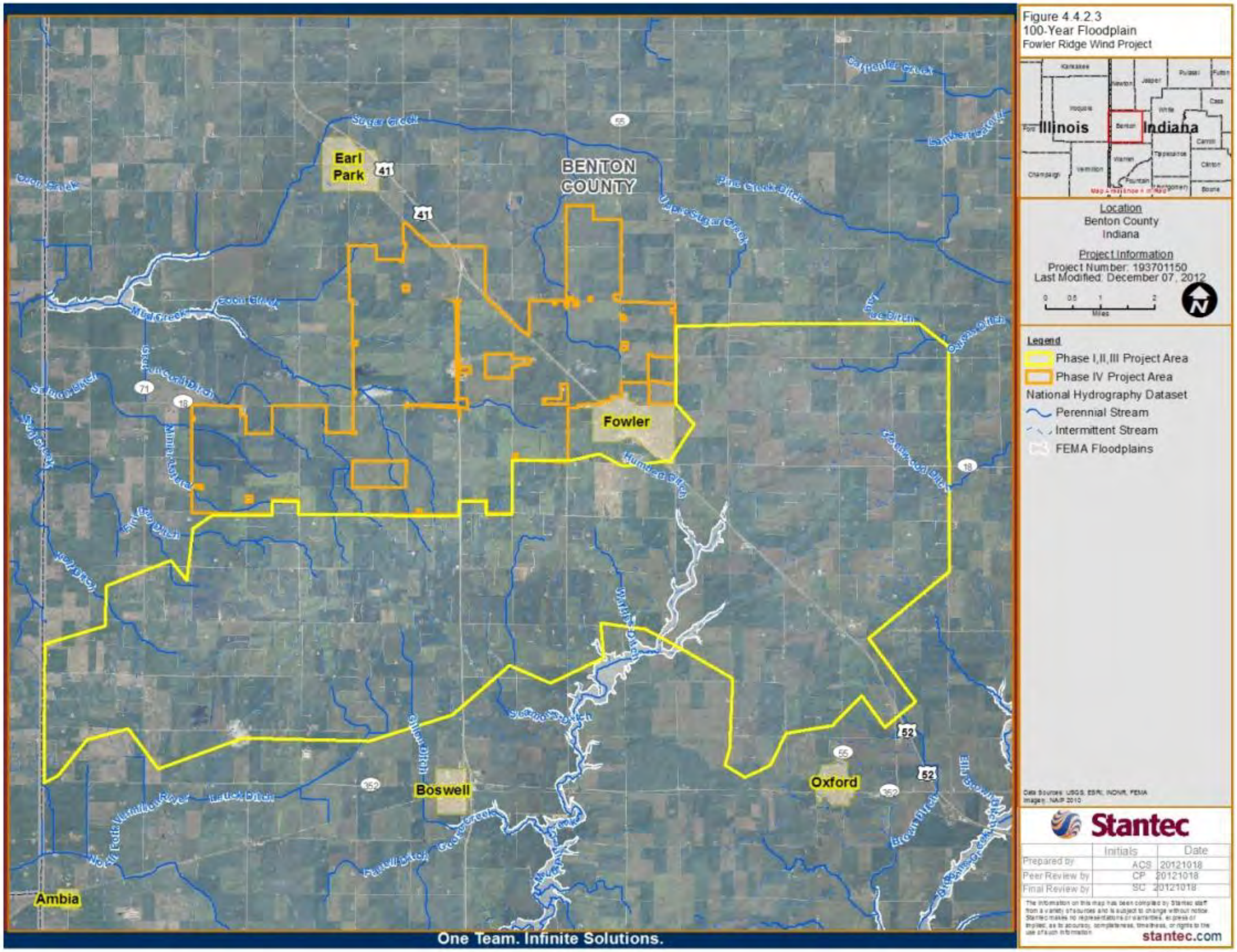


Figure 4.4.2.3
100-Year Floodplain
Fowler Ridge Wind Project
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 07, 2012
Miles
Legend
Phase I,II,III Project Area
Phase IV Project Area
National Hydrography Dataset
Perennial Stream
Intermittent Stream
FEMA Floodplains
Stantec
Initials
Date
Prepared by
ACS
20121018
Peer Review by
CP
20121018
Final Review by
SC
20121018
stantec.com
One Team. Infinite Solutions.
Earl Park
BENTON COUNTY
Fowler
Boswell
Oxford
Ambia
Sugar Creek
Carpenter Creek
Coon Creek
Pine Creek Ditch
Upper Sugar Creek
Mud Creek
Big Pine Creek
Ditch
Jordan Ditch
Wabash River

According to Fleming et al. (1995) five unconsolidated aquifer systems are mapped in Benton County: Till Veneer; Iroquois Basin; Iroquois Till; Iroquois Till Subsystem; and Iroquois Complex. The Till Veneer Aquifer System consists of areas where the unconsolidated material is predominantly thin till overlying bedrock. Along some of the major streams, this system also includes thin alluvium and surficial sand and gravel outwash deposits overlying shallow bedrock. The Till Veneer Aquifer System in Benton County is mapped in portions of the eastern half of the county. This system has the most limited ground-water resources of the unconsolidated aquifer systems in the county. There is little potential for ground-water production in this system in Benton County.

The Iroquois Basin Aquifer System in Benton County is mapped along most of the northwestern quarter of the county. Characteristics of this system generally consist of either thick clay deposits with thin intermittent sands and gravels that overlie shallow bedrock, or isolated surface sands with thin to no clay that directly overlie bedrock. Total thickness of these deposits ranges from about 10 feet to over 120 feet. This system is capable of meeting the needs of most domestic users and some high-capacity users in the county.

The Iroquois Till Aquifer System ranges from approximately 100 to 400 feet in thickness. Wells completed in this system are capable of meeting the needs of most domestic users in Benton County. However, approximately 40% of wells started in this system utilize the underlying bedrock aquifer. Saturated aquifer materials include sand and/or gravel deposits that are commonly 2 to 10 feet thick and are generally overlain by 40 to 100 feet of till. The Iroquois Till Aquifer Subsystem is mapped similar to the Iroquois Till Aquifer System; however, potential aquifer materials are typically thinner and potential yield is generally less in the subsystem. The unconsolidated material in the Iroquois Till Aquifer Subsystem ranges from about 50 to 200 feet thick. Potential aquifer materials include thin intratill sand and gravel deposits. This subsystem is capable of meeting the needs of some domestic users in the county.

The Iroquois Complex Aquifer System is characterized by unconsolidated deposits that are quite variable in materials and thickness. Aquifers within the system range from thin to thick and include single or multiple intratill sands and gravels. The aquifers are highly variable in depth and lateral extent and are typically confined by thick clay layers. The total unconsolidated thickness of the Iroquois Complex Aquifer System generally ranges from about 150 to 300 feet in Benton County. This system is capable of meeting the needs of domestic and most high-capacity users in the county.

The only sole-source aquifer in Indiana, the St. Joseph Aquifer at South Bend in northern Indiana, is not located within the Project Area.

4.5 WILDLIFE AND AQUATIC RESOURCES

4.5.1 Scope of Analysis

This section describes the existing wildlife and aquatic resources within the Project Area. This section does not discuss rare, threatened, or endangered wildlife species: these species are discussed in Section 4.6 of this EIS. The wildlife and aquatic resources analysis is based on data from site-specific biological surveys and standard biological literature for the region. In order to establish baseline information regarding wildlife use of the Project Area and to evaluate the potential impacts from construction and operation of FRWR, a number of wildlife studies were conducted (Johnson and Bay 2008; Carder et al. 2010; Johnson et al. 2010a, b; Good et al. 2011a, b, 2012) according to survey plans that were developed in coordination with IDNR and USFWS, which are summarized in the following sections. A summary of the results of preconstruction bird and bat studies can be found in the FRWF BBCS (Appendix D), and detailed descriptions of post construction survey methods, results, and discussion can be found in the BBCS and HCP.

4.5.2 Existing Conditions

4.5.2.1 *Terrestrial Wildlife*

Greater than 90% of land within the Project Area is used for the production of cultivated crops. Less than 1% of the Project Area consists of woodlands. Therefore, the majority of the terrestrial wildlife found in the Project Area consists of generalist, edge species adapted to surviving in a highly agricultural environment. Although limited, woodlands may be used by common mammal species, such as white-tailed deer, raccoons (*Procyon lotor*) and squirrels (*Sciurus* spp.), for food and cover. Birds also may use the woodlots. Likely bird species include wild turkey (*Meleagris gallopavo*), ring-necked pheasant (*Phasianus colchicus*), hawks such as the red-tailed hawk (*Buteo jamaicensis*), owls such as the great horned owl (*Bubo virginianus*) and barred owl (*Strix varia*), American crow (*Corvus brachyrhynchos),* northern cardinal (*Cardinal cardinalis*), and red-winged blackbird (*Agelaius phoeniceus*). Other potential wildlife habitats include road ditches, edges of agricultural fields, and fencerows and hedgerows, all which provide more varied sources for food, cover, and nesting.

Wetlands and streams, although limited in the Project Area, are used by amphibians such as the American toad (*Anaxyrus americanus*) and northern leopard frog (*Lithobates pipiens*); reptiles such as the northern painted turtle (*Chrysemys picta*) and garter snake (*Thamnophis sirtalis*); and, waterfowl such as mallard (*Anas platyrhynchos*) and Canada goose (*Branta canadensis).* These species use these areas for breeding, food and cover, and serve as a water source for many species. Mammals, such as beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*) and mink (*Mustela vison*), may also use wetlands and streams for food and cover.

4.5.2.2 *Birds*

Neotropical migratory birds are those species in the Western Hemisphere that migrate north of the Tropic of Cancer (i.e., Nearctic or United States and Canada) to breed during the summer months and migrate south of that latitude to winter in Mexico, Central America, South America, or the Caribbean (Stangel 1992 as cited in Koford et al. 1994). Nearctic migrant birds migrate entirely within the Nearctic (Hayes 1995), often referred to as short-distance migrants.

Migratory birds are protected by the MBTA. Species protected under the MBTA include all species listed within 50 CFR 10.13. These include songbirds, raptors, ducks, waterbirds, and others[20]. The MBTA generally prohibits the taking (both intentional and unintentional) of migratory birds, the destruction or disturbance of migratory bird nests, or the disturbance of any eggs or young of migratory birds without prior authorization from the Service.

The Indiana Chapter of the Audubon Society designates Important Bird Areas (IBA) that provide essential habitat for one or more bird species. Audubon designated an IBA for migrating American golden-plovers (*Pluvialis dominica*) in Benton County in 2006 (Figure 4.Figure 4.5.2.2). The site is located immediately northeast of Phase IV and consists primarily of

[20] For a complete list of the birds protected, refer to http://www.fws.gov/migratorybirds/RegulationsPolicies /mbta/mbtintro.htm

the plovers use as migratory resting and feeding grounds. The American golden-plover is not currently listed as state- or federally threatened or endangered but is protected under the MBTA.

Birds Within the FRWF Project Area

Spring and fall fixed point avian use surveys, raptor nest surveys, and American golden-plover surveys were conducted in 2007, 2008 and 2009 within the Project Area (Johnson and Bay 2008; Carder et al. 2010). No federally-listed bird species were observed as part of the surveys (Johnson and Bay 2008; Carder et al. 2010). Two state-endangered bird species, northern harrier (*Circus cyaneus)* and upland sandpiper (*Bartramia longicauda)*, were observed as part of the avian use surveys.

A total of 46 species of birds, including a variety of shorebirds, passerines, doves and pigeons, waterfowl, raptors and other birds were identified during fixed point avian use surveys (Johnson and Bay 2008; Carder et al. 2010). Shorebirds observed included: American golden-plover, killdeer (*Charadrius vociferus*), least sandpiper (*Calidris minutilla)*, Wilson's snipe (*Gallinago delicata*), and white-rumped sandpiper (*Calidris fuscicollis)*. Passerines observed included: American crow, American goldfinch (*Carduelis tristis)*, American robin (*Turdus migratorius)*, barn swallow (*Hirundo rustica)*, blue jay (*Cyanocitta cristata)*, brown-headed cowbird (*Molothrus ater)*, chipping sparrow (*Spizella passerina)*, eastern meadowlark (*Sturnella magna)*, eastern phoebe (*Sayornis pheoebe)*, horned lark (*Eremophila alpestris)*, house finch (*Carpodacus mexicanus)*, indigo bunting (*Passerina cyanea)*, northern cardinal, red-winged blackbird, song sparrow (*Melospiza melodia*), and American tree sparrow (*Spizella arborea*).

A single bald eagle was observed during regular point-count surveys conducted in 2008 (Carder et al. 2010). In addition, two bald eagles were observed incidentally to post-construction surveys conducted at the site in 2011 (Good et al. 2012). Other raptors observed on-site included: Cooper's hawk (*Accipiter cooperii)*, sharp-shinned hawk (*Accipiter striatus*), red-tailed hawk, northern harrier, American kestrel (*Falco sparverius*), and osprey (*Pandion haliaetus)*. Waterfowl observed included: Canada goose, blue-winged teal (*Anas discors*), and mallard. Other birds observed included: American coot (*Fulica americana)*, turkey vulture (*Cathartes arua)*, mourning dove (*Zenaida macroura)*, belted kingfisher (*Ceryle alcyon)*, chimney swift (*Chaetura pelagica)*, northern flicker (*Colaptes auratus*), and northern flicker (*Colaptes auratus*).

A total of 18 additional species were observed incidentally within the Project Area: ring-necked duck (*Aythya collaris*), bufflehead (*Bucephala albeola)*, green-winged teal (*Anas crecca)*, wood duck (*Aix sponsa)*, pied-billed grebe (*Podilymbus podiceps)*, ruddy duck (*Oxyura jamaicensis)*, merlin (*Falco columbarius)*, northern shoveler (*Anas clypeata*), lesser yellowlegs (*Tringa flavipes)*, greater yellowlegs (*Tringa melanoleuca)*, great blue heron (*Ardea herodias)*, upland sandpiper, sandhill crane (*Grus canadensis)*, solitary sandpiper (*Tringa solitaria)*, spotted sandpiper (*Actitis macularia)*, black-bellied plover (*Pluvialis squatarola)*, rough-legged hawk (*Buteo lagopus)*, and common yellowthroat (*Geothlypis trichas)* (Johnson and Bay 2008; Carder et al. 2010).

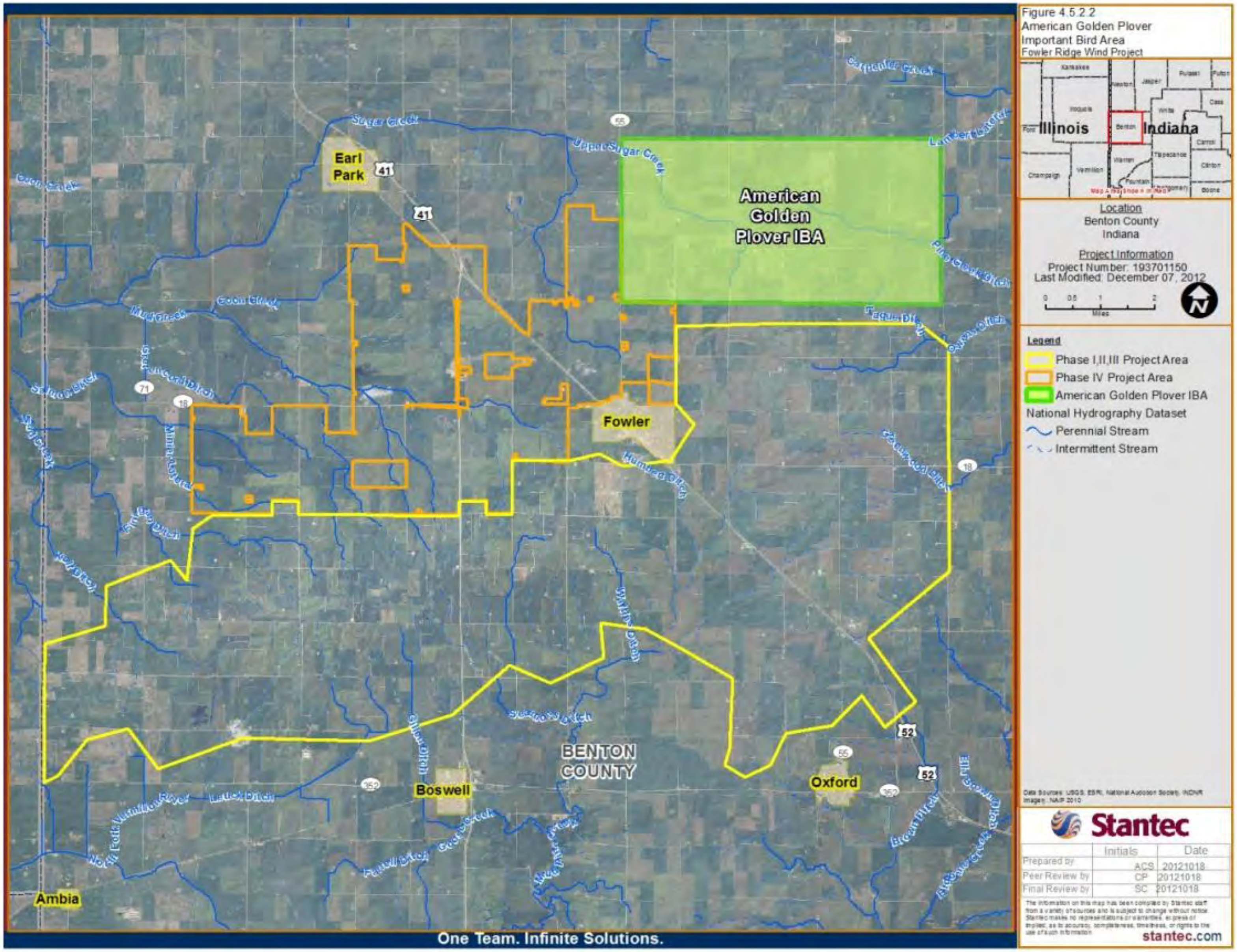


Figure 4.5.2.2
American Golden Plover
Important Bird Area
Fowler Ridge Wind Project
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 07, 2012
Legend
Phase I,II,III Project Area
Phase IV Project Area
American Golden Plover IBA
National Hydrography Dataset
Perennial Stream
Intermittent Stream
American Golden Plover IBA
Earl Park
Fowler
BENTON COUNTY
Boswell
Oxford
Ambia
Stantec
Initials
Date
Prepared by
ACS
20121018
Peer Review by
CP
20121018
Final Review by
SC
20121018
stantec.com
One Team. Infinite Solutions.

The Project Area is located within the migration range of an experimental population of whooping cranes (*Rhus americana)*. This population, which currently consists of approximately 100 cranes, was reintroduced to the Midwest in 2001 and is listed as a non-essential, experimental population under the ESA. 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.

The Service listed the whooping crane as endangered June 2, 1970 (35 FR 8495). The Service's Whooping Crane Recovery Plan was developed and signed on January 23, 1980 (USFWS 1980). Revisions to the recovery plan were approved in 1986 and 1994. The third revision was approved on May 29, 2007 (72 FR 29544) (Canadian Wildlife Service (CWS) and USFWS 2007). Final ruling for designated critical habitat for the whooping crane was published on August 17, 1978 (43 FR 36588-36590). No critical habitat for the whooping crane is found within the Project Area.

Whooping cranes migrate twice annually, usually in small groups of one to three individuals (Armbruster 1990). Whooping cranes are diurnal (daytime) migrants and make temporary stopovers nightly, during periods of inclement weather, and for short periods of resting or foraging (Armbruster 1990). Temporary stopover habitat for whooping cranes consists primarily of palustrine wetlands (i.e., water depth < 6.6 feet) and riverine systems (Austin and Richert 2001). During migration, whooping cranes generally fly at altitudes between 1,000 and 6,000 feet; cranes fly at lower altitudes when starting or ending a migration flight, especially when thermal currents are minimal or when making brief mid-day stops to forage (USFWS 2009).

An ultralight aircraft was used to imprint birds of the reintroduced eastern population to migrate annually between breeding grounds at Necedah National Wildlife Refuge (NWR) in central Wisconsin and wintering grounds in west-central 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 (Johnson and Tidhar 2007).

Bird Mortality at the FRWF

FRWF has been conducting post-construction mortality surveys at FRWF since 2009. The survey data have provided information on the circumstances surrounding bird mortality at FRWF. The survey reports provide detailed discussions of the results of the post-construction mortality surveys (Johnson et al. 2010 a, b, Good et al. 2011a, 2012).

Three years of post-construction mortality surveys conducted from 2009 to 2011 found 168 bird carcasses of 34 identified species (Table 4.5).

Table 4.5 Bird carcasses found at FRWF during mortality surveys from 2009 to 2011, by species.

Species	Scientific Name	Total Carcasses
Killdeer	*Charadrius vociferus*	34
European starling	*Sturnus vulgaris*	12
Mourning dove	*Zenaida macroura*	10
Red-tailed hawk	*Buteo jamaicensis*	9
Golden-crowned kinglet	*Regulus satrapa*	7
Tennessee warbler	*Oreothlypis peregrina*	7
Cliff swallow	*Petrochelidon pyrrhonota*	5
Horned lark	*Eremophila alpestris*	5
Chimney swift	*Chaetura pelagica*	4
Nashville warbler	*Oreothlypis ruficapilla*	4
Red-eyed vireo	*Vireo olivaceus*	3
Rock pigeon	*Columbia livia*	3
Ruby-crowned kinglet	*Regulus calendula*	3
Tree swallow	*Tachycineta bicolor*	3
American redstart	*Setophaga ruticilla*	2
American robin	*Turdus migratorius*	2
Common yellowthroat	*Geothlypis trichas*	2
Ring-necked pheasant	*Phasianus colchicus*	2
Rough-legged hawk	*Buteo lagopus*	2
Ruby-throated hummingbird	*Archilochus colubris*	2
Yellow-throated vireo	*Vireo flavifrons*	2
Black-throated green warbler	*Setophaga virens*	1
Blue-winged teal	*Anas discors*	1
Brown-headed cowbird	*Molothrus ater*	1
Canada warbler	*Cardellina canadensis*	1
Common grackle	*Quiscalus quiscula*	1
Eastern kingbird	*Tyrannus tyrannus*	1
Green-winged teal	*Anas carolinensis*	1
House sparrow	*Passer domesticus*	1
House wren	*Troglodytes aedon*	1
Indigo bunting	*Passerina cyanea*	1
Pine warbler	*Setophaga pinus*	1
Red-winged blackbird	*Agelaius phoeniceus*	1
Yellow-rumped warbler	*Setophaga coronata*	1
Unidentified large bird		8
Unidentified bird		6
Unidentified duck		4
Unidentified passerine		3
Unidentified waterfowl		3
Unidentified bird (small)		2
Unidentified dove		2
Unidentified warbler		2
Unidentified kinglet		1
Unidentified sparrow		1
Total		**168**

During the three years of mortality surveys, no Indiana state listed or federally listed bird species were found. Additionally, no American golden plover fatalities were found.

4.5.2.3 *Bald and Golden Eagle*

On July 9, 2007, the Service announced that the bald eagle would be removed in the lower 48 states from the Federal List of Endangered and Threatened Wildlife (72 Fed.Reg. 37346-37372). The rule became effective on August 8, 2007. The bald eagle remains protected under the BGEPA.

Bald eagles are typically found associated with large, permanent water sources such as lakes, reservoirs, and major rivers. Important habitat components for bald eagles include an adequate food supply (primarily fish, but also waterfowl and other waterbirds, small mammals, and carrion), perching sites in large shoreline trees, and nesting sites in large, mature old-growth trees, dead trees, cliffs, and rock promontories.

Based on the 2011 draft guidance from the Service regarding Eagle Conservation Plans (ECP) (USFWS 2011a), Western EcoSystems Technologies, Inc. (WEST) conducted an eagle use assessment to identify the risk category most appropriate for the FRWF (Good and Simon 2011). The eagle use assessment included a review of data from pre-construction and post-construction bird surveys, as well as carcass monitoring studies conducted at the FRWF, a landscape-level summary of potential habitat for bald and golden eagles, proximity of known important eagle use areas as provided by the Service, and an overall summary of Risk Factors and Assignment of Risk Category in accordance with the 2011 draft guidance from the Service regarding ECPs (USFWS 2011a).

The Service defines important eagle use areas 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 nests, foraging area or roost site that are essential for the continued viability of the site for breeding, feeding or sheltering eagles” (USFWS 2011a).

Bald eagles typically nest in forested areas adjacent to large bodies of water for foraging opportunities (Buehler 2000). The FRWF lacks primary bald eagle habitat in the form of mature forest and large, fish-bearing waters. Potential sites for bald eagles to nest and hunt are located outside of the FRWF along forested corridors of major rivers such as the Tippecanoe River (located approximately 25 miles east of the FRWF) and the Wabash River (located approximately 12 miles southeast of the FRWF). Some potential also exists for bald eagles to nest and hunt along Big Pine Creek (located approximately 5 miles east of the FRWF), which is a smaller creek with a forested riparian corridor and fish populations. No large, fish-bearing waters are present within the Project Area.

A single bald eagle was observed at the FRWF during regular point count surveys conducted in 2008 (Carder et al. 2010). In addition, two bald eagles were incidentally observed during post-construction surveys conducted at the site in 2011 (Good et al. 2012).

A database search for known bald eagle nests located within 10 miles of the FRWF boundary identified one nest within the 10-mile search area, but outside of the Project Area. This nest was recorded as active in 2009 and 2010 (Matt Stuber, USFWS, personal communication (March 4, 2011)). No bald eagle nests are known to occur within the FRWF Project Area (Matt

Stuber, USFWS, personal communication (March 4, 2011)). The Indiana nest information provided by the USFWS is current as of the end of the 2010 nesting season.

FRWF also lacks primary golden eagle habitat in the form of grasslands and other native habitats. No records of nesting golden eagles are known within the state of Indiana (Brock 2006). In addition, the project lacks potential winter and foraging habitat for golden eagles (Good and Simon 2011).

On April 25, 2011, Matt Sailor from the Service stated that there are no records of bald or golden eagle use within the FRWF or within the Illinois portion of the 10-mile buffer as of the 2009 nesting season, which is the most current data set the Service has for Illinois. The Service has records of bald eagle nests located along the Wabash River within 20 miles of the FRWF, with the closest nest reported as 12 miles away from the FRWF boundary.

4.5.2.4 *Bats*

Bats Within the FRWF Project Area

There are 12 species of bats that can occur in Indiana. Nine species, all members of the family Vespertilionidae, have geographic distributions that include Benton County (Simon et al. 2002; Whitaker and Mumford 2008). Of these, the Indiana bat is federally endangered and state endangered, and the evening bat (*Nycticeius humeralis)* is listed as state endangered. Six species, the little brown bat (*Myotis lucifugus)*, northern *myotis (Myotis septentrionalis)*, silver-haired bat (*Lasionycteris noctivagans*)*,* red bat (*Lasiurus borealis*)*,* hoary bat (*Lasiurus cinereus*)*,* and tri-colored bat (*Perimyotis subflavus)*, are listed as special concern species by the IDNR[21]. Of the nine species with potential to occur in the Project Area, only the big brown bat (*Eptesicus fuscus)* is not listed as either endangered or special concern.

All nine bat species use woodland habitat for feeding or roosting at some time during the year. In addition, many species of bats feed along stream corridors or over water. A 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.

Limited information is available on how bats use agricultural areas in the Midwest; however, species such as the big brown 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 and little brown bat.

WEST conducted pre-construction, ground-based bat acoustical surveys at the FRWF from August 15 through October 19, 2007 and from July 17 through October 15, 2008 (Gruver et al. 2007, Carder et al. 2009). The survey periods cover the time frame during which most bat mortality occurs at wind energy facilities throughout North America (Arnett et al. 2008). WEST installed three AnaBat® II bat detectors (Titley Electronics Pty Ltd., NSW, Australia) approximately 3.2 feet above the ground in habitat in the Project Area similar to that found at the

[21] http://www.in.gov/dnr/fishwild/files/fw-Indiana_Species_of_Greatest_Conservation_Need.pdf

turbine locations and programmed the detectors to record from 0.5 hour before sunset to 0.5 hour after sunrise. The results of these studies are presented in Table 4.6, below.

Table 4.6 Results of acoustic studies conducted at FRWF in 2007 and 2008

<table>
<tr><th rowspan="1"></th><th>Total calls</th><th>Calls/detector night</th><th colspan="6">Percentage of calls</th></tr>
<tr><td rowspan="2">2007</td><td rowspan="2">648</td><td rowspan="2">4.7</td><td colspan="3">LF (<35 kHz)</td><td colspan="3">HF (>35 kHz)</td></tr>
<tr><td colspan="3">51%</td><td colspan="3">49%</td></tr>
<tr><td rowspan="2">2008</td><td rowspan="2">851</td><td rowspan="2">6.45</td><td colspan="2">LF (<30 kHz)</td><td colspan="2">MF (30-40 kHz)</td><td colspan="2">HF (>40 kHz)</td></tr>
<tr><td colspan="2">47.4%</td><td colspan="2">18.4%</td><td colspan="2">34.2%</td></tr>
</table>

In 2007, bat activity peaked in late September and early October (Gruver et al. 2007). In 2008, bat activity was highest in early August with a second peak occurring from mid-August through early September (Carder et al. 2009). The high frequency (>35 kHz) calls recorded in 2007 may have included *Myotis* species but may also have consisted of several other bat species, including the common red bat, due to the broad classification. The high frequency (>40 kHz) calls recorded in 2008 were likely attributable to tri-colored bats and several *Myotis* bat species.

In 2010 and 2011, WEST conducted acoustic monitoring simultaneously with carcass searches to research the relationship between bat-use rates and mortality levels in the Project Area (Good et al. 2011a, 2012). WEST monitored bat activity at the base of four turbines that were searched daily from April 9 through May 14, 2010 (spring) and at reference sites. Bat activity was also monitored at turbine bases from August 1 through October 18, 2010 (fall). Bat activity was monitored at nacelle units on the four daily search turbines from August 17 through October 18, 2010 (fall). In 2011, bat activity was monitored at the base and the nacelle of four turbines from March 31 through May 15 (spring), and again at four turbines and two reference locations from July 14 through October 31 (fall). The three call frequency categories were defined using the same frequencies as were used in the 2008 study. The results of these studies are presented in Table 4.7 and Table 4.8, below.

Table 4.7 Average calls recorded during acoustic studies at FRWF in 2010 and 2011, by season and detector type

<table>
<tr><th rowspan="3"></th><th colspan="4">Calls/detector night</th></tr>
<tr><th colspan="2">Spring</th><th colspan="2">Fall</th></tr>
<tr><th>Ground</th><th>Nacelle</th><th>Ground</th><th>Nacelle</th></tr>
<tr><td>2010</td><td>1.34 ± 0.29</td><td>-</td><td>11.46 ±1.29</td><td>3.10 ± 0.42</td></tr>
<tr><td>2011</td><td>2.57 ± 0.06</td><td>0.56 ± 0.02</td><td>16.72 ± 1.52</td><td>5.19 ± 0.59</td></tr>
</table>

Table 4.8 Percent composition by frequency category of calls recorded during acoustic studies at FRWF in 2010 and 2011, by season and detector type

<table>
<tr><th rowspan="4"></th><th colspan="9">Percentage of calls</th></tr>
<tr><th colspan="3">Spring</th><th colspan="6">Fall</th></tr>
<tr><th rowspan="2">LF</th><th rowspan="2">MF</th><th rowspan="2">HF</th><th colspan="3">Ground</th><th colspan="3">Nacelle</th></tr>
<tr><th>LF</th><th>MF</th><th>HF</th><th>LF</th><th>MF</th><th>HF</th></tr>
<tr><td>2010</td><td>46.5%</td><td>28.1%</td><td>25.4%</td><td>52.9%</td><td>22.7%</td><td>24.3%</td><td>71.6 %</td><td>19.4%</td><td>9.0%</td></tr>
<tr><td rowspan="2">2011</td><td rowspan="2">38.5%</td><td rowspan="2">39.8%</td><td rowspan="2">21.7%</td><td colspan="2">LF</td><td colspan="2">MF</td><td colspan="2">HF</td></tr>
<tr><td colspan="2">45.5%</td><td colspan="2">29.9%</td><td colspan="2">24.6%</td></tr>
</table>

In 2010, the highest periods of bat use occurred during the first two weeks of August, before the nacelle detectors were active. The highest period of bat use at the nacelle detectors occurred during the third and fourth weeks of August (the first weeks the detectors were active). In 2011, the highest period of bat use occurred during mid to late August.

Very few *Myotis* calls (15.6% of identifiable calls) were recorded during the course of the 2010 study; most of the 30 calls potentially resembling Indiana bat calls were recorded on August 9-10, at a reference station located away from the turbines. Observed bat casualty rates were found to be positively correlated with bat activity in WEST's analysis of the data, 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 (Good et al. 2011a).

In 2011, *Myotis* species composed 0.2% of calls identified to species group, and no calls were identified as Indiana bat calls by WEST biologists. Assessment of the relationship between bat casualty rates, bat activity, and weather indicated that about 77% of all bat fatalities and 73% of all bat activity recorded by detectors on nacelles occurred when wind speeds were below 12.3 mph (5.5 m/s). WEST's study report concluded that wind speeds above certain thresholds greatly reduce the ability of bats to fly near nacelle height (Good et al. 2012).

Bat Mortality at the FRWF

The Applicant has been conducting post-construction mortality surveys at FRWF since 2009. The survey data have provided information on the circumstances surrounding bat activity in Benton County and bat mortality at FRWF and wind facilities in general. A detailed discussion of the results of the post-construction mortality surveys is found in the FRWF HCP.

Three years of post-construction mortality surveys conducted from 2009 to 2011, found 1,543 bat carcasses of 10 identified species (Table 4.9).

Table 4.9 Bat carcasses found at FRWF during mortality surveys from 2009 to 2011, by species

Species	Total Carcasses	Status
Eastern red bat	877	Special Concern
Silver-haired bat	235	Special Concern
Hoary bat	355	Special Concern
Big brown bat	52	--
Little brown bat	5	Special Concern
Tri-colored bat	3	Special Concern
Evening bat	4	State Endangered
Seminole bat	3	--
Indiana bat	2	Federal Endangered State Endangered
Northern Myotis	1	Special Concern
Unknown	6	N/A
Total	**1,543**	**--**

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 bats exist in Indiana, the species has occasionally been found outside of its range in other states, as well.

4.5.2.5 *Aquatic Wildlife*

There are no major rivers or lakes within or near the Project Area. There are a few perennial, intermittent, and ephemeral streams and several farm ponds in the Project Area. Common fish species found in some of the larger streams and farms ponds include largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), bluegill (*Lepomis macrochirus*), and crappie (*Pomoxis* spp.).

4.5.2.6 *State Wildlife Action Plan*

The Indiana Wildlife Diversity Section is responsible for the conservation and management of over 750 species of non-game and endangered wildlife across Indiana, representing more than 90% of the state's mammals, birds, fish, mussels, reptiles, and amphibians. According to the Indiana Comprehensive Wildlife Strategy, over 270 species are listed as Species of Greatest Conservation Need (SGCN)[22], including 22 mammals, 40 birds, 28 reptiles and amphibians, and 25 fish. Some of these species include badger (*Taxidea taxus)*, bobcat (*Lynx rufus),* barn owl (*Tyto alba)*, common nighthawk (*Chordeiles minor)*, hoary bat, eastern red bat, silver-haired bat, northern leopard frog, river otter (*Lontra canadensis)*, and sandhill crane.

4.5.2.7 *Natural and Conservancy Areas*

Four natural and conservancy areas, including privately-owned lands where known, are found within the Project Area. According to IDNR Division of Fish and Wildlife, three Gamebird Habitat Areas (GHA) are located within the Project Area[23] (Figure 4.5.2.7). These areas are owned and managed by IDNR to maintain gamebird habitat for bobwhite quail (*Colinus*

[22] http://www.in.gov/dnr/fishwild/files/fw-Indiana_Species_of_Greatest_Conservation_Need.pdf
[23] http://www.indianamap.org/data.html

virginianus), ring-necked pheasant, ruffed grouse (*Bonasa umbellus*), and wild turkey. Properties under this program are open to the public but contain certain restrictions. The Watland Gamebird Habitat Area is approximately 142 acres and located in the central portion of the Phase IV (Figure 4.5.2.7).

4.6 RARE, THREATENED AND ENDANGERED SPECIES

4.6.1 Scope of Analysis

This section considers plant and animal species that are federally-listed as threatened, endangered, candidate, proposed, and species of concern or state-listed as threatened, endangered or special concern. Because most wildlife is mobile and would be able to move around within and outside the four project phases, this analysis includes those species that could potentially occur within the Project Area and the surrounding vicinity. Information collected or reviewed for this analysis includes USFWS correspondence with FRWF and the IDNR's Natural Heritage Database[24].

4.6.2 Existing Conditions

4.6.2.1 *Federally-Listed Species*

The Service, in their letter dated October 13, 2006 (Appendix C), indicated the proposed project is within the known range of the following species:

- Indiana Bat (*Myotis sodalis)* – Endangered (also Indiana state-listed Endangered)
- Bald Eagle (*Haliaeetus leucocephalus)* – Not Currently Listed[25] (see Section 4.5.2.3)
- Whooping Crane (*Rhus americana)* – Non-Essential, Experimental Population

Indiana Bat

The Service listed the Indiana bat as endangered on March 11, 1967 (32 FR 4001). The Service's Indiana Bat Recovery Plan was first developed and signed on October 14, 1983 (USFWS 1983). An agency draft of the Revised Recovery Plan was released in March 1999 (USFWS 1999). The Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision was made available for public comment on April 16, 2007 (72 FR 19015-19016; USFWS 2007).

The Applicant coordinated with the Service prior to construction of Phases I, II, and III. In a letter dated September 10, 2007 (Appendix C), the Service indicated there was very little habitat for the Indiana bat within the Project Area. However, the Service indicated several summer records of Indiana bats were known from Tippecanoe and Warren counties, located immediately adjacent to Benton County, along Mud Pine Creek, Big Pine Creek, and Little Pine Creek. Of these areas, the Service was most concerned about Big Pine Creek, where there are Indiana bat records within three miles downstream of a transmission line (Appendix C) that was constructed concurrent with the first three phases of the FRWF. 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 (Appendix C).

[24] http://www.in.gov/dnr/naturepreserve/files/np_benton.pdf
[25] Listed as threatened at the time of the October 13, 2006 letter; however, this species was removed from the federal list in 2007.

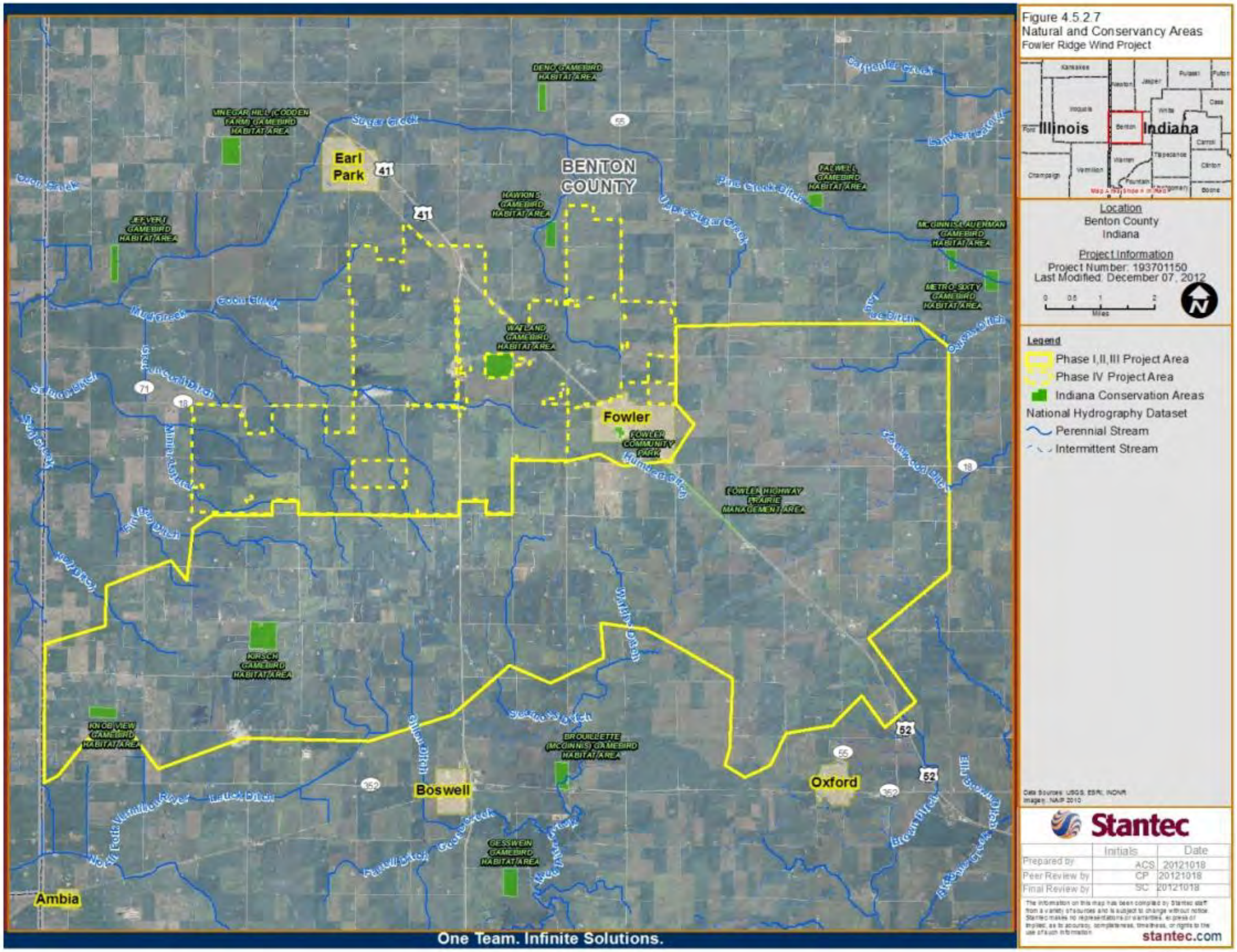


Figure 4.5.2.7
Natural and Conservancy Areas
Fowler Ridge Wind Project
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 07, 2012
Legend
Phase I,II,III Project Area
Phase IV Project Area
Indiana Conservation Areas
National Hydrography Dataset
Perennial Stream
Intermittent Stream
Stantec
Initials
Date
Prepared by
ACS
20121018
Peer Review by
CP
20121018
Final Review by
SC
20121018
stantec.com
BENTON COUNTY
Earl Park
Fowler
Boswell
Oxford
Ambia
One Team. Infinite Solutions.

The Service has designated 11 caves and two mines as critical habitat for the Indiana bat. Final ruling for critical habitat for the Indiana bat was published on September 24, 1976 (41 FR 41914). There is no designated critical habitat for the Indiana bat in the Project Area (USFWS 2007). 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 radius could travel through the Project Area. Although there are no known maternity colonies in Benton County, maternity colonies have been documented in counties adjacent to Benton County (USFWS 2007), the closest of which is found in Warren County where the estimated distance to the edge of the maternity colony is 1.5 miles from the FRWF project boundary. Therefore, potential does exist for migrating/dispersing Indiana bats to occur within the Project Area.

In September 2009, the first documented take of an Indiana bat at a wind facility occurred at the FRWF; this was also the first record of an Indiana bat in Benton County. The second documented take also occurred at the FRWF in September 2010. Since then, Indiana bat mortality has been reported at three additional wind facilities:

(1) A single Indiana bat was taken at Duke Energy Corporation's North Allegheny Wind Farm located in Cambria and Blair counties, Pennsylvania in September 2011 (USFWS 2011b).

(2) A single Indiana bat was taken at The AES Corporation's Laurel Mountain Wind Power Facility located in Preston, Tucker, Barbour, and Randolph counties, West Virginia in July 2012 (USFWS 2012b).

(3) A single Indiana bat was taken at Iberdrola Renewable's Blue Creek Wind Farm located in Van Wert and Paulding counties, Ohio in 2012 (USFWS 2012c).

Mortality monitoring studies conducted under the FRWF's Scientific Research and Recovery Permit indicate that Indiana bat mortalities are not frequent or widespread at the FRWF (Good et al. 2011a). Fall bat mortality studies at the FRWF have verified that Indiana bats are taken at the FRWF during the fall migration period. Therefore, the Applicant has prepared an HCP and is applying for an ITP to ensure ESA coverage for operation of all four phases of the FRWF.

The two Indiana bat fatalities found at the FRWF were both determined to be fall-migrating individuals, based on the timing of the fatalities and the environmental characteristics of the Project Area (February 24, 2010 meeting minutes summary, Good et al. 2011a). The first fatality, collected September 11, 2009, was an intact, partially decomposed female found near Turbine 240. The second fatality, an adult female, was documented on September 18, 2010 at Turbine 640. At the time of the documented fatality, this turbine was being curtailed at a cut-in speed of 5.0 m/s (without a "feathering" strategy). No Indiana bat fatalities were documented at the site in 2011.

Species Description

Indiana bats are medium-sized, grayish brown bats with a forearm length of 1.4-1.6 inches and a total length of 2.8-3.8 inches. The tragus is short and blunt and measures slightly less than half the height of the ear. The tail is approximately 80% of the length of the head and body. The skull has a small sagittal crest and a small, narrow braincase. Indiana bats may be distinguished from the similar little brown bat and the northern long-eared bat by the presence of a keeled calcar and toe hairs that are shorter than the claws.

The distribution of Indiana bats is associated with the major cave regions of the Midwestern and eastern U.S. The range extends from Oklahoma, Iowa and Wisconsin east to Vermont and south to northwestern Florida. The bats migrate seasonally between winter and summer roosts. Hibernation typically occurs from October through April.

Indiana bats are relatively long-lived and produce few young per year (Barclay and Harder 2005). Similar to most temperate *Myotis* species, female Indiana bats give birth to one offspring per year (Humphrey et al. 1977; Kurta and Rice 2002). Mating occurs in the vicinity of the hibernacula in late summer and early fall during what is termed the swarming period, and fertilization is delayed until the spring (Guthrie 1933).

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

Habitat Requirements

Indiana bats have two distinct habitat requirements; (1) a stable environment in which to hibernate during the winter, and (2) deciduous woodland habitat for maternity roosts in the summer.

Indiana bats generally hibernate between October and April, although this may be extended from September to May in northern parts of their range (USFWS 2007). The majority of hibernacula are located in karst areas of the east-central U.S.; however, they are known to hibernate in other cave-like structures such as abandoned mines, buildings, a railroad tunnel in Pennsylvania, and a hydroelectric dam in Michigan (Kurta and Teramino 1994; Hicks and Novak 2002; Butchkoski and Hassinger 2002; USFWS 2007). Indiana bats typically require low, stable temperatures (below 50°F) for successful hibernation (Brack 2004; Tuttle and Kennedy 2002). Caves with the highest Indiana bat populations are typically large, complex systems that allow air flow, but their volume and complexity often buffer or slow changes in temperature (Brack 2004). These caves often have large rooms or vertical passages below the lowest entrance that allow entrapment of cold air that is stored throughout the summer, providing bats with relatively low temperatures in early fall (Tuttle and Kennedy 2002). Indiana bats tend to hibernate in large, dense clusters ranging from 300 to 500 bats per square foot (USFWS 2007; Boyles et al. 2008).

Following hibernation, female Indiana bats may travel up to 350 miles to their summer habitat where they form maternity colonies (Winhold and Kurta 2006); though individuals radio-tracked in the northeastern U.S. appear to travel much shorter distances (< 42 miles; Butchkoski et al. 2008; USFWS 2007). Habitat requirements during migration are not known. Roosting may occur at multiple locations while bats are migrating, or bats may fly directly to summer habitat, rarely stopping to roost along the way (Butchkoski and Turner 2006; Britzke et al. 2006; Hicks et al. 2005). Some male and non-reproductive female Indiana bats do not migrate as far as reproductive females and instead remain in the vicinity of their hibernaculum throughout the summer (Gardner and Cook 2002; Whitaker and Brack 2002).

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

In the summer, female Indiana bats predominantly roost under slabs of exfoliating bark, preferring not to use tree cavities, such as those created by rot or woodpeckers, but occasionally using narrow cracks in trees (Kurta 2004). Due to their cryptic nature, the first Indiana bat maternity colony was not located until 1971 (Cope et al. 1974; Gardner and Cook 2002); however, since that time, much of the work pertaining to summer Indiana bat habitat has concentrated on identifying and describing maternity colonies. Maternity colonies vary greatly in size in terms of number of individuals and number of roost trees used, with members of the same colony utilizing over 20 trees during one season (Kurta 2004). Roosts are usually located in dead trees, though partly dead or live trees (for example, if the species has naturally peeling bark) may also be used (USFWS 2007).

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

At least 33 species of trees have been used as roost trees, including various ash, elm, hickory, maple, poplar, and oak (USFWS 2007). Documented roost trees most frequently used include northern red oak (*Quercus rubra*), slippery elm (*Ulmus rubra*), eastern cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*), and shagbark hickory (*Carya ovata*) and typically have been located within 1,600 feet of a perennial or intermittent stream (Hoffman 1996). However, the species of the roost tree appears to be less of a factor than the tree's structure (i.e., the availability of exfoliating bark with roost space underneath) (USFWS 2007). Studies show that Indiana bats have strong fidelity to summer habitats. Females have been documented returning to the same roosts from one year to the next (Humphrey et al. 1977; Gardner et al. 1991; Callahan et al. 1997) and males have been recaptured when foraging in habitat occupied during previous summers (Gardner et al. 1991).

Maternity colonies generally have several separate roost areas located near one another that collectively provide the colony with the necessary roosting resources (including cover and correct temperature provided by exfoliating bark) needed during different environmental conditions. These colonies typically utilize one to a few primary roost trees (Callahan et al. 1997) that provide the proper roosting conditions most of the time and are normally large, dead trees with exfoliating bark that are exposed to abundant sunlight (Miller et al. 2002).

Indiana bats return to the vicinity of the hibernaculum in late summer and early fall where they exhibit a behavior known as "swarming". This involves large numbers of bats flying in and out of the cave entrances from dusk to dawn, though relatively few of the bats roost in the cave during the day (Humphrey and Cope 1977). During the swarming period most Indiana bats roost within approximately 1.5 miles of the cave, suggesting that the forests around the caves provide important habitat prior to hibernation (USFWS 2007). It is at this time that bats gain fat stores vital not only for winter survival, but also for when mating occurs. While females enter the hibernaculum soon after arrival at the site, males remain active for a longer period and may also travel between hibernacula - both of which may increase mating opportunities (USFWS 2007). Spring emergence from the hibernacula generally occurs from mid-April to the end of May and varies across the range, depending on latitude and weather conditions. Females typically emerge before males, traveling sometimes hundreds of miles to their summer habitat (Winhold and Kurta 2006).

Demographics

Very little is known about annual survival rates and background mortality for Indiana bats, either for adults or juveniles (USFWS 2007). It is expected however, that, similar to many other species, survival of Indiana bats is lowest during the first year of life and threats and sources of mortality vary during the annual cycle. During summer months, sources of mortality may include loss of occupied forested habitat, predation, human disturbance, and other man-made disturbances (Kurta et al. 2002; USFWS 2007). Sources of winter mortality may include natural predation, natural disasters that impact hibernacula, disturbance or modifications at the hibernacula and surrounding areas that physically disturb the bats or change the microclimate within the hibernacula, and direct human disturbance during hibernation that leads to disruption of normal hibernation patterns (USFWS 2007). More recently, WNS is impacting hibernating bats more than any other disturbance.[26]

In a study in Indiana, survival rates among male and female Indiana bats ranged from 66% to 76% for six to ten years after marking, with female longevity approximately 12 to 15 years and males 14 years (Humphrey and Cope 1977). The oldest known Indiana bat was captured 20 years after the first capture (LaVal and LaVal 1980). Research from banding studies during the 1970's suggests that adult Indiana bat survival during the first six years varies from approximately 70-76% annually (Humphrey and Cope 1977; O'Shea et al. 2004; USFWS 2007). After this period, annual survival varied from 36-66% and after 10 years dropped to approximately 4% (Humphrey and Cope 1977). There is less information available on neonatal survival, with one published study suggesting a neonatal survival rate of 92% based on observations at a maternal colony over a single season (Humphrey et al. 1977). More research is needed to accurately define annual survival rates of Indiana bats; however, available information suggests that annual mortality is likely to be between 8% and 64% during the first 10 years of life (USFWS 2007).

O'Shea et al. (2004) summarize survival rates for a number of species, including little brown bat, which is considered a similar species in terms of life history. The range of survival rates cited varies considerably from approximately 13-86% (O'Shea et al. 2004). Other *Myotis* species also had variable survival rates, ranging from 6-89%; however, general studies indicated that survival for first year juveniles was generally lower than for adults.

As with mortality or survival rates for Indiana bats, little is known about recruitment rates for the species; however, female Indiana bats typically give birth to one young per year (Mumford and Calvert 1960; Humphrey et al. 1977; Thomson 1982). The proportion of females in a population that produce young in a year is thought to be fairly high (USFWS 2007). In one study, greater than 90% of the females produced young each year (Humphrey et al. 1977) and in another it was estimated that 89% of adult females were annually reproductively active (Kurta and Rice 2002). Location and environmental factors likely influence reproductive rates and there is

[26] http://www.fws.gov/WhiteNoseSyndrome/

concern that environmental threats such as WNS may lead to lower reproduction rates (USFWS 2011c). Recruitment in the total Indiana bat population over the past five-year period has been variable by region with the Ozark-Central, Midwest, and Northeast Recovery Units showing decreasing trends from approximately 4 - 36% between 2007 and 2009; between 2009 and 2011, the Northeast Recovery Unit decreased approximately 54% with all other Recovery Units showing increasing trends from approximately 3 - 8% (USFWS 2012d). All Recovery Units except the Northeast demonstrated longer term increases from approximately 11 - 65% between 2003 and 2011; the Northeast Recovery Unit increased by 60% between 2003 and 2007 but has shown a decreasing trend since 2007 due to WNS (USFWS 2012d).

Range and Distribution

The range of the Indiana bat extends throughout much of the eastern U.S. and includes 22 States (Gardner and Cook 2002; USFWS 2007). Before the onset of WNS, the general population trends of Indiana bats over the past 40 years appeared to be decreasing in the southern and increasing in the northern regions of its range (USFWS 2007, 2012e).

Historically, Indiana bat winter range was restricted to areas of cavernous limestone in the karst regions of the east-central U.S., apparently concentrated in a relatively small number of large, complex cave systems, including Wyandotte Cave in Indiana; Bat, Coach, and Mammoth Caves in Kentucky; Great Scott Cave in Missouri; and Rocky Hollow Cave in Virginia. More recently, increasing numbers of Indiana bats have been found extending their winter range into some caveless parts of the country using man-made structures such as mines, tunnels, and buildings for hibernation (Kurta and Teramino 1994). For example, they have been found hibernating in several man-made tunnels and a church in Pennsylvania (Butchkoski and Hassinger 2002); and in 1993, an Indiana bat was discovered hibernating in a hydroelectric dam in Manistee County, Michigan 281 miles from the closest recorded hibernaculum located in LaSalle County, Illinois (Kurta and Teramino 1994). In 2005, approximately 30% of the population hibernated in man-made structures (predominantly mines) with the rest using natural caves (USFWS 2007).

Migration

According to the Draft Recovery Plan, the primary spring migration season is from the end of March to late-May and the primary fall migration period is from the end of July to mid-October. The actual migration periods may vary by latitude and weather with spring emergence occurring earlier in more southern areas and fall migration occurring earlier in more northern areas (USFWS 2007). Little is known about behavior of Indiana bats during migration such as flight heights, echolocation frequency, influence of weather, or whether they migrate singularly or in groups.

Data regarding the height at which Indiana bats fly during migration are severely lacking. However, it is clear that at least a portion of myotid bats are flying well above the tree canopy at rotor-swept height during migration, based on the five Indiana bat fatalities documented at wind facilities (two at FRWF; one each at the North Allegheny, Laurel Mountain and Blue Creek wind facilities), and the documented mortality of many other myotids at other wind facilities primarily during late summer and fall (USFWS unpublished data, as cited in USFWS 2011c). However, data indicate that these species are probably not flying within the rotor-swept zone as frequently as long-distance migrating tree bats; of all bat mortalities detected at wind power facilities, myotids and tri-color bats comprise only about 10% of total bat fatalities within the range of the Indiana bat (USFWS unpublished data, as cited in USFWS 2011c). This assumption is supported by anecdotal and empirical data that suggest that Indiana bats primarily migrate at the tree canopy level (Turner 2006; Robbins, Missouri State Univ., pers comm. 2010; Butchkoski pers. comm. 2010; Herzog NY Dept. of Env. Conserv., pers. comm. 2011; as cited in USFWS 2011c). It is unknown whether flight heights during spring and fall migration are similar.

Evidence from radio-tracking studies in New York and Pennsylvania indicate that Indiana bats are capable of migrating at least 30-40 miles in one night (Sanders et al. 2001; Hicks 2004; Butchkoski and Turner 2006). Studies reviewed in the Draft Recovery Plan appear to indicate that Indiana bat migration from winter to summer habitat is fairly linear and short-term, while in the fall it may be more dispersed and varied, with some studies showing that individuals may travel between 9-17 miles from a roost site to a swarming site (hibernaculum cave) (USFWS 2007). In addition, males and females appear to display different dispersal behavior, with females moving quickly between the hibernacula and maternal colonies, while males commonly remain in the proximity of the hibernacula or travel between hibernacula (USFWS 2007).

Species Status

<u>*Nationwide*</u> - A key component to the survival and recovery of the Indiana bat is maintenance of suitable hibernacula that ensure the over-winter survival of sufficient individuals to maintain population viability. The Draft Indiana Bat Recovery Plan (USFWS 2007) categorizes hibernacula into four groups based on the priority to the species population and distribution. Priority 1 hibernacula are essential to the recovery and long-term conservation of the species and have a current or historically observed winter population of ≥10,000 individuals. Priority 2 hibernacula contribute to the recovery and long-term conservation of the species and have a current or historical population of >1,000 but <10,000 individuals. Priority 3 sites have a current or historical population of 50-1,000 bats and Priority 4 sites have a current or historical population of fewer than 50 bats.

Since the release of the first Indiana Bat Recovery Plan (USFWS 1983), the USFWS implemented a biennial monitoring program at Priority 1 and 2 hibernacula (USFWS 2007). In 1965, the overall population was estimated to be over 880,000 individuals; however, while variation in the data collection apparently has led to variable estimates, in general, there has been a long-term declining population trend to approximately 380,000 individuals in 2001.

As of 2005, the estimated total population of Indiana bats, based upon a census of hibernacula, was approximately 457,000 bats, down from approximately 883,000 bats in 1965 (USFWS 2007), representing a decline of approximately 52%. In November 2006, there were 281 known extant Indiana bat hibernacula in 19 states (USFWS 2007). Over 90% of the population hibernated in just five states: Indiana (45.2%), Missouri (14.2%), Kentucky (13.6%), Illinois (9.7%), and New York (9.1 %); with 71.6% hibernating in just 10 caves. Overall, approximately 82% of the estimated total population in 2006 hibernated in 22 of the 23 Priority 1 hibernacula (USFWS 2007).

In 2007, the population showed a gradual increase to 467,947; however fell to an estimated 415,512 in 2009, a decrease of 11.2% in two years. The population had increased by 2.2% to 424,708 by 2011 (USFWS 2012d).

General patterns in the overall population estimates have shown a decreasing trend through the core range of the species in the Midwest and increasing trends on the periphery and more northern states (USFWS 2007). The causes of these population changes are unknown;

however, climate change may play a role by negatively affecting hibernacula temperature (USFWS 2007). More recently, populations across eastern North America have been affected by WNS which is having a dramatic effect on some populations, such as in Vermont (Frick et al. 2010). WNS is caused by the fungus *Geomyces destructans* and has caused the deaths of an estimated 5.7 million to 6.7 million bats, including Indiana bats (USFWS 2012e). The condition is associated with loss of winter fat stores, pneumonia, and the disruption of hibernation and feeding cycles. Mortality rates have been shown to exceed 90% over two years in infected caves (Frick et al. 2010).

Midwest Recovery Unit - The Draft Indiana Bat Recovery Plan divides the species range into four recovery units based on several factors, such as traditional taxonomic studies, banding returns, and genetic variation (USFWS 2007). The FRWF falls within the Midwest Recovery Unit (MRU) which includes the states of Indiana, Kentucky, Ohio, Tennessee, Alabama, southwestern Virginia, and Michigan (USFWS 2007). According to the Draft Indiana Bat Recovery Plan (USFWS 2007), the Revised 2007 Rangewide Population Estimate (USFWS 2008), and the 2011 Rangewide Population Estimate (USFWS 2012d), the overall population within the MRU was approximately 320,342 in 2007 and 281,909 in 2009 - a decrease of 12.0%; the 2011 population was approximately 305,297 – an increase of 8.3% from 2009 levels (Table 4.10; USFWS 2007, 2008, 2011d, 2012e). The MRU represents approximately 71.9% of the 2011 rangewide population of Indiana bats (USFWS 2012d). According to the Draft Recovery Plan, there are 190 known Indiana bat hibernacula within the MRU, with 116 being classified as extant (at least one record since 2000; USFWS 2007). There are 12 Priority 1 hibernacula in the MRU – seven in Indiana and five in Kentucky.

Table 4.10 Indiana Bat Population Estimates for the Midwest Recovery Unit (USFWS 2011d, 2012e)

State	2001	2003	2005	2007	2009	2011
Indiana	173,111	183,337	206,610	238,068	213,170	222,820
Kentucky	51,053	49,544	65,611	71,250	57,325	70,329
Ohio	9,817	9,831	9,769	7,629	9,261	9,870
Tennessee	4,192	3,246	3,221	2,929	1,663	1,690
Alabama	173	265	296	258	253	261
SW Virginia	272	430	202	188	217	307
Michigan	20	20	20	20	20	20
Total	**238,739**	**246,673**	**285,729**	**320,342**	**281,909**	**305,297**

Indiana - In 2007, approximately 50.8% of the estimated range-wide population of Indiana bats hibernated in Indiana (USFWS 2008). This increased to approximately 51.3% in 2009 and further to 52.5% in 2011 (USFWS 2012d). The long term trend since 2001 has been an increase in the numbers of Indiana bats in Indiana from approximately 173,111 to 222,280 (Table 4.10; USFWS 2011d, 2012e).

There are 37 known Indiana bat hibernacula in the state and of these, 32 have extant winter populations (at least one record since 2000; USFWS 2007). Of the extant Indiana hibernacula, seven are classified as Priority 1 (≥ 10,000), one is Priority 2 (1,000-9,999), 15 are Priority 3 (50-999), nine are Priority 4 (1-49) hibernacula, and two are unclassified (USFWS 2007). The Priority 1 hibernaculum, Wyandotte Complex in Crawford County, was estimated to have

126,448 Indiana bats in 2007 (USFWS 2008). All of the hibernacula in Indiana are found in the south central part of the state within the Interior Plateau ecoregion (USFWS 2007). All of Indiana is located in the Midwest Recovery Unit for Indiana bat (USFWS 2007).

The summer range of Indiana bats in Indiana is fairly ubiquitous. As of the 2007 Draft Indiana Bat Recovery Plan (USFWS 2007), 51 counties in Indiana (out of 92 total counties) had records of summer maternity colonies and an additional 14 counties had other summer records of Indiana bats (USFWS 2007).

Project Site / Local Population - Prior to the FRWF monitoring studies in 2009, there were no Indiana bat records from Benton County (USFWS 2007). The nearest known winter population is a Priority 2 hibernacula located approximately 105 miles away in La Salle County, Illinois (USFWS 2007).

Pre-and post-construction acoustic and mortality surveys conducted at the FRWF indicate that late summer mating and/or seasonal swarming do not occur within the Project Area. The Service 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 FRWF during the spring bat migration period (see letter dated August 5, 2011 in Appendix C). Based on the lack of potentially suitable summer habitat, no Indiana bats are expected to be in the FRWF area during the summer maternity season, approximately May to July. The two Indiana bat casualties were found in September, suggesting that fall migration is the period of highest risk for Indiana bats at the FRWF.

4.6.2.2 *Indiana State-Listed Species*

As part of coordination for FRWF Phases I – III, the IDNR indicated that 13 rare, threatened or endangered wildlife species had been documented in the vicinity of the FRWF (see IDNR letter dated September 22, 2006, Appendix C). As part of coordination for Phase IV, the IDNR indicated that 14 rare, threatened or endangered wildlife species had been documented in the vicinity of the FRWF (see IDNR letter dated July 5, 2013, Appendix C). Currently, the IDNR lists 23 wildlife species and 10 plants species as being documented in Benton County that are classified as endangered, threatened, rare or of special concern[27], including:

- Three Mollusks
  - Purple Lilliput (*Toxolasma lividus)* – Special Concern
  - Ellipse (*Venustaconcha ellipsiformis*) – Special Concern
  - Little Spectaclecase (*Villosa lienosa)* – Special Concern
- Two Insects
  - Beer's Blazing Star Borer Moth (*Papaipema beeriana)* – Threatened
  - A Noctuid Moth (*Macrochilo hypocritalis)* – Rare
- One Fish
  - Variegate Darter (*Etheostoma variatum)* – Endangered
- Two Reptiles
  - Blanding's Turtle (*Emydoidea blandingii)* – Endangered
  - Smooth Green Snake (*Liochlorophis vernalis)* – Endangered
- Eight Birds

[27] http://www.in.gov/dnr/naturepreserve/files/np_benton.pdf accessed August 15, 2012.

  - Short-eared Owl (*Asio flammeus*) – Endangered
  - Upland Sandpiper (*Bartramia longicauda)* – Endangered
  - Northern Harrier (*Circus cyaneus)* – Endangered
  - Sedge Wren (*Cistothorus platensis)* – Endangered
  - Least Bittern (*Ixobrychus exilis*) – Endangered
  - King Rail (*Rallus elegans)* – Endangered
  - Barn Owl (*Tyto alba)* – Endangered
  - Western Meadowlark (*Sturnella neglecta)* – Special Concern
- Seven Mammals[28]
  - Franklin's Ground Squirrel (*Spermophilus franklinii)* – Endangered
  - Plains Pocket Gopher (*Geomys bursarius)* – Special Concern
  - Eastern Red Bat (*Lasiurus borealis)* – Special Concern
  - Hoary Bat (*Lasiurus cinereus)* – Special Concern
  - Least Weasel (*Mustela nivalis)* – Special Concern
  - Northern Myotis (*Myotis septentrionalis)* – Special Concern
  - American Badger (*Taxidea taxus)* – Special Concern
- Ten Vascular Plants
  - Wild Hyacinth (*Camassia angusta)* - Endangered
  - Heavy Sedge (*Carex gravida)* – Endangered
  - Hill's Thistle (*Cirsium hillii)* – Endangered
  - Earleaf Foxglove (*Agalinis auriculata)* – Threatened
  - Downy Gentian (*Gentiana puberulenta)* – Threatened
  - Cattail Gay-feather (*Liatris pycnostachya)* – Threatened
  - Leiberg's Witchgrass (*Panicum leibergii)* – Threatened
  - Prairie Violet (*Viola pedatifida)* – Threatened
  - Western Silvery Aster (*Aster sericeus)* – Rare
  - Rough Rattlesnake-Root (*Prenanthes aspera)* – Rare

Many of these species have specific habitat requirements and little or no habitat for these species is present within the Project Area, and any habitat that may be present is generally marginal. To date, no mortality of threatened or endangered species is known from the FRWF, with the exception of the evening bat (see Section 4.5.2.4) and the Indiana bat (see Section 4.6.2.2.1).

4.7 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

4.7.1 Scope of Analysis

This section of the EIS describes the socioeconomic characteristics of Indiana, Benton County and the incorporated towns of Fowler, Boswell, Earl Park, and Oxford, all of which are within close proximity to the Project Area. U.S. Census 2000 and 2010 data (as available) were obtained for these areas; however, census data for unincorporated communities are not available and are not included in this section.

[28] Indiana bat and evening bat were recorded at the FRWF during post-construction surveys; however, neither species is currently included on the IDNR list for Benton County.

4.7.2 Existing Conditions

4.7.2.1 *Population Levels and Trends*

Population growth trends based on U.S. Census Bureau data (2000 and 2010) are summarized in Table 4.11.

Table 4.11 Historical Population Growth

Community	2000	2010	% Growth/Decline
Indiana	6,080,645	6,483,802	6.2%
Benton County	9,421	8,854	-6.0%
Fowler	2,415	2,317	-4.1%
Oxford	1,271	1,162	-8.6%
Boswell	827	778	-5.9%
Earl Park	485	348	-28.2%

Source: U.S. Census Bureau[29]

4.7.2.2 *Population Characteristics – Age and Racial Composition*

Population characteristics for the study area are presented in Table 4.12. Census data indicate the population of the study area is very homogeneous with respect to age. The median age of Fowler and Oxford residents is 38 years, compared to 36 years in Boswell and Earl Park. The median age in Benton County is 37 years.

A total of three census tracts are located within Benton County (Figure 4.7.2.2). Census tract data show that some areas of the county contain slightly higher minority populations than the county as a whole (Table 4.13).

Table 4.12 Population Characteristics

	2000 Population	Persons Under 19	Persons 20 through 64	Persons 65 and Older	Median Age
Indiana	6,080,645	1,763,386	3,564,268	752,831	35.2
Benton County	9,421	2,861	5,083	1,477	36.7
Fowler	2,415	709	1,270	436	37.6
Oxford	1,271	370	703	198	37.5
Boswell	827	254	407	166	36.1
Earl Park	485	150	241	94	35.5

Source: U.S. Census Data (2000)[30]

[29] http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml
[30] Ibid., U.S. Census

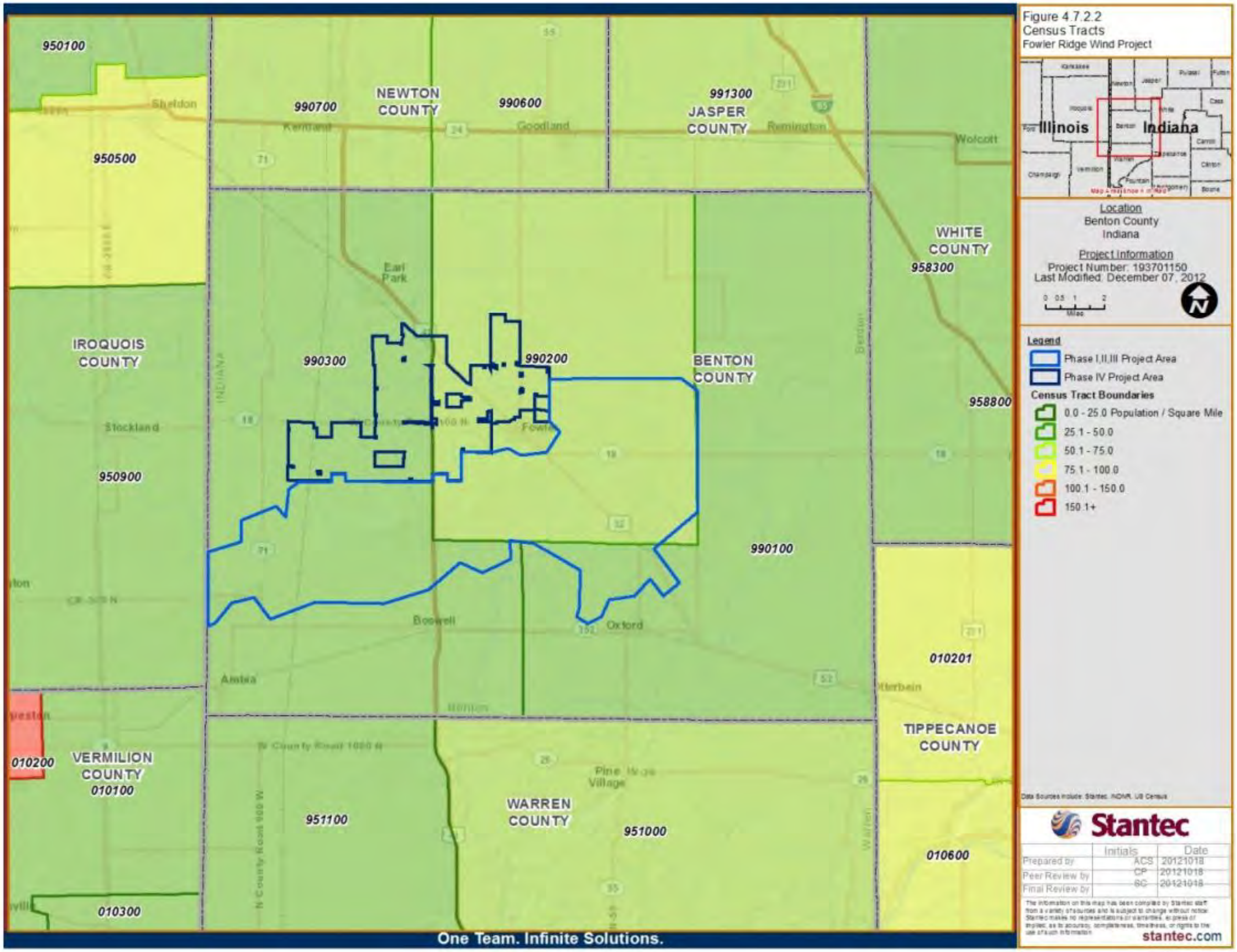


Figure 4.7.2.2
Census Tracts
Fowler Ridge Wind Project
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 07, 2012
Legend
Phase I,II,III Project Area
Phase IV Project Area
Census Tract Boundaries
0.0 - 25.0 Population / Square Mile
25.1 - 50.0
50.1 - 75.0
75.1 - 100.0
100.1 - 150.0
150.1+
Stantec
stantec.com
One Team. Infinite Solutions.
950100
950500
950900
010200
010100
010300
990700
990600
991300
990300
990200
990100
958300
958800
010201
010600
951100
951000
NEWTON COUNTY
JASPER COUNTY
WHITE COUNTY
IROQUOIS COUNTY
BENTON COUNTY
VERMILION COUNTY
WARREN COUNTY
TIPPECANOE COUNTY
Earl Park
Boswell
Oxford
Ambia
Goodland
Remington
Wolcott
Kentland
Sheldon
Pine Village
Stockland

Table 4.13 Racial Composition

	White	Black	American Indian	Asian	Native Hawaiian	Other[a]	Hispanic[b]	Total[c]	% Minority
Indiana	5,320,022	510,034	15,815	59,126	2,005	173,483	214,536	6,080,645	12.5
Benton County	9,129	20	13	8	0	251	245	9,421	3.1
Fowler	2,370	7	0	2	0	36	21	2,415	1.9
Oxford	1,244	2	1	1	0	23	13	1,271	2.1
Boswell	762	2	2	2	0	59	81	827	7.8
Earl Park	480	1	0	0	0	4	5	485	1.0
Census Tracts[d]									
9901	3,452	2	4	2	0	66	29	3,526	2.1
9902	3,175	12	0	3	0	60	39	3,250	2.3
9903	2,502	6	9	3	0	125	177	2,645	5.4

[a] Other indicates some other race or those persons of mixed descent.
[b] Hispanic can be of any race.
[c] Total does not include Hispanic
[d] See Figure 4.7.2.2
Source: U.S. Census Data (2000)[31]

4.7.2.3 *Environmental Justice*

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, states that “each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority populations and low-income populations.”

Environmental justice requirements were assessed by identifying and analyzing minority and low-income populations within the Project Area. Minority and low-income populations exist within Benton County and within the Project Area (Table 4.13). Census data indicate these populations are concentrated in certain census tracts (Figure 4.7.2.2) and within incorporated towns within the Project Area.

Economic Setting

Overall Economy

The major economic centers in the project vicinity are the towns of Fowler, Oxford, Boswell, and Earl Park. Income data for the study area is presented in Table 4.14 and is based on 2000 U.S. Census data which were created using economic data from 1999. The median household income for the state of Indiana was $41,567, while the median family income for the state was $50,261. The median household income and the median family income for Benton County were both lower than the state values and were $39,813 and $46,869 respectively.

Of the four incorporated towns near the Project Area, all had median household and median family incomes below the state levels, and only Fowler had median family income levels higher than the median county levels. Census tract data show that Tracts 9901 and 9902

[31] Ibid., U.S. Census

(Figure 4.7.2.2) had higher median household income and median family income than the county values, while Tract 9903 had lower median incomes.

The 2000 U.S. Census data indicate the percentage of people below the poverty level in Benton County (5.5%) and in the towns of Boswell (8.3%), Fowler (5.8%) and Oxford (5.1%) is below that of the state of Indiana (9.5%). The town of Earl Park had higher poverty levels than the state at 10.4%. Census tracts 9901 and 9902 have lower poverty levels than Benton County, while Tract 9903 had a higher poverty rate of 6.3%.

Table 4.14 Income

	Median Household Income	Median Family Income	Persons Below Poverty Level (%)
Indiana	$41,567	$50,261	559,484 (9.5%)
Benton County	$39,813	$46,869	505 (5.5%)
Fowler	$40,396	$50,586	132 (5.8%)
Oxford	$39,375	$45,966	63 (5.1%)
Boswell	$33,224	$36,136	70 (8.3%)
Earl Park	$32,981	$37,188	45 (10.4%)
Census Tracts			
9901	$42,193	$50,339	176 (5.1%)
9902	$40,368	$50,609	165 (5.3%)
9903	$35,349	$40,405	164 (6.3%)

Source: U.S. Census Data (2000)[32]

Housing

Table 4.15 shows the 2000 Census data for housing types in Benton County as well as the four incorporated towns in the study area. Census data indicate the majority of housing in the county, as well as incorporated towns, is single-family detached units. Single-family attached units were not common in the study area and generally make-up less than 1% of the housing units. Fowler had a higher percentage of multi-family attached units when compared to the other towns and Earl Park had the highest percentage of mobile homes.

Table 4.15 Housing Types

	Total Dwelling Units	Single-Family Detached Units (% of total)	Single-Family Attached Units (% of total)	Multi-Family Attached Units (% of total)	Mobile Homes (% of total)	Boat, RV, Van, etc. (% of total)
Benton County	3818	3340 (87.5)	42 (1.1)	287 (7.5)	145 (3.8)	4 (0.1)
Fowler	1014	848 (83.6)	9 (0.9)	153 (15.1)	0 (0)	4 (0.4)
Oxford	521	454 (87.1)	5 (1.0)	40 (7.7)	22 (4.2)	0 (0)
Boswell	365	322 (88.2)	2 (0.6)	28 (7.7)	13 (3.6)	0 (0)
Earl Park	177	155(87.6)	0(0)	8 (4.5)	14 (7.9)	0 (0)

Source: U.S. Census Data (2000)[33]

[32] Ibid., U.S. Census
[33] Ibid., U.S. Census

Table 4.16 shows the 2000 Census data household characteristics by county as well as by town. According to the 2000 Census data, the entire county of Benton is considered rural; therefore, all households in the county are considered rural. About 70% of households are located within incorporated towns in Benton County. The median owner occupied home value for the county is $75,000. The towns of Boswell and Earl Park have significantly lower median home values, while the towns of Fowler and Oxford have median home values that are comparable to those of the county. The median contract rent for the county is $341 and the median contract rent for each of the towns varies no more than 6.4% from the county value.

Table 4.16 Household Characteristics

	Number of Households	Average Persons Per Household Owner Occupied/Renter Occupied	Persons in Group Quarters	Median Value of Owner Occupied Housing	Median Contract Rent
Benton County	3558	2.62 / 2.51	202	$75,000	$341
Fowler	948	2.49 / 2.26	110	$77,100	$330
Oxford	485	2.60 / 2.35	40	$72,200	$319
Boswell	329	2.60 / 2.19	0	$59,300	$353
Earl Park	168	2.54 / 2.67	53	$57,300	$364

Source: U.S. Census Data (2000)[34]

4.7.2.4 *Work Force*

The following overview includes work force profiles for Benton County. Between 2000 and 2009, the population of Benton County decreased by 8.6% from 9,421 to 8,613. According to the U.S. Census Bureau, the 2009 population comprises approximately 0.1% of the state. A total of 3,771 people who live in Benton County are employed. This is a 60% decrease from the 6,335 people who lived in Benton County and were employed in 2000. As of March 2011 the unemployment rate for Benton County and Indiana as a whole was 8.8%, compared to 9.2% for the United States as a whole[35].

The industries which employed the greatest number of people in 2009 included educational services, manufacturing and wholesale trade. In 2009, these industries provided about 46% of the jobs in Benton County. Retail trade and federal, state and local governments also employed relatively large numbers of people, comprising 19% of the jobs in the county[36].

4.7.2.5 *Community Services*

This section discusses some of the community services provided by the county, towns and the incorporated population centers in the Project Area. Community facilities are located primarily within Fowler, which provides a full complement of municipal services to meet the community's needs.

[34] Ibid., U.S. Census
[35] http://www.stats.indiana.edu/profiles/profiles.asp?scope_choice=a&county_changer=18007
[36] Ibid., STATS Indiana

Fowler offers municipal water and wastewater and has a town water supply system that includes two high capacity municipal wells and a water supply plant incorporating the latest in water treatment technology, all of which is regulated by the city. A water storage facility has been constructed to provide water by gravity for balancing pressures, fire protection, and an emergency reserve. Fowler Sewer Department provides sewage treatment for residents and industry with a modern, fully certified water pollution control plant[37].

Fowler's police force offers resident security and traffic control. Fowler has dispatch capability through the Benton County Sheriff's Department, and also participates in area 911 service which provides for backup by county and state law enforcement personnel. The Fowler/Center Township fire department is a volunteer force of 24 personnel that work in cooperation with other area fire departments for mutual support and backup in Fowler and surrounding countryside.

4.8 CULTURAL AND HISTORIC RESOURCES

4.8.1 Scope of Analysis

For the purposes of this EIS, the assessments of cultural resources are focused on historic properties and archaeological data and properties found within Phase IV, particularly as they relate to the requirements of Section 106 of the of the NHPA, eligibility for inclusion on the National Register of Historic Places (NRHP), and requiring consideration of potential effects by federal agencies as per the NHPA (36 CFR 800) (see Section 1.3.6).

The standard methodology for assessment of cultural resources uses two distinct study areas:

(1) Direct Area of Potential Effect (APE), which includes any areas of ground disturbance caused by project-related activities; and

(2) Visual APE, which includes the viewshed of a project or the area within which project facilities can be viewed.

APE is the standard terminology used by cultural resources agencies and professionals to describe impacts on archaeological and architectural resources. For this Project, the direct APE is considered to be the Phase IV project area and the Indiana bat mitigation areas because it is only construction of Phase IV and restoration activities at the mitigation areas that have potential to directly impact cultural resources. Specifically, the direct APE includes the up to 94 turbine locations, access roads and buried interconnect lines, construction staging areas, and the substation location; and, Indiana bat mitigation sites including Wyandotte Cave and sites selected by FRWF and approved by the Service within a 2.5 mile radius circle around known maternity colonies in Indiana. At the request of the Indiana State Historic Preservation Office (SHPO), the visual APE includes the area within 1 mile of Phase IV turbine locations.

Cultural resources studies that have been completed to date for Phase IV include examination of the records of the IDNR Division of Historic Preservation & Archaeology's State Historic Architectural and Archaeological Research Database (SHAARD), the Indiana Register of Historic Sites and Structures, and the NRHP Database for previously recorded historic resources located within a one-mile radius of the Phase IV project area (Stantec 2012a, Stantec 2012b).

[37] Ibid., Town of Fowler

4.8.2 Existing Conditions

4.8.2.1 *Archaeological Resources*

In October 2012, Stantec Consulting Services conducted a desktop review of previously identified archaeological sites and searched SHAARD records for previously recorded archaeological resources within a one-mile radius of Phase IV.

Results of the review indicate that no known archaeological sites are located within Phase IV. Seven sites are located outside, but within one mile, of Phase IV.

Specific sites for the summer habitat mitigation have not yet been identified. Once sites have been identified, a search for previously identified archaeological sites on the selected properties would be conducted as per the PA described in Section 5.8.2.1.

4.8.2.2 *Historic Structures*

In September 2012, Stantec Consulting searched the SHAARD, Indiana Register of Historic Sites and Structures, and NRHP Database for previously recorded historic resources located within a one-mile radius of the Project.

A total of 262 historic resources are located within a one-mile radius of a proposed Phase IV wind turbine. Of the 262, 186 resources are rated as Non-contributing (i.e., not eligible for inclusion to the NRHP) or Contributing (i.e., not eligible for inclusion to the NRHP except if located in a historic district).

The remaining 76 resources are rated as Notable (i.e., potentially eligible for inclusion to the NRHP) or Outstanding (i.e., eligible for inclusion to the NRHP), including three NRHP listed resources:

(1) Fraser & Isham Law Office
(2) Fowler Theater
(3) Benton County Courthouse

All three NRHP listed resources are located within the town of Fowler and outside of Phase IV.

The remaining 73 resources, all but three of which are located within the town of Fowler and outside of Phase IV, include 17 Outstanding (i.e., eligible for inclusion to the NRHP) and 56 Notable (i.e., potentially eligible for inclusion) resources. The majority of these resources are historic houses but also include a smaller number of commercial buildings, places of worship, and a school.

Only three of the structures, all listed as Notable (i.e., potentially eligible for inclusion to the NRHP), are located within Phase IV:

(1) Windler Farm – located near the intersection of N 200 W and W Division Road
(2) Fowler Farm – located near the intersection of S 500 W and W 100 S
(3) Farm Building – located near the intersection of N 500 W and State Highway 18

All three structures have an area of significance listed as "Agriculture, Architecture". Two of the structures are located within one mile of several existing turbines constructed during earlier phases of the Fowler Ridge project.

4.8.2.3 *Tribal Resources*

Pursuant to the NHPA and American Indian Religious Freedom Act (AIRFA) and in an effort to identify other significant cultural resources that may be affected by a project or FWS action, the Service's Region 3 has developed interim guidance regarding consulting with federally-recognized Tribes based on the type of project or FWS action. No Tribal lands are located within or near the FRWF project area. The Service followed Region 3's interim guidance and determined that no further Tribal coordination was required.

4.9 TRANSPORTATION

4.9.1 Scope of Analysis

This section of the EIS describes the existing transportation facilities within and adjacent to the Project Area. This analysis area was used to account for the potential regional effects of the Project on transportation infrastructure. The transportation analysis is based on review of maps and satellite imagery and publicly available information from Indiana Department of Transportation (INDOT) and Benton County.

4.9.2 Existing Conditions

Roadways provide the primary source of transportation in this region. Roadways are used to reach major, commercial airports, such as the Indianapolis International Airport (approximately 100 miles southeast of the Project Area) and O'Hare International Airport in Chicago, Illinois (approximately 100 miles northwest of the Project Area).

U.S. Highway 52, which consists of a four-lane roadway through Fowler, U.S. Highway 41, located approximately three miles west of Fowler, and Interstate 65, located approximately 15 miles east of Fowler, connect the Project Area to the Chicago area to the north and Indianapolis to the south.

Two railroad lines traverse the Project Area: one runs north to south along the west side of the Project Area, and a second line runs northwest to southeast through the middle of the Project Area (Figure 4.9.2). Both lines are owned and operated by the Kankakee, Beaverville and Southern Railroad.

Limited air service in the Project Area is provided by the Kentland Airport, located approximately 12 miles north of Fowler. Charter service is available at the airport; however, no scheduled passenger service is provided.

There are no designated bikeways, scheduled public transit routes, or state-designated public recreational trails in the Action Area.

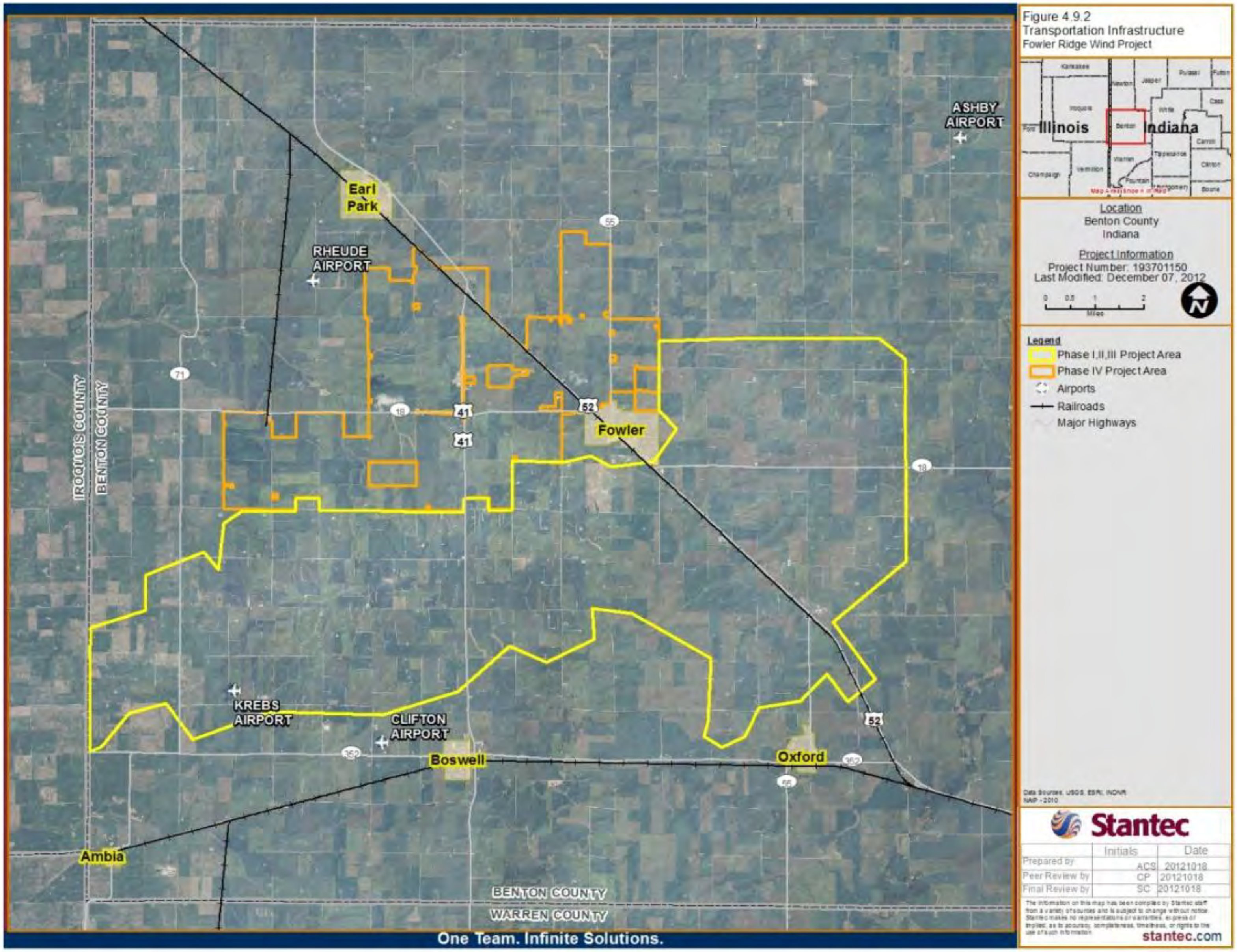


Figure 4.9.2
Transportation Infrastructure
Fowler Ridge Wind Project
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 07, 2012
Legend
Phase I,II,III Project Area
Phase IV Project Area
Airports
Railroads
Major Highways
Stantec
Initials
Date
Prepared by
ACS
20121018
Peer Review by
CP
20121018
Final Review by
SC
20121018
stantec.com
One Team. Infinite Solutions.
ASHBY AIRPORT
Earl Park
RHEUDE AIRPORT
Fowler
KREBS AIRPORT
CLIFTON AIRPORT
Boswell
Oxford
Ambia
BENTON COUNTY
WARREN COUNTY
IROQUOIS COUNTY
BENTON COUNTY

4.10 NOISE

4.10.1 Scope of Analysis

The noise analysis presented in this EIS covers Phase IV where up to 94 additional turbines would be constructed, with focus on the nearest potentially sensitive receptors to the wind turbine generators. The noise analysis is based on information from scientific literature, a background sound level survey that was conducted within and around Phase IV (TetraTech 2007), and a sound modeling program (Stantec 2011).

4.10.2 Existing Conditions

Noise is generally defined as loud, unpleasant, unexpected, or undesired sound that interferes or disrupts normal activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. Reaction of individuals to similar noise events is diverse and influenced by numerous factors, such as the type of noise, its perceived importance, the time of day during which the noise occurs, its duration, frequency, level, and community attitudes towards the source of noise.

Sound level measurements are often reported using the ‘A-weighting’ scale of a sound level meter. Since the human ear does not respond equally to all frequencies (or pitches), measured sound levels are often adjusted or weighted to correspond to the frequency response of human hearing and the human perception of loudness. A-weighting slightly boosts high frequency sound, while reducing low frequency components providing a better indicator of perceived loudness at relatively modest volumes. These measurements are called A-weighted levels, (abbreviated dBA). Ambient noise rarely occurs at a constant sound pressure. The concept of equivalent continuous sound pressure level (L_{eq}) is used to establish a measurement for average noise exposure in a given period to account for both high-level single events (bursts of noise) and relatively steady background sounds (quieter events). The L_{eq} quantifies the entire ambient noise as a single value for a specified period, i.e., an average sound level. Table 4.17 illustrates ranges of A-weighted levels for common noise sources.

Table 4.17 Common Sound Levels/Sources and Subjective Responses

Thresholds/Noise Sources	Noise Level (dBA)	Subjective Evaluations
Human Threshold of Pain Carrier jet takeoff (50 ft)	140	Deafening
Siren (100 ft) Loud rock band	130	
Jet takeoff (200 ft) Auto horn (3 ft)	120	
Chain saw Noisy snowmobile	110	
Lawn mower (3 ft) Noisy motorcycle (50 ft)	100	Very Loud
Heavy truck (50 ft)	90	
Pneumatic drill (50 ft) Busy urban street, daytime	80	Loud
Normal automobile at 50 mph Vacuum cleaner (3 ft)	70	
Large air conditioning unit (20 ft) Conversation (3 ft)	60	Moderate
Quiet residential area Light auto traffic (100 ft)	50	
Library Quiet home	40	Faint
Soft whisper	30	
Slight rustling of leaves	20	Very Faint
Broadcasting Studio	10	
Threshold of Human Hearing	0	

Noise standards applicable to WECS in Benton County are contained in Chapter 8, Zoning, Subdivision, Comprehensive Plan, Article 1. Zoning Code of Benton County, Section 8-7, Paragraph 7.B. Noise and Vibration Standards that Apply to WECS. The zoning regulations limit octave band sound levels to a maximum level in each of the eight standard octave bands from 63 Hertz (Hz) to 8 kilohertz (kHz) as measured at a distance of 200 feet from any primary residence as shown in Table 4.18.

The existing levels of background noise in Phase IV were determined by an ambient noise survey performed within the Project Area in August 2007 (TetraTech 2007). The ambient noise survey was conducted at three locations in the Project Area to determine the levels of ambient noise that correlate with different wind speeds related to the full operating range of the turbines from cut-in to fully operational. Noise levels ranged from a low of about 32 dBA to a high of 50 to 60 dBA for the L90 level. L50 levels were typically about 3 to 5 dBA higher (Figure 4.10.2).

Table 4.18 Benton County Noise Standards for WECS

Octave Band Center Frequency (Hz)	Maximum Permitted Level at 200 feet (dB)
63	75
125	70
250	65
500	59
1000	53
2000	48
4000	44
8000	41

4.11 VISUAL RESOURCES

4.11.1 Scope of Analysis

For the purposes of this EIS, the assessments of visual resources are focused on characterizing the visual environment of the visual APE, which consists of Phase IV and a one-mile buffer around the up to 94 Phase IV turbines, and on identifying existing and potential visual and aesthetic effects of wind turbines. Phases I – III are not included in the visual APE because the turbines in those phases were constructed in 2008 and 2009 and are now part of the visual landscape. The visual analysis is based on information gathered from review of aerial photography and site photographs, windshield surveys of Phase IV and the surrounding area, and photo simulations from various points within the APE.

4.11.2 Existing Conditions

Several basic land uses make up the landscape of Phase IV, including agricultural lands, rural farmsteads and residences, wetlands and waterways, and woodlands. Approximately 93% of landcover within Phase IV consists of agricultural land used for row crop production. The topography in Phase IV is generally flat with gently rolling slopes. The highest elevation of the study area is found within the town of Fowler, with the elevation gradually decreasing to the east, west, and north at an average slope of approximately 0.75%. There is a small natural increase in grade immediately south of the city center, rising only approximately 70 feet within one mile. These gradual slopes create wide, open views in both a north/south and east/west direction from the center of the city. There are currently 355 wind turbines in operation as part of FRWF Phases I through III, in addition to several wind farms operated by others in the county. These turbines are visible from Fowler and other communities within Benton County.

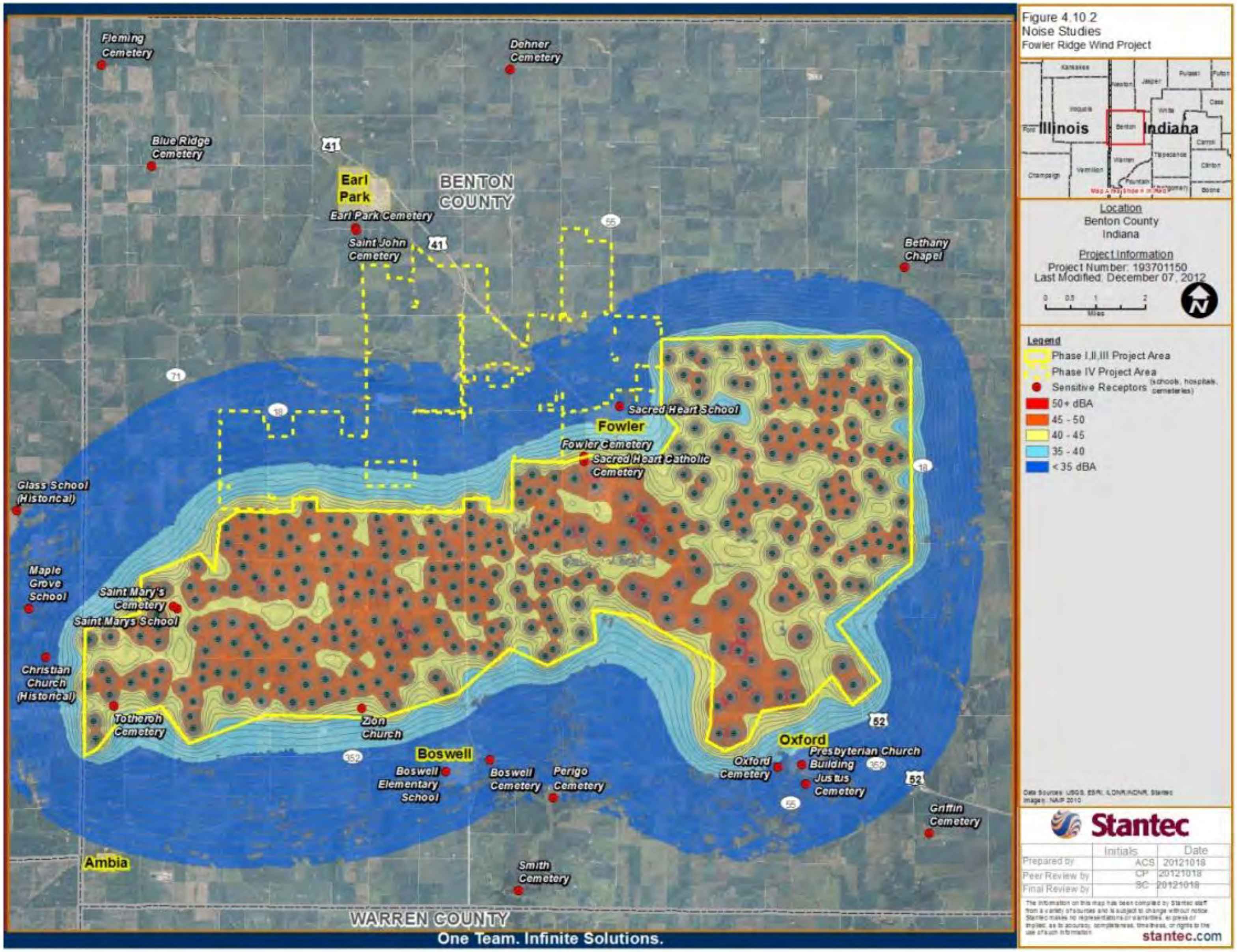


Figure 4.10.2
Noise Studies
Fowler Ridge Wind Project
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 07, 2012
Legend
Phase I,II,III Project Area
Phase IV Project Area
Sensitive Receptors (schools, hospitals, cemeteries)
50+ dBA
45 - 50
40 - 45
35 - 40
< 35 dBA
Fleming Cemetery
Dehner Cemetery
Blue Ridge Cemetery
Earl Park
BENTON COUNTY
Earl Park Cemetery
Saint John Cemetery
Bethany Chapel
Sacred Heart School
Fowler
Fowler Cemetery
Sacred Heart Catholic Cemetery
Glass School (Historical)
Maple Grove School
Saint Mary's Cemetery
Saint Marys School
Christian Church (Historical)
Totheroh Cemetery
Zion Church
Boswell
Boswell Elementary School
Boswell Cemetery
Perigo Cemetery
Oxford
Oxford Cemetery
Presbyterian Church Building
Justus Cemetery
Griffin Cemetery
Ambia
Smith Cemetery
WARREN COUNTY
One Team. Infinite Solutions.
Data Sources: USGS, ESRI, ILDNR/INDNR, Stantec
Imagery: NAIP 2010
Stantec
Initials
Date
Prepared by
ACS
20121018
Peer Review by
CP
20121018
Final Review by
SC
20121018
stantec.com

The towns of Fowler and Earl Park are located within the visual APE. These towns are characterized by residential and commercial development. Buildings (typically 2-3 stories tall or less) and other man-made features dominate the landscape. These structures are highly variable in their size, architectural style, and arrangement. Views within the towns are typically focused on the roadways and adjacent structures. Outward views occur most often at open road corridors, across yards and adjacent fields, and at the edges of the towns.

Currently, 355 wind turbines are in operation as part of Phases I through III, and there are 150 turbines associated with two other wind farms operated by others that are adjacent to FRWF. Turbines from all of these existing wind farms are visible from many locations within Phase IV and from locations within Fowler and Earl Park.

The Visual APE includes resources (sites and locations) that are potentially sensitive to changes in the visual landscape:

(1) Historic Sites: Three NRHP listed resources (see Section 4.8.2.2). All three are located within the town of Fowler.

(2) Resources that are regionally or locally significant, such as schools, churches, and cemeteries

Viewer groups within the visual APE can be classified into two general groups: 1) local residents which view the wind farm on a daily basis; and, 2) those groups which view the wind farm while traveling through Benton County and the Project Area.

4.12 AIR QUALITY AND CLIMATE

4.12.1 Scope of Analysis

No air monitoring sites are located in Benton County. Therefore, the air quality analysis presented in this EIS is based on the closest air monitoring station to the Project Area. The land use type in Benton County and these adjacent counties are similar (i.e., mostly rural and small town); therefore, ambient concentrations obtained from these stations were assumed to be representative of the ambient concentrations in the Project Area. The air quality analysis in this EIS is based on the air quality data described above and information from publicly available online databases and/or documents produced by the USEPA, the primary federal agency mandated with protecting and regulating air quality in the U.S.

4.12.2 Existing Conditions

Data presented in this section were obtained using the USEPA AirData website.[38] The closest active air-quality monitoring station, located approximately 28 miles southeast of Phase IV, is the Lafayette Cinergy Substation located in the town of Lafayette in Tippecanoe County.

The Lafayette Cinergy Substation monitoring station monitors carbon monoxide, nitrogen dioxide, ozone, and sulfur dioxide levels, in addition to particulate matter greater than 2.5 micrometers in size. All levels monitored at the station are within air quality standards set forth by the USEPA.[39] Based on the available air quality information[40], the air quality in the Project area is in attainment for all monitored criteria pollutants[41].

[38] http://www.epa.gov/airdata/
[39] Ibid. USEPA Air Data

4.12.3 Greenhouse Gases

Greenhouse gases (GHGs) are gases that warm the earth's atmosphere by absorbing solar radiation reflected from the earth's surface. The most common greenhouse gases are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). According to USEPA (2009), scientists know with virtual certainty that increasing greenhouse gas concentrations are warming the planet and that rising temperatures may, in turn, produce changes in precipitation patterns, storm severity, and sea level, commonly referred to as "climate change."

The atmospheric buildup of carbon dioxide and other greenhouse gases is largely the result of human (anthropogenic) activities, such as the burning of fossil fuels (USEPA 2000). Of the total amount of U.S. greenhouse gases emitted in 2010, approximately 87% were energy-related, and 91% of those energy-related gases were carbon dioxide from the combustion of fossil fuels[42]. Global carbon emissions from fossil fuels have significantly increased since 1900. In addition to carbon, combustion of fossil fuels also produces other air pollutants, such as nitrogen oxides, sulfur dioxide, volatile organic compounds and heavy metals, which negatively affect human health, along with air and water quality.

Electric power generation is the largest source of energy-related CO_2 emissions in the U.S., accounting for 40% of the nation's total energy-related CO_2 emissions in 2011[43]. Nationwide, the U.S. currently obtains 72% of its electricity from fossil fuels, with 49.6% coming from coal[44]. Coal has the highest carbon dioxide content per unit of electricity produced of all fossil fuels used to provide electricity in the U.S.[45]. Emissions from coal-fired power plants account for approximately 80% of carbon dioxide emissions by electric power plants[46]. Indiana relies heavily upon coal for its electrical generation, with 83% of electricity generated in 2011 produced from coal[47], and Indiana ranks sixth in terms of tons of carbon dioxide emissions produced annually, following California, Florida, Ohio, Pennsylvania, and Texas.

4.13 COMMUNICATIONS

4.13.1 Scope of Analysis

This section of the EIS describes the communication facilities that may be present within Phase IV, including radio and television broadcast signals, microwave, cellular and two-way radio signals, and wireless internet. The existing conditions presented here are based on publically available information sources.

---

[40] http://www.epa.gov/airdata/
[41] http://www.in.gov/idem/6785.htm
[42] http://www.eia.gov/energy_in_brief/greenhouse_gas.cfm
[43] Ibid
[44] http://www.epa.gov/cleanenergy/energy-and-you/index.html
[45] http://www.eia.gov/tools/faqs/faq.cfm?id=73&t=11
[46] http://www.eia.gov/oiaf/1605/ggrpt/carbon.html
[47] http://www.eia.gov/state/state-energy-profiles.cfm?sid=IN

4.13.3 Existing Conditions

4.13.3.1 *Microwave Paths*

Microwave telecommunications systems transmit and receive line-of-sight signals across Phase IV. The microwave band beam range is generally 960 megahertz to 23 gigahertz frequency band range.

4.13.3.2 *Television*

Television broadcast signals pass through and are received within Phase IV.

4.13.3.3 *Cellular and Two-Way Radio*

Cellular and two-way radio signals are transmitted through Phase IV.

4.13.3.4 *Wireless Internet*

Wireless internet connections are influenced by the strength of incoming signals which rely on line-of-sight between antennae for maximum signal strength. Wireless internet systems within Phase IV are unknown.

4.14 HEALTH AND SAFETY

4.14.1 Scope of Analysis

This section describes the issues related to public health and safety as they relate to a wind power facility located in a rural agricultural setting. The safety issues described in this section are primarily related to operation and/or failure of one or more FRWF components and are limited to the Project Area. The health and safely analysis is based on information from scientific studies and data generated from wind projects currently operating in the U.S.

Public safety concerns associated with a wind facility may arise during project construction, operation, or decommissioning, and are largely due to the potential for falling overhead objects. Examples include ice shedding, tower collapse and blade failure. Other health and safety concerns may include stray voltage, fire, lightning strikes, and shadow flicker. Wind turbine noise is also a concern and is discussed in Section 4.10.

To date, FRWF has not experienced any catastrophic failure of Project components. The entire facility operates under a Health and Safety Plan which addresses, among other things, conducting daily job safety evaluations prior to the start of any work activities, safely approaching potential icing situations, emergency response, working at heights, energy isolation, ground disturbance and driving safety. FRWF restricts access to the substation and O&M building, which are fenced as required for public safety.

4.14.2 Existing Conditions

4.14.2.1 *Structural Failure and Ice Shedding*

Turbine structural failure includes turbine collapse and blade shear. Blade shear occurs when a turbine blade detaches and is thrown due to the spinning motion. Ice shedding occurs when ice builds up on a turbine blade and either sheds straight to the ground or is thrown by the spinning motion. Under such conditions, ice would build up on the rotor blades and/or sensors, slowing its rotational speed and potentially creating an imbalance in the weights of the blades. Turbine control systems are designed to sense such effects of ice accumulation and to shut down the turbine until the ice melts. Threats to public safety are expected to be minimal due to required setbacks from residential structures and roads. Turbines in FRWF Phases I – III are a minimum of 1,320 feet from residences, a minimum of 1.5 times the turbine height (turbine height is defined as maximum blade tip height) from 4-lane highways and a minimum of 1.1 times the turbine height from all other roads.

4.14.2.2 *Lightning Strikes*

Wind turbines are susceptible to lightning strikes due to their height and metal/carbon components. The energy discharged during a lightning strike can cause severe damage to blades, which may lead to complete blade failure, although blade failure from lightning strikes is uncommon. All modern wind turbines include lightning protection systems which are designed to prevent catastrophic blade failure. To protect wind turbines from damage caused by lightning strikes and to provide grounding for the electrical components of the turbine, each turbine is equipped with an electrical grounding system.

4.14.2.3 *Shadow Flicker*

Shadow flicker from wind turbines can occur when moving turbine blades pass in front of the sun, creating alternating changes in light intensity or shadows. These flickering shadows can cause an annoyance when cast on nearby residences (“receptors”). The distance between a wind turbine and a receptor, along with weather characteristics such as wind direction and sunshine probability are key factors related to shadow-flicker impacts. Shadow flicker becomes much less noticeable at distances beyond about 305 m (1,000 ft), except at sunrise and sunset when shadows are long (NRC 2007). The effects of shadow flicker are expected to be minimal due to setbacks from residential structures and roads. Turbines in FRWF Phases I – III are a minimum of 1,320 feet from residences and a minimum of 1.5 times the turbine height (turbine height is defined as maximum blade tip height) from 4-lane highways and a minimum of 1.1 times the turbine height from all other roads

4.14.2.4 *Fire and Fuels*

Although the turbines contain relatively few flammable components, the presence of electrical generating equipment and electrical cables, along with storage and use of various oils, including diesel fuels, lubricating oils, and hydraulic fluids, can create the potential for fire or medical emergencies within the tower or the nacelle, or in places where these oils may be stored such as the substation, electrical transmission structures, staging area(s), and the operations and maintenance building.

The fire risk associated with FRWF operations and maintenance is similar to risk associated with other industrial and storage facilities. Wind turbine operations and maintenance personnel are trained in fire safety and response.

5.0 ENVIRONMENTAL CONSEQUENCES

This chapter describes the environmental effects of each of the four alternatives in Chapter 3 that were retained for detailed analysis and are summarized in Table 5.1. The chapter is organized by resource as in Chapter 4. Each of the alternatives would include construction of Phase IV (i.e., the same number and location of turbines and other Project-related facilities) and operation of Phases I through IV of the FRWF. The four alternatives differ from each other only with respect to operational adjustments. As such, resources that are not affected by operational adjustments (e.g., soils, water resources, vegetation, cultural resources, etc.), and are only affected by construction or the physical footprint of Phase IV, would be affected in the same manner under any of the four alternatives. Therefore, in order to avoid redundancy and streamline the chapter, within each resource section, the environmental effects of each alternative are discussed by impact type:

(1) Construction impacts

(2) Operations impacts

(3) Maintenance impacts

(4) Decommissioning impacts

The Applicant has determined preliminary locations for up to 94 turbines (Figure 1.1, Chapter 1), and minor modifications to the locations may occur prior to finalization of construction. The up to 94 Phase IV turbines would be sited entirely in agricultural fields within Phase IV, and all regulations, requirements, and minimization and avoidance measures described in this chapter would be implemented for up to 94 additional turbines.

This chapter describes the effects of construction of up to 94 Phase IV turbines and the operation of 449 (355 Phase I – III and 94 Phase IV) turbines. For the purposes of the EIS, “Project” refers to FRWF Phases I – IV, and “Phase IV” refers only to the proposed FRWF Phase IV project. Phase IV Project Area refers to an area including all Phase IV turbines bounded by a one-mile buffer. The direct and indirect effects of each alternative are described in each resource section. Each resource section concludes with a summary of effects each alternative would have on that resource. These sections are followed by a cumulative effects analysis.

Table 5.1 Summary of Alternatives

Alternative	Facility	Operations	HCP Implemented	BBCS[1] Implemented
No Action Alternative	449 (355 Phase I – III and up to 94 Phase IV) turbines and associated facilities and infrastructure	All 449 turbines would be shut down (i.e., non-operational) from sunset to sunrise from August 1 - October 15	No	Yes
3.5 m/s Cut-In Speed (Feathered) Alternative	Same as No Action Alternative	Cut-in speed on all 449 turbines would be set to 3.5 m/s from sunset to sunrise from August 1 - October 15 each year of the operational life of the Project. Blades feathered below cut-in wind speed	Yes	Yes
5.0 m/s Cut-In Speed Alternative	Same as No Action Alternative	Cut-in speed on all 449 turbines would be raised to 5.0 m/s when nightly air temperatures are 50° F or above from sunset to sunrise between August 1 and October 15 each year during the operational life of the Project. Blades feathered below cut-in wind speed	Yes	Yes
6.5 m/s Cut-In Speed Alternative	Same as No Action Alternative	Cut-in speed on all 449 turbines would be raised to 6.5 m/s when nightly air temperatures are 50° F or above from sunset to sunrise from August 1 – October 15 each year of the operational life of the Project. Blades feathered below cut-in wind speed	Yes	Yes

[1] Bird and Bat Conservation Strategy, Appendix D

5.1 GEOLOGY AND SOILS

5.1.1 Impact Criteria

There are no specific regulations regarding soils or geology that are applicable to this analysis. Impacts to soils and geologic resources may, however, have indirect and secondary effects on other resources. NEPA and CEQ guidelines indicate that unique geologic resource features should be protected and soil erosion minimized. In addition, project siting should avoid potential geologic and landslide hazards, including known earthquake faults, and other such hazards that may pose high risk loss or damage to people, structures, plants, or animals. No concerns related to geology and soils were identified during the scoping period.

5.1.2 Construction Effects

All four alternatives under consideration include using the following measures to avoid or minimize impacts to geology and soils during construction of Phase IV. For a full list of best management practices (BMP), see Appendix E.

(1) A SWPPP, including an Erosion and Sediment Control Plan, would be implemented, consisting of stabilization of steep slopes with geotextiles or other similar devices (particularly during rain events), silt fences, hay bale dikes, or other suitable methods of slowing sheet flow and retaining sediment onsite.

(2) The National Pollutant Discharge Elimination System (NPDES) General Construction Storm Water permit would include restoration measures to ensure that disturbed ground is stabilized, preventing ongoing erosion and sedimentation of storm water run-off. These restoration measures consist of revegetation (preferably using native species, but exceptions may be made based on land use), regrading, and permanent swales or catch basins as needed.

(3) Topsoil removed from disturbed areas would be stockpiled and retained for reapplication once site disturbance is complete.

(4) Construction access outside of roads would be minimized in order to limit soil compaction.

(5) Compacted soils would be restored through manual or mechanical cultivation to re-aerate the soil and promote seed germination.

(6) Areas subject to temporary disturbance (outside the permanent Project footprint but disturbed during construction) would be revegetated in accordance with the Erosion and Sediment Control Plan. In areas that are currently under active agricultural use, revegetation would likely consist of resuming existing agricultural production. In non-cultivated areas, revegetation would involve reseeding with native vegetation or other suitable seed mix[48] made based on land use and mulching to encourage new growth.

Construction activities for up to 94 Phase IV turbines would take place over a period of 12 months. Under any of the four alternatives, the effects of construction of Phase IV would be

[48] http://www.wfyi.org/NaturalHeritage/participate/INPAWS2.pdf

limited largely to surface soil disturbance. Construction would not impact karst formations or caves. The Project is located in a low-level earthquake risk zone[49].

Although the preliminary locations for up to 94 turbines have been determined (Figure 1.1, Chapter 1), minor modifications to the locations may occur prior to finalization of construction. Turbine locations will not change by more than 95 feet from the currently proposed locations. These preliminary locations are necessary to allow modifications should sensitive resources be discovered at a turbine site at the start of construction. Nonetheless, final turbine sites will remain within the delineated Phase IV Project Area and within active agricultural land.

Most of the impacts resulting from turbine construction would occur on land that is currently used for row crop production and is regularly disturbed through cultivation. Phase IV would necessitate construction of temporary crane pads at each turbine site, temporary travel roads for the cranes, temporary turning areas for oversized equipment at certain county and local road intersections, temporary laydown areas around each turbine, trenching for the underground electrical collection and communication system, substation construction, and temporary storage/stockpile areas. Construction of each turbine would result in temporary impacts of approximately 10 feet on either side of the permanent roadway width, a 60-foot x 80-foot gravel crane pad extending from the roadway to the turbine foundation, and a 150-feet radius rotor laydown area centered on the turbine foundation. Construction of the substation would require a 5-acre parcel currently in row-crop production.

Construction of the up to 94 turbines, associated infrastructure and the substation would affect no more than 554 acres of soil; 475.8 acres would be temporarily disturbed during construction and would be restored to pre-construction conditions at the end of construction, and approximately 78.2 acres would be permanently impacted and covered with impervious surfaces and/or gravel which would remain in place for at least the life of the Project.

Restored sites would be returned to the original land uses following construction. All disturbed areas would be graded to the approximate original contour. Restored areas would be stabilized using appropriate erosion control measures, including site-specific contouring, reseeding, or other measures agreed to by the landowner and designed and implemented in compliance with the Project's SWPPP. Disturbed areas around each turbine (outside of the foundation and pad) would be left to passively re-vegetate or be returned to crops.

Surface disturbance would be contained within road ROWs, which would average a width of 36 feet along turbine/crane access roads. Final road grading and preparation would include reducing the construction road width to the final 16 feet. Adjacent areas would be reclaimed to current landcover types, and surface contours would be directed away from any cut-and-fill slopes and into ditches that discharge to natural drainages as necessary. SWPPPs include standard sediment control devices to minimize soil erosion during and after construction. Following construction, all unused construction materials and waste would be picked up and removed from the Phase IV area and waste materials would be disposed of at approved and appropriate landfills.

Under any of the four alternatives, there would be periodic and localized soil disturbance resulting from construction of Phase IV. None of the alternatives is expected to result in

[49] http://earthquake.usgs.gov/earthquakes/states/indiana/hazards.php

significant soil erosion during construction provided that BMPs are effectively implemented. Construction of Phase IV under any of the four alternatives would not result in significant adverse effects to geologic features or soils. Phase IV construction includes the measures 1-6 listed above. The Applicant is committed to maintaining site soil integrity so that temporarily disturbed lands continue to serve as prime farmland and high-quality agricultural land.

5.1.3 Operations Effects

No effects to site soils or geological resources are anticipated from the operation of Phase IV under any of the four alternatives.

5.1.4 Maintenance Effects

No impacts to site soils or geological resources are anticipated from the maintenance of Phase IV under any of the four alternatives.

5.1.5 Decommissioning Effects

Impacts on soils and geology associated with decommissioning activities under any of the four alternatives would be related to removal of the turbines, concrete foundations, and other facilities, with the exception of the underground collection systems or other landowner requests. Concrete foundations would be removed to a depth of at least four feet below the surface. Removal of access roads would occur if required by the landowner. The impact of road removal (i.e., ground disturbance) would be generally equivalent to that of the construction phase. In general, the impacts of decommissioning would be temporary and comparable to construction-related impacts. As with construction, the Applicant is committed to restoring site soil integrity so that disturbed lands serve as high-quality agricultural land following reclamation.

5.1.6 Mitigation for Impacts to Geology and Soils

No adverse impacts on soils and geologic resources would occur during Phase IV construction or Project operations, maintenance, and decommissioning under any of the four alternatives. During construction of Phase IV, impacts would be primarily temporary and localized, and BMPs (Appendix E) would be implemented to minimize soil erosion. Therefore, no specific mitigation measures for geology and soils in addition to the avoidance and minimization measures listed above would be implemented for any of the four alternatives.

5.1.7 Summary of Effects to Geology and Soils

- No concerns related to geology and soils were identified during the scoping period.
- Construction and decommissioning of Phase IV under any of the four alternatives would result in short-term and localized effects on soils and geologic resources.
- Implementation of a SWPPP is expected to minimize soil erosion during construction, maintenance, and decommissioning.
- No effects on soils and geologic resources would occur as a result of operation of the FRWF.
- Effects to soils and geologic resources are expected to be minor, and none of the four alternatives would result in significant adverse effect to soils and geologic resources.

- No specific mitigation measures for geology and soils in addition to the avoidance and minimization measures listed above would be implemented under any of the four alternatives.

5.2 LAND USE

5.2.1 Impact Criteria

NEPA analysis must consider the effects of the alternatives on land use and recreation. Effects of an alternative would be considered significant if they result in elimination of current land uses within Phase IV. This analysis evaluates the Project's compatibility with local land use, planning, zoning, planned development, and the positive or negative effects on existing recreational areas and resources. In addition, because the purpose of the FPPA is to minimize the extent to which Federal programs contribute to unnecessary conversion of farmland to non-agricultural uses, this analysis also includes effects on farmland preservation programs. No issues related to land use were identified during the scoping period.

5.2.2 Construction Effects

The effects on land use associated with the construction of Phase IV would be the same under any of the four alternatives and are anticipated to be largely temporary. Phase IV would be sited and constructed in compliance with Benton County's Wind Energy Siting Ordinance[50] (see Section 1.3.13.1), and all required permits would be obtained. All turbines would be sited to meet the required setbacks as per the ordinance and meet all specifications related to safety, color, lighting, and noise.

Construction of Phase IV would be consistent with the goals set forth in Benton County's draft Comprehensive Land Use Plan[51], which states that Benton County was chosen as the site for Indiana's first wind farm and lists as one of the plan's goals to "support wind farms and renewable energy projects". The plan identifies future land use in the Phase IV area as agricultural. Phase IV is consistent with this planned future use, would provide income to local farmers through lease payments, and provide incentive for conserving agricultural land. In addition, construction of Phase IV would make economic contributions to the local communities through tax payments (see Section 5.7, Socioeconomics and Environmental Justice).

Multiple BMPs will be implemented at the project (Appendix E), and significant impacts to agricultural land will specifically be avoided through efforts to:

(1) Coordinate with landowners on Phase IV design, including using existing field entrances and farm lanes and locating infrastructure along field edges;

(2) Avoid disturbance of surface and subsurface drainage features and repair all inadvertently damaged tile lines;

(3) Maintain access roads throughout construction to allow continued use/crossing by farmers and farm machinery; and,

(4) Confine construction access to roads in order to minimize soil compaction.

---

[50] http://www.in.gov/oed/files/Benton_County_Wind_Ordinance.pdf
[51] http://ldm.agriculture.purdue.edu/Pages/Resources/PlanIN.html#LinksAdams

The Phase IV footprint would affect a small amount of land relative to the size of the project area. Construction of Phase IV would not alter the predominantly agricultural land use in the Phase IV area or the surrounding area. Furthermore, Phase IV construction would not have adverse effects to recreation resources found on public lands.

In accordance with the FPPA, a Farmland Conversion Impact Rating Form, AD-1006, was completed to determine impacts to prime and unique farmland as a result of construction of Phase IV (Appendix F). Approximately 97% of the farmable land in Benton County is considered prime and unique farmland (Appendix F). Construction of Phase IV would permanently impact only 78.2 acres of prime and unique farmland (0.03% of the prime and unique farmland in the county). Therefore, construction of Phase IV under any of the four alternatives would not result in significant effects to prime and unique farmland.

The presence of heavy construction equipment, workers, and increased traffic are not typically associated with rural-agricultural areas; however, dust, noise, and large farm machinery on public roads are common at certain times of the year. These impacts are not anticipated to occur in areas used for recreation, such as golf courses or parks, and any such effects would be short-term and last only until construction activities were completed.

5.2.3 Operations Effects

Operation of all Phases of the Project would not directly impact local land use categorizations (i.e., agricultural land). Additionally, neither the current nor future designation would be altered by the operation of Project. Landowners whose property is directly impacted by the project would be compensated through lease payments throughout the life of the project. Aside from land utilized for turbine pads and access roads, land surrounding each turbine would remain in agricultural use. Based on the local plans analyzed, Project operations would be consistent and compatible with the goal set forth by Benton County's draft Comprehensive Land Use Plan of supporting wind farms and renewable energy projects.

5.2.4 Maintenance Effects

Maintenance activities associated with Project operations under any of the four alternatives would not result in significant adverse effects to overall land use within any Phase of the Project area.

5.2.5 Decommissioning Effects

Decommissioning of the Project would not immediately affect the land use or recreational resources of the area. Similar to construction, impacts would be minimized through planning and implementation of avoidance and minimization measures (see Section 5.2.2 above). It is anticipated that as Project facilities are removed, affected areas would be returned to row crop production.

5.2.6 Mitigation for Impacts to Land Use

Construction and operation of Phase IV would not have a significant effect on land use or recreation, therefore, no specific mitigation measures are proposed in addition to the avoidance and minimization measures discussed above.

5.2.7 Summary of Effects to Land Use

- No issues related to land use were identified during the scoping period.
- None of the four alternatives under consideration includes actions that are inconsistent with local land use, zoning or future planned development.
- No significant adverse effects to land uses are anticipated as a result of construction of Phase IV, or operation, maintenance, and decommissioning of all four phases under any of the four alternatives.
- No specific mitigation measures are proposed in addition to the avoidance and minimization measures discussed above under any of the four alternatives.

5.3 VEGETATION

5.3.1 Impact Criteria

The State of Indiana monitors the introduction and spread of invasive plants and protects State-listed plants, potential impacts to which are included in the discussion below. Executive Order 13112 addresses federal coordination and response to the problems associated with invasive species. No other State or Federal rules pertinent to this Project regulate non-listed plants.

Plant impacts can occur at the individual, population, or community level. For purposes of this EIS, the Service considers impacts to vegetation resources to be significant should implementation of an alternative result in:

(1) Naturally occurring population reduced in numbers to levels below viable local or regional levels;
(2) Substantial loss of soil stabilization services;
(3) Substantial loss of habitat for rare, threatened or endangered species;
(4) Introduction of invasive species that results in substantial loss of native species.

No concerns related to vegetation were identified during the scoping period.

5.3.2 Construction Effects

Agricultural land comprises more than 95% of the Phase IV Project area. The area impacted and thus potential vegetation loss associated with construction of up to 94 Phase IV turbines is 554 acres and would be entirely in cultivated cropland, with the exception of where access roads and collector lines would cross road ditches. It is anticipated that no CRP land would be affected by the construction. No plant species occurring in Phase IV would be extirpated and no populations would be significantly reduced as a result of construction activities. Disturbed areas around each turbine (outside of the foundation and pad area) would be left to passively re-vegetate or be returned to crops.

Construction activities have the potential to introduce invasive species into the Phase IV project area which could spread outside of the Project area. If such infestations occur, they are not anticipated to be severe enough to result in substantial loss of native species. For the most part, there are only small patches of native vegetation remaining in the Project area and they have already been affected by invasive plant species. Most of the land is agricultural; it is unlikely that any new invasive plants not already present would be introduced or have significant effects. The Applicant would monitor around the substation and turbine locations for invasive plant species and take the steps necessary for control of noxious weeds and pests. For a full list of BMPs refer to Appendix E.

Areas requiring restoration or reclamation would be leveled or re-contoured to match the surrounding area, covered with topsoil, and re-seeded, if needed, as per the NPDES permit and Erosion and Sediment Control Plan.

5.3.3 Operations Effects

No impacts to site vegetation are anticipated from the operation of Phases I-IV under any of the four alternatives. No additional vegetation clearing would be required during Project operations.

5.3.4 Maintenance Effects

Maintenance under any of the four alternatives would have minor effects on vegetation. Maintenance activities would consist of periodic mowing to retain previously cleared areas associated with Project infrastructure (roads, transmission lines) and ROWs. The need for mowing would be evaluated by site operations staff periodically during the growing season and would occur on an as-needed basis. Maintenance would also consist of building inspection and repairs, as needed; periodic grading of roads to restore the road surface or repair of culverts, as needed; and annual inspection and removal of hazards (e.g., downed trees or encroaching branches) on transmission lines. This level of maintenance would be routine along county roads and farms and, in general, would be consistent with the level currently occurring in the Project area.

5.3.5 Decommissioning Effects

Impacts on vegetation associated with decommissioning activities would be related to removal of the turbines, foundations, and roads (see Section 1.2.4.1). Some roads would not be removed, per landowner request. Foundations (e.g., of turbines, transformers, MET towers) would be excavated to a depth sufficient to remove anchor bolts, rebar, conduits, cable, and concrete to a depth of four feet below grade. Hence, some roads and concrete material would remain in place. The collector and communications cables and conduits would be cut back to a depth no greater than four feet. All cable and conduit buried greater than four feet would be left in place and abandoned. Generally speaking, decommissioning impacts would be similar to those associated with construction activities and occur in areas previously disturbed by construction.

Access roads would be widened as necessary to accommodate movement of cranes or other machinery required for the disassembly and removal of the turbines. After decommissioning of the turbines is completed, access roads and construction pads would be removed, unless the landowner requests that access roads remain in place. The physical impacts of road widening and removal on vegetation (equipment footprints, ground disturbance, etc.) would be generally equivalent to the impacts incurred during the construction phase.

Areas requiring restoration or reclamation would be leveled or re-contoured to match the surrounding area, covered with topsoil, and re-seeded, if needed. Other steps necessary to prevent soil erosion, establish vegetation cover, and control noxious weeds and pests would be conducted as necessary. A monitoring and remediation period of approximately three years would follow the completion of decommissioning and restoration activities. Where practical, restoration measures would reclaim disturbed areas to original or similar vegetation types for all areas impacted by Phases I - IV. This would include restoring row-crop production lands. For a full list of BMPs which will be implemented, refer to Appendix E.

5.3.6 Mitigation for Impacts to Vegetation

The construction of Phase IV and decommissioning of Phases I - IV would impact vegetation. However, impacts on vegetation that would occur as a result of the Project would not be inconsistent with the level of vegetation disturbance already present in an intensively farmed landscape. Other than the avoidance, minimization, and site restoration measures discussed above, no specific mitigation measures for vegetation would be implemented for any of the four alternatives under consideration.

5.3.7 Summary of Effects to Vegetation

- No concerns related to vegetation were identified during the scoping period.
- Vegetation loss associated with construction of Phase IV under any of the four alternatives under consideration would be entirely in cultivated cropland, with the exception of where access roads and collector lines would cross road ditches.
- The Project is not expected to cause reductions in the numbers of any naturally occurring State-listed or non-listed plant population or result in the loss or degradation of habitat for any rare, State-threatened or endangered plant species, community, or population.
- Removal of vegetation as a result of construction of Phase IV would result in minor effects to soil stabilization services during construction and decommissioning; however, these effects would be minimized through implementation of an Erosion and Sediment Control Plan.
- Implementation of BMP's (Appendix E) would attempt to avoid and control noxious plant invasions in the Phase IV area.
- Effects to vegetation resources are expected to be minor, and none of the four alternatives would result in significant adverse effects to vegetation resources.
- Other than the avoidance, minimization, and site restoration measures discussed above, no specific mitigation measures for vegetation would be implemented under any of the four alternatives.

5.4 WATER RESOURCES

5.4.1 Impact Criteria

This analysis evaluates how the four alternatives under consideration would potentially affect existing water resources. Water resources evaluated include surface waters (i.e., rivers, streams, lakes, and ponds), wetlands, floodplain, and groundwater and drinking supply. Project effects to water resources would be considered significant should any of the following result:

(1) Lost function of wetlands or floodplain;

(2) Compromised safety or quantity of any water supplies;

(3) Degraded aquatic resources that result in losses in biodiversity or degraded water quality or quantity; or

(4) Dramatic changes to other resources, such as flora or fauna, related to affected water resources conditions.

At the Federal level, water resource impacts are regulated by the Federal Water Pollution Control Act (Clean Water Act) of 1972, Executive Order 11988: Floodplain Management (1977), Wild and Scenic Rivers Act of 1968, and the Safe Drinking Water Act of 1974. In addition, state and local agencies, including the Indiana Natural Resources Commission (Indiana Flood Control Act (IC 14-28-1)), have developed legislation that regulate floodplain development.

No concerns related to water resources were identified during the scoping period.

5.4.2 Construction Effects

All four alternatives under consideration would include construction of Phase IV; therefore, potential effects to water resources would be the same for any of the alternatives. Potential effects to water resources as a result of construction are discussed below.

5.4.2.1 *Surface Waters*

Gretencord Ditch, Salmon Ditch, Minier Lateral, in addition to Sugar Creek, Mud Creek, Coon Creek, and their tributaries are found within Phase IV (Figure 4.4.2.1-2, Chapter 4). Phase IV contains no streams identified by IDEM as having outstanding ecological, recreational, or scenic importance. No waterbodies within Benton County as a whole have been designated as having outstanding ecological, recreational or scenic importance[52]. Sugar Creek, located within the Phase IV project limits, is identified on the IDEM 2008 303(d) List of Impaired Waterbodies approved by the U.S. EPA in 2008[53] (Figure 4.4.2.1-2, Chapter 4).

No permanent stream crossings (i.e., access roads) or temporary stream crossings for collector lines (i.e., open trench) would occur as a result of construction of Phase IV. Directional boring would be implemented at all collector line crossings of regulated streams, and no permanent fill would be placed below the ordinary high water mark at any stream crossing. Therefore, no impacts to regulated streams would occur as a result of construction of access roads or collector lines. In the event that any intermittent or ephemeral streams have active flow at the time of construction, the Applicant would hold off construction until the stream is no longer flowing or directionally bore, rather than open-trench through open stream flow. If construction equipment must cross a stream, temporary crossings will be constructed using standard BMPs (Appendix E). If temporary crossings are needed, prior to construction, the Applicant will consult with appropriate state and federal agencies regarding any permit requirements or other

[52] http://www.in.gov/dnr/water/2452.htm
[53] http://www.in.gov/idem/nps/2647.htm

authorizations that may be required. Once construction is complete, any temporary crossings would be removed and the streambanks restored and revegetated.

Surface water runoff from unpaved roads or accidental spills that could occur during construction activities has the potential to contribute sediments and/or pollutants to streams in the Phase IV area. However, construction activities would be performed using standard construction BMPs so as to minimize the potential for accidental spills of solid material, contaminants, debris, and other pollutants. For project-specific BMPs, refer to Appendix E. In addition, a SWPPP, including an Erosion and Sediment Control Plan, would be implemented consisting of measures such as stabilization of steep slopes (particularly during rain events), silt fences, hay bale dike or other suitable methods for slowing sedimentation into waterways.

The NPDES General Construction Storm Water permit obtained for Phase IV would also include restoration measures to ensure that disturbed ground is stabilized, preventing ongoing erosion and sedimentation of storm water runoff. These restoration measures may include, as appropriate, revegetation (preferably using native species, but exceptions may be made based on land use), regrading, and permanent swales or catch basins. Following construction, areas disturbed by construction would be restored as per the SWPPP and NPDES permit.

No named lakes or ponds are located within Phase IV; however, farm ponds are scattered throughout the area. While these ponds may provide a drinking water source for some wildlife species, their suitability for providing wildlife habitat is likely limited based on water quality and the seasonal nature of some of the ponds (i.e., natural drawdown during dry conditions). The Applicant has committed to complete avoidance of these ponds; therefore, no adverse effect to these resources would occur as a result of construction.

5.4.2.2 *Wetlands*

Landcover data (NLCD 2006) indicate approximately 21.65 acres of wetland and open water occur within Phase IV, accounting for approximately 0.13% of total landcover within Phase IV (see Section 4.1.2.1). USFWS NWI maps identify approximately 60 acres of wetland within Phase IV (Figure 4.4.2.2, Chapter 4). During windshield surveys in 2011, Stantec Consulting Services identified approximately 48.1 acres of potential wetland within the Phase IV project area (Figure 4.4.2.2, Chapter 4). The Applicant has committed to complete avoidance of all wetland impacts during construction of Phase IV (see Project Specific BMPs in Appendix E). No turbines would be located in wetlands, and no access roads would be constructed within potential wetland boundaries. In addition, if collector lines cannot completely avoid wetlands, directional boring would be implemented to avoid impacting wetlands.

Surface water runoff from unpaved roads or accidental spills that could occur during construction activities has the potential to contribute sediments and/or pollutants to wetlands in the Phase IV area. However, construction activities would implement standard BMPs to avoid impacting wetlands (Appendix E). As per a pending NPDES permit, the Applicant would implement a SWPPP, including an Erosion and Sediment Control Plan, to ensure that all ground disturbance is stabilized to prevent erosion and sedimentation into wetlands. Following construction, areas disturbed by construction would be restored as per the SWPPP and NPDES permit.

No adverse effect to wetlands would occur as a result of construction of Phase IV under any of the alternatives under consideration for the following reasons:

1. Potential wetlands within Phase IV were located and mapped (see Section 4.4.3.2).
2. Comparison of the locations of the wetlands with the locations of the 94 proposed Phase IV turbines, which would not change more than 95 feet from the currently proposed locations (see Section 5.1.2), indicates no turbines or access roads would be placed in wetlands.
3. Collector lines will avoid wetlands where possible. If collector lines cannot completely avoid wetlands, directional boring would be implemented to avoid impacting wetlands.

Prior to construction, the Applicant will consult with the appropriate state and federal agencies regarding any permit requirements or other authorizations that may be required.

5.4.2.3 *Floodplain*

No mapped 100-year floodplain or floodways are located within the Phase IV boundary (Figure 4.4.2.3, Chapter 4). Therefore, no effects to mapped 100-year floodplains or floodways or significant effects to floodwater attenuation would occur as a result of construction of Phase IV under any of the alternatives under consideration.

5.4.2.4 *Groundwater and Drinking Water Supply*

The regional hydrogeology consists of two bedrock aquifer systems and five unconsolidated aquifer systems. The only sole-source aquifer in Indiana, the St. Joseph Aquifer at South Bend in northern Indiana, is not located within Phase IV (see Section 4.4.2.4). No discharge of water or materials into the groundwater system would occur as a result of construction of Phase IV.

Construction of Phase IV would include excavation to approximately 12 feet below the surface at all turbine tower locations to install turbine foundations. Excavation activities would not be expected to affect any aquifer system because of the shallow depth of excavation. In addition, no new groundwater wells would be drilled as a result of Phase IV construction; therefore, no large ground water withdrawals would occur that may affect groundwater supplies.

No significant adverse effect to groundwater would occur as a result of Phase IV construction under any of the four alternatives under consideration.

5.4.3 Operation Effects

No significant effects to water resources would occur as a result of operation of the Project under any of the four alternatives under consideration.

Operating the Project could result in minor oil spills from leaking transformers or gear boxes which could cause localized effects to water quality should these spills enter surface waters; however, significant effects would be unlikely due to the small volume of oil that could potentially spill. Any potential oil spills would be addressed in the Applicant's Spill Prevention, Control and Countermeasure (SPCC) Plan.

5.4.4 Maintenance Effects

No significant effects to water resources would occur as a result of Project maintenance under any of the four alternatives under consideration.

Maintaining Project electrical or turbine components could result in minor oil spills from leaking transformers or gear boxes installed at Phase IV, which could cause localized effects to water quality should these spills enter surface waters; however, significant effects would be unlikely due to the small volume of oil that could potentially spill. Any potential oil spills would be addressed in the Applicant's SPCC Plan.

5.4.5 Decommissioning Effects

Potential effects to water resources as a result of decommissioning would be similar to those of construction. The Applicant has committed to complete avoidance of all streams and potential wetland areas; therefore, no significant effects would occur as a result of decommissioning activities.

5.4.6 Mitigation for Impacts to Water Resources

No significant adverse effects to surface waters, wetlands, floodplain or groundwater are anticipated as a result of the Project under any of the four alternatives under consideration. Based on this, no mitigation is proposed.

5.4.7 Summary of Effects to Water Resources

- No concerns related to water resources were identified during the scoping period.
- No significant adverse effects to surface waters, wetlands, floodplain or groundwater are anticipated as a result of construction of Phase IV, or operation, maintenance, and decommissioning of all four phases under any of the four alternatives.
- The Applicant has committed to avoidance of all stream and wetland impacts within the Phase IV area. No designated 100-year floodplain or floodways are found within Phase IV, and no impacts to groundwater aquifers would occur.
- No specific mitigation measures for water resources would be implemented under any of the four alternatives.

5.5 WILDLIFE AND AQUATIC RESOURCES

5.5.1 Impact Criteria

Most regulations associated with fish and wildlife impacts are concerned with effects to rare, threatened, and endangered species, which are discussed in Section 5.6. In addition, the MBTA protects non-listed birds, and BGEPA protects bald and golden eagles.

Significant impacts to wildlife and aquatic resources are those that substantially affect a species' population (locally, regionally, or range-wide) or significantly reduce its habitat quality or quantity. Impacts to species can be both direct and indirect. Disturbance, injury, mortality, and habitat alteration are examples of potential direct effects. Examples of indirect effects include habitat loss or degradation over time or in another place in association with another impacted resource, such as surface water or groundwater alterations, modification or creation of habitat edges and openings that favor a different mix of species, and changes in plant species composition. Animal displacement or avoidance due to changed or increased traffic patterns can also be termed indirect or secondary effects.

The analysis in this section considers construction effects, operation effects, maintenance effects, and decommissioning effects on four categories of wildlife:

(1) Terrestrial wildlife

(2) Aquatic resources

(3) Bats not listed under the ESA

(4) Birds, including some species or groups of particular concern

The analysis considers the Project's potential to affect species distribution and life history with respect to an effect's intensity, duration, and frequency. BMPs and mitigation measures to minimize and reduce impacts are incorporated into the following evaluation of potential effects. The effects of construction, operation, maintenance, and decommissioning are summarized for all species of Wildlife and Aquatic Resources in Section 5.5.7.

5.5.2 Construction Effects

5.5.2.1 *Construction Effects on Terrestrial Wildlife*

Incidental injury and mortality from construction of Phase IV under any of the four alternatives under consideration would be limited to sedentary/slow-moving/burrowing species, such as small mammals, reptiles, and amphibians that are unable to move away from the active construction area. A few bird species will nest in the early stages of crop growth, such as horned lark and killdeer. Construction activities conducted during the early growing season may adversely affect nests and young birds that nest in early crops. No significant areas of woodland or grassland are found within the Phase IV project area (see Table 4.1), and as such, none would be cleared as part of the project. For the most part, construction activities are not anticipated to kill or harm a significant number of animals. Mobile species and mature individuals present in the vicinity of construction activities should be able to move away from the areas being disturbed. All of the Phase IV components are sited in cultivated cropland, with the exception of where access roads and collector lines would cross road ditches, that has limited wildlife habitat value for those species that require grassland, woodland, open water and other natural communities. Mortality of terrestrial wildlife may occur as a result of road kills during construction of Phase IV, but these impacts are expected to be minor under any of the four alternatives, given the relatively low levels of primarily daytime traffic on-site and the site-wide 25 mph speed limit.

Increased noise and human activity associated with construction may result in some short-term displacement of wildlife species that use cropland and field edges, such as white-tailed deer, ring-necked pheasant, raccoon and skunk. However, due to the existing disturbance from tractors, plows, and other agricultural equipment, most wildlife in the Phase IV area are likely accustomed to a certain amount of acoustic disturbance. Phase IV related noise impacts would be minor and temporary.

For a full list of the BMPs which will be employed, refer to Appendix E. For the reasons discussed above, effects on terrestrial wildlife associated with construction of Phase IV under any of the four alternatives under consideration are anticipated to be minor.

Population Level Effects of Construction on Terrestrial Wildlife

Little available natural habitat for terrestrial animals is found in the Phase IV project area and impacts across all potentially affected species are anticipated to be minor; consequently, population level effects from construction of Phase IV are not expected to occur under any of the four alternatives for any species of terrestrial wildlife.

5.5.2.2 *Construction Effects on Aquatic Resources*

Aquatic habitats are limited in Phase IV, and those present have been altered considerably by intensive agriculture. There are no major rivers or lakes within or near the Phase IV area. The majority of the historical streams that remain have been channelized and converted to deep drainage ditches. There are a limited number of perennial, intermittent and ephemeral streams, along with farm ponds; however, none would be directly affected by construction of Phase IV (see Section 5.4). Indirect impacts on aquatic wildlife could occur if sediment loads in runoff from disturbed areas decrease water quality. However, these effects would be minimized or avoided through implementation of an Erosion and Sediment Control Plan, horizontal directional boring, implementation of BMPs (Appendix E), and other measures that would result in minor, if any, impacts to aquatic wildlife. Effects to aquatic resources associated with construction of Phase IV are anticipated to be minor under any of the four alternatives under consideration.

Population Level Effects of Construction on Aquatic Species

Because of the limited amount and poor quality of aquatic resources in the Phase IV project area, and because of the measures FRWF will implement to avoid and minimize impacts, population level effects from construction of Phase IV under any of the four alternatives are not expected for any aquatic species.

5.5.2.3 *Construction Effects on Bats Not Listed Under the ESA*

Habitat Loss

During the micro-siting process for Phase IV, the results of a habitat mapping study were used to site turbines or access roads away from areas deemed potentially suitable for roosting and foraging bats (e.g., woodlot habitats and open water). Phase IV turbines and access roads have been sited entirely in cultivated croplands with the exception of where access roads would cross road ditches. Consequently, no maternity, roosting, or native foraging habitat for bats would be lost due to Phase IV construction under any of the four alternatives. Additionally, construction of Phase IV would not impact fall swarming habitat for bats or hibernacula for cave-dwelling species under any of the four alternatives. Due to their demonstrated preference for forested, forest edge, and wetland (e.g., farm ponds, emergent wetlands, streams) habitat, most bat species that may occur within the Project area are unlikely to be affected by the loss of disturbed, agricultural habitat. In addition, disturbed, agricultural habitat is abundant in the area and available for bat species, such as the big brown bat, that may occasionally forage over croplands.

Disturbance/Displacement

Several of the more common species, such as the little brown bat and big brown bat, are known to roost in attics or the peaks of other large buildings. Natural habitat features or resource areas that typically attract bats are limited within the Phase IV area. However, large outbuildings associated with agricultural settings may provide suitable roosting/maternity locations for some of the more common bat species (e.g., little brown and big brown bats). A limited amount of marginally suitable summer foraging habitat is present; however, no swarming/staging habitat or bat hibernacula are present. Although some bat species may forage within the Phase IV area at night, nighttime construction activities would be minimal. Additionally, bat use of Phase IV is expected to occur primarily over open water and forested habitat (see Section 4.5.2.4), and these areas would be avoided during construction. For a full list of BMPs refer to Appendix E. Construction activities and associated increases in noise, light, vibration, human activity, and/or traffic are not expected to disturb or displace bat species under any of the four alternatives.

Mortality

Construction of Phase IV is not expected to result in mortality or loss of reproductive fitness for bat species due to the lack of suitable summer maternity habitat and the absence of hibernacula in the Project area and vicinity. Construction is not expected to cause mortality of roosting bats because activities would not impact any potentially suitable roosting habitat associated with man-made structures or limited woodlots within Phase IV. Foraging bats are not expected to be at risk of mortality from Phase IV construction because nighttime construction activities would be minimal and areas of marginally suitable foraging habitat would be avoided. Therefore, mortality of bats is not expected to occur as a result of Phase IV construction under any of the four alternatives.

Population Level Effects of Construction on Bats Not Listed Under the ESA

Virtually no habitat for non-ESA listed bats is found in the Phase IV project area; therefore, any impacts to bat habitat as a result of construction of Phase IV would be minor, and essentially no potential exists for direct take or displacement of bats not listed under the ESA. Consequently, population level effects from construction of Phase IV under any of the four alternatives are not expected for any bats not listed under the ESA.

5.5.2.4 *Construction Effects on Birds*

Habitat Loss

During the micro-siting process for Phase IV, results from an avian use and habitat mapping study were used to site turbines or access roads away from habitat for sensitive species and potential areas of high bird-use (e.g., riparian, grassland, woodlot habitats, and gamebird areas). Phase IV turbines and access roads have been sited entirely in agricultural fields and consequently, no native bird habitat would be lost due to Phase IV construction. The loss of disturbed, agricultural habitat is likely to be inconsequential for the local bird community under any of the four alternatives due to the large amounts of similar habitat available adjacent to all permanently disturbed areas.

Disturbance/Displacement

Potential disturbance or displacement impacts to birds during construction of Phase IV are likely to be minimal under any of the four alternatives. Certain bird species may be temporarily displaced due to noise and increased human presence during construction; however, due to the existing disturbance from tractors, plows, and other agricultural equipment, most birds in the Phase IV area are likely accustomed to a certain amount of disturbance. Grassland birds have the potential to be particularly susceptible to displacement; however, grassland and pasture habitat within Phase IV is limited to that of small fragments with little core habitat. The majority of birds detected during surveys within and near Phase IV were common species adapted to human disturbance (Johnson and Bay 2008, Carder et al. 2010); these species are less likely to be displaced due to Phase IV construction activities (Shaffer and Johnson 2008, Kerlinger 2002). The potential displacement of American golden-plovers and other birds from the presence of Phase IV turbines on the landscape is discussed below in Section 5.5.3.4.

Mortality

Adult mortality is not expected to occur during construction activities due to the alertness and mobility of avian species. Mortality of juvenile birds could occur if construction activities occur in non-tilled areas during the breeding season. However, nesting habitat for ground- and shrub-nesting birds is limited within the Phase IV, due to the predominance of active agriculture (>95%). Horned larks, killdeer, and a handful of other disturbance-tolerant bird species may nest in areas used for row crop production. Of the thousands of acres of agricultural nesting habitat available for these species within and adjacent to Phase IV, construction of Phase IV would impact no more than 554 acres, with 475.8 acres consisting of temporary impacts that would affect at most only one nesting season. The construction schedule and location of proposed construction activities would be evaluated against habitat mapping results to determine the potential for construction to occur within areas of potentially-suitable habitat for state-listed bird species or nesting raptors. Should this evaluation indicate that state-listed birds or nesting raptors may be affected by construction activities, the Applicant would contract biologists to monitor for birds during those times when construction would overlap with the breeding season (approximately late April to mid-July). The biologist would be present on-site several days per week and would conduct surveys within the proposed construction footprint at least once per week during the breeding season in order to identify and prevent disturbance of newly established bird nests. Additionally, sensitive species training would be part of the standard construction orientation for all Phase IV staff. Therefore, bird mortality due to Phase IV construction is anticipated to be minor under all four alternatives.

Population Level Effects of Construction on Birds

Phase IV contains little nesting habitat for any species of bird; therefore, direct take of birds as a result of construction of Phase IV is not expected to occur and any impacts to avian habitat that might occur are expected to be minor. Consequently, population level effects from construction of Phase IV are not expected for any bird species under any of the four alternatives.

5.5.3 Operation Effects

5.5.3.1 *Operation Effects on Terrestrial Wildlife*

There are limited data available addressing impacts to mammals, reptiles, and amphibians associated with habitat loss due to displacement from operating wind farm developments in the U.S.; the majority of studies have focused on bird and bat collision mortality. Because the affected habitat, cropland, is of such low value for wildlife, the habitat loss impacts under any of the four alternatives are expected to be minor.

It is possible that some animals would avoid the Project, especially in the Phase IV project area as it becomes added to the landscape. However, common species, such as white-tailed deer, raccoon, and skunk, tend to become habituated to human activity and habitat modification. While habituation may not be immediate, species likely to occur in the Phase IV project area would adapt quickly to the presence of man-made features in their habitat, as evidenced by the abundance of these species in suburban settings. Deer have been observed at recently constructed wind power projects (Stantec 2010a, 2010b). Significant displacement of common mammals from a wind power site has not been reported.

Terrestrial wildlife mortality is not expected to occur as a result of Project operations under any of the four alternatives because the risk of turbine collision is confined to the rotor-swept zone of each turbine.

Population Level Effects of Operation on Terrestrial Wildlife

Little available natural habitat for terrestrial animals is found in the Project Area; therefore, avoidance or displacement effects, should they occur, are expected to be minor. All species of terrestrial wildlife inhabit an area below the rotor-swept zone and no direct morality of these species is expected to occur. Consequently, population level effects from operation of the Project under any of the four alternatives are not expected for any species of terrestrial wildlife.

5.5.3.2 *Operation Effects on Aquatic Resources*

There would be no effect on aquatic resources associated with operation of the Project under any of the four alternatives, as operational impacts are primarily confined to the rotor-swept zone of each turbine.

Population Level Effects of Operation on Aquatic Resources

Operation of the Project is not expected to impact aquatic resources; consequently, population level effects from operation of the project under any of the four alternatives are not expected for any aquatic species.

5.5.3.3 *Operation Effects on Bats Not Listed Under the ESA*

Operating commercial wind facilities have been found to affect many bat species (Arnett et al. 2008). These impacts may include the displacement of individuals, fragmentation of habitat, and direct mortality from turbine interaction (Kunz et al. 2007a).

Disturbance/Displacement

Limited information is available regarding the disturbance/displacement of bats at wind facilities (Kunz et al. 2007a). The Service provided guidance specific to the disturbance and displacement of bats and has indicated that it is reasonable to assume that bats would shift away from human disturbances (e.g., habitat modifications, loud activities, etc.) (USFWS 2011c).

However, based on the number and frequency of documented deaths of bat species observed at wind energy facilities throughout North America, there appears to be no active avoidance of wind facilities by bat species (USFWS 2011c). Indeed, many recent studies suggest that wind turbines may attract bats.

Some researchers have suggested that migratory tree bats (i.e., hoary bats, eastern red bats, and silver-haired bats) may be attracted to wind turbines because of their migratory and mating behavior patterns (Kunz et al. 2007b; Cryan 2008). 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 (Cryan and Brown 2007). Migrating bats may also fly higher to maximize efficiency. As further support for these hypotheses, the majority of bat fatalities occur mid-summer through fall, approximately the same time frame as southward migration of tree bats (Arnett et al. 2008).

Therefore, bats are not expected to be disturbed or displaced from the Project area as a result of Project operation under any of the four alternatives.

Mortality

Whether bats are attracted to turbines and the exact mechanisms by which turbines cause mortality are unclear (reviewed in Kunz et al. 2007b). Recently, researchers have hypothesized and tested various elements potentially connected to bat-turbine interactions. These elements include the role of land cover and environmental conditions in attracting bats to turbine sites, behavioral factors that might make 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). Determining the effects of wind farms on bats is of critical importance to the future conservation of these poorly understood mammals.

Post-construction mortality studies that were well-executed and are publicly available are uncommon. Further, it is difficult to make direct comparisons among post-construction studies due to differences in study length, metrics used for searches and calculations for compensating bias (Arnett et al. 2008). In general, however, the number of bat fatalities recorded at wind facilities has varied regionally; reports of mortality have been highest along forested ridgetops in the eastern U.S. and lowest in open landscapes of Midwestern and western states (Kunz et al. 2007b). In the Midwestern U.S., bat fatalities range from 0.1 to 50.5 bats killed/turbine, but higher fatality rates (up to 69.6 bats/turbine) have been reported in the eastern U.S. (Poulton 2010 and Arnett et al. 2008). Estimates based on mortality studies conducted within USFWS Region 3 (Ohio, Michigan, Indiana, Illinois, Wisconsin, Missouri, Iowa, and Minnesota[54]) suggest that fatalities range from 2.37 to 27.59 bats killed/MW (mean, 10.07) (Marissa Reed, USFWS, personal communication (May 30, 2012)). Estimated bat fatality at the Project, without operational mitigation strategies in place, is expected to average 33.73 bats/turbine/year (19.84 bats/MW/year), of which, bats not listed under the ESA are expected to comprise 33.68 bats/turbine/year, based on two years of intensive monitoring (Good et al. 2011a, 2012).

The influence of small-scale landcover differences on bat mortality at turbine sites within a project site is unclear (Arnett et al. 2008). Johnson et al. (2004), for example, found no significant relationship between bat fatalities and landcover type within 328 feet of 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 a significant impact on bat mortalities (Arnett et al. 2008, Good et al. 2012).

[54] Mortality study data not available for Michigan and Ohio. Missouri data limited to one mortality study.

Bat mortality and insect activity are both high on nights with low wind speed and bat fatalities drop 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 tree bat species (i.e., hoary bats, eastern red bats, and silver-haired bats) that mostly emit low-frequency calls (Johnson et al. 2004; reviewed by Kunz et al. 2007b). Bats that use low frequency calls may be more inclined to forage above the treeline where there are few obstructions. Thus, tree bats may be more likely to fly in the rotor swept zone of turbines when compared to smaller bat species that have different foraging and migration strategies. 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, hoary bat, eastern red bat, and silver-haired bat have contributed nearly 75% of the total documented fatality at wind facilities (Kunz 2007a). Two bat species, Indiana bat and evening bat, not listed by Arnett et al. (2008) have since been found as fatalities at the Project; nevertheless, migratory tree bats have comprised 95% of the documented fatalities at FRWF.

Studies at FRWF and several other wind energy facilities demonstrated that turbine operational protocols (i.e., adjusting the wind speed at which turbines are allowed to begin generating power and/or feathering turbine blades to prevent free-wheeling below that speed) significantly influence bat mortality (Fiedler 2004, Kerns et al. 2005, Arnett et al. 2008, Baerwald et al. 2008, Good et al. 2011a and 2012). Therefore, it is expected that impacts to bat species at the FWRF would vary greatly depending on the alternative under which the Project turbines are operated.

Under all three of the alternatives under consideration, migratory tree bats are expected to account for the majority of bat fatalities at the Project as eastern red bats have comprised 57%, hoary bats 23%, and silver-haired bats 15% of the fatalities documented during post-construction monitoring at FRWF from 2009 to 2011. Other bat species documented as fatalities at FRWF to-date include: big brown bat, little brown bat, evening bat, Seminole bat, tri-colored bat, northern myotis, and Indiana bat (see Section 4.5.2.4) (Johnson et al. 2010 a, b : Good et al. 2011a, 2012).

Without turbine operational adjustments during the fall season, approximately 89.4% (30.17 bats/turbine) of the total annual bat mortality (33.73 bats/turbine) expected at the Project would be expected to occur during the fall migratory season (August 1 – October 15) based on two years of intensive post-construction mortality studies at FRWF (Good et al. 2011a, 2012). Based on the species composition of bat mortalities recorded at FRWF to-date, Indiana bats are expected to comprise approximately 0.16% of the fall mortality at FRWF. Therefore, bats not listed under the ESA are expected to average 30.12 bats/turbine during the fall without turbine operational adjustments; this mortality rate is expected to vary greatly across the alternatives under consideration, as described below. The remaining 10.6% (3.56 bats/turbine[55]) of the total annual bat mortality that is predicted to occur during the spring and summer months would not be affected by the protocol under which the turbines are operated during the fall migration season, and therefore is consistent across the alternatives. Because Indiana bat mortality is not expected to occur during the spring and summer, it is assumed that mortality of bats not listed under the ESA would average 3.56 bats/turbine during the spring and summer.

[55] Spring rate = 0.66 bats/turbine, summer rate = 2.90 bats/turbine (Good et al. 2012). Summer rate may have been affected by short duration and late schedule (July 15-31, 2011) of search effort.

No Action Alternative

Under the No Action Alternative, all FRWF turbines would be shut off from sunset to sunrise between August 1 and October 15, the primary fall migratory period for all bats in the Project area, each year during the operational life (22 years) of the FRWF. Therefore, it is expected that bat mortality would not occur during the fall migration season under this alternative. Mortality during the spring and summer would still occur and is expected to be similar to the bat mortality observed during spring and summer in the 2010 and 2011 post-construction mortality studies.

Spring and summer bat mortality rates combined at FRWF have been calculated to average 3.56 bats/turbine/year, or 1,264 total bats per year when Phases I - III are operating (355 turbines), 1,598 total bats per year when Phases I - IV are operating (449 turbines), and 335 total bats per year when only Phase IV is operating (94 turbines) (Table 5.2). Because Indiana bat take is not expected to occur during the spring and summer, it is assumed that other bat species would comprise 100% of the mortality at FRWF under this alternative. Over the 22-year life of the Project, it is estimated that approximately 28,173 bats not listed under the ESA ([1,264 bats x 2 years] + [1,598 bats x 15 years] + [335 bats x 5 years]) would be killed under the No Action Alternative (
Table 5.3).

Mortality monitoring would be conducted according to the FRWF BBCS (Appendix D) under the No Action Alternative. The BBCS includes an adaptive management framework through which FRWF would respond to high levels of bat mortality. However, bats would not receive the habitat enhancement and protection benefits inherently associated with the Indiana bat take mitigation and conservation measures that would be implemented as part of the HCP.

Table 5.2 Predicted Fatalities of Bats Not Listed Under the ESA per Year by EIS Alternative

Alternative	Bat Fatalities			
	Bats/Turbine/Year (spring/summer + fall =total)	355 Turbines[4] (bats/yr)	449 Turbines[5] (bats/yr)	94 Turbines[6] (bats/yr)
No Operational Adjustment Scenario[1]	(3.56[3] + 30.12) = 33.68	11,956	15,122	3,166
No Action Alternative[2]	(3.56 + 0.00) = 3.56	1,264	1,598	335
3.5m/s Cut-In Speed (Feathered) Alternative	(3.56 + 19.28) = 22.84	8,108	10,255	2,147
5.0m/s Cut-In Speed Alternative (Applicant Proposed Action)	(3.56 + 15.07) =18.63	6,614	8,365	1,751
6.5m/s Cut-In Speed Alternative	(3.56 + 6.63) = 10.19	3,617	4,575	958

[1]No curtailment, no feathering below 3.5 m/s wind speed. Not an alternative under consideration. Included only for comparison purposes.
[2]No nightly operation during the fall migration period (August 1-October 15).
[3]Spring rate=0.66 bats/turbine, summer rate=2.90 bats/turbine (Good et al. 2012). Summer rate may have been affected by short duration and late schedule (July 15-31, 2011) of search effort.
[4]Phases I - III in operation; 2 years of the 22-year life of the Project
[5]Phases I - IV in operation; 15 years of the 22-year life of the Project
[6]Phase IV only in operation; 5 years of the 22-year life of the Project

Table 5.3 Predicted Fatalities of Bats Not Listed Under the ESA over the 22-Year Life of Fowler Ridge Wind Farm by EIS Alternative

Alternative	Bat Fatalities[1]
No Operational Adjustment Scenario[2]	266,572
No Action Alternative[3]	28,173
3.5m/s Cut-In Speed (Feathered) Alternative	180,776
5.0m/s Cut-In Speed Alternative (Applicant Proposed Action)	147,458
6.5m/s Cut-In Speed Alternative	80,649

[1]Fatalities = (total bats killed per year Phases I - III (355 turbines) x 2 years) + (total bats killed per year Phases I - IV (449 turbines) x 15 years) + (total bats killed per year Phase IV x 5 years)
[2]No curtailment, no feathering below 3.5 m/s wind speed. Not an alternative under consideration. Included only for comparison purposes
[3]No nightly operation during the fall migration period (August 1-October 15).

3.5 m/s Cut-In Speed (Feathered) Alternative

Under the 3.5 m/s Cut-In Speed (Feathered) Alternative, FRWF turbines would be feathered[56] under wind speeds of 3.5 m/s from sunset to sunrise between August 1 and October 15. Based on the results of post-construction curtailment studies at FRWF (Good et al. 2012), it is expected that fall bat mortality under this alternative would be reduced by 36% from the levels of fall bat mortality observed at un-curtailed turbines during the 2010 and 2011 post-construction mortality studies. Therefore, bat mortality during the fall migration season is expected to average 19.31 bats/turbine under this alternative. Based on the species composition of bat mortalities recorded at FRWF to-date, Indiana bats are expected to comprise approximately 0.16% of the fall mortality at FRWF, leaving other bat species to average 19.28 bats/turbine during fall under this alternative. Mortality during the spring and summer would still occur and is expected to be similar to the bat mortality observed during spring and summer in the 2010 and 2011 post-construction mortality studies (3.56 bats/turbine). Because Indiana bat take is not expected to occur during the spring and summer, it is assumed that other bat species would comprise 100% of the spring and summer mortality at FRWF under this alternative.

Overall, mortality of bats not listed under the ESA is predicted to average 22.84 bats/turbine under the 3.5 m/s Cut-In Speed (Feathered) Alternative, or 8,108 total bats per year when Phases I - III are operating (355 turbines), 10,255 total bats per year when Phases I - IV are operating (449 turbines), and 2,147 total bats per year when only Phase IV is operating (94 turbines) (Table 5.2). Over the 22-year life of the Project, it is estimated that approximately 180,776 bats not listed under the ESA ([8,108 bats x 2 years] + [10,255 bats x 15 years] + [2,147 bats x 5 years]) would be killed under the 3.5 m/s Cut-In Speed (Feathered) Alternative (Table 5.3).

Mortality monitoring would be conducted according to the Project HCP under the 3.5 m/s Cut-In Speed (Feathered) Alternative. The HCP includes an adaptive management framework through which FRWF would respond to high levels of bat mortality. Additionally, bats would receive the habitat enhancement and protection benefits inherently associated with the Indiana bat take mitigation and conservation measures that would be implemented as part of the HCP.

5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action)

Under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action), FRWF turbines would be feathered under wind speeds of 5.0 m/s when the ambient temperature is 50° F or above from sunset to sunrise between August 1 and October 15. It is expected that fall bat mortality under this alternative would be reduced by 50% from the levels of fall bat mortality observed at un-curtailed turbines during the 2010 and 2011 post-construction mortality studies (see Section 4.1.1.3 of the HCP). Therefore, bat mortality during the fall migration season is expected to average 15.09 bats/turbine under this alternative. Based on the species composition of bat mortalities recorded at FRWF to-date, Indiana bats are expected to comprise approximately 0.16% of the fall mortality at FRWF, leaving other bat species to average 15.07 bats/turbine during fall under this alternative. Mortality during the spring and summer would still occur and is expected to be similar to the bat mortality observed during spring and summer in the 2010 and 2011 post-construction mortality studies (3.56 bats/turbine). Because Indiana bat take is not

[56] Adjust the turbine operational parameters so that the rotation of the turbine rotors below cut-in wind speed is minimized. Feathering reduces the blade angle to the wind in order to slow or stop the turbine from spinning.

expected to occur during the spring and summer, it is assumed that other bat species would comprise 100% of the spring and summer mortality at FRWF under this alternative.

Overall, mortality of bats not listed under the ESA is predicted to average 18.63 bats/turbine under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action), or 6,614 total bats per year when Phases I - III are operating (355 turbines), 8,365 total bats per year when Phases I - IV are operating (449 turbines), and 1,751 total bats per year when only Phase IV is operating (94 turbines) (Table 5.2). Over the 22-year life of the Project, it is estimated that approximately 147,458 bats not listed under the ESA ([6,614 bats x 2 years] + [8,365 bats x 15 years] + [1,751 bats x 5 years]) would be killed under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action) (
Table 5.3).

Mortality monitoring would be conducted according to the Applicant Proposed HCP under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action). The HCP includes an adaptive management framework through which FRWF would respond to high levels of bat mortality. Additionally, bats would receive the habitat enhancement and protection benefits inherently associated with the Indiana bat take mitigation and conservation measures that would be implemented as part of the HCP.

6.5 m/s Cut-In Speed Alternative

Under the 6.5 m/s Cut-In Speed Alternative, FRWF turbines would be feathered under wind speeds of 6.5 m/s when the ambient temperature is 50° or above from sunset to sunrise between August 1 and October 15. Based on the results of post-construction curtailment studies at FRWF (Good et al. 2011a), it is expected that fall bat mortality under this alternative would be reduced by 78% from the levels of fall bat mortality observed at un-curtailed turbines during the 2010 and 2011 post-construction mortality studies. Therefore, bat mortality during the fall migration season is expected to average 6.64 bats/turbine under this alternative. Based on the species composition of bat mortalities recorded at FRWF to-date, Indiana bats are expected to comprise approximately 0.16% of the fall mortality at FRWF, leaving other bat species to average 6.63 bats/turbine during fall under this alternative. Mortality during the spring and summer would still occur and is expected to be similar to the bat mortality observed during spring and summer in the 2010 and 2011 post-construction mortality studies (3.56 bats/turbine). Because Indiana bat take is not expected to occur during the spring and summer, it is assumed that other bat species would comprise 100% of the spring and summer mortality at FRWF under this alternative.

Overall, mortality of bats not listed under the ESA is predicted to average 10.19 bats/turbine under the 6.5 m/s Cut-In Speed Alternative, or 3,617 total bats per year when Phases I - III are operating (355 turbines), 4,575 total bats per year when Phases I - IV are operating (449 turbines), and 958 total bats per year when only Phase IV is operating (94 turbines) (Table 5.2). Over the 22-year life of the Project, it is estimated that approximately 80,649 bats not listed under the ESA ([3,617 bats x 2 years] + [4,575 bats x 15 years] + [958 bats x 5 years]) would be killed under the 6.5 m/s Cut-In Speed Alternative (
Table 5.3).

Mortality monitoring would be conducted according to the Project HCP under the 6.5 m/s Cut-In Speed Alternative. The HCP includes an adaptive management framework through which FRWF would respond to high levels of bat mortality. Additionally, bats would receive the habitat enhancement and protection benefits inherently associated with the Indiana bat take mitigation and conservation measures that would be implemented as part of the HCP.

Population Level Effects of Operation on Bats Not Listed Under ESA

It is almost certain that all of the four alternatives under consideration will kill bats not listed under the ESA. Based on the results of post-construction monitoring conducted at the existing three phases of the Project, the majority of the bats killed will be migratory tree bats (e.g., eastern red bat, silver-haired bat and hoary bat). The impact of between 28,173 (No Action Alternative) and 180,776 (3.5 Cut-In Alternative) primarily tree bat fatalities over the course of 22 years at FRWF (
Table 5.3) is unknown, in part because accurate estimates of most bat populations do not exist. It is known that migratory tree bats, and the other bat species that are likely to be killed at FRWF, are comparatively long-lived organisms that produce few (1-3) offspring per year, although details on demographics (e.g., age at which females first reproduce, how long they reproduce, and what percentage of females breed) are not fully known. There remains insufficient information to understand the population level effects of this magnitude of loss to the various bat species that will be killed at the Project. The ongoing monitoring required at FRWF and other facilities will allow tracking of impacts, including the proportions of fatalities among the various species.

5.5.3.4 *Operation Effects on Birds*

FRWF has been sited and will be operated throughout the life of the Project to avoid and minimize, when possible, impacts to birds. Measures for reducing impacts to birds were developed based on 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 IDNR. These data and conservation measures (including turbine siting, phased development, avian-safe design factors, adaptive management, etc.) are discussed in detail in the FRWF BBCS (Appendix D) and demonstrate FRWF's good faith effort to avoid and reduce potential impacts to birds throughout the life of the Project.

Operational impacts of wind facilities on birds include varying degrees of displacement from the wind turbines and surrounding habitat as well as mortalities resulting from collisions with turbines, transmission lines, and other project-related structures (Winegrad 2004). The four alternatives under consideration vary only in nighttime operational adjustments (i.e., adjusting cut-in speed between sunset and sunrise). Nighttime turbine operations are not known to affect avian use in the vicinity of turbines, and the few documented nighttime impacts (primarily to migrating passerines) are episodic and appear to be related to weather events and not turbine operation. Therefore, potential disturbance impacts to birds are not expected to differ among the four alternatives. The potential effects of wind turbines on birds in general and the effects documented at FRWF are discussed in detail below.

Disturbance/Displacement

Wind turbines may displace birds from an area due to the creation of edge habitat, introduction of vertical structures, and disturbances directly associated with turbine operation (e.g., noise, shadow flicker). Disturbance impacts are often complex, involving shifts in abundance, species composition, and behavioral patterns. The magnitudes of these impacts vary across species, habitats, and regions. Concerns have been raised that displacement from habitat may significantly affect certain avian populations (The Ornithological Council 2007). Although most research to-date has focused on collision mortality associated with wind energy facilities, the limited data available indicate that avoidance impacts to birds generally extend 246 feet to 2,624 feet from a turbine, depending on the environment and the bird species affected (Strickland 2004). Little research has been done on the displacement impacts of wind development on birds in the eastern U.S. However, studies in the western and Midwestern U.S. consistently show small-scale (<330 feet) impacts on birds (Strickland 2004). Because there is very little grassland, forest, or wetland habitat on the Project site, and no large blocks of any of these habitat types that might support area-sensitive species, few disturbance and displacement impacts to birds are expected.

Grassland birds appear to exhibit particularly high levels of avoidance behavior (e.g., grasshopper sparrow (*Ammodramus savannarum*); Strickland 2004, Shaffer and Johnson 2008). Other bird groups, such as forest birds, may not be as strongly affected by displacement/disturbances from wind turbines. Studies by Shaffer and Johnson (2008) and Kerlinger (2002) have concluded that, in general, bird species adapted to human disturbances or agricultural or edge habitat (e.g., killdeer) are less likely to exhibit avoidance behavior near turbines. Only one report of raptor avoidance of wind energy facilities has been published; based on area of available habitat, raptor nest densities at the Buffalo Ridge site were lower than expected (Strickland 2004).

Population level consequences of displacement/disturbances from wind turbines are not yet understood. Initial studies indicate that when considered on a regional scale, reductions in habitat use by songbirds have been observed to be relatively minor and are not expected to have population consequences (Strickland 2004). However, displacement of breeding birds has varied across sites, leaving the impact of turbines on breeding success unclear (The Ornithological Council 2007). Additional studies are needed to assess the broad-scale, population level consequences of displacement impacts on other avian groups, as well as the cumulative effects that time and increased wind energy development may have on avian population dynamics.

Although Project operation has the potential to cause displacement of birds from the Project area due to noise, lights, or tall structures (i.e., turbines), bird species sensitive to disturbance currently exhibit low use of the Project area and minimal grassland or forest habitat is present. The majority of birds occurring within the Project area are 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. The exception is the American golden plover, which uses the agricultural fields in the project area and surrounding agricultural landscape.

Displacement and disturbance impacts to American golden-plovers from the Project may be likely under any of the four alternatives, based on surveys conducted in 2007, 2008, and 2009 by WEST (Johnson et al. 2009). No plovers were observed near the newly-erected turbines during the 2009 surveys, despite plovers using these areas in 2007 and 2008 prior to the erection of the turbines. It is possible that plovers 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 the plovers. In addition, differences in plover-use 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 the plovers continue to avoid areas near Project turbines, they may be displaced from much of the Project area (Figure 4.5.2.2, Chapter 4). Displacement impacts are not expected to extend into the IBA located north of the Project, as all turbines have been sited at least 1,760 feet from the IBA border (Figure 4.5.2.2, Chapter 4). Therefore, the effect of potential displacement of plovers from the Project area is expected to be minor, given that both protected and comparably large areas of other suitable habitat are available adjacent to the Project area.

Turbine Related Mortality

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 a few other birds. The Service and IDNR both expressed concern for migrating American golden-plover, a species protected by the MBTA and listed as a species of special interest by the IDNR, and whooping cranes, a federally endangered species with a population (listed under the ESA only as experimental, non-essential) that migrates across Indiana. The IDNR also expressed concern for several state-listed species that 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, American golden-plover, upland sandpiper, northern harrier, and western meadowlark, were observed within the Project area during pre-construction surveys (Johnson and Bay 2008, Carder et al. 2010) (see Section 4.5.2.2 in Chapter 4). With the exception of American golden-plover and northern harrier, all sensitive species observed were low in number. Given the small number of individuals observed and limited available habitat, many of these species are therefore considered to be at low collision risk. Initial post-construction surveys recorded no fatalities of state or federally threatened or endangered bird species (Johnson et al. 2010a, b, Good et al. 2011a).

Under all four of the alternatives under consideration, the operating turbines would pose a risk of mortalities from collisions for birds within the Project area. Collision with various man-made structures is a significant source of bird mortality (Trapp 1998, Kerlinger 2000, Shire et al. 2000, and many others). Nationally, Erickson et al. (2002) estimated wind turbines are responsible for 0.01-0.02% of all avian fatalities due to human structures. An estimated 20,000 to 37,000 birds were killed by approximately 17,500 wind turbines in the United States in 2003 (Erickson et al. 2005). Fatalities ranged from zero to about 9 birds/turbine/year (b/t/y), yielding an average of 2.1 b/t/y (Erickson et al. 2005). Studies have shown avian mortality rates to be very consistent across wind energy facilities, both nationally and within regional ranges. 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). However, 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.

The estimated avian mortality during the 7-month 2009 study at Phase I, the only FRWF study in which avian mortality was estimated, was 5.26 birds/turbine (Johnson et al. 2010b). Based on this estimate, the Project may kill approximately 1,867 total birds per year when Phases I - III are operating (355 turbines), 2,362 total birds per year when Phases I-IV are operating (449 turbines), and 494 birds per year when only Phase IV is operating (94 turbines). Over the 22-year life of the Project, it is estimated that approximately 41,634 birds ([1,867 birds x 2 years] + [2,362 birds x 15 years] + [494 birds x 5 years]) would be killed. Total bird carcasses by species found at Phases I – III during mortality surveys from 2009 to 2011 are shown in Chapter 4. With the exception of the 2009 study at Phase I, fatality rate estimates were not calculated for birds in most of these studies because the monitoring efforts were focused on estimating impacts to bats.

Avian collision mortality can occur during both the breeding and migration seasons; however, patterns in avian mortality at tall towers, buildings, wind turbines, and other man-made structures suggest that the majority of fatalities occur during the spring and fall migration periods (NRC 2007). Limited data from existing wind facilities suggest that migrant species represent roughly half of documented fatalities, while resident species represent the other half (NRC 2007). Bird fatality rates at the Project area are likely to peak during the spring and fall migration seasons, as has been observed at most wind energy facilities (Johnson et al. 2002) and as indicated by the results of initial post-construction monitoring studies at the FRWF (Johnson et al. 2010b).

Given the high numbers of American golden-plovers which occur within the Project area and adjacent IBA during the spring migration period (58,943 individuals were observed during the 2007 plover surveys), it is likely that some plovers will collide with Project turbines or the Project transmission line. Flocks of plovers will fly at altitudes within the rotor-swept area as they migrate into and out of the IBA and Project area, and this behavior may increase their risk of turbine collision. During all three years of plover surveys within the Project area, plovers were observed to spend the majority of time flying at their typical foraging altitudes below blade height (Johnson et al. 2009). During the 2009 surveys, no plovers were observed within 1,312 feet of the newly-erected turbines; plovers continued to use the IBA and croplands within the Project area that were not in the vicinity of the turbines (Johnson et al. 2009). Based on their observed flight patterns and the apparent avoidance of newly-constructed turbines by plovers during the 2009 surveys, it was concluded that plovers 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 plover carcasses (Johnson et al. 2010a, b, Good et al. 2011a).

Raptor mortality at wind energy facilities has been a high-profile issue in the past, largely due to the high levels of mortality observed at the Altamont Wind Resource Area (Altamont) in California. New wind energy facilities, however, have greatly lessened their impacts to raptors, mostly based on the new turbine design. New generation turbines have tubular support structures instead of lattice structures, which eliminate perching by raptors. Newer turbines also have larger blades, which reduces motion blur. Outside of California, where rates are greatly influenced by the Altamont site, nation-wide raptor mortality rates average 0.006 birds/turbine/year (Erickson et al. 2002). Studies have documented high raptor avoidance behaviors at modern wind facilities (Whitfield and Madders 2006, Chamberlain et al. 2006). Raptors' mechanism for turbine avoidance is unknown; however, most raptors are diurnal and have good eyesight, suggesting they may be able to detect turbines visually as well as acoustically. 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, Carder et al. 2010). 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, Good et al. 2011a). During three years of monitoring between 2009 and 2011 at Phases I - III, no harriers and no kestrels were found as fatalities (Johnson et al. 2010a, b, Good et al. 2011a.

Resident and migrating songbirds (passerines) 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 pre-construction surveys within and near the Project area (Johnson and Bay 2008, 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% of avian fatalities at most sites, but no particular species or group of species has been identified as incurring greater numbers of fatalities (Erickson et al. 2002). During initial post-construction monitoring studies at the Project, killdeer were the most frequently-found species of all bird mortalities. However, as a group, passerines constituted the majority of bird fatalities recorded (Johnson et al. 2010b, Good et al. 2011a). It is likely 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 at the greatest risk of collision (Kerlinger 1995). Nationally, it has not been determined that these mortalities have resulted in a significant population level impact to any one species, mainly because the migratory species with relatively high collision mortality are regionally abundant (Erickson et al. 2002).

Other Sources of Mortality during Operation

Power lines, including those at wind energy facilities, can pose an electrocution risk to raptors due to their larger body sizes and broader wing spans. To avoid the risk of avian electrocution at the Project, FWRF has minimized the amount of aboveground collection and transmission lines across Phases I, II, and III as a best practice; this best practice would also be applied to Phase IV. All aboveground lines have been designed in accordance with recommendations in Avian Power Line Interaction Committee's (APLIC) Suggested Practices for Avian Protection on Power Lines (APLIC 2006). Any aboveground lines constructed for Phase IV would also be designed to the APLIC spacing recommendations.

Other possible risks to birds may result from collisions with the MET towers at wind energy facilities. Data on MET tower impacts to birds are currently limited to two post-construction monitoring surveys. Over a four-year study at the Foote Creek Rim Wind Plant in Wyoming, avian fatalities were found at all five MET towers (Young et al. 2003). Habitat in the project area consisted primarily of mixed grass prairie and sagebrush shrubland. An average of 8.09 birds were killed per MET tower per year; fatalities comprised resident and migrant species. On average, avian mortality was three times greater at MET towers than at the turbines (Young et al. 2003). Over a one-year study at the Klondike Wind Project in Oregon, no avian fatalities were found at the single MET tower (Johnson et al. 2003). Habitat at this wind energy facility consisted of grazed shrub-steppe, cultivated wheat fields, and other agricultural fields (Johnson et al. 2003). The difference in these study results may be due to differences in location, habitat, and structural characteristics between the two projects. There are not enough data to support conclusions about potential impacts to different avian groups.

Impacts to birds from MET towers may be comparable to impacts caused by similar communications towers, for which more data are available. Direct avian mortality appears to be the primary impact associated with these structures. Avian mortality at communications towers varies greatly depending on tower height, lighting, color, structure, and the presence of guy wires (The Ornithological Council 2007). Although variable across habitats, the majority of collision fatalities at communications towers consist of passerines, particularly night migrants. Guyed towers of similar height to the typical MET tower (377 - 479 feet) may have mortality rates ranging from one per tower per 20 days to 12.3 per tower per 20 days, depending on the type of lighting on the tower – white strobe lighting typically results in the lowest mortality rate

(The Ornithological Council 2007). In addition to baseline mortality rates, single-night mass mortality events periodically occur at lighted communications towers on cloudy nights; it would be possible for such events to also occur at MET towers. MET towers may therefore have the potential to result in single and small-scale bird fatality events; however, the number of fatalities may be reduced through the use of bird flight diverters on the guy wires or the use of unguyed towers, and white strobe lighting on the towers. The FRWF MET towers are unguyed and fitted with red strobe lighting.

Of particular concern relative to bird collisions with all types of structures are episodic events involving large numbers of one or a few bird species during migration. These have been recorded at multiple locations, 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.

The Applicant has incorporated many measures to avoid and minimize impacts to birds, including: siting the Project in an area of moderate avian use; developing the Project in phases to observe the effect of the Project on American golden-plover use of the area prior to development of phases located closer to the plover IBA; micro-siting all Phase IV turbines in cultivated croplands and locating all Phase I - III turbines and facilities to avoid native bird habitat and IDNR Gamebird Habitat Areas including re-routing the Project's transmission line to avoid a Gamebird Habitat Area; building the transmission line to APLIC's avian-safe standards (2006); burying collection lines underground; equipping the Project substation with downward facing shields on all lights; and, providing sensitive species awareness training for all on-site workers. All operators and technicians on site are required to turn off internal lights in turbines at night when lights are not required for safety or compliance purposes. However, nighttime modified turbine operational protocols have not been demonstrated to significantly or consistently reduce the risk of bird collisions at wind turbines. Therefore, impacts to birds from operation of the Project are expected to be generally similar regardless of the alternative under which the Project operates.

Population Level Effects of Operation on Birds

No population level disturbance or displacement impacts to bird species would occur under any of the four alternatives. The location of the Project is a landscape that is over 90% agricultural row crop, with very limited natural habitat of any other kind present in the project area. Specifically, there is not sufficient forest, grassland, or aquatic habitat to support forest interior or grassland sensitive species, or large numbers of wetland species. Although there will likely be some displacement of American golden plover from their spring stopover habitat, there is sufficient other habitat in the area, including the IBA, that the presence of FRWF is not expected to cause population level displacement or disturbance impacts.

The operation of FRWF will result in bird mortality, primarily from collisions with turbines, and although FRWF has taken steps to avoid it, episodic bird mortality from collision with other structures (e.g., met towers) is possible. The Project does not exhibit any characteristics indicating a high level of collision risk, but turbines are expected to regularly kill a small number of birds each year, based on the results of post-construction mortality studies at FRWF and similar facilities. Bird mortality across all species was estimated at 5.26 birds/turbine during the 7-month 2009 study for Phase I (Johnson et al. 2010b).

Because large numbers of golden plovers use the agricultural fields in the vicinity of the FRWF as stopover habitat during spring migration, they have the potential to be disproportionately impacted. Plover mortality, however, 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 surveys.

Impacts to raptors are frequently a concern at commercial wind facilities. Given the lack of major raptor migration lines through the Project area, low expected prey densities, and lack of raptor nesting habitat observed during surveys (Johnson and Bay 2008, Carder et al. 2010), raptor fatality rates at the Project site are expected to be similar to those at other sites outside of California. The documented level of red-tailed hawk mortality (six known fatalities) at FRWF likely represents in part, the abundance of this habitat-generalist species versus other raptors in the Project area. While not a particular concern in terms of red-tailed hawk populations, impacts to this species will continue to be monitored at FRWF.

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 (see Section 4.5.2.2), mortality rates are likely to remain within the 0.00 to 11.83 birds/turbine/year range reported from other Midwestern sites (Barclay et al. 2007 and Poulton 2010). The Project is also not expected to disproportionately affect any vulnerable species. Bird populations are generally large compared to the number of birds killed, and bird reproductive rates are expected to withstand the level of loss at the Project. Therefore, operation of the Project under any of the four alternatives under consideration is not expected to have population level effects on any avian species.

5.5.3.5 *Operation Effects on Bald and Golden Eagles*

Golden eagles are rare migrants in the project area. No effects are anticipated to golden eagles from FRWF.

Although bald eagles are no longer listed under the ESA and are not listed by the IDNR, they remain protected under the BGEPA and are considered by the Service to be a species of concern at wind energy facilities. An eagle risk assessment was conducted in 2011 for the Project using the 2011 draft ECP guidance (USFWS 2011a) (see Section 4.5.2.3). Potential risks to eagles from the Project are discussed specifically below.

In February 2012, the Service provided additional comments regarding bald 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, developed as outlined in the 2011 Draft ECP Guidance, for the Fowler Ridge Wind Energy Development concluded that risk to eagles from the Project may be relatively low (see Appendix B of the BBCS [Appendix D of this document]). The eagle risk assessment indicates that the FRWF a.) does not appear to overlap with any "important eagle use areas," b.) does appear 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% confidence interval between 0 and 0.604 bald eagles per year. Extrapolated over the 22-year life of the Project, the fatality estimate adds up to 4 bald eagles; however, total take over the life of the Project could be as low as zero, given the confidence intervals associated with the calculation of risk. As with other bird species, modified nighttime turbine operational protocols are not known to significantly or consistently reduce the risk of eagle collisions at wind turbines. Therefore, impacts to eagles from operation of the Project are expected to be similar regardless of the alternative under which the Project operates. At the recommendation of the Service, FRWF has developed an eagle management plan for evaluating risk to eagles and outlined a management strategy. The Project's eagle management plan is included in Section 5.3.3 of the BBCS (Appendix D).

Service (2011a) guidance, as currently written, states that any wind energy facility with important eagle use areas (e.g., nests) within 10 miles of turbines should fall within Category 2—moderate to high risk to eagles. However, the eagle use assessment conducted for the Project (Good and Simon 2011; see Section 4.5.2.3) 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 7, 2007 (Appendix C), 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 (Appendix C) 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).

Population Level Effects of Operation on Bald and Golden Eagles

No population level effects are expected for bald or golden eagles under any of the four alternatives under consideration.

5.5.4 Maintenance Effects on Wildlife and Aquatic Resources

Maintenance activities would be required to ensure the safety and operability of FRWF under all four of the alternatives under consideration, and consequently, maintenance impacts to wildlife, including bats and birds, are the same for all of the alternatives. Maintenance may include changing oil in the turbine nacelle, maintaining electrical equipment inside the turbine tower, etc. Additionally, approximately every three years, or on an as-needed basis, tree branches identified as hazardous to the continued operation of the generation tie-in lines (that connect all phases of the Project to the Dequine Substation) would be trimmed.

The impacts on wildlife in general from noise, vibration, and/or increased human activity and traffic associated with maintenance activities would be similar in character as those for construction activities, but they would occur intermittently and in shorter periods of time. Avoidance and minimization measures implemented for maintenance would be similar to those prescribed for construction activities. Trimming of tree branches may occasionally displace bats or birds from roosting or foraging habitat, but this impact would be intermittent, short-term, localized, and minor. No impacts to aquatic species would occur as a result of maintenance activities.

Population Level Effects of Maintenance on Wildlife and Aquatic Resources

No population level effects of maintenance are expected for any species of wildlife or any aquatic species.

5.5.5 Decommissioning Effects on Wildlife and Aquatic Resources

Decommissioning of FRWF would occur under all four of the alternatives under consideration and consequently, decommissioning impacts to wildlife, including bat species and bird species, are the same for all of the alternatives. Decommissioning of the Project would 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. Impacts on wildlife from decommissioning activities would be similar in character as those for construction activities, but they would occur intermittently and in shorter periods of time. Avoidance and minimization measures implemented for decommissioning would be similar to those prescribed for construction activities. Effects to aquatic species as a result of decommissioning are expected to be similar to those of construction and would result in minor, if any, impacts to aquatic wildlife.

Population Level Effects of Decommissioning on Wildlife and Aquatic Resources

No population level effects of decommissioning are expected for any species of wildlife or any aquatic species.

5.5.6 Mitigation for Impacts to Wildlife and Aquatic Resources

No specific mitigation is proposed for terrestrial wildlife, aquatic resources, birds, or bats not listed under the ESA.

5.5.7 Summary of Effects to Wildlife and Aquatic Resources

5.5.7.1 *Terrestrial Wildlife and Aquatic Resources*

- No substantial changes to wildlife habitat or populations of terrestrial or aquatic wildlife would occur under any of the four alternatives.
- Mortality of terrestrial wildlife may occur as a result of road kills during construction of Phase IV, but these impacts are expected to be minor under any of the four alternatives.

- Population level effects from construction of Phase IV are not expected to occur under any of the four alternatives for any species of terrestrial wildlife.
- Terrestrial wildlife mortality is not expected to occur as a result of Project operations under any of the four alternatives. Likewise, population level effects from operation of the Project under any of the four alternatives are not expected for any species of terrestrial wildlife.
- Effects to aquatic resources associated with construction of Phase IV are anticipated to be minor under any of the four alternatives. Population level effects from construction of Phase IV are not expected for any aquatic species under any of the four alternatives.
- No effect on aquatic resources would occur as a result of operation of the Project under any of the four alternatives. Likewise, population level effects from operation of the project under any of the four alternatives are not expected for any aquatic species.
- No effects as a result of maintenance or decommissioning are expected for any species of terrestrial wildlife or any aquatic resource.
- No specific mitigation measures for terrestrial wildlife or aquatic resources would be implemented under any of the four alternatives.

5.5.7.2 *Birds*

- No significant adverse effects to the local bird community are anticipated under any of the four alternatives due to the large amounts of similar habitat available adjacent to all permanently disturbed areas.
- Bird mortality due to Phase IV construction is anticipated to be minor under any of the four alternatives and population level effects from construction of Phase IV are not expected for any bird species under any of the four alternatives.
- Over the 22-year life of the Project, it is estimated that approximately 41,634 birds ([1,867 birds x 2 years] + [2,362 birds x 15 years] + [494 birds x 5 years]) would be killed.
- No population level disturbance or displacement impacts to bird species would occur under any of the four alternatives.
- The effect of potential displacement of American golden plovers from the Project area is expected to be minor, given that both protected and comparably large areas of other suitable habitat is available adjacent to the Project area.
- No impacts to bald or golden eagles from the Project are anticipated based on the location of the Project area and the distribution of eagles in the area.
- No effects as a result of maintenance or decommissioning are expected for any bird species.

- No specific mitigation measures for birds would be implemented under any of the four alternatives.

5.5.7.3 *Bats Not Listed Under the ESA*

- No maternity, roosting, or native foraging habitat for bats not listed under the ESA would be lost due to Phase IV construction under any of the four alternatives. Additionally, construction of Phase IV would not impact fall swarming habitat for bats or hibernacula for cave-dwelling species under any of the four alternatives.
- Phase IV construction activities and associated increases in noise, light, vibration, human activity, and/or traffic are not expected to disturb or displace bats not listed under the ESA under any of the four alternatives.
- Mortality of bats not listed under the ESA is not expected to occur as a result of Phase IV construction under any of the four alternatives and population level effects from construction of Phase IV under any of the four alternatives are not expected for any bats not listed under the ESA.
- Bats not listed under the ESA are not expected to be disturbed or displaced from the Project area as a result of Project operation under any of the four alternatives
- Mortality of bats not listed under the ESA are expected to average 30.12 bats/turbine during the fall without turbine operational adjustments; this mortality rate is expected to vary greatly across the alternatives under consideration.

Over the 22-year life of the Project, it is estimated that approximately 28,173 bats not listed under the ESA ([1,264 bats x 2 years] + [1,598 bats x 15 years] + [335 bats x 5 years]) would be killed under the **No Action Alternative** (

- Table 5.3).

Over the 22-year life of the Project, it is estimated that approximately 180,776 bats not listed under the ESA ([8,108 bats x 2 years] + [10,255 bats x 15 years] + [2,147 bats x 5 years]) would be killed under the **3.5 m/s Cut-In Speed (Feathered) Alternative** (

- Table 5.3).

Over the 22-year life of the Project, it is estimated that approximately 147,458 bats not listed under the ESA ([6,614 bats x 2 years] + [8,365 bats x 15 years] + [1,751 bats x 5 years]) would be killed under the **5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action)** (

- Table 5.3).

Over the 22-year life of the Project, it is estimated that approximately 80,649 bats not listed under the ESA ([3,617 bats x 2 years] + [4,575 bats x 15 years] + [958 bats x 5 years]) would be killed under the **6.5 m/s Cut-In Speed Alternative** (

- Table 5.3).

- Insufficient information currently exists to understand the population level effects of the magnitude of loss to the various bat species that will be killed at the Project.
- No effects as a result of maintenance or decommissioning are expected for bats not listed under the ESA.
- No specific mitigation measures for bats not listed under the ESA would be implemented under any of the four alternatives.

5.6 RARE, THREATENED AND ENDANGERED SPECIES

5.6.1 Impact Criteria

The ESA and the State of Indiana protect species that are federally and/or state-listed as threatened, endangered, or other listing status from unauthorized taking. Taking includes harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting. Federal agencies must ensure any federally-funded or authorized action is unlikely to jeopardize listed species' continued existence or destroy or adversely modify designated critical habitat.

This review includes potential direct and indirect effects[57] to threatened and endangered species. Direct effects consist of the taking of the listed species due to Project construction and operation, and include changes to the species' habitat use due to noise, vibration, visual disturbance, and transportation activities. Indirect effects include issues such as increased competition for resources or habitat due to displaced individuals, habitat destruction, or other indirect effects that cause mortality, decreased breeding and future population recruitment, or decreased fitness. Both direct and indirect effects on habitat types that affect population size and viability are addressed

5.6.2 State-listed Species

As summarized in Section 4.6, state-listed threatened and endangered species with the potential to occur in or migrate through the Project area were considered in this EIS, including three aquatic species, two insects, two reptiles, eight birds, seven mammals and 10 plants (see Indiana state-listed species in Section 4.6.2.2).

Impacts to all state-listed species, with the exception of the seven state-listed bat species, are expected to be the same under all four alternatives under consideration. Impacts to state-listed plants are covered in the inclusive discussion in Section 5.3 and impacts to state-listed wildlife species are addressed in the inclusive discussion in Section 5.5, above. Impacts to the seven listed bat species (one endangered: evening bat, and six special concern: little brown, northern myotis, tri-colored, silver-haired, hoary and eastern red) are addressed comprehensively with non-listed bat species in Section 5.5, above. The rest of this section discusses impacts to the one federally-listed species that may occur within the Project area, the federally-endangered Indiana bat.

[57] Per the definitions in the ESA, the discussion on threatened and endangered species uses the following terms: "direct effects" are those caused by the Project and occur at the same time and place, and "indirect effects" are those caused by the Project and that are later in time, but are still reasonably certain to occur (50 CFR §402.02).

5.6.3 Indiana Bat

5.6.3.1 *Construction Effects*

Construction of Phase IV would occur under all four of the alternatives under consideration and consequently, construction impacts to the Indiana bat are the same for all of the alternatives. The Service, in a letter dated October 13, 2006, has determined that no potentially suitable summer habitat, fall swarming habitat, or hibernacula are found within the Project area overall or within Phase IV and that Indiana bats are not expected to be in the Phase IV area during the summer maternity season, approximately May to July (Appendix C). Therefore, construction of Phase IV would not affect summer maternity habitat, fall swarming habitat, or hibernacula for Indiana bats.

Construction activities and associated increases in noise, vibration, human activity, and/or traffic are not expected to disturb or displace Indiana bats from the Project area due to the lack of suitable maternity habitat, roosting habitat, foraging habitat, fall swarming habitat, and hibernacula for Indiana bats within the Project area. The only Indiana bat activity expected to occur in the Project area is during migration. Because construction activities are not known to impact migrating bats and will occur primarily during daylight hours, little impact to migrating bats is anticipated. Any movement of Indiana bats through the Project area is also expected to be short in duration since the Project area lacks suitable foraging or roosting habitat (i.e., individuals are expected to simply travel through the Project area and not stop to forage or roost). Therefore, potential displacement effects to migrating Indiana bats from increased noise, light, vibration, human activity, or traffic associated with construction and maintenance activities are not expected to rise to the level of take.

Construction of Phase IV is not expected to result in mortality or loss of reproductive fitness for Indiana bats due to the lack of suitable summer maternity habitat, foraging habitat and the absence of hibernacula in the Project area and vicinity. Therefore, take of Indiana bats is not expected to occur during the construction of Phase IV.

Impacts to Local Summer Maternity Colonies

There are no known maternity colonies in Benton County, and, as mentioned above, there is no potentially suitable Indiana bat maternity habitat within the Project area. The closest known maternity colony to FRWF is located in adjoining Warren County, where the estimated distance to the edge of the maternity colony is 9.1 miles from Phase IV's southern-most project boundary. The distance as well as the lack of suitable habitat precludes the potential for that maternity colony to extend into the Project area. Therefore, no impacts to maternity colonies as a result of construction of Phase IV are anticipated under any of the four alternatives under consideration.

5.6.3.2 *Operations Effects*

Disturbance/Displacement

Indiana bats are not expected to be disturbed or displaced from the Project area as a result of Project operation under any of the four alternatives under consideration. Although Indiana bat behavior at wind energy facilities is not well understood, displacement from wind facilities has not been documented for any species of bat. Additionally, the Project area does not provide suitable maternity habitat, roosting habitat, summer foraging habitat, fall swarming habitat, or hibernacula from which Indiana bats could be displaced.

Mortality

Turbine operational protocols have been demonstrated by studies at FRWF and several other wind energy facilities to significantly influence bat mortality (Fiedler 2004, Kerns et al. 2005, Arnett et al. 2008, Baerwald et al. 2008, Good et al. 2011a and 2012). Therefore, it is expected that impacts to Indiana bats at the FWRF would vary greatly depending on the alternative under which the Project turbines are operated.

Under each of four alternatives under consideration, Indiana bats are expected to be at risk of turbine collision and/or barotrauma only during the fall migratory season (August 1 – October 15) and not the spring migration season or summer maternity season. This is based on the timing of the five documented Indiana bat fatalities at wind facilities, the lack of suitable maternity habitat within the Project area, and the distance to the nearest known hibernaculum (105 miles) (USFWS 2007), as well as the results of the spring bat mortality surveys completed at Phases I - III (Appendix D).

Impacts to Local Summer Maternity Colonies

There are no known maternity colonies in Benton County; however, maternity colonies have been documented in counties adjacent to Benton County (USFWS 2007). The closest known maternity colony to FRWF is located in adjacent Warren County, where the estimated distance to the edge of the maternity colony is 1.5 miles from FRWF's southern-most project boundary. As previously mentioned, the distance as well as the lack of suitable habitat between the maternity colony and FRWF precludes the potential for that maternity colony to extend into the Project area. Additionally, the Service has determined that Indiana bats are not expected to be in the Phase IV area during the summer maternity season, approximately May to July, based on the lack of Indiana bat summer habitat within the Project area. Therefore, no mortality impacts to local maternity colonies are anticipated to occur during summer maternity season as a result of operation of the FRWF under any of the four alternatives under consideration.

Impacts to Migrating Indiana Bats

Little is known about Indiana bat migration, but the post-construction monitoring at FRWF and other facilities suggest that movement of migratory Indiana bats is dispersed in time and space (i.e., multiple Indiana bat fatalities have not been found together nor has more than one Indiana bat been found dead at any facility in one season). Based on the best available data, Indiana bat movement through the Project area is not expected to occur in large concentrations or be focused at any particular section of the approximately 20-mile wide Project area. For all three alternatives below that result in take of fall migrating bats, the maternity colonies from which those bats would come are unknown. Multiple maternity colonies are known to exist north of FRWF and it is assumed there are more colonies north of FRWF that have not been discovered, based on the estimated MRU population. Therefore, fall migrating Indiana bats that pass through the Project area on their way to hibernacula (primarily in southern Indiana and Kentucky) are assumed to come from multiple maternity colonies. The specific hibernacula to which fall migrating bats passing through the Project area return is also unknown. With numerous hibernacula south of the Project area, it is a reasonable assumption that Indiana bats migrating through the project area in the fall are flying to multiple hibernacula. There are no good data on the effect of the loss of fall migrating bats on a hibernating population. There is likely some threshold at which a hibernating population is no longer viable; however, some populations of hibernating bats are quite small. P4 hibernacula are defined as having current or observed historic populations of fewer than 50 bats, and Indiana bats have been found roosting in small groups or even singly (USFWS 2007).

No Action Alternative

Under the No Action Alternative, all FRWF turbines would be shut off from sunset to sunrise between August 1 and October 15, the primary Indiana bat fall migratory period, each year during the operational life (22 years) of the FRWF. Therefore, it is expected that Indiana bat mortality would not occur during the fall migration season under this alternative (Table 5.4 and Table 5.5). Because Indiana bat take is not expected to occur during spring or summer (see Section 4.5.2.4 and Section 4.1.1.3 of the HCP), it is expected that the No Action Alternative would avoid take of Indiana bats altogether at the FRWF and issuance of an ITP would not be necessary.

Mortality monitoring would be conducted according to the FRWF BBCS (Appendix D) under the No Action Alternative. However, Indiana bats would not receive the habitat enhancement and protection benefits associated with the mitigation and conservation measures that would be implemented as part of an HCP. If take of an Indiana bat were to occur during the unrestricted period (i.e., spring or summer), the Applicant would meet with the Service and determine the appropriate mechanism for future authorization for take and the need for operational restrictions

Table 5.4 Predicted Indiana Bat Fatalities per Year by EIS Alternative

Alternative	**Indiana Bat Take**			
	Bats/Turbine/Year (fall only)	355 Turbines[3] (bats/yr) (90% CI)	449 Turbines[4] (bats/yr) (90% CI)	94 Turbines[5] (bats/yr) (90% CI)
No Operational Adjustment Scenario[1]	0.048[58]	17.0 (14.0-21.1)	21.6 (18.0-26.9)	4.5 (3.8-5.6)
No Action Alternative[2]	0	0	0	0
3.5m/s Cut-In Speed (Feathered) Alternative	0.031	10.9 (9.0-13.5)	13.9 (11.5-17.2)	2.9 (2.4-3.6)
5.0m/s Cut-In Speed Alternative (Applicant Proposed Action)	0.024	8.6 (7.0-10.6)	10.9 (8.8-13.4)	2.3 (1.9-2.8)
6.5m/s Cut-In Speed Alternative	0.011	3.9 (3.1-4.6)	4.9 (4.0-5.9)	1.0 (0.8-1.2)

[1]No curtailment, no feathering below 3.5 m/s wind speed. Not an alternative under consideration. Included only for comparison purposes.
[2]No nightly operation during the fall migration period (August 1-October 15).
[3]Phases I - III in operation; 2 year of the 22-year life of the Project
[4]Phases I - IV in operation; 15 years of the 22-year life of the Project
[5]Phase IV only in operation; 5 years of the 22-year life of the Project

[58] Rounded to 0.05 Indiana bats/turbine in the HCP.

Table 5.5 Predicted Indiana Bat Fatalities over the 22-Year Life of Fowler Ridge Wind Farm by EIS Alternative

Alternative	Indiana Bat Take [3]
No Operational Adjustment Scenario[1]	381
No Action Alternative[2]	0
3.5m/s Cut-In Speed (Feathered) Alternative	245
5.0m/s Cut-In Speed Alternative (Applicant Proposed Action)	193
6.5m/s Cut-In Speed Alternative	86

[1]No curtailment, no feathering below 3.5 m/s wind speed. Not an alternative under consideration. Included only for comparison purposes.
[2]No nightly operation during the fall migration period (August 1-October 15).
[3]Take = (total bats killed per year Phases I - III (355 turbines) x 2 years) + (total bats killed per year Phases I - IV (449 turbines) x 15 years) + (total bats killed per year Phase IV x 5 years)

3.5 m/s Cut-In Speed (Feathered) Alternative

Under the 3.5 m/s Cut-In Speed (Feathered) Alternative, FRWF turbines would be feathered under wind speeds of 3.5 m/s from sunset to sunrise between August 1 and October 15. Based on the results of post-construction curtailment studies at FRWF (Good et al. 2012), it is expected that fall bat mortality under this alternative would be reduced by 36% from the levels of fall bat mortality observed at un-curtailed turbines during the 2010 and 2011 post-construction mortality studies. A 36% reduction in mortality would result in an average annual bat mortality rate of approximately 19.31 bats/turbine during the fall season. Based on the species composition of bat mortalities recorded at FRWF to-date, Indiana bat fatality is estimated at approximately 0.031 bats/turbine during the fall migration season under the 3.5 m/s Cut-In Speed (Feathered) Alternative (Table 5.4). Indiana bat take is not expected to occur during spring or summer.

Based on post-construction mortality data collected at FRWF, total Indiana bat take under the 3.5 m/s alternative is predicted to be approximately 10.9 Indiana bats per year when Phases I - III are operating (355 turbines), 13.9 Indiana bats per year when Phases I - IV are operating (449 turbines), and 2.9 Indiana bats per year when only Phase IV is operating (94 turbines) (Table 5.4). Over the 22-year life of the Project, it is estimated that approximately 245 Indiana bats would be killed under the 3.5 m/s Cut-In Speed (Feathered) Alternative (Table 5.5).

It is predicted that 75% of the Indiana bats killed at FRWF would be adult females (see Section 4.2 of the HCP); the reproductive capacity of 184 females taken by the Project is estimated as potentially contributing an additional 202 bats to the population by Year 22 of the Project. Thus, the total impact of the taking under this alternative would be 447 Indiana bats over the life of the Project, or 20.3 bats per year on average. The loss of 20.3 Indiana bats per year would represent a loss of 0.007% of the estimated 2011 population of the MRU (305,297 Indiana bats) (USFWS 2012d). The loss to the rangewide population would be 0.005%, based on the 2011 estimated population size of 424,708 Indiana bats (USFWS 2012d). Losses of this magnitude across the range of the Indiana bat or within the MRU would not in itself pose a threat to any population or the species as a whole. How these impacts are distributed among maternity colonies and hibernacula are, however, important to consider.

The effect on a maternity colony or hibernaculum, however, is most appropriately measured by the greatest number of bats killed in any one year, since that highest number of bats would be removed from one or more hibernacula and one or more maternity colonies in each of those years. Therefore, under the 3.5 m/s alternative 13.9 Indiana bats are estimated to be killed each year for 15 years while all four phases are operational. The loss of 13.9 Indiana bats would likely be distributed among multiple hibernating populations because maternity colonies are known to be comprised of bats from more than one hibernaculum and multiple large and small hibernacula exist south of FRWF (USFWS 2007). In Indiana, there are seven P1, one P2, 16 P3, and nine P4 hibernacula and in Kentucky there are five P1, 15 P2, 34 P3, and 20 P4 hibernacula (note that not all of the Kentucky hibernacula would be used by bats migrating through FRWF). The loss of 13.9 Indiana bats would represent a minor impact if, as predicted, the impact would be distributed among multiple hibernating populations, including large P1 and P2 hibernacula.

Although it is unknown where most Indiana bat maternity colonies are located, the summer habitat north of the FRWF and within the range of the Indiana bat likely supports multiple colonies from which migrating bats potentially encountering FRWF would come. The impact of killing 13.9 Indiana bats each year for multiple years could be unsustainable and lead to the decline or extirpation of one or more of those maternity colonies if all the bats came from one or a small number of maternity colonies each year. The larger the number of bats taken (or the fewer potentially affected colonies), the greater the likelihood that impacts would be significant for one or more colonies. The greater the number of consecutive years this occurred would likely also contribute to potential decline or extirpation of affected colonies. Whether or not the level of take estimated for the 3.5 m/s alternative (13.9 bats / year for 15 years) is sustainable is unknown, but the best biological judgment suggests it would be sustainable if the bats would be taken from multiple maternity colonies.

Mortality monitoring would be conducted according to the Project HCP under the 3.5 m/s Cut-In Speed (Feathered) Alternative. To facilitate responsiveness in management actions that would ensure that the 22-year take estimate is not exceeded, the HCP would intensively monitor mortality and include associated annual and within-year adaptive management take thresholds. Under the HCP, mortality monitoring would track the take of Indiana bats and mortality of all bats in general on an annual basis, and adaptive management would be used to ensure that Indiana bat take does not exceed the authorized take limit. Additionally, Indiana bats would receive the habitat enhancement and protection benefits associated with the mitigation and conservation measures that would be implemented as part of the HCP intended to fully offset the impacts of take at the FRWF and promote recovery of the species.

5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action)

Under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action), FRWF turbines would be feathered under wind speeds of 5.0 m/s when the ambient temperature is at or above 50° F from sunset to sunrise between August 1 and October 15. It is conservatively[59] expected that

[59]. In 2010, a cut-in speed of 5.0 m/s, no feathering, resulted in a mortality reduction of 50% (Good et al. 2011a). In 2011, cut-in speeds of 4.5 m/s and 5.5 m/s, feathered, and resulted in mortality reductions of 57% and 73%, respectively (Good et al. 2012). It is therefore reasonable to assume that a cut-in speed of 5.0 m/s, feathered, would result in a mortality reduction between 57% and 73%.

fall bat mortality under this alternative would be reduced by 50% from the levels of fall bat mortality estimated for un-curtailed turbines based on the 2010 and 2011 post-construction mortality studies (see Section 4.1.1.2 of the HCP). A 50% reduction in mortality would result in an average annual bat mortality rate of approximately 15.09 bats/turbine during the fall season. Based on the species composition of bat mortalities recorded at FRWF to-date, Indiana bat fatality is estimated at approximately 0.024 bats/turbine during the fall migration season under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action) (Table 5.4). Indiana bat take is not expected to occur during spring or summer.

Total Indiana bat take under the 5.0 m/s alternative is predicted to be approximately 8.6 Indiana bats per year when Phases I-III are operating (355 turbines), 10.9 Indiana bats per year when Phases I-IV are operating (449 turbines), and 2.3 Indiana bats per year when only Phase IV is operating (94 turbines) Table 5.4). Over the 22-year life of the Project, it is estimated that approximately 193 Indiana bats would be killed under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action) (Table 5.5). Actual Indiana bat mortality is likely to be lower than these estimates, because they were based on the minimum reductions in mortality that were observed in studies using similar operational adjustments.

It is predicted that 75% of the Indiana bats killed at FRWF would be adult females (see Section 4.2 of the HCP); the reproductive capacity of 145 females taken by the Project is estimated as potentially contributing an additional 160 bats to the population by Year 22 of the Project. Thus, the total impact of the taking under this alternative would be 353 Indiana bats over the life of the Project, or 16.0 bats per year on average.

The loss of 16.0 Indiana bats per year would represent a loss of 0.005% of the estimated 2011 population of the MRU (305,297 Indiana bats) (USFWS 2012d). The loss to the rangewide population would be 0.004%, based on the 2011 estimated population size of 424,708 Indiana bats (USFWS 2012d). As previously discussed, losses of this magnitude across the range of the Indiana bat or within the MRU would not be considered a significant adverse effect.

For the reasons discussed above, the loss of 10.9 Indiana bats per year for 15 years is expected to be sustainable in terms of both reproductive and hibernating populations provided, as our best biological judgment indicates, that the impacts are spread over multiple maternity colonies and hibernacula. Fewer bats taken decreases the probability, everything being equal, that the impacts would occur to a single or small number of maternity colonies or hibernacula and be unsustainable. The impacts to Indiana bats under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action) are not expected to have population level consequences.

Mortality monitoring would be conducted according to the Project HCP under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action). To facilitate responsiveness in management actions that would ensure that the 22-year take estimate is not exceeded, the HCP proposes intensive mortality monitoring and associated annual and within-year adaptive management take thresholds, which are described in detail in Chapter 5 of the HCP. Under the HCP, mortality monitoring would track the take of Indiana bats and mortality of all bats in general on an annual basis, and adaptive management would be used to ensure that Indiana bat take does not exceed the authorized take limit. Additionally, Indiana bats would receive the habitat enhancement and protection benefits associated with the mitigation and conservation measures that would be implemented as part of the HCP to fully offset the impacts of take at the Project and promote recovery of the species.

6.5 m/s Cut-In Speed Alternative

Under the 6.5 m/s Cut-In Speed (Feathered) Alternative, FRWF turbines would be feathered under wind speeds of 6.5 m/s when the ambient temperature is at or above 50° or above from sunset to sunrise between August 1 and October 15. Based on the results of post-construction curtailment studies at FRWF (Good et al. 2011a), it is expected that fall bat mortality under this alternative would be reduced by 78% from the levels of fall bat mortality observed at un-curtailed turbines during the 2010 and 2011 post-construction mortality studies. A 78% reduction in mortality would result in an average annual bat mortality rate of approximately 6.64 bats/turbine during the fall season. Based on the species composition of bat mortalities recorded at FRWF to-date, Indiana bat fatality is estimated at approximately 0.011 bats/turbine during the fall migration season under the 6.5 m/s Cut-In Speed Alternative (Table 5.4). Indiana bat take is not expected to occur during spring or summer.

Based on post-construction mortality data collected at FRWF, total Indiana bat take under the 6.5 m/s alternative is predicted to be approximately 3.9 Indiana bats per year when Phases I - III are operating (355 turbines), 4.9 Indiana bats per year when Phases I - IV are operating (449 turbines), and 1.0 Indiana bats per year when only Phase IV is operating (94 turbines) (Table 5.4). Over the 22-year life of the Project, it is estimated that approximately 86 Indiana bats would be killed under the 6.5 m/s Cut-In Speed Alternative (Table 5.5).

It is predicted that 75% of the Indiana bats killed at FRWF would be adult females (see Section 4.2 of the HCP); the reproductive capacity of 65 females taken by the Project is estimated as potentially contributing an additional 72 bats to the population by Year 22 of the Project. Thus, the total impact of the taking under this alternative would be 158 Indiana bats over the life of the Project, or 7.2 bats per year on average.

The loss of 7.2 Indiana bats per year would represent a loss of 0.002% of the estimated 2011 population of the MRU (305,297 Indiana bats) (USFWS 2012d). The loss to the rangewide population would be 0.002%, based on the 2011 estimated population size of 424,708 Indiana bats (USFWS 2012d). Losses of this magnitude across the range of the Indiana bat or within the MRU would not be considered a significant adverse effect.

As discussed above, the loss of this number of Indiana bats is expected to be sustainable in terms of both reproductive and hibernating populations provided, as has been assumed, that the impacts are spread over multiple maternity colonies and hibernacula. If these impacts were to fall on a small number of maternity colonies they may be unsustainable and result in the loss of those colonies. However, fewer bats taken decreases the probability, everything being equal, that the impacts would occur to a single or small number of maternity colonies or hibernacula and therefore be unsustainable. The impacts to Indiana bats under the 6.5 m/s Cut-In Speed Alternative would not be expected to have population level consequences.

Mortality monitoring would be conducted according to the Project HCP under the 6.5 m/s Cut-In Speed Alternative. To facilitate responsiveness in management actions that would ensure that the 22-year take estimate is not exceeded, the HCP would intensively monitor mortality and include associated annual and within-year adaptive management take thresholds. Under the HCP, mortality monitoring would track the take of Indiana bats and mortality of all bats in general on an annual basis, and adaptive management would be used to ensure that Indiana bat take does not exceed the authorized take limit. Additionally, Indiana bats would receive the habitat enhancement and protection benefits associated with the mitigation and conservation measures that would be implemented as part of the HCP intended to fully offset the impacts of take at the FRWF and promote recovery of the species.

5.6.3.3 *Maintenance Effects*

Maintenance activities would be required to maintain the safety and operability of the Project under all four of the alternatives under consideration and consequently, maintenance impacts to Indiana bats are the same for all of the alternatives. Maintenance may include changing oil in the turbine nacelle, maintaining electrical equipment inside the turbine tower, etc. Additionally, approximately every three years, or on an as-needed basis, tree branches identified as hazardous to the continued operation of the generation tie-in lines (that connect all phases of the Project to the Dequine Substation) would need to be trimmed.

As stated previously, because the Project area lacks suitable foraging or roosting habitat for the Indiana bat, and because movement of Indiana bats through the Project area is expected to be limited to migrating individuals that simply travel through the Project area and do not stop to forage or roost, potential direct effects to migrating bats from maintenance activities are not expected to rise to the level of take.

5.6.3.4 *Decommissioning Effects*

Decommissioning of the Project would occur under each of the alternatives under consideration and consequently, decommissioning impacts to listed species are the same for all of the alternatives. Decommissioning of the Project would 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. Impacts to Indiana bats from decommissioning activities would be the same as for construction activities and similar avoidance and minimization measures would be implemented. The impacts would be intermittent, short-term, and localized and are not expected to rise to the level of take.

5.6.3.5 *Mitigation for Take of Indiana Bats*

Mitigation would not occur under the No Action Alternative. Mitigation for Indiana bats is described below for the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action). Mitigation under the 3.5 m/s Cut-In Speed (Feathered) Alternative and the 6.5 m/s Cut-In Speed Alternative would be qualitatively similar to that described for the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action). Mitigation proposed by the HCP is designed to compensate for the 353 total Indiana bats expected to be lost from the population (from direct take and consequent reproductive loss) as a result of Project operation. It is expected that the summer habitat mitigation, described below, would be sufficient to mitigate the take of 131 Indiana bats (37% of the total affected bats) and that the winter habitat mitigation would be sufficient to mitigate the take of the remaining 222 Indiana bats (63% of the total affected bats).

In cooperation with the USFWS, the Applicant would implement the following mitigation actions to further the recovery of the Indiana bat (see Section 5.3 in the Applicant's HCP for a detailed description). Considered together, the summer and winter habitat mitigation efforts are expected to produce a population increase sufficient to fully offset the impacts of Indiana bat take and associated lost reproductive capacity caused by the Project under any of the action alternatives. The impacts of mitigation efforts would be monitored to ensure that the mitigation goals are met.

Summer Habitat Mitigation

Habitat Preservation/Restoration. Proposed mitigation includes steps to preserve and restore 240 acres of summer maternity habitat within the home range of an extant Indiana bat maternity colony(ies) in Putnam County, Tippecanoe County, Vermillion County, or Warren County. Summer mitigation efforts would focus on 60-acre or larger habitat blocks associated with extant maternity colonies in the target counties. Parcels less than 60 acres can count towards the total mitigation requirement of 240 acres if they are functionally connected to an area of existing suitable Indiana bat habitat and, together, the parcels total at least 60 acres. The Service would have final approval as to whether or not the land parcel selected for mitigation is part of a functional 60-acre unit.

Mitigation Bank Option. FRWF has the option to utilize any mitigation bank that has been set up and approved by the USFWS for mitigation of Indiana bats in the MRU that includes lands within Indiana provided such a bank is operational at the time FRWF must meet its mitigation obligations. FRWF may have the option to contribute to the mitigation bank at a level sufficient to offset the impacts of taking 131[60] Indiana bats.

Effect of Summer Habitat Mitigation. No direct negative effect to Indiana bats would occur as a result of protection and/or restoration of summer habitat (i.e., tree planting and monitoring activities). Monitoring activities, including acoustic monitoring and exit counts are expected to result in very minimal, if any, human disturbance due to the short duration of these activities and the limited time people would be in the vicinity of roosting bats. Therefore, summer habitat mitigation is not expected to have any negative direct or indirect effects to Indiana bats.

Winter Habitat Mitigation

Proposed mitigation includes the protection of winter habitat by installing a new bat gate near the entrance of a Priority 1 hibernaculum, Wyandotte Cave, in Crawford County, Indiana, currently the largest known Indiana bat hibernaculum, with an estimated population of 61,618 bats in 2011 (L. Pruitt, pers. comm.). IDNR will be responsible for monitoring the winter mitigation (see letter dated February 28, 2013 in Appendix C).

Effect of Winter Habitat Mitigation. Winter habitat mitigation would include activities that have the potential to result in harm or take of Indiana bats, including gate construction and maintenance of human activity monitoring devices (i.e., speloggers and dataloggers), and monitoring activities. Construction activities would cause short-term surface disturbance at the cave entrance. However, potential direct effects to Indiana bats from noise, vibration, and human activity during construction of the cave gate are not expected because construction would not occur during the winter or fall when Indiana bats are hibernating or swarming. Further, the area in the vicinity of the planned gate installation would be inspected prior to construction activities to evaluate potential effects to roosting Indiana bats. Measures would be taken to avoid direct impacts to Indiana bats that may be roosting at the cave entrance at the time of gating according to guidance and oversight from the Service's Bloomington Field Office.

[60] Under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action), a total of 353 Indiana bats would need to be mitigated for (i.e., impact of taking). The 131 bats equates to 37% of that impact, which is the amount accounted for by summer mitigation. The other 222 bats (63%) would be mitigated for by the Wyandotte Cave gating.

Additionally, an air curtain would be installed each day during construction to prevent exposure to construction fumes (e.g., dust, generator, welding) of bats roosting inside the cave, if air flow is moving into the cave.

Potential disturbance to Indiana bats as a result of maintenance of speloggers and dataloggers that would be used to monitor human visitation to the cave and cave microclimate would be eliminated by performing maintenance outside of the winter hibernation period. Speloggers and dataloggers would be downloaded and maintained annually between April 1 and May 31. Other potential direct effects of cave gating could result if bats collided with gate slats, were not able to fly through the bars of the gate and had to land and crawl through, or had to expend extra energy to navigate between gate slats. However, these direct effects are not expected because the cave gates would be modeled after designs of other successful bat gates that have resulted in increased populations of Indiana bats and because post-gating monitoring would be conducted to be certain that the gate is not adversely affecting bat movement (more information on gate design is provided in Chapter 5 of the HCP). Spacing between the angle irons would be sufficient to restrict human access to the cave, but not so tight as to impede bat flight through the gate or result in collisions.

Indirect effects of cave gating could include increased predation by owls, snakes, raccoon, feral cats, or other predators if the gate slows down or stops the flight of bats as they move in and out of the cave opening. Predation at the entrances of hibernacula is a relatively common and natural phenomenon at caves with large populations of bats. However, the gate would be designed so that spacing between gate slats would be sufficient to restrict human access to the cave, but not so narrow as to hinder or slow bat flight through the gates. This should minimize predators' abilities to capture bats as they are moving in and out of the cave. Further, during gate construction, special attention would be paid to removing or modifying any potential overhangs, nearby branches, or other perches or structures that might provide easier access to predators. Post-gating monitoring would be conducted to be certain that the gate is not adversely affecting bat movement (which could increase bat susceptibility to predators). The gates would also be inspected for potential predator perches during biennial surveys and perches would be modified or removed as needed. Since there is currently a gate at Wyandotte Cave that has not resulted in population decreases, it is not expected that predation associated with the new gate would hinder population growth. Therefore, indirect effects that might rise to the level of take are not expected from winter habitat mitigation.

5.6.4 Summary of Effects to Rare, Threatened and Endangered Species

- Impacts to state-listed plants and non-bat species are expected to be minor and the same under all four alternatives and are discussed in Sections 5.3 and 5.5.
- Impacts to the seven state-listed bat species (one endangered: evening bat, and six special concern: little brown, northern myotis, tri-colored, silver-haired, hoary and eastern red) are addressed comprehensively in Section 5.5 with bats not listed under the ESA.
- Construction of Phase IV and maintenance and decommissioning of the FRWF are not expected to disturb, displace, or cause mortality of Indiana bats under any of the four alternatives due to the lack of available maternity, roosting, foraging, fall swarming, and hibernacula for Indiana bats within the Project area.

- Indiana bat take as a result of operation of the Project is not expected to occur during spring or summer under any of the four alternatives.
- It is expected that the **No Action Alternative** would avoid take of Indiana bats altogether.
- Over the 22-year life of the Project, it is estimated that approximately 245 Indiana bats would be killed under the **3.5 m/s Cut-In Speed (Feathered) Alternative** (Table 5.5). The total impact of the taking (females + pups) would be 447 Indiana bats over the life of the Project, or 20.3 bats per year on average.
- Over the 22-year life of the Project, it is estimated that approximately 193 Indiana bats would be killed under the **5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action)** (Table 5.5). The total impact of the taking (females + pups) would be 353 Indiana bats over the life of the Project, or 16.0 bats per year on average.
- Over the 22-year life of the Project, it is estimated that approximately 86 Indiana bats would be killed under the **6.5 m/s Cut-In Speed Alternative** (Table 5.5). The total impact of the taking (females + pups) would be 158 Indiana bats over the life of the Project, or 7.2 bats per year on average.
- Under any of the three action alternative, the Applicant would:
    1) Preserve and restore summer maternity habitat in the vicinity of existing maternity colonies in Putnam County, Tippecanoe County, Vermillion County, or Warren County;
    2) Protect winter habitat by installing a new bat gate near the entrance of a Priority 1 hibernaculum, Wyandotte Cave, in Crawford County, Indiana.

5.7 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

5.7.1 Impact Criteria

Pursuant to NEPA, effects to the human environment include those to socioeconomic conditions (40 CFR 1508.14). Additionally, Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires assessment of socioeconomic effects on minority and low-income communities. This section of the EIS describes the effects of the four alternatives under consideration on socioeconomic conditions of Indiana, Benton County and the incorporated towns of Fowler, Boswell, Earl Park, and Oxford, all of which are in close proximity to the Project. Current socioeconomic conditions are described in Section 4.7. Public scoping did not raise concerns regarding the Project's potential effects on the socioeconomic conditions in the Project area.

Effects would be considered significant if any of the following occurred as a result of implementing any of the four alternatives:

(1) Decline in local or regional employment;

(2) Decrease in local or regional property values;

(3) Decline in valuable community services; or

(4) Disproportionate share of adverse environmental effects placed on any minority or low-income community.

5.7.2 Construction Effects

Implementation of any of the four alternatives under consideration would include construction of Phase IV. Benefits to the socioeconomic conditions from construction of Phase IV at the state and local levels would apply to all alternatives. Benefits would include an estimated $300 million benefit to the local economy[61] and an indirect benefit of having construction workers living and working in the area of Phase IV. Because local and state construction trades would be used for constructing Phase IV, total wages and salaries paid to contractors and workers would increase temporarily and contribute to the total personal income in the region. During construction, local businesses would benefit from increased sales and revenue associated with the addition of construction workers as clientele. No minority or low-income communities would be disproportionately affected by construction of Phase IV under any of the four alternatives.

5.7.3 Operations Effects

Implementation of any of the four alternatives under consideration is not likely to result in alteration of any existing land uses. Project operations have been a part of the agricultural landscape since early 2009, and farming continues be an important component of the economic landscape.

Implementation of any of the four alternatives would likely have the same effect, if any, on property values. Losses in property values in those lands in and surrounding the Project have not been documented. In Illinois, Hinman (2010) used an improved methodology for analyzing wind facility impacts on property valuation. An initial stigma associated with wind farms may have caused property values to diminish during the facility proposal and planning stage. However, after development of the wind facility, property values rebounded and some increased around the Illinois facility. Similarly, Hoen et al. (2009) looked at data from roughly 7,500 homes situated within 10 miles of wind facilities. Hoen et al. (2009) found no conclusive evidence of any widespread property value impacts in these communities. Specifically, Hoen et al. (2009) did not find any consistent, measurable, or statistically significant effect on home sales prices relative to the view of a wind facility nor the distance of the home to the facility. Implementation of any alternative is not expected to result in reduced valuation in those properties in and around the Project. No minority or low-income communities would be disproportionately affected by operation of the Project under any of the four alternatives.

Implementation of any of the four alternatives under consideration would result in an average of $5 million in annual property taxes paid to Benton County. It should be noted that this value includes all Phases of the Project including Phase IV. Implementation of any of the four alternatives would result in similar benefits to those community services that receive funding derived from taxes paid by the FRWF. The education system in Benton County is a principle beneficiary of funds derived from the Project. .

Additional personal income would be generated for residents in the local area and the state by circulation and recirculation of dollars paid out by the Applicant as business expenditures and state and local taxes. Expenditures made for equipment, energy, fuel, operating supplies, and

[61] Based on the industry standard that estimates benefits to local economy are $2 million per MW of installed capacity.

other products and services would benefit businesses in Benton County and the State of Indiana.

Implementation of any of the four alternatives is not expected to affect community services such as water and wastewater services. Any of the four alternatives would have the same effect on those community-based services that derive funding from the tax revenue provided by the Project. Project operation and maintenance would not cause additional impacts on leading industries within the Project area. None of the four alternatives would indirectly affect those community-based services that derive funding from the tax revenue provided by the Project. Property taxes and the number of permanent jobs would not be affected.

Landowners with turbines receive royalty payments, which are in part based on the actual generation of the turbine on their land. As production is reduced, the landowner receives less income down to a minimum value. Energy production would be highest under the 3.5 m/s alternative, which is equivalent to unrestricted operation in terms of energy production, followed by the 5.0 m/s and 6.5 m/s alternatives, respectively. The No Action alternative would produce the least electricity annually because the turbines would be shut down nightly between August 1 and October 15 each year. Insufficient data exists to characterize the extent of the effect that restricted operations under any individual alternative would have on royalty payments to the landowners.

5.7.4 Maintenance Effects

Impacts associated with maintaining the Project are not expected to vary among the four alternatives. Implementation of any of the four alternatives is expected to need the same level of maintenance in the event or absence of operational restrictions. Effects to socioeconomic conditions from project maintenance are not expected to vary among alternatives. All four phases of the Project would necessitate approximately 60 full-time jobs to monitor and maintain the site.

5.7.5 Decommissioning Effects

There is little information on the effects to economic conditions associated with decommissioning large, commercial-scale wind farms. European countries like Denmark and Germany have begun re-powering or decommissioning projects only recently. Impacts associated with decommissioning are not expected to vary among the four alternatives under consideration. Implementation of any considered alternative is expected to require the same level of effort for decommissioning. The presence of the added temporary labor force would benefit the socioeconomic conditions at the state and local levels. Because local and state construction trades would be used for decommissioning activities, total wages and salaries paid to contractors and workers would increase temporarily and contribute to the total personal income in the region.

5.7.6 Mitigation for Impacts to Socioeconomics and Environmental Justice

Adverse effects to socioeconomic conditions at the state and local levels are not anticipated as a result of any of the four alternatives under consideration. A disproportionate share of adverse environmental effects as a result of construction of Phase IV or operation, maintenance and decommissioning of all four phases of the Project would not be placed on any minority or low-income community. No specific mitigation measures for socioeconomics or environmental justice would be implemented under any of the four alternatives.

5.7.7 Summary of Effects to Socioeconomics and Environmental Justice

- No concerns related to socioeconomics or environmental justice were identified during the scoping period.
- Implementation of any of the four alternatives under consideration is not expected to result in adverse effects in the form of changes in population levels or trends at the state or local levels; lost valuation in properties due to the presence of the Project; declines in community services; or disproportionate effects on low-income or minority populations.
- No specific mitigation measures for socioeconomics or environmental justice would be implemented under any of the four alternatives.

5.8 CULTURAL AND HISTORIC RESOURCES

5.8.1 Impact Criteria

Qualifying cultural resources are protected under the NHPA. NHPA defines a historic property as:

…any Pre-European contact or historic district, site, building, structure, or object included in, or eligible for listing on the National Register, including artifacts, records, and material remains related to such a property or resource (46 CFR 800, as amended 2006 Public Law 89-665; 16 U.S.C. 470, TITLE III, Section 301 (5)).

In general, a property must be at least 50 years old and possess both historic significance and integrity to be considered eligible for listing in the NRHP.

Adverse effects to cultural resources (e.g., historic structures, archaeological sites, traditional cultural properties, etc.) eligible for NRHP listing occurs when an action directly or indirectly alters any characteristic of an historic property in a way that diminishes the integrity of the property's design, location, setting, materials, workmanship, feeling, or association. Adverse effects may include reasonably foreseeable impacts that may occur later in time or are cumulative.

For this EIS, the direct APE is considered to be the Phase IV project area and the Indiana bat mitigation areas because it is only construction of Phase IV and restoration activities at the mitigation areas that have potential to directly impact cultural resources. Specifically, the direct APE includes the up to 94 turbine locations, access roads and buried interconnect lines, construction staging areas, and the substation location; and, Indiana bat mitigation sites including Wyandotte Cave and sites selected by FRWF and approved by the Service within a 2.5 mile radius circle around known maternity colonies in Indiana. The visual APE includes the area within 1 mile of Phase IV turbine locations at the request of the Indiana SHPO.

A significant adverse effect would be considered to be visual effects, noise effects, and/or cultural effects to cultural resources identified as eligible for or listed in the NRHP and located within the APE. Significant beneficial effects could result from the removal of an adverse effect (i.e., decommissioning). No issues related to cultural resources were identified during the scoping period.

5.8.2 Construction Effects

5.8.2.1 *Archaeological Resources*

A PA has been developed by the Service Region 3 Historic Preservation Office in coordination with the Applicant and the SHPO. The PA (Appendix G) commits the Applicant to archaeological investigation of the Phase IV project area, including but not limited to the 94 turbine sites, access roads and buried interconnect lines, construction staging areas, and the substation location; and Indiana bat mitigation sites including Wyandotte Cave and sites selected by the Applicant and approved by the Service within a 2.5 mile radius circle around known maternity colonies in Indiana once their exact locations have been established to avoid all archaeological impacts. As has been previously discussed, this may require that one or more of the turbine locations be changed to avoid impacts should any resources requiring avoidance be discovered.

Prior to the initiation of any construction or mitigation activities that could potentially disturb or damage archaeological resources, the Applicant shall carry out archaeological investigations in accordance with the provisions of IC 14-21-1, 312 IAC 21, 312 IAC 22, and the most current Guidebook for Indiana Historic Sites and Structures Inventory- Archaeological Sites and in accordance with the methodology set forth in the PA. The Service shall ensure that all scopes of work for archaeological identification and evaluation produced by the Applicant include a plan for the treatment of human remains and funerary objects that might be encountered.

1. <u>Phase I Archaeological Survey</u>. The Service shall ensure that a Phase I Scope of Work will be developed by the Applicant in consultation with SHPO. Phase I work will be designed to provide information regarding the significance of all identified archaeological sites to the NRHP. This work will be done in consultation with SHPO and all deliverables will be submitted by the Service to SHPO for review and comment.

    a. If the Service determines and SHPO concurs that a “site is not eligible” for the NRHP, then no further investigations of that site will be conducted.

    b. If the Service determines and SHPO concurs that a site with indeterminable eligibility can and will be avoided,, which would be the preferred option, then no further investigation of that site will be conducted, unless avoidance no longer becomes feasible.

2. <u>Phase II Archaeological Testing</u>. If all parties agree that the “eligibility of a site is indeterminable” and avoidance is not feasible, the Service shall ensure that a Phase II Research Design will be developed by the Applicant in consultation with the SHPO. This document will be consistent with SHPO guidelines. Phase II work will be designed to provide information regarding the significance of an archaeological site as “site is not eligible” or “site is eligible” to the NRHP. This work will be done in consultation with SHPO and all deliverables will be submitted by the Service to SHPO for review and comment.

    a. If the Service determines and SHPO concurs that a “site is not eligible” for the NRHP, then no further investigations of that site will be conducted.

    b. If the Service determines but SHPO will not concur regarding eligibility, all appropriate information regarding the site will be submitted by the Service to the

Keeper of the National Register, National Park Service, for review. The Keeper's determination of eligibility will be final.

c. If the Service determines and SHPO concurs that an eligible site can and will be avoided which would be the preferred option, then no further investigation of that site will be conducted, unless avoidance no longer becomes feasible.

5.8.2.2 *Historic Structures*

The results of a desktop review conducted by Stantec Consulting Services found that no NRHP listed historic resources are located within the footprint of the 94 Phase IV turbines; therefore, none would be directly affected by the project. A total of 73 resources which are listed in SHAARD as "Notable" (i.e., potentially eligible), or "Outstanding" (i.e., considered eligible) are located within the indirect APE, within one mile of a Phase IV turbine. Additionally, three resources located within the town of Fowler are actually listed on the NRHP. Construction of FRWF Phase IV would have no adverse effect on these 76 structures due to their location within the town and their current rating status in SHAARD. The Indiana SHPO, in a letter dated October 18, 2012, concurred with this finding (Appendix C).

5.8.3 Operations Effects

5.8.3.1 *Archaeological Resources*

No effects to archaeological resources would occur as a result of operations under any of the four alternatives under consideration.

5.8.3.2 *Historic Structures*

Based on the current project layout, of the 94 Phase IV turbines, 70 would have no visual effect on NRHP Listed, Notable, or Outstanding resources. A total of 76 NRHP Listed, Notable, or Outstanding resources are located within one mile of a Phase IV turbine, all but three of which are located within the town of Fowler. The three Notable structures located outside of the town of Fowler are each located within one mile of several Phase IV turbines; however, two of the structures are also located within one mile of several existing turbines constructed during earlier phases of the Fowler Ridge project. The remaining 73 structures are located within the town of Fowler, including the three NRHP listed structures, and are located within one mile of five Phase IV turbines. All of these resources are also within one mile of a number of existing turbines constructed during earlier phases of the Fowler Ridge project. Photosimulations conducted at all three of the NRHP listed resources (Fowler Theater, Fraser & Isham Law Office, and Benton County Courthouse) indicate that the tip of a single blade of one turbine may be seen at times from the Fowler Theater. None of the proposed Fowler IV turbines would be seen from street level. In addition, the potentially eligible or eligible structures within Fowler have a low potential for visual effects from the project due to their location within the town and their current rating status in SHAARD. Based on this, the Service made a determination of no effect on historic properties as a result of Phase IV regardless of the alternative chosen. The Indiana SHPO, in a letter dated October 18, 2012, concurred with the Service's finding that no historic structures within the APE would be adversely affected by Phase IV (Appendix C).

5.8.4 Maintenance Effects

Maintenance activities involved with upkeep and repair of Phases I - IV turbines has little potential to affect buried archaeological resources as long as any ground-disturbing activities associated with operation are confined to previously surveyed areas. No adverse effects to historic properties would occur as a result of Project maintenance under any of the four alternatives under consideration.

5.8.5 Decommissioning Effects

Decommissioning activities would be similar to those associated with construction; however, a shorter duration than construction. Decommissioning has the potential to impact buried archaeological resources within the footprint of all turbines, facilities, and other components of the Project that would be removed. If any previously unsurveyed areas would be directly affected by decommissioning, archaeological surveys would be required to determine the presence of archaeological sites, and the potential effects.

5.8.6 Mitigation for Impacts to Cultural and Historic Resources

5.8.6.1 *Archaeological Resources*

If all parties agree that construction of Phase IV and/or Indiana bat mitigation will have an “adverse effect” on an eligible site and avoidance is not a feasible option, then the Service will consult with SHPO to identify measures to minimize and mitigate the adverse effect to the site. The Service shall ensure that a Treatment (Data Recovery) Plan within a Memorandum of Agreement (MOA) will be developed by the Applicant in consultation with SHPO. The plan will be consistent with SHPO guidelines and all deliverables will be submitted by the Service to SHPO for review and comment.

Following SHPO review and concurrence of proposed Phase III Archaeological Data Recovery deliverables, no further investigations of that site will be conducted, unless an unanticipated post-review discovery is made. Procedures for handling post-review discoveries are described in the PA (Appendix G).

5.8.6.2 *Historic Structures*

Construction of Phase IV and operation, maintenance, and decommissioning of all Project Phases would have no adverse effect on historic structures regardless of the alternative chosen. Therefore, no mitigation is proposed.

5.8.7 Summary of Effects to Cultural and Historic Resources

- No concerns related to cultural and historic resources were identified during the scoping period.
- Construction of Phase IV, Indiana bat mitigation, operation, maintenance, and decommissioning of all Project Phases would have no adverse effect on historic structures under any of the alternatives.
- A PA has been developed by the Service Region 3 Historic Preservation Office in coordination with the Applicant and the SHPO. The PA commits the Applicant to

archaeological investigation of the Phase IV project area, including but not limited to, the 94 turbine sites, access roads and buried interconnect lines, construction staging areas, and the substation location; and Indiana bat mitigation sites including Wyandotte Cave and sites selected by the Applicant and approved by the Service within a 2.5 mile radius circle around known maternity colonies in Indiana once their exact locations have been established to avoid all archaeological impacts.

- The Applicant commits to relocating one or more of the turbine locations to avoid impacts to archaeological resources should any resources requiring avoidance be discovered.
- If construction of Phase IV or the Indiana bat mitigation under any of the four alternatives will have an "adverse effect" on an eligible site and avoidance is not a feasible option, then the Service will consult with SHPO to identify measures to minimize and mitigate the adverse effect to the site.
- The Service shall ensure that a Phase III Archaeological Data Recovery Plan within an MOA will be developed by the Applicant in consultation with SHPO.

5.9 TRANSPORTATION

5.9.1 Impact Criteria

Potential transportation issues would primarily be associated with increased truck traffic during construction of Phase IV. In general, potential issues that may occur during construction include traffic congestion on local and regional roads as a result of the transport of Phase IV materials (e.g., tower sections, blades, nacelles, etc.), increased vehicle emissions and increased traffic noise, all of which are common as a result of typical construction activities. No transportation issues were identified during the scoping period.

Prior to construction activities, the Benton County Wind Siting Ordinance (the Ordinance) requires that an Improvement Location Permit be obtained from the Benton County Building Commissioner. As part of this permit application, a transportation plan must be prepared that would describe how vehicles would access the site and describe the effects of the proposed wind facility on the local and regional road system during construction and operation. An Improvement Location Permit per the Ordinance was obtained for all existing phases of the Project and the Applicant has indicated that this permit would also be obtained for Phase IV prior to construction.

5.9.2 Construction Effects

Potential transportation issues as a result of construction of Phase IV may include traffic congestion on local and regional roads as a result of the transport of construction materials and equipment, increased heavy truck traffic, increased vehicle emissions and increased traffic noise, all of which are common as a result of typical construction activities. These effects are expected to be limited to the duration of construction activities. Regardless of the alternative chosen, traffic levels during construction of Phase IV would be similar to those experienced during construction of the first three phases of the Project, during which, no transportation issues were identified. No significant adverse effect to local and regional traffic is anticipated as a result of construction of Phase IV.

Minor improvements to local roads may be required prior to construction of Phase IV to improve existing turn radii, expand road widths to accommodate large trucks, etc., where necessary. Any proposed construction routes would be approved by the Benton County Highway Supervisor prior to construction. The County Supervisor would conduct a pre-construction baseline survey to determine existing road conditions for assessing future damage. Any road damage caused by construction of Phase IV would be repaired to the satisfaction of the Benton County Highway Supervisor, as required by the Ordinance.

Two railroad lines traverse the Project area, one of which is found within the limits of the Phase IV area (Figure 4.9.2, Chapter 4). The Applicant has indicated that should a collector line need to cross this rail line, directional boring would be used so as not to impact rail service. Therefore, regardless of the alternative chosen, rail service would continue to operate as normal and no adverse effects to railroad operations would occur as a result of construction of Phase IV.

FRWF has received a Determination of No Hazard to Air Navigation from the FAA for 91 of the 94 Phase IV turbine locations. FRWF would continue to work with the FAA to resolve siting of the remaining three turbines. Revised turbine locations will remain within the Phase IV boundary and in active cropland. Regardless of the alternative chosen, all required approvals from FAA would be obtained prior to construction of Phase IV so that none of the turbines pose a risk to air navigation.

5.9.3 Operations Effects

Operation of Phases I-IV under any of the four alternatives under consideration would not have a significant adverse effect on local and regional traffic as only a small number of employees would travel to or within the Project area on a daily or weekly basis. In addition, rail service would continue to operate as normal and no adverse effect to railroad service would occur as a result of operations.

By the time of construction and operation, Phase IV would be in compliance with all applicable FAA requirements. Therefore, regardless of the alternative chosen, no significant adverse effects to air navigation would occur as a result of Phase IV operations.

5.9.4 Maintenance Effects

Potential transportation issues as a result of Project maintenance would be similar to those experienced during construction; however, it is anticipated that the level of heavy truck traffic would be less. The number of maintenance vehicles using local and regional roads would be similar to those present as a result of maintenance of the existing phases of the Project. Rail service and air navigation would not be affected by maintenance activities. No significant adverse effect to local and regional traffic, rail service or air navigation would occur under any of the four alternatives under consideration as a result of Project maintenance.

5.9.5 Decommissioning Effects

Potential transportation issues as a result of decommissioning of Phases I-IV would be similar to those experienced during construction. Any road damage caused by decommissioning activities would be repaired to the satisfaction of the Benton County Highway Supervisor, as required by the Ordinance. No significant adverse effect to local and regional traffic, rail service or air navigation would occur as a result of Phase IV decommissioning.

5.9.6 Mitigation for Impacts to Transportation

No significant adverse effect to local and regional traffic, rail service or air navigation would occur as a result of Phase IV construction, operation or decommissioning; therefore, no specific mitigation measures are proposed.

5.9.7 Summary of Effects to Transportation

- No concerns related to transportation were identified during the scoping period.
- No significant adverse effects to local and regional traffic, rail service or air navigation would occur as a result of construction or operation of Phase IV, or decommissioning of the Project.
- Local roads may be improved in preparation for construction of Phase IV, resulting in a beneficial effect to local and regional transportation systems.
- No significant adverse effects to transportation resources are anticipated as a result of construction of Phase IV, or operation, maintenance, and decommissioning of all four phases under any of the four alternatives.
- No specific mitigation measures for transportation would be implemented under any of the four alternatives.

5.10 NOISE

The analysis area for noise effects is the Phase IV Project Area. Noise generated from Phases I - III is already part of the existing environment. Hence, the noise analysis addresses the effects associated with adding up to 94 Phase IV turbines to the existing Project. This added effect will be contained largely within the Phase IV Project Area.

5.10.1 Impact Criteria

Noise standards applicable to WECS in Benton County are contained in Chapter 8, Zoning, Subdivision, Comprehensive Plan, Article 1. Zoning Code of Benton County, Section 8-7, Paragraph 7.B. Noise and Vibration Standards that Apply to WECS. The zoning regulations limit octave band sound levels to a maximum level in each of the eight standard octave bands from 63 Hertz (Hz) to 8 kilohertz (kHz) as measured at a distance of 200 feet from any primary residence (see Section 4.10).

Noise levels that exceed the maximum level established in the County zoning regulations would be a significant effect. Public scoping did not identify noise concerns.

5.10.2 Construction Impacts

Construction of Phase IV would generate noise that would likely be audible at homes and public areas within and surrounding the Phase IV area. Assessing noise impacts as a result of construction is difficult because the location of construction activities in the area may be variable. Noise levels would vary with each phase of construction depending on the construction activity and the amount of equipment used.

Noise levels from the construction activities, including increased truck traffic noise, would occur mostly during daylight hours. Noise audible to surrounding residences or businesses would be similar to that of a few days to a few weeks of a typical road construction project or the sound of farm machinery operating on a nearby farm. The sounds from Phase IV construction would likely only be faintly heard at residences that are located some distance away. Audible sounds may include heavy truck traffic, earthmoving equipment or clanking metal tracks. No significant adverse effect to noise levels would occur as a result of construction activities under any of the four alternatives under consideration. Construction noise is not expected to have adverse effects on receptors.

5.10.3 Operations Impacts

Stantec Consulting Services used predictive noise modeling to evaluate two scenarios within the Phase IV Project Area (Appendix H). The first scenario considered the resulting effect of the operation of Phase IV alone, and the second scenario considered the combined effect of the operation of the entire Project on the Phase IV area.

Benton County's noise standards impose separate limits in the eight octave bands. When converted to A-weighted sound (weighted according to perception thresholds of people) the limits have a total sound limit of 62 dBA. This would be the applicable limit only if the spectrum of the turbine sound emissions matched exactly the spectrum of the octave band limits, which is unlikely to be the case. To be in compliance, turbine sound emissions must be estimated for each of the individual octave bands.

Stantec assessed the aggregate emissions along with each of the eight octave band sound emissions from 1) just the Phase IV turbines, and 2) the collective Phases I - IV turbines. Stantec found that the 1000 Hz octave band emissions are the highest relative to the limits set in the County's noise standard. The study determined that aggregate turbine sound could be as high as 57 dBA before exceeding the 1000 Hz limit of 53 dBA. Therefore, for the turbines to be in compliance with the Benton County standards, noise levels within 200 feet from any primary residence must not exceed 57 dBA. The model indicates that the highest predicted noise levels in Phase IV, under either of the two scenarios studied, ranged from 45 – 50 dBA with much of the Phase IV area in the 40 – 45 dBA range (see Appendix H). Therefore, operation of Phase IV would be in compliance with the Benton County noise standards and no significant noise effects are anticipated under any of the four alternatives under consideration. It should be noted that the analysis was based on the turbines operating at full power, with respect to sound emissions. Reduced operating speeds or control modes will result in lower sound levels.

Some rural residents, primarily those nearest to Phase IV turbines, may perceive and become annoyed with a change or increase in the amount of turbine noise once Phase IV begins operations. Noise levels within the town of Fowler are expected to be virtually unchanged from the existing condition (35-40 dBA) (Appendix H). Construction-related traffic on local and regional roads would decrease following construction of Phase IV; therefore, impacts from traffic noise are not anticipated during Project operations.

Daytime sound levels would not differ between alternatives. Conversely, projected nighttime noise levels would vary slightly among alternatives relative to the amount of time turbines would be operational at night during the fall bat migration period:

(1) Under the No Action Alternative, Project turbines would be turned off nightly from August 1 – October 15. Therefore, no noise would be produced at night during this time period. There would be no effect to receptors associated with nighttime operations under the No Action Alternative.

(2) Under the 3.5 m/s Cut-In Speed (Feathered) Alternative, turbines would be fully feathered when nighttime wind speeds are below 3.5 m/s from August 1 – October 15, but would begin spinning when wind speed exceeds 3.5 m/s. This alternative would result in more audible turbine noise at night when compared to the No Action Alternative because turbines would be operational for longer periods of time. Based on the results of the noise modeling, nighttime noise is not expected to exceed the standards applicable to WECS in Benton County. Nighttime noise is not expected to have adverse effects on receptors.

(3) Under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action), turbines would be fully feathered when nighttime wind speeds are below 5.0 m/s and nightly air temperatures are 50° F or above from August 1 – October 15. Turbines would begin spinning when wind speed is above 5.0 m/s regardless of air temperature. Based on the assumed amount of time turbines would be operational at night, this alternative would result in more audible turbine noise at night than the No Action Alternative, but less than the 3.5 m/s Cut-In Speed (Feathered) Alternative. Based on the results of the noise modeling, nighttime noise is not expected to exceed the standards applicable to WECS in Benton County. Nighttime noise is not expected to have adverse effects on receptors.

(4) Under the 6.5 m/s Cut-In Speed Alternative, FRWF turbines would be fully feathered when nighttime wind speeds are below 6.5 m/s and nightly air temperatures are 50° or above from August 1 - October 15. Turbines would begin spinning when wind speed is above 6.5 m/s regardless of air temperature. Based on the assumed amount of time turbines would be operational at night, this alternative would result in more audible turbine noise at night than the No Action Alternative, but less than the 3.5 m/s Cut-In Speed (Feathered) Alternative and the 5.0 m/s Cut-In Speed Alternative. Based on the results of the noise modeling, nighttime noise is not expected to exceed the standards applicable to WECS in Benton County. Nighttime noise is not expected to have adverse effects on receptors.

(5) The predictive noise model indicates that regardless of the alternative chosen, with the addition of Phase IV the sound pressure levels in Fowler are, for the most part, unchanged (35 – 40 dBA) (see Appendix H). Individual residences within Phase IV would experience increased sound levels over the existing conditions, and individual dwellings located within Phase IV would experience sound levels greater than 40 dBA.

5.10.4 Maintenance Impacts

Potential effects to noise levels as a result of Project maintenance would be similar to those experienced during construction; however, it is anticipated that the level of heavy truck traffic and heavy equipment usage would be less. Noise levels would be very similar to what is currently experienced as a result of maintenance on the existing phases of the Project and would occur mostly during daylight hours. No significant adverse effect to noise levels would occur as a result of Project maintenance under any of the four alternatives under consideration. Maintenance noise is not expected to have adverse effects on receptors.

5.10.5 Decommissioning Impacts

Potential effects to noise levels as a result of Project decommissioning would be similar to those experienced during construction. Other than short-term and localized noise during decommissioning, which would occur primarily during daylight hours, no significant adverse effect to noise levels would occur as a result of Project decommissioning under any of the four alternatives under consideration. Noise emitted from decommissioning activities is not expected to have a significant adverse effect on receptors.

5.10.6 Mitigation for Noise Impacts

No adverse effects related to noise are anticipated under any of the four alternatives under consideration. Therefore, no specific noise mitigation measures are proposed.

5.10.7 Summary of Noise Effects

- No concerns related to noise were identified during the scoping period.
- No significant adverse effect to noise levels would occur as a result of construction, maintenance, and decommissioning activities under any of the four alternatives.
- Some residences would have increased noise levels as a result of operation of Phase IV; however, Phase IV would be in compliance with the Benton County noise standards and no significant noise effects are anticipated under any of the four alternatives.
- Nighttime noise would differ between the four alternatives from August 1 – October 15; however, nighttime noise is not expected to have adverse effects to receptors under any of the four alternatives.
- The construction of Phase IV, or operation, maintenance, and decommissioning of Phases I - IV under any of the four alternatives would not have significant adverse noise effects in the Phase IV area.
- No specific mitigation measures for noise would be implemented under any of the four alternatives.

5.11 VISUAL RESOURCES

5.11.1 Impact Criteria

Pursuant to NEPA, the human environment “include[s] the natural and physical environment and the relationship of people with that environment” (40 CFR 1508.14). Aesthetics in the environment are important to most people, and visual appreciation of natural and man-made views is a universal way for people to interact with their environment. The current condition of visual resources associated with Phase IV is described in Section 4.11. Public scoping did not raise concerns regarding the proposed action’s potential effects on visual resources relative to the Phase IV Project Area.

This EIS addresses the potential for the proposed action to affect visual resources. For the purposes of this EIS, the effects of Phase IV on sensitive visual resources were analyzed within a one-mile buffer of the Phase IV project area. Affected visual resources do not include NRHP and other cultural resources, which are assessed in Section 5.8 – Cultural and Historic Resources. Phases I, II, and III (comprising 355 turbines) are not included in the visual effects analysis area; these turbines have been operating and a part of the visual landscape since 2009.

The analysis of visual resource impacts is qualitative in nature and targeted to those locations where Phase IV would be visible. Aerial photographs, site photographs, and windshield surveys were used to assess the visual character of Phase IV and surrounding area. Photosimulations are most often used for illustrating potential visual impacts associated with projects involving highly visible structures; they are effective and easily interpreted. Viewsheds are photographed from locations identified for their potential to provide scenic value. These locations, often referred to as sensitive receptor locations, may include schools and churches, parks and other recreational areas, designated scenic byways, and wildlife management areas and nature preserves.

Due to the character of the landscape and topography, and the nature of the structures proposed, Phase IV would be visible from almost everywhere in and around the site. Hence, it was not practical to evaluate every conceivable location where Phase IV might be visible. Sensitive receptors proximal to Phase IV do not include designated scenic byways, wildlife management areas, or nature preserves. The evaluation of visual impacts was limited to five locations within the visual analysis area that are likely to be of aesthetic importance, including one church, one cemetery, one town park, and two roadways (Figure 5.11.1). Photosimulations of Phase IV were created using photographs of the project area taken from the five locations. Scaled images of turbines were added to the photographs for comparison and to illustrate potential effects to the five locations (see Photos 5.1 through 5.12 below).

The evaluation of visual effects is subjective due to varying opinions about aesthetics and perceived viewsheds. Wind turbine generators may be perceived as appealing and interesting or disturbing and obtrusive depending on the individual. For the purposes of this EIS, views of one or more wind turbines in the five illustrated viewsheds were considered to be a significant effect, either negative or positive, depending on the viewer. Viewers were classified as either 1) local residents that would view the wind farm on a daily basis, or 2) individuals that would view the wind farm while traveling through Benton County and proximal to the Project Area.

Although considered significant, the effect of one or more turbines may be diminished or pronounced based on the context of the adjacent elements in the viewshed; i.e., vegetation, open sky, other structures, etc. In other words, one or two turbines that are visible in flat terrain against a backdrop of sky may have a diminished appearance as opposed to 30 or so turbines in a rolling landscape with open fields as a backdrop making the turbines more visible.

As described in Section 4.11.2, the Phase IV landscape is one of flat to gently rolling topography and rural character. Land cover is dominated by agriculture dotted with small communities, farmsteads, residences, and wind turbines. Naturally occurring vegetation is almost completely confined to roadsides, farmyards, ditches, small streams, fencerows, and residual trees. In addition to FRWF's existing 355 wind turbines, there are two other wind farms (150 turbines) in Benton County that are visible from the towns of Fowler, Earl Park, farmsteads, rural residences, and roadways.

Among the four alternatives under consideration, effects to visual resources would be the same. Implementation of any considered alternative includes constructing and operating the 94 Phase IV turbines. The alternatives vary in their operational adjustments, which would largely occur when the turbines are not visible to people (i.e., at night). Nonetheless, visual impact assessments for wind projects do not usually make distinctions between spinning and stationary wind turbines, and it is assumed there would not be perceived differences in visual impacts associated with operational adjustments.

5.11.2 Construction Effects

Implementation of any of the four alternatives under consideration would include construction of Phase IV. Turbine components would be transported through the visual analysis area on large trucks. Construction would involve the large, mobile cranes that would work briefly at each turbine location. The presence of the trucks and cranes would be temporary and create short-term impacts. Depending on the individual, the installation of a wind turbine generator could be viewed as a fascinating spectacle. Especially during those times when towers are raised and rotors are installed, it is expected that certain individuals may wish to observe the construction of Phase IV, and the open landscape would allow those to do so safely.

It is recognized that Phase IV construction would have effects on visual resources, but the larger concern is with the more prolonged nature of those effects associated with operations.

5.11.3 Operations Effects

Phase IV turbines are visible from all five of the viewing locations analyzed (Photos 5.1 through 5.12). Existing turbines are visible from the viewshed illustrated in Photo 5.10. Based on the simulated views provided in the photos below, trees, which are abundant only in the Town of Fowler, provide the only screening to restrict turbine visibility. Filtered or framed views of turbines are illustrated in photographs taken from the three locations in the Town of Fowler (Photos 5.1 through 5.3). Conversely, turbine visibility is comparatively more pronounced from the roadway locations (Photos 5.4 and 5.5).

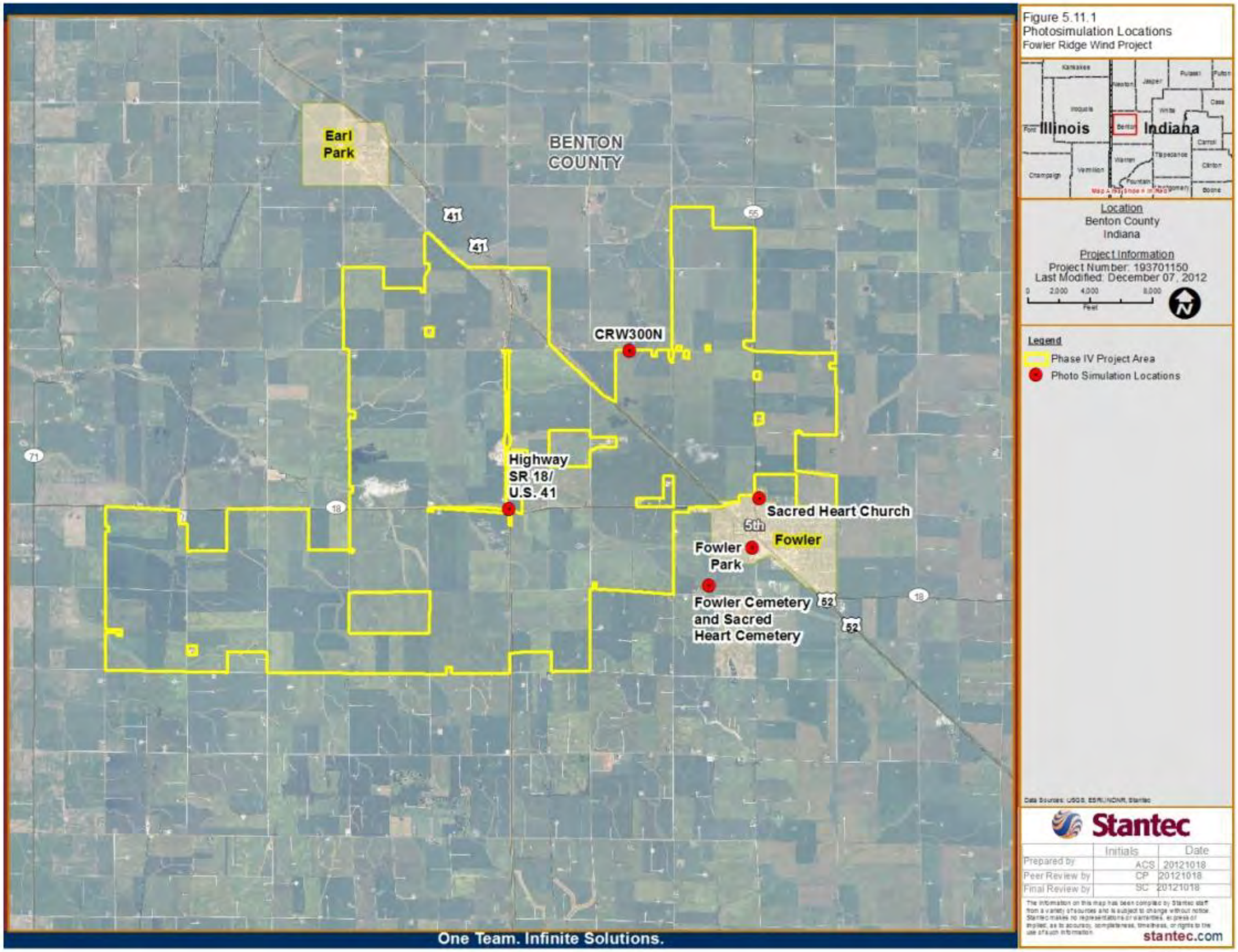


Figure 5.11.1
Photosimulation Locations
Fowler Ridge Wind Project
Illinois
Indiana
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 07, 2012
Legend
Phase IV Project Area
Photo Simulation Locations
Earl Park
BENTON COUNTY
CRW300N
Highway SR 18/ U.S. 41
Sacred Heart Church
Fowler
Fowler Park
Fowler Cemetery and Sacred Heart Cemetery
Stantec
Initials
Date
Prepared by
ACS
20121018
Peer Review by
CP
20121018
Final Review by
SC
20121018
stantec.com
One Team. Infinite Solutions.

Photo 5.1 Existing view from Fowler Park.

Photo 5.2 Simulated view from Fowler Park.
Note that proposed turbines are highlighted in red.

Photo 5.3 Existing view from Fowler Cemetery.

Photo 5.4 Simulated view from Fowler Cemetery.
Note that proposed turbines are highlighted in red.

Photo 5.5 Existing view from Sacred Heart Church.

Photo 5.6 Simulated view from Sacred Heart Church.

Photo 5.7 Existing view from State Route 18 near intersection with U.S. Route 41 looking east.

Photo 5.8 Simulated view from State Route 18 near intersection with U.S. Route 41 looking east.

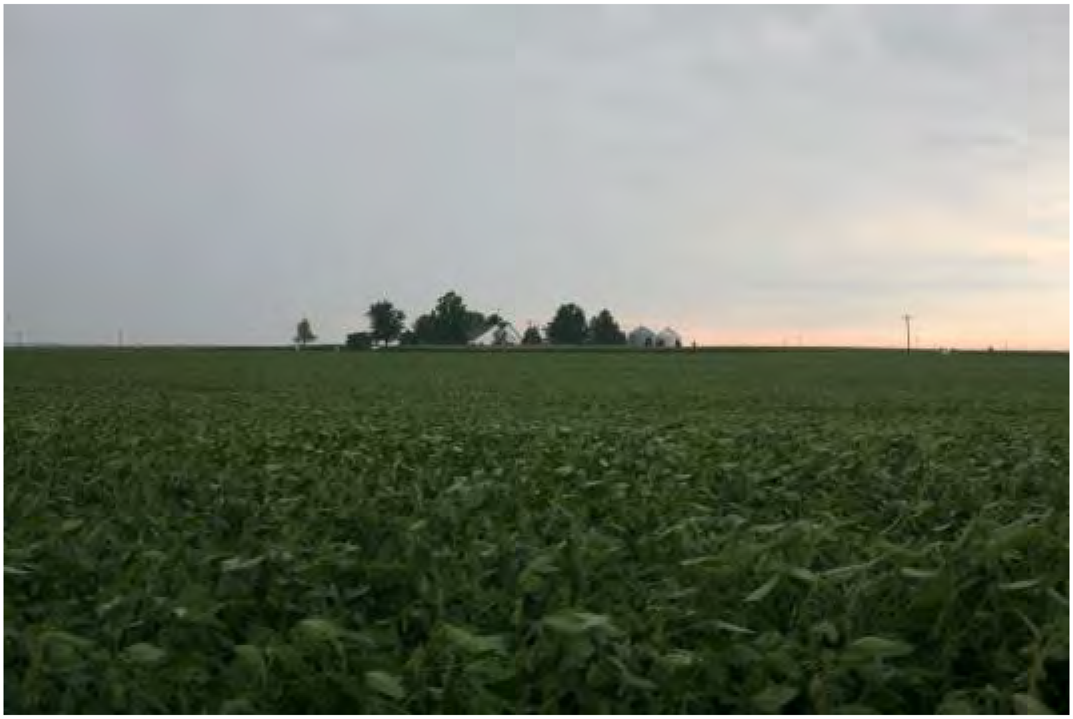


Photo 5.9 Existing view from State Route 18 near intersection with U.S. Route 41 looking southwest.

Photo 5.10 Simulated view from State Route 18 near intersection with U.S. Route 41 looking east.

Photo 5.11 Existing view from County Road W 300 N (~ ½-mile from U.S. Route 52) looking south.

Photo 5.12 Simulated view from View from County Road W 300 N (~ ½-mile from U.S. Route 52) looking south.

Because the landscape is relatively flat with few trees, the Phase IV turbines would present noticeable vertical elements in the Project Area. Excepting those rare sites with enough trees to provide screening, views of turbines would be irrefutably prominent. Some factors tend to moderate turbine prominence. As indicated in the photosimulations, cloudy or hazy conditions would tend to diminish turbine visibility as the structures tend to blend in with the sky. Views framed by trees or power poles also tend to diminish turbine visibility as shown in Photos 5.1 through 5.3.

The Project, including Phase IV, would be viewed by local residents and those individuals traveling through Benton County. Those living in the Towns of Fowler and Earl Park would have screened and pronounced views of Phase IV. It is important to note that the same noticeable vertical elements already have been introduced to nearby sites south and east of the Phase IV project area. The addition of Phase IV would further extend an already familiar view in the landscape.

People traveling through the area on U.S. Routes 41 and 52 would have largely unobstructed views of Phase IV for roughly six miles in addition to the four to six miles of viewing the existing FRWF. This could have a startling effect on some individuals if they have had no experience viewing a commercial-scale wind farm in an open landscape. Additionally, reactions to Phase IV would be variable and impacts would be based in subjectivity. Wind turbines, whether there is one or several visible, may degrade or enhance the aesthetic experience of a viewer.

As required by the FAA, Phase IV would include red, flashing lights positioned at the top of towers to mark obstructions for aviation. This effect would be the same for all four alternatives under consideration. Not all turbines would have this lighting; it is not necessary nor is it desirable from the standpoint of protecting nighttime migrating birds. However, these lights are visible nighttime elements within the visual analysis area. Given the flat topography and open character of the landscape, many of these lights would be visible from numerous locations. Because this kind of lighting is already present in Phases I, II, and III, along with the other two wind farms operated by others, it is not anticipated that nighttime lighting at Phase IV would add significantly to the existing visual intrusion.

In addition to the turbines, Phase IV would require new access roads, transmission line, and collector lines. These are considered to be minor visual impacts. The access roads would not be highly visible or perceived as out-of-place elements in the agricultural landscape. The transmission line would be notably visible but it would not have as striking a presence as the wind turbines. As is the case for the existing phases of the FRWF, collector lines would be buried and contribute no additional visual impact.

5.11.4 Maintenance Effects

Impacts associated with maintaining Phases I - IV are not expected to vary among the four alternatives under consideration. Implementation of any considered alternative is expected to need the same level of maintenance in the event or absence of operational restrictions. Impacts to visual resources from maintenance activities are not expected. It is possible that large, mobile cranes may be necessary to make certain repairs, but this would be an unusual and short-term circumstance.

5.11.5 Decommissioning Effects

Implementation of any of the four alternatives under consideration would include decommissioning of Phase IV just as with the other Phases of the Project. Decommissioning activities would be similar in character to those associated with construction. However, the decommissioning timeframe is not likely to be as long as that for constructing any of the Project Phases. Decommissioning would involve the large, mobile cranes that would work briefly at each location to dismantle the turbines. The presence of the trucks and cranes would be temporary and create short-term visual impacts. Depending on the individual, dismantling a wind turbine generator is not likely to be as fascinating as installation. However, it is expected there would be some individuals that wish to observe the decommissioning of Phase IV, and the open landscape would allow those to do so safely. Dismantled turbine components would be transported through the visual analysis area on large trucks.

5.11.6 Mitigation for Impacts to Visual Resources

The construction of Phase IV and operation of all Phases would have impacts to visual resources in the visual analysis area. However, in a landscape with 355 operating FRWF turbines and 150 other wind farm turbines, the addition of up to 94 Phase IV turbines would not have adverse effects to visual resources. Nonetheless, the Applicant plans to implement measures for minimizing visual impacts associated with wind turbines. These measures are typically implemented for the construction and operation of land-based wind farms.

To minimize visual complexity, all turbines would be similar in color and overall appearance and rotate in the same direction as existing turbines in Phases I, II, and III. Turbines would not be used for commercial advertising or possess overly conspicuous lettering or logos. The blades, nacelle, and tower would be neutral off-white in color. Where manufacturer specifications permit, non-specular paint would be used on all outside surfaces to minimize reflected glare.

5.11.7 Summary of Effects to Visual Resources

- No concerns related to visual effects were identified during the scoping period.
- Phase IV would result in minor visual impacts under any of the four alternatives.
- Phase IV would add to the nighttime landscape red, flashing lights in the visual analysis area; however, this additional nighttime lighting is not anticipated to add significantly to the existing visual intrusion created by the existing wind farms.
- Visual impacts associated with wind farms would be further extended to a currently unaffected area. However, in a landscape with 355 operating FRWF turbines and 150 other wind farm turbines, a Comprehensive Land Use Plan that has a stated goal of supporting wind farms, and no concerns regarding visual impact having been raised by residents during the first three phases of FRWF or during scoping for Phase IV, these impacts are not likely to be considered adverse.
- As described above, the Applicant plans to implement typical measures for the construction and operation of land-based wind farms for minimizing visual impacts associated with wind turbines.

5.12 AIR QUALITY AND CLIMATE

5.12.1 Impact Criteria

The Clean Air Act of 1970 (CAA), and the CAA Amendments of 1990 established National Ambient Air Quality Standards (NAAQS) for selected pollutants. The NAAQS established maximum levels of acceptable background pollution with a margin of safety to protect public health and welfare. NAAQS compliance in Indiana is monitored by IDEM.

Per the CAA and the Amendments of 1990, USEPA has established New Source Performance Standards (NSPS) to regulate air pollution emissions from new stationary sources. These standards apply to various facilities, but because wind turbines generate electricity without releasing air pollutants, NSPSs do not apply to this Project.

The Acid Rain Program, established by CAA Amendments of 1990 to lower sulfur dioxide and nitrogen oxides emissions, does not apply to the Project because wind turbines generate electricity without releasing air pollutants. Likewise, the Prevention of Significant Deterioration (PSD) does not apply to the Project for the same reason.

Recent federal greenhouse gas (GHG) policy has focused on voluntary initiatives to reduce GHG emissions. In 2010, the CEQ drafted guidance regarding GHG emissions in evaluating Federal actions under NEPA. The guidance indicated that if the Project leads to 25,000 metric tons or more of carbon dioxide equivalent emissions then it may warrant some description in the appropriate NEPA analysis.

No phase of the Project would emit new major sources of air pollutants; therefore, the Project would not be a source of air pollution. No issues related to air quality were identified during the scoping period.

5.12.2 Construction Effects

During the site preparation and construction phase, temporary and localized impacts to air quality would result from the operation of construction equipment and vehicles. Impacts would occur as a result of emissions from engine exhaust (criteria pollutants and GHGs), fugitive dust generation during earth-moving and vegetation removal, and travel on unpaved roads. Dust may annoy existing residents and travelers, and could potentially be deposited on surfaces at certain locations in public areas or near residences. Fugitive dust associated with vehicle travel on gravel roads and with agricultural practices is a normal occurrence in rural areas such as Phase IV and residents in these areas are likely acclimated to dealing with dust. Construction of Phase IV may increase the amount of fugitive dust in some areas within Phase IV, but this would be temporary and last only during construction.

No significant adverse effect to air quality would occur as a result of construction of Phase IV under any of the four alternatives under consideration.

5.12.3 Operations Effects

No significant adverse effect to air quality would occur as a result of Project operations, regardless of which of the four alternatives under consideration is chosen. Adverse impacts to air quality would not occur, as the Project would not release pollutants into the atmosphere. Project operations may require a small amount of vehicular traffic resulting in the release of carbon dioxide emissions and particulates. These emissions are not estimated to have a significant effect on local or regional air quality or contribute greatly to the amount of greenhouse gases. Project operation would not generate any new sources of air pollutants.

Energy production would be highest under the 3.5 m/s alternative, followed by the 5.0 m/s and 6.5 m/s alternatives, respectively. The No Action alternative would produce the least electricity annually because the turbines would be shut down at night between August 1 and October 15 each year. Nevertheless, under any of the four alternatives under consideration, power delivered to the grid from the Project would not cumulatively add to the emissions produced at existing conventional power plants.

Operation of Phase IV along with the existing Project would not cause direct emissions of 25,000 metric tons or more of carbon dioxide-equivalent greenhouse gas emissions annually; therefore, the Phase IV would not result in greenhouse gas emissions that would contribute to problems associated with climate change.

5.12.4 Maintenance Effects

No significant adverse effect to air quality would occur as a result of Project maintenance, regardless of which of the four alternatives under consideration is chosen. As with project operation, some vehicular traffic would be required resulting in the emission of carbon dioxide emissions and particulates. Some localized impacts to air quality may result from engine exhaust emitted from maintenance equipment and vehicles. These emissions are not estimated to have a significant effect on local or regional air quality or contribute greatly to the amount of greenhouse gases.

5.12.5 Decommissioning Effects

No significant adverse effect to air quality would occur as a result of Project decommissioning, regardless of which of the four alternatives under consideration is chosen. Air quality impacts associated with decommissioning would be similar to those during construction and may include localized engine exhaust emissions from equipment and vehicles. These emissions are not estimated to have a significant effect on local or regional air quality or contribute greatly to the amount of greenhouse gases.

5.12.6 Mitigation for Impacts to Air Quality and Climate

During the Phase IV construction, and Project maintenance and decommissioning phases, air quality impacts would be intermittent, short term, and localized. BMPs (e.g., watering roads; see Appendix E) would be implemented to reduce the amount of fugitive dust produced during construction and decommissioning. Exposed soil would be stabilized as quickly as possible in compliance with the site's NPDES permit. No adverse effects to air quality would occur as a result of Project operations, regardless of which of the four alternatives under consideration is chosen. Therefore, mitigation for air quality impacts is not warranted and no mitigation measures would be implemented.

5.12.7 Summary of Effects to Air Quality and Climate

- No concerns related to air quality were identified during the scoping period.
- Construction of Phase IV under any of the four alternatives would have short-term negative impacts on air quality in the Phase IV area due to increased emissions from vehicles and equipment used during construction.
- Minor localized effects on air quality would occur associated with fugitive dust and vehicle emissions during Phase IV construction and throughout the lifetime maintenance and decommissioning of the entire Project.
- No adverse effects to air quality would occur as a result of Project operations under any of the four alternatives.
- Phase IV and the FRWF project in general are expected to have a long term beneficial effect on air quality by replacing carbon producing sources of energy with clean, renewable energy.
- No specific mitigation measures for air quality in addition to the BMPs discussed above would be implemented under any of the four alternatives.

5.13 COMMUNICATIONS

5.13.1 Impact Criteria

The Project could potentially effect and interfere with microwave paths, radio and television broadcast signals and cellular and two-way radio signals and wireless internet within the Phase IV area. Effects of the Project on communication resources would be significant if users are unable to rely on these systems. Phases I, II and III of the Project are in compliance with all FCC rules and policies. No issues related to communications were identified during the scoping period.

5.13.2 Construction Effects

There would be no significant difference in potential impacts to communications as a result of construction of Phase IV under any of the four alternatives under consideration. Any interference from (and impacts due to) the partially or fully completed turbines during the construction phase would be comparable to, but less intense than, the interference that might be expected during the operations phase of the Project.

5.13.3 Operations Effects

Phase IV would comply with all FCC rules and policies. Therefore, no significant negative impacts would occur as a result of operation of Phase IV under any of the four alternatives under consideration.

Two microwave paths intersect the Phase IV project area. Both paths utilize the same air space because they connect the same two towers. No significant interference with these microwave paths would occur as a result of operations. In addition, operation of Phase IV is not likely to cause interference with cellular or two-way radio communications.

All television stations serving the Phase IV area have transitioned from analog to digital signals, thus reducing the likelihood that Phase IV would adversely impact television reception. Digital television systems would not experience shimmering, ghosting, or poor picture quality that has been known to occur within analog systems. During construction and operation of Phases I – III, the Applicant has dealt with television reception issues on a case-by-case basis by working with any affected residents to identify the best solution. It is anticipated that the Applicant would continue to do so during and after construction of Phase IV

Wireless system reliability and performance is strongly affected by the strength of the incoming signal. To maximize signal strength, links are usually designed with a clear line-of-sight between antennae. A wireless customer may have reliability and/or performance issues if the path between antennae is blocked by a turbine, or if a turbine blade intersects the signal path. If necessary, any wireless internet degradation that occurs with Phase IV due to turbines would be dealt with on a case-by-case basis by working with any affected residents to identify the best solution.

5.13.4 Maintenance Effects

Potential impacts to television, microwave paths, cellular and two-way radio, and wireless internet signals as a result of maintenance activities are expected to be similar to those of operations (discussed in 5.13.2 above). Effects to any of these are likely to be sporadic and would impact only a few residents or businesses. Accordingly, maintenance of Phase IV, regardless of the alternative chosen, would have no significant negative direct or indirect impacts on communications.

5.13.5 Decommissioning Effects

During decommissioning, turbines and other Project structures would be dismantled and removed. Any interference from (and impacts due to) the partially or fully dismantled turbines during the decommissioning phase would be comparable to the interference that might be expected during the construction phase. Decommissioning activities would have no significant effect on communications regardless of the alternative chosen.

5.13.6 Mitigation for Impacts to Communications

Should Phase IV result in any impacts to any existing communications systems, each problem would be addressed individually. Resolutions could include the provision of stronger digital antennas, or cable or satellite television service in lieu of non-functional over-the-air television.

5.13.7 Summary of Effects to Communications

- No concerns related to communications were identified during the scoping period.
- The construction of Phase IV, or operation, maintenance, and decommissioning of the Project under any of the four alternatives would not have significant adverse effects to communications services in the region.
- Should Phase IV result in any impacts to any existing communications systems, each problem would be addressed on a case-by-case basis by working with any affected residents to identify the best solution.

5.14 HEALTH AND SAFETY

5.14.1 Impact Criteria

This section evaluates potential concerns related to health and safety that could occur as a result of construction of Phase IV and operation of Phases I - IV. This analysis includes evaluation of risks to the rural communities in Benton County, major transportation routes, utility corridors, buildings, residences, and public and private recreational areas. Effects would be significant if any of the features listed above would be at a measurable risk to tower collapse, blade failure, ice throw or excessive shadow flicker. Measurable risk is based on identified setbacks. No issues related to health and safety were identified during the scoping period.

5.14.2 Construction Effects

Most safety concerns associated with construction of Phase IV are similar to those potential risks associated with construction of other tall structures, such as the potential for injuries to workers and the general public from the movement of construction vehicles, equipment, and materials; falls from structures or into open excavations; and electrocution.

The Applicant is fully committed to a program of responsible management in all areas of health, safety and the environment. For construction of Phase IV, the Applicant would prepare a Site Safety Plan that would provide the framework for communicating specific policies and demonstrating management's commitment to health and safety. The plan would address issues such as personal protective equipment, housekeeping, maintaining a safe workplace, fire prevention, and safe work practices. The Site Safety Plan would apply internally and externally as appropriate and every contractor company involved in the construction of Phase IV would be expected to adhere to the requirements of the Site Safety Plan at a minimum. Compliance with federal, state, and local safety regulations as well as the safety and training requirements of the contractor(s) and the Applicant would be mandatory.

Beyond the potential general risks associated with construction described above, the Project would have no adverse effect on health and safety. Assuming proper planning, implementation and monitoring of potential construction-related health and safety risks, construction of Phase IV would have no significant adverse effect on health and safety regardless of which of the four alternatives under consideration is chosen.

5.14.3 Operations Effects

Potential safety risks as a result of Project operations are described in Section 4.14.2 and include structural failure and ice shedding, lightning strikes, shadow flicker, and fire and fuels. All design safety measures for Phase IV would be in compliance with the Benton County Wind Siting Ordinance and all applicable industry standards.

Phases I, II and III operate under an existing health and safety plan which addresses potential safety risks to Project staff and to general public safety. The plan addresses procedures for safe work practices, personal protective equipment, fire prevention, emergency procedures and safe driving, among others. It is anticipated that Phase IV would operate under a similar health and safety plan with similar requirements.

5.14.3.1 *Structural Failure and Ice Shedding*

Turbine structural failure includes turbine collapse and blade shear, both of which are potentially very serious, but also very rare. Such occurrences have been largely eliminated due to technological improvements and mandatory safety standards during turbine design, manufacturing, and installation. There are no known occurrences of tower collapse or blade shear at large-scale wind farms within the state of Indiana, and to date, FRWF has not experienced any failure of Project components.

Currently, there are no standard setbacks in the wind industry. The Benton County Wind Siting Ordinance requires a setback distance of 1,000 feet or more for turbines with a rated capacity of 1.0 MW or more. Rademakers and Braam (2005) reviewed documented incidences of turbine failure in Europe and found:

- 1,650 feet was the maximum throw distance for small blade parts and tips
- 495 feet was the maximum confirmed throw distance for an entire blade
- The risk zone is approximately equal to one half the rotor diameter for rotor and nacelle collapse
- The risk zone is equal to the height of the tower plus one half the rotor diameter for entire tower collapse

Ice shedding occurs when ice builds up on a turbine blade and either sheds straight to the ground or is thrown by the spinning motion. Although limited observations of ice throw exist, field observations indicate that most fragments fall within 330 feet of the turbine base (Morgan et al. 1998).

Phase IV turbines would be located a minimum of 1,320 feet from residences, a minimum of 1.5 times the turbine height (turbine height is defined as maximum blade tip height) from 4-lane highways and a minimum of 1.1 times the turbine height from all other roads. Turbines in Phases I-III are sited similarly. Based upon the implementation of these setbacks, control of public access to the site, and the low known incidence rate of blade shear, tower collapse, and ice throw, it is unlikely that the Project would result in risks to health and safety of the general public.

5.14.3.2 *Lightning Strikes*

An electrical grounding system is installed at each turbine to prevent damage caused by lightning strikes and provide grounding for electrical components. Modern turbines have lightning protection systems, which typically include automatic shutdown procedures in the case of damage to the blades or turbine. As such, Phase IV and all Project turbines would have no significant adverse impact on health and safety due to lightning strikes.

5.14.3.3 *Shadow Flicker*

Shadow flicker from wind turbines can occur when moving turbine blades pass in front of the sun, creating alternating changes in light intensity or shadows. These flickering shadows can cause an annoyance when cast on nearby residences (“receptors”). The distance between a wind turbine and a receptor, along with weather characteristics such as wind direction and sunshine probability are key factors related to shadow-flicker impacts. Beyond a distance of 1,000 feet, shadow flicker becomes much less noticeable, except at sunrise and sunset when shadows are long (NRC 2007).

Phase IV turbines would be located a minimum of 1,320 feet from residences, a minimum of 1.5 times the turbine height from 4-lane highways and a minimum of 1.1 times the turbine height from all other roads. Turbines in Phases I-III are sited similarly. Travelers along local roads are likely to experience some shadow flicker at times while driving; however, exposure is expected to be minimal and not significantly different than existing conditions, such as sun shining through trees, utility poles and other obstructions. Due to the rural nature of the Project area, residences tend to be widely spaced. In addition, some houses would be screened by wind breaks, trees and outbuildings. Based on this, and the setbacks that would be implemented, it is unlikely that Phase IV or all Project turbines would result in an adverse impact due to shadow flicker.

5.14.3.4 *Fire and Fuels*

Lightning, short circuit, or mechanical failure/malfunction poses the most significant risk of fire for turbines. Standard industry practice in the event that a wind turbine catches fire is to allow the fire to burn itself out while maintenance and fire personnel maintain a safety area around the turbine and protect against the potential for spot ground fires that might start due to sparks or falling material. The Applicant would prepare emergency response plans that comply with Occupational Safety and Health Administration (OSHA) regulations. Wind turbine operations and maintenance personnel are trained in fire safety and response. Phase IV would have no significant adverse impact on health and safety due to fire and fuels.

5.14.4 Maintenance Effects

Potential safety concerns associated with Project maintenance would be similar to those expected during construction, including potential injuries to workers and the general public as a result of movement of Project vehicles and equipment; falls from structures and electrocution. Assuming that the Site Health and Safety Plan is implemented and proper emergency procedures are followed, Project maintenance activities would have no significant adverse effect on health and safety.

5.14.5 Decommissioning Effects

Potential safety concerns associated with decommissioning activities would be similar to those expected during construction. Assuming proper planning and implementation of a health and safety plan, the general risks associated with decommissioning of the Project would have no significant adverse effect on health and safety.

5.14.6 Mitigation for Impacts to Health and Safety

Phase IV would operate under a health and safety plan, similar to that implemented for Phases I – III that would address potential safety risks to FRWF staff and to the general public. The Project is not expected to have a significant adverse effect on health and safety; therefore, no specific mitigation measures are proposed.

5.14.7 Summary of Effects to Health and Safety

- No concerns related to health and safety were identified during the scoping period.
- Construction of Phase IV and operation of all Project phases under any of the four alternatives would have minor effects on human health and safety.

- Threats to public safety during operation of the Project are expected to be minimal due to the implementation of required setbacks from residential structures and public roads.
- Phase IV would operate under a health and safety plan similar to that implemented for Phases I – III that would address potential safety risks to FRWF staff and to the general public.
- Assuming proper planning and implementation of a site health and safety plan under nay of the four alternatives, the general risks associated with construction, operation, maintenance and decommissioning of the Project would have no significant adverse effect on health and safety.
- No specific mitigation measures for health and safety would be implemented under any of the four alternatives.

5.15 CUMULATIVE EFFECTS

The CEQ defines cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). In 1997, the CEQ published *Considering Cumulative Effects under the National Environmental Policy Act* as a comprehensive guidance document for cumulative analyses. The CEQ guidelines acknowledge that while "in a broad sense all the impacts on affected resources are probably cumulative," it is important to "count what counts" and narrow the focus of the analysis to important national, regional, and local issues. While the CEQ recommends this be done through scoping, they also caution that "not all potential cumulative effects issues identified during scoping need to be included" in an EIS, but only those effects with direct influence on the Project and Project decision-making.

This section analyzes the cumulative effects on each of the specific resources discussed in Sections 5.1 to 5.14, and provides an overall, synergistic analysis of the cumulative effects of the alternatives and other past, current, and reasonably foreseeable actions in the region surrounding the Project. Reasonably foreseeable actions are future actions that have been proposed. The geographic scope of this cumulative effects analysis varies for each resource depending on the spatial extent of potential cumulative impacts. The temporal scope of the cumulative analysis extends approximately 22 years into the future, which is the duration of the ITP.

5.15.1 Methodology for Cumulative Effects Analysis

The CEQ guidelines (1997) recommend analyzing cumulative effects according to a tiered approach, which allows for a quantitative, resource-specific analysis of regional actions. As per the CEQ guidelines, resources that would not be impacted by the action alternatives, have beneficial effects, or are only subject to temporary effects were excluded from this analysis (CEQ 1997). Table 5.6 summarizes the screening process to determine the resources included in the cumulative effects analysis.

Table 5.6 Summary of Cumulative Effects of the Project

Resource	Potential Long Term Adverse Effects as a Result of the Project?	Potential Significant Effect	Cumulative Effects Analysis Required?	Analysis Area
Geology and Soils	No	No	No	N/A
Land Use	No	No	No	N/A
Vegetation	No	No	No	N/A
Water Resources	No	Only temporary effects during construction of Phase IV	No	N/A
Birds	Yes	Project would have no significant effect	Yes – Direct mortality, displacement, habitat loss	Partners in Flight Physiographic Region 31
Indiana Bat	Yes	Project would have no significant effect on Indiana bat	Yes – Direct mortality, displacement, habitat loss	Indiana Bat MRU
Bats Not Listed Under the ESA	Yes	Potential for significant effect is uncertain	Yes – Direct mortality, displacement, habitat loss	USFWS Region 3
Socioeconomic Resources	No	No	No	N/A
Cultural and Historic Resources	No	No	No	No
Transportation	No	No	No	N/A
Noise	No	No	No	N/A
Visual Resources	No	No	No	N/A
Air Quality and Climate	No	Minor beneficial effect	No	N/A
Communications	No	No	No	N/A
Hazardous Materials	No	No	No	N/A
Health and Safety	No	No	No	N/A

5.15.2 Reasonably Foreseeable Actions That Could Contribute Cumulative Effects

Reasonably foreseeable future development in Phase IV is expected to be limited to road maintenance and building projects, agricultural practices such as land clearing, cultivation and installation of drainage structures, and residential development. Conversations with the Director of the Benton County Economic Development Office indicate no large-scale industrial or commercial operations, or residential developments, are known to be planned for Benton County. Individual small or medium-sized businesses may come into the area; however, these businesses would likely move into existing facilities or would be constructed immediately adjacent to other industrial/commercially zoned areas in the county.

5.15.3 Birds

5.15.3.1 *Geographic and Temporal Scale and Types of Impacts*

Due to their extraordinary range of mobility, the cumulative effects analysis area for birds addresses potential effects within the Partners in Flight (PIF) Physiographic Region 31 (Prairie Peninsula) (Figure 5.15.3.1).

Mortality of 168 birds of 34 identified species has been documented at the first three Phases of FRWF (see Section 4.5.2.2, Chapter 4), and the proposed Phase IV has the potential to kill additional birds. This cumulative effects analysis for birds primarily focuses on mortality impacts attributable to the Project in the context of other existing and planned wind facilities in PIF Region 31. However, this analysis also considers some other anthropogenic (i.e., caused or produced by humans) sources of bird mortality. Elements that are known to cause avian mortality are discussed briefly and on a national scale. This is largely due to how the current data have been treated to provide estimates, which are most often provided on a national scale.

The proposed Project has the potential to displace birds due to Project presence and habitat alteration. These effects are analyzed for PIF Region 31 so as to remain in the context of a similar landscape.

It is recognized that birds that breed in PIF Region 31 are affected by habitat loss on their wintering grounds located outside of these areas. In addition, birds sustain injury and death from weather, disease, and hunting. Hunting is a regulated activity, and the numbers of birds harvested are closely monitored by federal and state agencies to avoid adverse effects to those species that are hunted. We did not include impacts to birds from extraction of, and power generation from, other fuel sources, such as coal, oil, gas, and nuclear.

This analysis includes past and present actions and reasonably foreseeable future sources of impacts to birds during the 22-year operation of the Project.

5.15.3.2 *Wind Energy Development*

PIF Region 31

PIF Region 31 stretches from northeastern Missouri, across much of Illinois and through the middle of Indiana into Ohio (Figure 5.15.3.1) and is contained entirely within the Service's Region 3, covering approximately 39% of Region 3 in Illinois, Indiana, Missouri, and Ohio. Currently, there are approximately 1,946.11 MW of wind energy development installed (excluding FRWF) and 814.94 MW under construction in PIF Region 31, as estimated based on the best available data concerning the distribution of wind energy facilities in each state in PIF Region 31. Over the 22-year life of the Project, it is assumed that wind energy build-out in PIF Region 31 could possibly reach up to 70,859.91 MW, or 25% of the region's potential installed capacity as estimated from National Renewable Energy Laboratory (NREL) projections based on the percent of Region 3 comprised by the PIF Region. Already, approximately 28,607.70 MW of development are proposed in PIF Region 31.

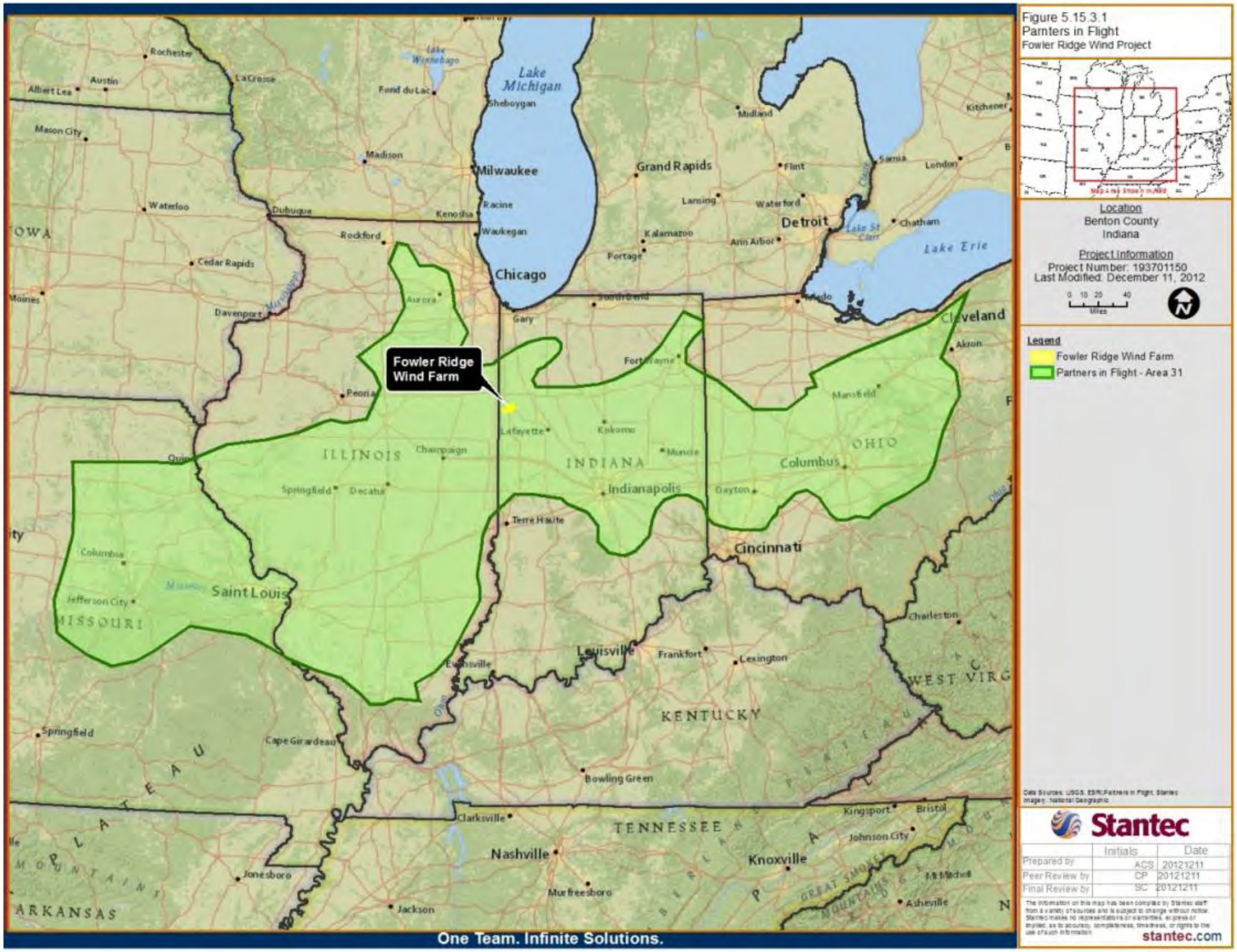


Figure 5.15.3.1
Parnters in Flight
Fowler Ridge Wind Project
Location
Benton County
Indiana
Project Information
Project Number: 193701150
Last Modified: December 11, 2012
Legend
Fowler Ridge Wind Farm
Partners in Flight - Area 31
Fowler Ridge
Wind Farm
Lake Michigan
Lake Erie
Chicago
Milwaukee
Grand Rapids
Detroit
Cleveland
Columbus
Indianapolis
Cincinnati
Saint Louis
Louisville
Nashville
Knoxville
ILLINOIS
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSOURI
ARKANSAS
Stantec
One Team. Infinite Solutions.
stantec.com

Results from mortality monitoring studies at eight facilities in the Region average 3.01 birds killed per MW per year, of which, migrating and resident passerines have comprised approximately 75% (Poulton 2010, Barclay et al. 2007, Johnson et al. 2010b). Applying the Region 3 avian mortality rate to the estimated installed capacity of the PIF Region 31 indicates that approximately 5,858 birds may currently be killed at other wind energy facilities in PIF Region 31 each year. It is expected that approximately 4,393 of these fatalities may be passerines. As discussed in Section 5.5 above, the additional level of bird mortality contributed by Fowler is expected to be generally similar regardless of the alternative under which the Project operates: approximately 2,362 birds per year at the maximum build-out of 449 turbines. Therefore, FRWF will contribute an additional 40% of the total bird mortality in PIF Region 31 each year, approximately.

Applying the current regional average bird mortality rate to the expected level of build-out in 22 years results in an estimated 213,288 total birds killed annually at other wind energy facilities across PIF Region 31 at the end of the life of the Project. Although the rate at which wind energy development would occur over the next 22 years is difficult to predict, averaging the expected maximum rate of bird mortality (213,288 birds/year at the 22-year maximum build-out capacity) with the current rate of bird mortality (5,858 birds/year at the currently-installed capacity) indicates that an average of 109,573 total birds may be killed in PIF Region 31 each year for the next 22 years, for an overall total of 2,410,606 birds killed in PIF Region 31 during the life of FRWF. In addition to this mortality, FRWF will contribute over its lifespan a total of approximately 41,634 birds, entailing an increase of 1.73% to the overall mortality of birds at wind energy facilities over the next 22 years in PIF Region 31. Compared to other anthropogenic sources of avian mortality (see Section 5.15.3.3 below), the effect of avian mortality at wind energy facilities in PIF Region 31 is expected to be minor and unlikely to cause population level effects.

5.15.3.3 *Anthropogenic Sources of Avian Mortality Other than Wind Farms*

Many sources of mortality can affect birds, including predation by feral and domestic cats, poisoning from pesticide use and other hazardous materials releases, electrocution, and mortality due to collisions with human-made obstacles such as aircraft, vehicles, buildings, high tension lines, and communication towers. It is expected that impacts to birds from these sources of mortality would generally remain the same for the foreseeable future.

Table 5.7 provides annual mortality levels of birds due to anthropogenic sources in the U.S. The national level is not the cumulative effects analysis area selected for birds in this EIS, but similar estimates for PIF Region 31 are not available.

Table 5.7 Estimated annual avian mortality from anthropogenic causes in the U.S.

Mortality Source	Estimated Annual Mortality	% of Overall Mortality
Collisions with buildings (including windows)	97-1,200 million	17-66
Collisions with power lines	130-174 million	10-23
Legal harvest	120 million	7-21
Depredation by domestic cats	100 million	6-18
Automobiles	50-100 million	9-18
Pesticides	67 million	4-12
Communication towers	4-50 million	1-3
Oil pits	1.5-2 million	0.1-0.3
Wind turbines	20,000-440,000	<0.1
Total mortality	569.5-1,813 million	--

Source: Various cited in Erickson et al. (2005), Thogmartin et al. (2006), and Manville (2009).

Communication Towers

Avian collisions with communication towers in the U.S. present a significant source of annual mortality, particularly for nocturnally migrating songbirds (Erickson et al. 2005). As of June 2003, 93,000 towers were listed with the Federal Communication Commission Antenna Structure Registry Database. However, the actual number of towers is probably much higher and constantly increasing (Manville 2005). Erickson et al. (2005) suggest the number of communication towers in the U.S. may be as high as 200,000 towers; and that 5,000 to 10,000 new towers are built each year. Cellular, radio, and television towers range in height from less than 100 feet to over 2,000 feet (Kerlinger 2000).

Mortality estimates range from 4-5 million to 40-50 million birds per year in the U.S. and involve over 230 species (Shire et al. 2000, Kerlinger 2000, Manville 2005, Erickson et al. 2005, Thogmartin et al. 2006). Estimates of mean annual collisions per tower have ranged from 82 birds per year at a 250-m (825 feet) tower in Alabama, to 3,199 birds per year at a 305-m (1000-feet) tower in Wisconsin (Erickson et al. 2005). Collisions occur throughout the year though are most frequently documented during migration periods. Studies indicate fatality rates are highest at taller, guyed towers (Gehring et al. 2009, 2011), and pulsating beacons and steady burning FAA obstruction lighting result in higher collision rates than towers lit only with flashing or white strobe beacons (Erickson et al. 2005, Gehring et al. 2009, 2011). Some researchers suspect that during nights with fog or low cloud-ceiling heights, nocturnal migrants become disoriented by strobe and/or steady burning lights on towers (Erickson et al. 2005).

Buildings

Based on the probable number of commercial buildings and residential houses in the U.S., estimates of bird mortality due to collisions with buildings and windows range from 3.5 million to

1,200 million bird deaths per year (Erickson et al. 2005, Thogmartin et al. 2006). The American Bird Conservancy (ABC) has suggested these numbers may be significantly higher (ABC 2013). The vast majority of avian building and window collisions involve passerines (Erickson et al. 2005). A study conducted in 1996 in Toronto, Ontario estimated 733 avian fatalities per building per year (Erickson et al. 2005). A study of avian collisions with residential windows indicated that avian fatalities range from 0.65 to 7.7 birds per house per year (Erickson et al. 2005). Collisions with other tall structures such as smoke stacks are estimated to result in tens to hundreds of thousands of collisions.

Power Lines

Manville (2005) estimated that there is collectively 500,000 miles of transmission lines in the U.S. Williams (2000) indicated there are 116,531,289 distribution poles in the U.S[62]. An accurate estimate of the collective distance of distribution lines is not feasible, but Manville (2005) suggests the length to be in the millions of miles. In general, avian collision and electrocution mortality at power transmission and distribution lines are not systematically monitored and are subject to observational biases. Collision estimates range from hundreds of thousands to 175 million birds annually, and estimates of electrocutions range from tens to hundreds of thousands of birds annually. Raptors, particularly eagles, are most commonly reported for collision or electrocution with transmission or distribution lines in the U.S. (Manville 2005). The species composition of birds involved in power line collisions is largely dependent on location. For example, power lines located in wetlands have resulted in collisions of mainly waterfowl and shorebirds; while power lines located in uplands and away from wetlands have resulted in collisions of mainly raptors and passerines (Erickson et al. 2005, Manville 2005).

Vehicles and Airplanes

Vehicle strikes are estimated to result in 50 million to 100 million avian fatalities per year (Thogmartin et al. 2006). Numbers and species involved in vehicle collisions are dependent on habitat and geographical location (Erickson et al. 2005). Including both United States Air Force and civil aircraft strikes, it is estimated that over 28,500 avian collisions occur each year (Erickson et al. 2005). The majority of bird species involved in airplane strikes includes gulls, waterfowl, and raptors (Erickson et al. 2005).

Pesticides

Based on data collected in the 1980s and 1990s, approximately 160 million acres of cropland in the U.S. are treated with pesticides each year. Consequently, 67 million birds (10% of the 672 million birds estimated to be exposed) die in the U.S. annually due to pesticide exposure (Pimental et al. 1991 as cited by Erickson et al. 2005, USFWS 2000). Other estimates indicate 72 million pesticide-related avian fatalities per year (USFWS 2002). One study indicated that there are 0.1 to 3.6 avian fatalities per acre of pesticide-treated cropland (Mineau 1988 as cited by Erickson et al. 2005).

Domestic Cats

Dauphiné and Cooper (2009) estimate that 117 to 157 million feral and free-ranging domestic cats within the U.S. kill at least 1 billion birds annually. Based on this estimate and others

[62] http://archive.audubonmagazine.org/incite/incite0001.html

(Manville 2005, Erickson et al. 2005), cat predation may be the most significant anthropogenic source of bird mortality in the U.S. (Dauphiné and Cooper 2011). Butchart et al. (2006) cited domestic cats as significant threats to rare, threatened, and endangered birds and sources of species extinction worldwide.

5.15.3.4 *Habitat Loss and Displacement*

In PIF Region 31, avian resources have experienced impacts due to land conversion (habitat loss) associated with oil and gas development, urbanization, agriculture, and residential development. All of these activities are likely to continue into the reasonably foreseeable future. Most of these land conversion activities often include extensive road networks.

Agriculture activities, urbanization, and residential development convert habitat for the length of time that the development is maintained. Development that results in pavement (asphalt, concrete) results in an extreme conversion of habitat with a very slow recovery rate unless pavement is removed. Conversely, some active agricultural lands may become inactive and revert to native habitats within the 22-year time frame.

Reasonably foreseeable future actions in the Project area for the next 22 years that would affect avian resources include low-density development for residences. This would largely affect those birds that would be likely to use agriculture lands.

5.15.3.5 *Summary of Cumulative Effect to Birds*

In summary, many sources of mortality can affect birds, including predation by domestic cats, poisoning from pesticide use and other hazardous materials releases, electrocution, and collision interactions with human-made obstacles such as aircraft, vehicles, buildings, power lines, and communication towers. The extent and severity of these impacts to birds from these sources of mortality have been ongoing for decades and are expected to generally remain the same for the foreseeable future. Compared to these sources of anthropogenic mortality, wind energy development currently contributes a very low magnitude of bird mortality, less than 1% (see Table 5.7) and is therefore not expected to have population level effects on bird populations.

5.15.4 Indiana Bat and Bats Not Listed Under the ESA

Many sources of mortality can affect bats, including mortality due to collisions with human-made obstacles such as lighthouses, communication towers, aircraft, and buildings (Johnson 2004, Peurach et al. 2009). It is expected that impacts to bats from these sources of mortality would generally remain the same for the foreseeable future. Therefore, this section focuses on new and foreseeably increasing sources of mortality for both listed (including Indiana bat) and non-listed bat species.

For the purposes of this EIS, the cumulative effects analysis area for Indiana bats is the MRU, which includes the states of Michigan, Ohio, Indiana, Kentucky, Tennessee, northern Alabama, and the tip of southwest Virginia. The cumulative effects analysis area for bats not listed under the ESA is the Region 3. The cumulative effects analysis used a 22-year timeframe based on the requested duration for the ITP. The selected spatial and temporal scales provide a reasonable assessment of past and potential future cumulative effects. Not enough data are available to understand what spatial scale may be appropriate for bats not listed under the ESA, so Region 3 is the best available and most reasonable spatial scale to use for all bat species.

The cumulative effects analysis for bats considers the effects of wind projects associated with land clearing for roads, turbine pads, and transmission lines (habitat-related impacts), and Project operation (injury and mortality). We also address two other actions, WNS and habitat loss or alteration that can have significant effects to bats that may accumulate over time.

5.15.4.1 *Wind Energy Development*

Over the 22-year life of the Project, it is assumed that wind energy build-out in Region 3 could possibly reach up to 486,793.15 MW, or 25% of the region's potential installed capacity as estimated by the NREL, excluding FRWF. It is assumed that build-out in the MRU (Michigan, Ohio, Indiana, Kentucky, Southwest Virginia, Tennessee, Alabama) could reach up to 64,920.40 MW, excluding FRWF, over the life of the Project. Already, approximately 82,525.02 MW of development are proposed in Region 3, and 73,538.53 MW are proposed in the MRU. Currently, there are 13,082 MW of wind energy development installed (excluding FRWF) in the USFWS Region 3 and 821.56 MW installed in the MRU.

Bats Not Listed Under the ESA

Results from 23 mortality monitoring studies in the region average 10.07 bats killed per MW per year, of which, tree bats have comprised 80.62%. Applying this mortality rate to the installed capacity of the region indicates that approximately 131,736 bats may currently be killed at other wind energy facilities in Region 3 each year. It is expected that approximately 106,206 of these fatalities may be tree bats (red bats, hoary bats, and silver-haired bats). As discussed in Section 5.5 above, the additional level of mortality contributed by the FRWF would depend on the alternative under which the Project is operated. It is predicted that mortality of bat species not listed under the ESA at FRWF, at its maximum build-out of 449 turbines, would range from 10,255 bats per year under the 3.5 m/s Cut-In Speed (Feathered) Alternative, to 8,365 bats per year under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action), to 4,575 bats per year under the 6.5 m/s Cut-In Speed Alternative, to 1,598 bats per year under the No Action Alternative. Therefore, FRWF would contribute anywhere from an additional 7.8% to 6.3% to 3.5% to 1.2% of the total bat mortality in Region 3 each year under the Project Alternatives, respectively.

Applying the current regional average bat mortality rate to the expected level of build-out in 22 years results in an estimated 4,902,000 total bats killed annually at other wind energy facilities across the region at the end of the life of the Project. Although the rate at which wind energy development will occur over the next 22 years is difficult to predict, averaging the expected maximum rate of bat mortality (4,902,000 bats/year at the 22-year maximum build-out capacity) with the current rate of bat mortality (131,736 bats/year at the currently-installed capacity) indicates that an average of 2,516,870 total bats may be killed in the region each year for the next 22 years, for an overall total of 55,371,140 bats killed in Region 3 during the life of FRWF. In addition to this mortality, FRWF would contribute over its lifespan a total of 180,776 bats under the 3.5 m/s Cut-In Speed (Feathered) Alternative, 147,458 total bats under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action), 80,649 bats under the 6.5 m/s Cut-In Speed Alternative, and 28,173 bats under the No Action Alternative. FRWF's mortality contribution would entail an increase of 0.33%, 0.27%, 0.15%, or 0.05%, under the Project Alternatives, respectively, to the overall mortality of bats not listed under the ESA over the next 22 years in Region 3. Therefore, mortality of bat species not listed under the ESA at FRWF is not expected to be a significant addition to the overall level of bat mortality at wind energy facilities in Region 3, particularly under the adjustment alternatives.

The actual level of bat mortality across the region may be lower, as many wind energy facilities in Region 3 now implement at least some degree of modified turbine operations during the fall bat migration season, although several older facilities in the region remain unregulated under ESA or state laws. Additionally, a growing body of research and improved understanding of the factors affecting bat mortality risk at wind energy facilities is likely to increase the effectiveness of future turbine operational protocols at reducing bat mortality. If all wind energy facilities in the region implemented modified turbine operations that reduced bat mortality by 50%, the cumulative impacts of wind energy development on bat species not listed under the ESA in Region 3 would be greatly reduced. Predicted bat mortality would decrease to approximately 1,258,435 bats per year on average, or approximately 27,685,570 bats killed in Region 3 during the life of the FRWF. FRWF's mortality would contribute an increase of 0.66%, 0.54%, 0.30%, or 0.10%, under the Project alternatives, respectively, to this reduced level of overall mortality of bats not listed under the ESA over the next 22 years in Region 3. FRWF's mortality contribution would therefore still not entail a significant addition to overall bat mortality in the region.

As discussed above, based on current data, fatalities at industrial wind facilities are heavily skewed toward the three species of migratory tree bats. If the build-out scenarios are implemented and the estimates based on current post-construction monitoring remain more or less the same, millions of tree bats would die at wind facilities in Region 3 alone. Because we do not have good population estimates for most bat species including migratory tree bats, it is unclear how either the cumulative mortality under no curtailment (55,371,140 bats), under 50% curtailment (27,685,570 bats), or some scenario in-between would impact the various affected bat species. As far as we understand, bat species potentially impacted by wind development in Region 3 have an evolutionary strategy focused on high adult survival and low fecundity. This suggests that a high level of adult loss could be detrimental to the affected populations. The loss of millions of tree bats over the life of the project is unknown but may be unsustainable. Kunz, et al. (2007b) essentially characterized the current state of our understanding in their 2007 article on the ecological impacts of wind development: "Our current knowledge and the projected future development of wind energy facilities in the U.S. suggest the potential for a substantial population impact to bats." Research is ongoing to estimate population levels and the potential impacts of wind facilities focused on migratory tree bats.

Indiana Bat

Although FRWF is one of only two wind energy facilities in the MRU at which Indiana bat fatalities have been documented thus far, it is expected that any wind energy facility within the Indiana bat's range has the potential to take an Indiana bat during the fall migration season. Because the factors influencing Indiana bat mortality risk at wind energy facilities are not understood at this point, it is assumed that risk of Indiana bat mortality may be similar across all wind energy facilities in the MRU.

Applying the estimated baseline (i.e., no turbine operational adjustments) rate of Indiana bat mortality (0.05 Indiana bats/MW/year) derived from studies at FRWF to the current installed capacity (excluding FRWF) at wind energy facilities in the MRU (821.56 MW), indicates that approximately 41 Indiana bats may be killed at other wind energy facilities in the MRU each year. This mortality would represent 0.013% of the 2011 MRU Indiana bat population (305,297) (USFWS 2012d). As discussed in Section 5.6 above, the additional level of mortality contributed by FRWF would depend on the alternative under which the Project is operated. FRWF would be expected to contribute, at its maximum build-out of 449 turbines, approximately

13.9 Indiana bat fatalities per year under the 3.5 m/s Cut-In Speed (Feathered) Alternative, 10.9 Indiana bat fatalities per year under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action), 4.9 Indiana bat fatalities per year under the 6.5 m/s Cut-In Speed Alternative, and zero (0.0) Indiana bat fatalities per year under the No Action Alternative. Therefore, FRWF would contribute anywhere from an additional 34.0% to 26.6% to 12.0% to 0.0% of the total Indiana bat mortality in the MRU each year under the Project alternatives, respectively.

Applying the recovery unit's current estimated baseline Indiana bat mortality rate to the expected level of build-out in 22 years (64,920.40 MW) results in an estimated 3,246 total Indiana bats killed annually at wind energy facilities across the recovery unit at the end of the life of the Project. Although the rate at which wind energy development would occur over the next 22 years is difficult to predict, averaging the expected maximum rate of Indiana bat mortality (3,246 Indiana bats/year at the 22-year maximum build-out capacity) with the current rate of Indiana bat mortality (41 Indiana bats/year at the currently-installed capacity) indicates that an average of 1,644 Indiana bats may be killed in the recovery unit each year for the next 22 years, representing 0.54% of the MRU's 2011 population. At this rate, a total of 36,168 Indiana bats would be killed in the MRU during the life of FRWF, assuming no operational adjustments are implemented. In addition to this mortality, FWRF would contribute over its lifespan a total of 245 Indiana bat fatalities under the 3.5 m/s Cut-In Speed (Feathered) Alternative, 193 Indiana bat fatalities under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action), 86 Indiana bat fatalities under the 6.5 m/s Cut-In Speed Alternative, and zero (0) Indiana bat fatalities under the No Action Alternative. FRWF's mortality contribution would entail an increase of 0.68%, 0.53%, 0.24%, or 0.00%, under the Project alternatives, respectively, to the overall mortality of Indiana bats over the next 22 years in the MRU. However, mitigation measures designed to fully compensate for the level of expected take and the associated loss in reproduction would be implemented as a part of the HCP under the 3.5 m/s Cut-In Speed (Feathered) Alternative, the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action), and the 6.5 m/s Cut-In Speed Alternative. Therefore, mortality of Indiana bats at FRWF is not expected to be a significant addition to the overall level of Indiana bat mortality at wind energy facilities in the MRU. The loss of 1,644 Indiana bats each year during the 22 year life of the Project would be distributed across many maternity colonies and hibernacula. In the absence of other major threats, we would not expect this level of impact to negatively affect either the MRU population or specific maternity or hibernating populations. We do not yet fully understand the impacts of WNS on the MRU; however, this may alter the dynamics of the MRU population (see Section 5.15.4.2 for a discussion of WNS).

Actual risk of Indiana bat mortality is likely to vary among wind energy facilities in the MRU. In particular, wind energy facilities located in proximity to Indiana bat maternity colonies are likely to present a risk of greater mortality for the species than the level of mortality documented at FRWF; however, it is expected that such facilities would be required to implement significant mortality minimization and mitigation measures. Additionally, because take of Indiana bats is illegal under the ESA, it is expected that nearly all future wind energy facilities in the MRU would either implement modified turbine operations adequate to avoid Indiana bat take or would obtain ITPs and implement the associated HCPs, including modified turbine operations to reduce Indiana bat take and mitigation measures to fully compensate for the level of authorized take. Consequently, actual Indiana bat mortality at wind energy facilities in the MRU is likely to be much lower than the estimate presented above.

5.15.4.3 *White-Nose Syndrome*

White-nose Syndrome (WNS) is a rapidly spreading epidemic that has caused mass mortality of cave-dwelling bats in the Northeastern U.S. since its discovery in February, 2006. In January, 2012, the Service estimated that the death toll had exceeded 5.5 million bats (USFWS 2012e). WNS is characterized by white fungal growth on the muzzle and other body parts of infected hibernating bats, caused by the fungus *Geomyces destructans*. Although the actual mechanism by which the fungus kills bats is not currently understood, WNS is associated with uncharacteristic behavior and extremely high rates of mortality among infected bats and hibernacula (USFWS 2012f).

WNS mortality in the Northeast has varied by species and state, ranging from 12% in small-footed myotis (*Myotis leibii*) populations to 98% in northern myotis populations, and from 68% in Virginia to 98% in Pennsylvania. Overall mortality averages 88% for all species combined. The reasons for mortality variation are not currently understood and may be due in part to census biases resulting from behavioral differences among species and in WNS-infected bats. Species with smaller WNS-related population reductions documented to-date are hopefully less susceptible or more resistant to *G. destructans*, but it is possible that they are just declining at a slower rate, with total mortality rates eventually reaching those of the other species (Turner et al. 2011). Consequently, the best assumption at this time is that newly infected bat populations will experience a similar overall rate of mortality.

Although some populations in the Northeast show some evidence of stabilization post-WNS, at severely reduced levels these populations remain very susceptible to the impacts of disease, predation, weather impacts, stochastic events, and other sources of mortality and much less resilient than larger populations. For example, post-WNS annual survey numbers have stabilized at just over 1,000 bats for the past four years in Hailes Cave, NY, down from a pre-WNS survey count of 15,374 bats (Turner et al. 2011). Unfortunately, many results of WNS monitoring in the Northeast have indicated levels of mortality consistent with the models developed by Frick et al. (2010) which predict potential regional extinction of the little brown bat, a previously (pre-WNS) common and ubiquitous species throughout much of North America, due to WNS in the next 7 to 30 years. Based on observed WNS mortality rates, similar fate may await Indiana bats, northern long-eared bats, and tricolored bats (Turner et al. 2011). Even if certain species are not lost to extinction, the species composition of impacted bat communities is expected to change dramatically, as has already been observed in the Northeast.

Bats Not Listed Under the ESA

Although WNS has not yet caused severe mortality in Region 3 bat populations, our current understanding of the disease indicates that it should be expected to have impacts similar to those documented in the Northeast as the epidemic progresses in the Midwest. WNS has been confirmed in Region 3 since winter 2010-2011 and is now known to occur in three states (Ohio, Indiana, and Missouri) in the region. As of May 2012, WNS had been confirmed in nine counties in Indiana (USFWS 2012g). It is expected that WNS may eventually affect all cave-dwelling bat species which occur in Region 3. The rate at which WNS may impact Region 3 bat populations cannot be predicted, as the progression from detection of a single bat with visible fungus to large-scale mortality has been observed to occur within a matter of weeks at some sites in the Northeast but at others it has not occurred until the next hibernation season, or even later (Turner et al. 2011). However, it is expected that WNS will ultimately have similarly devastating impacts on Region 3 hibernacula, causing mortality near 88% and possibly the abandonment or extinction of certain hibernacula.

Collection of accurate population counts prior to the onset of WNS in the Midwest may allow for a better understanding of WNS-related declines and improved monitoring of population level impacts. Although efforts are ongoing to study the basic biology of WNS and to generate a toolkit of mitigation strategies, it is unknown if and when effective mechanisms for fighting WNS will be developed. Therefore, the impacts of WNS on cave-dwelling bat populations in Region 3 are expected to be severe, which will make additional mortality from other sources, such as wind energy facilities, more significant. Indiana bats will serve as an indicator of WNS impacts to cave-dwelling bat species in the region because more population data are available for this species than any other in the region, enabling the most accurate evaluation of WNS impacts. If the population of Indiana bats in the MRU becomes substantially reduced as a result of WNS, FRWF would take corresponding action as described in Section 8.4.6 – Changed Circumstances in the HCP. These actions are expected to also protect other cave-dwelling bats in the region from the impacts of additive mortality from FRWF, since increased turbine operational restrictions and hibernaculum protection have been demonstrated to reduce mortality of all cave-dwelling bats in general.

Indiana Bat

Indiana bat is among the species impacted by the disease. WNS mortality in the Northeast Recovery Unit's Indiana bat population has varied by state, ranging from 30% in Virginia to 100% in Pennsylvania. Overall, Indiana bat mortality in the Northeast has averaged 72% (Turner et al. 2011). The reasons for mortality variation between states are not currently understood and may be due in part to census biases resulting from behavioral differences in WNS-infected bats. Based on observed WNS mortality rates in already-fragile populations of Indiana bats in the Northeast, Turner et al. (2011) have expressed concern that regional extinction due to WNS, as predicted by Frick et al.'s (2010) models of WNS impacts on the previously common little brown bat, may also await Indiana bats. Thogmartin et al. (2012) modeled the impact of WNS on the status and trends of Indiana bat populations in the Northeast, finding that although the overall species population has not credibly declined due to WNS, WNS has stalled and in some cases reversed population gains made by Northeast populations in recent years.

Although WNS has not yet caused severe mortality in the MRU Indiana bat populations, it should be expected to have impacts similar to those documented in the Northeast Indiana bat populations as the epidemic progresses through the Midwest. In winter 2011, WNS was confirmed on bats hibernating in Wyandotte Cave, the Indiana bat hibernacula at which FRWF would focus its winter habitat mitigation measures (see HCP Sections 5.3.2 and 5.4.3). FRWF would monitor signs of WNS at the cave entrances and follow decontamination protocols following installation of gates to prevent unauthorized human access to the cave (USFWS 2010).

The rate at which WNS may impact the MRU's Indiana bat populations cannot be predicted, as timeline of disease progression has been observed to vary widely among sites in the Northeast. However, it is expected that WNS would ultimately have similarly devastating impacts on Indiana bat hibernacula in the MRU, causing mortality near 72% and possibly the abandonment or extinction of certain hibernacula. This would reduce the Midwest population from its 2011 level of 305,297 to a post-WNS level of 85,483. Because the MRU currently includes 71.9% of the total Indiana bat population (USFWS 2012d), the impacts of WNS in the recovery unit are expected to have significant consequences for the species as a whole; a 72% population loss due to WNS in the MRU would constitute a loss of 51.8% of the total species population.

Due to its federally endangered status, population levels and hibernacula use are better understood for the Indiana bat than for most bat species in the Midwest or North America. This is expected to allow for a more accurate assessment of WNS impacts at both the hibernacula and population levels. However, effective mechanisms for fighting WNS have yet to be developed, so although WNS impacts may be better understood for Indiana bats, they cannot currently be mitigated. Therefore, the impacts of WNS on Indiana bat populations in the MRU are expected to be severe, which would make additional mortality from other sources, such as wind energy facilities, more significant. If the population of Indiana bats in the MRU becomes substantially reduced as a result of WNS, FRWF would take corresponding action as described in Section 8.4.6 – Changed Circumstances in the HCP. These actions are intended to protect Indiana bats from the impacts of additive mortality at FRWF, through methods such as alternative hibernaculum mitigation site(s), increased turbine operational restrictions, and possible methods of bat deterrence from turbines.

5.15.4.4 *Habitat Loss and Fragmentation*

The following section on habitat loss and fragmentation addresses bat species not listed under the ESA and Indiana bats together to allow for a broader discussion of cumulative habitat impacts.

Summer

For the most part, agriculture has been the predominant land use in the MRU for decades. Suitable summer foraging and roosting habitat for Indiana bats and other bats is either absent or severely fragmented. However, some parts of the MRU are experiencing increases in forested habitat. For example, since 1940 in Ohio, forests have been increasing in those places where agricultural practices have been abandoned and fields have been reverting back to forest. Other states in the MRU may have also been exhibiting this trend although likely at a slower rate. However, time and proper management is needed before young forests become suitable habitat for bats, especially Indiana bats.

Future losses in forested habitat are likely to occur as a result of expanding urban areas. It is difficult to state whether or not this effect would be offset by any concurrent reversion of croplands to forests.

Phase IV would not add to cumulative effects associated with summer habitat loss. The project does not include removing forests or trees. Mitigation proposed by the Applicant would have positive effects to Indiana bat summer habitat by restoring 240 acres of forest. This mitigation would add cumulatively to positive impacts to overall summer habitat in the MRU.

Winter

The original 1983 recovery plan cited winter habitat destruction and degradation to be the dominant threat to the Indiana bat population. In the past, modifications to Indiana bat caves impacted the ability of those caves to provide the specific optimal conditions necessary for hibernating bats resulting in large scale disappearances of thousands of hibernating bats. Many of the primary threats to winter habitat largely have been addressed and are no longer adversely affecting the species to the degree or extent that they once had. Additional protective measures for hibernacula are a reasonably foreseeable beneficial cumulative effect, particularly in association with other future wind projects that may be required to do so for compensating impacts to Indiana bats and other cave-dwelling bats.

Conservation and management of Indiana bat hibernacula is listed as a Recovery Action in the Indiana Bat Draft Recovery Plan, First Revision (USFWS 2007). Gating and other measures designed to restrict access at hibernacula and/or stabilize entrances, when done correctly have been shown to have positive effects on wintering Indiana bats (USFWS 2007). Mitigation proposed by the Applicant would have positive effects to Indiana bat winter habitat in the form of a gating project at a Priority 1 hibernaculum. This mitigation would add cumulatively to any future positive impacts to overall winter habitat in the MRU resulting from on-going hibernacula protection and restoration projects conducted by entities such as state resource agencies, Bat Conservation International, private mining companies, and other wind developers.

5.15.4.5 *Summary of Cumulative Effect to Bats*

The biological significance of cumulative impacts is dependent on the life-history strategy of the species in question. Life-history characteristics of a species population determine the degree to which its viability is affected by added mortality. Organisms whose populations are characterized by low birth-rate, long life-span, naturally low mortality rates (Pianka 1970), high trophic level, and small geographic ranges are likely to be most susceptible to cumulative, long-term impacts on population size, genetic diversity, and ultimately, population viability (McKinney 1997, Purvis et al. 2000 as cited in NRC 2007).

With some variation, bats as a group have relatively long life spans and produce relatively few offspring compared with other small mammals. Given the historic stressors typically associated with their life history strategies, the mortality of bats caused by turbine collision or barotrauma is considered to be an additive effect to other modern stressors now adversely affecting population levels (such as disease, predation, and habitat loss and degradation which decrease reproduction and survival). Even though individual wind projects may only contribute a small percentage of cumulative effects, the multiple sources of mortality together may result in significant losses, especially in light of the mortality observed due to WNS.

Bats Not Listed Under the ESA

The effect of cumulative mortality on cave-dwelling and tree-roosting migratory bat populations is highly uncertain because estimates of current population sizes are unknown. The cumulative effect of wind power mortality on low fecundity, cave-dwelling bats is additive to the already high mortality caused by WNS. Tree-roosting bat mortality at wind power projects is significantly higher than that experienced by cave-dwelling bats; however, other significant sources of mortality for tree-roosting bats are unknown. It is unknown whether or not tree bat populations can be sustained under a new threat that may cause the loss of millions of bats over the next two decades.

Indiana Bats

Many cave-dwelling bats are experiencing moderate to significant population declines from WNS. Seemingly negligible annual mortality of bats at a wind farm may become an important population impact in time should populations of cave-dwelling bats, including Indiana bats, become reduced to the point that they cannot recover. WNS may reduce cave-dwelling bats to such low numbers it may become necessary for the Applicant, under the Service's direction, to implement changed circumstances for Indiana bats. In Section 8.4, the Applicant's HCP discusses those foreseeable changed circumstances and the Applicant's proposed measures for addressing them should they occur. The responses are designed to reduce the impact to Indiana bats under the reduced population numbers brought about by WNS. It is likely that other wind energy projects regulated under the ESA would have similar measures in place. This would presumably lessen the cumulative impact of wind energy on Indiana bat populations affected by WNS in MRU.

To understand the implications of cumulative bat mortality requires knowledge of baseline populations. Unfortunately, there is little information on current population estimates for most bat species in North America at local, regional, or continental scales (O'Shea et al. 2004, Kunz et al. 2007a). We have a better understanding of past and current population levels for Indiana bats than for any other species, which is largely an artifact of their long-standing endangered status and the ability to monitor populations through hibernacula counts. The total impact of the taking (353 Indiana bats) over the 22-year life of the FRWF sought by the Applicant is roughly 0.1% of the 2011 MRU Indiana bat population. Additionally, the Applicant's strategy for addressing changed circumstances, including population declines associated with WNS, provide further mechanisms for reducing the Project's contribution to cumulative effects to Indiana bats.

The impact of the 25% build-out scenario on Indiana bats in combination with the other major stressor, WNS, is unknown. There are various possibilities including a synergistic effect of two new stressors affecting the species at the same time. It is also possible that as the population of Indiana bats is reduced by WNS, as it almost certainly will be, the total number of bats taken by wind facilities will be less. However, the impacts of taking those fewer bats could increase, since each individual will become more important as the population decreases. Research into these questions is ongoing and will likely focus in part on how these new stressors will affect not only the numbers of bats but also their life histories, particularly maternity colony and hibernaculum dynamics.

5.16 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible commitment of resources refers to the loss, as a result of the Project, of future options for resource development or management, especially of nonrenewable resources such as minerals and cultural resources (40 CFR 1508.1 1). Irretrievable commitment of resources refers to the lost production or use value of renewable natural resources as a result of the Project (40 CFR 1508.1 1). Construction of Phase IV and operation of the Project would involve the irreversible and irretrievable commitment of material resources, energy, and biological resources.

Regardless of which of the four alternatives under consideration is chosen, the use of material resources would be required for construction of Phase IV, including building materials for new turbines, access roads, underground and overhead electricity collection lines, MET towers, and a substation. Equipment used for construction of Phase IV would require use of fossil fuels, a nonrenewable natural resource; however, operation of FRWF would have the benefit of lowering overall fossil fuel use since power generated by FRWF would offset that generated at existing conventional power plants powered by the combustion of fossil fuels.

Under any of the four alternatives under consideration, construction of the Phase IV would result in an irreversible or irretrievable loss of some resources over the life of the Project, including prime and unique farmland. Operation of all four phases of FRWF would result in an irreversible or irretrievable loss of some biological resources over the life of the Project, federal and state listed bats, non-listed bats, and birds. These are discussed by alternative in the following sections.

5.16.1 No Action Alternative

Construction of Phase IV under the No Action Alternative would result in an irreversible or irretrievable alteration of 78.2 acres of prime and unique farmland. However, turbines would be removed during decommissioning (after a 22-year operation life), and the land would be restored to agricultural use.

Operation of the Project under the No Action Alternative would result in the incidental take of 0 Indiana bats over the life of the Project (see Section 5.6.7). Up to 41,634 birds and 28,173 bats not listed under the ESA may be incidentally taken during the life of the Project (see Section 5.5.7).

5.16.2 3.5 m/s Cut-In Speed (Feathered) Alternative

Construction of Phase IV under the 3.5 m/s Cut-in Speed (Feathered) Alternative would result in the same irreversible or irretrievable alteration as the No Action Alternative.

Operation of the Project under the 3.5 m/s Cut-in Speed (Feathered) Alternative would result in the incidental take of approximately 245 Indiana bats over the life of the Project (see Section 5.6.7). Additionally, up to 41,634 birds and 180,776 bats not listed under the ESA may be incidentally taken during the life of the Project (see Section 5.5.7).

5.16.3 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action)

Construction of Phase IV under the 5.0 m/s Cut-In Speed Alternative would result in the same irreversible or irretrievable alteration as the No Action Alternative.

Operation of the Project under the 5.0 m/s Cut-In Speed Alternative would result in the incidental take of approximately 193 Indiana bats over the life of the Project (see Section 5.6.7). Additionally up to 41,634 birds and 147,458 bats not listed under the ESA may be incidentally taken during the life of the Project (see Section 5.5.7).

5.16.4 6.5 m/s Cut-In Speed Alternative

Construction of Phase IV under the 6.5 m/s Cut-in Speed Alternative would result in the same irreversible or irretrievable alteration as the No Action Alternative.

Operation of the Project under the 6.5 m/s Cut-in Speed Alternative would result in the incidental take of approximately 86 Indiana bats over the life of the Project (see Section 5.6.7). Additionally, up to 41,634 birds and 80,649 bats not listed under the ESA may be incidentally taken during the life of the Project (see Section 5.5.7).

5.17 IDENTIFICATION OF PREFERRED ALTERNATIVE

The Department of the Interior (DOI) defines the preferred alternative as "the alternative which the [agency] believes would best accomplish the purpose and need of the proposed action while fulfilling its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors" (43 CFR 46.420(d)). The preferred alternative may or may not be the same as the project proponent's proposed action or the environmentally preferable alternative. When an EIS has been prepared the ROD must identify all alternatives considered and specify the environmentally preferable alternative(s) (40 CFR 1505.2(b). The environmentally preferable alternative is that which reflects the policy in Section 101 of NEPA, i.e., the alternative that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources (43 CFR 46.30).

The "preferred alternative" is a preliminary indication of the federal responsible official's preference of action, which is chosen from among the alternatives analyzed in an EIS. The preferred alternative may be selected for a variety of reasons (such as the priorities of the particular lead agency) in addition to the environmental considerations discussed in the EIS. The preferred alternative is not a final agency decision; rather, it is an indication of the agency's preference. The final agency decision is presented in the ROD.

In accordance with NEPA and the CEQ reulations and based on consideration of agency and public comments on the DEIS, the Service has selected the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action) as the preferred alternative. Of the alternatives evaluated in this FEIS, this alternative best fulfills the agency's statutory mission and responsibilities while meeting the purpose and need for the following reasons:

1. Issuance of an ITP under the 5.0 m/s Cut-In Speed Alternative (Applicant Proposed Action) would reduce impacts to Indiana bats and other non-listed bats and provide compensatory mitigation to offset the loss of Indiana bats as a result of operation of the FRWF.

2. Issuance of an ITP meets the need of the existing FRWF and allows all four phases of the FRWF to operate legally under the ESA.

6.0 CONSULTATION AND COORDINATION

6.1 CONSULTATION AND COORDINATION

Section 1.4 summarizes the initial public scoping process used in development of this EIS, including issuance of the NOI, and a summary of the issues identified by the public during the scoping process. In addition, scoping letters were sent to federal, state and local agencies as described in Section 6.1.1 below.

6.1.1 Agency Coordination

On June 2, 2011, a scoping letter was sent via e-mail to federal, state and local agencies and Non-governmental Organizations (NGOs) to familiarize them with the project and allow them the opportunity to provide comments. Scoping letters were sent to the following entities:

- U.S. Army Corps of Engineers, Louisville District
- U.S. Department of Agriculture – Rural Development – Covington Area Office
- U.S. Environmental Protection Agency (USEPA) – Region 5
- U.S. Department of Housing and Urban Development – Indiana Field Office
- Indiana Department of Environmental Management (IDEM)
- Indiana Department of Natural Resources (IDNR) – Division of Fish and Wildlife
- IDNR – Division of Nature Preserves
- IDNR – Division of Historic Preservation and Archaeology
- Indiana Department of Transportation (IDOT) – Aeronautics Division
- Indiana Karst Conservancy
- Benton County Commissioners
- City of Fowler – City Clerk
- Audubon Society – Indiana
- Hoosier Environmental Council
- National Wildlife Federation (NWF) – Indiana
- The Nature Conservancy – Indiana
- Center for North American Bat Research and Conservation

No written comments were received from these entities during the scoping period.

6.1.2 Distribution of the Draft EIS

In accordance with NEPA, the DEIS was circulated for public review and comment. The DEIS was published in the Federal Register for public review on April 5, 2013 (78 Fed. Reg. 20690-20692) in accordance with requirements set forth in the NEPA and its' implementing regulations. Public comments were accepted during a 60-day period following publication of the Federal Register Notice of Availability. One public information meeting was held during the comment period, on April 18, 2013 in Fowler, Indiana. Responses to substantive comments on the DEIS and Draft HCP can be found in Appendix I of this EIS.

The DEIS was distributed via copies or web links to the following elected officials, federal agencies, and state, county and local offices, and to individuals and organizations who specifically requested a copy of the document:

- Federal Agencies
  - U.S. Department of the Interior
  - U.S. Department of the Interior, U.S. Fish and Wildlife Service
  - U.S. Department of Transportation, Office of the Secretary
  - U.S. Army Corps of Engineers, Louisville District
  - U.S. Environmental Protection Agency, Region 5
  - U.S. Department of Agriculture Rural Development
  - Natural Resources Conservation Service
  - U.S. Department of Energy
  - Federal Emergency Management Agency, Region 5
  - Federal Communications Commission
  - Federal Aviation Administration
  - Federal Railroad Administration
  - Federal Highway Administration, Indiana Division
  - U.S. Department of Commerce
  - Advisory Council on Historic Preservation

- State Agencies
  - Indiana Department of Environmental Management
  - Indiana Department of Transportation, Aeronautics Section
  - Indiana Department of Natural Resources
  - Indiana Geological Survey
  - Indiana Department of Health
  - Indiana Attorney General's Office
  - Indiana Board of Health

- Federal and State Elected Officials
  - Governor Mike Pence
  - Honorable Dan Coats (U.S. Senator)
  - Honorable Joe Donnelly (U.S. Senator)
  - Honorable Pete Visclosky (U.S. Representative)
  - Honorable Sue Landske (State Senator)
  - Honorable Sharon Negele (State Representative)

- Local Units of Government
  - Benton County Commissioners
  - Town of Fowler
  - Benton County Public Library
  - Otterbein Public Library
  - Benton County Sheriff

- Others
  - Hoosier Environmental Council
  - The Nature Conservancy – Indiana

- Audubon Society
- Indiana Wildlife Federation
- Center for North American Bat Research and Conservation
- Indiana Karst Conservancy
- Maine Department of Inland Fisheries and Wildlife
- Northeast Bat Working Group
- Southeast Bat Diversity Network
- Midwest Bat Working Group

7.0 LIST OF PREPARERS

Name	Project Role and Qualifications
U.S. Fish and Wildlife Service	
Forest Clark Bloomington Field Office	EIS Project Manager, EIS Preparation and Review
Marissa Reed Bloomington Field Office	EIS Preparation and Review
Scott Pruitt Bloomington Field Office	EIS Review and Technical Advisor
Lori Pruitt Bloomington Field Office	EIS Review and Technical Advisor – Indiana Bat
Georgia Parham Bloomington Field Office	Communications and Scoping
Rick Amidon Regional Office	EIS Review
Tara Lewis FWS Solicitor	EIS Review
Kelly Bakayza FWS Solicitor	EIS Review
Stantec Consulting Services Inc.	
Terry VanDeWalle	EIS Manager; EIS Preparation M.A. Biology 25 years' experience with ESA Section 7 and Section 10 consultation, T&E surveys, Indiana bat studies and NEPA documentation
Stacey Carlson	EIS Preparation B.A. Biological Resources 13 years' experience with environmental studies, including wetland delineations and permitting, NEPA documentation and Indiana bat studies
Quintana Baker	EIS Preparation; Indiana Bat, Birds and Cumulative Effects B.A. Biology 7 years' experience with environmental studies, including wildlife and T&E surveys (including Indiana bat), Section 7 consultation and NEPA documentation.

Name	Project Role and Qualifications
Elizabeth Annand	EIS Preparation and Senior Review M.S. Wildlife Biology 18 years' experience with environmental studies, including NEPA and ESA consultation and CWA permitting
Josh Otten	EIS Preparation B.S. Animal Ecology 6 years' experience with environmental studies, including T&E surveys and Indiana bat studies
Andy Selk	Senior GIS Analyst and Graphics Preparation M.S. GIS Science 12 years' experience in GIS studies
Tom Girman	Senior Review of EIS B.S. Geography, Land Use and Environmental Studies 20 years' experience in multidisciplinary environmental analysis and assessment, potential benefits and impacts of development and environmental projects

8.0 REFERENCES

American Bird Conservancy (ABC). 2013. Birds and Collisions. http://www.abcbirds.org/abcprograms/policy/collisions/index.html.

APLIC (Avian Power Line Interaction Committee). 2006. Suggested practices for raptor protection on powerlines: the state of the art in 2006. Edison Electric Institute, APLIC, and the Washington, DC, and California Energy Commission, Sacramento, California, USA.

Armbruster, M.J. 1990. Characterization of habitat used by Whooping Cranes during migration. U.S. Fish and Wildlife Service Biological Report 90(4). 16pp.

Arnett, E.B., W.K. Brown, W.P. Erickson, J.K. Fiedler, B.L. Hamilton, T.H. Henry, A. Jain, G.D. Johnson, J. Kerns, R.R. Koford, C.P. Nicholson, T.J. O'Connell, M.D. Piorkowski, and R.D. Tankersley. 2008. Patterns of bat fatalities at wind energy facilities in North America. Journal of Wildlife Management 72: 61-78.

Austin, J.E. and A.L. Richert. 2001. A comprehensive review of observational and site evaluation data of migrant whooping cranes in the United States, 1943-1999. U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, ND.

Baerwald, E.F., G.H. D'Amours, B.J. Klug, and R.M.R. Barclay. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology 18: R695-R696. Canadian Wildlife Service. 2006. Wind turbines and birds: a guidance document for environmental assessment. Environment Canada, Canadian Wildlife Service. Gatineau, Quebec.

Barclay, R.M.R., E.F. Baerwald, and J.C. Gruver. 2007. Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height. Canadian Journal of Zoology 85, 381-387.

Barclay, R.M.R. and L.D. Harder. 2005. Life Histories of Bats: Life in the Slow Lane. *In*: Bat Ecology. Pp. 209-253. T.H. Kunz and M.B. Fenton, eds. The University of Chicago Press, Chicago and London.

Barnes, J.R. 1989. Soil Survey of Benton County, Indiana. USDA Soil Conservation Service, Purdue Agricultural Experiment Station, and Indiana Department of Natural Resources.

BHE Environmental, Inc. (BHE). 2010. Post-Construction Bird and Bat Mortality Study, Cedar Ridge Wind Farm, Fond du Lac County, Wisconsin, Interim Report. Prepared for Wisconsin Power and Light. February 2010. 123pp

Boyles, J.G., J.J. Storm, and V. Brack. 2008. Thermal Benefits of Clustering During Hibernation: A Field Test of Competing Hypotheses on *Myotis sodalis*. Functional Ecology 22: 632-636.

Brack, V. Jr. 2004. The Biology and Life History of the Indiana Bat: Hibernacula. *In*: Indiana Bat and Coal Mining: A Technical Interactive Forum. Pp. 7-14. K.C. Vories and A. Harrington, eds. US Department of Interior, Office of Surface Mining, Alton, Illinois Coal Research Center, Southern Illinois University, Carbondale, Illinois, Louisville, Kentucky.

Britzke, E.R., A.C. Hicks, S.L. von Oettingen, and S.R. Darling. 2006. Description of Spring Roost Trees Used by Female Indiana Bats (*Myotis sodalis*) in the Lake Champlain Valley of Vermont and New York. American Midland Naturalist 155: 181-187.

Brock, K.J. 2006. Birds of Indiana. Amos Butler Audubon Society, Indianapolis, Indiana.

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). No. 506. Poole, A. and F. Gill, eds. *In*: The Birds of North America. The Birds of North American, Inc. Philadelphia, Pennsylvania.

Butchart, S.H.M., A.J. Stattershield, and N.J. Collar. 2006. How many bird extinctions have we prevented? Oryx 40:266-278.

Butchkoski, C.M., and J.D. Hassinger. 2002. Ecology of a Maternity Colony Roosting in a Building. *In*: The Indiana Bat: Biology and Management of an Endangered Species. A. Kurta and J. Kennedy, eds. Bat Conservation International (BCI), Austin, Texas. Pp. 130-142.

Butchkoski, C.M., and G. Turner. 2006. Indiana Bat (*Myotis sodalis*) Summer Roost Investigations. Pennsylvania (PA) Game Commission. Harrisburg, Pennsylvania.

Butchkoski, C., J. Chenger, A. Hicks, and R. Reynolds. 2008. Spring Indiana bat migration telemetry. Presentation at the Joint Meeting of 13th Annual Meeting of the Southeastern Bat Diversity Network, 10th Annual Meeting of the Northeast Bat Working Group, 18th Colloquium on Conservation of Mammals in the Southeastern United States, Blacksburg, Virginia.

Callahan, E.V., R.D. Drobney, and R.L. Clawson. 1997. Selection of Summer Roosting Sites by Indiana Bats (*Myotis sodalis*) in Missouri. Journal of Mammalogy 78(3): 818-825.

Canadian Wildlife Service (CWS) and U.S. Fish and Wildlife Service (USFWS). 2007. International recovery plan for the whooping crane. Ottawa: Recovery of Nationally Endangered Wildlife (RENEW), and U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 162 pp.

Carder, M., R.E. Good, J. Gruver, and K. Bay. 2009. Final Report, Bat Acoustic Studies for the Fowler II Wind Resource Area, Benton County, Indiana. July 17-October 15, 2008. Prepared for BP Wind Energy North America, Inc. Prepared by Western EcoSystems Technology, Inc., Cheyenne, Wyoming. March 31, 2009.

Carder, M., R.E. Good, and K. Bay. 2010. Wildlife Baseline Studies for the Fowler Ridge Wind Resource Area, Benton County, Indiana. Final Report, March 31, 2007-April 9, 2009. Prepared for BP Wind Energy North America, Inc. Houston, Texas. August 3, 2010. 82 pp.

Chamberlain, D.E., M.R. Rehfisch, A.D. Fox, M. Desholm, and S.J. Anthony. 2006. The effect of avoidance rates on bird mortality predictions made by wind turbine collision risk models. Ibis 148: 198-202.

Cope, J.B., A.R. Richter., and R.S. Mills. 1974. A Summer Concentration of the Indiana Bat, *Myotis sodalis*, in Wayne County, Indiana. Proceedings of the Indiana Academy of Science 83: 482-484.

Cowardin, L.M., V. Carter, F.C. Golet and E.T. LaRoe, 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service. FWS/OBS-79/31. Washington, D.C.

Cryan, P.M. 2008. Mating behavior as a possible cause of bat fatalities at wind turbines. Journal of Wildlife Management 72:845-849.

Cryan, P.M., and A.C. Brown. 2007. Migration of bats past a remote island offers clues toward the problem of bat fatalities at wind turbines. Biological Conservation 139:1–11.

Dauphiné, N., and R.J. Cooper. 2011. Pick one: outdoor cats or conservation. The Wildlife Professional 5:50-56.

Dauphiné, N., and R. J. Cooper. 2009. Impacts of free-ranging domestic cats (*Felis catus*) on birds in the United States: a review of recent research with conservation and management recommendations. Pages 205-219 *in* Proceedings of the Fourth International Partners in Flight Conference, 13-16 February 2008, McAllen, Texas, USA.

Erickson, W.P., G.D. Johnson, D.P. Young, M.D. Strickland, R.E. Good, M. Bourassa, K. Bay and K.J. Sterna. 2002. Synthesis and comparison of baseline avian and bat use, raptor nesting and mortality information from proposed and existing wind developments. Final report prepared for Bonneville Power Administration, Portland OR. WEST, Inc., Cheyenne, WY. 124 pp.

Erickson, W.P., G.D. Johnson, and D.P. Young. 2005. A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions. USDA Forest Service, General Technical Report PSW-GTR-191.

Fiedler, J.K. 2004. Assessment of bat mortality and activity at Buffalo Mountain Windfarm, eastern Tennessee. Thesis, University of Tennessee, Knoxville, USA.

Fleming, A.H., P. Bonneau, S.E. Brown, G. Grove, D. Harper, W. Herring, E.S. Lewis, A.J. Moeller, R. Powell, P. Reehling, R.F. Rupp, and W.J. Steen, 1995. Atlas of hydrogeologic terrains and settings of Indiana, Final Report to the Office of the Indiana State Chemist, Contract No. E005349-95-0, *Indiana Geological Survey, Open-File Report 95-7*.

Frick, W.F., J.F. Pollock, A.C. Hicks, K.E. Langwig, D.S. Reynolds, G.G. Turner, C.M. Butchkoski, and T.H. Kunz. 2010. An Emerging Disease Causes Regional Population Collapse of a Common North American Bat Species. Science. Vol. 329. 679-682.

Gardner, J. E., and E.A. Cook. 2002. Seasonal and geographic distribution and quantification of potential summer habitat. Pages 9-20 in A. Kurta and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, USA.

Gardner, J. E., J.D. Garner, and J.E. Hoffman. 1991. Summer roost selection and roosting behavior of *Myotis sodalis* (Indiana bat) in Illinois. Illinois Natural History Survey, Bloomington, Illinois.

Gehring, J.E., P. Kerlinger, and A.M. Manville II. 2009. Communication towers, lights, and birds: successful methods of reducing the frequency of avian collisions. Ecological Applications 19:505-514.

Gehring, J. E., P. Kerlinger, and A. M. Manville II. 2011. The role of tower height and guy wires on avian collisions with communication towers. Journal of Wildlife Management 75:848–855.

Good, R.E., W.P. Erickson, A. Merrill, S. Simon, K. Murray, K. Bay, and C. Fritchman. 2011a. Bat Monitoring Studies at the Fowler Ridge Wind Energy Facility, Benton County, Indiana: April 13 - October 15, 2010. Prepared for Fowler Ridge Wind Farm. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. January 28, 2011.

Good, R.E., W. Erickson, and A. Merrill. 2011b. Spring 2011 Bat Monitoring Protocol, Fowler Ridge Wind-Energy Facility, Phases I, II and III. Benton County, Indiana. Prepared for: Fowler Ridge Wind Farm. Prepared by: Western EcoSystems Technology Inc. Cheyenne, WY. March 30, 2011. 15 pp.

Good, R.E. and S. Simon. 2011. Assessment of Bald and Golden Eagle Use at the Fowler Ridge Wind Farm, Benton County, Indiana. Prepared for Fowler Ridge Wind Farm. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. June 9, 2011. 14 pp.

Good. R.E., A. Merrill, S. Simon, K.L. Murray, and K. Bay. 2012. Bat Monitoring Studies at the Fowler Ridge Wind Farm, Benton County, Indiana. Final Report: April 1 – October 31, 2011. Prepared for Fowler Ridge Wind Farm, Fowler, Indiana. Prepared by Western EcoSystems Technology, Inc. (WEST, Inc.), Bloomington, Indiana.

Gruver, J.,D. Solick, G. Johnson, and D. Young. 2007. Final Report, Bat Acoustic Studies for the Fowler Wind Resource Area, Benton County, Indiana. August 15-October 19, 2007. Prepared for BP Alternative Energy North America. Prepared by Western EcoSystems Technology, Inc., Cheyenne, Wyoming. November 15, 2007.

Gruver, J., M. Sonnenburg, K. Bay, and W. Erickson. 2009. Post-Construction Bat and Bird Fatality Study at the Blue Sky Green Field Wind Energy Center, Fond du Lac County, Wisconsin. July 21, 2008-October 31, 2008 and March 15, 2009-June 4, 2009. WEST, Inc. Cheyenne, Wyoming. 104pp.

Guthrie, M.J. 1933. The Reproductive Cycles of Some Cave Bats. Journal of Mammalogy 14: 199-216.

Gutschick, R.C. 1966. Bedrock Geology. In: Lindsey, A.A. (ed.) Natural Features of Indiana. Indiana Academy of Science, Indiana State Library, Indianapolis, Indiana, p. 1-20.

Hayes, F.E. 1995. Definitions for migrant birds: What is a Neotropical migrant? Auk 112: 521-523.

Hicks, A. 2004. Indiana Bat (*Myotis sodalis*): Protection and Management in New York State. Endangered Species Investigations Performance Report. Prepared for project number W-166-E, Segment 2003-2004, New York Department of Environmental Conservation (NYSDEC). 15 pp.

Hicks, A. and P.G. Novak. 2002. History, Status, and Behavior of Hibernating Populations in the Northeast. *In*: The Indiana Bat: Biology and Management of an Endangered Species. Pp. 35-47. A. Kurta and J. Kennedy, eds. Bat Conservation International (BCI), Austin, Texas.

Hicks, A., C. Herzog, and M. Clark. 2005. Indiana Bat (*Myotis sodalis*) Protection and Management in New York State. Annual report on New York Department of Environmental Conservation (NYSDEC) Activities. 30 pp.

Hinman, J.L. 2010. Wind farm proximity and property values: a pooled hedonic regression analysis of property values in central Illinois. Masters thesis, Illinois State University, Normal, Illinois.

Hoen, B., R. Wiser, P. Cappers, M. Thayer, and G. Sethi. 2009. The impact of wind power projects on residential property values in the United States: a multi-site hedonic analysis. Lawrence Berkeley National Laboratory, Berkley, California, USA. December. <http://eetd.lbl.gov/ea/ems/reports/lbnl-2829e.pdf>. Accessed 28 October 2012.

Hoffman, J. 1996. Indiana bats in Illinois. Illinois Natural History Survey Reports, March-April. On-line address: http://www.inhs.uiuc.edu/inhsreports/mar-apr96/bats.html.

Horn, J.W., E.B. Arnett and T.H. Kunz. 2008. Behavioral responses of bats to operating wind turbines. Journal of Wildlife Management 72(1):123-132.

Humphrey, S.R., A.R. Richter and J.B. Cope. 1977. Summer Habitat and Ecology of the Indiana Bat, *Myotis sodalis.* J. Mamm. 58:334-346.

Humphrey, S.R. and J.B. Cope. 1977. Survival Rates of the Endangered Indiana Bat, *Myotis sodalis*. Journal of Mammalogy 58: 32-36.

Johnson, G. and K. Bay. 2008. Draft Final Report: Wildlife Baseline Studies for the Fowler Ridge Wind Resource Area, Benton County, Indiana. March 31-November 16, 2007. Prepared for BP Alternative Energy North America. Houston, Texas. February 25, 2008. 48 pp.

Johnson, G.D., M.K. Perlik, W.P. Erickson and M.D. Strickland. 2004. Bat Activity, Composition and Collision Mortality at a Large Wind Plant in Minnesota. *Wildlife Society Bulletin.* 32(4): 1278-1288.

Johnson, G., M. Carder, R. Good, D. Tidhar, and K. Bay. 2009. American Golden-Plover Study for the Fowler Ridge Wind Farm, Benton County, Indiana. Spring 2007 through Spring 2009. Prepared for BP Wind Energy North America. Prepared by Western EcoSystems Technology, Inc. (WEST, Inc.), Cheyenne, Wyoming.

Johnson, G.D., M. Ritzert, S. Nomani, and K. Bay. 2010a. Bird and Bat Fatality Studies, Fowler Ridge I Wind-Energy Facility, Benton County, Indiana. Unpublished report prepared for British Petroleum Wind Energy North America Inc. (BPWENA) by Western EcoSystems Technology, Inc. (WEST, Inc.).

Johnson, G.D., M. Ritzert, S. Nomani, and K. Bay. 2010b. Bird and Bat Fatality Studies, Fowler Ridge III Wind-Energy Facility, Benton County, Indiana. April 2 - June 10, 2009. Prepared for BP Wind Energy North America. Prepared by Western EcoSystems Technology, Inc. (WEST, Inc.), Cheyenne, Wyoming.

Johnson, G. D., W.P. Erickson, M.D. Strickland, M.F. Shepherd, D.A. Shepherd, and S.A. Sarappo. 2002. Collision mortality of local and migrant birds at a large-scale wind-power development on Buffalo Ridge, Minnesota. *Wildlife Society Bulletin*. 30: 879-887.

Johnson, G., Erickson, W., White, J., and R. McKinney. 2003. Avian and Bat Mortality During the First Year of Operation at the Klondike Phase I Wind Project, Sherman County, Oregon. Northwestern Wind Power c/o WEST, Inc. Cheyenne, WY.

Johnson, G.D., M.K. Perlik, W.P. Erickson, and M.D. Strickland. 2004. Bat activity, composition, and collision mortality at a large wind plant in Minnesota. Wildlife Society Bulletin 32:1278-1288.

Johnson, G. and W. Tidhar. 2007. Whooping Crane Issues Associated with the Fowler Ridge, Indiana Windpower Site. Prepared for BP Alternative Energy North America. Prepared by Western EcoSystems Technology, Inc. Cheyenne, WY. June 29, 2007. 16pp.

Kerlinger, P. 1995. How Birds Migrate. Stackpole Books. Mechanicsburg, PA.

Kerlinger, P. 2000. Avian mortality at communication towers: A review of recent literature, research, and methodology. Prepared for: United States Fish and Wildlife Service Office of Migratory Bird Management. Curry & Kerlinger, L.L.C., Cape May Point, New Jersey. March.

Kerlinger, P. 2002. An Assessment of the Impacts of Green Mountain Power Corporation's Wind Power Facility on Breeding and Migrating Birds in Searsburg, Vermont: July 1996-July 1998. Prepared for the Vermont Department of Public Service. Montpelier, Vermont. 83pp.

Kerns, J., W.P. Erickson, and E.B. Arnett. 2005. Bat and bird fatality at wind energy facilities in Pennsylvania and West Virginia. Pages 24–95 in E. B. Arnett, editor. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International, Austin, Texas, USA.

Kerns, J. and P Kerlinger. 2004. A Study of Bird and Bat Collision Fatalities at the Mountaineer Wind Energy Center, Tucker County, West Virginia: Annual Report for 2003. February 14, 2004. Prepared for: FPL Energy and Mountaineer Wind Energy Center Technical Review Committee. Prepared by: Curry & Kerlinger, LLC.

Koford, R.R., J. B. Dunning, C. A. Ribic, and D. M. Finch. 1994. A glossary for avian conservation biology. Wilson Bulletin 106: 121-137.

Kunz, T.H., E.B. Arnett, B.M. Cooper, W.P. Erickson, R.P. Larkin, T. Mabee, M.L. Morrison, M.D. Strickland, and J.M. Szewczak. 2007a. Assessing impacts of wind-energy development on nocturnally active birds and bats: a guidance document. Journal of Wildlife Management 71:2449-2486.

Kunz, T.H., E.B. Arnett, W.P. Erickson, A.R. Hoar, G.D. Johnson, R.P. Larkin, M.D. Strickland, R.W. Thresher and M.D. Tuttle. 2007b. Ecological impacts of wind energy development on bats: questions, research needs and hypotheses. Frontiers in Ecology and the Environment 5:315-324.

Kurta, A. 2004. Roosting Ecology and Behavior of Indiana Bats (*Myotis sodalis*) in Summer. *In*: Indiana Bat and Coal Mining: A Technical Interactive Forum. Pp. 29-42. K. C. Vories and A. Harrington, eds. US Department of Interior, Office of Surface Mining, Alton, Illinois Coal Research Center, Southern Illinois University, Carbondale, Illinois. Louisville, Kentucky, Louisville, Kentucky.

Kurta, A., and H. Rice. 2002. Ecology and management of the Indiana bat in Michigan. Michigan Academician 33:361–376.

Kurta, A., S.W. Murray, and D.H. Miller. 2002. Roost selection and movements across the summer landscape. Pages 118-129 in A. Kurta and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, USA.

Kurta, A. and J.A. Teramino. 1994. A Novel Hibernaculum and Noteworthy Records of the Indiana Bat and Eastern Pipistrelle (Chiroptera: Vespertilionidae). American Midland Naturalist 132: 410-413.

LaVal, R.K and L.M. LaVal. 1980. Ecological Studies and Management of Missouri Bats, With Emphasis on Cave Dwelling Species. Terrestrial Series, Missouri Dept. of Conservation, Jefferson City, MO; 53 pp.

Manville, A.M., II. 2005. Bird strikes and electrocutions at power lines, communication towers, and wind turbines: state of the art and state of the science – next steps toward mitigation. Bird Conservation Implementation in the Americas: Proceedings 3rd International Partners in Flight Conference 2002, C.J. Ralph and T.D. Rich, editors. USDA Forest Service, GTR-PSW-191, Albany, California, USA.

McKinney, M. L. 1997. Extinction vulnerability and selectivity: combining ecological and paleontological views. Annual Review of Ecology and Systematics 28:495-516.

Miller, N.E., R.D. Drobney, R.L. Clawson and E.V. Callahan. 2002. Summer habitat in northern Missouri. Pp. 165-171 *In* The Indiana Bat: Biology and Management of an Endangered Species (A. Kurta and J. Kennedy, Eds.). Bat Conservation International, Austin, Texas.

Mitsch, W.J. and J.G. Gosselink. 2000. Wetland, 3rd Edition. John Wiley & Sons, New York, New York. 920 pp.

Morgan, C., E. Bossanyi and H. Seifert. 1998. Assessment of Safety Risks Arising from Wind Turbine Icing. BOREAS IV. March 31 – April 2, 1998. Hetta, Finland.

Mumford, R.E. and L.L. Calvert. 1960. *Myotis sodalis* Evidently Breeding in Indiana. Journal of Mammalogy 41: 512.

National Landcover Data (digital version). 2006.

National Research Council (NRC) of the National Academies. 2007. Environmental Impacts of Wind Energy Projects. Committee on Environmental Impacts of Wind Energy Projects, Board on Environmental Studies and Toxicology. Division of Earth and Life Sciences. The National Academies Press, Washington, DC.

Ornithological Council, The. 2007. Critical Literature Review: Impact of Wind Energy and Related Human Activities on Grassland and Shrub-steppe Birds. Prepared for the National Wind Consulting Council. Literature Review by Sarah Mabey and Ellen Paul. October 2007.

O'Shea, T.J., L.E. Ellison, and T.R. Stanley. 2004. Survival Estimation in Bats: Historical Overview, Critical Appraisal, and Suggestions for New Approaches. *In*: Sampling Rare and Elusive Species: Concepts, Designs, and Techniques for Estimating Population Parameters. Pp. 297-336. W.L. Thompson, ed. Island Press, Washington, D.C.

Pianka, E. R. 1970. On r and K selection. American Naturalist 104:592-597.

Peurach, S.C., C.J. Dove, and L. Stepko. 2009. A decade of U.S. Air Force bat strikes. Human-Wildlife Conflicts 3(2):199-207, Fall 2009.

Poulton, V. 2010. Summary of Post-Construction Monitoring at Wind Projects Relevant to Minnesota, Identification of Data Gaps, and Recommendations for Further Research Regarding Wind-Energy Development in Minnesota. State of Minnesota Department of Commerce c/o WEST, Inc. Cheyenne, Wyoming.

Rademakers, L.W.M.M., and H. Braam. 2005. Analysis of risk-involved incidents of wind turbines, Version 1.1. Energy Research Centre of the Netherlands, Petten, Netherlands. January.

Sanders, C., J. Chenger, and B. Denlinger. 2001. Williams Lake Telemetry Study: New York Indiana Bat Spring Migration Tracking Study. Report for Bat Conservation and Management. 21 pp. Available online at: http://www.batmanagement.com

Shaffer, J.A. and D.H. Johnson. 2008. Displacement Effects of Wind Developments on Grassland Birds in the Northern Great Plains. In *Proceedings of the NWCC Wind Wildlife Research Meeting VII.* Milwaukee, WI. October 28-29, 2008.

Shire, G.G., K. Brown, and G. Winegrad. 2000. Communication towers: A deadly hazard to birds. American Bird Conservancy, Washington, DC. June.

Simon, T.P., J.O. Whitaker, Jr., J.S. Castrale and S.A. Minton. 2002. Checklist of the Vertebrates of Indiana. Proceedings of the Indiana Academy of Science 101:95-126.

Stantec Consulting Services Inc. 2010a. Stetson I Mountain Wind Project, year 1 post-construction monitoring report, 2009 for the Stetson Mountain Wind Project in Penobscot and Washington Counties, Maine. Prepared for First Wind Management, LLC. Stantec Consulting, Topsham, Maine, USA. February.

Stantec Consulting Services Inc. 2010b. Cohocton and Dutch Hill wind farms year 1 post-construction monitoring report, 2009 for the Cohocton and Dutch Hill Wind Farms in Cohocton, New York. Prepared for Canandaigua Power Partners, LLC and Canandaigua Power Partners II, LLC. Stantec Consulting Services Inc., Topsham, Maine, USA. March.

Stantec Consulting Services Inc. 2011. Initial Noise Modeling Results, Fowler Ridge Wind Farm Phase IV. November 21, 2011.

Stantec Consulting Service Inc. 2012a. Historic Structures Screening and Impact Analysis, Proposed Fowler Ridge Wind Farm Phase IV, Benton County, Indiana. September 11, 2012.

Stantec Consulting Service Inc. 2012b. Archaeological Screening, Proposed Fowler Ridge Wind Farm Phase IV, Benton County, Indiana. October 31, 2012.

Strickland, D. 2004. Overview of Non-Collision Related Impacts from Wind Projects. In *Proceedings of the Wind Energy and Birds/Bats Workshop: Understanding and Resolving Bird and Bat Impacts.* Washington, DC. May 18-19, 2004. Prepared by RESOLVE, Inc., Washington, D.C., Susan Savitt Schwartz, ed. September 2004.

TetraTech 2007. Noise Impact Assessment Study. Prepared for BP Wind Energy North America. November 2007.

Thogmartin, W. E., F. P. Howe, F. C. James, D. H. Johnson, E. T. Reed, J. R. Sauer, and F. R. Thompson, III. 2006. A review of the population estimation approach of the North American landbird conservation plan. The Auk 123: 892-904.

Thogmartin, W.E., R.A. King, P.C. McKann, J.A. Szymanski, and L. Pruitt. 2012. Population-level impact of white-nose syndrome on the endangered Indiana bat. Journal of Mammalogy, 93(4):1086-1098. 2012.

Thompson, C.E. 1982. *Myotis sodalis.* Mamm. Species 163:1-5.

Trapp, J. L. 1998. Bird kills at towers and other human-made structures: An annotated partial bibliography (1960-1998). US Fish and Wildlife Service, Office of Migratory Bird Management, Arlington, Virginia.

Transeau, E. N. 1935. The prairie peninsula. Ecology 16:423-437.

Turner, G. 2006. Bat Migratory Behaviors and Routes in Pennsylvania and Maryland. Proceedings of the National Wind Coordinating Collaborative (NWCC) Wildlife Workgroup Research Planning Meeting VI, San Antonio, Texas. November 14-15, 2006.

Turner, G.G., D.M. Reeder, and J.T.H. Coleman. 2011. A Five-year Assessment of Mortality and Geographic Spread of White-nose Syndrome in North American Bats and a Look to the Future. Bat Research News. 52:2, pp 13-27.

Tuttle, M. D., and J. Kennedy. 2002. Thermal requirements during hibernation. Pp. 68–78, in The Indiana Bat: Biology and Management of an Endangered Species (A. Kurta and J. Kennedy, eds.). Bat Conservation International, Austin, Texas. 265 pp.

United States Environmental Protection Agency (USEPA). 2000. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1998, 236-R-00-01, Washington, D.C., USA. http://www.epa.gov/globalwarming. Accessed August 30, 2012.

United States Environmental Protection Agency (USEPA). 2009. Climate Change: Science, State of Knowledge. http://www.epa.gov/climatechange/science/stateofknowledge.html. Accessed August 30, 2012.

U.S. Fish and Wildlife Service (USFWS). 1980. Whooping Crane Recovery Plan. Region 2, U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

USFWS. 1983. Recovery Plan for the Indiana Bat. Region 3, U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 80 pp.

USFWS. 1999. Indiana Bat (*Myotis sodalis)* Revised Recovery Plan. Region 3, U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 53 pp.

USFWS. 2000. Pesticides and birds. Office of Migratory Bird Management, Arlington, Virginia, USA. March. <http://library.fws.gov/pubs/mbd_pesticides-3-00.pdf>. Accessed 6 December 2011.

USFWS. 2002. Migratory bird mortality: many human-caused threats afflict our bird population. Division of Migratory Bird Management, Arlington, Virginia, USA. January. <http://www.fws.gov/birds/mortality-fact-sheet.pdf>. Accessed 25 August 2011.

USFWS. 2003. Fish and Wildlife Service NEPA reference handbook. http://www.fws.gov/r9esnepa/NEPA_HANDBOOK2.pdf.

USFWS. 2007. Indiana Bat (*Myotis sodalis)* Draft Recovery Plan: First Revision. Region 3, U.S. Fish and Wildlife Service, Fort Snelling, Minnesota.

USFWS. 2008. Revised 2007 Rangewide Population Estimate for the Indiana Bat, Myotis sodalis. USFWS, Region 3. October 15, 2008.

USFWS. 2009. Whooping Cranes and Wind Development-An Issue Paper, by Regions 2 and 6, U.S. Fish and Wildlife Service. April 2009. 27pp.

USFWS. 2010. White-Nose Syndrome Decontamination Protocol (v.3) U.S. Fish and Wildlife Service – Draft 7.31.2010 <http://www.fws.gov/whitenosesyndrome/pdf/WNS1pageDecontaminationProtocol_073110.pdf>

USFWS. 2011a. Draft Eagle Conservation Plan Guidance. January 2011. http://www.fws.gov/windenergy/docs/ECP_draft_guidance_2_10_final_clean_omb.pdf

USFWS. 2011b. Pennsylvania Field Office News. Indiana bat fatality at Pennsylvania wind facility. http://www.fws.gov/northeast/pafo/index.html

USFWS. 2011c. "Indiana Bat Section 7 and Section 10 guidance for Wind Energy Projects. Revised 26 October, 2011. Available online at: http://www.fws.gov/midwest/endangered/mammals/inba/pdf/inbaS7and10WindGuidanceFinal26Oct2011.pdf.

USFWS. 2011d. 2009 Rangewide Population Estimate for the Indiana Bat (Myotis sodalis) by USFWS Region. http://www.fws.gov/midwest/Endangered/mammals/inba/pdf/2011inbaPopEstimate21Dec11.pdf>. Accessed 6 January 2012.

USFWS Bloomington Field Office (BFO). 2012a. Bloomington Field Office Draft Indiana Bat (Myotis sodalis) Mitigation Guidance for Wind Energy Habitat Conservation Plans. 28 November.

USFWS. 2012b. West Virginia Field Office News. Indiana bat fatality at West Virginia wind facility. http://www.fws.gov/westvirginiafieldoffice/ibatfatality.html

USFWS. 2012c. USFWS Newsroom. Endangered Indiana bat found dead at Ohio wind facility; Steps underway to reduce future mortalities. http://www.fws.gov/midwest/News/release.cfm?rid=604

USFWS. 2012d. 2011 Rangewide Population Estimate for the Indiana Bat (Myotis sodalis) by USFWS Region and Recovery Unit. Revised 1-4-2012. http://www.fws.gov/midwest/endangered/mammals/inba/pdf/2011inbaPopEstimate04Jan12.pdf

USFWS. 2012e. U.S. Fish and Wildlife Service News Release: North American bat death toll exceeds 5.5 million from white-nose syndrome. http://www.fws.gov/WhiteNoseSyndrome/pdf/WNS_Mortality_2012_NR_FINAL.pdf

USFWS. 2012f. White-nose syndrome: The devastating disease of hibernating bats in North America. March 2012. http://www.fws.gov/WhiteNoseSyndrome/pdf/White-nose_fact_sheet_4-2012.pdf.

USFWS. 2012g. 05/03/2012 Bat White Nose Syndrome (WNS) Occurrence by County/District (or portions thereof). http://www.fws.gov/WhiteNoseSyndrome/maps/WNSMAP05-03-12_300dpi.jpg

USFWS and National Marine Fisheries Service (NMFS). 1996. Habitat conservation planning and incidental take permit processing handbook. 4 November.

Whitaker, Jr., J. O. and R. E. Mumford. 2008. Mammals of Indiana. Indiana University Press, Bloomington, IN. 668 pp.

Whitaker, J. O., Jr., and V. Brack, Jr. 2002. Distribution and summer ecology in Indiana. Pages 48-54 in A. Kurta and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, Texas, USA.

Whitfield, D.P., and M. Madders. 2006. A review of the impacts of wind farms on hen harriers (*Circus cyaneus*) and an estimation of collision avoidance rates. Natural Research Information Note 1 (Revised). Natural Research, LTD. Banchory, Aberdeenshire, UK. August.

Williams, D. L. 1981. Reconstruction of prairie peninsula vegetation and its characteristics from descriptions before 1860. *In*: R. Stuckey and K.J. Reese, eds. Proceedings of the Sixth North American Prairie Conference. Ohio Biological Survey Notes No. 15. Pages 83-86

Winegrad, G. 2004. Wind Turbines and Birds. In *Proceedings of the Wind Energy and Birds/Bats Workshop: Understanding and Resolving Bird and Bat Impacts.* Washington, DC. May 18-19, 2004. Prepared by RESOLVE, Inc., Washington, D.C., Susan Savitt Schwartz, ed. September 2004.

Winhold, L., and A. Kurta. 2006. Aspects of Migration by the Endangered Indiana Bat, *Myotis sodalis*. Bat Research News 47:1-11.

Young, D.P., Jr., W.P. Erickson, R.E. Good, M.D. Strickland, and G.D. Johnson. 2003. Avian and Bat Mortality Associated with the Initial Phase of the Foote Creek Rim Windpower Project, Carbon County, Wyoming: November 1998-June 2002. Pacificorp, Inc., SeaWest Windpower, Inc., and BLM Rawlins District Office c/o WEST, Inc. Cheyenne, Wyoming.