Appendix A - Eagle Conservation Plan

Final
Eagle Conservation Plan
for the Rock Creek Wind Facility
Atchison County, Missouri

Prepared by

Rock Creek Wind Project, LLC

100 Brickstone Square
Andover, Massachusetts 01810

November 2018

CONFIDENTIAL BUSINESS INFORMATION

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

§	Section
Audubon	National Audubon Society
BBS	Breeding Bird Survey
BGEPA	Bald and Golden Eagle Protection Act
BBCS	Bird and Bat Conservation Strategy
C	collision probability
CBC	Christmas Bird Counts
CBI	Conservation Biology Institute
CFR	Code of Regulations
Company	Rock Creek Wind Project, LLC
CRS	Code of State Regulations
DEM	Digital Elevation Model
E&E	Ecology and Environment, Inc.
ECP	Eagle Conservation Plan
ECPG	The 2013 USFWS *Eagle Conservation Plan Guidance, Version 2*
ITP	eagle take permit
FR	Federal Register
ft	foot
ft^2	square foot
GPS	Global Positioning System
ha	hectare
hr	hour
IBA	Important Bird Area
km	kilometer
km^2	square kilometer
m^2	square meter
MBTA	Migratory Bird Treaty Act
MDOC	Missouri Department of Conservation
met	meteorological
m	meter
mi^2	square mile
min	minute
MW	megawatt
NAD	North American Datum
NEPA	National Environmental Policy Act
NLCD	National Land Cover Data/Database
NWR	National Wildlife Refuge
O&M	operations and maintenance
RCWF	Rock Creek Wind Facility
SOAR	Saving Our Avian Resources
US	United States
USC	United States Code
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
UTM	Universal Transverse Mercator
WEG	The 2012 USFWS Land-Based Wind Energy Guidelines
WEST	Western EcoSystems Technology, Inc.
WRRS	Wildlife Reporting and Response System
ε	expansion factor
λ	exposure rate
τ	daylight hours

1 INTRODUCTION AND PURPOSE

1.1 Project History and Overview

Rock Creek Wind Project, LLC[1] (the Company) has developed the Rock Creek Wind Facility (RCWF), in Atchison County, Missouri. The RCWF has a footprint that covers approximately 37,727 acres and has a generating capacity of up to 300 megawatts (MW; Figure 1). The Company has prepared this Eagle Conservation Plan (ECP) to document compliance with the requirements of the Bald and Golden Eagle Protection Act (BGEPA) as described in Part 50 of the Code of Federal Regulations (CFR; 50 CFR § 22.26) as well as support an application to the US Fish and Wildlife Service (USFWS) for a bald eagle (*Haliaeetus leucocephalus*) non-purposeful incidental take permit (ITP).

In accordance with the 2013 USFWS *Eagle Conservation Plan Guidance, Version 2* (ECPG; USFWS 2013b), this ECP provides information on background eagle studies and agency coordination as well as project siting, design, construction, and operation measures that avoid and minimize the take of eagles to the point where remaining take is unavoidable. It includes detailed analyses of risk, including estimation of anticipated levels of eagle take, and discusses conservation measures, mitigation measures, and adaptive management measures to ensure permit compliance. The ECP supports an application for an ITP for the unavoidable non-purposeful (incidental) take of eagles as a result of the project.

The Company has collaborated with the USFWS since 2008, at which point it began a series of environmental studies. More recently, the Company began avian use studies following the most recent USFWS guidance on December 14, 2014, and continued these surveys into the spring of 2016. An eagle/raptor nest survey was completed in April 2015, and a raptor migration survey was done in April and September of 2015. Given these surveys, sufficient information is available to prepare this ECP.

The Company is committed to siting, constructing, operating, and decommissioning the RCWF in an environmentally responsible and sustainable manner. To support this effort, the Company has adopted the “staged” and “tiered” decision frameworks outlined in the ECPG (USFWS 2013b) and the *Wind Energy Guidelines* (WEG; USFWS 2012), respectively. Following these frameworks have been useful in assessing project risk and designing the project to avoid and minimize impacts to natural resources, including bald eagles, golden eagles (*Aquila chrysaetos*), and their associated habitats.

[1] Tradewind Energy originally proposed development of the RCWF on behalf of the Company.

1.2 REGULATORY AND PERMIT COMPLIANCE

1.2.1 Federal Laws and Regulations

1.2.1.1 Bald and Golden Eagle Protection Act (BGEPA)

Bald and golden eagles are afforded legal protection under authority of the BGEPA (16 United States Code [USC] §§ 668–668d). The BGEPA prohibits the take, sale, purchase, barter, offer of sale, purchase, or barter, transport, export or import, at any time or in any manner of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof. Take is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb," (16 USC § 668c), and includes criminal and civil penalties for violating the statute. Disturb is defined as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury, or either a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior (72 Federal Register [FR] 31132).

In 2009, the USFWS promulgated a final rule on two new permit regulations that specifically authorize under BGEPA the non-purposeful (i.e., incidental) take of eagles and removal of eagle nests in certain situations (see 50 CFR § 22.26 and § 22.27, USFWS 2009b). The permits authorize limited take of bald and golden eagles; authorizing individuals, companies, government agencies and other organizations to disturb or otherwise take eagles in the course of conducting lawful activities.

To facilitate issuance of ITPs for wind energy facilities, the USFWS revised its ECPG in 2013. If eagle risk is identified at a project site, developers are strongly encouraged to follow the ECPG. The ECPG describes specific actions that are recommended to achieve compliance with the regulatory requirements in BGEPA for an ITP, as described in 50 CFR § 22.26 and § 22.27. The ECPG provides a framework for assessing and mitigating risk specific to eagles through development of ECPs and issuance of ITPs for eagles at wind facilities to assure that there will be no population-level effects to bald or golden eagles with the issuance of ITPs.

On December 16, 2016, the USFWS issued a revised rule that includes changes to the regulations for eagle incidental take permits and eagle nest take permits (2016 Eagle Rule). The Service also issued a final Programmatic Environmental Impact Statement (PEIS) analyzing the revisions. The revisions to the Eagle Rule went into effect on January 17, 2017, and include changes to permit issuance criteria, duration (including a maximum permit term of 30 years), compensatory mitigation standards, and permit application requirements. Additionally, the revised Eagle Rule codifies and further defines the USFWS-approved protocols for pre-construction eagle use surveys (referencing the ECPG) and post-permit fatality monitoring.

In coordination with USFWS, the Company has developed this ECP to avoid and minimize potential impacts to eagles, predict levels of fatality associated with the project, and apply for take authorization under BGEPA per the 2016 Eagle Rule.

1.2.1.2 Migratory Bird Treaty Act (MBTA)

In addition to the BGEPA, bald and golden eagles are protected by the Migratory Bird Treaty Act (MBTA). The MBTA is the cornerstone of migratory bird conservation and protection in the US. The MBTA implements four treaties that provide for international protection of migratory birds. It is a strict liability statute, meaning that proof of intent, knowledge, or negligence is not an element of an MBTA violation. Actions resulting in a "taking" or possession (permanent or temporary) of a protected species, in the absence of a USFWS permit or regulatory authorization, are violations of the MBTA. The MBTA states, "Unless and except as permitted by regulations…it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill…possess, offer for sale, sell…purchase…ship, export, import…transport or cause to be transported…any migratory bird, any part, nest, or eggs of any such bird….[The Act] prohibits the taking, killing, possession, transportation, import and export of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior…" (see 16 USC § 703). The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect…" (see 50 § CFR 10.12). The US Department of the Interior released a memorandum (M-37050) on December 22, 2017 interpreting the intention of the MBTA. This new legal opinion states that the MBTA only applies to "affirmative actions that have as their purpose the taking or killing of migratory birds" and does not prohibit the accidental or incidental take of migratory birds. Based on these interpretations, the MBTA does not apply to incidental take (such as accidental deaths that might be caused by wind turbines or power lines) and only applies to intentional actions (such as hunting and poaching) that result in the killing of migratory birds, including eagles.

1.2.1.3 National Environmental Policy Act (NEPA)

The NEPA [42 USC §§ 4321 et seq.] establishes national environmental policy and goals for the protection, maintenance, and enhancement of the environment and provides a process for implementing these goals within federal agencies. The NEPA requires federal agencies to incorporate environmental considerations in their planning and decision-making through a systematic approach. Issuance of an ITP by the USFWS constitutes a federal action and thus requires an assessment of the potential environmental impacts associated with the action and alternatives under NEPA.

1.2.2 Missouri Laws and Regulations

At the state level, the legal protection status of wildlife species is determined by the Missouri Department of Conservation (MDOC) in accordance with Title 3 of the Missouri Code of State Regulations (CSR), Division 10, Chapter 4: General Provisions (3 CSR 10-4.110 General Prohibition), which prohibits the pursuit, taking, possession, or any use of wildlife except as provided in the CSR. Beyond this general prohibition, the State of Missouri does not provide further protections to breeding and wintering bald and golden eagles beyond those afforded under the BGEPA or MBTA.

2 PROJECT DESCRIPTION

The RCWF consists of 150 utility-scale wind turbines and their associated infrastructure (turbine pads, access roads, and underground electric collection system), a project substation, an operations and maintenance (O&M) building, and approximately 15 mile (mi; 24 kilometers [km]) of new overhead transmission line from the project substation to the project's interconnection point to the electric grid. All of these facilities were planned for, are being built by, and will be owned, operated and controlled by the Company. The wind turbine generators at this RCWF are Vestas V-110 2.0MW and will be operated for at least 30 years. These turbines include 54-meter blades with the turbine nacelles mounted on 95-meter towers; the rotor swept zone for these turbines is 110 meters in diameter. Construction of the RCWF began in early 2017 and became commercially operational at the end of 2017.

The RCWF is located in an area of about 37,727 acres in Atchison County, in northwest Missouri (Figure 2). The proposed project area is located in the Western Corn Belt Plains Level III Ecoregion, with portions in the Steeply Rolling Loess Prairies and Rolling Loess Prairies Level IV Ecoregions (US Environmental Protection Agency [USEPA] 2013a). This region, previously dominated by tall-grass prairies, riparian and oak(*Quercus* spp.) -prairie savannah forests, and woody and herbaceous wetlands, has extensively been converted to farmland and cropland, livestock production, and pasture lands, making the region a leader in corn (*Zea mays*) and soybean (*Glycine max*) production (USEPA 2013b). Topography in the region is flat to gently rolling. The primary land cover within the project boundary is tilled, upland agricultural land. According to the US Geological Survey National Land Cover Database (USGS NLCD 2011), the majority of land cover within the RCWF is cultivated crops (69.8%) and hay/pasture (20.1%). Developed open space (4.0%), herbaceous lands (3.3%), and deciduous forest (2.5%) are also present in small patches throughout the RCWF. Other land cover types each account for less than 1% of the RCWF. These small contributors to the land cover within the project include woody wetlands, low intensity development, open water, medium intensity development, and emergent herbaceous wetlands (Table 1, Figure 3).

Table 1. Land use/cover types present within the Rock Creek Wind Facility.

Land Use/Cover	Project Acres	Percent Total
Cultivated Crops	26,326.3	69.8
Hay/Pasture	7,570.6	20.1
Developed, Open Space	1,512.2	4.0
Herbaceous	1,228.6	3.3
Deciduous Forest	938.5	2.5
Developed, Low Intensity	64.5	0.2
Woody Wetlands	41.6	0.1
Open Water	21.6	0.1
Emergent Herbaceous Wetlands	20.2	0.1
Developed, Medium Intensity	2.7	0.0
Total	**37,726.8**	

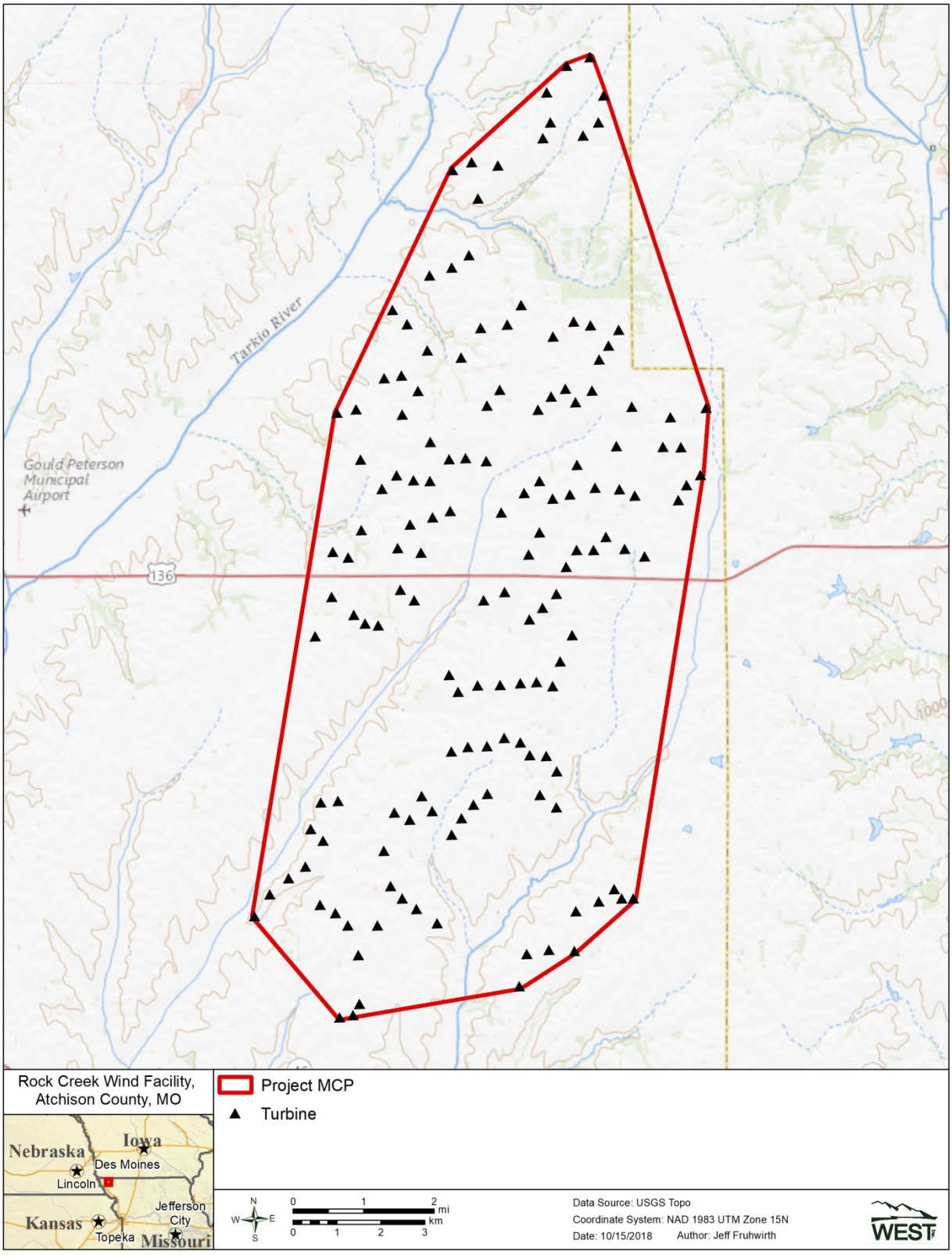

Figure 1. Turbine layout (optimized project footprint) of the Rock Creek Wind Facility.

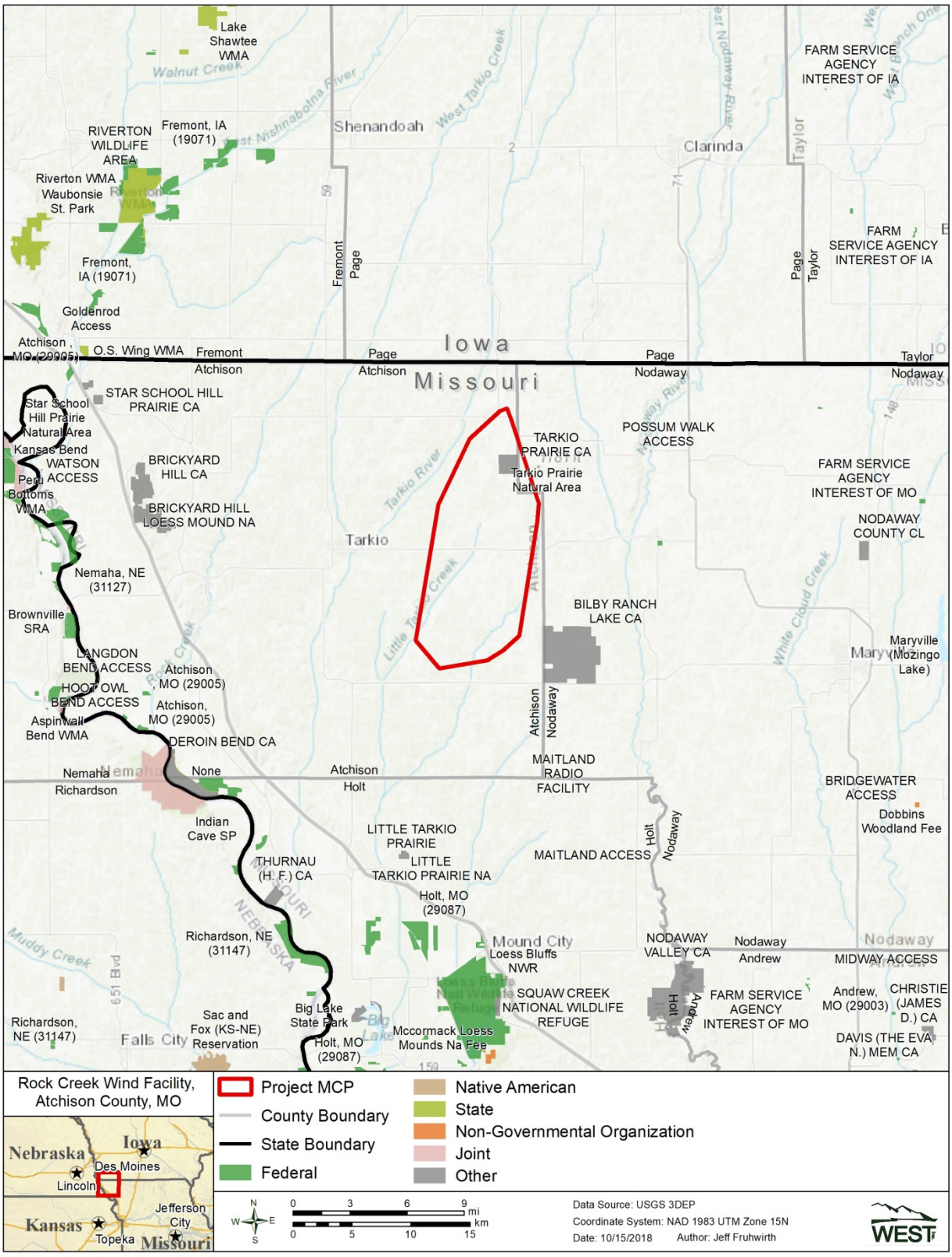

Figure 2. General location map for the Rock Creek Rock Creek Wind Facility.

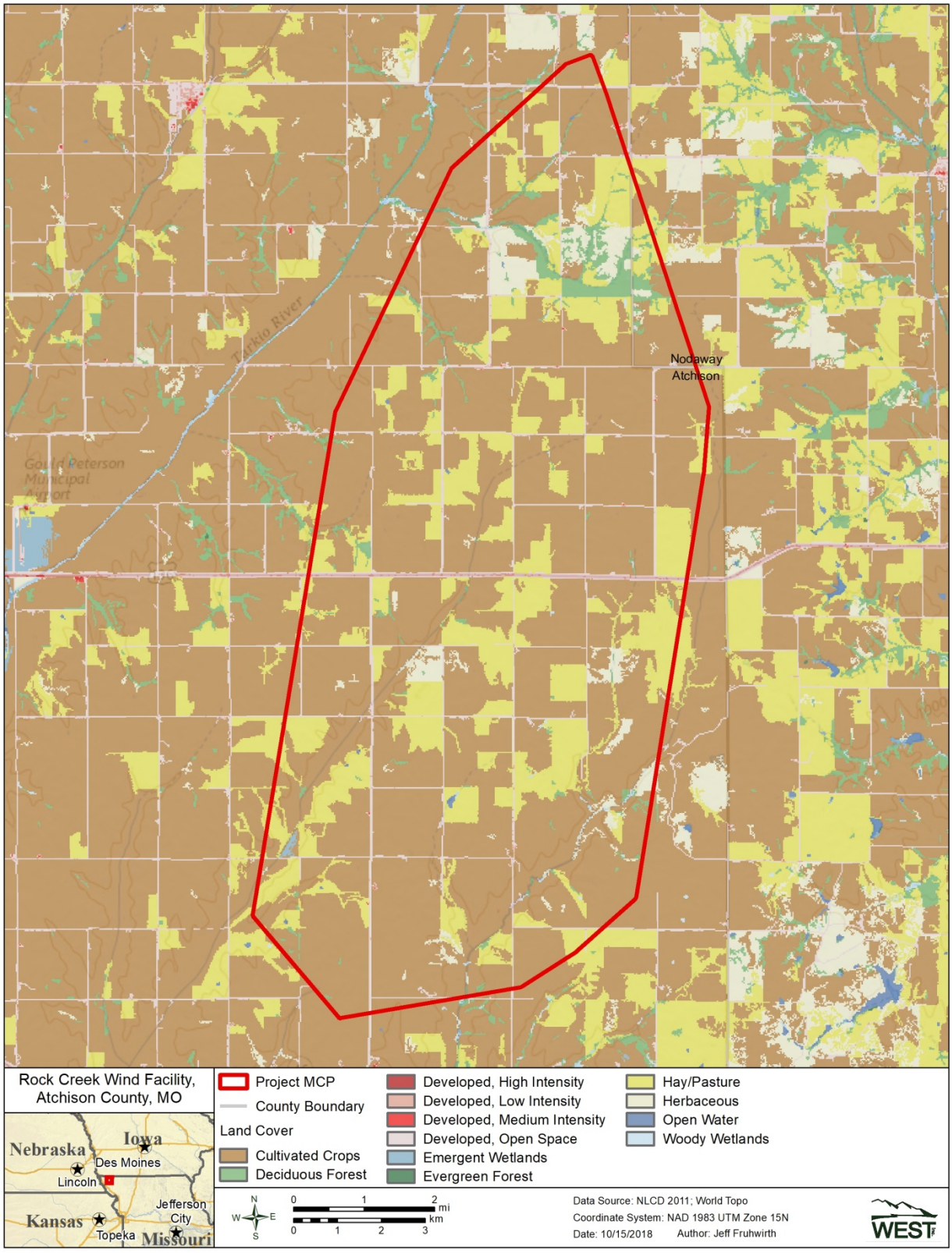

Figure 3. Land cover at the Rock Creek Wind Facility.

3 CONSULTATION HISTORY

Consistent with the ECPG, the Company has communicated on a regular basis with the USFWS and the MDOC regarding studies and impact avoidance measures since 2008 (Table 2). In-person meetings, phone calls and emails between the Company (and its technical consultants), USFWS, and MDOC have guided project development studies and impact avoidance decisions. Meetings in 2014 focused on development and implementation of the WEG Tier 1, 2 and 3 studies and ECPG Stage 1 and 2 studies, and expansion of the initial survey effort. Meetings and regular conference calls in 2015 and 2016 focused on continued sharing of study results, as well as discussion of the ECP content and ITP process. The Company will continue to coordinate with the agencies during the permit application and review process, as well as for the life of the project as described in this ECP.

Table 2. Agency consultation summary for the Rock Creek Wind Facility.

Date	Type	Participants	Topics/Notes
July 23, 2008	E-mail	E&E	E&E requested comments from the USFWS regarding the RCWF.
July 23, 2008	E-mail	E&E	E&E requested comments from the MDOC regarding the RCWF.
July 29, 2008	Letter	MDOC	The MDOC provided natural heritage program report of the RCWF project site. No records of federal listed or state endangered species/habitats, or species/habitats of conservation concern.
September 5, 2008	Letter	USFWS	The USFWS provided comments regarding fish and wildlife resources in/around the RCWF project area (in response to letter received on July 23, 2008). No records of federally listed/threatened species, or critical habitat within the project area. Recommended pre-construction and post-construction wildlife surveys. Recommended adoption of guidelines to minimize wildlife impacts from wind turbines.
September 26, 2008	Letter	E&E	Response to USFWS comments provided on September 5, 2008, on the RCWF. Review of project design in accordance with USFWS guidelines.

Table 2. Agency consultation summary for the Rock Creek Wind Facility.

Date	Type	Participants	Topics/Notes
November 11, 2008	Letter	USFWS	Response to E&E comments provided on letter from September 26, 2008. Project adequately designed following USFWS guidelines. No significant impact to protected birds and bat resources anticipated.
May 15, 2012	E-mail	Company	Updated map provided to the MDOC for the RCWF. Requested information on known eagle nests in vicinity of the project.
May 23, 2012	Meeting	USFWS Company	Project update and transmission line route.
June 13, 2012	E-mail	MDOC	The MDOC provided email to the Company on eagle nests and use with the RCWF project area. No known nests within or near the project (nearest nest near the Missouri River). Reports of bald eagle activity during summer months. Recommended eagle use/activity surveys.
July 17, 2012	E-mail	Company	Company requested additional comments and feedback on project and bald eagle survey guidelines from the USFWS.
July 23, 2012	E-mail	USFWS	The USFWS agreed to provide additional feedback related to eagles. Pre-construction nesting and winter use surveys recommended.
March 13, 2015	Conference call	USFWS MDOC Company WEST	Project update for the RCWF. Discussed 2015 biological study plans.
March 30, 2015	Conference call	USFWS Company WEST	Project discussion for the RCWF. Reviewed the preliminary results of the 2015 eagle/raptor nest survey.
September 9, 2015	Meeting	USFWS MDOC Company WEST	Project update for the RCWF. Discussed results of bat and bird biological studies during 2015. Discussed general organization and contents of the ECP and Bird and Bat Conservation Strategy (BBCS).
November 2, 2015	Conference call	USFWS Company WEST	Project discussion for the RCWF about proposed post-construction wildlife fatality monitoring protocols to be included in the ECP and BBCS.

Table 2. Agency consultation summary for the Rock Creek Wind Facility.

Date	Type	Participants	Topics/Notes
November 10, 2015	Meeting	USFWS Company WEST	Project discussion for the RCWF about eagle take calculations. Reviewed contents of the ECP.
January 7, 2016	Conference call	USFWS Company WEST	Reviewed USFWS preliminary comments on draft ECP (version 1).
April 7, 2016	Conference call	USFWS Company WEST	Reviewed USFWS comments on draft ECP (version 2)
May 9, 2016	Conference call	USFWS Company WEST	Reviewed winter 2016 survey results and updated eagle risk calculations
July 21, 2016	ITP Application	Company	Provided ITP application and ECP (version 3) to the USFWS
February 9, 2017	Conference call	Company USFWS WEST	Potential application changes given 2016 Eagle Rule
February 16, 2017	Conference call	Company USFWS WEST	Potential application changes given 2016 Eagle Rule
March 2, 2017	Conference call	USFWS Company WEST	Potential application changes given 2016 Eagle Rule Eagle take prediction approach Tiering to Programmatic Environmental Impact Statement
June 2, 2017	Conference call	USFWS Company WEST	ECP discussion Eagle take predictions Eagle use data
July 5, 2017	Conference call	USFWS Company WEST	Post-construction monitoring plan changes ECP discussion
October 20, 2017	Conference call	USFWS Company WEST	Post-construction monitoring plan review
December 1, 2017	Conference call	USFWS Company WEST	Comments on post-construction monitoring plan Nesting monitoring ECP finalization

Company = representatives of Tradewind Energy for the RCWF site; USFWS = US Fish and Wildlife Service; MDOC = Missouri Department of Conservation; E&E = Ecology and Environment, Inc.; WEST = Western EcoSystems Technology, Inc.

4 STAGE 1 – INITIAL SITE ASSESSMENT

The USFWS released the ECPG to provide specific in-depth guidance for conserving bald and golden eagles in the course of siting, construction and operating wind energy facilities (USFWS 2013b). Stage 1 of the ECPG includes the preliminary site evaluation based on publicly available literature and a desktop review to identify important use areas to resident breeding and non-breeding eagles, and to migrant and wintering eagles.

The preliminary site evaluation for this project was prepared by Ecology and Environment, Inc. (E&E), in June of 2010 and focused on wetlands and waterbodies. The project boundary has since been altered. Although there are no significant waterbodies or areas of potentially high prey concentration within the RCWF, the proximity of the project to the Missouri River, an area that is known to include an abundance of bald eagles during the winter months, suggests the site warranted closer evaluation (see eBird 2015).

The USGS Watson Breeding Bird Survey (BBS) route intersects the project and was surveyed almost every year since 2002 (it was not surveyed in 2009 and 2011; see Pardieck et al. 2015). No bald or golden eagles have been recorded along this route at any time.

The Tarkio Prairie Conservation Area (approximately 640 acres [259 ha]) is a state-owned area in the vicinity of the RCWF that is managed by the MDOC. This area is one of the few remaining high-quality prairies in the glaciated plains for northern Missouri and features a diverse assortment of prairie flora that may serve as stopover habitat for migrating prairie bird species. Although the Tarkio Prairie Conservation Area falls within the Project footprint (see Figure 2), it is not part of the leased project area and there are no turbines closer than 1,800 feet to this area. The Bilby Ranch Lake Conservation Area is another State Park near the RCWF. This park is approximately 1.3 mi (2.1 km) east of the RCWF in Nodaway County, and contains grassland, cropland, abandoned cropland/pasture, and some forest, with a focus on ring-necked pheasant (*Phasianus colchicus*) management.

The closest National Audubon Society (Audubon) Important Bird Area (IBA) is Indian Cave State Park (Audubon 2015), approximately 14.3 mi (22.9 km) southwest of the RCWF. This is a state-priority IBA located in southeastern Nebraska along the Missouri River, consisting of large mature eastern deciduous forest with some upland, wetland, and riverine habitats. This site provides important stopover habitat for many migrating species. The next closest IBA is the Loess Bluffs National Wildlife Refuge (NWR) which is about 15.4 mi (24.8 km) south of the RCWF. This IBA was historically a mosaic of tallgrass prairie and marshland and is now mostly managed wetland and grassland habitats with some loess hill prairies, forests, and cropland. The Loess Bluffs NWR provides excellent wetland habitat for breeding, migrating, and wintering wetland birds.

4.1 Golden Eagles

A small number of golden eagles may winter in northwest Missouri; golden eagles do not breed or nest in the area. The closest observations of golden eagles recorded by eBird in the vicinity

of the project were recorded at the Loess Bluffs NWR in Holt County in 2013, 2012, 2011, 1997, and 1968 (eBird 2015). Another observation was made at the Nodaway Valley Conservation area in October of 2014 (eBird 2015). All observations were made between October and April, with no observations recorded during the summer months.

The eBird database is housed and managed by the Cornell Laboratory of Ornithology and is currently the largest compendium of geospatial data on birds in the world, receiving over three million records per month for North America, and providing an unparalleled resource for the analysis of bird distributional patterns over time and space for most of North America (Sullivan et al. 2009). Data is gathered by birdwatchers that also use the database to track their own personal history of bird observations, and it is quality controlled by regional editors who review and evaluate unusual records on an individual basis. The utility of the eBird database for analyzing bird occurrence patterns within a given region is purely a function of the extent of eBird data submission within the region, and coverage is a function of birdwatcher activity. eBird was created in 2002, and although it is possible for users to submit older historical records, the vast majority of records within this database are from 2008 to the present, due to the recent rise in usage of this database.

In addition to the eBird database, the Audubon Christmas Bird Counts (CBC) are a valuable resource for evaluating avian use and wintering activity. The CBC is the longest-running citizen science bird project. The CBC is administered by the Audubon and provides information on wintering bird abundance throughout the US Bird occurrence data is gathered annually by volunteer observers at a series of 15-mile diameter circles on a single day within two weeks of Christmas. The CBC data are generally regarded as a useful source of wintertime geospatial data for birds in much of the US (e.g., Paprocki et al. 2014) because of the very large spatiotemporal extent of this database, with the program originating in 1900, and currently being conducted at over 2,300 circles across North and South America.

The Maryville CBC Circle is closest to the project site (about 7.4 mi [11.9 km] away) and has had surveys completed every year since 2003. Golden eagles have been reported at the Maryville CBC circle each year between 2003 and 2013, with a 10-year average of 0.00117 golden eagles per party hour reported, suggesting that golden eagles may occur within the project in very low numbers.

4.2 Bald Eagles

The RCWF is about 12.5 mi (20.1 km) northeast of the Missouri River, which serves as a major migration corridor and provides suitable nesting habitat for bald eagles. The eBird database shows several bald eagle observations along the Missouri River and several more within Atchison County, including one observation less than two miles (3.2 km) west of the RCWF (eBird 2015). Bald eagles are a commonly occurring species in the area according to existing datasets that evaluate eagle use; however, it is the expectation of the Company, USFWS, and MDOC that avoidance measures (landscape level siting and turbine siting, along with other measures) will reduce the predicted eagle take for the RCWF to a level that can be permitted and will not result in significant impacts to the local-area population.

Bald eagles have been reported at the Maryville CBC circle each year between 2003 and 2013, with a 10-year average of 0.6271 bald eagles per party hour reported, suggesting that bald eagles may occur within the project.

4.3 Conclusions and Recommendations

Results from the preliminary Stage 1 evaluation determined a relatively low level of risk to golden eagles. The Stage 1 review also noted the potential for a moderate level of bald eagle use and the potential for bald eagle nesting within the vicinity of the project boundary. This information has been used to modify the original project boundary and expand the raptor/avian use survey effort to ensure an accurate and thorough representation of eagle and raptor use within the current proposed project boundary.

The information gathered from available datasets and the ECPG Stage 1 assessment indicates that studies to further define potential eagle impacts and inform siting and impact avoidance measures, per the ECPG, should be conducted. These surveys included monthly avian use surveys and an eagle nest survey out to 10 miles from the project site. These surveys were implemented in coordination with USFWS, following the protocols identified in the ECPG (USFWS 2013b) and are further discussed below.

5 STAGE 2 – SITE-SPECIFIC SURVEYS AND ASSESSMENT

Based on the results of the initial Stage 1 site assessment and consultation with the USFWS, the Company conducted ECPG Stage 2 studies, including aerial nest surveys and eagle use studies.

5.1 Eagle Nest Surveys

Raptor nest surveys were conducted from a helicopter in 2015 (March 25 – 27, 2015; Mattson et al. 2015) and 2016 (March 16 – 18, 2016; Mattson et al. 2016), before leaf out when raptors would be actively tending to a nest or incubating eggs. Aerial surveys were conducted in accordance with the guidance provided in the USFWS Eagle Conservation Plan Guidance (April 2013) and the USFWS Inventory and Monitoring Protocols (Pagel et al. 2010).

Bald eagle nest surveys focused on locating eyries (large, stick nest structures) in suitable eagle nesting substrate (trees, transmission lines, etc.) within and around the proposed RCWF, considering two different buffer areas: during 2015 the survey included a 1-mile buffer and an informed 5-mile buffer and during 2016 the survey included a 1-mile buffer and a 10-mile buffer. Surveys within the 1-mile boundary documented all potential raptor nests, while the surveys outside of the 1-mile boundary focused only on identifying potential bald eagle nests.

In 2015, a WEST biologist detected a total of 57 raptor nests and two great-blue heron (*Ardea herodias*) rookeries during aerial surveys conducted on March 25 - 27. The raptor nests were identified as bald eagle, red-tailed hawk (*Buteo jamaicensis*), great-horned owl (*Bubo virginianus*), and unknown raptor. All occupied raptor nests, regardless of species, had one

adult bird sitting in an incubating position on the nest. Overall, a total of two bald eagle nests (occupied and active) and four potential bald eagle nests were identified within the informed 5-mile buffer during the aerial nest survey; one additional nest that had been identified by a biologist from the ground during avian use surveys as a potential bald eagle nest was not located during the aerial survey. Both of the active bald eagle nests (Nest #2 and #5) were located near the Nodaway River six to 10 miles (10 to 16 km) from the eastern boundary of the project area (which is even further from the nearest proposed turbine). The remaining raptor nests found in the project area during 2015 included a total of 13 occupied red-tailed hawk nests and 37 unoccupied unknown raptor nests. No federal- or state-listed threatened or endangered raptor species with potential to occur in Atchison or Nodaway Counties, Missouri, were documented during the survey.

In 2016, a WEST biologist detected a total of 46 nests representing three species, during aerial surveys conducted on March 16 – 18 (Mattson et al. 2016). Four occupied and active bald eagle nests, two occupied and inactive bald eagle nests, two unoccupied and inactive nests consistent with bald eagle, two nests occupied by great-horned owls, 17 nests occupied by red-tailed hawks, and 19 unknown raptor nests were identified. One occupied but inactive bald eagle nest was located near the revised project boundary along the Tarkio River (Figure 4). The remaining bald eagle nests identified during this survey were located over 5 miles from the revised project boundary (Figure 4). No other federal or state-listed threatened or endangered raptor species were observed nesting within the project or associated buffers in 2016.

5.1.1 Follow-Up Ground Nest Monitoring Surveys

Biologists completed four survey observation hours at two potential bald eagle nests west of the project boundary near the Tarkio River at each fixed-point on April 17, 2015. No chicks or adults bald eagles were documented in either nest or in close proximity to either nest, and both nests were determined to be unoccupied after the initial ground survey effort. No bald eagle activity was documented at all during the monitoring of the western-most nest; and one perched location and one flight path of a sub-adult bald eagle was observed during monitoring of the eastern-most nest at distance of approximately 0.7 mile (1.1 km) from the nest location. This sub-adult bald eagle flight and perch location was actually documented partially in the 800-meter (m; 2,625-foot [ft]) survey plot of the western-most nest, yet still approximately 0.6 mile (1.0 km) from the western-most nest location.

During May 2016, a biologist also conducted a follow up observation of the occupied bald eagle nest near the project boundary on the Tarkio River (Nest 100 on Figure 4). No adult or juvenile bald eagles were observed in flight or in the nest during that visit.

The eagle nest located to the west of the project boundary along the Tarkio River was not active in 2015 or 2016. As such, it was not possible to gather data on the size and shape of this potential eagle territory. Given its location on the Tarkio River, it seems likely that eagles that nest along this river would predominately use this river corridor for travel and foraging.

During construction of the RCWF, another eagle nest was observed west of the project turbines along the Little Tarkio Creek (about 1,600 feet west of the closest turbine, Turbine G-8). The Company contracted a biologist to monitor this nest between May and August to better understand eagle use patterns around this nest. A majority of eagle use observed during this period was concentrated near the nest and along the adjacent creek.

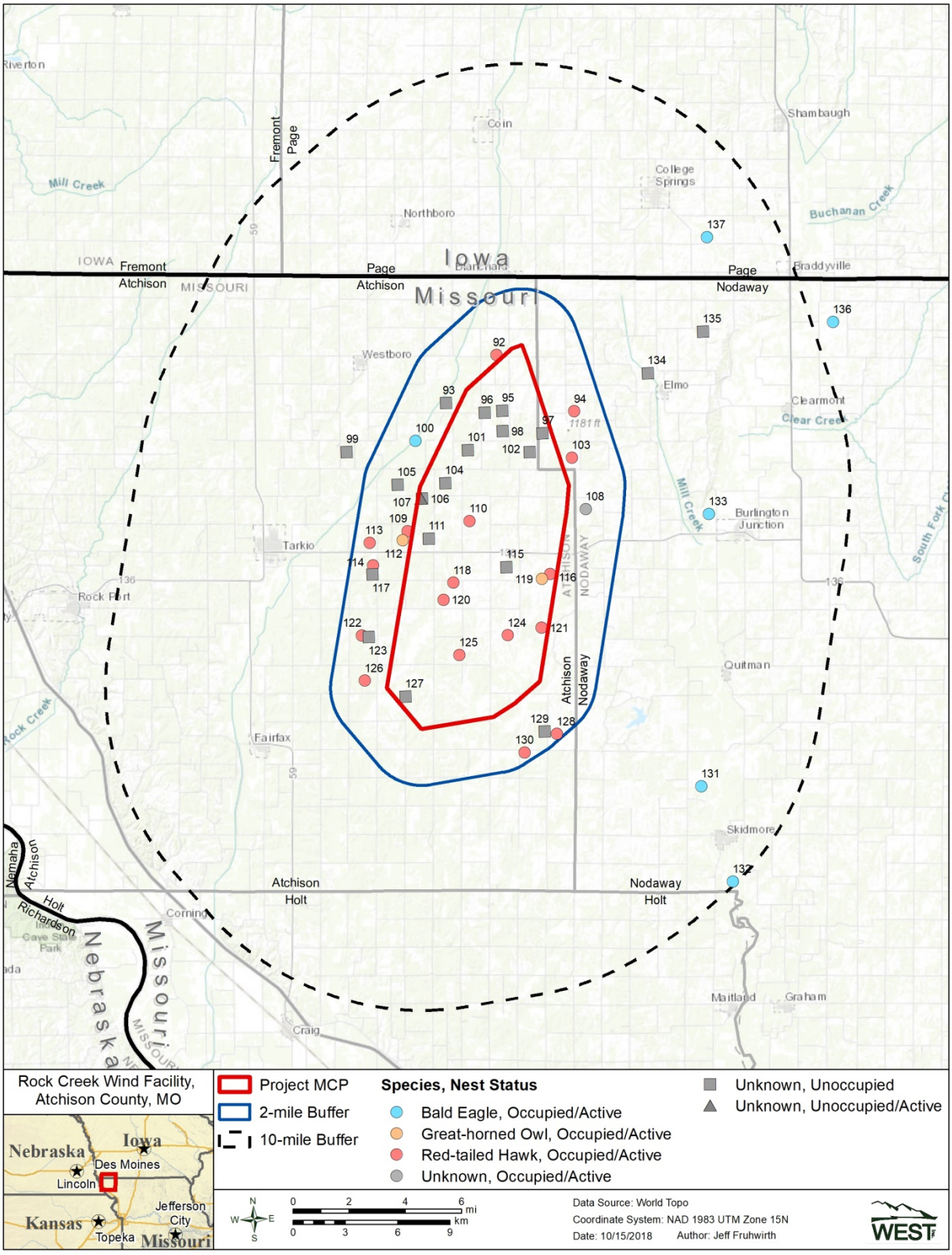

Figure 4. Raptor nests observed during the raptor nest surveys from March 16 – 18, 2016 at the Rock Creek Wind Facility, Atchison County, Missouri.

5.2 Eagle Use Studies

Fifteen months (including two winter seasons) of eagle use point count surveys were conducted by WEST. The objective of the fixed-point bird use surveys was to estimate seasonal and spatial use of the study area by birds, particularly bald eagles and golden eagles or other large bird types. Fixed-point bird surveys (variable circular plots) were conducted using methods described by Reynolds et al. (1980) and consistent with the WEG and ECPG. Surveys began December 13, 2014, and ran through March 16, 2016, thus capturing a full year and two winter seasons of avian use. Initially, 24 avian point count stations were established. This number increased to 36 points in January 2015 to accommodate changes in the project boundary and to address feedback from the USFWS (Figure 5).

5.2.1 Survey Methods

WEST biologists recorded all large bird and small birds seen during each survey using a unique observation number, regardless of distance, with an emphasis on eagles. All large bird species observed within a 2,625-ft (800-m) plot and all small bird species observed within a 328-ft (100-m) plot at each point count location were recorded. Point count surveys were conducted for one hour (60 minutes [min]). Biologist recorded all small and large birds for the first 20-min of each 60-min survey then recorded large birds only for the remaining 40-min of each 60-min survey. In some cases, the tally of observations may represent repeated sightings of the same individual. Biologists recorded observations of large birds beyond the 800-m radius; however, these observations were not included in the statistical analyses. Large birds included waterbirds, waterfowl, rails and coots, grebes and loons, gulls and terns, shorebirds, diurnal raptors, owls, vultures, upland game birds, doves/pigeons, large corvids (e.g., ravens [*Corvus* spp.], magpies (*Pica* spp.), and crows [*Corvus* spp.]), and goatsuckers.

WEST field staff recorded the date, start and end time of the survey period, and weather information (e.g., temperature, wind speed, wind direction, precipitation, and cloud cover) for each survey. Species or best possible identification, number of individuals, sex and age class (if possible), distance from plot center when first observed, closest distance, altitude above ground, activity (behavior), and habitat(s) were recorded for each observation. Other information recorded about the observation included whether or not the observation was auditory only and the 10-min interval of the 60-min survey in which it was first observed.

Biologists recorded bird behavior and habitat for each bird observation. For bald eagle or golden eagle observations, additional behavior and habitat data were recorded during each 1-min interval the bird was within view, per the ECPG (USFWS 2013b). Behavior categories included soaring flight, flapping-gliding, hunting or kiting-hovering stooping/diving at prey, stooping or diving in an antagonistic context with other bird species, perched, being mobbed, undulating/territorial flight, auditory, and other (noted in comments). For each bird observation, biologists identified the initial and changing flight patterns and habitat types on the data sheet. The flight direction of observed birds was also recorded on the data sheet map. Approximate flight height at first observation was recorded to the nearest five m (16 ft); the approximate

lowest and highest flight heights observed were also recorded. The biologist also noted any comments or unusual observations in the comments section of the data sheet.

5.2.2 Observation Schedule

WEST designed the sampling intensity to document bird use and behavior by habitat and season within the project area. Fixed-point bird use surveys were conducted at each fixed survey point once per month throughout the year. Field biologists carried out the surveys during daylight hours and survey periods varied to approximately cover all daylight hours during a season. To the extent practical, each point was surveyed roughly the same number of times.

Incidental wildlife observations were recorded to provide information on wildlife seen outside of the standardized surveys. Field biologists recorded all sensitive species, unusual species or behavior observations, mammals, reptiles, and amphibians in a similar fashion to standardized surveys. The observation number, date, time, species, number of individuals, sex/age class, distance from observer, activity, height above ground (for bird species) and habitat were recorded. Biologists recorded the location of sensitive species by Universal Transverse Mercator (UTM) coordinates using a hand-held Global Positioning System (GPS) unit.

In addition to avian point count studies, raptor migration surveys were conducted during spring and fall and included counts of birds observed within a circular plot around two fixed observation points following standard methods (Reynolds et al. 1980). Surveys were conducted three times during spring (April 20 – May 15, 2015) and fall (September 1 – November 15, 2015), resulting in 18 hours of observation during each migration period.

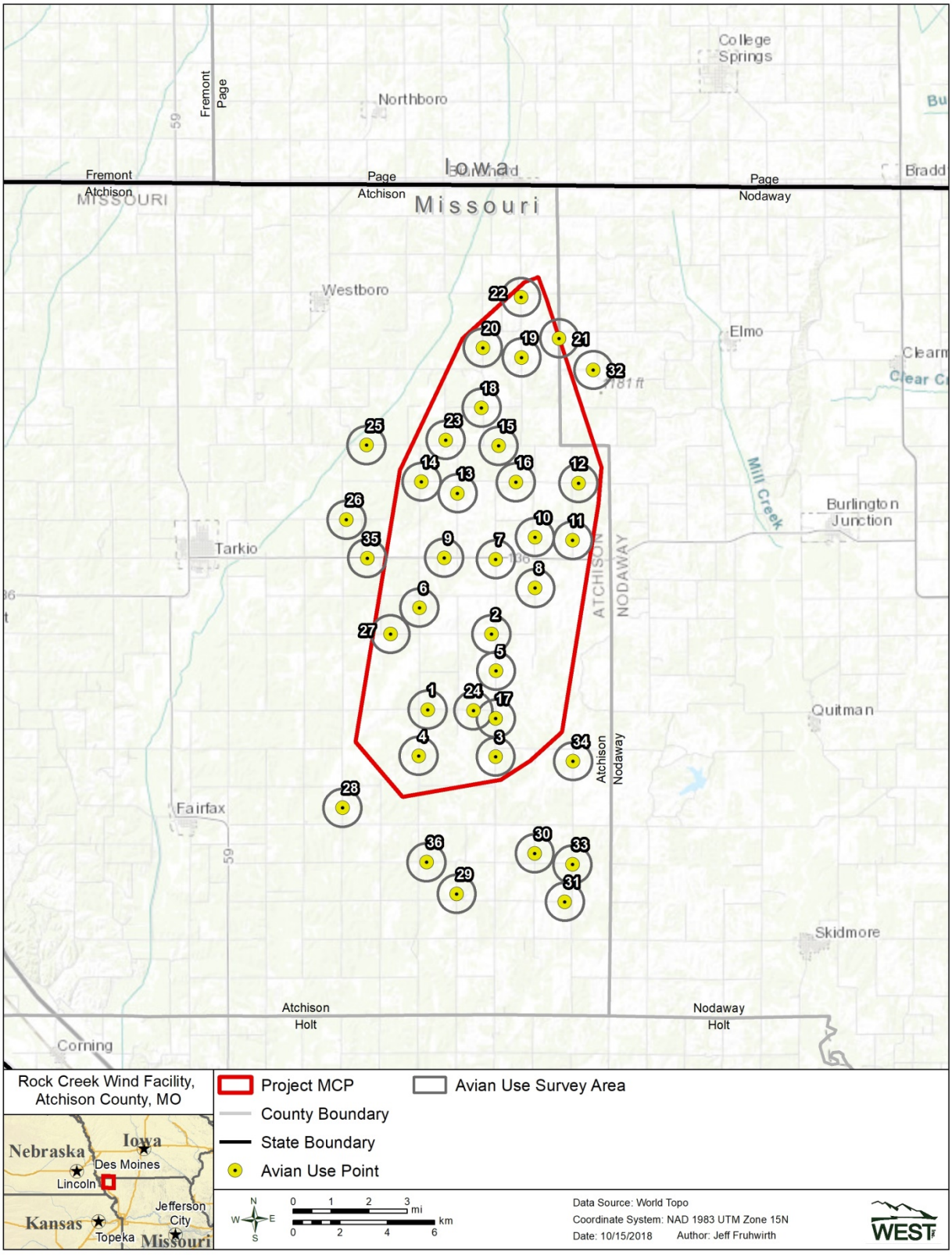

Figure 5. Avian survey points at the Rock Creek Wind Facility.

5.2.3 Results and Discussion

During the avian point count surveys, a total of 564 survey hours have been completed at the RCWF between December 2014 and March 2016. During this period, 479 bald eagle and 4 golden eagle observations have been made. A total of 754 bald eagle flight minutes were recorded within the rotor-swept zone (within 800 m of observer and below 200 m [256 ft]); this included 533 bald eagle flight minutes under 200 m within the 25 fixed-point plots that overlap the current project footprint.

Surveys show eagle minutes in the RCWF were highest in November and December 2015 (Figure 6). Eagle activity observed was primarily of general soaring or flapping flights through the area.

During the raptor migration surveys from May 1 to May 12, 2015 (spring migration) and September 26 to October 12, 2015 (fall migration) 2,773 raptors and other large birds were observed in 300 groups. The observations consisted of 23 bird species. Bald eagles were observed in 6 groups of 6 individuals (3 during each season).

Figure 7 shows the number of eagle observations per 800-plot per 60-minute survey at each of the survey points. This illustrates that eagle use appears to be distributed relatively evenly throughout much of the project area.

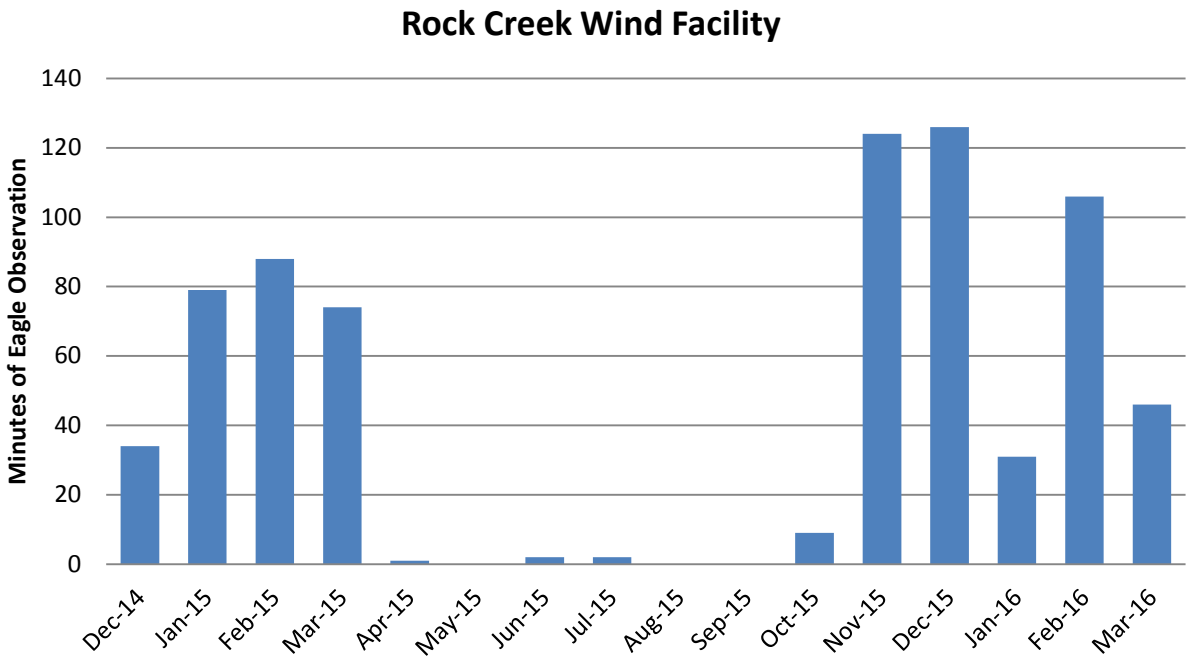

Figure 6. Season observations (in minutes) of eagles at the Rock Creek Wind Facility, December 2014 – March 2016.

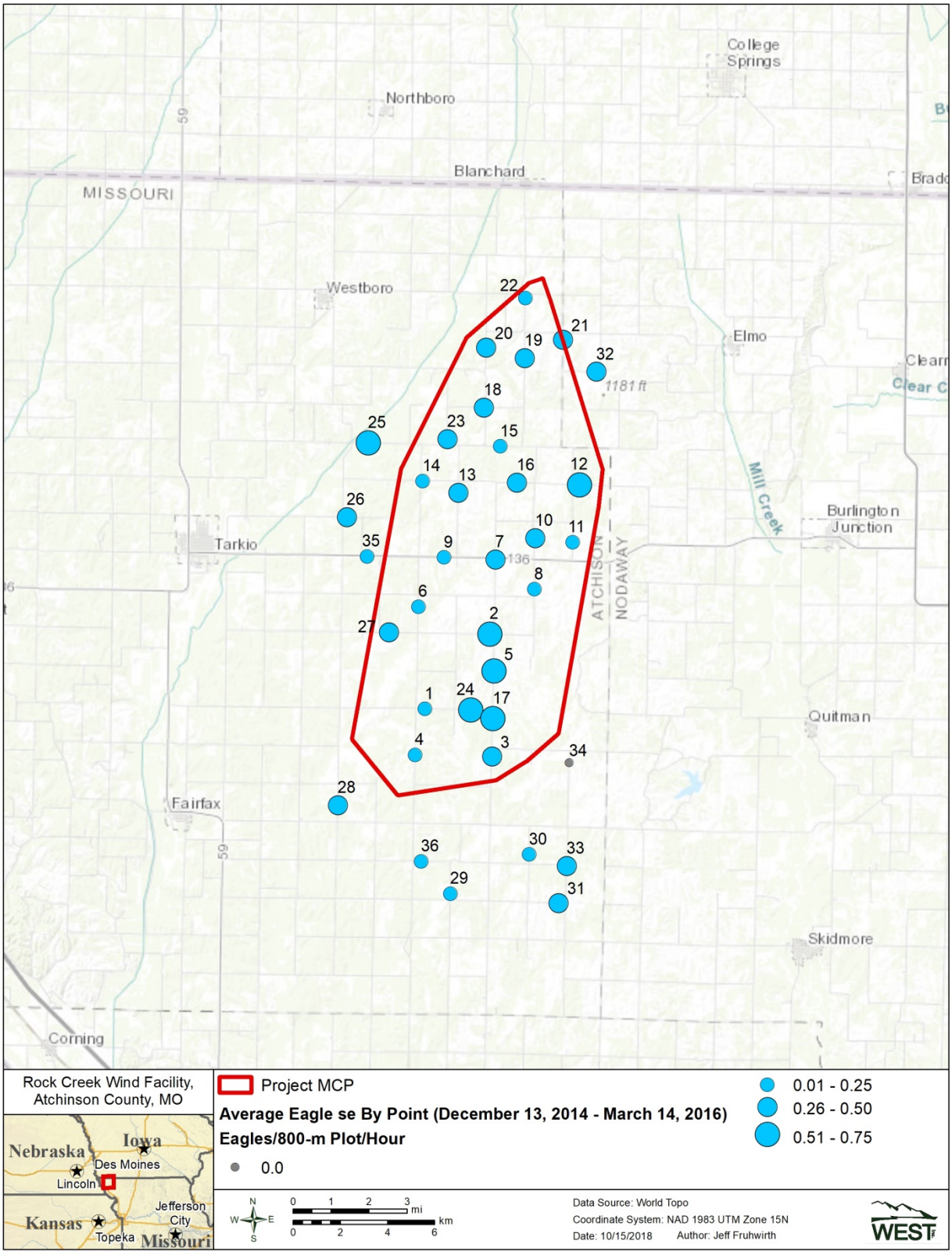

Figure 7. Average eagle use by point at the Rock Creek Wind Facility, December 2014 – March 2016.

6 STAGE 3 – PREDICTING EAGLE FATALITIES

6.1 Qualitative Risk Assessment

Based on a study by Pagel et. al. (2013), 85 eagle fatalities at wind energy facilities throughout the US were reported between 1997 and mid-2012 (excluding eagle fatalities at the Altamont Pass Wind Resource Area in California). Of these 85 fatalities, 79 have been of golden eagles and the remaining six were bald eagles. As described above, golden eagles were not commonly observed or expected in the project area and are considered at very low risk of impact from the project. Conversely, bald eagles are common and expected to interact with the Project on a fairly regular basis. According to more recent publicly available information, 49 additional bald eagle fatalities or injuries have been documented at commercial-scale wind energy facilities since March 1, 2013, 24 of which were in the Great Lakes region (USFWS 2018).

The number of bald eagle fatalities or injuries at wind farms in the region is likely higher than the incidental finds that have been publically reported thus far. However, it appears that there are far fewer records of bald eagle fatalities or injuries than golden eagle fatalities (Pagel, et al. 2013). This may be due to a number of different factors and evidence to support any particular theory is lacking. However, the 55 reported bald eagle fatalities or injuries compared to the total number of turbines within the range of the species suggest that bald eagles may not be particularly susceptible to collisions with wind turbines, potentially due to avoidance behavior as discussed below. This is supported by the fact that up to 20% of the contiguous US bald eagle population winters in Iowa, where nearly 3,200 utility-scale wind turbines have been built (Neumann 2009, AWEA 2014). And yet, only 14 bald eagle injuries or mortalities have been publicly reported in Iowa to date.

The few available studies of bald eagle use, flight paths, and nesting before and after construction of wind facilities suggest that bald eagles may avoid wind facilities. At the Forward Wind Energy Center in Wisconsin, pre-construction bald eagle use observed during point counts was 0.004 bald eagles/plot/20-min survey; bald eagle use declined in the first year after construction (0.001 bald eagles/plot/20-min survey), and no bald eagles were observed during point counts two years following construction (Garvin and Drake 2011). During a comparison of pre- and post-construction bald eagle use at the Pillar Mountain Wind Project near Kodiak, Alaska, bald eagle mean annual use of the area was similar between 2007 and 2010, yet no flight paths crossed the ridge between turbine locations in 2010 after turbines were erected, even though flights over the ridge at that location were observed in 2007 (Sharp et al. 2010, 2012). In 2011, bald eagles were only observed crossing the ridge between turbines when turbines were off (four of 18 flights: Sharp et al. 2012). These observations suggest that eagles may actively avoid operating wind turbines or at least reduce the level of use in and around wind farms.

6.2 Quantitative Risk Assessment

6.2.1 US Fish and Wildlife Service Bayesian Collision Risk Model Methodology

For the purposes of the RCWF eagle risk assessment, the USFWS (2013b) requires the use of the Bayesian modeling framework to predict impact to bald eagles. This approach uses statistical models to define the relationship between eagle exposure, collision probability, and fatalities, and to account for uncertainty. Variables used are presented in Table 3 and discussed in this section. Details of the model and approach are presented in the ECPG (USFWS 2013b).

Table 3. Definitions of variables used in the US Fish and Wildlife Service approach for predicting annual eagle fatalities from turbine collisions at a wind facility (USFWS 2013b; Eagle Conservation Plan Guidance [ECPG], Appendix D).

Parameter	Variable Name	Definition
F	Annual Fatalities	Annual eagle fatalities from turbine collisions
λ	Exposure Rate	Eagle-minutes flying within the project footprint (in proximity to turbine hazards) per hour (hr) per square kilometer (km^2), or stated another way, the expected number of exposure events (eagle-minutes) per survey hour per square kilometer ($hr \cdot km^2$)
C	Collision Probability	The probability of an eagle colliding with a turbine given exposure
ε	Expansion Factor	Product of daylight hours and total hazardous area $hr \cdot km^2$
k	Eagle-Minutes	Number of minutes that eagles were observed flying within 800 m and below 200 m during survey point counts
δ	Turbine Hazardous Area	Rotor-swept area around a turbine or proposed turbine (km^2)
n	Trials	Number of trials for which events could have been observed (the number of $hr \cdot km^2$ observed)
τ	Daylight Hours	Total daylight hours (e.g., 4,383 hrs per year adjusted for expected operational time in each season)
n	Number of Turbines	Number of turbines (or proposed turbines) for the project

6.2.1.1 Turbine Specifications

The RCWF includes 150 wind turbine generators. The Company installed and operates the Vestas V110-2.0MW turbines at the RCWF. These turbines have a rotor diameter of 110 m (361 ft) and a total rotor swept area of 9,503 square m (m^2; 102,289 ft^2). The rotors will be mounted on tubular steel towers at hub heights of 95 m (312 ft). As such, the turbine blades will be at heights from the ground of between about 40 and 150 m (131 and 492 ft).

6.2.1.2 Exposure Rate

Exposure rate (λ) is the expected number of exposure events (eagle-minutes) per survey hour per square kilometer ($hr \cdot km^2$). The USFWS prior distribution for exposure rate was derived from data from a range of projects under USFWS review and the projects from Whitfield (2009). The prior distribution is intended to model exposure rates for any wind energy facility. The USFWS defines the prior distribution for exposure rate as:

$\text{Prior } \lambda \sim \text{Gamma}(\alpha, \beta)$, with shape and rate parameters $\alpha =$ 0.97 and β = 2.76.

Pre-construction eagle exposure data are used to update the prior distribution to estimate the parameters for the posterior distribution. By assuming the exposure minutes follow a Poisson distribution with rate parameter λ, the posterior distribution for exposure rate is:

$$\text{Posterior } \lambda \sim \text{Gamma}\left(\alpha + \sum_{i=1}^{n} k_i,\ \beta + n\right)$$

where $\sum k_i$ is the total observed eagle minutes, n is the number of trials, and α and β are from the prior distribution. The number of trials is the number of hr/km^2 that were conducted in the pre-construction survey.

From December 2014 through March 2016, a total of 754 bald eagle flight minutes under 200 m were recorded within the 36 final fixed-point plots that covered the sampled portion of the initial project during 564 survey hours; this included 533 bald eagle flight minutes under 200 m within the 25 fixed-point plots that overlap the current project footprint (Table 4; see Figure 7). A *Gamma* (α = 0.97, β = 2.76) prior distribution with mean (0.35) and standard deviation (0.357) has been recommended by the USFWS for the exposure prior. Posterior exposure distributions of eagle use at the project were estimated as distributions with the α parameters equal to the sum of the prior α and total flight minutes below 200 m, and the β parameters equal to the sum of the prior β and effort (hours of surveys x km^2 of area surveyed). This resulted in a posterior distribution for the bald eagle exposure rate that ranges from 0.0187 to 1.0082 eagle flight minutes observed per hour per km^2 (Table 4). This was calculated by a high risk season (Nov 1 through April 30) and low risk season (May 1 through October 31) since the level of survey was not even throughout seasons (i.e., the study involved two winter survey periods). For purposes of estimating exposure rates, data was used from the December 2014 to March 2016 eagle use studies that were conducted at the project following the USFWS's ECPG protocols. Subsequent information on new eagle presence or activity in the area, including the new nest along the Little Tarkio Creek (see Section 5.1), were qualitatively considered in this document but were not formally included in the exposure rate calculations.

Table 4. Estimated exposure rate (λ) for bald eagles from eagle observations made during point count surveys at the Rock Creek Wind Facility.

Variable	High Season Exposure (11/1 - 4/30)	Low Season Exposure (5/1 - 10/31)
Number of Surveys	249	150
Average Length of Survey (hours)	1	1
Survey Hours	249	150
Survey Radius (m)	800	800
Recorded Flight Minutes Below 200 m at Points	528	5
Eagle Flight Minutes (α : Line 5 + 0.97)	528.97	5.97
Effort (β; survey hours x km^2 of area surveyed+2.76)	503.404	304.353
Mean Exposure Rate (Line 6 / Line 7)	1.051	0.020

6.2.1.3 Expansion Factor

The expansion factor (ε) is used to scale the per unit fatality rate (fatalities per hr per km^2) to the daylight or operational hours (τ) in one year and total hazardous area (km^2) within the project. The expansion factor is:

$$\varepsilon = \tau \sum_{i=1}^{n} \delta_i$$

where *n* is the number of turbines, and δ is the circular area (2-dimentional hazardous area) centered at the base of a turbine having radius equal to the rotor-swept radius of the turbine (or proposed turbine). The expansion factor is dependent on the number of proposed turbines as well as the proposed rotor diameter.

For purposes of input into this model, wind data from the site was used to calculate the number of daylight hours wind turbines would be operating by season (i.e., high = 1700; low = 2,165).

6.2.1.4 Collision Probability

The collision probability, *C*, is the probability of an eagle colliding with a turbine given exposure in the hazardous area, where all collisions are considered to be fatal. The prior distribution presented by USFWS in the ECPG baseline model was estimated using results taken from the Whitfield (2009) study of avoidance rates. The Beta distribution is intended to model collision probabilities across all sites considered for prediction of annual eagle fatalities. The USFWS baseline collision probability prior distribution is given as:

Prior $C \sim Beta(v, v')$, with parameters $v = 2.31$ and $v' = 396.69$

The USFWS estimates the parameters for the collision probability prior distribution using results from the Whitfield (2009) study of avoidance rates, including golden eagle data from four wind facilities: Altamont, Tehachapi, San Gorgonio Wind Resource Areas in California, and the Foote Creek Rim Wind Resource Area in Wyoming. It is generally assumed that the modeling results using these collision probability prior distributions will result in conservative measure of risk to bald eagles.

6.2.1.5 Predicted Annual Fatalities

The distribution of predicted annual fatalities can be estimated as the product of the expansion factor, the exposure rate posterior distribution, and the collision probability distribution:

$$F = \varepsilon \cdot \text{posterior } \lambda \cdot \text{prior } C.$$

The distribution of estimated annual fatalities is used to obtain statistics such as estimates for the mean, standard deviation, and 80th credible interval of annual fatalities.

6.2.2 Collision Risk Models with Alternative Priors

As described in Appendix D of the ECPG and the preamble to the revised 2016 Eagle Rule, the USFWS encourages project developers or operators to develop additional candidate models for direct comparison with, and evaluation of, the baseline model and modeling approach. In addition to the baseline ECPG model, this ECP includes two collision risk models ran with alternative priors. These models are included to show the range of eagle take levels estimated by various models and are not intended to determine the permitted level of take. The requested level of permitted take is based on the 80th percent credible interval determined using the baseline ECPG model (Table 5a).

The updated collision risk models are built around the same Bayesian modeling framework as the risk model in the ECPG but include alternative priors determined largely from facilities with modern wind turbines. The alternative priors in the draft Habitat Conservation Plan developed by MidAmerican Energy Company were also determined using bald eagle data from sites in the Midwest (MidAmerican 2018). While these alternative priors provide other options for considering bald eagle risk at modern facilities in the Midwest, the data used in the development of these priors is still under review by the USFWS and therefore these priors are not currently the accepted standard for determining permitted take levels.

6.2.2.1 Bay et al. 2016 Alternative Priors

An alternative model was included using the alternative priors described by Bay et al. (2016). These priors are:

Prior C ~ Beta (v, v'), with parameters v = 9.28 and v' = 3,224.51

This updated collision probability prior distribution was developed from the golden eagle fatalities and exposure data from 26 modern wind farms in the western US (Bay et al. 2016) in addition to the four projects described in Whitfield (2009). Because these priors were based on data collected for golden eagles in the western US, they may not accurately predict risk to bald eagles or eagles in the Midwest. Nonetheless, these priors might help define the range of risk that may occur at the RCWF.

6.2.2.2 Bald Eagle Alternative Priors

Another alternative model was included using the following alternative priors, which were described in the draft MidAmerican HCP (MidAmerican 2018):

Prior C ~ Beta (v, v'), with parameters v = 2.13 and v' = 2705.84

This updated collision probability prior distribution is based on extensive studies of bald eagle use and fatalities at 18 operating wind farms in Iowa that were completed between late 2014 and early 2017 (see appendix D of the MidAmerican Habitat Conservation Plan; MidAmerican 2018). Given the size of this data set, the fact that these data were collected specific to bald eagles, and these modern wind farms were located in similar habitats as the RCWF, these prior

distributions could be a more useful starting point for predicting take for bald eagles than the prior probability distributions presented in other collision risk models.

Because eagles and raptors generally appear to detect and avoid operating wind turbines to a degree (MidAmerican 2018, Johnston et al. 2014, Ferrer et al. 2011, Garvin et al. 2010), the use of pre-construction bald eagle use data with the bald eagle prior probability distributions shown above will likely result in a somewhat more conservative prediction than would be provided through the use of post-construction bald eagle use data.

6.2.3 Risk Modeling Results

Credible intervals (i.e., Bayesian confidence intervals) were calculated using a simulation of 10,000 Monte Carlo draws from the posterior distribution of eagle exposure λ and the collision probability (*C*) distribution (Manly 1991). The product of each of these draws, with the exposure area corresponding to turbine type, was used to estimate the distribution of possible fatality at the project. Following the ECPG, the mean and upper 80-percent credible interval limit were used to predict annual fatality rates at the project.

A configuration-specific expansion factor is included to account for the hazardous area within the project and this expansion factor is multiplied by the eagle exposure rate listed in Table 4 to estimate the potential annual eagle-wind turbine interactions (minutes of flight within the turbine hazardous area). Expansion factors (ε) were calculated using the estimated annual operating time.

Based on the assumptions and input described above, the annual mean predicated bald eagle fatalities were calculated under several scenarios, including both the use of the baseline ECPG model (see section 6.2.1; Table 5a) and the updated ECPG model using alternative priors (see section 6.2.2; Table 5b).

Table 5a. Predicted annual bald eagle fatalities at the Rock Creek Wind Facility (using USFWS ECPG collision rate prior distributions).

Scenarios	Predicated Mean Fatalities	80-Percent Credible Interval
Baseline ECPG Model		
High Use Season	12.18	17.92
Low Use Season	0.29	0.43
ANNUAL PREDICTIONS	**12.47**	**18.21**

Table 6b. Alternative models for predicted annual bald eagle fatalities at the Rock Creek Wind Facility.

Scenarios	Predicated Mean Fatalities	80-Percent Credible Interval
Bay et al. Alternative Priors		
High Use Season	6.04	7.63
Low Use Season	0.14	0.20
ANNUAL PREDICTIONS	**6.18**	**7.77**
Bald Eagle Alternative Priors		
High Use Season	1.66	2.46
Low Use Season	0.04	0.06
ANNUAL PREDICTIONS	**1.69**	**2.50**

The Baseline ECPG Model and the updated model using the alternative priors determined in Bay et al. (2016) are based on information from prior golden eagle fatalities and exposure events. The model updated with alternative priors provided in MidAmerican Energy Company's draft Habitat Conservation Plan are based on information from prior bald eagle fatalities and exposure events (MidAmerican Energy Company 2018). Because bald eagles exhibit different foraging and flight behaviors, it seems likely these eagles are at different risk of collision as evidenced by the different prior distributions between the three models shown above. Nevertheless, for purposes of the ITP application, the USFWS requires the use of the 80-percent credible limit for the baseline ECPG model (18.2 eagles/year). The upper 80-precent credible interval for a 5-year fatality rate is 91 bald eagles. As only one bald eagle fatality has been reported from operating wind farms in similar habitats in northwestern Missouri (USFWS 2018), this level of take seems likely to be an overestimate. Given the seasonal eagle use in the area, the Company expects a majority of eagle fatalities will occur during the migration or wintering periods (High Use Season: November through March). After the first five years of operation the Company will work with the USFWS to update the take predictions for the ongoing operations of the RCWF.

7 STAGE 4 – AVOIDANCE AND MINIMIZATION OF RISK AND COMPENSATORY MITIGATION

7.1 Development of Conservation Measures

Per the USFWS's ECPG (USFWS 2013b), the RCWF should be considered a "Category 2" site. A Category 2 site indicates moderate to high risk to eagles, but with the opportunity to mitigate impacts. Projects in this category will potentially take eagles, but the risk might be reduced to an acceptable level through a combination of conservation measures and reasonable compensatory mitigation. This indication of risk categorization by USFWS does not reflect a permit decision, which would follow only after review of a take permit application and consideration of a NEPA review. A list of avoidance and minimization measures for an applicant to consider is included in Appendix E in the ECPG. Included below is a review of the conservation measures that the Company will implement to avoid or minimize risk to eagles as part of the RCWF.

7.1.1 Project Design/Construction Avoidance and Minimization Measures

7.1.1.1 General Project Siting

The location of the RCWF is in an area of Atchison County that generally lacks the types of habitat features that tend to concentrate large numbers of bald eagles for extended periods of time; features such as large bodies of water with abundant fish and/or waterfowl populations that can provide eagle foraging opportunities or distinct ridges oriented north and south that may be used as migration corridors by eagles are not found within the RCWF. The Missouri River, over 10 to 15 miles to the western or southwestern side of the RCWF, tends to attract the largest concentrations of bald eagles in the region during the winter months (see eBird 2015).

7.1.1.2 Turbine Siting and Setbacks

At the RCWF, the Company has identified turbine locations in areas shown or suspected to be used less frequently by eagles. This includes siting turbines in cultivated agricultural fields or pastures generally 1,000 feet or more from forest patches, wetlands, and riparian corridors. In particular, the Company minimized siting turbines at the suspected highest use areas in the vicinity of the Tarkio River, the East Fork of the Little Tarkio Creek, and the Tarkio Prairie Conservation Area (Figures 7). By prioritizing locating turbines on lands that provide relatively lower potential for use by eagles, overall risk to eagles has been reduced.

7.1.1.3 Minimize Habitat Disturbances

The project layout has been developed to use the existing public and private road network to the degree possible. Overall efforts will be made to avoid forest clearing and natural habitats during project construction.

7.1.1.4 Avoid Use of Structures that are Attractive to Birds for Perching

The Company will use turbines with monopoles (non-lattice structures) that will not attract birds for perching or nesting.

7.1.1.5 Free-Standing Meteorological Towers

The Company will install permanent meteorological (met) towers that are free-standing and avoid the use of guy-wires, which can provide a collision hazard to birds. The temporary met towers used at the site during pre-construction and construction phases will be removed within one year after construction and calibration of the permanent met towers has been completed.

7.1.1.6 Bury Power Lines to Reduce Avian Collision and Electrocution

The Company will install an onsite electrical collection system underground, thus minimizing the risk for bird collisions or electrocutions.

7.1.2 Project Operations Avoidance and Minimization Measures

7.1.2.1 Landowner Outreach/Education

On an ongoing basis, the Company will provide information to participating landowners on the possible wildlife interactions resulting from livestock carcass disposal procedures (e.g.,

attracting scavenging eagles into the area). Through direct communications, newsletters, and/or web-based materials, the Company will encourage landowners to dispose of livestock carcasses in a manner that will minimize attracting scavenging eagles into the project area where they could be at risk of colliding with project turbines. This communication will be completed annually during the early fall to minimize carcasses within the project area during winter and spring periods when eagle use in the area is highest.

7.1.2.2 Carrion Monitoring/Removal

The Company and/or its contractors will establish a worker education and training program for regularly monitoring livestock or wildlife carcasses found near project turbines. The Company may remove and dispose of large livestock or wildlife carcasses found by site personnel anywhere within the project boundary, with particular focus on removing those carcasses found less than 1,000 feet from turbines within three business days of discovery or as soon as possible. Carcass disposal might be handled through a rendering facility, composting, sanitary landfill, incineration and/or on-site burial. Any on-site composting or burial will require the use of appropriate depth of cover to minimize the potential for exposed carcasses.

7.1.2.3 Driving Speed Restrictions

The Company and/or its contractors will comply with maximum driving speeds of 25 miles per hour when on the RCWF access roads, thus minimizing the chance for injuring or killing wildlife that could serve as an attractant to scavenging eagles. On local and county roads, posted speed limits will be observed.

7.2 COMPENSATORY MITIGATION

Per the ECPG, where take which may occur after avoidance and minimization measures have been used to the maximum extent possible and when eagle populations at the scale of the USFWS eagle management units are not healthy enough to sustain additional mortality over existing levels, permit applicants must reduce the effect of permitted mortality to a level that is compatible with the preservation of eagles, best accomplished through compensatory mitigation (USFWS 2013a; 2016).

The allowable annual threshold of bald eagle take in the USFWS Mississippi Flyway eagle management unit is 1,640 eagles (USFWS 2016). This sustainable annual take is based on the predicted population of bald eagles in this geographical area (27,334 for Mississippi Flyway) in conjunction with the harvest threshold for estimated annual production of the population (6.0%; USFWS 2016).

The estimated annual level of take at the project, 18.2 eagles, is 1.1% of the overall take limit for the Mississippi Flyway eagle management unit.

7.2.1 Population Status and Local-Area Population Thresholds

In addition to considering impacts to eagles at the eagle management unit scale, the local area population was also considered. To determine if the RCWF's impact on the local-area bald

eagle population is biologically problematic, local-area 1% and 5% benchmarks were calculated. The local-area population of bald eagles is the number of bald eagles within an 86 mile radius of the turbines (see Figure 8). This 86-mile distance is based on the median distance eagles disperse from the nest where they are hatched to where they settle to breed (USFWS 2016). This local area falls within two Eagle Management Units (the Mississippi Flyway – 15,384 square miles and the Central Flyway – 10,298 square miles) where eagle densities are expected to be different (Mississippi Flyway – 0.062 eagles/square miles; Central Flyway – 0.007 eagles/square miles). As such, the total local-area population is estimated to be about 1,026 bald eagles[2].

Take rates between 1% and 5% of the estimated local-area eagle population size are considered sustainable by USFWS, with 5% being at the upper end of what might be appropriate under the BGEPA preservation standard (USFWS 2013a). The conservative estimated level of take for the project is 18.2 bald eagles per year. This level of estimated annual take represents 1.8% of the total local-area population of 1,026 bald eagles, between the lower threshold of 1% (10.3 eagles) and the upper 5% threshold (51.3 eagles) at the local-area level.

The local-area population calculation assumes that bald eagle density is uniform across a given area (in this case Region 3 and Region 6 within the Mississippi Flyway and Central Flyway, respectively). Within the 86 mile local-area buffer surrounding the project lies the Missouri River, a feature that likely attracts concentrated eagle nesting and activity that has the potential to increase the bald eagle local-area population. If USFWS develops more reliable models for predicting the distribution of eagles at finer scales, the Company will coordinate with the USFWS on how to incorporate this information on any future five-year check-in associated with the permit.

It is important to note that the overwhelming majority of bald eagle use within the project appears to be due to eagles that are overwintering, but not residing during the breeding season, and so are likely not contributors to the local-area populations. It is possible some of these eagles are coming from more northern latitudes where eagle populations are relatively high (e.g., Minnesota).

7.2.2 Cumulative Impacts

According to the ECPG, cumulative impacts are evaluated at both the management unit and local-area population level. Both analyses require an understanding of the anthropogenic sources of eagle mortality at these two scales. The objective of the analysis at the local-area level is to identify cases where new authorized take would, either by itself, or cumulatively in

[2] The Project Company expects that the USFWS will complete a final Local Area Population (LAP) analysis for the RCWF using data on eagle densities not publically available as well as its cumulative effects tool and propriety data on known eagle mortality within the LAP area.

combination with other known sources of ongoing take, exceed 5% of the estimated local-area population of eagles.

Currently, the Company does not have access to information on any other source of eagle take that has been formerly permitted through the USFWS eagle take permit program relevant to this local-area population.

7.2.3 Voluntary Eagle Conservation

Currently, there is much uncertainty about the vulnerability of bald eagles to wind turbine collision. Current assessment models use collision risk estimates developed for golden eagles which are likely higher but are believed to be conservative estimates for bald eagles. Nevertheless, the analysis included in this document estimated average annual bald eagle fatalities of about 12.5 bald eagles per year, with an upper 80-percent credible interval of about 18.2 bald eagles. Even at the upper 80-percent credible interval, this level of take is below the local-area 5% benchmark of about 51 eagles. This suggests that the bald eagle population could sustain this level of take without adverse impacts to the local population.

Despite the fact that compensatory mitigation is not required, the Company plans to voluntarily contribute to ongoing eagle conservation programs. Prior to issuance of the ITP or within the first year of the start of commercial operation of the RCWF (whichever occurs first), the Company will make a significant contribution for use by:

- a local non-profit environmental organization actively involved in educating the public on the negative impacts of lead in the environmental on eagles and other wildlife;
- a local non-profit environmental organization actively involved in reducing environmental sources of heavy metals and impacts to eagles;
- a local rehabilitation center actively involved in the treatment, rehabilitation, and re-release of wild eagles to the local/regional eagle population; and/or
- other eagle conservation programs identified during discussions with the USFWS that could include directing conservation dollars towards power pole retrofits to minimize eagle electrocution risks, habitat protection/enhancement, or road kill carcass removal programs to reduce risk of eagle-vehicle collisions.

At the time of each five-year check in with the USFWS, the Company in coordination with the USFWS will review the estimated take of eagles for the preceding permit term. If the estimated eagle take is less than 13 eagles per year over the five-year term, no additional voluntary eagle conservation contributions will be made. If the estimated eagle take is 13 or more eagles per year over the five-year term, the Company will consider making additional contributions towards eagle conservation.

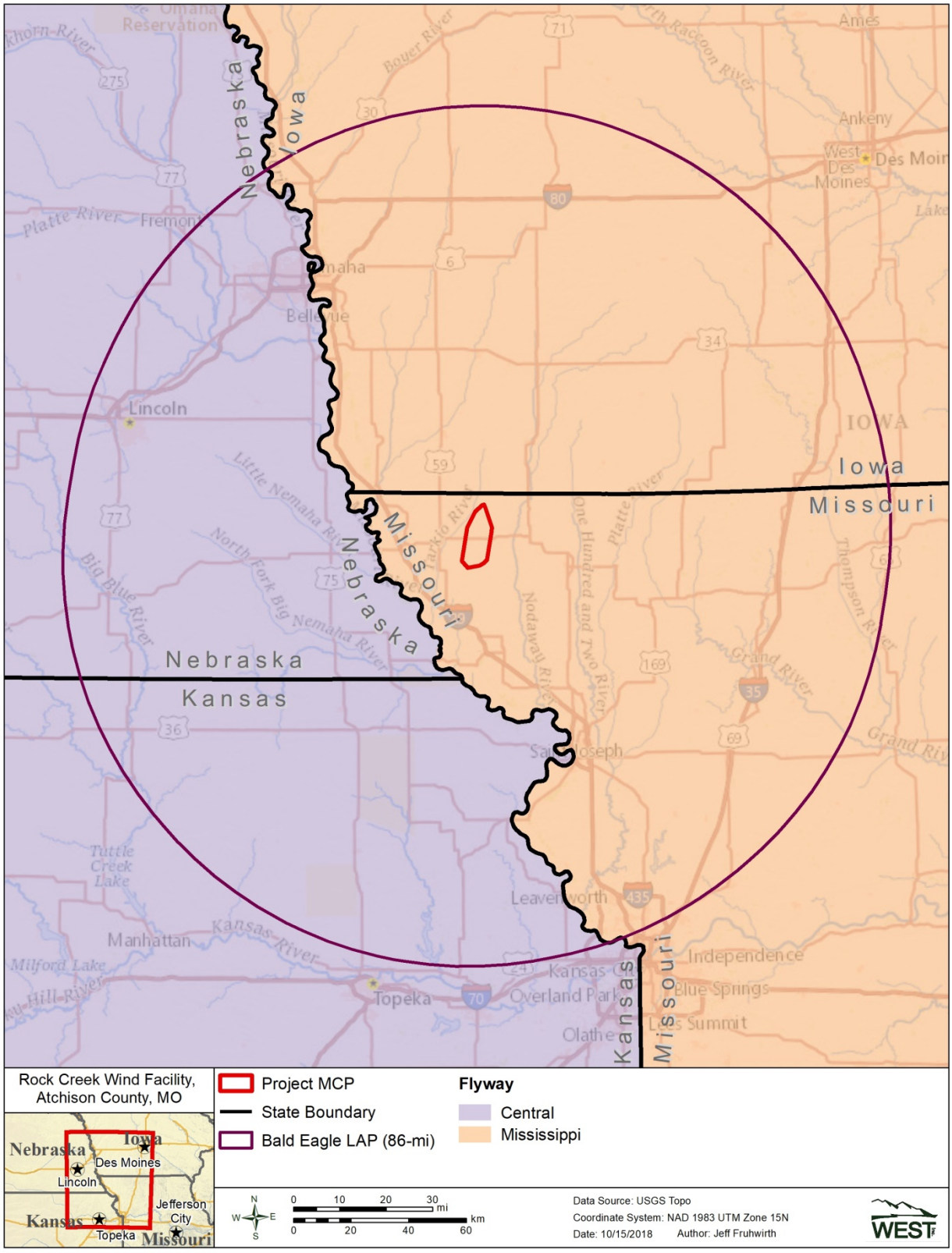

Figure 8. Bald eagle local-area population at the Rock Creek Wind Facility.

8 STAGE 5 – CALIBRATING AND UPDATING OF THE FATALITY PREDICTION AND CONTINUED RISK-ASSESMENT

The Company will implement an ongoing monitoring program to assess potential project impacts to eagles. This program will include an initial 2-year effort completed by an independent third-party and thereafter by trained operations staff.

8.1 Post-Construction Fatality Monitoring

The Company will contract with an independent third-party to complete a formal post-construction eagle fatality monitoring study for the first two years after the RCWF goes into operation. Based on eagle use data collected thus far, the highest risk period for eagle fatalities at the RCWF will be November 1 through March 31. Given minimal vegetation cover during this period, eagle carcasses are expected to be highly visible at most of the turbines. Additionally, eagle carcasses are expected to persist on the landscape for relatively long periods. As such, eagle carcasses detected during monitoring will provide a reliable measure of take.

The first year of monitoring will be completed by a qualified biologist visiting all of the project turbines and conducting 360 degree visual searches to a 100 meter radius centered at the base of the turbine, including the road and pad. Within one month of the declaration of commercial operations, search intervals will be completed based on the following:

- December 1 through March 31 – Twice monthly
- April 1 through October 31 – Once monthly (discontinued when biologists confirm during a site visit that crops are greater than 12 inches high and obstruct view – typically expected by June/July)

Depending on the start of commercial operations, this effort could be broken over multiple seasons (e.g., twice monthly searches could be in January and February 2018, and be completed during December 2018).

Searcher efficiency trials and carcass removal trials will be included in this monitoring effort because some eagle carcasses may be missed or be removed from the landscape prior to monitoring efforts.

The objective of the searcher efficiency trials is to estimate the percentage of casualties that are found by searchers. Searcher efficiency trials will be conducted in the same areas carcass searches occur. Trials will be conducted throughout the survey period where searcher efficiency will be estimated by major habitat type (e.g., turbine road and pad, tilled ground, crops, and grassland). Estimates of searcher efficiency will be used to adjust the total number of carcasses found for those missed by searchers, correcting for detection bias. Personnel conducting carcass searches will not know when trials are conducted or the location of the carcasses. To estimate searcher efficiency, a minimum of 25 eagle-sized carcasses or decoys will be placed in

the search area throughout the survey period as crops allow (this will include the placement of a minimum of 4 carcasses or decoys per month).

The objective of carcass removal trials is to estimate the likelihood a carcass is removed by scavengers as a function of the day since the trial carcasses are placed in the field. Carcass removal includes removal by predation/scavenging, or removal by other means, such as being plowed into a field. Carcass removal studies will be conducted approximately one a month. In total, 20 large bird carcasses will be used as part of these trials. Estimates of carcass removal will be used to adjust the total number of carcasses found for those removed from the study area, correcting for removal bias. Carcasses will be checked every day for the first four days, and then on day seven, day 10, day 14, day 20, and day 30.

The second year of monitoring will follow the same general approach, although will likely be modified by the Company in coordination with USFWS based on the results of the first year of monitoring. For example, actual carcass persistence time and/or searcher efficiencies may be greater or less than expected. As such, monitoring frequency or transect spacing could be modified to reduce monitoring costs or improve searcher efficiencies.

A third year of formal third-party monitoring will be conducted if triggered by the adaptive management framework described in Section 9 (see Table 7).

In addition to the eagle-specific monitoring described above, the Company will also complete two years of carcass searches for small birds and bats throughout the year as described in appendix E of the BBCS. This monitoring will include road and pad searches of all turbines throughout the year as well as 100x100 meter plot searches during the fall. Eagle or other large bird carcasses could also be discovered and reported during these formal fatality searches. Table 6 illustrates the seasonal breakdown of these post-construction fatality monitoring searches.

At Year 5 of project operations, the Company will also complete an additional full year of eagle fatality monitoring (via eagle scans) by a qualified third-party following the protocols described above or as agreed to by the Company and the USFWS. Similar third-party monitoring will be completed thereafter on five-year intervals through the operational life of the project (i.e., Year 10, 15, 20, 25).

Table 6. Schedule of post-construction fatality monitoring searches at the Rock Creek Wind Facility.

Rock Creek Survey Schedule	Turb	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Season		Winter			Spring		Summer		Fall				Winter
100m Eagle scan (twice monthly)	150	→											→
100m Eagle scan (once monthly as crops allow)	150				→						→		
Road & pad (once monthly)	150	→											→
Road & pad (once weekly)	150				→			→					
Road & pad (twice weekly)	120								→		→		
100x100 transect plot (twice weekly)	30								→		→		

8.1.1 Preliminary Post-Construction Monitoring Results

Post construction monitoring has been conducted since the Project began operations on January 29, 2018. Monitoring has included eagle scans, road and pad searches, and plot searches as described above. No eagle fatalities were found during data collection between January and early November 2018 (Table 7 summarizes the level of survey effort from January through July). Overall eagle detection probabilities have not yet been calculated for these efforts. However, based on other similar studies from the region, we expect overall detection probabilities (*g*) at the site to be around 0.5 during the high use season, ranging from 0.42 to 0.78 (MidAmerican 2018). Given no dead or injured eagles have been found over the first ten months of monitoring at the Project, it seems likely that actual impact to eagles will be lower than predicted by the baseline ECPG model.

Table 7. Post-construction monitoring data collected at the Project through July

Month	Eagle Scans (all turbines)	Road & Pad Searches	100x100 m Plots	Eagle injuries or fatalities found
January 2018	75	38	0	0
February 2018	225	186	0	0
March 2018	299	614	0	0
April 2018	114	626	0	0
May 2018	90	629	0	0
June 2018	0	622	0	0
July 2018*	0	275	0	0
Total	**803**	**2990**	**0**	**0**

*Does not include all surveys completed in the month.

8.2 Post-Construction Nest Monitoring

During the two to three years of formal third-party monitoring, the eagle nest identified near Turbine G-8 during the 2017 construction period (see Section 5.1) will be visually monitored. Monitoring will include observing adult activity and indication of nesting attempt during once monthly checks in the months of February through May. If a nesting attempt is document, the number of fledglings will be recorded during monthly monitoring in the months of May and June.

8.3 Ongoing Operations Staff Monitoring

In the course of their normal operational and maintenance activities, the Company's staff or its contractors visit each of the operating turbines on a regular basis. These personnel will be directed to inspect roads, pads and any other cleared area in the immediate vicinity of turbines visible from their vehicle and report any eagle carcasses discovered or incidentally observed.

8.4 Agency Reporting

Any dead or injured eagles found within the project boundary by Company employees or contractors will be recorded, and the location will be reported to the site supervisor. The site supervisor or other designated individual will proceed to the site of the discovery and complete an incident report. The Company will notify the USFWS within one business day of discovering any injured or dead eagle at the RCWF. Additionally, if the dead or injured animal is an eagle, the Company will prepare and submit an eagle incident report to the USFWS within five business days that will include a description of the find, photographs, and a data sheet that provides such information as: date/time, turbine # and location, physical description of the find (including any obvious injuries and general carcass condition). The carcass or injured animal will not be moved or removed by any individual who does not have the appropriate permits.

In addition to specific incident reports, the Company will provide the USFWS with an annual report after each year of formal fatality monitoring. These reports will present estimates of facility-wide eagle fatalities using an appropriate statistical estimator if necessary. The Huso method (a Horvitz-Thompson estimator) will likely be used to calculate fatality estimates (Huso 2011, Huso et al. 2012). However, an alternative estimator could be used if improved techniques become available and are agreed to by the Company and the USFWS (e.g., Evidence of Absence). Annual reports and facility-wide fatality estimates will be provided after the first two years of formal monitoring and on five-year intervals thereafter. Individual eagle incident reports will continue to be provided throughout the operational life of the RCWF.

8.5 Training

Training is integral to the successful implementation of this ECP. The Company will provide training annually and additionally as needed for on-site personnel regarding the importance and proper procedures for reporting eagle and other avian and wildlife incidents in the project area.

The Company will implement a Wildlife Incident Reporting Form (WIRF) process. The purpose of the WIRF is to standardize the actions and information taken by RCWF or its subcontractors in response to any wildlife injuries or fatalities observed within the project boundary. All project

employees will be trained on how to complete the WIRF and to be vigilant while traversing the project site for signs of dead or injured wildlife.

9 ADAPTIVE MANAGEMENT

Adaptive management is an iterative process implemented throughout the 30-year life of the project, which allows for continuous improvement regarding decisions and actions taken in an effort to avoid or minimize impacts to eagles. For the RCWF, adaptive management will consist of a program designed to monitor and assess impacts to eagles at the project and an iterative process of assessing and implementing additional avoidance and minimization measures should results of the monitoring indicate that such additional measures are warranted.

Over the course of the life of the project, eagle use patterns of the site may change, eagle populations may increase (thus increasing allowable take), risk management measures may evolve, and improved monitoring and conservation measures may become available. The Company commits to revisiting this adaptive management plan with the USFWS at every 5-year review to ensure that the best strategies for avoiding, minimizing, and reducing eagle take are being implemented. Should both parties agree that modifications to this plan are warranted, such modification can occur as long they continue to meet permit conditions and the annual compensation amounts agreed to as part of the permit terms are not exceeded.

Table 8 provides the adaptive management framework that would be implemented at the RCWF.

Table 8. Adaptive management framework for the Rock Creek Wind Facility

Level	Management Trigger	Adaptive Management Response Options	Cost
Level I	1 to 7 estimated eagle fatalities in any 12-month period	Continue implementation of ECP and voluntary eagle conservation; and Assess the cause or likely contributing risk factor(s) to the eagle fatalities and whether a management response is warranted and/or feasible.	ECP Avoidance and Minimization Measures
Level II	8 to 12 estimated eagle fatalities in any 12-month period	Level I adaptive responses; Complete a site evaluation and/or additional site monitoring to better understand the nature of the risk to eagles; Implement additional livestock carcass removal or landowner outreach efforts to further minimize the presence of eagle attractants with the project (e.g., remove all carcasses out to 2,000 feet from turbines, if livestock is the source of mortality); and Confer with the USFWS to determine if additional response or management action is needed and/or a longer term action plan will be needed to ensure take remains within authorized levels.	Level 1 + additional practicable avoidance and minimization measures
Level III	13 to 18 estimated eagle fatalities in any 12-month period	Level 1 and 2 adaptive responses; and Complete another year of third-party eagle fatality monitoring to further assess estimated take levels. As appropriate and in discussion with the USFWS, temporarily implement and test the effectiveness of additional conservation measures to further avoid or minimize risk to eagles (e.g., light/noise/drone deterrent systems). Consider long-term deployment of proven conservation measures.	Level 1 + Level 2 + additional practicable conservation measures including those that make use of the most recent proven technologies.
Level IV	19 or more estimated eagle fatalities in any 12-month period	Consult with the USFWS regarding the need for a permit amendment to allow for higher levels of authorized eagle take.	

As described in Table 7, at Level 3, the Company would consider the implementation of additional conservation measures that might include:

- seasonal, daily, or weather-related turbine shut-downs (potentially limited to only “problem” turbines);
- detect-and-curtail systems through the use of biomonitors, radar, or camera imaging systems (or other available systems) that could be used to are used to identify at-risk eagles and shut down or slow turbine operations;
- detect-and-deter systems that might detect eagles and use sound, light, or drones to deter eagles from the area; and/or

- other technological solutions for avoiding or minimizing eagle impacts that become available in the future.

As listed in Table 7, costs for implementation of any additional conservation measures would be subject to a practicable cost cap. The Company will discuss with the USFWS these additional measures to implement to reduce risk to eagles at the site. Such measures would be implemented in a manner that specifically addresses the root cause(s) of take. For example, if take has only been documented during the winter months, additional measures may only be implemented during the winter months at the site. Or, if take has only occurred in one area of the site, additional measures would only be implemented in those areas where take has previously occurred.

Over the life of the permit and project it is also possible that conservation measures that were once deemed effective will later become obsolete and be replaced by more effective measures. Should the implementation of additional conservation measures be necessary, and should more effective measures be identified that would reduce risk to a greater degree than existing measures, the Company will discuss changing the eagle avoidance and minimization strategy with USFWS.

10 LITERATURE CITED

10.1 References

Allison, T. D. 2012. Eagles and Wind Energy: Identifying Research Priorities. American Wind Wildlife Institute, Washington, D.C. May 2012. Available online at: http://awwi.org/uploads/files/AWWI_White_Paper_Eagles_and_Wind_Energy_May_2012.pdf

American Wind Energy Association (AWEA). 2014. State Fact Sheet: Iowa. Accessed February 2014. Available online at: http://www.awea.org/Resources/state.aspx?ItemNumber=5224 and http://awea.files.cms-plus.com/FileDownloads/pdfs/iowa.pdf

Bay, K., K. Nasman, W. Erickson, K. Taylor, and K. Kosciuch. 2016. Predicting Eagle Fatalities at Wind Facilities. The Journal of Wildlife Management; DOI: 10.1002/jwmg.21086

Conservation Biology Institute (CBI). 2012. Protected Areas Database of the US, PAD-US (CBI Edition). Accessed May 2015. Downloads available online at: http://consbio.org/products/projects/pad-us-cbi-edition

Contiguous USA Albers. 2011. Contiguous USA Albers Equal Area Conic - Spatial Reference.

eBird. 2015. eBird: An Online Database of Bird Distribution and Abundance [Web Application]. eBird, Ithaca, New York. Available online at: http://www.ebird.org

ESRI. 2015. Geographic Information System (GIS) Online Topographic Base Map. ESRI, producers of ArcGIS software. Redlands, California.

Garvin, J. C. and D. Drake. 2011. Assessing Post-Construction Avian Use at the Forward Energy Center. Final Report. Public Service Commission (PSC) of Wisconsin. PSC REF#:152050. Prepared for Forward Energy LLC. Prepared by Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, Madison, Wisconsin. August 2011.

Manly, B. F. J. 1991. Randomization and Monte Carlo Methods in Biology. Chapman and Hall, London, United Kingdom.

MidAmerican Energy Company. 2018. Draft Habitat Conservation Plan, MidAmerican Energy Company, Iowa Wind Energy Project Porfolio, April 2018. Available online from: https://www.fws.gov/midwest/RockIsland/te/MidAmericanHCP.html

Millsap, B. A. and G. T. Allen. 2006. Effects of Falconry Harvest on Wild Raptor Populations in the United States: Theoretical Considerations and Management Recommendations. Wildlife Society Bulletin 34: 1392-1400.

National Audubon Society (Audubon). 2015. The Important Bird Areas. Updated February 2015. IBAs by state available online at: http://www.audubon.org/bird/iba

National Geographic Society (National Geographic). 2015. World Maps. Digital Topographic Map.

National Land Cover Data (NLCD). 2011. National Land Cover Database NLCD, Multi-Resolution Land Characteristics Consortium (MRLC). US Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota. Information available online at: http://www.mrlc.gov/nlcd11_leg.php

Neumann, K. 2009. Bald Eagle Lead Poisoning in Winter. R. T. Watson, M. Fuller, M. Pokras, and W. G. Hunt, eds. *In:* Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund. Boise, Idaho.

North American Datum (NAD). 1983. NAD83 Geodetic Datum.

Pagel, J. E., K. J. Kritz, B. A. Millsap, R. K. Murphy, E. L. Kershner, and S. Covington. 2013. Bald Eagle and Golden Eagle Mortalities at Wind Energy Facilities in the Contiguous United States. Journal of Raptor Research 47(3): 311-315.

Pagel, J. E., D. M. Whittington, and G. T. Allen. 2010. Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance. US Fish and Wildlife Service (USFWS). February 2010. Available online at: http://steinadlerschutz.lbv.de/fileadmin/www.steinadlerschutz.de/terimGoldenEagleTechnicalGuidanceProtocols25March2010_1_.pdf

Paprocki, N., J. A. Heath, and S. J. Novak. 2014. Regional Distribution Shifts Help Explain Local Changes in Wintering Raptor Abundance: Imiplications for Interpreting Population Trends. PLoS ONE: eB6814. doi: 10.1371/journal.pone.0086814.

Pardieck, K. L., D. J. Ziolkowski, Jr., and M.-A.R. Hudson. 2015. North American Breeding Bird Survey Dataset 1966 - 2014, Version 2014.0. US Geological Survey (USGS) Patuxent Wildlife Research Center (PWRC). Information available online at: https://www.pwrc.usgs.gov/BBS/RawData/

Reynolds, R. T., J. M. Scott, and R. A. Nussbaum. 1980. A Variable Circular-Plot Method for Estimating Bird Numbers. Condor 82(3): 309-313.

Sharp, L., C. Herrmann, R. Friedel, K. Kosciuch, and R. MacIntosh. 2010. Comparison of Pre- and Post-Construction Bald Eagle Use at the Pillar Mountain Wind Project, Kodiak, Alaska, Spring 2007 and 2010. Powerpoint Presentation for the National Wind Coordinating Collaborative (NWCC) Wind Wildlife Research Meeting VIII, October 19-21, 2010.

Sharp, L., C. Herrmann, R. Friedel, K. Kosciuch, and R. MacIntosh. 2012. Bald Eagle Behavior before and after Construction of the Pillar Mountain Wind Project in Kodiak, Alaska, 2007-2012. Poster presented at the WindPower 2012 Conference and Exhibition, Atlanta, Georgia, June 3- 6, 2012.

Sullivan, B. L., C. L. Wood, M. J. Iliff, R. E. Bonney, D. Fink, and S. Kelling. 2009. eBird: A Citizen-Based Bird Observation Network in the Biological Sciences. Biological Conservation 142: 2282-2292.

US District Court for Northern District of California. 2015. Debra Shearwater et al., Plaintiffs, Versus Dan Ashe, Director, US Fish and Wildlife Service; Sally Jewell, Secretary, US Department of the Interior, Defendants, and American Wind Energy Association, Defendant-Intervenor. Case No. 14-CV-02830-LHK. Order Granting in Part and Denying in Part Motions for Summary Judgment of Plaintiffs, Federal Defendants, and Defendant-Intervenor. US District Court for Northern District of California, San Jose Division. August 11, 2015. 46 pp. Available online at: https://www.californialandusedevelopmentlaw.com/wp-content/uploads/sites/7/2015/08/Shearwater-v.-Ashe-No.14-CV-02830-LHK-N.-Dist.-Ca-Aug.-11-2015.pdf

US Environmental Protection Agency (USEPA). 2013a. Level III and IV Ecoregions of the Continental United States. Map scale 1:3,000,000. USEPA National Health and Environmental Effects Research Laboratory, Corvallis, Oregon. Accessed May 2015. Available online at: http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm (select "downloads", "ecoregion maps").

US Environmental Protection Agency (USEPA). 2013b. Primary Distinguishing Characteristics of Level III Ecoregions of the Continental United States. Map scale 1:3,000,000. USEPA National Health and Environmental Effects Research Laboratory, Corvallis, Oregon. Accessed May 2015. Available online at: http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm (select "downloads", "ecoregion descriptions").

US Fish and Wildlife Service (USFWS). 2009a. Title 50 - Wildlife and Fisheries. Chapter I - United States Fish and Wildlife Service, Department of the Interior (Continued). Subchapter B - Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants (Continued). Part 22 - Eagle Permits. Subpart C - Eagle Permits: Permits for Eagle Take That Is Associated with, but Not the Purpose of, an Activity. 50 CFR § 22.26 (a)(2). October 1, 2009.

US Fish and Wildlife Service (USFWS). 2009b. United States Fish and Wildlife Service, Department of the Interior. 50 CFR 13 and 22. Eagle Permits; Take Necessary to Protect Interests in Particular Localities. 74 Federal Register (FR) 46836-46879. September 11, 2009.

US Fish and Wildlife Service (USFWS). 2012. Final Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online at: http://www.fws.gov/cno/pdf/Energy/2012_Wind_Energy_Guidelines_final.pdf

US Fish and Wildlife Service (USFWS). 2013a. Authorizations under the Bald and Golden Eagle Protection Act for Take of Eagles. Department of the Interior Fish and Wildlife Service. 50 CFR Parts 13 and 22. RIN 1018–AX91. 78 Federal Register (FR) 236; 73704-73725. December 9, 2013. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2013-12-09/pdf/2013-29088.pdf

US Fish and Wildlife Service (USFWS). 2013b. Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy, Version 2. US Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management. April 2013. Executive Summary and frontmatter + 103 pp.

US Fish and Wildlife Service (USFWS). 2016. Midwest Wind Energy Multi-Species Habitat Conservation Plan. Public Review Draft. April 2016. 587 pp. https://www.fws.gov/midwest/endangered/permits/hcp/r3wind/DraftHCPandEIS.html

U.S. Fish and Wildlife Service. 2018. Bald Eagle Mortalities and Injuries at Wind Energy Facilities in the United States. A poster presented at The Wildlife Society 25th Annual Conference in Cleveland, Ohio, Oct. 7-11, 2018.

US Geological Survey (USGS). 2015. The National Map/US Topo. Last updated January 2015. Homepage available at: http://nationalmap.gov/ustopo/index.html

US Geological Survey (USGS) Digital Elevation Model (DEM). 2011. Digital Elevation Model (DEM) Imagery.

US Geological Survey (USGS) National Land Cover Database (NLCD). 2006. NLCD Land Cover 2006. USGS, Sioux Falls, South Dakota. Publication date: February 16, 2011.

Whitfield, D. P. 2009. Collision Avoidance of Golden Eagles at Wind Farms under the 'Band' Collision Risk Model. Report to Scottish National Heritage. March 2009.

10.2 Laws, Acts, and Regulations

16 United States Code (USC) 668 - 668d. 1940. Title 16 - Conservation; Chapter 5a - Protection and Conservation of Wildlife; Subchapter II - Protection of Bald and Golden Eagles; Sections (§§) 668-668d - Bald and Golden Eagles. 16 USC 668-668d. (June 8, 1940, Chapter [Ch.] 278, § 1,54 Statute [Stat.] 250; Public Law [Pub. L.] 86–70, Section [§] 14, June 25, 1959, 73 Stat. 143; Pub. L. 87–884, October 24, 1962, 76 Stat. 1246; Pub. L. 92–535, § 1,October 23, 1972, 86 Stat. 1064)

16 United States Code (USC) 703-712. 1973. Title 16 - Conservation; Chapter 7 - Protection of Migratory Game and Insectivorous Birds; Subchapter II - Migratory Bird Treaty; Sections (§§) 703-712. 16 USC 703-712. Available online at: http://www.gpo.gov/fdsys/pkg/USCODE-2010-title16/pdf/USCODE-2010-title16-chap7-subchapII.pdf

16 United States Code (USC) § 703. 1918. Title 16 - Conservation; Chapter 7 - Protection of Migratory Game and Insectivorous Birds; Subchapter II - Migratory Bird Treaty; Section (§) 703 - Taking, Killing, or Possessing Migratory Birds Unlawful. 16 USC 703. [July 3, 1918, Chapter (ch.) 128, § 2, 40 Statute (Stat). 755; June 20, 1936, ch. 634, § 3, 49 Stat. 1556; Pub. L. 93–300, § 1, June 1, 1974, 88 Stat. 190; Pub. L. 101–233, § 15, December 13, 1989, 103 Stat. 1977; Public Law (Pub. L.) 108-447, divison E, title I, § 143(b), December 8, 2004, 118 Stat. 3071.].

42 United States Code (USC) §§ 4321-4370h. 1970. Title 42 - the Public Health and Welfare; Chapter 55 - National Environmental Policy; Subchapters I (Policies and Goals) and II (Council on Environmental Quality); Sections (§§) 4321-4370h; National Environmental Policy Act. (Pub. L. 91–190, § 2, Jan. 1, 1970, 83 Stat. 852.).

50 Code of Federal Regulations (CFR) 22.3. 1974. Title 50 - Wildlife and Fisheries; Chapter I -United States Fish and Wildlife Service, Department of the Interior; Subchapter B - Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants; Part 22 - Eagle Permits; Subpart a - Introduction; Section (§) 22.3 - Definitions. 50 CFR 22.3. [39 Federal Register (FR) 1183, January 4, 1974, as amended at 48 FR 57300, December 29, 1983; 64 FR 50472, September 17, 1999; 72 FR 31139, June 5, 2007; 74 FR 46876, September 11, 2009].

50 Code of Federal Regulations (CFR) 22.27. 2009. Title 50 - Wildlife and Fisheries; Chapter I -United States Fish and Wildlife Service, Department of the Interior; Subchapter B - Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants; Part 22 - Eagle Permits; Subpart C - Eagle Permits; Section (§) 22.27 - Removal of Eagle Nests. 50 CFR 22.27. [74 Federal Register (FR) 46877, September 11, 2009].

50 Code of Federal Regulations (CFR) § 10.12. 2010. Title 50 - Wildlife and Fisheries; Chapter I -United States Fish and Wildlife Service, Department of the Interior; Subchapter B Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants; Part 10 - General Provisions; Subpart B - Definitions; Section (§)10.12. Definitions. 50 CFR 10.12. [38 Federal Register (FR) 22015, Augugust 15, 1973, as amended at 42 FR 32377, June 24, 1977; 42 FR 59358, November 16, 1977; 45 FR 56673, August 25, 1980; 50 FR 52889, December 26, 1985; 72 FR 48445, August 23, 2007].

50 Code of Federal Regulations (CFR) § 22.26. 2009. Title 50 - Wildlife and Fisheries; Chapter I - United States Fish and Wildlife Service, Department of the Interior; Subchapter B - Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants; Part 22 - Eagle Permits; Subpart C - Eagle Permits; Section (§) 22.26 - Permits for Eagle Take That Is Associated with, but Not the Purpose of, an Activity. 50 CFR 22.26. [74 FR 46877, September 11, 2009, as amended at 79 FR 73725, December 9, 2013].

72 Federal Register (FR) 31132. 2007. 50 Code of Federal Regulations (CFR) Parts 13 and 22. Protection of Eagles and Authorizations under the Bald and Golden Eagle Protection Act for Take of Eagles; Final Rule and Proposed Rule; Protection of Eagles and National Bald Eagle Management Guidelines; Notices; 50 CFR 22; Protection of Eagles; Definition of "Disturb". Department of the Interior, Fish and Wildlife Service. 72 FR 107: 31132-31140. June 5, 2007.

78 Federal Register (FR) 236: 73704-73725. 2013. United States Fish and Wildlife Service, Department of the Interior. 50 CFR Parts 13 and 22. Eagle Permits; Changes in the Regulations Governing Eagle Permitting. Final Rule. December 9, 2013.

Bald and Golden Eagle Protection Act (BGEPA). 1940. 16 United States Code (USC) § 668-668d. Bald Eagle Protection Act of 1940, June 8, 1940, Chapter 278, Section (§) 2, 54 Statute (Stat.) 251; Expanded to include the related species of the golden eagle October 24, 1962, Public Law (PL) 87-884, 76 Stat. 1246. As amended: October 23, 1972, PL 92-535, § 2, 86 Stat. 1065; November 8, 1978, PL 95-616, § 9, 92 Stat. 3114.

Freedom of Information Act (FOIA). 1966. Public Law 89-554, 80 Statute (Stat.) 383; amended 1996, 2002, 2007. September 6, 1966.

Migratory Bird Treaty Act (MBTA). 1918. 16 United States Code (USC) §§ 703-712. July 13, 1918.

Missouri Code of State Regulations (CSR) § 10-4.110. Rules of Department of Conservation Division 10 - Conservation Commission; Chapter 4 - Wildlife Code: General Provisions; § 10.4.110 - General Prohibition; Applications. [Authority: sections 40 and 45 of Art. IV, Mo. Const. Original rule filed June 26, 1975, effective July 7, 1975. Amended: Filed July 15, 1976, effective Dec. 31, 1976. Amended: Filed April 20, 1978, effective Aug. 15, 1978. Amended: Filed July 15, 1978, effective Oct. 12, 1978. Amended: Filed July 30, 1979, effective Jan. 1, 1980. Amended: Filed Aug. 1, 1980, effective Jan. 1, 1981. Amended: Filed July 31, 1981, effective Jan. 1, 1982. Amended: Filed July 27, 1982, effective Jan. 1, 1983. Amended: Filed Aug. 1, 1983, effective Jan. 1, 1984. Amended: Filed Aug. 6, 1985, effective Jan. 1, 1986. Amended: Filed Aug. 7, 1986, effective Jan. 1, 1987. Amended: Filed July 30, 1987, effective Jan. 1, 1988. Amended: Filed Aug. 8, 1989, effective Jan. 1, 1990. Amended: Filed May 10, 1990, effective Jan. 1, 1991. Amended: Filed May

10, 1991, effective Jan. 1, 1992. Amended: Filed April 28, 1992, effective Feb. 26, 1993. Emergency amendment filed Dec. 29, 1992, effective Jan. 9, 1993, expired May 8, 1993. Emergency amendment filed April 28, 1993, effective May 9, 1993, expired June 7, 1993. Amended: Filed Dec. 29, 1992, effective June 7, 1993. Sections (5), (6) and (10) changed to 3 CSR 10-9.110, effective Jan. 31, 1994. Amended: Filed April 27, 1994, effective Jan. 1, 1995. Amended: Filed April 25, 1996, effective March 1, 1997. Amended: Filed June 27, 1996, effective March 1, 1997. Amended: Filed June 11, 1997, effective March 1, 1998. Amended: Filed June 11, 1998, effective March 1, 1999. Amended: Filed April 24, 2000, effective March 1, 2001. Amended: Filed Oct. 9, 2003, effective March 30, 2004. Amended: Filed Sept. 29, 2004, effective Feb. 28, 2005. Amended: Filed Sept. 14, 2005, effective Feb. 28, 2006.]. Available online at: http://www.sos.mo.gov/cmsimages/adrules/csr/previous/3csr/3csr0107/3c10-4.pdf

National Environmental Policy Act (NEPA). 1970. 42 United States Code (USC) 4321-4370h. Public Law 91–190, § 2, January 1, 1970, 83 Statute 852.