# Bird and Bat Conservation Strategy
# Deuel Harvest North Wind Farm
# Deuel County, South Dakota

## Draft Report

**Prepared for**

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WEST Inc.

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# 1 INTRODUCTION

Deuel Harvest Wind Energy LLC (Deuel Harvest) is proposing to construct the up to 310.1-megawatt (MW) Deuel Harvest North Wind Farm (Project) in Deuel County, South Dakota (Figure 1.1). The Project area is approximately 19,726 hectares (ha; 48,743 acres [ac]). The proposed Project consists of several components, including 124 proposed wind turbine locations, access roads, underground electrical collector lines and communication cable, a project substation, an interconnection substation, a 150 foot gen-tie line, and additional associated facilities The Project currently anticipates beginning construction in Q4 2019, and beginning commercial operations in Q4 2020. The Project Bird and Bat Conservation Strategy (BBCS) provides strategies for mitigating risks to birds and bats during the construction and operation phases of the Project.

Environmental surveys of the Project area commenced in April 2016. An area larger than the final Project area was studied to provide the developer the flexibility to site the Project facilities away from high value environmental areas. The total area studied (Study Area) is 30,974 ha (76,542 ac) (Figure 1.2). The first year study area consisted of 21,248 ha (52,950 ac), and the Study Area expanded in early 2017 by an additional 9,548 ha (23,595 ac; expansion study area). The second year of field studies was conducted in the Current Project Area, hereafter referred to as the Project area (Figure 1.3).

## 1.1 Background

Deuel Harvest completed Tier 1, 2, and 3 wildlife studies consistent with the 2012 Land-Based Wind Energy Guidelines (WEG; U.S. Fish and Wildlife Service [USFWS] 2012), which correspond to stages 1 and 2 of the 2013 Eagle Conservation Plan Guidance (ECPG; USFWS 2013), and the Siting Guidelines for Wind Power Projects in South Dakota (South Dakota Game, Fish and Parks [SDGFP] 2009). Deuel Harvest will conduct Tier 4 WEG studies (corresponding to stage 5 of the ECPG, the SDGFP Guidance) in the Project area once the Project is operational.

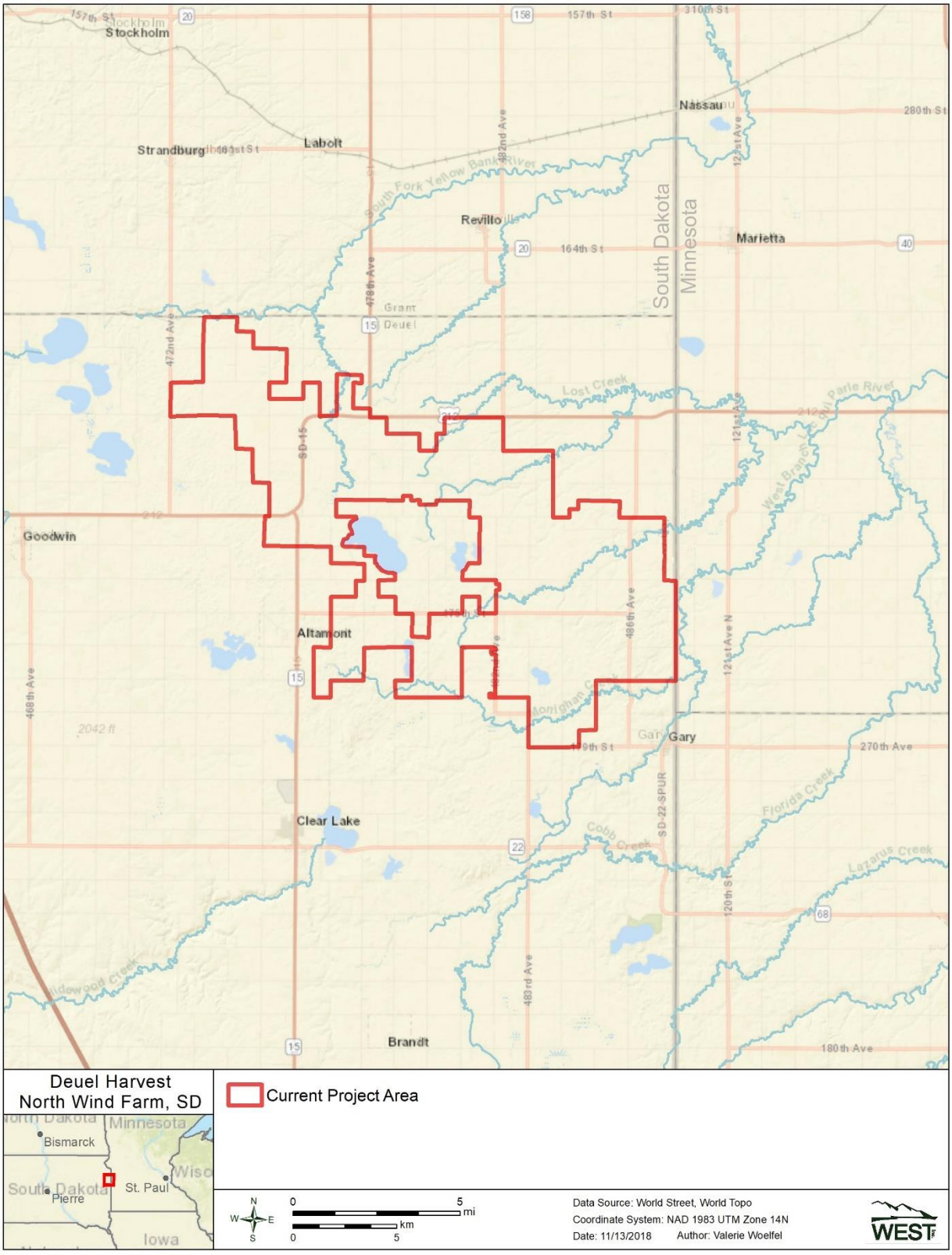


**Figure 1.1 Deuel Harvest Wind Farm Project area in Deuel County, South Dakota.**

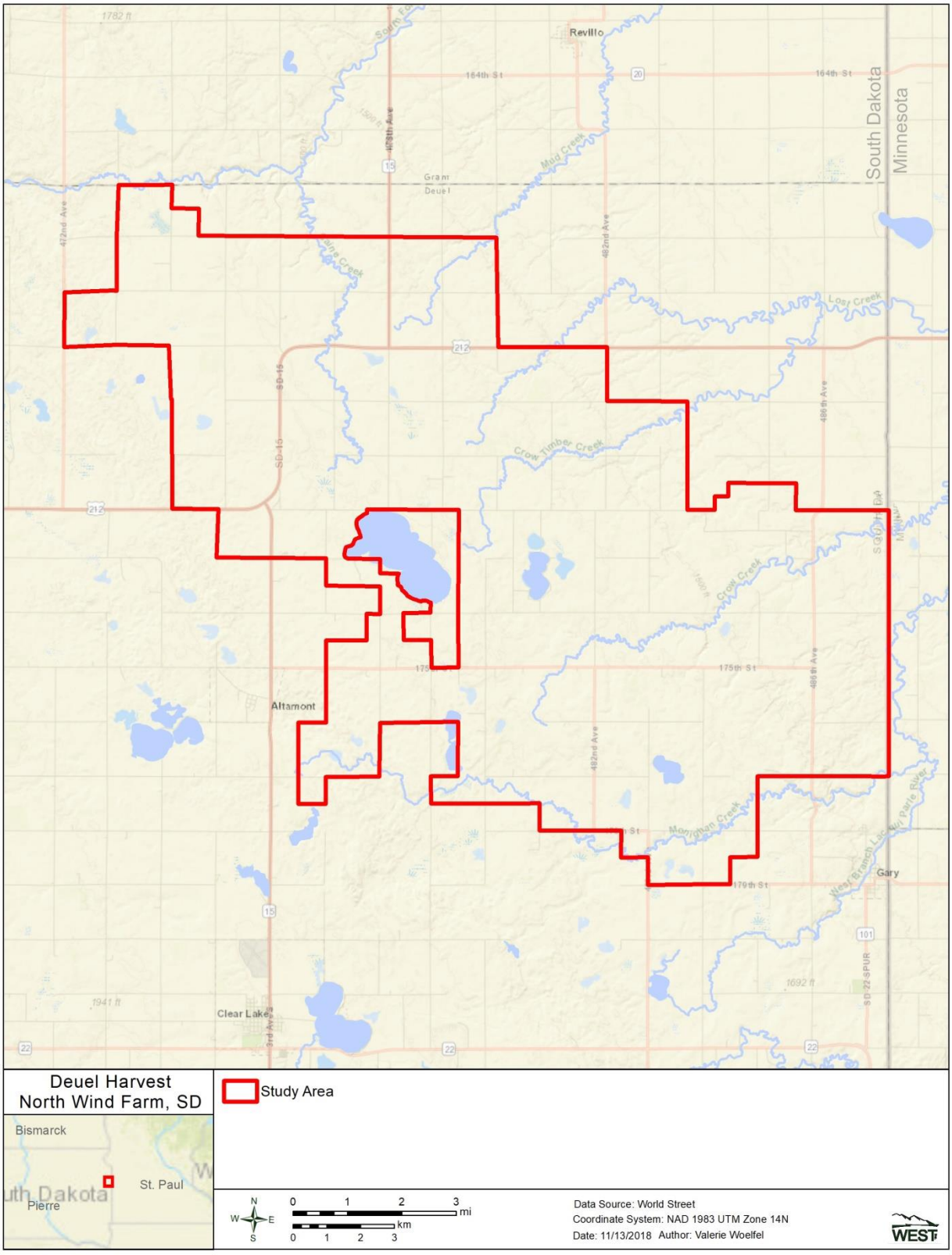


**Figure 1.2 Deuel Harvest North Wind Farm Study Area in Deuel County, South Dakota.**

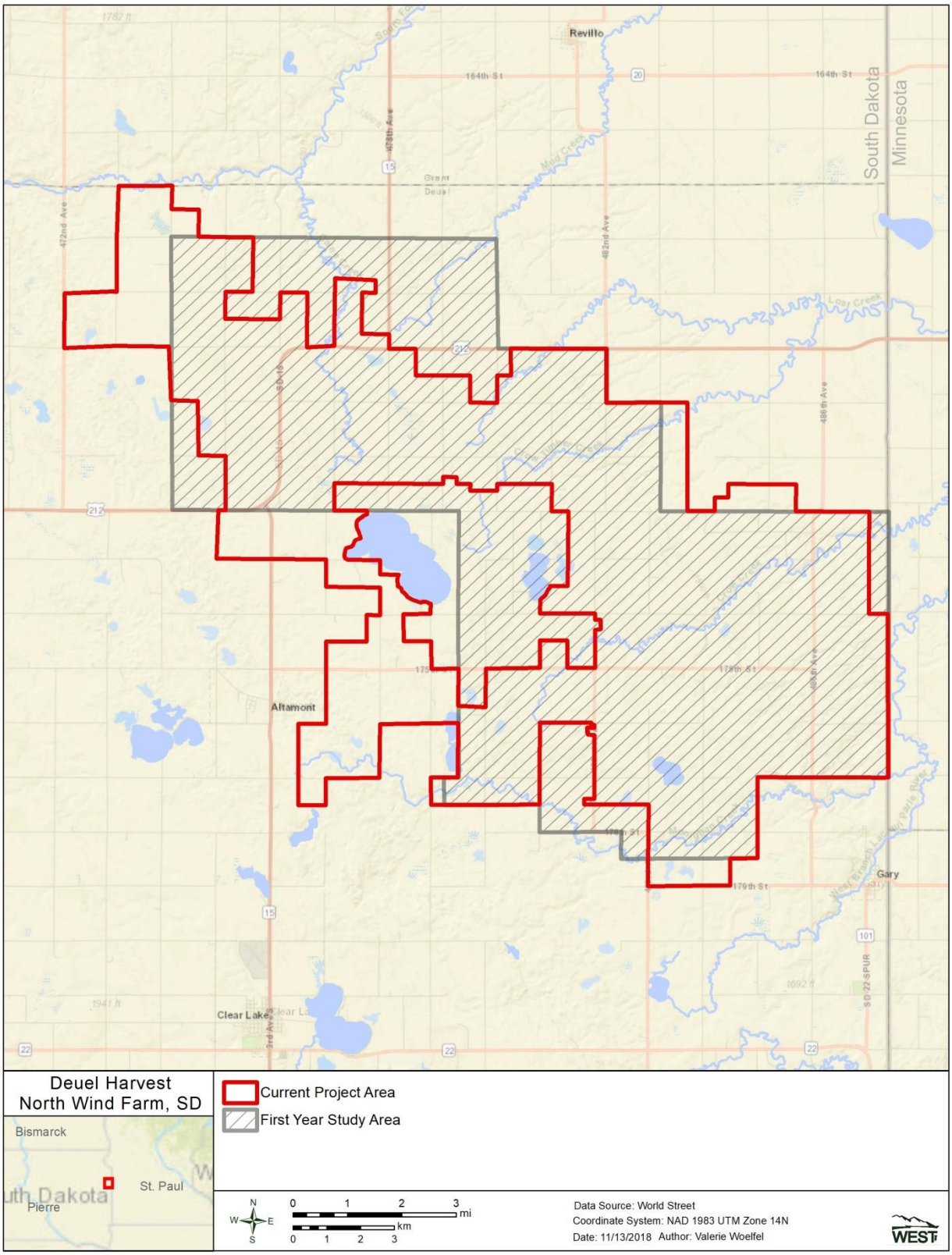


**Figure 1.3 Deuel Harvest North Wind Farm first year study area and the current project area in Deuel County, South Dakota.**

## 1.2 Purpose and Objectives

The objectives of the Deuel Harvest BBCS are as follows:

1) Document the results of the Project's habitat evaluation and wildlife surveys and its progression through the WEG assessments, ECPG assessments, and agency consultation.
2) Identify measures that, when implemented during construction, operation, maintenance, and decommissioning at the Project, will avoid and minimize potential impacts to birds and bats.
3) Describe post-construction monitoring and adaptive management procedures.

This BBCS is a living document that will evolve throughout the life of the Project as needed in response to changing conditions. The document is also labeled as a draft as the final Project layout and other conditions are determined.

## 1.3 Project Facilities

The 310.1-MW Project includes124 proposed wind turbine locations and associated facilities. Deuel Harvest has selected the GE 2.3-116 and the GE 2.82-127 wind turbine generators for use at the Project. The wind turbine generators will be supported by three-section tubular towers, and their dimensions are outlined in the table below in greater detail. Support facilities will include step-up transformers, underground communication cables and 34.5-kilovolt (kV) underground collector lines, permanent meteorological (met) towers, a 150 foot 345 kV overhead gen-tie line, a 345-kV substation, a 34.5-kV to 345-kV step-up switchyard, an operations and maintenance (O&M) building, and other ancillary facilities or structures.

| Manufacturer | Turbine Name | Hub Height | Rotor Diameter | Tip Height | MW Rating |
|---|---|---|---|---|---|
| General Electric | GE 2.3-116 | 80 M (263 FT) | 116 M (381 FT) | 138 M (452 FT) | 2.3 |
| General Electric | GE 2.82-127 | 88.6 M (291 FT) | 127 M (417 FT) | 152.1 M (499 FT) | 2.82 |

## 1.4 Regulatory Framework

### *1.4.1 Environmental Law Compliance*

Federal, state and local environmental regulations that govern the Project are described below. The Project's intent is to comply with all of these regulations. This document is a guide by which construction and operations staff will be able to determine whether they are in compliance with these regulations.

In South Dakota, wind energy developments of 100 MW or greater and transmission facilities with a design of more than 115 kV require a permit from the Public Utilities Commission (PUC).

The SDGFP provides comments as part of the Facility Permit application and has developed Siting Guidelines for Wind Power Projects in South Dakota.

### *1.4.2 Endangered Species Act*

The federal Endangered Species Act (ESA) of 1973 (16 U.S. Code [U.S.C.] §§ 1531 *et seq*.) provides for the listing, conservation, and recovery of endangered and threatened species. The USFWS implements the ESA to conserve terrestrial species and resident fish species. Section 9 of the ESA prohibits the unauthorized take of listed species. Under the ESA, "take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" a listed species (ESA § 3(19), 16 U.S.C 1532(19)). The term "harm" has been further defined in agency regulations to mean habitat modification that actually kills or injures a federally listed species. Because some of the Project facilities are proposed to be built on USFWS easements, a federal nexus occurs in connection with the associated easement exchange review process.

### *1.4.3 Migratory Bird Treaty Act*

The Migratory Bird Treaty Act (MBTA; 16 U.S.C. §§ 703-711) prohibits the take of migratory birds, their eggs, parts, and nests, except when specifically permitted by regulations. Under the MBTA, "take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 Code of Federal Regulations [CFR] § 10.12). The USFWS maintains a list of all species protected by the MBTA at 50 CFR § 10.13. This list includes over 1,000 species of migratory birds including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. At present, there is no MBTA permit authorizing the incidental or non-purposeful take of an MBTA-protected species.

### *1.4.4 Bald and Golden Eagle Protection Act*

The Bald and Golden Eagle Protection Act (BGEPA; 16 U.S.C. §§ 668-668d) prohibits the take of bald (*Haliaeetus leucocephalus*) and golden (*Aquila chrysaetos*) eagles unless authorized by a permit. Under the BGEPA, take is defined as "…to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest or disturb" (50 CFR § 22.3). The term "disturb" is defined as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle; (2) a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior" (50 CFR § 22.3).

BGEPA authorizes the Secretary of the Interior to permit the take of bald or golden eagles for several defined purposes, including when "necessary to permit the taking of such eagles for the protection of wildlife […] or other interests in any particular locality." Based on this authority, the USFWS published a final rule (Eagle Permit Rule) on September 11, 2009 (50 CFR § 22.26), authorizing permits for the take of bald eagles and golden eagles where take: (1) is compatible with the preservation of the bald and golden eagle; (2) is associated with and not the purpose of an otherwise lawful activity; and (3) cannot practicably be avoided.

On May 2, 2013, the USFWS published the ECPG to assist wind energy developers in avoiding, minimizing, and mitigating risks to eagles during the construction and operation of a wind energy facility. The ECPG interpreted and clarified the permit requirements in the regulations at 50 CFR 22.26 and 22.27, but it did not impose any binding requirements beyond those specified in the regulations.

Effective January 17, 2017, the 2009 Eagle Rule was replaced by a new rule governing eagle take permits (81 FR 91495 [December 16, 2016]). The new rule adjusted the standards, maximum duration, and requirements for eagle take permits.

### *1.4.5 SDGFP Siting Guidelines for Wind Power in South Dakota*

At the state level, the Siting Guidelines for Wind Power Projects in South Dakota address activities and concerns associated with siting and permitting wind turbines in South Dakota. The guidelines highlight the Coteau des Prairies in eastern South Dakota, which is where the Project area is located, and the Missouri River in central South Dakota as areas identified as potential sites for wind development which are unique to South Dakota. These guidelines also contain contact information for state agencies, wildlife experts and universities, interest groups, and local resource management agencies (SDGFP 2009).

## 1.5 Agency Consultation

Deuel Harvest coordinated with the USFWS and state agencies as part of the Project planning and development process. The USFWS Information, Planning, and Conservation System (USFWS 2015a; IPac) report was generated and reviewed in September 2015 to conduct an initial review of the Project area. On March 31, 2016, Deuel Harvest conducted an online presentation and call with the USFWS Madison Wetlands Management District (WMD) to introduce the Project, discuss proposed avian and bat surveys, and to determine if existing grassland and wetland easements may occur in the Project area. On April 4, 2016, a Project boundary shape file was shared with the WMD to identify any USFWS easements. Deuel Harvest had a follow-up phone conversation with the WMD on August 4, 2016, to discuss the USFWS easement resources identified in the Project area, which Deuel Harvest have sited its facilities to avoid.

Deuel Harvest submitted an information request to USFWS South Dakota Ecological Services Field Office and a Natural Heritage Information System (NHIS) data request to the SDGFP on June 20, 2016, for information on state and federally listed species and sensitive natural resources within the Study Area. The USFWS responded to the environmental review request in a letter dated August 16, 2016. The USFWS's August 16, 2016, response stated that the federally threatened northern long-eared bat (*Myotis septentrionalis*) occurs within Deuel County, and some hibernacula has been documented in caves and mines in the Black Hills along the western border of South Dakota, and the species has also been documented in other areas of the state during summer and along the Missouri River in the center of South Dakota during migration. Four other records of sensitive species were noted including, Topeka shiner (*Notropis topeka*, federally endangered), Poweshiek skipperling (*Oarisma poweshiek*, federally endangered), Dakota skipper (*Hesperia dacotae*, federally threatened), and the rufa red knot

(*Calidris canutus rufa*, federally threatened). These species are further discussed in Section 2.5. No other records of significant natural features were noted in the vicinity of the Project area. The SDGFP responded to the NHIS request letter on August 10, 2016. The SDGFP letter stated the federally endangered Poweshiek skipperling and the federally threatened Dakota skipper have been documented in Deuel County. No other state or federally listed species were included in the SDGFP response letter.

Deuel Harvest also met with the USFWS and SDGFP on August 12, 2016 to provide an overview of the site characterization study, preliminary results of baseline studies, and discuss additional proposed surveys. The USFWS agreed with the separate survey effort for large and small birds and asked if any survey points were located in grassland away from roads. Deuel Harvest confirmed that it conducted breeding bird surveys in grassland habitat in June 2016. The USFWS reviewed the northern long-eared bat mist-net protocol and confirmed it followed the 2016 Range Wide Indiana Bat Summer Survey Guidelines. Lastly, SDGFP asked if lek surveys were proposed for greater prairie chicken (*Tympanuchus cupido*), and were to provide known lek locations to Deuel Harvest.

On May 25, 2017, Deuel Harvest met with the USFWS and SDGFP to review the Study Area characteristics, as the boundary had expanded in early 2017, and to discuss the Year 1 study results and ongoing survey protocols for Year 2. The SDGFP recommended that Deuel Harvest consider avoiding grasslands and focus turbine siting in croplands. Deuel Harvest confirmed they were minimizing impacts to grasslands. The USFWS mentioned that large wetlands occur within the Project area and Deuel Harvest confirmed they would avoid wetlands to the extent practicable; the USFWS further recommended that Deuel Harvest avoid placing turbines between wetlands. The USFWS stated they approved the ongoing survey protocols and requested that Deuel Harvest consult the Region 3 guidelines on Dakota skipper habitat features as they had been updated. The USFWS also stated that greater prairie chicken leks are unlikely to occur within the Project area.

A site visit at the Project area was conducted by the USFWS with Deuel Harvest on June 27, 2017 to further review site characteristics and potential environmental areas of concern. The USFWS reiterated its recommendation to minimize impacts to intact grasslands and to minimize impacts to waterfowl by siting turbines away from wetland clusters to the extent practicable. The SDGFP was unable to attend the site visit.

On January 24, 2018, the WMD contacted Deuel Harvest after reviewing a draft layout and noticing a turbine sited on a USFWS grassland easement. Deuel Harvest responded by removing that turbine from the layout to avoid all impacts to USFWS easements.

Deuel Harvest met with the USFWS and SDGFP on February 13, 2018 to discuss grassland and wetland habitat within the Project area, and to further assess the recommended minimization measures. Deuel Harvest also coordinated with USFWS in July and August 2018 ahead of butterfly habitat surveys in September 2018. Deuel Harvest confirmed they are committed to minimizing impacts, especially to grasslands and wetlands, and have set turbines

back from high value environmental areas identified by the USFWS and SDGFP throughout the development process to the extent practicable.

On February 11, 2019, Deuel Harvest had a discussion with the USFWS and SDGFP regarding a bald eagle nest located north of Lake Alice in Deuel County. Deuel Harvest indicated they would conduct activity monitoring surveys of the bald eagle nest and an aerial stick nest survey in 2019.

Through development, construction, and operation, Deuel Harvest will continue to coordinate with the USFWS and the SDGFP as appropriate.

# 2 TIER 1 AND TIER 2 – SITE CHARACTERIZATION

## 2.1 Land Cover Types and Habitat within the Project Area

The Project is located within the Prairie Couteau of the Northern Glaciated Plains Ecoregion, which encompasses the eastern edge of South Dakota (U.S. Environmental Protection Agency 2016). This area was historically dominated by tallgrass and shortgrass prairie (Bryce et al. 1996). The native grasses in the ecoregion have since been predominately converted to cultivated croplands (Bryce et al 1996), with corn (*Zea mays*) and soybeans (*Glycine max*) as the dominant crops (Miller 1997).

Cultivated cropland is the dominant land cover type (35%) within the Project area (Table 2.1 and Figure 2.1, NLCD 2011, Homer et al. 2015), followed closely by herbaceous land cover (32%). Hay/pasture and emergent wetland land cover types are the third and fourth most common and comprise approximately 24% and 4% of the Project area, respectively. Developed open space and open water comprise 4% and 2% of the Project area, respectively, and all other land cover types each compose less than 1% of the Project area (Chodachek and Agudelo 2017; Burns & McDonnell Engineering Company, Inc. [BMEC] 2018f).

**Table 2.1 National Land Cover Database land cover types within the Deuel Harvest North Wind Farm in Deuel County, South Dakota.**

| Habitat | Hectares | Acres[a] | % Composition |
|---|---|---|---|
| **Current Project Area** | | | |
| Cultivated Crops | 6,968 | 17,219 | 35 |
| Herbaceous[b] | 6,305 | 15,581 | 32 |
| Hay/Pasture[b] | 4,636 | 11,456 | 24 |
| Emergent Herbaceous Wetlands[b] | 692 | 1,710 | 4 |
| Developed, Open Space | 690 | 1,705 | 4 |
| Open Water[b] | 344 | 849 | 2 |
| Deciduous Forest[b] | 72 | 177 | <1 |
| Shrub/Scrub[b] | 11 | 26 | <1 |
| Woody Wetlands[b] | 6 | 16 | <1 |
| Barren Land[c] | 1 | 3 | <1 |
| **Total** | **19,726** | **48,743** | **100** |

[a] These land cover data are from the U.S. Geological Survey 2011 National Land Cover Database (USGS NLCD 2011, Homer et al. 2015)

[b] Land cover types constituting native wildlife habitat (untilled and undeveloped).

[c] Barren land likely represents strip mines, gravel pits, and/or other accumulations of earthen material.

Sum of values may not add to total value shown, due to rounding.

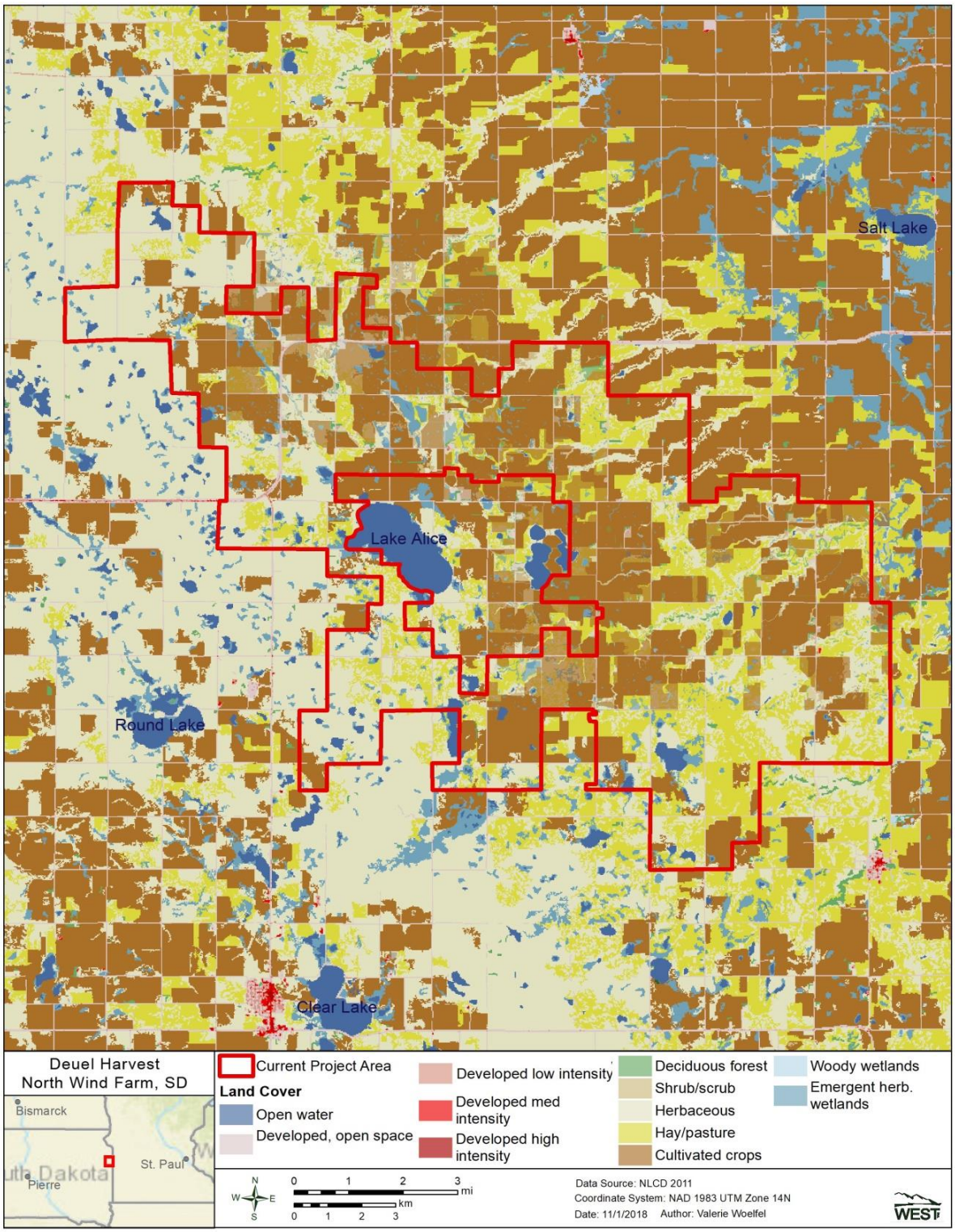


**Figure 2.1 National Land Cover Database (NLCD) land cover types within and adjacent to the Deuel Harvest North Wind Farm in Deuel County, South Dakota (USGS NLCD 2011, Homer et al. 2015).**

## 2.2 Water Resource Evaluation

Desktop evaluations and partial ground-truthing field evaluations were conducted for the first year study area and the expansion study area (together comprising the Study Area) to confirm or correct the presence or absence of landscape features to the extent possible by viewing from public roads and other accessible areas.

From these combined methods, approximately 918 ha (2,268 ac) of the first year study area is comprised of wetlands and water bodies. Wetland types documented within the first year study area included freshwater emergent wetlands (770 ha [1,901 ac]), freshwater pond (47 ha [116 ac]), riverine (two ha [four ac]), lake (88 ha [217 ac]), and freshwater forested/shrub wetlands (12 ha [29 ac]). These wetlands were found to primarily occur as fringe wetlands along the riparian zones along Caine Creek and Crow Timber Creek within the north-central and central portion of the first year study area. There is potential for depressions within croplands to be saturated and/or to pond water during the spring or following large precipitation events, as was observed during ground-truthing field evaluations. Several named streams, including Caine Creek, Crow Timber Creek, Crow Creek, Lost Creek, Mud Creek, and Monighan Creek occur within with the first year study area, as well as two named lakes, Lone Tree Lake and Lake Francis (Chodachek and Agudelo 2017).

Based on the combined desktop evaluation and partial ground-truthing of water resources, there are approximately 1,453 ha (3,591 ac) of wetlands in the expansion study area. Wetland types documented within the expanded study area included freshwater emergent wetlands 976 ha [2,411 ac], lake (416 ha [1,029 ac]), freshwater pond (49 ha [120 ac], and freshwater forested/shrub wetlands (13 ha [31 ac]). Most of these wetlands were located along the riparian corridors of waterbodies within the second year study area. Several named streams are present, including portions of Monighan Creek, Crow Timber Creek, and South Fork Yellow Bank River (Figure 2.2). Lake Alice and a few smaller unnamed bodies of water are also located within the vicinity of the expansion study area (BMEC 2018f).

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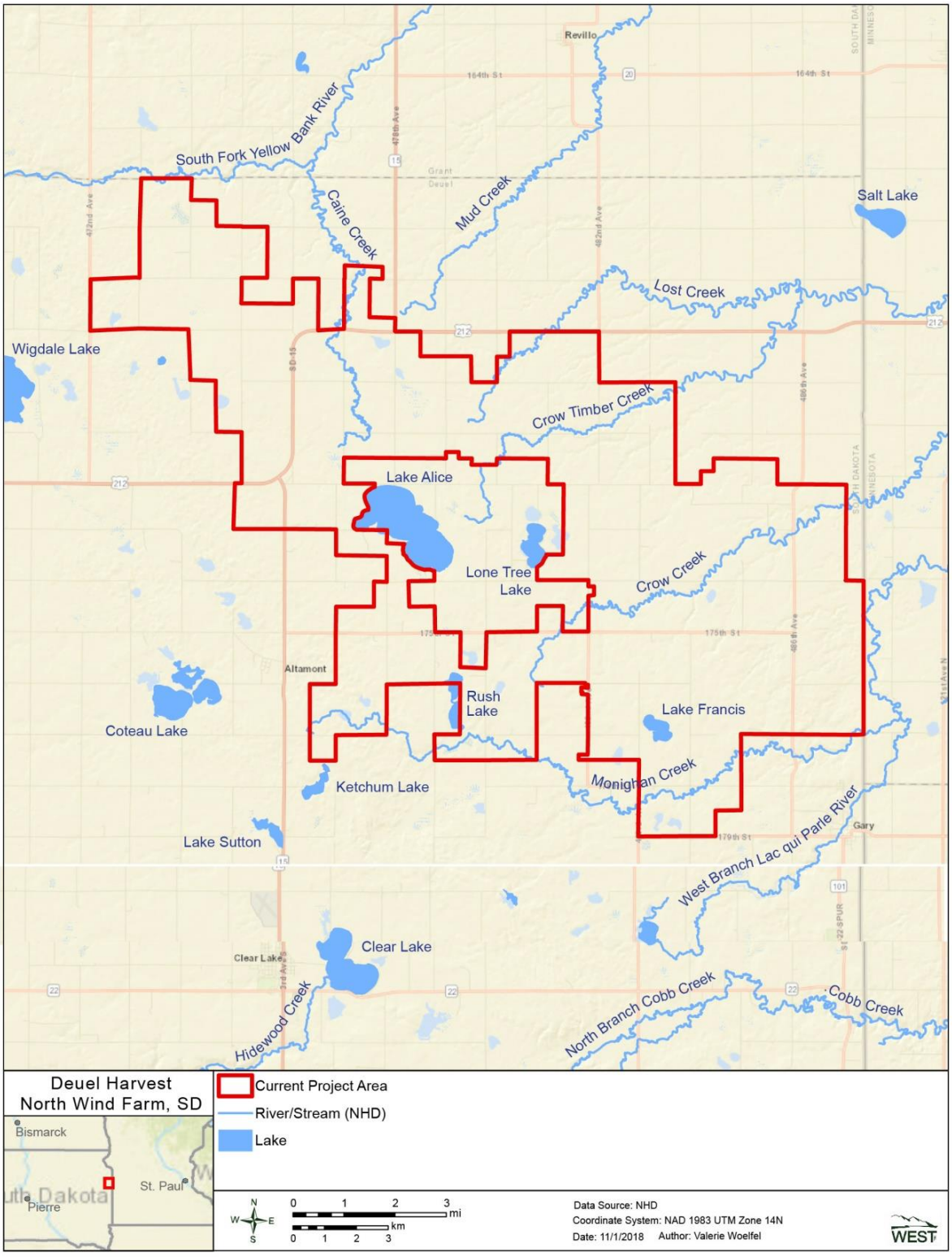


**Figure 2.2 Water resources within and adjacent to the Deuel Harvest North Wind Farm in Deuel County, South Dakota.**

## 2.3 Native Grassland Evaluation

Based on the desktop evaluation of the South Dakota State University (SDSU) Extension's Potentially Undisturbed Lands GIS layer (Bauman et al. 2016), and an on-site reconnaissance, an estimated 6,592 ha (16,288 ac) of potentially undisturbed grasslands (i.e., not previously tilled) occur within the Project area. The Project coordinated with the USFWS, SDGFP, and The Nature Conservancy (TNC) on minimizing impacts to native grasslands. Conservatively, the Project is expected to be sited on up to 5.76 ha (14.24 ac) of potentially undisturbed grasslands, which represents approximately 0.09% of the potentially undisturbed grassland in the Project area (Figure 2.3).

These areas include the locations of seven of the 124 proposed turbine locations (5.6% of all turbine locations) and approximately 3,210 m (10,530 ft) of facility roads (6.0% of all facility roads) that overlap with potentially undisturbed grasslands (Figure 2.3). Assuming 0.04 ha (0.10 ac) of permanent impact per turbine, the Project turbines have the potential to impact 0.3 ha (0.7 ac) of potentially undisturbed grassland habitat. Assuming a 4.9-m (16.0-ft) wide permanent road, the Project roads may impact 1.56 ha (3.87 ac) of potentially undisturbed grassland, which represents 0.02% of all potentially undisturbed grassland in the Project area. Assuming a 12.2 m (40 ft) temporary road width, the Project has the potential to temporarily impact 3.91 ha (9.67 ac) of potentially undisturbed grassland, or 0.06% of all potentially undisturbed grassland in the Project area.

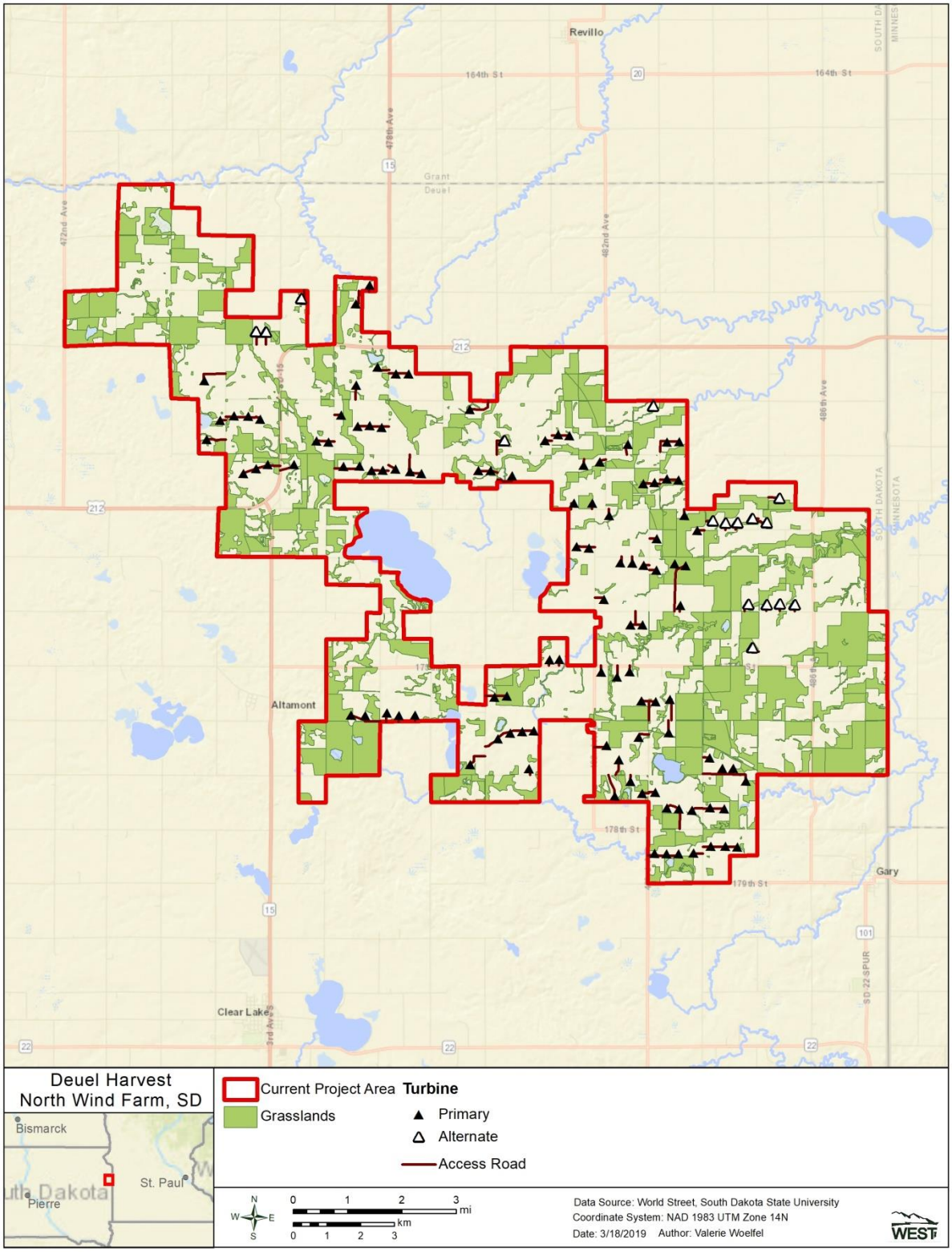


**Figure 2.3. Potentially Undisturbed Grassland within the Deuel Harvest North Wind Farm in Deuel County, South Dakota.**

## 2.4 Wildlife Resources within the Project Area

### *2.4.1 Avian Resources*

Native avian habitat within the Project area includes herbaceous, hay/pasture, emergent herbaceous wetland, deciduous forest, woody wetland, and shrub/scrub land cover types. Small groves of trees and wooded fencerows near homesteads also may provide potential avian habitat. The Project area surrounds Lake Alice from 1.21 km (0.75 mi) to 4.8 km (3.0 mi) out and directly abuts the western shore of the lake. Lake Alice is an important aquatic habitat feature on the landscape used by birds during migration, and possibly by some sensitive bird species. Other lakes and rivers throughout the Project area also may provide important aquatic habitats used for migrating birds and possibly some sensitive bird species.

The USFWS administers a number of Waterfowl Production Areas (WPA) within the Project area vicinity; one located in the Project area, three directly abutting the Project area, and six additional WPAs occur within an 8-km (5-mi) radius of the Project area (Figure 2.4). Other federal easements, including the Dakota Tallgrass Prairie Wildlife Management Areas [WMA]) also are located within the Project area and vicinity (Figure 2.4). The WPAs and Dakota Tallgrass Prairie WMA easements include prairie and wetland communities that provide habitat for grassland- and wetland-dependent species, including but not limited to waterfowl, waterbirds, upland game birds, and raptors that prey upon waterfowl and shorebirds.

Several Game Production Areas (GPA), owned and managed by the SDGFP, including the Lone Tree Game Production Area (GPA), Crystal Springs GPA, Lake Alice GPA, Mitchell GPA, are located in the vicinity of the Project area, and Lake Francis GPA is located within the Project area. These and several other GPAs in the vicinity of the Project area are managed for hunting opportunities, including small game, big game, and waterfowl; however, upland birds and other non-game wildlife also benefit from these areas (SDGFP 2017a, Figure 2.4). Also located within the vicinity of the Project area are two Minnesota Scientific and Natural Areas (SNA) and several WMAs owned and managed by the Minnesota Department of Natural Resources (MDNR); these areas preserve native plant and animal communities and protect lands with high recreational uses, respectively (MDNR 2017b, Figure 2.4). The Minnesota Board of Water and Soil Resources (MBWSR) also manages easements in the vicinity of the Project area with a focus on protecting and improving soil and water quality for fish and wildlife, including birds (Figure 2.4). Within the Project area, the Altamont Prairie Fee Area, owned by TNC, is a 25-ha (62-ac) area composed of upland native prairie, marsh, native shrubland, and cottonwood groves used by a variety of upland bird species, and numerous species of songbirds (TNC 2017a). TNC also owns two additional conservation areas in the vicinity of the Project area (Figure 2.4), including Jacobsen Fen, a 65- ha (160- ac) conservation area located approximately 1.6 km (1.0 mi) south of the Project area, and 7-mile Fen, an 88- ha (217- ac) site located approximately 4.8 km (3.0 mi) south of the Project area. These two conservation areas are part of the Crystal Springs Complex, a protected ecoregion containing a mixture of tallgrass prairie and pothole habitat within the Prairie Coteau Region of Deuel County (TNC 2017b). These areas provide native habitat that support several species of birds, possibly including

sensitive species. The closest Audubon registered Important Bird Areas (IBA) to the Project area are located in Minnesota. These include the Prairie Coteau Complex IBA, located 4.8 km (3.0 mi) south, and the Salt Lake IBA, located approximately 7.6 km (4.7 mi) north of the Project area (Audubon 2016).

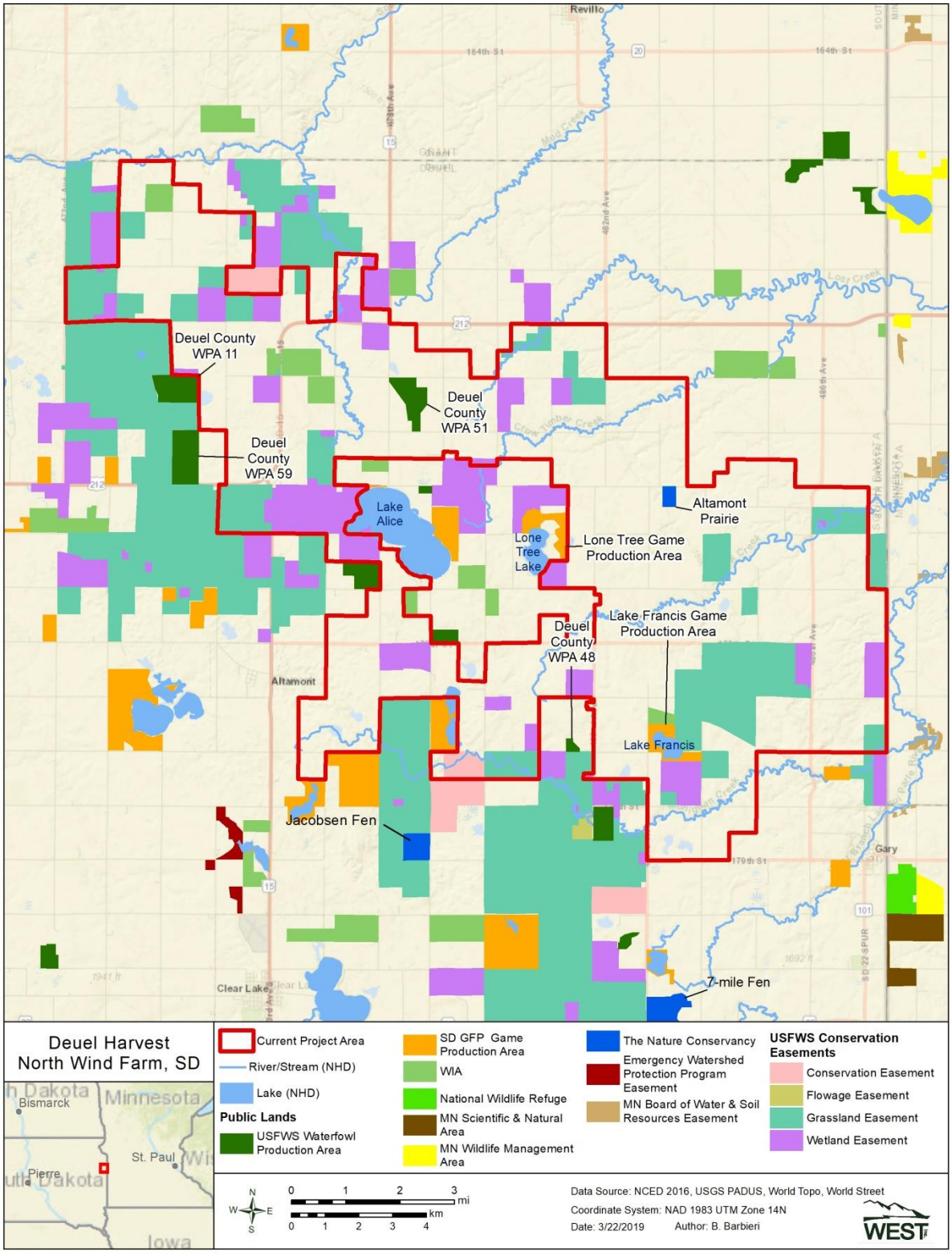


**Figure 2.4. Federally administered, state-managed, and other protected lands within and adjacent to the Deuel Harvest North Wind Farm in Deuel County, South Dakota**

The Project area is located within the Central Flyway, which is used by migrating raptors, shorebirds, songbirds, waterbirds, and waterfowl (Flyways.us 2016) and may be used as stopover habitat in spring and fall by migrating birds. If depressions within croplands in the Project area are saturated and/or pond water during the wet season, these areas may provide stopover habitat for shorebirds and waterfowl during spring migration. Wetlands and recently harvested croplands may provide stopover habitat and foraging opportunities for birds during fall migration. A number of water resources in and adjacent to the Project area could be utilized by migrating birds. These resources include South Fork Yellow Bank River, Cain Creek, Lost Creek, Crow Timber Creek, Crow Creek, Monighan Creek, Lone Tree Lake, Lake Alice, and Lake Francis, located within the vicinity of the Project area, and portions of the West Branch Lac qui Parle River located within 16 km (10 mi) of the Project area (Figure 2.2).

Raptors may fly over or move through the Project area during migration; however, because the Project area lacks the defined topographical ridges or other features that typically concentrate use by migrating raptors (e.g., raptors are more likely to travel along north-south oriented large water bodies during migration [Liguori 2005]). Higher use by migrating raptors may occur along Lone Tree Lake, Lake Francis, Lake Alice, and riparian corridors along the streams and unnamed drainages within or surrounding the Project area. Potential foraging habitats for a wide range of raptor species occur throughout the Project area, but no unique land features or habitat types are known to occur in the Project area that could concentrate raptor prey species and therefore, potential raptor use. Based on presence of potentially suitable nesting habitat in the Project area and maps of raptor species' breeding ranges, fifteen raptor species have the potential to breed in the Project area (Chodachek and Agudelo 2017; NatureServe 2017; SDGFP 2017b).

Two U.S. Geological Survey (USGS) Breeding Bird Survey (BBS) routes occur in the vicinity of the Project area, including (the Dawson Route, located approximately 26 km [16 mi] east, and the Tyler Route, located approximately 45 km [28 mi] southeast of the Project area, respectively. The most common bird species recorded along these routes were common grackle (*Quiscalus quiscula*) and red-winged blackbird (*Agelaius phoeniceus*) (Pardieck et al. 2016). Ten Birds of Conservation Concern species have been observed on the Dawson and Tyler Route, respectively, including the bald eagle and Swainson's hawk (*Buteo swainsoni*); however no federally or South Dakota state-listed threatened or endangered species have been recorded (Pardieck et al. 2016).

### *2.4.2 Bat Resources*

The Project is within the range of six bat species, including the hoary bat (*Lasiurus cinereus*), big brown bat (*Eptesicus fuscus*), little brown bat (*Myotis lucifugus*), eastern red bat (*Lasiurus borealis*), silver-haired bat (*Lasionycteris noctivagans*), and northern long-eared bat (Bat Conservation International 2016; SDGFP 2017b; USFWS 2016b, 2017).

A desktop habitat assessment using NLCD data (NLCD 2011, Homer et al. 2015) and a review of aerial imagery were conducted for the Study Area to confirm or correct the presence or absence of landscape features to the extent possible. Approximately 107 ha (265 ac) of forested

habitat (deciduous forest) that may provide foraging and roosting habitat opportunities for tree-roosting bats was estimated to be present within the current Project area. The majority of this forested habitat is located along the forested patches of Lost Creek, Crow Timber Creek, and Monighan Creek as well as scattered wooded patches throughout the Project area (Chodachek and Agudelo 2017). Bats likely forage and travel throughout the Project area, but may be particularly active near forest edges, wetlands, and streams where prey and water resources are more abundant (BMEC 2018f). The presence of wetlands, ponds, drainages, and cultivated cropland throughout the Project area may provide additional foraging and drinking opportunities for bats. No public documentation is available indicating the presence of caves known to support bats or hibernacula in Deuel County (South Dakota Bat Working Group 2004); however, a narrow band of potential karst features, often associated with caves that may serve as hibernacula for bats, extends through eastern South Dakota, including Deuel County (Weary and Doctor 2014).

## 2.5 Endangered, Threatened, and Sensitive Species

The USFWS county distribution list and SDGFP county distribution list identified the potential for several federally listed and state listed species to occur within Deuel County. These include: Topeka shiner (federally endangered), Poweshiek skipperling (federally endangered), Dakota skipper (federally threatened), rufa red knot (federally threatened), and the northern long-eared bat (Federal threatened). Although not included in the USFWS county distribution list, the federally endangered whooping crane is a state-endangered species in South Dakota, and may move through the Study Area during migration (Chodachek and Agudelo 2017; BMEC 2018f) based on distribution ranges and/or regional sightings (eBird 2017; NatureServe 2017).

Habitat for protected or sensitive species was identified within the Study Area including wetlands, grasslands, prairie, depressions, and other habitats potentially utilized by endangered, threatened, and sensitive species. Based on the results of the Tier 2 evaluations, Deuel Harvest coordinated (and is continuing to coordinate) with wildlife agencies, and has conducted multiple surveys within and around the Study Area (described further in Section 3 Tier 3 Field Studies).

### *2.5.1 Birds*

Rufa red knot is a potential migrant over Deuel County, South Dakota. According to the eBird database, the nearest rufa red knot observation to the Project area was made during spring migration approximately 27 km (16 mi) northeast of the Project area (eBird 2017). During migration, rufa red knot stopover sites include marine habitats, coastal inlets, estuaries, and bays (USFWS 2014a). Although there is potential for rufa red knot to migrate through the Project area in spring and fall, the species is unlikely to occur based on lack of suitable stopover habitat within the Project area and lack of confirmed observations in the region (eBird 2017).

Whooping crane stopover sites include areas along rivers, and croplands interspersed with palustrine wetlands. The closest eBird observation relative to Project area was approximately 51 km (32 mi) southeast of the Project area during fall of 2008 (eBird 2017). The Project area is primarily composed of cropland and herbaceous cover, with interspersed streams and areas of

open water, which may provide potentially suitable stopover habitat during the spring and fall migration for whooping cranes. However, the likelihood of whooping cranes occurring in the Project area during migration is low based on the limited amount of wetlands and open water in the Project area (approximately 7%), and the Project area's location 121 km (75 mi) east of the state's "primary occurrence area" for the species (Pearse et al. 2015).

The South Dakota state-threatened Osprey (*Pandion haliaetus*) also may occur within Deuel County. Osprey have been recorded in the general region of the Project area, primarily during migration, with the closest observation recorded approximately 10 km (six mi) north in Salt Lake, Minnesota (eBird 2017). Migrating Osprey may forage in the Project area using forested areas along riparian corridors, open water bodies, and open wetlands. However, the likelihood that osprey will occur in the Project area is low due to the limited amount of suitable breeding and foraging habitat and the lack of reported sightings of the species in both Deuel County and the Project area.

Bald and golden eagles are protected under the BGEPA and both occur in South Dakota. Bald eagles have the potential to occur in the Project area year-round, based on typical habitat associations and records to date. There is suitable bald eagle nesting, roosting, and foraging habitat within the Project area and vicinity, particularly near Lake Alice, Lake Francis, Lone Tree Lake, and surrounding rivers, creeks, scattered drainages and wetlands. Migrating bald eagles may forage in the Project area during the spring and fall periods, using the wetlands and waterbodies within the Project area (Chodachek and Agudelo 2017; BMEC 2018f).

Golden eagles do not breed in the region of the U.S. where the Project area is located, but observations have been reported in eastern South Dakota during spring, fall, and winter, and bald eagles have been publicly recorded within approximately 40 km (25 mi) of the Project area (eBird 2017). Potentially suitable foraging areas within the Study Area for migrating or wintering golden eagles primarily include herbaceous land cover types. Incidental occurrences of golden eagles are possible in the Project area; however, based on the low number of historical occurrences in the region and lack of incidental observations reported for the Project area, use is likely limited to rare occurrences during migration or winter (Chodachek and Agudelo 2017; BMEC 2018f).

### *2.5.2 Bats*

The northern long-eared bat is the only federally listed bat species with the potential to occur in the Project area. The final 4(d) rule[1] published January 14, 2016 (81 FR 1900), exempts from

[1] The final 4(d) rule published January 14, 2016 (81 FR 1900), exempts all incidental take of northern long-eared bats from otherwise lawful activities from take prohibitions under Section 9 of the ESA, except: take of northern long-eared bats in their hibernacula in areas affected by white-nose syndrome, take resulting from tree removal within 0.4 km (0.25 mi) of a known northern long-eared bat hibernaculum, and take resulting from removal of a known northern long-eared bat maternity roost tree or tree removal within a 45-meter [m] (150-foot [ft]) radius of a known northern long-eared bat maternity roost tree during the pup season (from June 1 – July 31). Incidental take

Section 9 take prohibitions the incidental take of northern long-eared bats resulting from most otherwise lawful activities, including incidental take of northern long-eared bats due to the operation of wind turbines (see footnote in Section 1.4.1 for more information).

Northern long-eared bats were documented during acoustic studies conducted in 2011 and 2012 by the SDGFP 200 km (124 mi) south of the Project area in Union County, South Dakota (SDGFP 2014 in USFWS 2015c). Similarly, the closest known publically available capture record of northern long–eared bat was in central South Dakota, 200 km (124 mi) south of the Study Area (Swier 2006; Kiesow and Kiesow 2010). The nearest known maternity roost trees and hibernacula are located in Minnesota approximately 209 km (130 mi) and 241 km (150 mi) east, respectively, of the Project area (MDNR 2017c).

Although northern long-eared bats may migrate through the Project area, limited roosting and foraging habitat occurs within most of the Project area. Based on 2011 NLCD forest land cover types and additional forested areas digitized from aerial images, an estimated 107 ha (265 ac) of potentially suitable forest habitat occurs in the current Project area (Chodachek and Agudelo 2017; Figure 2.5). Although a minimum patch size has not been defined for suitable northern long-eared bat roosting habitat, studies of northern long-eared bats in agricultural landscapes have found that northern long-eared bats may use woodlots and riparian areas with as little as 6–20 ha (15–49 ac) of forest cover (Foster and Kurta 1999, Henderson and Broders 2008). Many of the forested patches are small and highly fragmented; however, a few woodlots and forested riparian corridors along the eastern part of the Project area may provide potential roosting habitat for northern long-eared bats. Additionally, suitable habitat is likely present along the limited riparian areas within the Project area, although mist-netting surveys conducted in the first year study area determined northern long-eared bats were likely absent from these areas. Thus, summer roosting and foraging habitat for northern long-eared bats from maternity colonies, if present, may exist in the larger contiguous woodlots and some forested riparian corridors in the Project area. Northern long-eared bats also may move through the Project area when migrating from these forested tracts to undocumented hibernacula in the region. However, northern long-eared bats are not expected to occur in the Project area based on: 1) the distance to the closest known hibernacula in eastern Minnesota (approximately 241 km [150 mi] east of the Project area), 2) the lack of evidence of caves or mines (based on publically available data and site reconnaissance) suitable for bat hibernacula within the Project area, and 3) the lack of northern long-eared bat captures during on-site mist-netting in the Study Area (Section 3.2.2).

resulting from hazard tree removal for protection of human life and property is exempt from take prohibitions, regardless of where and when it occurs.

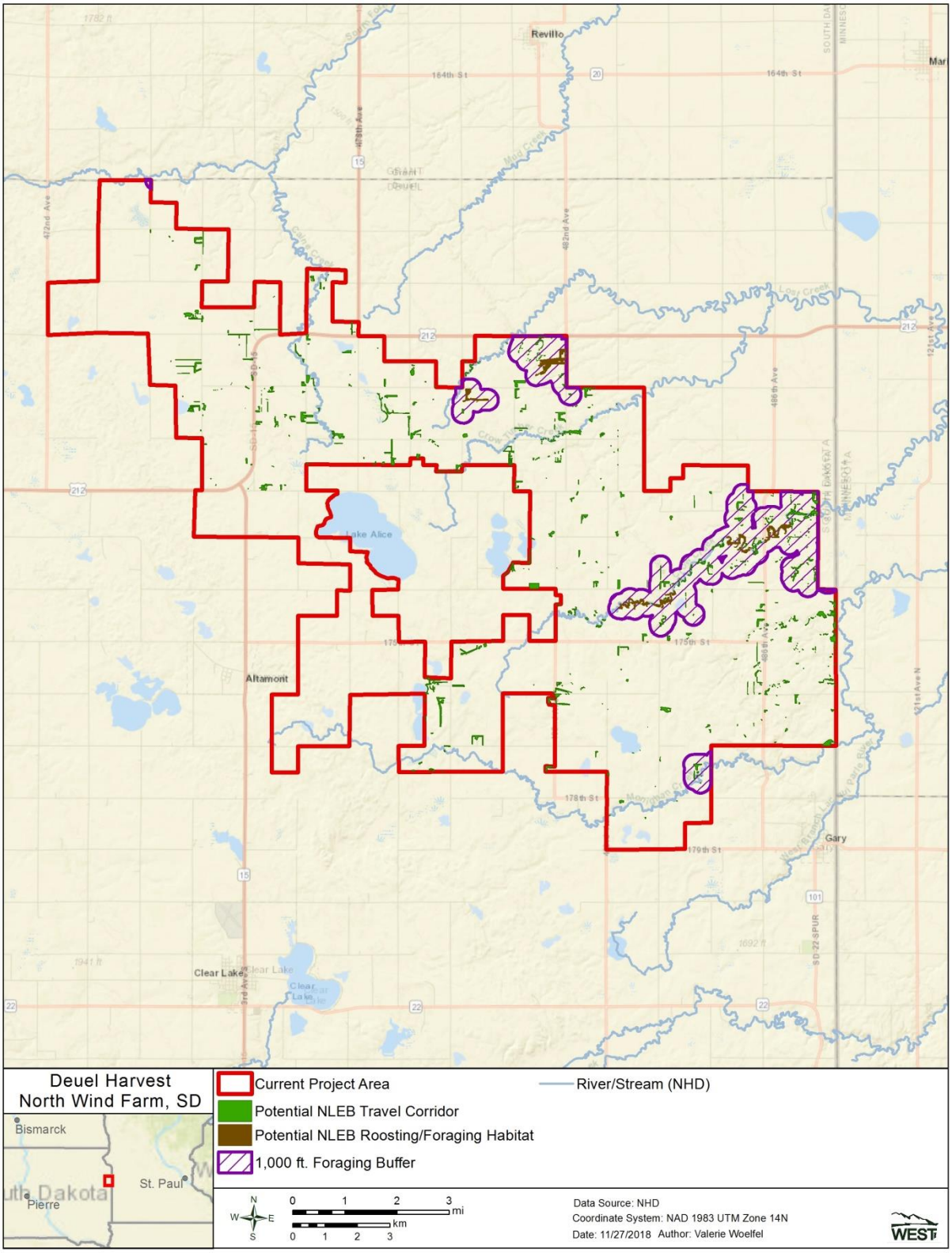


**Figure 2.5 Results of the desktop habitat assessment for northern long-eared bats within the Deuel Harvest North Wind Farm in Deuel County, South Dakota.**

# 3 TIER 3 – FIELD STUDIES

To evaluate avian resources and bat activity within the Study Area and assess potential impacts from the proposed Project, several Tier 3 studies were conducted and others are ongoing.

Tier 3 studies completed in the first year (2016-2017) of study include:

- Raptor nest study (Chodachek 2017c)
- Large-bird use study (Chodachek and DiDonato 2017)
- Small-bird use study (Chodachek and DiDonato 2017)
- Breeding bird study (Chodachek 2017b)
- Bat acoustic study (Chodachek 2017a)
- Bat mist-netting study (Chodachek et al. 2016)

Tier 3 studies completed in the second year (2017-2018) of study include:

- Raptor nest study (BMEC 2018a)
- Large-bird use study (BMEC 2018b)
- Bat acoustic study (BMEC 2018c)
- Butterfly habitat assessments (BMEC 2018d; 2018e) (these studies are not detailed in this document as they do not evaluate avian or bat resources; however, they are referenced here as additional Tier 3 studies)

## 3.1 Birds

### *3.1.1 Raptor Nest Study*

#### 3.1.1.1 Methods

The first year raptor nest aerial survey was conducted from a helicopter from March 28, 2016 – April 1, 2016, within the first year study area and 3.2- and 16.1-km (2.0- and 10.0-mi) buffers around the first year study area for all raptor nests and eagle nests, respectively (Chodachek 2017c). Parallel transects were flown approximately 0.8 km (0.5 mi) apart for complete coverage of the first year study area. Within the 3.2- and 16.1-km (2.0- and 10.0-mi) buffers, a survey route was planned using aerial imagery and the USGS National Land Cover Dataset (NLCD 2011, Homer et al. 2015) to identify potentially examine suitable bald eagle and other raptor nesting habitat within the buffer areas. Suitable nesting habitat included forested areas, riparian corridors, and forested margins of waterbodies.

The second year survey was conducted from May 27 – 30, 2017. A ground-based raptor nest survey was conducted from public roads in the Project area to identify nests documented in the 2016 aerial survey (Chodachek 2017c) and record any new nests in the Project area. The study encompassed driving all public roads within the Project area scanning woodlots, shelterbelts, riparian areas, and other treed habitats.

A potential bald eagle nest was also monitored from February 5 – 6, 2019 to determine the activity status of the nest. The nest is located north of Lake Alice at approximate coordinates 44.893 degrees latitude, -96.631 degrees longitude, in T117N, R48W, S31 (southwest quarter). Additional monitoring of this nest and eagle flight path mapping will be completed over seven survey events during the period of March – July 2019. Raptor nest aerial surveys will be conducted from a helicopter in March – April 2019 within a survey area that includes the proposed Project layout and 1-km (0.6-mi) plus a 3.2-km (2.0-mi) buffer for all raptor nests, as well as a 16.1-km (10.0-mi) buffer for eagle nests. Parallel transects will be flown approximately 1.6 km (1.0 mi) apart within the 3.2-km (2.0-mi) buffer and areas of woodland habitat potentially suitable for eagle nests will be flown in the area between the 3.2-km (2.0-mi) and 16.1-km (10.0-mi) buffer.

#### 3.1.1.2 Results

During the first year study, within the raptor nest study area (first year study area plus 3.2-km [2.0-mi] buffer, five occupied red-tailed hawk (*Buteo jamaicensis*) nests, two unoccupied, inactive potential bald eagle nests, one occupied unknown raptor (non-eagle) nest, and 15 unoccupied inactive raptor (non-eagle) nests were documented (Figure 3.1). The five red-tailed hawk nests and one occupied unknown raptor (non-eagle) nest were located within the first year study area.

Within the eagle nest study area (first year study area plus 16.1-km (10.0-mi) buffer, seven occupied bald eagle nests and one unoccupied or inactive potential bald eagle nests were located (Figure 3.1). All seven occupied, active bald eagle nests had at least one adult on the nest in an incubating position. The closest occupied bald eagle nest was 2.4 km (1.5 mi) southwest of the Project area. One unoccupied, inactive potential bald eagle nest was documented in the current Project area. No federally or state-listed threatened or endangered species were documented during the raptor nest survey.

During the second year study, six occupied red-tailed hawk nests, one occupied unknown raptor nest, and 12 unoccupied inactive raptor nests were identified in the Project area. Of these 19 nests, 13 were in the approximate locations of previously recorded nests documented in the 2016 aerial nest survey. No bald eagle nests were documented in the Project area. No federally or state-listed threatened or endangered species were documented during the raptor nest survey.

One large stick nest was observed during the February 2019 eagle nest monitoring and two eagle flight observations were noted in the vicinity of the nest. No eagles were observed sitting on or near the nest. The March – July 2019 bald eagle nest monitoring and flight path mapping are ongoing.

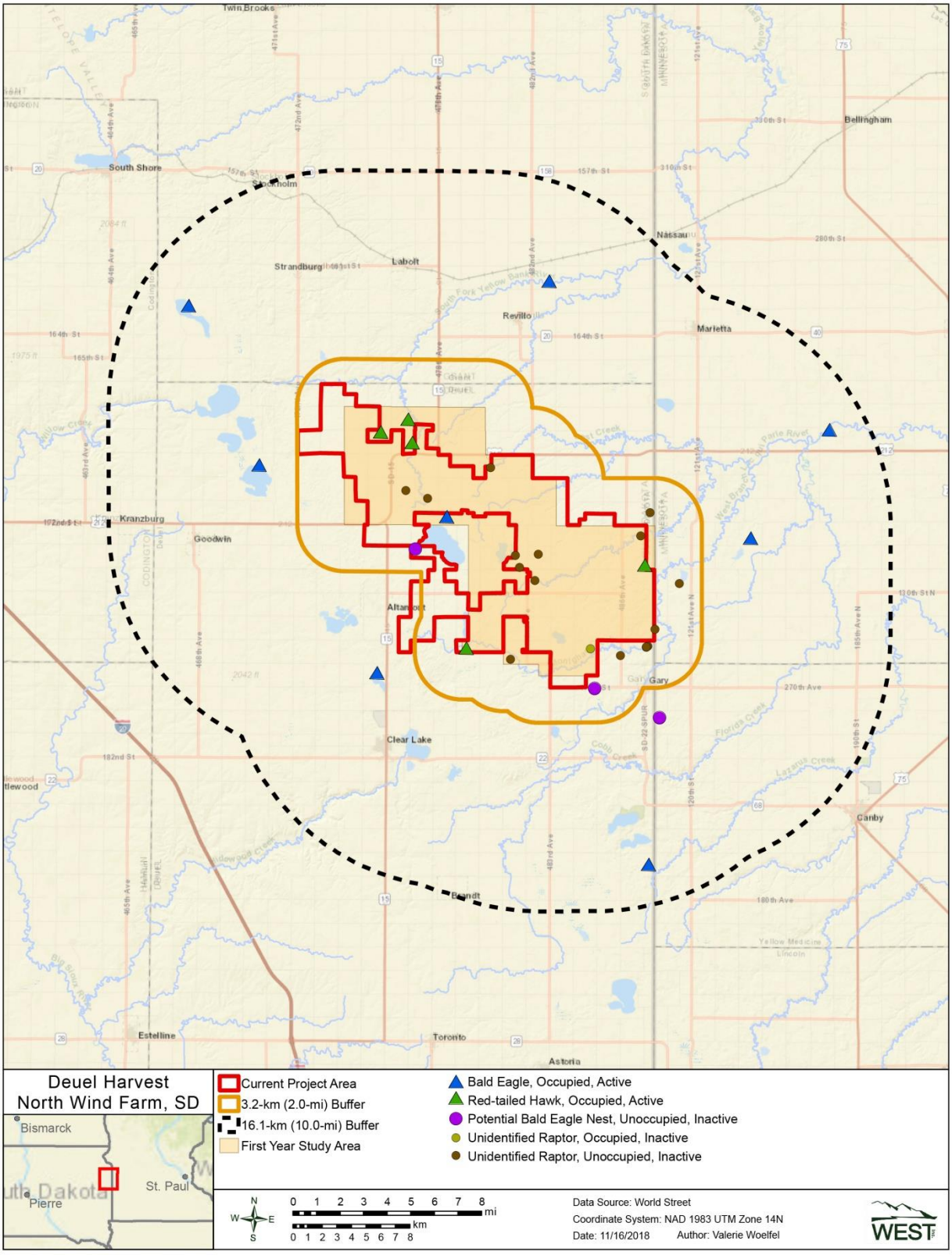


**Figure 3.1 Results of a raptor nest study conducted from March 28 – April 1, 2016 within the Deuel Harvest North Wind Farm first year study area and 3.2- and 16.1-kilometer buffers.**

### *3.1.2 Large-bird Use Study*

#### 3.1.2.1 Methods

The objective of the large-bird use study was to evaluate (1) species composition, relative abundance, and diversity; (2) overall use, percent of use, and frequency of occurrence; (3) flight height; and (4) spatial use by large birds. Additional objectives were to document potential use of the Project area by federally or state-listed threatened, endangered, and sensitive avian species and to record the number of minutes eagles were present within the Project area. This study effort was conducted using methods described by Reynolds et al. (1980). Data for eagle observations were recorded according to the ECPG (USFWS 2013). Large-bird avian use studies were conducted for two years.

The first year of the study was conducted from April 3, 2016 – March 24, 2017. At the initiation of the study on April 3, 2016, 24 survey points consisting of 800-m (2,625-ft) radius circular plots were established along public roads throughout first year study area. In January 2017, the first year study area was expanded and 10 additional survey points were established to provide coverage of the expansion study area, resulting in a total of 34 survey points for the remainder of the study. Surveys were conducted at half of the survey points approximately every two weeks, rotating between odd- and even-numbered points, resulting in 13 total visits to each point over the survey year. Surveys were conducted during daylight hours for 60 minutes (min)at each survey location and the order for surveying locations was rotated to ensure each plot was surveyed at various times of the day over the study period.

All large-bird species observed were recorded, regardless of distance. Large birds included the subtypes of waterbirds, waterfowl, rails and coots, grebes and loons, gulls and terns, shorebirds, diurnal raptors, owls, upland game birds, doves/pigeons, large corvids, and goatsuckers. Large birds observed or heard within the 800-m (2,625-ft) plot at each survey location were included in statistical analyses (Chodachek and DiDonato 2017).

Bald eagle and golden eagle observations were recorded at 1-min intervals, documenting when an eagle was within the 800-m (2,625-ft) plot and at or below 200 m (656 ft) above ground level (AGL), per the ECPG (i.e., eagle minutes). Flight height, distance, and activity (e.g., flying or perched) also were recorded during each 1-min interval. Eagles observed outside of the 800-m (2,625-ft) plot or at heights greater than 200 m (656 ft) were recorded, but were not included in the statistical analyses for eagle use. For eagle minutes, only observations of eagles flying within the 800-m (2,625-ft) plot x 200-m (656-ft) high cylinder were included. Perch locations and flight paths of eagles were mapped to qualitatively assess areas of eagle use within the Study Area. USGS topographic maps were used to record locations of observations as accurately as possible (USGS 2017).

Incidental bird observations were recorded when in transit between the standardized survey plots, focusing on sensitive species or large flocks of individuals. Sensitive species included species protected under the federal Endangered Species Act (1973), federal Bald and Golden

Eagle Protection Act (BGEPA; 1940), and state Endangered and Threatened Species. If sensitive species were observed, their approximate location was recorded.

The second year study was conducted from May 2017 – April 2018. Due to changes in the Project area, and accessibility of some survey sites, surveys were conducted monthly at 33 to 46 survey plots throughout the second year study period. In the second year, 60 minute surveys were conducted at survey plots that consisted of an 800-m (2,625-ft) radius x 200-m (656-ft) high cylindrical area and the order of sites surveyed was varied monthly (BMEC 2018b). Only large birds in flight within the cylindrical area described above were recorded; this methodology differs from the first year study, where all large birds were recorded within the 800-m (2,625-ft) buffer, but also included perched observations and unlimited height within each survey plot. Data collected for eagles was the same for both years of survey (i.e., only eagle observations in flight within an 800-m [2,625-ft] radius x 200-m [656-ft] high cylindrical area). Each eagle observed within the survey plot was recorded in "eagle minutes" and eagles observed outside of survey plots were recorded as incidental observations. Incidental observations also were recorded while in transit between standardized survey plots, focusing on sensitive species.

#### 3.1.2.2 Results

The first year of study included 342 large-bird use surveys. During these surveys, 30,398 large-bird observations within 1,021 separate groups were recorded within the 800-m (2,625-ft) survey plot. The observations consisted of 46 bird species. The most commonly recorded large-bird subtype was waterfowl (95.9% of large-bird observations), the majority of which were mixed flocks of snow goose (*Chen caerulescens*), greater white-fronted goose (*Anser albifrons*), Canada goose (*Branta canadensis*), and Ross's goose (*Chen rosii*), with 12,483 observations. Diurnal raptor species accounted for 0.7% of large bird observations (204 observations). The most common diurnal raptor species observed were red-tailed hawk and northern harrier (*Circus cyaneus*). Bald eagle and unidentified eagle accounted for 18.6% of the diurnal raptor observations (36 and 2 observations, respectively) and 0.1% of all large bird observations. Eagles were observed more often during spring (20 observations; 52.6% of all eagle observations) and winter surveys (12 observations; 31.6% of all eagle observations), than during summer (five observations; 7.9% of all eagle observations) or fall (three observations; 7.9% of all eagle observations).

Overall large-bird use over the first year study period was 78.9 observations/800-m (2,625-ft) plot/60-min survey, with the highest use recorded during the spring (250.3 observation/plot/60-minute survey); largely influenced by waterfowl observations), as compared to fall (34.9), winter (30.7), and summer (7.0). Raptor use was highest in the fall (1.6 observation/plot/60-min survey), followed by spring (0.9) summer (0.5), and winter (0.2). Eagle use accounted for 0.4% of large bird use in the winter and summer, 0.2% in the fall, and <0.1% in spring. Eagles were observed during 14.6% of spring surveys, 10.9% of winter surveys, 5.0% of fall surveys, and 3.1% of summer surveys.

Approximately, 51.5% of the 819 large-bird groups observed flying within the 800-m (2,625-ft) radius plots during the first year of study were within the estimated rotor-swept area (RSA) (25–150 m [82–492ft] above ground level), while 25.9% were flying below the RSA and 22.7% were flying above the RSA. Of these, 34.9% of diurnal raptors observed flying were within the RSA, 54.7% were below the RSA, and 10.4% were above the RSA.

During the first year of study, thirty-eight flying eagle observations were recorded. Half (50.0%) of these were within the RSA, 28.9% were below the RSA, and 21.1% were above the RSA. Eagle activity recorded within the first year of study amounted to a total of 114 eagle min. More eagle minutes were recorded during March 2017 (37 eagle min) and December 2016 (29 eagle min) than during any of the other months of the study (ranging from zero to 16 eagle minutes). Mapped bald eagle flight paths revealed no obvious concentrations of eagles in the Project area; eagle use was documented relatively evenly throughout the Project area.

During the second year surveys, 512 large-bird use surveys were conducted. A total of 3,528 large-bird observations within 484 groups consisting of 35 bird species were recorded. The most commonly recorded large-bird subtype was waterfowl (86.5% of large-bird observations), the majority of which were Canada goose (2,347 observations). Raptors accounted for 6.3% of large-bird individuals observed (223 individuals). The most common raptor species identified was red-tailed hawk, with 130 individuals observed. Bald and golden eagles (15 combined observations) accounted for 6.7% of all raptor observations and 0.4% of all large-bird observations.

Large-bird use was highest in spring (17.4 observations/plot/60-min survey), followed by fall (6.7), summer (2.4), and winter (1.3). Raptor use was highest in fall (0.8 observation/plot/60-min survey), followed by summer (0.5), spring (0.4), and winter (0.1). Eagle use was less than 0.1 individual per survey hour over the study period. Eagle use was highest in the winter and lowest in the summer, but was less than 0.1 observation/plot/60-min survey in all seasons.

Overall, 42.1% of the large birds observed flying during the second year study period were within the RSA. Among raptors observed flying, 35.7% were recorded within the RSA. Eagles were the raptor type most frequently observed within the RSH (53.3%), followed by buteos (40.6%).

Eleven bald eagle and four golden eagle observations were recorded. Eagle activity recorded within the second year of study amounted to 54 eagle minutes. More eagle minutes were recorded during December 2017 (29 eagle min) than during any of the other months of the study (ranging from zero to 15 eagle minutes). Eagle observations were scattered across several survey sites. Overall, no consistent flight patterns were observed based on location or direction of flight paths (BMEC 2018b).

### *3.1.3 Small-bird Use Study*

#### 3.1.3.1 Methods

The objective of the small-bird use study was to evaluate: (1) species composition, relative abundance, and diversity; (2) overall use, percent of use, and frequency of occurrence; (3) flight height; and (4) spatial use by small birds. Additional objectives were to document use of the Project area by threatened, endangered, and sensitive avian species.

The small-bird use study consisted of surveys conducted using the same point count locations as the first year of large bird surveys with the plot size reduced from an 800-m (2,625-ft) to a 100-m (328-ft) radius. Surveys were conducted approximately once per month for eight minutes per point at 24 survey locations from April 1, 2016 – December 2, 2016 and at 34 locations from March 7, 2017 - March 22, 2017. The additional 10 survey locations in March were added to provide coverage in the expansion study area which occurred in January 2017. As with the first year of large-bird surveys, small bird surveys were conducted at half of the survey points approximately every two weeks, rotating between odd- and even-numbered points to better account for temporal variation in bird use. All small-bird species observed within a 100-m (328-ft) plot at each point count location were recorded. Small birds observed beyond the 100-m (328-ft) radius were recorded as incidental observations. Incidental small bird observations were included in the development of species composition, relative abundance, and species diversity, but not included in analyses of avian use and flight heights (Chodachek and DiDonato 2017).

#### 3.1.3.2 Results

During 238 small-bird surveys conducted, 2,715 small-bird observations within 1,073 groups representing 49 bird species were recorded within and outside the 100-m (328-ft) survey plot. Passerines accounted for 96.2% of all small bird observations over the entire study period. The most abundant passerine species observed was horned lark (*Eremophila alpestris*; 397 observations), followed by brown-headed cowbird (*Molothrus ater*; 298 observations), and unidentified blackbird (245 observations). Woodpeckers, kingfishers, and unidentified birds combined accounted for 3.8% of small bird observations. Since only one belted kingfisher (*Megaceryle alcyon*) was observed during small bird use surveys, this species was excluded from the remaining results for small birds (Chodachek and DiDonato 2017).

Overall small bird use was highest in spring (9.5 observations/100-m [328-ft] plot/8-min survey) followed by fall (8.5) and summer (6.9). Passerines were observed during all three seasons, while woodpeckers were only observed in fall. Passerine use was highest during spring (8.8 observations/100-m [328-ft] radius plot/8-minsurvey) followed by fall (7.8) and summer (6.9). Passerines accounted for 99.8% of all small bird use in summer, 93.1% in spring, and 91.3% in fall. Passerines were observed during 96.9% of summer surveys, 80.1% of spring surveys, and 71.9% of fall surveys. Horned lark had the highest overall use of passerines (1.4 observations/100-m [328-ft] plot/8-min survey).

Overall, 2.7% of the small birds observed flying were within the RSA, 97.3% were below the RSA, and 0% were above the RSA.

### *3.1.4 Breeding Bird Study*

#### 3.1.4.1 Methods

The objective of the breeding bird study was to evaluate abundance and species composition of bird species that may use the grassland habitat within the Study Area. Additional objectives were to document use of the Study Area by threatened, endangered, and sensitive avian species.

The breeding bird study was conducted within nine grassland parcels with a minimum size of 65-ha (160-ac; U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines [USFWS 2012]) and a minimum distance of 100 m (328 ft) from gravel roads. Within each parcel, two 400-m (640-ft) long paired parallel transects 200 m (656 ft) apart were established to increase survey efficiency and minimize potential double counting of individual birds. Transect surveys were completed twice during the breeding season from June 15 – June 30, 2016 in the first year study area. Surveys were conducted from sunrise to 10:00 HR on days with no inclement weather (e.g., no rain, fog, winds greater than 35.0 km per hour [21.7 mi per hour]). Observers walked each transect at a constant pace and recorded all birds observed or heard within approximately 100 m (328 ft) of either side of the transect line.

#### 3.1.4.2 Results

During 18 breeding bird surveys conducted, 412 breeding bird observations in 244 groups composed of 30 species were recorded. Passerines accounted for 87.9% of all observations. The most common species observed was bobolink (*Dolichonyx oryzivorus*; 74 observations), followed by cliff swallow (*Petrochelidon pyrrhonota*; 72 observations), western meadowlark (*Sturnella neglecta*; 39 observations), common grackle (32 observations), barn swallow (*Hirundo rustica*; 31 observations), red-winged blackbird (23 observations), and Savannah sparrow (*Passerculus sandwichensis*; 21 observations). All other species observed had one to nine individual observations. Bird types observed included waterbirds, shorebirds, diurnal raptors, upland game birds, doves/pigeons, passerines, and goatsuckers. No federal or state endangered, threatened, proposed, or candidate species were observed during surveys.

## 3.2 Bats

### *3.2.1 Bat Acoustic Study*

#### 3.2.1.1 Methods

Bat acoustic studies were conducted from April 14 – November 3, 2016 (Chodachek et al. 2017) and July 20 – October 17, 2017 (BMEC 2018c). Study objectives were to: (1) estimate levels of bat activity near a forest/riparian area within the Study Area; and 2) estimate activity levels of bats with high high-frequency (HF) and low-frequency (LF) calls. Species with HF calls, such as eastern red bat, little brown bat, and northern long-eared bat have minimum frequencies above 30 kilohertz (kHz). Species with LF calls, such as big brown bat, silver-haired bat, and hoary bat, typically emit echolocation calls with minimum frequencies below 30 kHz.

For the first year of study, bat activity was recorded at one detector location using an AnaBat SD1 ultrasonic bat detector (Titley Electronics Pty Ltd., New South Wales, Australia) placed in a riparian area next to a forested patch near Long Tree Lake and an unnamed small creek. This site was chosen because it was considered likely to attract foraging bats within the first year study area. The detector was placed approximately 1.5 m (5 ft) above ground level, positioned towards an opening between forested patches, and programmed to record calls nightly from approximately 30 minutes (min) before sunset to 30 min after sunrise.

The resulting files were downloaded with CFCread© using the division ratio 16 and were viewed in Analook© software as digital sonograms that show changes in bat call frequency over time. Frequency versus time displays were used to separate bat calls from other types of ultrasonic noise (e.g., wind, insects) and to identify the call frequency group. A bat pass was defined as a sequence of at least two bat calls (pulses) produced by an individual bat with no pause between calls of more than one second (Fenton 1980). Any partial bat calls not meeting the definition of a full bat pass were labelled as noise. Bat passes per detector-night were calculated for all bats (based on the number of bat passes per detector-night when the detector was operating for the complete night) and separately for HF and LF call groups[2]. All averages of bat activity recorded across multiple dates were calculated as un-weighted averages of total bat activity (per night) at the detector. When appropriate, a standard error was calculated using bootstrapping. In those cases, 200 bootstrap samples were conducted with replacement from the pool of nights with functional detectors, and a standard error was calculated from the bootstrap samples. A standard error was not calculated if the number of functioning detector-nights was less than 10, a standard error was not calculated as aa bootstrap calculation with a sample sizeless than 10 may not result in a reliable estimate due to the selection of an unrepresentative sample or the tendency to repeat observations when the sample is small (Chernick 2008).

Temporal variation in bat activity was evaluated on a seasonal (spring [April 13 – May 15], summer [May 16 – August 15], and fall [August 16 – November 3]) and weekly basis. The period of peak sustained bat activity, calculated as a running average, was defined as the 7-day period with the highest average bat activity for each of the frequency classes (i.e., HF, LF) and the summed total.

For the second year of study, one Wildlife Acoustics SM3BAT recording device was deployed in the same location monitored the previous year. One ultrasonic microphone was placed at approximately three meters above ground. The detector was programmed to record calls nightly from 0.5 hour before sunset through 0.5 hour after sunrise. SM3BAT ultrasonic detectors record in full-spectrum and use omni-directional microphones. Because the first year of acoustic bat monitoring used Anabat detectors with directional microphones, a directional horn was attached to the microphone. The directional horns constrict the cone of detection, making the data more comparable to the data collected during the first year of study. Acoustic files were retrieved, and full spectrum audio files were converted to zero-cross format using Kaleidoscope Pro to make

[2] Bat pass rates represent indices of bat activity and do not represent numbers of individuals.

the data more comparable to recordings from to the first year of study. A filter was designed in Analook to remove noise files and partial calls. Bat passes were defined as at least two individual calls within one second. Bat passes were not identified to species, but were split into high-frequency (minimum frequency greater than 30 kHz) and low-frequency (minimum frequency less than 30 kHz) species groups.

#### 3.2.1.2 Results

During the first year of study, 5,468 bat passes were recorded over 204 detector-nights for an average bat activity rate (± standard error) of 26.8 ± 2.3 bat passes per detector-night. Bat activity was highest in the summer (May 16 – August 15; 38.1 ± 3.5 bat passes/detector-night), followed by fall (August 16 – November 3; 21.5 ± 3.3), and spring (April 13 – May 15; 7.6 ± 1.4). These seasonal patterns were the same for HF bat activity, with the highest levels of activity in summer (17.5 ± 2.0), followed by fall (14.5 ± 1.8), and spring (0.2 ±0.1). LF bat activity was highest in summer (20.6 ± 2.7), followed by spring (7.4 ± 1.4), and fall (7.0 ± 2.3). HF bat activity peaked at 51.9 bat passes per detector night from July 30 – August 5, and LF bat activity peaked at 56.0 bat passes per detector night from June 4 – June 10. Overall bat activity decreased substantially from mid-September to the end of the study in November.

During the second year of study, 4,196 bat passes were recorded over 89 detector-nights for an average bat activity rate (± standard error) of 47.1 ± 5.0 bat passes per detector-night. Bat activity was highest in the summer (July 20 – August 15; 91.6 bat passes/detector-night), and lower in the fall (August 16 – October 16; 27.8). These seasonal patterns were the same for both HF and LF bat activity.

### *3.2.2 Northern Long-eared Bat Presence / Absence Surveys*

#### 3.2.2.1 Methods

A mist-net study was conducted from July 22 – August 15, 2016 at seven mist-net sites to evaluate the potential presence of the federally threatened northern long-eared bat at the Study Area following the U.S. Fish and Wildlife Service 2016 Range-Wide Indiana Bat Summer Survey Guidelines (USFWS 2016a).

#### 3.2.2.2 Results

Bats were captured at five of the seven mist-net sites and included eight eastern red bats, four big brown bats, and one hoary bat. No northern long-eared bat were captured during surveys, therefore no telemetry was conducted and not bats were banded.

## 3.3 Sensitive Species Observations

During the first and second year large-bird use study, the small-bird use study, breeding bird study, and recordings of incidental observations, ten sensitive bird species were documented. No state-listed endangered species or federally listed species were observed during the large-bird use surveys, small-bird use surveys or incidentally. Four SDGFP Species of Greatest Conservation Need were observed, including American white pelican (*Pelecanus erythrorhynchos*; 206 observations in 58 groups), marbled godwit (*Limosa fedoa*; six

observations in three groups), willet (*Tringa semipalmata*; two observations in two groups), and great blue heron (*Ardea herodias*; one observation). Three sensitive raptor species were also observed, including bald eagle (BGEPA; 76 observations in 69 groups), golden eagle (BGEPA; four observations in four groups), and osprey (state-threatened; two observations in two groups). In addition, three USFWS Birds of Conservation Concern (USFWS 2008) were documented, including dickcissel (*Spiza americana*; six observations in five groups), grasshopper sparrow (*Ammodramus savannarum*; three observations in one group), and upland sandpiper (*Bartramia longicauda*; 12 observations in 12 groups).

## 3.4 Summary of Concerns Identified During Research and Analysis

### *3.4.1 Birds*

There are no records of the Rufa red knot in the vicinity of the Project area according to NHIS data. If the species were to occur within the Project area, it would likely be an isolated few individuals during spring or fall migration, stopping at ephemeral and permanent wetlands and ponds. Knot response to wind turbines is not well documented but is expected to be similar to many waterbirds and shorebirds, which in general do not appear to be significantly affected by wind turbines.

The Project area falls within the whooping crane migration corridor. It is possible that whooping cranes could stop during migration within the Project area, although this would not be expected to be a frequent or regular occurrence.

The Project has the potential to cause displacement of some bird species from the Project area due to increased human activity or the presence of tall structures. Many of the most-observed bird species within the first year study area were common, disturbance-tolerant species (Sections 3.1.1-3.1.4), similar to the species observed on the USGS BBS survey routes nearest the Project area (Section 2.2.1). However, shorebirds and waterfowl using saturated depressions within croplands in the Project area as stopover habitat during spring migration may be more sensitive to displacement by Project turbines, as displacement of these bird types has been reported at wind facilities in Europe (Winkelman 1990, Pedersen and Poulsen 1991, Spaans et al. 1998, Fernley et al. 2006).

In their 2017 report, “Wind Turbine Interactions with Wildlife and Their Habitats - A Summary of Research Results and Priority Questions” (American Wind Wildlife Institute [AWWI] 2017), the AWWI concluded that indirect impacts on birds from operating wind turbines due to displacement have been documented in a subset of the species studied, but these impacts have not been found consistently across studies. Research has indicated that indirect impacts of wind turbines on grassland nesting due to displacement vary across years, species, sites, and distance from turbines (Erickson et al., 2004; Hale et al., 2014; Hale, 2016; Johnson et al., 2000; Johnson, 2016; Leddy et al., 1999; Shaffer and Buhl, 2016; Shaffer and Johnson, 2009; Young et al., 2006). Indirect impacts due to displacement from wind turbines have also been studied in waterfowl. Loesch et al. (2013) studied changes in densities of five species of breeding waterfowl at two wind facilities in the Missouri Coteau of North Dakota and South

Dakota. Indirect impacts to breeding ducks were evident in about 50 percent of the site-year combinations, actual decreases in density were limited.

A combination of several factors contributes to avian and bat susceptibility to wind turbine collisions. These factors may include the abundance and composition of avifauna in the area, the way in which avifauna are dispersed across a geographic area, the presence of suitable nesting and foraging habitat, the presence and abundance of prey, the time of the day or night, season of the year, and the siting or layout of wind turbines. Predicting the fatality rates for the Project is best informed by examining the results of a number of key studies, Poulton (2010), the National Research Council (NRC; 2007), de Lucas et al. (2008), Ferrer et al. (2012), Hein et al. (2013), Marques et al. (2014), and Watson et al. (2018).

Based on Project data gathered to date, no significant adverse direct impacts are anticipated from the Project. The anticipated fatality rate for birds is expected to be within the range for other projects in Minnesota and South Dakota (Table 2). Publicly available studies from Minnesota and South Dakota (for studies conducted after 2005) suggest the range of estimated fatality rates is 0.44 to 8.25 birds/MW/year and 0 to 0.37 raptors/MW/year (Table 3.1).

At the Project, no single species is expected to experience a disproportionate amount of estimated mortality or impacts of a magnitude sufficient to affect the local or migratory population, as reflected in studies completed by Erickson et al. (2014). Additionally, the passerine species most- often observed during the pre-construction surveys and on the USGS BBS survey routes nearest the Project (i.e., common grackle and red-winged blackbird) are abundant (Chodachek and DiDonato 2017).

The Project area consists of several lakes and numerous creeks, rivers and drainages that are important aquatic habitat features on the landscape and concentrate use by waterfowl and shorebirds, potentially including some sensitive species, during migration and winter. Waterfowl were the most commonly recorded large-bird subtype during the large-bird use study (Section 3.1.2). However, waterfowl and shorebird carcass rates at wind energy projects have been low, even in areas of high use. Generally, waterfowl and shorebird carcass rates are insignificant at wind energy facilities compared to the relative abundance of these groups (Erickson et al. 2002). Relatively low numbers of waterfowl and shorebird carcasses have been consistently recorded during carcass monitoring studies at wind energy facilities over the past several years. For example, at nine wind energy facilities in the Midwest and western U.S., waterfowl comprised only 2.5% and shorebirds only comprised 0.2% of the 1,033 carcasses (Erickson et al. 2001). The NRC analyzed data from 14 studies (including four also used in Erickson et al. 2001) throughout the U.S. and found that waterfowl comprised about 2.0% and shorebirds comprised less than 1.0% of carcasses (NRC 2007). Therefore, based on available evidence, waterfowl and shorebirds do not seem especially vulnerable to turbine collisions and significant impacts are not likely.

**Table 3.1 Annual bird carcass rate results from post-construction monitoring studies conducted in Minnesota and South Dakota.**

| Project Name | State | Estimated Bird Carcasses/Megawatt/Year | Source |
|---|---|---|---|
| Big Blue | MN | NA | Chodachek et al. 2014 |
| Elm Creek | MN | 1.55 | Derby et al. 2010c |
| Elm Creek II | MN | 3.64 | Derby et al. 2012b |
| Grand Meadow | MN | NA | Chodachek et al. 2014 |
| Lakefield | MN | 1.07 | Westwood Professional Services 2015 |
| Moraine II | MN | 5.59 | Derby et al. 2010d |
| Oak Glen | MN | NA | Chodachek et al. 2014 |
| Prairie Rose | MN | 0.44 | Chodachek et al. 2015 |
| Buffalo Ridge I | SD | 5.06 | Derby et al. 2010b |
| Buffalo Ridge II | SD | 1.99 | Derby et al. 2012a |
| Prairie Winds | SD | 1.41 | Derby et al. 2012c and 2013 |
| Wessington Springs | SD | 0.89 – 8.25 | Derby et al. 2010a and 2011 |

The lakes and other water features in and around the Project area may increase the potential for bald eagles to use the Project area, particularly during winter. The presence of bald eagle nests within 16.1 km (10.0 mi) of the Project area may increase the potential for bald eagles to use the Project area during the nesting season. Based on avian use studies, eagle use of the Project was highest in winter and spring (and more eagle minutes were recorded in March and December than in any other month) and eagle activity did not appear to be concentrated around any particular landscape feature (Section 3.1.2). Golden eagles are expected to occur only as infrequent migrants through the Study Area (Section 2.2.1).

No federally threatened or endangered bird species were observed during pre-construction surveys within the first year study area or the second year Project area, and it is very unlikely that the Project would impact a federally listed bird species.

### *3.4.2 Bats*

Limited information is available regarding the disturbance or displacement of bats at wind energy facilities (Kunz et al. 2007a). Any bats roosting in the Project area may be temporarily disturbed by human activities, although roosting habitat is limited within the Project area and activities would largely occur away from drainages and human structures that could serve as bat roosts. Construction and decommissioning activities are not expected to require the removal of trees or old buildings, making it unlikely that roosting bats would be disturbed or incur mortalities. Turbines have been sited more than 305 m (1,000 feet) from roosting and foraging habitat, minimizing impacts to bats during operation. Therefore, it is unlikely that operation of the Project turbines would disturb or displace northern long-eared bats.

Six bat species known to occur in South Dakota may migrate through the Project area and the Project turbines are likely to result in some level of bat mortality. However, bat habitat for resident bats within the Project area is limited to a few forested patches, small groves of trees and fencerows near homesteads, and riparian corridors along creeks with fringe wetlands, particularly Crow Creek. Outbuildings and other anthropogenic structures may be used as roosting habitat by some species. Cultivated crops also may provide marginal foraging habitat

for bat species adapted to use such habitat. Due to the relatively small amount of habitat for resident bats, most bat mortality would likely involve migrating bats, as has been reported for numerous other projects (e.g., Johnson 2005, Arnett et al. 2008). Estimated bat carcass rates at the Project would likely be expected to be within the range of those reported from studies conducted at other wind facilities in the region. Based on publicly available studies conducted in Minnesota and South Dakota for studies conducted after 2005, the anticipated fatality rate for bats would range from 0.16 to 20.19 bats/MW/year, or an average of 3.36 bats/MW/year (Table 3.2).

Bat carcasses at wind energy facilities in the U.S. have mostly occurred in the swarming and migration seasons, typically between mid-July and mid-September (Howe et al. 2002, Johnson et al. 2003, Kerlinger et al. 2007, BHE Environmental 2010). Post-construction monitoring studies at wind energy facilities in Minnesota and Iowa also have reported a similar pattern, with most bat carcasses occurring during the fall migration season and consisting primarily of eastern red bats and hoary bats, both migratory tree bat species (Chodachek et al. 2014).

Based on these regional post-construction monitoring results and the Project's pre-construction acoustic study results, bat mortality risk from Project operations is expected to primarily affect migratory tree bats that are migrating through the Project area during the late summer or early fall. Turbines are sited away from wooded and riparian corridors to limit impacts to bats foraging or traveling along corridors. Additionally, certain weather conditions, including colder temperatures, low cloud ceilings, and high wind speeds, when turbines are most active, are likely to decrease the risk of bat carcasses (Kunz et al. 2007b, Gruver et al. 2009).

The Project area is located within the range of the federally listed northern long-eared bat. This species is not expected to breed or forage in the Project area during summer, although it could be present during migration (Section 2.3.2). Based on the Project's location relative to the nearest known northern long-eared bat hibernaculum (Section 2.3.2), no impacts to northern long-eared bats are expected to occur during the fall swarming period or during the winter when they are hibernating. As previously noted, the final 4(d) rule published on January 14, 2016 (81 FR 1900), exempts from Section 9 take prohibitions the incidental take of northern long-eared bats resulting from most otherwise lawful activities, including incidental take of northern long-eared bats due to the operation of wind turbines (see footnote in Section 1.4.1 for more information).

**Table 3.2 Annual bat carcass rate results from post-construction monitoring studies conducted in Minnesota and South Dakota.**

| Project Name | State | Estimated Bat Carcasses/Megawatt/Year | Source |
|---|---|---|---|
| Big Blue | MN | 6.33 | Chodachek et al. 2014 |
| Elm Creek | MN | 1.49 | Derby et al. 2010c |
| Elm Creek II | MN | 2.81 | Derby et al. 2012b |
| Grand Meadow | MN | 3.11 | Chodachek et al. 2014 |
| Lakefield | MN | 20.19 | Westwood Professional Services 2015 |
| Moraine II | MN | 2.42 | Derby et al. 2010d |
| Oak Glen | MN | 3.09 | Chodachek et al. 2014 |

| | | | |
|---|---|---|---|
| Prairie Rose | MN | 0.41 | Chodachek et al. 2015 |
| Buffalo Ridge I | SD | 0.16 | Derby et al. 2010b |
| Buffalo Ridge II | SD | 2.81 | Derby et al. 2012a |
| Prairie Winds | SD | 1.05 – 1.23 | Derby and Dahl 2012 and 2013 |
| Wessington Springs | SD | 0.41 – 1.48 | Derby et al. 2010a and 2011 |

# 4 AVOIDANCE AND MINIMIZATION MEASURES

## 4.1 Preconstruction Siting and Design

### *4.1.1 Turbine Siting*

- All wetlands, conservation easements, protected lands, and USFWS critical habitat will be avoided.
- Wind turbines and associated facilities for the Project will be sited with consideration for the topographic and environmental characteristics of the site, efficiency of selected turbine models, and minimal impacts to area residents.
- As recommended in the USFWS' Northern Long-Eared Bat Interim Guidance (USFWS 2014), all turbines will be sited more than 305 m (1,000 ft) from the edge of connected patches of forested habitat (Section 2.3.2) to avoid potential impacts to bats, including northern long-eared bats, during the summer.
- The Project's location in a predominantly previously disturbed landscape avoids the following habitat features: (1) habitats associated with any federally listed wildlife or plant species, (2) bird movement corridors, (3) landscape features that attract raptors, (4) bat hibernacula or maternity/nursery colonies, and (5) concentrated bird and/or bat use areas.
- Native habitat (including native prairie, forested habitat, and wetlands) will be avoided and previously disturbed lands (including existing roadways) will be used, where practical, to avoid wildlife habitat fragmentation. Potential undisturbed grassland impacts are estimated to be 0.09%.
- Turbines will be sited away from grassland habitat with records of Dakota skipper and Poweshiek skipperling, and any habitat potentially suitable for these species recorded during the Butterfly Habitat Assessments.
- Several alternative turbine locations were developed to provide an opportunity to avoid or minimize potential impacts to natural resources and to work around potential issues that may arise during Project development.
- All turbines will be sited away from the South Fork Yellow Bank River; the nearest turbine will be 3.73 km (2.32 mi) from the river.
- All turbines will be sited away from Lake Alice; the nearest turbine will be 1.21 km (0.75 mi) from the lake.
- All turbines will be sited away from Rush Lake, Lake Francis, and Lone Tree Lake; the nearest turbine to each lake will be 223 m (732 ft), 430 m (1,411 ft), and 863 m (2,831 ft), respectively.

- Turbines will be sited at least 800 m (2,625 ft) from the bald eagle nest identified north of Lake Alice (coordinates 44.893 degrees latitude, -96.631 degrees longitude, in T117N, R48W, S31 [southwest quarter]).
- All turbines will be sited away from the "Avoidance Areas" identified by the SDGFP.
- All turbines will be sited away from all USFWS WPAs and SDGFP GPAs; the nearest turbine to a WPA will be 442 m (1,450 ft) from Deuel County WPA 11; the nearest turbine to a GPA will be 244 m (801 ft) from Lone Tree GPA.

### *4.1.2 Turbine Design*

- Turbine towers will be designed and constructed to discourage bird nesting and wildlife attraction.
- The Project will employ unguyed, tubular towers with slow-rotating, upwind rotors.

### *4.1.3 Lighting*

- Aviation hazard lighting will be minimized to Federal Aviation Administration (FAA) requirements and strobed, minimum-intensity red lights will be installed on Project turbines, as recommended by the FAA and in the WEG (USFWS 2012) to avoid attracting birds or bats. Deuel Harvest will also employ an Aircraft Detection Lighting System (ADLS) at the Project, subject to availability and FAA approval
- Hoods/shields will be installed on exterior lights at the O&M building and substation to minimize skyward light.
- Turbine doors will not have exterior lights installed at the entrance.

### *4.1.4 Collection and Transmission Lines*

- Deuel Harvest will install an onsite electrical collection system underground; therefore, no bird collision or electrocution risks would apply to the buried lines.

- In the event the 34.5kV electrical collection lines require overhead construction, the structures will be designed and constructed in accordance with the Avian Power Line Interaction Committee's (APLIC) suggested practices to minimize potential electrocution risk to perching birds (APLIC 2006).

- Deuel Harvest will follow the most recent APLIC suggested guidelines to the extent possible based on local conditions and Project design and engineering. Specifically, this includes designing power lines for appropriate spacing and/or applying cover-up materials or devices to minimize electrocution risk of perching birds.
- The underground communication cables and power collection system will be buried along the access roads in trenches extending from each of the turbines to the Project's substation; lines will be buried along both private and public rights-of-way.
- If an avian collision risk is identified along the Project's transmission line during line operation, applicable measures to minimize the potential for bird collisions will be implemented in accordance with APLIC's suggested measures to increase the visibility of the smaller-diameter shield wire (e.g., flight diverters; APLIC 2012).

## 4.2 Construction

- Deuel Harvest will comply with all applicable federal, state, and local environmental laws, orders, and regulations.
- Prior to construction, all supervisory construction personnel will be instructed on the BBCS and wildlife resource protection measures, including: (1) applicable federal and state laws (e.g., those that prohibit animal collection or removal) and (2) the importance of these resources and the purpose and necessity of protecting them, and ensure this information is disseminated to applicable contractor personnel, including the correct reporting procedures.
- Construction personnel will be trained in the following areas when appropriate: awareness of sensitive bird species, potential bird nesting areas, potential bat roosting/breeding habitat, butterfly habitat, and general wildlife issues.
- Prior to construction, field surveys will be conducted to determine the presence of any jurisdictional wetlands or streams within the footprint of each turbine location and ancillary facilities; during construction, Deuel Harvest will comply with applicable federal regulations protecting waters of the U.S., as listed in Title 33 CFR Part 323.
- A Storm Water Pollution Prevention Plan will be prepared and implemented, as required by the U.S. Environmental Protection Agency (USEPA); the plan will include standard sediment control devices (e.g., silt fences, straw bales, netting, soil stabilizers, check dams) to minimize soil erosion during and after construction.
- Storm water management practices will be implemented to minimize open water resources that may attract birds and bats.
- During construction, existing trees, vegetation, water resources, and wildlife habitat will be protected and preserved to the extent practical.
- Traffic will be restricted to Project-specific roads; use of unimproved roads will be restricted to emergency situations.
- Speed limits will be set to ensure safe and efficient traffic flow; signs will be placed along roads, as necessary, to identify speed limits, travel restrictions, and other standard traffic control information.
- Following construction, temporary work areas will be graded to the approximate original contour, and the areas will be revegetated with approved seed mixtures; Deuel Harvest will consult with the Natural Resources Conservation Service and landowners on appropriate reclamation methods and seed mixtures.
- Noxious weeds will be controlled in all surface-disturbed areas using mowing and herbicides.
- All herbicide and pesticide mixing and applications will be conducted in accordance with all federal, state, and local laws and regulations and the specific product's label; herbicides and pesticides will only be directly applied to localized spots and will not be applied by broadcasting techniques.

## 4.3 Operation and Maintenance

### *4.3.1 Operational Procedures*

- Deuel Harvest will comply with all applicable federal, state, and local environmental laws, orders, and regulations.
- Traffic will be restricted to Project-specific roads; use of unimproved roads will be restricted to emergency situations.
- Speed limits will be set to ensure safe and efficient traffic flow; signs will be placed along roads, as necessary, to identify speed limits, travel restrictions, and other standard traffic control information.
- All carrion (with the exception of birds and bats) discovered on site during regular maintenance activities will be removed and disposed of in an appropriate manner to avoid attracting eagles and other raptors; birds and bats discovered on site will be addressed in conformance with the Project's incidental reporting process and the post-construction monitoring protocol in Section 5.
- In addition to carrion removal, Deuel Harvest will encourage landowners with livestock operations in and adjacent to the Project area to clear livestock carcasses regularly and expediently to avoid attracting eagles and other raptors to the Project area.
- Project turbines will be feathered below cut-in, 3.0 m per second (m/s; 6.7 mph) from sunset to sunrise April 1 – October 31 to reduce impacts to all bat species, including the northern long-eared bat. This feathering will reduce the speed that blades will rotate when the turbines are not generating electricity in order to minimize the risk of bat-blade collisions.
- Monitoring and adaptive management will be implemented in accordance with Sections 5 and 6 to ensure the effectiveness of the avoidance, minimization, and mitigation strategies incorporated into the Project, including the turbine operational protocol.

### *4.3.2 Training*

- All operations personnel will be provided training on the BBCS and practices to be used to avoid and minimize impacts to wildlife; this training will include identification of potential wildlife conflicts and the proper response, sensitivity to birds and other wildlife, and education on wildlife laws.
- An incidental reporting process will be developed for operations personnel ensuring they can document bird or bat casualties during routine maintenance work and at other times that they are within the Project area; incidentally found wildlife will be documented for the life of the Project to identify wildlife concerns, should they arise.
- All operations personnel will be directed to extinguish nighttime exterior lights at the collector station and at the substation when not in use, and operations personnel will be briefed on the importance of minimizing nighttime light use at the Project.

# 5 TIER 4 – POST-CONSTRUCTION AVIAN AND BAT MONITORING

## 5.1 Monitoring Goals

The goals of post-construction monitoring are to estimate bird and bat carcass rates for the Project, evaluate the circumstances under which carcasses occur, and provide an efficient, long-term survey protocol for detecting large-bird (i.e., large raptor, vulture, eagle) carcasses that may occur over the life of the Project. Post-construction monitoring results also provide the triggers for adaptive management, described in Section 6. In accordance with the WEG (USFWS 2012) and Bat Sampling and Collection Protocol Guidelines and Requirements (SDGFP 2001), the Project will analyze bird and bat carcass monitoring data to accomplish the following:

- Estimate bird and bat mortality rates for the Project
- Estimate mortality rates for species of concern
- Compare estimated mortality rates to predicted mortality rates
- Evaluate bird and bat carcasses within the Project site in relation to site characteristics
- Compare estimated mortality rates at the Project site to mortality rates at existing projects in similar landscapes with similar species composition and use
- Determine the composition of carcasses in relation to migrating and resident birds and bats at the site.
- Assess whether carcass data suggest the need for measures to reduce impacts

## 5.2 Permits and Wildlife Handling Procedures

### *5.2.1 Permits*

Any carcasses found during monitoring will be documented as described in Section 5.4.2.2. Deuel Harvest may elect to obtain federal and state collection permits; carcasses will be left in place and not handled unless permits are obtained, in which case carcasses will be handled in accordance with these permits.

### *5.2.2 Wildlife Handling Procedures*

All carcasses found will be documented as described in Section 5.4.2.2 and left in place (not handled) or handled in accordance with federal and state permits. In the event that a carcass of a federally or state-listed species or eagle is found, Deuel Harvest will cover the carcass with a container and contact the appropriate authorities. If an injured bird or bat is found, Deuel Harvest will contact the appropriate authorities and/or wildlife rehabilitator.

## 5.3 Monitoring

### *5.3.1 Study Design*

There are several sources of bias that may impact the results of post-construction monitoring at wind energy facilities. The wind industry, consultants, and various federal and state agencies have developed field and analytical methods to correct for these sources of bias. In particular,

post-construction monitoring practices account for sources of field-sampling bias, including: (1) variable carcass rates, (2) carcass removal by scavengers, (3) searcher efficiency, and (4) limited search area within nominal full plot area (e.g., road and pad surveys).

Details of the proposed post-construction monitoring will be dependent on final design (how many turbines are built, size and specifications of turbines and associated pads, etc.). The BBCS will be updated with the final protocol for post-construction monitoring once the final design is available.

Standardized carcass searches will be conducted weekly at Project turbines from March 15 to November 15 of the first full year of Project operations by a qualified consultant. The monitoring study design is meant to be intensive during the first year of monitoring to understand bird and bat carcass rates while also capturing important information about the distribution of carcasses around turbines. Collecting a robust data set through this design will provide important baseline information that can be used to assess impacts to birds and bats from the Project. Data will be used to determine how search parameters (e.g., number of turbines searched, search interval, necessity/size of cleared plots) can be adjusted if additional monitoring is pursued. Deuel Harvest will consider a second year of monitoring if results from the first year suggest a high degree of uncertainty on the level of bird and bat impacts (e.g., results show low searcher efficiency and/or high carcass removal rates that increase the level of uncertainty of actual impact). This decision will be made based on discussions with the SDGFP after the final report for the first year of monitoring is complete.

#### 5.3.1.1 Standardized Carcass Searches

Standardized carcass searches will be conducted using two types of surveys:

1) Road-and-pad surveys along access roads and on turbine pads within 60 m (197 ft) of approximately 50% of the turbines[3].
2) Cleared-plot surveys at approximately 10% of the turbines, or at least 10 turbines, along transects within cleared plots measuring 120 x 120-m (394 x 394-ft). These plots will be cleared of all vision-obstructing vegetation.

Surveying the roads and turbine pads generally ensures the highest probability of detection, with the added benefit of obviating crop clearing. Although these searches cover only a portion of the potential carcass deposition area underneath turbines, analytical methods for correcting carcass detection for unsearched area have progressed considerably (Hull and Muir 2010, Huso and Dalthorp 2014). Accurate and relatively precise estimates can be achieved by surveying easily searched areas with a high probability of detection, and using analytical methods to adjust for the amount of unsearched area (Huso and Dalthorp 2014). Furthermore, a larger sample of roads and pads (or in this case, the entire facility) can be surveyed for a fixed unit of

[3]The radius of the largest circle that fits inside a 120-m (394 x 394 ft) square is 60 m (197 ft). Therefore, 100-m (328-ft) radius road-and-pad plots cover more than the greatest extent of a 120-m (394 x 394 ft) cleared plot (out to about 85 m [279 ft] at the corners).

effort. A larger survey or full census provides additional information about spatial patterns within the facility and evaluation of landscape level variables that might affect carcass rate trends (e.g. distance to water features, relative composition of land cover within a fixed distance). The 60-m (197-ft) road-and-pad search radius should facilitate an efficient road-and-pad survey design, which minimizes the number of bat carcasses that go undetected due to falling (or being moved) outside of the plot radius.

Data collected through cleared-plot surveys will enable the development of a site-specific area correction to adjust estimated carcass rates calculated from carcasses found during road-and-pad searches. The 120 x 120-m (394 x 394-ft) area of cleared plots is expected to contain at least 89% of bat carcasses, based on carcass location data from eight post-construction carcass studies conducted in the Midwest (Barton I and II, BSGF, Elm Creek, Fowler I, II, III [2011], Fowler I, II, III [2012], Grand Ridge I, Moraine II, and Winnebago). Studies used to inform the bat distribution analysis were chosen based on availability of public bat carcass location data. Furthermore, models of bird-fall distributions suggest at least 80% of small-bird carcasses, and 50% of eagle and other large raptor carcasses may fall within 120 x 120-m (394 x 394-ft) cleared plots (Hull and Muir 2010).

#### 5.3.1.2 Search Intervals

The WEG recommend that “carcass search intervals should be adequate to answer applicable questions at an appropriate level of precision to make general conclusions about the project” (USFWS 2012). The WEG (USFWS 2012) further recommend that carcass search intervals should be adequate for the study’s target species.

The turbine search schedule and order will be randomized so each turbine’s search plot will be sampled at differing periods during the day. If more or less intensive monitoring is deemed necessary following initial data collection (carcass searches and carcass removal trials), the search intervals will be modified, accordingly.

Given the information presented above, road-and-pad searches and cleared-plot searches will be conducted weekly during spring, fall, and summer (March 15 - November 15) to estimate all-bird and all-bat carcass rates during the period of highest use. Search intervals will be adjusted if carcass removal data suggest faster removal times during some seasons after the initial data collection.

### *5.3.2 Field Methods*

#### 5.3.2.1 Carcass Search Protocol

During road-and-pad searches, a searcher will walk along the road and around the turbine pad, focusing search efforts for carcasses only on roads and pads. For cleared-plot searches, searchers will walk transects placed six m (20 ft) apart within the plot and scan the area on both sides of each transect out to three m (10 ft) for carcasses. Searchers will walk at a rate of approximately 45–60 meters per minute (m/min; 2 miles per hour [mph]).

5.3.2.2 Data Collection and Processing

All standardized carcass searches will be conducted by a biologist experienced in conducting carcass searches, including proper assessment and reporting of carcasses. Searchers will be familiar with and able to accurately identify bird and bat species likely to be found at the Project. Any unidentified birds and bats or suspected northern long-eared bats discovered during carcass searches will be picked up by an appropriate authority and sent to a qualified expert for positive identification.

For all carcasses found during standardized carcass searches, data recorded will include:

1) Date and time.
2) Initial species identification.
3) Sex, age, and reproductive condition (when identifiable).
4) Global positioning system location.
5) Distance and bearing to turbine.
6) Substrate/ground cover conditions.
7) Condition (intact, scavenged).
8) Any notes on presumed cause of death.
9) Wind speeds and direction and general weather conditions for nights preceding search.

At least one digital picture of each detected carcass will be taken. Bird and bat carcasses will be marked with spray paint and their location will be flagged with a short pin flag so searchers are aware the carcass has already been counted. Carcasses will either be left in place or collected in accordance with federal and state permits (Section 5.3).

Bird and bat carcasses found in non-search areas will be coded as “incidental finds” and otherwise documented in a similar fashion to those found during standard searches. The O&M personnel will be informed of the timing of standardized searches and, in the event that O&M personnel find a carcass or injured animal, they will report it (Section 5.5). Any carcasses found by O&M personnel also will be considered incidental finds. Incidental finds by O&M personnel within search areas will be included in survey summary totals and incorporated in the carcass rate estimates under the assumption that the carcass would have been found during the next search. Incidental finds by O&M personnel in non-search areas will be included in survey summary totals, but will not be included in the carcass rate estimates.

*5.3.3 Bias Trials*

5.3.3.1 Searcher Efficiency Trials

The objective of the searcher efficiency trials is to estimate the percentage of carcasses found by searchers. Searcher efficiency trials will be conducted in the same areas carcass searches occur. Searcher efficiency trials will begin when carcass searches begin. Personnel conducting carcass searches will not know when trials are conducted or the location of the carcasses.

Trials will be conducted to cover all seasons. Searcher efficiency rates will be estimated for each search type (e.g., turbine road and pad, tilled ground and cleared crops), size of carcass (large bird, small bird, and bat), and season (spring, summer, and fall). Estimates of searcher

efficiency rates will be used to adjust the total number of carcasses found to account for those expected to be missed by searchers.

To estimate searcher efficiency rates during the road-and-pad and cleared-plot surveys, approximately 15 carcasses of small birds and 10 large bird decoys will be placed in search areas during each search season (i.e., spring, summer, and fall), for a total of 75 carcasses. Bird carcasses used for searcher efficiency trials may consist of non-native/non-protected or commercially available species; examples include house sparrows (*Passer domesticus*) and juvenile common quail (*Coturnixcoturnix*) to represent small birds, and rock pigeons (*Columba livia*), mallards (*Anas platyrhynchos*), ring-necked pheasants (*Phasianus colchicus*), and adult common quail to represent large birds. Additional species may be utilized if they are more readily available than examples provided above. To measure detection bias for bats, up to 15 surrogate brown/black mice will be used during each season ( spring, summer, and fall), for a total of 45 "bat" searcher efficiency trials.

All carcasses will be placed at locations within areas being searched prior to the carcass search, but on the same day. Carcasses will be dropped from shoulder height and allowed to land in a random posture. Each trial carcass will be discreetly marked with a black zip-tie around the leg for birds or around the upper arm for bats (front leg for bat surrogates) prior to dropping so that it can be identified as a study carcass after it is found. The number and location of the detection carcasses found during the carcass search will be recorded. The number of carcasses available for detection during each trial will be determined immediately after the trial by the person responsible for distributing the carcasses.

#### 5.3.3.2 Carcass Removal Trials

The objective of carcass removal trials is to estimate the likelihood a carcass is available to be found as a function of the number of days it has been on the ground. Carcass removal includes removal by predation/scavenging or removal by other means, such as being plowed into a field. Carcass removal trials will be conducted approximately monthly to adequately cover all seasons and crop cover conditions. Estimates of carcass removal rates will be used to adjust the total number of carcasses found for those removed from the search area, correcting for removal bias.

Carcass removal trials will begin when carcass search studies begin. Trial carcasses will be placed in representative habitats within the facility, but at a great enough distance from turbines to avoid increasing risk to eagles and scavenging raptors, and to avoid carcass swamping at searched turbines. To estimate carcass removal rates during the road-and-pad and cleared-plot surveys, approximately 25 small bird carcasses will be placed along access roads within the facility, but outside of the search areas during each search season (i.e., spring, summer, and fall), for a total of 75 bird trial carcasses. Bird carcasses will consist of species similar to searcher efficiency trial specimens. In addition to birds, up to 10 surrogate bat carcasses will be placed during each of the spring, summer, and fall seasons, for a total of up to 30 trial carcasses. As for the searcher efficiency trials, bat carcass removal trials will be conducted using brown/black mice carcasses as a surrogate for bats.

As for the searcher efficiency trials, carcasses will be dropped from shoulder height and allowed to land in a random posture. Each trial carcass will be discreetly marked with a black zip-tie around the leg for birds or around the upper arm for bats (front leg for bat surrogates) prior to dropping so that it can be identified as a study carcass if it is found by other searchers or wind energy facility personnel.

Personnel conducting carcass searches will monitor the trial birds over a 30-day period according to the following schedule, as possible. Carcasses will be checked every day for the first four days, then on day 7, day 10, day 14, day 20, and day 30. This schedule may vary depending on weather and coordination with other survey work. Experimental carcasses will be left at the location until the end of the carcass removal trial. At the end of the 30-day period, any evidence of carcasses that remain will be removed from the search plot.

### 5.4 Incidental Monitoring

An incidental reporting process will be developed for operations personnel to ensure they can document bird or bat casualties during routine maintenance work and at other times they are within the Project area. Deuel Harvest will provide operations personnel with materials (e.g., posters) describing the incidental reporting process and reporting resources. Incidentally found wildlife carcasses will be documented for the life of the Project to identify wildlife concerns, should they arise.

### 5.5 Statistical Methods for Estimating Carcass Rates

Carcass rate estimation is a complex task due to a number of variables present in every study. Animal fatalities occur at an unknown rate, carcasses persist for variable amounts of time, and carcass detection is variable, based on carcass characteristics and ground cover. Fortunately, methods have been developed to account for these auxiliary variables in the estimation of carcass rates.

Estimates of facility-related carcass rates are based on:

1) Observed number of carcasses found during standardized searches during the monitoring year for which the cause of death is either unknown or is potentially facility-related.
2) Non-removal rates expressed as the estimated average probability a carcass is expected to remain in the search area and be available for detection by the searchers during scavenger removal trials.
3) Searcher efficiency expressed as the proportion of planted carcasses found by searchers during searcher efficiency trials.
4) Search area adjustment based on the plot size and carcass density.

Carcass rate estimates will be provided for the following groups, as appropriate, based on the results of the standardized carcass searches: (1) all birds, (2) small birds, (3) large birds, (4) raptors, (5) eagles, and (6) bats. The total number of carcasses found during standardized road-and-pad and cleared-plot searches will be tallied for each of the groups listed above. For each group, carcass rate estimates will be calculated by adjusting for carcass removal rates, searcher

efficiency rates, and (when appropriate) the proportion of carcasses expected to fall on roads and pads. In general, bias-adjusted carcass rate estimates are calculated via an equation of the form (Huso 2010, Korner-Nievergelt et. al 2011):

$$F = \frac{C}{r * p * A}$$

where $F$ is the adjusted carcass rate estimate, $C$ is the number of carcasses detected, $r$ is the probability a carcass is available to be found, $p$ is the probability a carcass is detected, and $A$ is density-weighted area correction for road and pad plots ($A = 1$ for cleared plots).

There are several carcass rate estimators that can be used for post-construction monitoring studies at wind energy facilities (e.g., Shoenfeld 2004, Huso 2010, Korner-Nievergelt et. al 2011). Some estimators are more appropriate under particular field conditions (e.g., removal time, search interval, detection probability) due to inherent biases in all estimators. The Huso (2010) estimator was demonstrated to be relatively robust under a wide range of field conditions, and will be used to estimate carcass rates for the Project; however, if a more appropriate carcass rate estimator is available at the time of analysis, and its implementation is agreed upon by all parties involved, then it may be implemented in lieu of the Huso estimator.

The estimates and 90% confidence intervals will be calculated using bootstrapping (Manly 1997). Bootstrapping is a computer simulation technique that is useful for calculating point estimates, variances, and confidence intervals for complicated test statistics. A total of 1,000 bootstrap replicates will be used. The lower 5$^{th}$ and upper 95$^{th}$ percentiles of the 1,000 bootstrap estimates will provide estimates of the lower limit and upper limit of an approximate 90% confidence interval on all estimates.

To account for unsearched area, a carcass density-weighted proportion of area approach is used to adjust carcass rate estimates found in searched areas (Huso and Dalthorp 2014). Separate estimates are calculated for birds and bats. A density-weighted approach assigns more weight to areas nearer the turbine (where carcass density is higher), and less weight to areas farther from the turbine (where carcass density is low). The result is an estimate of the proportion of carcasses expected to land within searched and unsearched areas around a turbine. Data collected from searched areas at the Project will be used to derive density models for bird and bat carcasses. If carcass counts are low, the carcass density distribution will be estimated using a Bayesian approach (Gelman et al. 2013), and existing publicly available data on bird and bat carcass distances from turbines in the U.S. will be used in conjunction with the Project's data.

## 5.6 Data Analysis and Reporting

### *5.6.1 Quality Assurance and Quality Control*

Quality assurance and quality control (QA/QC) measures will be implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field

surveys, observers will be responsible for inspecting data forms for completeness, accuracy, and legibility. A sample of records from an electronic database will be compared to the raw data forms and any errors detected will be corrected. Irregular codes or data suspected as being questionable will be discussed with the observer and/or project manager. Errors, omissions, or problems identified in later stages of analysis will be tracked back to the raw data forms, and appropriate changes for all steps or stages will be made.

#### *5.6.2 Data Compilation and Storage*

A database will be developed to store, organize, and retrieve survey data. Data will be keyed into the electronic database using a pre-defined format to facilitate subsequent QA/QC and data analysis. All data forms, field notebooks, and electronic data files will be retained for reference.

#### *5.6.3 Data Analysis*

Analysis of data collected during the post-construction monitoring study will include spring, summer, and fall season carcass rate estimates for bats and spring, summer, and fall carcass rate estimates for birds. Data analysis will be performed to assess carcass estimates by turbine location. Data also may be analyzed to determine the influence of factors such as date and location on bird and bat carcass rates.

A variety of statistical tests may be applied to the data to analyze the patterns of estimated carcass rates in relationship to species/genera/taxa, season, and location. Data will be analyzed using appropriate statistical procedures. Tests will be selected based on the parameter(s) under analysis, the ability of the data to meet test assumptions, and the suitability of tests for different forms of data.

#### *5.6.4 Reporting*

Deuel Harvest will prepare an internal annual carcass monitoring report following the completion of post-construction monitoring. The report will include carcass rate estimates and data summaries. Estimated carcass rates will be expressed both in terms of carcasses/turbine/year and carcasses/megawatt/year, as recommended by the WEG (USFWS 2012). This approach will facilitate comparison with other studies. The reports will include data analyses, including overall carcass rate estimates and a discussion of monitoring results and their implications.

If federal and state collection permits are obtained, Deuel Harvest will report carcasses in accordance with the permit requirements. Deuel Harvest will report any federally listed species or eagle carcasses found to the USFWS within one business day after species' identification has been confirmed.

# 6 ADAPTIVE MANAGEMENT

## 6.1 Adaptive Management Goals

The goals of the adaptive management plan are to enable the incorporation of results from the post-construction monitoring, O&M incidental reporting, industry research, and new regulatory

developments into the Project's bird and bat avoidance and minimization strategy. Certain trigger events and potential subsequent changes to the avoidance and minimization strategy have been defined as a part of the adaptive management plan to guide the adaptive management process. If the avoidance and minimization measures are not producing the desired results, adjustments will be made, as necessary, to reduce impacts to birds and bats.

## 6.2 Adaptive Management Triggers and Responses

Adaptive management measures for the Project will be triggered by the following events, which are further defined below:

- Greater-than-predicted bird or bat carcass rates (Section 3.4)
- Mass casualty event (ten or more carcasses documented at a single turbine in a five-day period)
- Discovery of the carcass of a federally listed species or eagle
- Discovery of a new and/or active eagle nest

Deuel Harvest understands that unanticipated events beyond these adaptive management triggers may arise, and Deuel Harvest will report and coordinate with the USFWS and SDGFP as necessary and appropriate to address any unanticipated issues. If appropriate, Deuel Harvest will conduct additional specific, targeted monitoring to determine if adaptive management measures are necessary and/or effective.

### *6.2.1 Greater-than-predicted Bird or Bat Carcass Rates or Mass Casualty Event*

Avian and bat carcass rates at the Project are expected to be within the range of those reported for similar facilities in Minnesota and South Dakota. The adaptive management triggers, based on the maximum bird and bat carcass rates from wind energy facilities in the region or a mass casualty event, will be structured to indicate whether the initial risk characterization was accurate and to identify whether certain factors have changed from the pre-construction conditions. Consequently, these triggers will communicate when risk re-evaluation from Project operation may be necessary.

If carcass rates are greater than the predicted range (Section 3.4) and are likely to exceed certain thresholds by species, or a mass casualty event is documented, Deuel Harvest will meet and confer with the USFWS and SDGFP as appropriate. If a particular cause can be identified, Deuel Harvest will develop specific mitigation measures in consultation with appropriate agencies to address the occurrence. Examples of potential adaptive management responses may include:

- Remove/modify the source of bird attraction
- Implement turbine operational protocols designed to reduce bat carcasses and target the particular issue identified during monitoring
- Implement technological solutions if new techniques or technology become available that are cost-effective and feasible to implement

### *6.2.2 Discovery of a Federally or State Listed Species' Carcass or Eagle Carcass*

If a federally listed species' carcass or eagle carcass is found at the Project, Deuel Harvest will take the following actions:

- Identify and secure the carcass at the place of its discovery in the field until USFWS can be reached and provide further instruction for carcass storage or pickup
- Notify the USFWS or SDGFP within one business day of the discovery and positive species identification confirmation of any federally or state listed species, respectively
- Notify the SDGFP in accordance with any state collection permits obtained
- Work with the USFWS to evaluate available data related to the carcass discovery and, as appropriate, identify and implement avoidance or minimization measures to avoid the risk of future fatalities; such measures may include adjusting the operational protocol at specific turbines during specific weather conditions or seasonal periods, followed by carcass monitoring to assess whether the avoidance or minimization measures are effective
- Assess the need to obtain take authorization under the ESA or BGEPA, or state law, in light of the new information

### *6.2.3 Discovery of a New and/or Active Eagle Nest*

Deuel Harvest will notify the USFWS if a new and/or active bald eagle nest is identified within 800 m (2,625 ft) of an operating turbine. If appropriate, Deuel Harvest may elect to monitor eagle activity in and around the eagle nest. Additionally, after the nesting season, Deuel Harvest will consider seeking a permit to remove the eagle nest in coordination with the USFWS and SDGFP.

# 7 KEY RESOURCES

| Resource | Phone Number |
|---|---|
| **U.S. Fish and Wildlife Service** | |
| South Dakota Field Office | 605-224-8693 |
| **South Dakota Department of Game, Fish and Parks** | 605-223-7660 |
| **South Dakota Public Utilities Commission** | 800-332-1782 |
| **Deuel Harvest North Wind Farm** | |
| Operations & Maintenance | TBD |

# 8 LITERATURE CITED

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## 8.3 Studies Used to Estimate Midwest Bat Distance Distribution

Big Blue

Chodachek, K., C. Derby, D. Bruns Stockrahm, P. Rabie, K. Adachi, and T. Thorn. 2014. Bat Fatality Rates and Effects of Changes in Operational Cut-in Speeds at Commercial Wind Farms in Southern Minnesota - Year 1: July 9 - October 31, 2013. Prepared for Minnesota Department of Commerce, St. Paul, Minnesota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota, and Minnesota State University Moorhead, Moorhead, Minnesota. May 23, 2014. Available online: http://mn.gov/commerce/energyfacilities/documents/MNDOC,%20Bat%20Fatality%20Study%20Year%201,%205.23.14.pdf

Elm Creek

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010c. Post-Construction Fatality Surveys for the Elm Creek Wind Project: March 2009- February 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Elm Creek II

Derby, C., K. Chodachek, and M. Sonnenberg. 2012b. Post-Construction Fatality Surveys for the Elm Creek II Wind Project. Iberdrola Renewables: March 2011-February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. October 8, 2012.

Grand Meadow

Chodachek, K., C. Derby, D. Bruns Stockrahm, P. Rabie, K. Adachi, and T. Thorn. 2014. Bat Fatality Rates and Effects of Changes in Operational Cut-in Speeds at Commercial Wind Farms in Southern Minnesota - Year 1: July 9 - October 31, 2013. Prepared for Minnesota Department of Commerce, St. Paul, Minnesota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota, and Minnesota State University Moorhead, Moorhead, Minnesota. May 23, 2014. Available online: http://mn.gov/commerce/energyfacilities/documents/MNDOC,%20Bat%20Fatality%20Study%20Year%201,%205.23.14.pdf

Lakefield

Westwood Professional Services (Westwood). 2015. 2014 Avian and Bat Fatality Monitoring, Lakefield Wind Project, Jackson County, Minnesota. Prepared for LWP Lessee, LLC, c/o EDF Renewable Energy, San Diego, California. Prepared by Westwood, Eden Prairie, Minnesota. March 30, 2015.

Moraine II

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010d. Post-Construction Fatality Surveys for the Moraine II Wind Project: March - December 2009. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Oak Glen

Chodachek, K., C. Derby, D. Bruns Stockrahm, P. Rabie, K. Adachi, and T. Thorn. 2014. Bat Fatality Rates and Effects of Changes in Operational Cut-in Speeds at Commercial Wind Farms in Southern Minnesota - Year 1: July 9 - October 31, 2013. Prepared for Minnesota Department of Commerce, St. Paul, Minnesota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota, and Minnesota State University Moorhead, Moorhead, Minnesota. May 23, 2014. Available online: http://mn.gov/commerce/energyfacilities/documents/MNDOC,%20Bat%20Fatality%20Study%20Year%201,%205.23.14.pdf

Prairie Rose

Chodachek, K., K. Adachi, and G. DiDonato. 2015. Post Construction Fatality Surveys for the Prairie Rose Wind Energy Facility, Rock County, Minnesota. Final Report: April 15 to June 13, 2014, and August 15 to October 29, 2014. Prepared for Enel Green Power, North America, San Diego, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. January 23, 2015. Available online: https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7BF38C2FEC-ED84-4813-AF3E-5A397A954A34%7D&documentTitle=20152-107006-01

Buffalo Ridge I

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010b. Post-Construction Fatality Survey for the Buffalo Ridge I Wind Project. May 2009 - May 2010. Prepared for Iberdrola Renewables, Inc., Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Buffalo Ridge II

Derby, C., K. Chodachek, and M. Sonnenberg. 2012a. Post-Construction Casualty Surveys for the Buffalo Ridge II Wind Project. Iberdrola Renewables: March 2011- February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 31, 2012.

Prairie Winds

Derby, C., A. Dahl, and A. Merrill. 2012c. Post-Construction Monitoring Results for the Prairiewinds Sd1 Wind Energy Facility, South Dakota. Final Report: March 2011 - February 2012. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. September 27, 2012.

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