Appendix K – Bird and Bat Conservation Strategy

BURNS McDONNELL

BIRD AND BAT CONSERVATION STRATEGY

SOUTH DEUEL WIND

DEUEL HARVEST WIND ENERGY SOUTH LLC

PROJECT NO. 134150

JUNE 14, 2024

CONTENTS

FIGURES

TABLES

List of Abbreviations

Abbreviation	Term/Phrase/Name
2016 Project Area	Project design at the time; roughly 55,642 acres.
2017 Project Area	Project design at the time; roughly 62,313 acres.
2019 Project Area	Project design at the time; roughly 35,644 acres.
2022 Project Area	Project design at the time; roughly 30,870 acres.
2023 Project Area	Project design at the time; roughly 48,730 acres.
ac	Acres
ADLS	Aircraft Detection Lighting System
APLIC	Avian Power Line Interaction Committee
AWWI	American Wind Wildlife Institute
BBCS	Bird and Bat Conservation Strategy
BGEPA	Bald Golden Eagle Protection Act
Burns & McDonnell	Burns & McDonnell Engineering Company, Inc
ECP	Eagle Conservation Plan
ECPG	Eagle Conservation Plan Guidance
ESA	Endangered Species Act
ETP	Eagle Take Permit
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
Ft	Feet
GPA	Game Production Area
ha	Hectares
IBA	Important Bird Area
Invenergy	Invenergy LLC
IPaC	Information for Planning and Consultation
Km	Kilometer
KMZ	Keyhole Markup Language, zipped
kV	Kilovolt
MBTA	Migratory Bird Treaty Act
MET	Meteorological
M	Meter
M/s	Meter per second

M/m	Meters per minute
Mi	Mile
Mph	Mile Per Hour
MW	Megawatt
NAIP	National Agriculture Imagery Program
NLCD	National Land Cover Dataset
NHIS	Natural Heritage Information System
NRC	National Research Council
NRCS	National Resources Conservation Service
NWI	National Wetlands Inventory
O&M	Operations and Maintenance
Project	South Deuel Wind Project
Project Area	The area that will be owned and developed
Project Components	Project facilities
Project Substation	Collection substation with 2 step-up transformers
QA	Quality assurance
QC	Quality control
SCA	State Conservation Area
SCADA	Supervisory Control and Data Acquisition
SDGFP	South Dakota Game, Fish and Parks
SGCN	Species of Greatest Conservation Need
South Deuel Wind	DEUEL HARVEST WIND ENERGY SOUTH LLC
SRA	State Recreational Area
Study Area	The Project Area + a buffer area
Transmission Line	Generation tie-in transmission facility
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WEG	Land-based Wind Energy Guidelines
WEST	Western EcoSystems Technology, Inc
WIHA	Walk-in Hunting Areas
Wind Farm	Wind energy conversion facility
WMA	Wildlife Management Area
WMD	Wetland Management District
WPA	Waterfowl Production Area

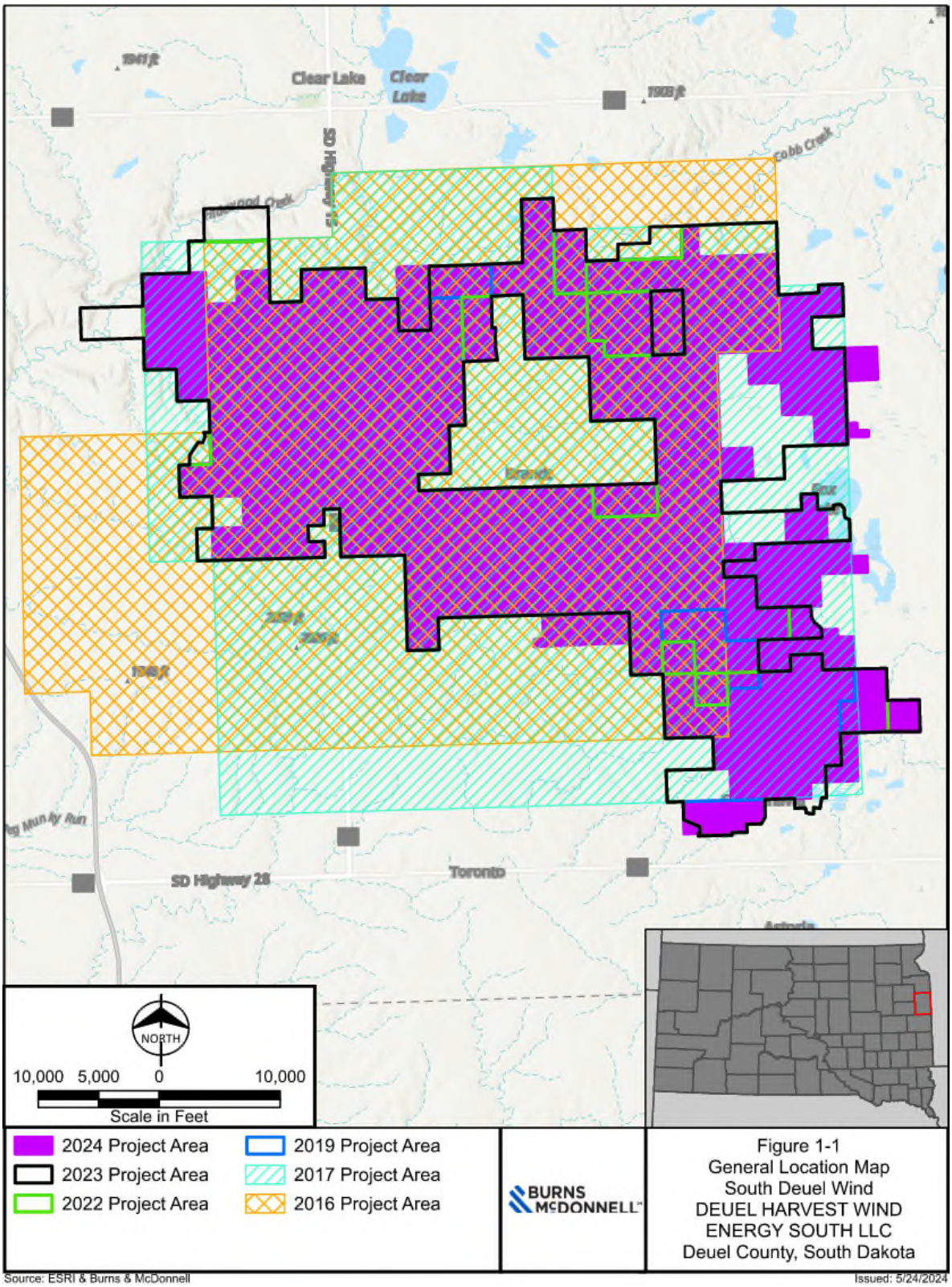
1.0 Introduction

DEUEL HARVEST WIND ENERGY SOUTH LLC (South Deuel Wind) developed this Bird and Bat Conservation Strategy (BBCS) for the South Deuel Wind Project (Project). Environmental surveys of the Project Area commenced in April 2016. An area larger than the 2024 Project Area was studied to provide the developer the flexibility to site the Project facilities away from sensitive environmental areas. The total area studied in 2016 (2016 Project Area) was 22,518 hectares (ha) (55,642 acres [ac]) (Figure 1-1). The 2017 Project Area consisted of 25,217 ha (62,313 ac), the 2019 Project Area consisted of 14,425 ha (35,644 ac), and the 2022 Project Area consisted of 12,493 ha (30,870 ac), The 2023 field studies were conducted in the 2023 Project Area which consisted of 19,720 ha (48,730 ac), and the hereafter referred to as the Project Area (Figure 1-1). Even though the Project Areas vary through the years, due to the similar land cover and ecological makeup across the region the results of each survey are consistent with what is expected for the 2024 Project Area.

The Project will consist of a wind energy facility (Wind Farm) with a nameplate capacity of up to 260 megawatts (MW) and deliver up to 250 MW to the point of interconnection. The wind energy facility will include up to 68 wind turbines. The transmission facility will operate at 345 kilovolts (kV) and be approximately 6 miles in length (Transmission Line). The Wind Farm and the Transmission Line are collectively referred to as the South Deuel Wind Project or Project. Project facilities (Project Components) will include the following:

- Up to 68 wind turbines
- The wind turbine generators will be supported by three-section tubular towers, and their maximum height will be 180 m.
- Electrical collection and supervisory control and data acquisition (SCADA) systems
- A 34.5 kV to 345 kV collector substation (Project Substation)
- An approximately 6-mile long 345 kV generator transmission tie line
- Improvements to enable the interconnection of the Project into the existing 345 kV Astoria interconnection switchyard
- An operations and maintenance (O&M) facility
- Access roads
- Up to three permanent meteorological (MET) towers
- An Aircraft Detection Lighting System (ADLS)
- Temporary construction areas, including crane paths, public road improvements, a general construction laydown yard, staging areas, and a concrete batch plant, as needed

Figure 1-1: General Location Map



1.1 Objectives

The objectives of the South Deuel Wind BBCS are as follows:

- Summarize the results of the Project's habitat evaluation and wildlife surveys and its progression through the Wind Energy Guidelines (WEG), Eagle Conservation Plan Guidance (ECPG), and agency coordination.
- Assess potential Project impacts to wildlife resources
- Identify measures that, when implemented during construction, operation, maintenance, and decommissioning at the Project, will avoid and minimize potential impacts to birds and bats
- Describe post-construction monitoring and adaptive management procedures to evaluate and then avoid or minimize potential impacts to species of special concern as defined in section 2.5.

This BBCS is a living document that will evolve throughout the life of the Project as needed in response to changing conditions.

1.2 Background

South Deuel Wind completed Tier 1, 2, and 3 studies consistent with the 2012 Land-Based WEG, which corresponds to Stages 1 and 2 of the 2013 ECPG, and the Siting Guidelines for Wind Power Projects in South Dakota. South Deuel Wind will conduct Tier 4 WEG studies (corresponding to stage 5 of the ECPG, and the SDGFP Guidance) in the Project Area once the Project is operational (USFWS 2012, USFWS 2013, SDGFP 2009). A summary of the pre-construction environmental studies completed to date for the Project is provided in Table 1-3 below and those pertaining to birds and bats are described in depth in Section 3.

Table 1-1: Environmental Studies Completed for South Deuel Wind

Studies	Year	Source
Breeding Bird Survey	2016	Western EcoSystems Technology (WEST)
Large Bird Use	2017	WEST
Large Bird Use	2018	Burns & McDonnell
Large Bird Use	2022	Burns & McDonnell
Raptor Nest	2016	WEST
Raptor Nest	2019	Burns & McDonnell
Raptor Nest	2022	Burns & McDonnell
Raptor Nest	2023	Burns & McDonnell
Bald Eagle Flight Path Monitoring	2023	Burns & McDonnell
Bat Habitat Assessment	2022	Burns & McDonnell
Bat Acoustic	2016	WEST
Bat Acoustic	2017	Burns & McDonnell
Bat Acoustic	2022	Burns & McDonnell
Protected Butterfly Species Habitat Assessment[a]	2017	Burns & McDonnell

Protected Butterfly Species Habitat Assessment[a]	2018	Burns & McDonnell
Protected Butterfly Species Habitat Assessment[a]	2022 – 2023	Burns & McDonnell
Grassland Assessment	2022	Burns & McDonnell
Wetland Delineation[a]	2017	Burns & McDonnell
Wetland Delineation[a]	2022 – 2023	Burns & McDonnell

[a] Indicates reports that are not discussed in detail in this document as they do not directly pertain to birds and bats.

1.3 Regulatory Framework

1.3.1 Endangered Species Act

The federal Endangered Species Act (ESA) defines and lists species as endangered and threatened and provides regulatory protection for the listed species (ESA 1973). The federal ESA provides a program for conservation of designated critical habitat that the USFWS has determined is required for the survival and recovery of these listed species. Section 9 of the federal ESA prohibits the take of species listed by USFWS as threatened or endangered. Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such conduct." In recognition that take cannot always be avoided, Section 10(a) of the federal ESA includes provisions for take that is incidental to, but not the purpose of, otherwise lawful activities. Section 10(a)(1)(b) permits (i.e., Incidental Take Permits) may be issued if take is incidental and does not jeopardize the survival and recovery of the species.

Section 7(a)(1) of the federal ESA requires all federal agencies, including the USFWS, to use their authorities in the furtherance of the purposes of the Act by carrying out programs for the conservation of endangered species and threatened species.

Section 7(a)(2) requires these agencies to evaluate projects with respect to any species proposed for listing or already listed as endangered or threatened and any proposed or designated critical habitat for the species. Federal agencies are prohibited from authorizing, funding, or carrying out any action that will jeopardize the continued existence of a listed species or destroy or modify its habitat. As defined in the federal ESA, individuals, organizations, states, local governments, and other non-federal entities are affected by the designation or critical habitat only if their actions occur on federal lands; require a federal permit, license, or other authorization, or involve federal funding (ESA 1973).

1.3.2 Bald and Golden Eagle Protection Act

The federal Bald and Golden Eagle Protection Act (BGEPA) of 1940 is administered by the USFWS and was enacted to protect bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*), their nests, eggs, and parts (e.g., feathers, talons, etc.). The BGEPA states that no person shall take, possess, sell, purchase, barter, offer for sale, purchase or barter, transport, export, or import any bald or golden eagle alive or dead, or any part, nest, or egg without a valid permit to do so. The BGEPA also prohibits the take or disturbance of bald and golden eagles unless pursuant to regulations. Take is defined by the BGEPA as an action "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." Disturbance is defined in the BGEPA 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" (USFWS 2023a). In addition

to immediate impacts, this definition also covers impacts that result from human-caused alterations initiated around a previously used nest site during a time when eagles are not present.

In 2009, the USFWS issued a final rule on new permit regulations that would allow some disturbance of eagles "in the course of conducting lawful activities" (74 FR 46836–46879). USFWS's description of its 2009 rule is "…regulations also establish permit provisions for intentional take of eagle nests under particular, limited circumstances", This would suggest that physical take of an eagle nest will only be authorized if every avoidance measure has been exhausted. Removal of nests will still generally be permitted only in cases where the nest poses a threat to human health, or where the removal would protect eagles. Explanations of the rule on USFWS's website specify that take permits may be issued when "necessary for the protection of…other interests in any particular locality" (USFWS 2009). The discussion expands the definition of such public and private interests to include utility infrastructure development and maintenance. Considerations for issuing take permits include the health of the local and regional eagle populations, availability of suitable nesting and foraging habitat for any displaced eagles, and whether the take and associated mitigation provides a net benefit to eagles (74 FR 46836–46879, USFWS 2009. In April 2013, USFWS issued ECPG Module 1: Land-based Wind Energy (Version 2) to address these new regulatory matters (USFWS 2013). Revisions to the final rule were issued in December of 2016. The permits authorize limited take of bald and golden eagles; authorizing individuals, companies, government agencies and other organizations to disturb or otherwise take eagles while conducting lawful activities. If eagles are identified as a potential risk at a project site, developers are encouraged to follow the ECPG. The ECPG describes specific actions that are recommended to achieve compliance with the regulatory requirements in the BGEPA and for an Eagle Take Permit (ETP), as described in 50 CFR 22.26 and 22.27. The ECPG provides a national framework for assessing and mitigating risk, specific to eagles, through development of Eagle Conservation Plans (ECPs) and issuance of programmatic ETPs for eagles at wind facilities. In September 2022, the USFWS proposed a new rule authorizing eagle take for other interests consisting of specific permits, general permits, and activity-specific permits (i.e., incidental take for qualifying wind energy projects and power lines projects, disturbance take, and nest take) to separate the regulations governing different activities (see 50 CFR 13 and 22).

1.3.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) makes it unlawful "by any means or in any manner, to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import …transport or cause to be transported… any migratory bird, any part, nest, or eggs of any such bird …" except as otherwise permitted under the regulations (16 USC 703). The USFWS has interpreted the MBTA to be a strict liability statute, meaning that proof of intent, knowledge, or negligence is not an element of an MBTA violation. Actions resulting in the "take" of a protected species, in the absence of a USFWS permit or regulatory authorization, are a violation.

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 MBTA does not have a provision directly prohibiting incidental takes and the definition of "take" does not include the broader terms of "harass" or "harm" that have been found to prohibit incidental take. At present, there is no MBTA permit authorizing the incidental or non-purposeful take of an MBTA-protected species.

The USFWS administers the MBTA and 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.

1.3.4 South Dakota State Threatened and Endangered Species

South Dakota's Endangered Species Statute (South Dakota Statutes, Title 34A Chapter 8) requires the SDGFP and the U.S. Department of Agriculture (USDA) to perform those acts necessary for the conservation, management, protection, restoration, and propagation of endangered, threatened, and nongame species of wildlife. In accordance with this mandate, the SDGFP has drafted a Wildlife Action Plan, which includes a list of Species of Greatest Conservation Need (SGCN; SDGFP 2023a). In addition to endangered and threatened species, the SGCN list includes species that are regionally or globally imperiled (or secure) and for which South Dakota represents an important portion of their remaining range and species with characteristics that make them vulnerable. The resulting List of Endangered, Threatened, and Special Concern Species is promulgated by the SDGFP Commission and reviewed biennially. The Endangered Species Statute also authorizes the Secretary of Agriculture and the Secretary of Games, Fish and Parks to enter cooperative agreements with federal or state agencies or private persons for management of nongame, endangered, or threatened species. The South Dakota Endangered Species Statute defines endangered, nongame, and threatened species as follows:

- *Endangered (E)* – any species of wildlife or plants which is in danger of extinction throughout all or a significant part of its range other than a species of insects determined by the South Dakota Game, Fish and Parks Commission or the secretary of the United States Department of Interior to constitute a pest whose protection under this chapter would present an overwhelming and overriding risk to man

- *Nongame species (NG)* – any wildlife species not legally classified a game species, fur-bearer, threatened species, or as endangered by statute or regulations of this state

- *Threatened (T)* – any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range

1.4 Agency Coordination

South Deuel Wind has been coordinating with the USFWS and SDGFP since 2016 as part of the Project development process. South Deuel Wind and the agencies had numerous discussions that included the sharing of public data on sensitive resources, environmental survey methods and results, and the incorporation of survey results into the Project design.

The USFWS Information, Planning, and Conservation System (IPaC; USFWS 2023b) report (2015, 2017 and 2018) and South Dakota Environmental Review query (SDGFP 2023c) (2016 and 2022) were generated and reviewed to conduct an initial review of the Project Area. These reviews were also completed in 2022 and 2023 to reflect the updated Project Area.

On March 31, 2016, South Deuel Wind 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. South Deuel Wind 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 South Deuel Wind have sited its facilities to avoid.

South Deuel Wind 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). No other records of significant natural features were noted in the vicinity of the Project area. 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.

South Deuel Wind 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. South Deuel Wind 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.

On May 25, 2017, South Deuel Wind conducted an online presentation and call with the USFWS South Dakota Ecological Services Field Office and SDGFP to review the Project Area at that time and to discuss the Year 1 avian study results as well as Year 1 bat survey methods including acoustic and mist-netting surveys. South Deuel Wind indicated that the next surveys planned may include Year 2 of large bird surveys, raptor nest surveys, wetland delineations, and assessments for grasslands. The USFWS recommended that South Deuel Wind continue with additional studies and consider avoiding grasslands and focus turbine siting in croplands. South Deuel Wind confirmed they were minimizing impacts to grasslands to the extent practicable and planning on conducting additional studies. The USFWS further recommended that South Deuel Wind avoid placing turbines between wetlands. The USFWS stated approval of the ongoing survey protocols and requested that South Deuel Wind 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.

The USFWS and SDGFP requested a site visit which was completed in 2017 as well. A site visit at the Project area was conducted by the USFWS with South Deuel Wind 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.

South Deuel Wind met with the USFWS and SDGFP on February 18, 2018, to discuss the results of the biological surveys that were conducted after the 2017 meeting and discuss updates to the Project siting as a result of engineering, stake holder interests, and environmental considerations. This meeting included a review of updates to completed and continued studies including avian use surveys and bat acoustic surveys . South Deuel Wind indicated there would be additional surveys to assess the Project Area for grasslands and avoid impacts to those areas to the extent practicable, assessments for protected butterfly species if needed, and raptor nest surveys in the future. South Deuel Wind reaffirmed they are committed to minimizing impacts, especially to grasslands and wetlands.

South Deuel Wind met with the USFWS and SDGFP on May 12, 2022, to provide an update on Project development and environmental surveys that would be completed in the near future. Results from Year 3 large bird surveys were reviewed and it was noted these studies were ongoing through June 2022. Additionally, South Deuel Wind stated that a raptor nest survey was completed, and passive bat acoustic surveys were underway in 2022 for the Project Area. South Deuel Wind stated that grassland and habitat assessment surveys were underway for protected butterfly species, but presence/absence surveys were not planned at this time. The SDGFP advised that an updated request to the Natural Heritage Database should be completed. This was subsequently completed in updates to the Project's Site Characterization Study. The USFWS suggested coordination with additional USFWS offices, specifically the WMD, to review USFWS easement information for wetlands and grassland easements. The SDGFP also stated that greater prairie chicken lek surveys are not likely needed for this Project and suggested SDGFP Game Production Areas (GPA), Waterfowl Production Areas (WPA), and Walk-in Hunting Areas (WIHA) be considered in siting where possible. South Deuel Wind included considerations for USFWS easements and SDGFP identified areas for Project design in subsequent surveys.

South Deuel Wind received written siting recommendations from SDGFP on October 3, 2022 that included eleven species of special concern as potentially occurring within five miles of the Project Area. Four of the eleven included species have statuses as threatened or endangered under federal or state statues including: Topeka shiner, Poweshiek skipperling, Dakota skipper, and the northern redbelly dace (*Chrosomus eos*, state threatened). Native grasslands, wetlands, fish species, and public lands were also included in the letter as other items to consider in the siting of the design. On October 25, 2022, the USFWS shared updated easement data with the Project as part of a data request, which have been incorporated into the design.

On September 26, 2023, South Deuel Wind contacted the USFWS Madison WMD to request maps of USFWS easements that were mentioned by the USFWS in 2022, that cross the Project Area. The USFWS responded on September 26, 2023, with the easement contracts and maps for the easements within the Project Area. The USFWS also confirmed that any wetland easement identified on a WPA, Wildlife Management Area (WMA), or other parcel with USFWS easements is specific to the delineated wetland basin on the parcel as shown in the easement maps and that only grassland easements are applied to the full parcel. South Deuel Wind then digitized the easement boundaries to inform infrastructure siting and provided that KMZ to the USFWS on October 6, 2023. On October 10, 2023, the USFWS completed their review of the KMZ and confirmed the content was accurate and aligned with Madison WMDs interpretation of the data. South Deuel Wind has sited facilities to avoid USFWS easements.

South Deuel Wind met with the USFWS and SDGFP on October 11, 2023 to discuss the biological studies that had occurred since the meeting in 2022 and to share the updated Project Area. The objective of the meeting was to demonstrate how data is being incorporated into the Project design since all wildlife studies were concluded and data was compiled. South Deuel Wind presented a summary figure of environmental data and siting setbacks incorporated by the Project which included turbine placement avoiding unbroken grasslands and potentially suitable habitat for protected butterfly species, eagle nests, great horned owl nests, a red-tailed hawk nest, and potential northern long-eared bat summer roosting habitat. There was no additional information, or other actions requested from the USFWS or SDGFP directly after or since this meeting.

2.0 Tier 1 and Tier 2 – Site Characterization

A Site Characterization Study Report (SCS) was first started in 2016, and updated and completed for the Project in 2023 with a field site visit occurring on October 24-28, 2022 (Burns & McDonnell 2023a). The study was completed using a combination of existing information obtained from available public sources including reports, published literature, online databases, geographic information system (GIS) data, agency coordination, and field reconnaissance survey. A buffer surrounding the Project Area, referred to herein as the Study Area, also was assessed during the Tier 2 site characterization. The buffer distances for the Study Area varied based on the resources being evaluated. The different Study Areas are defined as follows:

- Land Cover – Project Area + 2 miles
- Wetlands and Waterbodies – Project Area + 2 miles
- Ecologically Important Lands (both state and federal) –Project Area + 10 miles
- Species of Special Concern –Project Area + 2 miles
- Eagles Nests –Project Area + 2 miles
- Bat Maternity Colonies –Project Area + 5 miles
- Bat Hibernacula –Project Area + nearest known

2.1 Land Cover

The Project is in the Prairie Coteau and Big Sioux Basin Level IV Ecoregions as determined by the United States Environmental Protection Agency (USEPA). The Prairie Coteau region is defined by undulating terrain above surrounding plains with the primary land use being pastureland and agricultural land. The Big Sioux Basin is defined by erosional, rolling landscapes with the primary land use being agricultural land (Bryce et al. 1996).

Land cover was assessed using the 2019 National Land Cover Dataset (NLCD) (USGS, 2019). The dominant land cover within the Project Area is cultivated crop (66 percent; Table 2-1, Figure 2-1). Herbaceous (including grassland) is the second most common cover type at 20 percent. According to the data collected during the grassland assessment and site reconnaissance, the grassland areas include both introduced planted and native species. The remaining land cover types included emergent herbaceous wetlands (5 percent); developed, open space (3 percent); pasture/hay (2 percent); open water; deciduous forest; mixed forest; woody wetlands; shrub/scrub; barren land; and other developed areas (less than 1 percent each) (Table 2-1, Figure 2-1). The predominance of cultivated crops and introduced cool season grasses for forage has reduced and fragmented the extent of undisturbed or native habitats occurring within the Study Area. The Study Area refers to the Project Area plus a two-mile buffer.

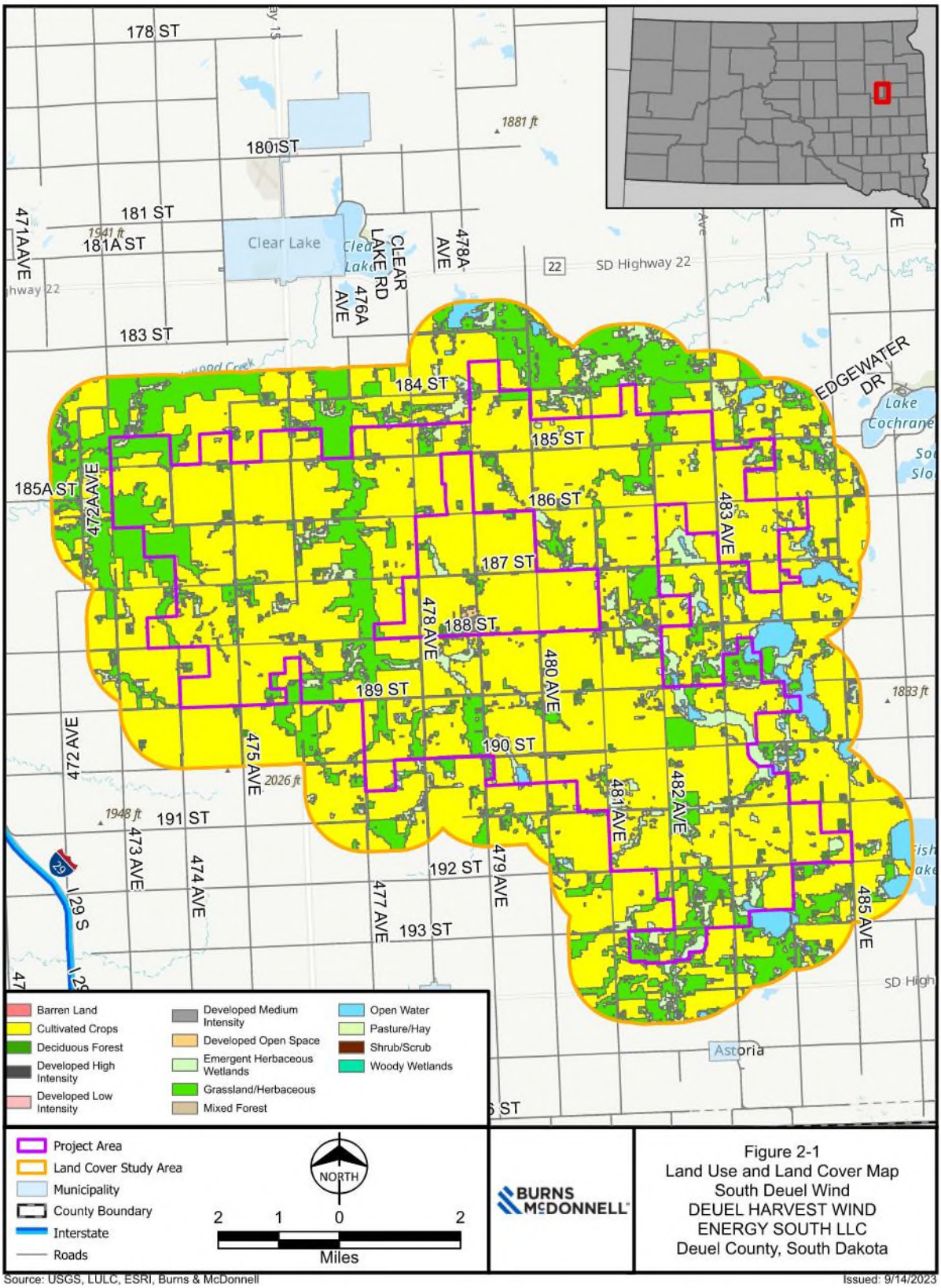
Table 2-1: Land Cover in Study Area

Land Cover Type	Acres[1]	Percent of Total
Cultivated crops	48,292	66

Grassland/Herbaceous	14,048	20
Emergent herbaceous wetlands	3,255	5
Developed, open space	2,118	3
Pasture/hay	2,054	3
Open water	1,537	2
Deciduous forest	616	1
Developed, low intensity	153	0.2
Developed, medium intensity	84	0.1
Mixed forest	14	0.0
Woody wetlands	11	0.0
Developed, high intensity	8	0.0
Shrub/Scrub	8	0.0
Barren Land	4	0.0
Total[1]:	**72,202**	**100**

[1] Total percentage may not add up to 100% due to rounding.

Figure 2-1: Land Use and Land Cover Map



2.2 Protected Lands

A review of federally, state, and privately managed lands for the Project Area plus a ten-mile buffer was completed. There were approximately 1,211 acres of USFWS WPAs within the Project Area and additional WPAs identified within the Study Area (Table 2-2). Other federal easements, including the Dakota Tallgrass Prairie WMA Unit 145, are also located in the Project Area (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.

Table 2-2: Federally Administered Lands

Unit Name	Type	Managing Agency	Acreage within Study Area	Acreage within Project Area
Unnamed Units	Agricultural Conservation Easement	National Resources Conservation Service (NRCS)	157	-
Unnamed Units	Floodplain Easement	NRCS	553	-
Unnamed Units	Wetlands Reserve Program	NRCS	145	-
Brookings County WPA	WPA	USFWS	2,942	-
Brookings County WPA Area 4	WPA	USFWS	539	-
Brookings County WPA Area 9	WPA	USFWS	83	-
Lac Qui Parle County WPA	WPA	USFWS	329	-
Lincoln County WPA	WPA	USFWS	1,317	-
Yellow Medicine County WPA	WPA	USFWS	1,469	-
Northern Tallgrass Prairie National Wildlife Refuge	Wildlife Refuge	USFWS	690	-
Dakota Tallgrass Prairie	WMA	USFWS	108	-
Dakota Tallgrass Prairie Unit 74	WMA	USFWS	400	-
Dakota Tallgrass Prairie Unit 100	WMA	USFWS	265	-
Dakota Tallgrass Prairie Unit 101	WMA	USFWS	2,282	-
Dakota Tallgrass Prairie Unit 103	WMA	USFWS	162	-
Dakota Tallgrass Prairie Unit 131	WMA	USFWS	372	-

Dakota Tallgrass Prairie Unit 139	WMA	USFWS	51	-
Dakota Tallgrass Prairie Unit 141	WMA	USFWS	108	-
Dakota Tallgrass Prairie Unit 142	WMA	USFWS	143	-
Dakota Tallgrass Prairie Unit 143	WMA	USFWS	160	-
Dakota Tallgrass Prairie Unit 144	WMA	USFWS	241	-
Dakota Tallgrass Prairie Unit 145	WMA	USFWS	355	0.2
Dakota Tallgrass Prairie Unit 146	WMA	USFWS	153	-
Dakota Tallgrass Prairie Unit 151	WMA	USFWS	313	-
Dakota Tallgrass Prairie Unit 152	WMA	USFWS	504	-
Dakota Tallgrass Prairie Unit 162	WMA	USFWS	258	-
Dakota Tallgrass Prairie Unit 164	WMA	USFWS	121	-
Dakota Tallgrass Prairie Unit 165	WMA	USFWS	76	-
Deuel County WPA	WPA	USFWS	66,162	1,211
Deuel County WPA Area 20	WPA	USFWS	19	-
Deuel County WPA Area 23	WPA	USFWS	150	-
Deuel County WPA Area 27	WPA	USFWS	80	-
Deuel County WPA Area 35	WPA	USFWS	158	-
Deuel County WPA Area 46	WPA	USFWS	150	-
Deuel County WPA Area 48	WPA	USFWS	162	-
Deuel County WPA Area 59	WPA	USFWS	274	-
Deuel County WPA Area 60	WPA	USFWS	44	-
Deuel County WPA Area 61	WPA	USFWS	69	-
Deuel County WPA Area 67	WPA	USFWS	147	-
Deuel County WPA Area 71	WPA	USFWS	118	-
Deuel County WPA Area 76	WPA	USFWS	119	-

Deuel County WPA Area 86	WPA	USFWS	325	-

One State Conservation Area (SCA), owned and managed by SDGFP, the Singsaas GPA, and one State Recreation Area (SRA) are in the Project Area (Table 2-3). 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 may utilize these areas (SDGFP 2023b, Figure 2-4). The closest Audubon registered Important Bird Areas (IBA) to the Project Area are located in Minnesota. These include the Prairie Coteau Complex IBA, located approximately 3 miles east, and the Salt Lake IBA, located approximately 18 miles northeast of the Project Area (Audubon 2023).

Table 2-3: State-Managed Lands

Unit Name	Type	Managing Agency	Acreage within the Study Area	Acreage within the Project Area
Altamont	SCA	SDGP	61	-
Astoria	SCA	SDGP	38	-
Black Slough	SCA	SDGP	218	-
Briggs Lake	SRA	SDGP	128	-
Cochrane	SRA	SDGP	29	-
Cole	SCA	SDGP	77	-
Cornell Slough	SCA	SDGP	30	-
Coteau Lakes Game Production Area	SRA	SDGP	685	-
Crystal Springs	SCA	SDGP	517	-
Fox Lake	SRA	SDGP	121	0.2
Gary Gulch	SCA	SDGP	117	-
Kvernmoe Slough	SCA	SDGP	197	-
Lake Francis	SCA	SDGP	246	-
Lake Hendricks	SCA	SDGP	21	-
Lake Hendricks	SRA	SDGP	8	-
Lake Hendricks Area 2	SCA	SDGP	3	-
Lake Ketchum	SCA	SDGP	255	-
Lake Oliver	SCA	SDGP	72	-
Lake Oliver	SRA	SDGP	71	-
Mud Lake	SRA	SDGP	643	-
Nelson	SCA	SDGP	71	-
Oak Lake	SCA	SDGP	3	-
Runge Slough	SCA	SDGP	40	-
Rush Lake	SRA	SDGP	320	-

Severson Dells	SCA	SDGP	39	-
Singsaas GPA	SCA	SDGP	120	2
Sutton	SCA	SDGP	40	-

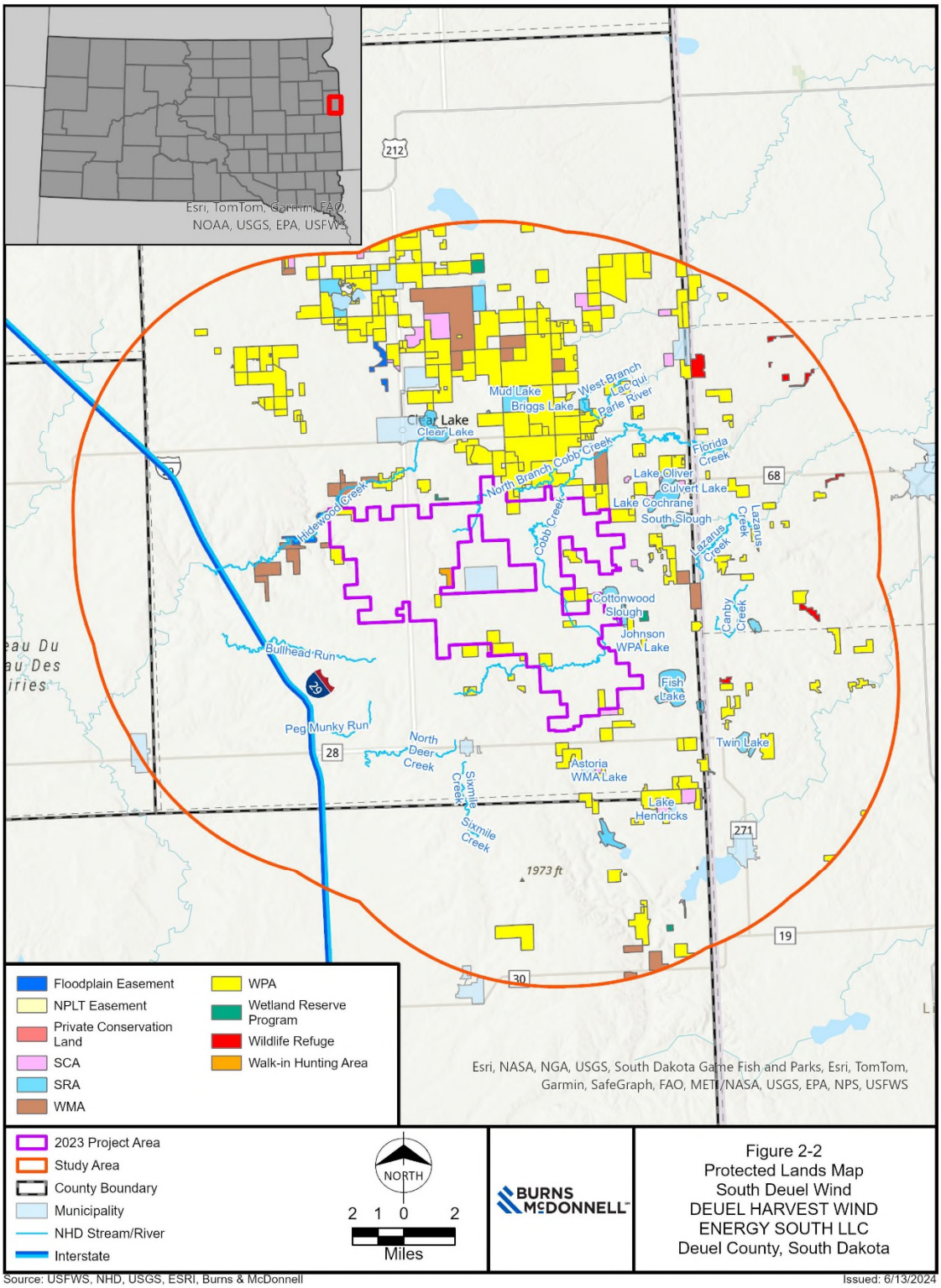
There are two private conservation lands within the Study Area, however none are in the Project Area (Table 2-4).

Table 2-4: Private Conservation Lands

Unit Name	Type	Owner	Acreage within the Study Area	Acreage within the Project Area
Crystal Springs	Private Conservation Lands	Unknown	379	-
Unnamed Unit	Private Conservation Lands	Northern Prairie Land Trust	1	-
Unnamed Unit	Walk-in Hunting Area	Unknown	162	162

On September 26, 2023 the Project received information regarding the wetland easements within the 2023 Project Boundary following a request to the USFWS Madison WMD for review of specific parcels. The USFWS Madison WMD provided the easement information as shown in the easement contracts and associated maps. These easements identify the wetland basins that are protected on each parcel. The Project digitized the wetlands on the easements to assist in the design process and avoidance by proposed infrastructure.

Figure 2-2: Protected Lands Map



2.3 Water Resource Evaluation

Water resources were analyzed for both the Project Area and the Study Area, which comprised of the Project Area plus a two-mile buffer around the Project Area (Table 2-4). According to USFWS National Wetland Inventory (NWI) (USFWS 2016) data, there are 6,282 acres of wetlands and waterbodies within the Study Area (Table 2-4). These areas differ slightly from the NLCD estimates listed in Table 2-1 because NLCD data are based on 2019 Landsat satellite data. Freshwater emergent wetlands compose the largest percentage of wetlands; accounting for 6 percent of the Study Area and 4 percent of the Project Area (Table 2-4, Figure 2-2).

Approximately 4.5 percent of the Project Area is composed of wetlands and other waterbody types, with the majority restricted to riparian zones around the North Branch of Cobb Creek and along Cobb Creek in the eastern portion of the Project Area. There are approximately 98 acres of Federal Emergency Management Agency (FEMA)-designated floodplain surrounding North Branch of Cobb Creek and along Cobb Creek (FEMA 2022) in the Project Area.

Table 2-5: Wetland Types

Wetland Type	Acres in Study Area[1,2]	Acres in Project Area[1,2]	Percent Composition Study Area	Percent Composition Project Area
Freshwater Emergent Wetland	4,549	1,974	6	4
Riverine	944	104	1	0.2
Freshwater Pond	451	80	0.6	0.2
Lake	246	45	0.3	0.1
Freshwater Forested/Shrub Wetland	92	15	0.1	0.0
Total3	**6,282**	**2,218**	**8**	**4.5**

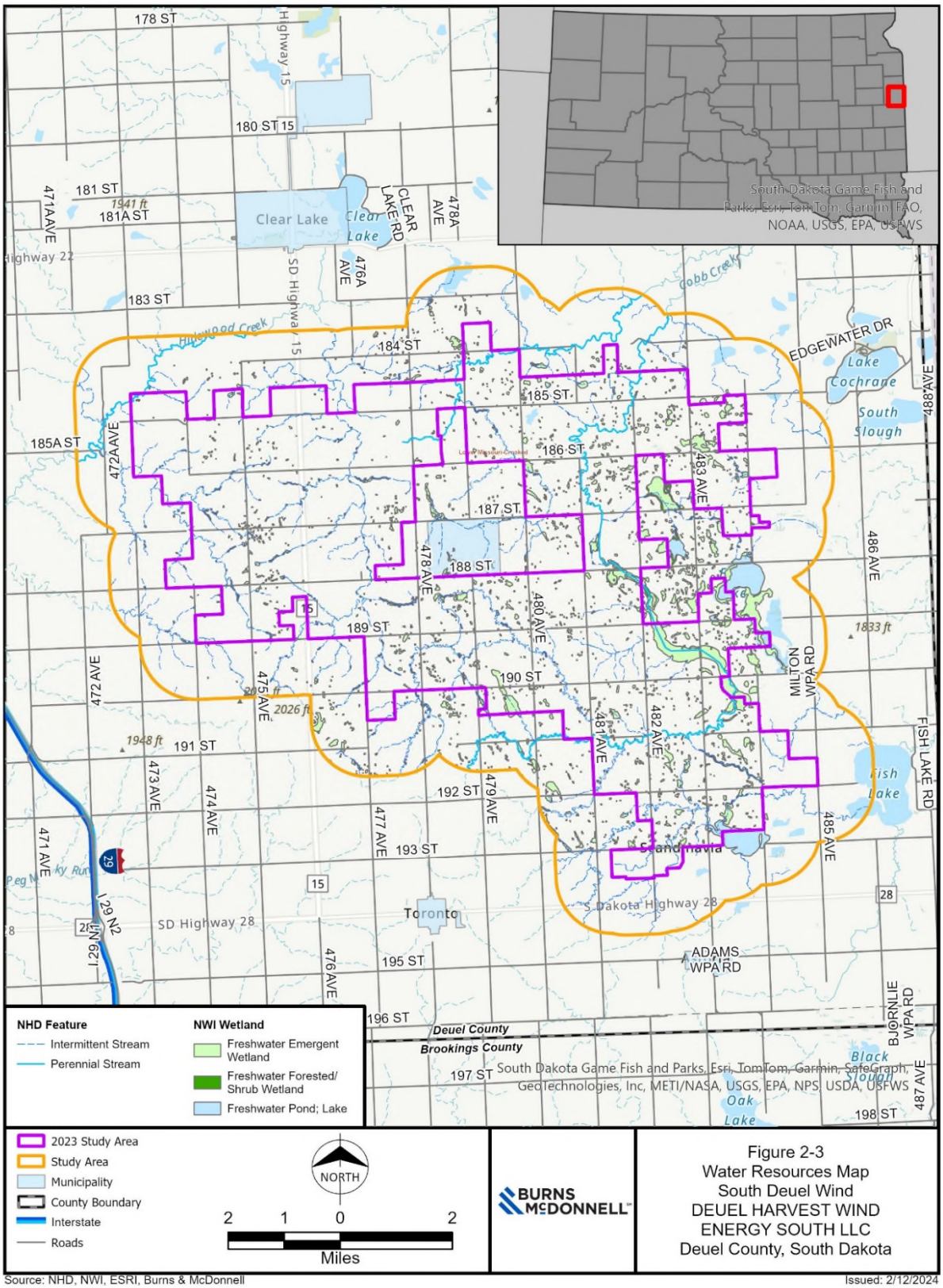
Source: USFWS 2016

[1] NWI data do not correlate with estimates derived from NLCD data shown in Table 4-1 due to difference in resources examined.

[2] Sums of values may not add to total value shown, due to rounding.

Burns & McDonnell completed a wetland delineation between October 24 through November 9, 2022, and from July 10 through August 1, 2023 (Burns & McDonnell 2023j). Field wetland delineations focused on a survey corridor, rather than the Project Area. The survey corridor does not **encompass** the whole of the Project Area, but it is based on the Project design and associated buffers. The Survey Corridor encompassed approximately 3,434 acres (Burns & McDonnell 2023j).

Figure 2-3: Water Resources Map



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, and woody wetland land cover types. Small groves of trees and wooded fencerows near homesteads also may provide potential avian habitat. Ponds and streams throughout the Project Area may provide important aquatic habitats used for migrating birds and possibly some sensitive bird species.

The Project Area is located within the Central Flyway, which is used by migrating raptors, shorebirds, songbirds, waterbirds, and waterfowl (Flyways.us 2016). 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 Hidewood Creek, Cobb Creek, North Branch Cobb Creek, as well as smaller streams and ponds throughout the Project Area.

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 waterbodies during migration [Liguori 2005]) high concentrations of raptors are not expected within the Project Area. Higher use by migrating raptors may occur along the 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 (Burns & McDonnell, 2023b).

2.4.2 Bat Resources

The Project is within the current range of seven 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*), tricolored bat (*Perimyotis subflavus*) and northern long-eared bat (*Myotis septentrionalis*) (Burns & McDonnell 2023c).

Habitat for bats was identified by NLCD data, totaling approximately 269 acres or less than one percent of the Project Area, and a field review, and includes forested areas where they roost, forage, or travel. The majority of this forested habitat is located along Hidewood Creek, Cobb Creek, and North Branch Cobb Creek, as well as scattered wooded patches throughout the Project Area (Burns & McDonnell 2023c). 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 (Burns & McDonnell 2023c). The presence of wetlands, ponds, and drainages 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 Protected Species

A list of species of special concern (Table 2-5), which are defined as species federally protected under the ESA, BGEPA, MBTA, and/or state-protected under state statutes and identified as potentially occurring in the Project Area based on historical records, distribution ranges, and habitat associations. The species of special concern discussed in this document only include bird and bat species, and do not include other species special of concern (non-bird or bat species) such as the Topeka shiner, Dakota skipper, or Poweshiek skipperling. Suitable habitat for bird and bat species was evaluated, and surveys were conducted, to assess the likelihood of these species to use the Project Area. The Study Area for species of special concern was the Project Area plus a two-mile buffer.

Table 2-6: Federal- and State-listed Bird and Bat Species

Common Name	Scientific Name	Status	Likelihood of Occurrence
Rufa red-knot	*Calidris canutus rufa*	FT	Unlikely
Whooping crane	*Grus americana*	FE	Unlikely
Osprey	*Pandion haliaetus*	ST	Unlikely
Northern long-eared bat	*Myotis septentrionalis*	FE	Unlikely
Tricolored bat	*Perimyotis subflavus*	FP	Unlikely

FE: Federally Endangered; FT: Federally Threatened; FP: Federally Proposed; ST: State Threatened

2.5.1 Birds

Federal- and state-listed bird species with potential to occur in the Project are rufa red-knot, whooping crane, and osprey (Table 2-5). The Study Area for species of special concern is defined as the Project Area plus a two-mile buffer.

The rufa red knot is protected under the ESA and listed as federally threatened. This species occupies shallow shorelines of lakes, rivers, and oceans. This species migrates up to 9,000 miles between its breeding grounds in the arctic to wintering grounds as far as Tierra del Fuego in South America. The red knot stops over in Delaware Bay to feed on horseshoe crab (*Limulus polyphemus*) eggs (USFWS 2023c). This species occasionally stops in wetlands and waterbodies of the Great Plains on its annual migration. Suitable stopover habitat within the 2023 Study Area includes the shoreline of Fox Lake, as well as some of the emergent wetlands and other waterbodies. This species has potential to occur in the 2023 Study Area during the spring and fall, but because the species is a long-distance migrant, occurrences are unlikely, and any stopovers are likely to be rare and brief. The closest sighting of this species, according to eBird, was in September 2021 when multiple rufa red knots were documented on Round Lake near Bruce, South Dakota, roughly 18 miles southwest of the Project (eBird 2023).

The whooping crane is a large migratory bird protected under the ESA as endangered that temporarily occurs in South Dakota during the spring and fall migrations. The Aransas/Wood Buffalo population nests in prairie wetlands in Saskatchewan, Canada, and migrates south to winter on the gulf coast of Texas. The USFWS developed the whooping crane observation corridor to document where most whooping cranes were being observed (USGS 2018). Very few (five percent) of whooping crane observations occur outside the corridor.

The 2023 Study Area is approximately 80 miles east of the USFWS whooping crane migration corridor. The closest sighting of this species, according to eBird, was in May 2020 when multiple whooping cranes were reported flying near Goodwin, South Dakota and Volga, South Dakota, roughly 13 miles northwest of the Project and 25 miles southwest of the Project, respectively (eBird 2023). Due to the lack of observations in the vicinity of the Project, and being outside of the whooping crane migratory corridor, it is unlikley that whooping crane will occur in the Project Area.

The osprey is protected under South Dakota Codified Law 34A-8 as threatened and is a piscivorous raptor typically found near fresh- and salt-water habitats, including coastlines, inland lakes, and rivers. Ospreys build large nests that contain sticks, lined with bark, sod, grasses, and vines atop dead trees or artificial structures. Historically, ospreys occurred in the same region that the Project is located in but declined from between the 1950s to the 1970s from the effects of pesticides.

Ospreys have been recorded in the general vicinity of the 2023 Study Area, mostly during migration. The closest observation to the 2023 Study Area being recorded approximately six km (four mi) to the south, at Oak Lake, South Dakota (eBird 2023). It is possible that migrating osprey may forage in the 2023 Study Area utilizing forested areas along riparian corridors, open waterbodies, and open wetlands.

2.5.1.1 Eagles

Bald eagles have the potential to occur in the Project Area year-round, based on typical habitat associations and records to date. Bald eagles will typically nest close to or adjacent to waterways or waterbodies that have a sufficient amount of prey. Within the Project, suitable bald eagle foraging habitat is associated with various waterbodies, including Fox Lake, Hidewood Creek, Cobb Creek, other small rivers, and scattered drainages and wetlands (Figures 2-2).

Migrating bald eagles may forage in the Project Area throughout the year, using the waterbodies and wetlands within the Project Area. The Project Area is located on flat to gently rolling agricultural fields that generally lack defined topographical features typically used by concentrations of migrating raptors during migratory movements. In winter, bald eagle movement patterns can be associated with available open water. If these resources are not available, eagles are opportunistic scavengers (e.g., roadkill, livestock operations). According to the national midwinter bald eagle survey conducted since 1986 along the Missouri River in South Dakota, wintering bald eagle counts have ranged from a low of 58 individuals in 1993 to a high of 458 bald eagles in 2012 (SDGFP 2017). Bald eagles have also been documented along the surrounding Breeding Bird Survey (BBS) routes located approximately 35 km (22 miles) east of the Project Area (Pardieck et al. 2016; WEST 2017a).

There is opportunity for nesting, roosting, and foraging activities associated with the forested periphery of Fox Lake, Hidewood Creek, and Cobb Creek Run within the Project and in or near several lakes and drainages located within 10 miles (16 km) of the Project Area. It is likely that bald eagles use the Project Area.

Golden eagles commonly breed in the western U.S. (Kochert et al. 2002). However, golden eagles are not known to breed in the region of the U.S. where the Project Area is located. Observations of golden eagles have been reported in eastern South Dakota during spring, fall, and winter, with independent sightings that have been reported within the Project Area (eBird 2023).

Golden eagles commonly forage in open habitats (Kochert et al. 2002). Suitable foraging areas within the Project Area for individual migrating or wintering golden eagles would primarily encompass the herbaceous

land cover types. Incidental occurrences of golden eagles are possible within the Project Area; however, likelihood of migrating or wintering birds moving through the area is low.

2.5.1.2 Migratory Birds

Nearly all native birds, including migratory birds, are protected under MBTA. Many native birds occur throughout South Dakota.

Migratory birds have a high likelihood of occurring in the Project Area year-round. Migratory birds may use the Project Area for nesting, breeding, or foraging.

2.5.2 Bats

The federal-listed bat species with potential to occur in the Project Area is the northern long-eared bat. The tricolored bat, which is currently proposed to be federally listed, may potentially occur in the Project Area as well.

The northern long-eared bat hibernates in caves or abandoned mines during the winter. During the summer, the northern long-eared bat may roost beneath the loose bark of live, dead, or dying trees. Additionally, the northern long-eared bat may roost in manmade structures such as barns, sheds, under bridges, or in other buildings that have little human disturbance. Female northern long-eared bats typically roost as a maternity colony, while male northern long-eared bats tend to roost singly or in small groups. Roosting and foraging habitat include forests, wooded fence rows, and riparian areas. Northern long-eared bats primarily occupy forest interiors. They occur in highly fragmented agriculturally dominated landscapes, but generally do not travel more than 1,000 feet from forested areas during summer roosting and foraging.

The northern long-eared bat occurs throughout South Dakota, but the closest documented location within South Dakota is approximately 200 km south of the Project Area in Union County, South Dakota (WEST 2017a). The nearest known maternity roosts for this species are approximately 210 km east of the Project Area in Minnesota (WEST 2017a). According to 2019 NLCD data, there are approximately 258 acres of deciduous forest within the Project Area. Most of the forested areas are small and highly fragmented and would have limited suitability as northern long-eared bat habitat. Suitable habitat is likely present along the limited riparian areas within the Project Area (Burns & McDonnell 2023c).

The proposed endangered tricolored bat hibernates in caves or abandoned mines during the winter. During the summer, the tricolored bat may roost within leaf clusters of live, dead, or dying trees. Additionally, the tricolored bat may roost in barns, under bridges, culverts, buildings with little human disturbance, or in Spanish moss or lichen at the southern and northern parts of their range, respectively. Female tricolored bats typically roost as a maternity colony, while male tricolored bats tend to roost singly or in small groups. Roosting and foraging habitat include forests, wooded fence rows, and riparian areas. Tricolored bats primarily occupy forest interiors. They occur in highly fragmented agriculturally dominated landscapes, but generally forage over waterways and forest edges.

The tricolored bat occurs in South Dakota but is considered rare with the records all being in the western portion of the state. The nearest known maternity roosts for this species are approximately 210 km east of the 2023 Study Area in Minnesota (WEST 2017a).

Tricolored bat habitat within the Project Area includes forested areas where they roost, forage, or travel. According to 2019 NLCD data, there are approximately 258 acres of deciduous forest within the Project Area. Most of the forested areas are small and highly fragmented and would have limited suitability as tricolored

bat habitat. Suitable habitat is likely present along the limited riparian areas within the Project Area (Burns & McDonnell 2023c).

3.0 Tier 3 – Field Studies

Tier 3 studies were conducted to assess the land use, the frequency of avian and bat species, and assess other potential impacts from the Project.

3.1 Raptor Nest Surveys

3.1.1 Objectives

The raptor nest surveys were conducted to identify the location and occupancy status of potential raptor nests within and surrounding the Project Area.

3.1.2 Methods

The first year of raptor nest survey was conducted via a Robinson R44 helicopter from March 28 to April 1, 2016, using the 2016 Project area, plus a 2-mile buffer for all stick nests and 10-mile buffer for eagle nests (WEST 2016b). The survey was conducted in accordance with ECPG guidelines before leaf-out, which would severely impair visibility of stick nests, and to coincide when bald eagles are most likely incubating eggs or tending to their young. The survey consisted of transects at approximately 1-mile (1.6 km) intervals. When suitable habitat for raptors was identified, the helicopter would approach and begin to circle slowly as to thoroughly assess the entirety of the wooded area to identify any stick nests. If a stick nest was identified, the pilot would approach slowly and position such the nest could be easily observed and photographed.

The second-year raptor nest survey was conducted via vehicle on public roads from May 27-30, 2017, using the 2017 Project Area. The survey focused on field review of the nest locations identified in raptor nest surveys (WEST 2016b) within the Project Area from March 28 to April 1, 2016, to the extent practicable, and incidental observation of any new nests for the 2017 breeding season (WEST 2017b).

The third-year raptor nest survey was conducted via a Robinson R44 helicopter from March 28 to April 2, 2019, using the 2019 Project Area plus a 2-mile buffer for all stick nests and 10-mile buffer for only eagle nests. The aerial surveys were conducted in the same manner as the first-year raptor nest survey (Burns & McDonnell 2021a).

The fourth-year raptor nest surveys were conducted via both a Robinson R44 helicopter on March 24, 2022, and April 26, 2022, and ground surveys on April 20 – 21, June 22, and August 11, 2022, using the 2022 Project Area and an additional 2-mile buffer for all stick nests. The aerial surveys were conducted in the same manner as the first-year raptor nest surveys. The ground-based surveys consisted of driving public roads within the survey area to identify new stick nests and document the status of previously found stick nests. When stick nests were found, binoculars were used to determine occupancy and species type (Burns & McDonnell 2023d).

The fifth-year raptor nests surveys were conducted via a Robinson R44 helicopter on March 29, 2023, using the Project Area and a 2-mile buffer for all stick nests. The aerial survey was conducted in the same manner as the first-year aerial raptor nest surveys (Burns & McDonnell 2023e).

3.1.3 Results

In the first-year survey, a total of 83 stick nests were documented in the 2016 Project area and 2-mile buffer. The identified nests included 13 red-tailed hawk (*Buteo jamaicensis*) nests, 17 great horned owl (*Bubo virginianus*) nests, 52 unidentified raptor nests, and one great blue heron (*Ardea herodias*) rookery. A total of four occupied bald eagle nests and three unoccupied, inactive potential eagle nests were observed within the 10-mile buffer around the 2016 Project area; none were within the Project area. No federal- or state-threatened or endangered species were documented during the first-year survey effort.

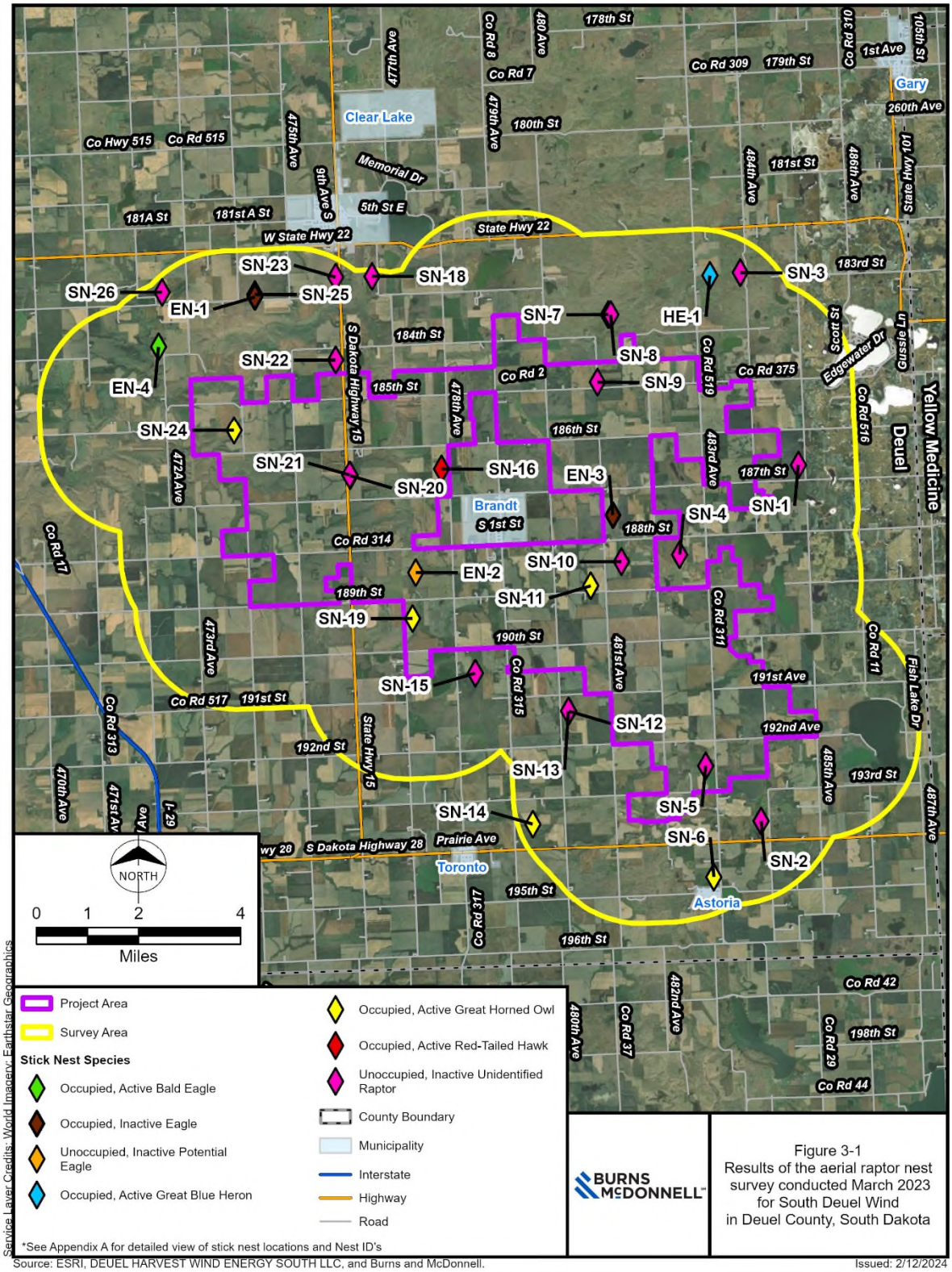
In the second-year survey, a total of 29 stick nests were documented in the 2017 Project Area. The identified nests included 8 red-tailed hawk (*Buteo jamaicensis*) nests, 3 great horned owl (*Bubo virginianus*) nests, 17 unidentified raptor nests (3 active, 13 inactive), and 1 great blue heron (*Ardea herodias*) rookery (WEST 2016b). No bald eagle nests were observed within the Project Area. No federal- or state-threatened or endangered species were documented during this survey effort.

In the third-year survey, a total of seven eagle nests were identified. Five of the eagle nests were actively occupied by bald eagles. One eagle nest was unoccupied/inactive and met the requirements for an eagle nest, but the species that occupied it was unknown. One eagle nest was actively occupied by a great horned owl. All 7 eagle nests were identified within 10.0 miles (16.0 km) of the 2019 Project Area. No eagle nests were identified within the 2019 Project Area (Burns & McDonnell 2021a). No federal or state-threatened or endangered species were documented during the raptor nest survey.

In the fourth-year survey, a total of two bald eagle nests and one potential bald eagle nest were identified within the 2-mile buffer and the 2022 Project Area. One of the bald eagle nests and the potential bald eagle nest were identified within the 2022 Project Area. The second bald eagle nest was not located in the 2022 Project Area. The potential bald eagle nests within the 2022 Project Area met the requirements for an eagle nest but was occupied by a red-tailed hawk. A total of 33 non-eagle stick nests were identified within the 2-mile buffer and 2022 Project Area. The species identified included three raptor species (red-tailed hawk, unidentified raptor, and great horned owl) and one waterbird species (great blue heron) (Burns & McDonnell 2023d). No federal or state-threatened or endangered species were documented during the raptor nest survey.

In the fifth-year survey, three bald eagle nests, and one potential bald eagle nest, were identified. Two of the bald eagle nests were in the 2-mle buffer around the Project Area, and one of the bald eagle nests and the potential bald eagle nest were in the Project Area. A total of 48 non-eagle stick nests were identified within the 2-mile buffer and the Project Area (Figure 3-1). The species identified include three raptor species (red-tailed hawk, unidentified raptor, and great horned owl) (Burns & McDonnell 2023e). No federal or state-threatened or endangered species were documented during the fifth-year survey effort.

Figure 3-1: Results of the Aerial Survey for South Deuel Wind in Deuel County, South Dakota March 29, 2023



3.2 Bald Eagle Flight Path Mapping and Nest Monitoring

3.2.1 Objectives

The bald eagle flight mapping and nest monitoring survey was conducted to monitor the activity of one bald eagle nest and one potential bald eagle nest identified in the 2022 Project Area during the 2022 stick nest surveys.

3.2.2 Methods

One bald eagle nest and one potential bald eagle nest were identified within the Project Area in the fourth year (2022) of raptor nest surveys. Nest A was an active bald eagle nest and Nest B was a potential eagle nest. The nests are located at approximately 44.666827 degrees latitude, -97.578053 degrees longitude (Nest A) and 44.652848 degrees latitude, -97.657214 longitude (Nest B, Figure 3-1). Nests were observed from a single observation point for three, two-hour intervals. The survey was conducted seven times over a five-month period (March 6, March 27, April 17, May 8, May 29, June 19, and July 10, 2023). The surveyor recorded status of the nest, the condition of the young eaglets (when observable), behavior, flight paths (including beginning and end points, and direction), prey-types, number of eagles, and abiotic factors such as temperature, wind-speed, and precipitation (Burns & McDonnell 2023f).

3.2.3 Results

Nest A was observed to be active during the March 6th survey, where two adult bald eagles were seen brooding (i.e., the action of sitting on a clutch of eggs) on the nest. During this survey when two bald eagles were seen nesting, most of the observations were seen during the mid-day and evening surveys. The flight paths were mostly contained within the nest area, exhibiting nest up-keep behavior. During the March 27th survey, a great-horned owl had taken over the nest and was seen brooding on the nest. During that survey, two bald eagles (one adult, one subadult) were seen briefly flying across the survey point in a northeast direct. After the March 6th survey, no bald eagles were seen nesting in Nest A for the duration of the study. Nest B was not observed to be active throughout the entire study (Burns & McDonnell 2023f).

3.3 Breeding Bird Survey

3.3.1 Objectives

The breeding bird survey was conducted to determine what avian species occur in the 2016 Project Area.

3.3.2 Methods

The breeding bird survey was conducted from June 15 – June 30, 2016, and included 11, 400 meter (m) transects within the 2016 Project Area (WEST 2016a). The surveys were conducted from sunrise to 10:00 AM. The surveyor documented species, number of individuals, approximate distance away, flight height, flight direction, activity, and the detection type. While the survey was not conducted on the Project Area, the survey area encompassed this area. Therefore, these results describe the bird species within and surrounding the Project Area.

3.3.3 Results

A total of 412 individual bird observations in 244 separate groups belonging to 30 avian species were recorded within 100 meters of the observer (WEST 2016a). There were no threatened, endangered, or candidate species observed during the survey. One SDGFP SGCN species, American pelican (*Pelecanus erythrorhynchos*), was identified during the survey. Three USFWS birds of conservation concern, a designation for bird species that may become listed as federally threatened or endangered without

conservation measures being enacted, were observed: dickcissel (*Spiza americana*), grasshopper sparrow (*Ammodramus savannarum*), and upland sandpiper (*Bartramia longicauda*) were observed.

3.4 Large Bird Survey

3.4.1 Objectives

The large bird survey was conducted to identify the temporal and spatial use of large birds within the Project Area, document any threatened, endangered, and other species of special concern, and to document eagle observations within the Project Area as defined at the time of survey.

3.4.2 Methods

The first-year large bird survey was conducted from April 4, 2016 – March 23, 2017, on the 2016 Project Boundary, with 35 survey points (WEST 2017b), the second-year was from May 2017 – April 2018, on the 2017 Project Boundary, with 33 to 40 survey points (Burns & McDonnell 2021b), and the third-year was from June 2021 – July 2022, on the 2019 Project Boundary, with 31 survey points (Burns & McDonnell 2023g). Each survey plot had an 800-meter radius and was surveyed for an hour once a month for the year. The surveyor documented species, number of individuals, approximate distance away, flight direction, and activity occurring within the vicinity of the plots. The number of survey points varied for the three surveys due to changes for the Project Area at the time of the survey.

3.4.3 Results

The first-year survey recorded 15,163 large bird observations of 41 species. Waterfowl made up 88.8% of the large birds recorded during the survey year, with most of them being species of goose. There were 200 observations identified as raptors with 10 species documented. There were 11 bald eagle observations, 1 golden eagle observation, and most of the rest were identified as red-tailed hawk or northern harrier (*Circus hudsonius*). Overall observations and eagle observations were most common in the winter months. No federally threatened or endangered species were observed during the first-year surveys. The American white pelican (*Pelecanus erythrorhynchos*), which is listed as one of South Dakota's Species of Greatest Conservation Need, had 13 observations during the survey. Bald eagles and golden eagles are protected under the BGEPA. A total of 11 bald eagles and 1 golden eagle were observed during the large bird use surveys in the first year (WEST 2017b).

The second-year survey recorded 2,076 large bird observations of 24 species. Waterfowl made up 82.2% of the large birds recorded during the survey year, with most of them being species of goose. One hundred ninety-five observations were identified as raptors with 29 observations identified as eagles, 26 bald eagles and 3 golden eagles, and most of the rest were identified as red-tailed hawk (96 observations). Overall observations and eagle observations were most common in spring months. No federally threatened or endangered species were observed during the second-year surveys. The American white pelican had 45 observations during the second-year survey. A total of 26 bald eagles and 3 golden eagles were observed during the large bird use surveys in the second year (Burns & McDonnell 2021b).

The third-year survey recorded 1,259 large bird observations of 26 species. Waterfowl made up 51.7% of the large birds recorded during the survey year, most of them being species of goose. One hundred seventy observations were identified as raptors with 35 observations identified as eagles, 35 bald eagles and 0 golden eagles, and the majority of the rest identified as red-tailed hawks (58 observations). Overall observations and eagle observations were most common in fall months. No federally threatened or endangered species were observed during the third-year surveys. The American white pelican had 60 observations during the third-

year survey. A total of 35 bald eagles and 0 golden eagles were observed during the large bird use surveys in the third year (Burns & McDonnell 2023g).

3.5 Bats

3.5.1 Bat Habitat Assessment

3.5.1.1 Objectives

The bat habitat assessment was conducted to identify areas of potential summer roosting and foraging habitat within, and one mile around the Project Area.

3.5.1.2 Methods

Potentially suitable summer roosting habitat was evaluated using desktop and field methods. The area evaluated included the Project Area and a one-mile buffer of the Project Area. The desktop methodology included a review of 2022 NAIP aerial imagery to hand-digitize areas of forest (USDA 2020). Areas of at least 10 acres of contiguous forest were selected as the core areas of potential northern long-eared bat roosting habitat. Forest areas of any size that were within 1000 feet of the core areas were also included as potential habitat. Anthropogenic structures were not included in this assessment, although some suitable structures may occur within 1000 feet of suitable forest habitat. Isolated anthropogenic structures, isolated trees, and isolated small forest stands (less than 10 ac in size) located more than 1,000 ft away from suitable forested habitat were considered unsuitable habitat for northern long-eared bat (Henderson and Broders 2008, USFWS 2023d). A total of 14 areas met the desktop criteria for potentially suitable summer roosting habitat, 6 of which were within the Project Area (Burns & McDonnell 2023c).

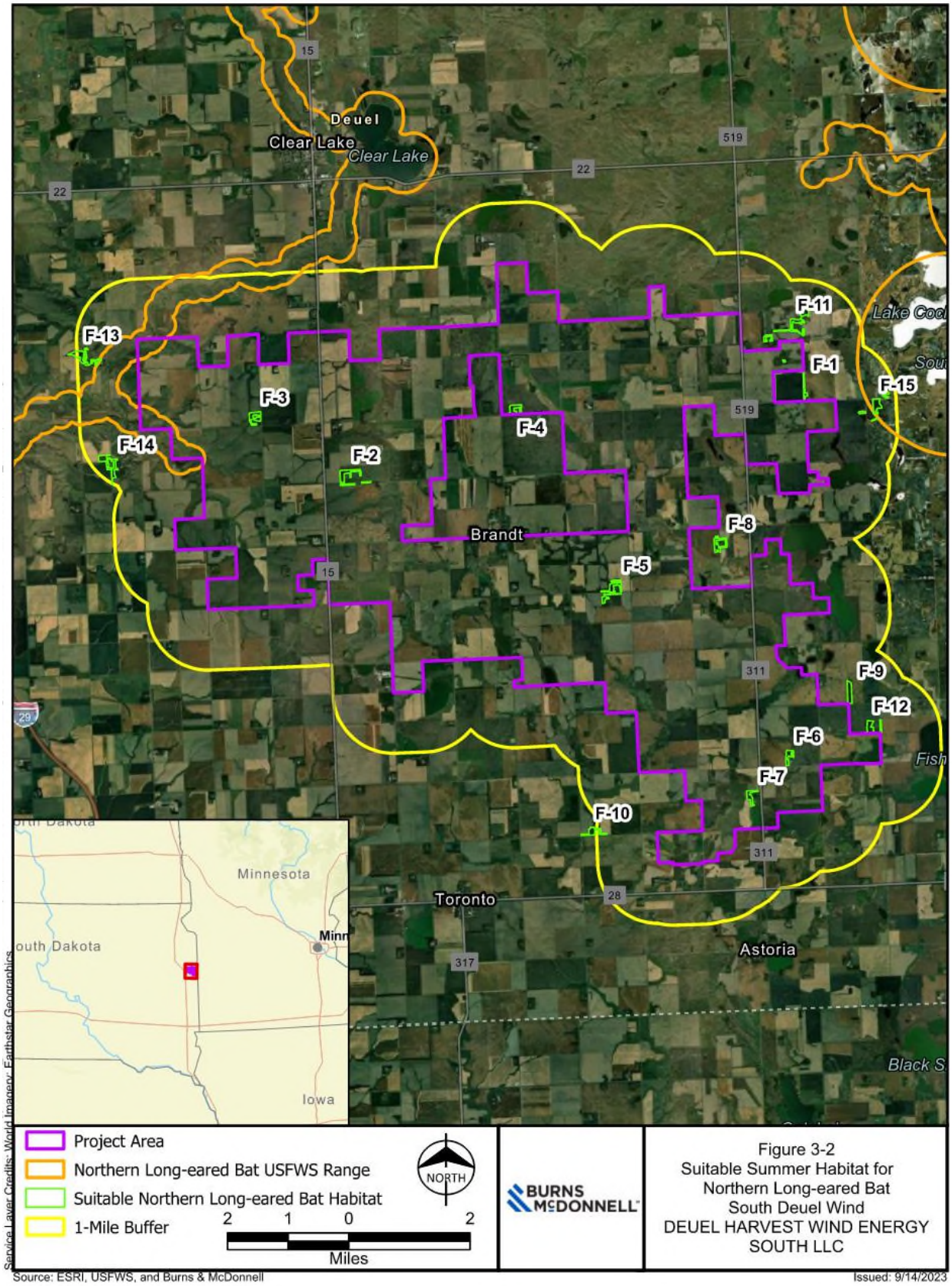
The field assessment was conducted between October 10 and October 12, 2022. During the field habitat assessment, the areas identified through the desktop assessment were viewed and photographed from public roads. Dominant tree species, tree sizes, and occurrence of potential roost trees were noted for each area. Areas with mid- to late-successional forest were determined to be suitable for the northern long-eared bat, whereas areas that had been cleared or were dominated by early successional forest, such as windbreaks consisting of eastern red cedar (*Juniperus virginiana*), would be determined to be unsuitable.

3.5.1.3 Results

All 14 areas meeting the desktop criteria for potentially suitable summer roosting habitat were assessed in the field and were determined to be suitable for northern long-eared bat (Figure 3-2). Dominant tree species included eastern cottonwood (*Populus deltoides*), black willow (*Salix nigra*), ash (*Fraxinus* sp.), and maple (*Acer* sp.). One additional area (F-15) was added based on an expansion of the Project Area in 2023 (Figure 3-2). This area has not been evaluated in the field but is assumed to be suitable for the northern long-eared bat. Six of the 15 areas, totaling approximately 90 acres, were identified as potentially suitable habitat were in the Project Area.

A small portion of forest areas F-13 and F-15, totaling approximately 19 acres, intersect the current range of the northern long-eared bat. F-13 is located approximately 0.6 miles outside the Project Area. F-15 is located approximately 0.4 miles outside the Project Area. All the other potentially suitable summer roosting habitat areas are outside the current range of the species.

Figure 3-2: Suitable Summer Habitat for Northern Long-eared Bat



3.5.2 Acoustic Bat Surveys

3.5.2.1 Objectives

The acoustic bat surveys were conducted to identify the level and seasonality of bat activity and the genus of bats within the Project Are as defined at the time of survey.

3.5.2.2 Methods

For the first year, the acoustic bat survey for the Project was conducted at one monitoring location within the Project Area from April 13 through November 3, 2016. Detectors were deployed on a MET tower in an open crop field with a microphone at a height of approximately 3 meters and a microphone at a height of approximately 45 meters. Detectors were programmed to begin recording 30 minutes before sunset and continued recording until 30 minutes after sunrise. Bat passes were viewed in Analook and CFCread to note potential *Myotis* calls, remove additional noise files from analysis, and to sort bat call files into high-frequency (minimum frequency > 30 kHz) and low-frequency (minimum frequency < 30 kHz) species groups (WEST 2017c).

For the second year, the acoustic bat survey for the Project was conducted at one monitoring location within the Project Area from July 20 through October 17, 2017. The detector was deployed on a MET tower in an open crop field (same location as the previous study) with a microphone at a height of approximately 3 meters and a microphone at a height of approximately 45 meters. Detectors were programmed to begin recording 30 minutes before sunset and continued recording until 30 minutes after sunrise. Bat passes were viewed in Kaleidoscope to note potential *Myotis* calls, remove additional noise files from analysis, and to sort bat call files into high-frequency (minimum frequency > 30 kHz) and low-frequency (minimum frequency < 30 kHz) species groups. Potential *Myotis* calls were viewed in full spectrum to determine potential occurrence of northern long-eared bat (*Myotis septentrionalis*) and little brown bat (*Myotis lucifugus*) (Burns & McDonnell 2018a).

For the third year, the acoustic bat surveys for the Project were conducted at two monitoring locations within the Project Area from March 31 through November 2, 2022. Detector M-1 was deployed on a MET tower in an open crop field (same location as the previous studies) with a microphone at a height of approximately 3 meters (M-1L) and a microphone at a height of approximately 45 meters (M-1H). Detector G-1 was deployed with a temporary mast at a height of 3 meters in a hay field along a windbreak of eastern redcedar, which is a potentially suitable habitat for some bat species. . Detectors were programmed to begin recording 30 minutes before sunset and continued recording until 30 minutes after sunrise. Bat passes were viewed in Kaleidoscope to note potential *Myotis* calls, remove additional noise files from analysis, and to sort bat call files into high-frequency (minimum frequency > 30 kHz) and low-frequency (minimum frequency < 30 kHz) species groups. Potential *Myotis* or *Perimyotis* calls were viewed in full spectrum to determine potential occurrence of northern long-eared bat (*Myotis septentrionalis*), little brown bat (*Myotis lucifugus*), and tricolored bat (*Perimyotis subflavus*) (Burns & McDonnell 2023h).

3.5.2.3 Results

For the first year the two microphones were operating for 205 calendar nights. Across all microphones, a total of 410 detector-nights were completed. A total of 690 bat passes were recorded, resulting in an average of 1.7 bat passes per detector night across the Project Area. Relative bat activity was observed to be highest in the summer (WEST 2017c).

For the second year the two microphones were operating for 89 calendar nights. Across all microphones, a total of 178 detector-nights were completed. A total of 950 bat passes were recorded, resulting in an average

of 5.3 bat passes per detector night across the Project Area. Relative bat activity was observed to be highest in the summer (Burns & McDonnell 2018a).

For the third year the three microphones were operating for 216 calendar nights. Table 3-1 summarizes the sampling effort for each microphone. Across all microphones, a total of 648 detector-nights were completed. A total of 6,536 bat passes were recorded, resulting in an average of 10.1 bat passes per detector night across the Project Area. Relative bat activity was observed to be highest in the summer (Burns & McDonnell 2023g). The increase of bat passes during the third-year survey is likely due to the location of a detector being near potentially suitable habitat whereas in the first and second years, detectors were located in relatively unsuitable habitat i.e., crop fields.

No potential *Myotis* or *Perimyotis* calls were identified in any year of analysis.

Table 3-1: Project Data Collection Summary for the Bat Acoustic Study, March 31 – November 2, 2022

Monitoring Location	Latitude and Longitude	No. Nights Deployed	No. Complete Detector-Nights[1]	Dates of Incomplete Detector Nights[2]	No. Bat Passes Recorded
M-1H	44.700311 -96.694424	216	216	0	1,158
M-1L	44.700311 -96.694424	216	216	0	1,247
G-1	44.594084 -96.539327	216	216	0	4,131

[1] Total number of nights that equipment functioned and recorded for the entire night.
[2] Nights when recording did not occur or was interrupted before a complete night of survey was completed.

3.5.3 Bat Mist Netting Surveys

3.5.3.1 Objectives

The bat mist netting surveys were conducted to identify the bat species within the 2016 Project Area (WEST 2016c).

3.5.3.2 Methods

The bat mist netting surveys were conducted from July 22 – August 15, 2016, within the Project Area. The survey was conducted in accordance with the study plan that was approved by the USFWS on July 18, 2016 (WEST 2016c). Ten net sites were surveyed, and recorded data included species, age, sex, weight, and reproductive condition was recorded for all bats identified. If northern long-eared bats were caught, they were to be banded and tracked using radio telemetry. No other species were to be banded or tracked (WEST 2016c).

3.5.3.3 Results

Bats were caught at eight of the 10 sites throughout the survey. Seventeen bats of three species were caught: seven big brown bats (*Epstesicus fuscus*), six eastern red bats (*Lasiurus borealis*), and four hoary bats (*Lasiurus cinereus*). WEST 2016c). None of these species are on the USFWS or SDGFP lists and no federally listed or state listed bats were observed throughout the survey (WEST 2016c).

3.6 Grassland Assessment

3.6.1 Objectives

Grasslands can be classified as broken or unbroken, with unbroken representing grasslands that have little historical disturbance and are true grasslands. Broken grasslands are grasslands that have been disturbed in some way, which can include farming, human disturbance, or being replanted grassland. In order to identify the location and quality of grassland within the Project Area, areas that were identified as potentially being unbroken grasslands from a desktop review were reviewed during a site visit (Burns & McDonnell. 2023i).

3.6.2 Methods

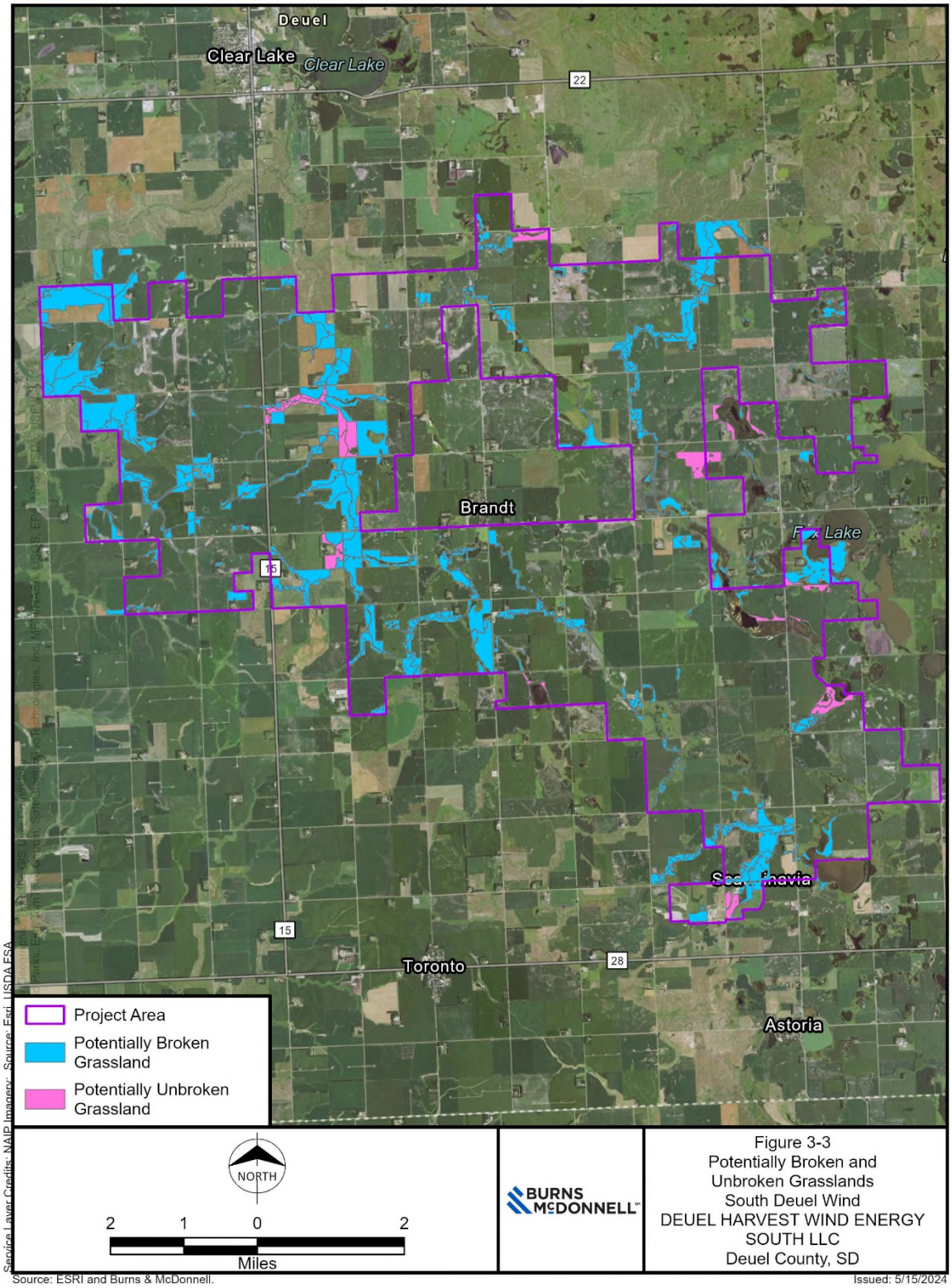
A desktop review of potential grasslands in the Project Area was conducted by reviewing the grassland layers from South Dakota State University (Bauman et al. 2016), National Land Cover Data (NLCD) (U.S. Department of Agriculture [USDA] Natural Resource Conservation Service, 2019), National Agriculture Imagery Program (NAIP) aerial photography (USDA, 2020), USFWS NWI maps (USFWS, 2016), and USFWS conservation, grassland, and wetland easement locations obtained from Deuel Harvest (Burns & McDonnell 2023i). From this desktop survey, areas that were identified as potentially being intact grasslands were assigned an observation point. In total, 244 observation points were marked. Observation points were surveyed in the field from October 10 to 12, 2022 and July 31 through August 1, 2023 (Burns & McDonnell. 2023i).

Each observation point was classified into probabilities of being an unbroken grassland, with classifications being 'low', 'medium', or 'high'. A classification of "low" was given when there was a high level of human disturbance and the vegetation was comprised of a relatively few native warm season grasses, or the dominant grass species appeared to be sod-forming, cool season that are common in areas used for pastureland or invasive species such as *Festuca* sp., *Typha* sp., and *Phalaris arundinacea* (Burns & McDonnell. 2023i). Areas with the presence of human disturbance and relative high abundance of two or more of the following: little bluestem, big bluestem, sideoats grama (*Bouteloua curtipendula*), prairie dropseed (*Sporobolus heterolepis*), and needle grass species combined with the lack of a dominant sod-forming, cool season grass layer were given a classification of "medium" (Burns & McDonnell. 2023i). Areas without any evidence of human disturbance and where blooming native forbs were observed and in relative high abundance in conjunction with the warm season grass species previous listed resulted in a classification of "high" (Burns & McDonnell. 2023i). Areas identified as "low" and "medium" are considered broken grasslands, due to the level of human activity and the lack of native vegetation. Those areas identified as "high" are considered to be unbroken grasslands due to the dominance of native vegetation and the lack of human disturbance (Burns & McDonnell. 2023i).

3.6.3 Results

Approximately 5,124 acres of potential-unbroken grasslands within the Project Area were identified based on the desktop analysis (Burns & McDonnell. 2023i). Areas of potential unbroken and broken grasslands were field-verified in 2022 and 2023 by qualified biologists. The field verification identified approximately 317 acres of potential unbroken grasslands (Figure 3-3). This indicates that much of the Project Area has previously been impacted due to land conversion to row-crop agriculture and the introduction of non-native, cool-season grass species, both of which has led to the Project Area to contain a lower amount of potential unbroken grasslands than what was identified during the desktop review.

Figure 3-3: Potentially Broken and Unbroken Grasslands



3.7 Summary of Concerns Identified During Research and Analysis

3.7.1 Birds

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 from the avian use studies were common, disturbance-tolerant species (Sections 3.1.3.2). 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 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.

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 3-2). 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 3-2).

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).

The Project Area consists of several ponds, creeks, rivers, and drainages that are important aquatic habitat features on the landscape and concentrate use by waterfowl and shorebirds, potentially including some species of special concern, during migration and winter. Waterfowl were the most commonly recorded large-bird subtype during the large-bird use study (Section 3.1.3.2). 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 National Research Council (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 3-2: Annual Bird Carcass Rate results from Post-Construction Monitoring Studies Conducted in Minnesota and South Dakota

Project Name	State	Estimated Bird Carcass/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
Crowned Ridge II	SD	0.41	Chodachek et al. 2022
Prairie Winds	SD	1.41	Derby et al. 2012c and 2013
Wessington Springs	SD	0.89 – 8.25	Derby et al. 2010a and 2011

3.7.2 Bats

A portion of the Project Area is located within the range of the federally endangered northern long-eared bat. As this species was not detected in netting or acoustic studies, the USFWS range does not overlap much of the Project Area, and the habitat assessment showed little suitable habitat areas (Section 4.5), this species is not expected to breed or forage in the Project Area during summer; although it could be present during migration. Based on the Project's location relative to the nearest known northern long-eared bat hibernaculum (Section 2.5.2), no impacts to northern long-eared bats are expected to occur during the fall swarming period or during the winter when they are hibernating.

The Project is also within range of the proposed federally endangered tricolored bat. This species is not expected to breed or forage within the Project Area during summer due to lack of captures in the area and the nearest known colonies being located on the other side of the state (Section 2.5.2), although it could be present during migration. Based on the Project's location relative to the nearest known tricolored bat capture site (Section 2.5.2), no impacts to tricolored bats are expected to occur during the fall swarming period or during the winter when they are hibernating.

Seven other 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 Cobb 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., Arnett et al. 2008). The Project has been designed to minimize impacts to bat species to the extent possible.

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 3-3).

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 mortality 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).

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. Therefore, operation of the Project turbines may temporarily disturb or displace bats, but significant impacts are not likely.

Table 3-3: 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
Crowned Ridge II	SD	0.74	Chodachek et al. 2022

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

4.0 Avoidance and Minimization Measures

4.1 Preconstruction Siting and Design

- All permanent impacts to conservation easements, protected lands, and USFWS critical habitat will be avoided, to the extent possible. Permanent impacts to wetlands will be minimized to the extent possible.
- 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' Land-based Wind Energy Interim Voluntary Guidance for the Northern Long-eared bat (USFWS 2023e), 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 and tricolored 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.
- All turbines will be sited outside of native habitat (including unbroken grasslands, forested habitat, and wetlands). Native habitat will be avoided when possible and previously disturbed lands (including existing roadways) will be used, where practical, to avoid wildlife habitat fragmentation.
- Turbines will be sited out of grassland habitat with records of Dakota skipper and Poweshiek skipperling, and any habitat potentially suitable for these species recorded during the Protected Butterfly Species Habitat Assessments (Burns & McDonnell 2023a).
- 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.
- Known nest setbacks, which include 1 mile for eagles, 520 meters for red-tailed hawks, and 400 meters for great horned owls, great blue heron rookeries, and unidentified raptors, will be used.
- 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.
- 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.
- South Deuel Wind will also employ an ADLS at the Project, subject to availability and FAA approval.
- Hoods/shields will be installed on exterior lights at the O&M facility and collector substation to minimize skyward light.
- Turbine doors will not have exterior lights installed at the entrance.

- South Deuel Wind will install collector circuits underground; therefore, no bird collision or electrocution risks would apply to the buried lines.
- In the event the 34.5kV electrical collection system require overhead construction, the structures will be designed and constructed in accordance with the APLIC suggested practices to minimize potential avian electrocution risk (APLIC, 2006).
- If an avian collision risk is identified along the Gen-Tie 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 Minimization and Avoidance Measures

- 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 disseminate this information to applicable contractor personnel, including the correct reporting procedures.
- Construction personnel will be trained on protected wildlife species and avoidance areas during construction.
- A Storm Water Pollution Prevention Plan will be prepared and implemented, as required by the EPA or relevant local authority; 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, as necessary.
- 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, South Deuel Wind will comply with applicable federal regulations protecting waters of the U.S., as listed in Title 33 CFR Part 323.
- Speed limits will be set for 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, all disturbed areas will be restored to surrounding grade, reclaimed with soils of similar physical and chemical properties, and seeded with vegetation consistent with the surrounding land use.
- 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.

4.3 Operation Minimization and Avoidance Measures

- All non-restricted carrion discovered on site during regular maintenance activities may 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.
- South Deuel Wind will encourage landowners with livestock operations in and adjacent to the Project Area, if necessary, to clear livestock carcasses regularly and expediently to avoid attracting eagles and other raptors to the Project Area.

- Turbines will be feathered below cut-in, 3.0 m per second (meters per second [m/s]; 6.7 miles per hour[mph]) from sunset to sunrise April 1 – July 14 and October 16 – October 31 and 5.0 m per second (m/s; 11.2 mph) from sunset to sunrise July 15 – October 15 to minimize impacts to all bat species, and avoid impacts to the northern long-eared bat and tricolored 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 facilitate the effectiveness of the avoidance, minimization, and mitigation strategies incorporated into the Project.

5.0 Tier 4 – Post-Construction Avian and Bat Monitoring

5.1 Monitoring Goals

The goals of post-construction mortality monitoring are to evaluate the circumstances under which carcasses occur and a 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 conduct one year of post-construction mortality monitoring and analyze bird and bat carcass monitoring data to accomplish the following:

- Evaluate bird and bat carcasses within the Project Area in relation to site characteristics
- 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

Details of the proposed post-construction monitoring will be developed and the BBCS will be updated prior to operations at the Project.

5.2 Incidental Monitoring

An incidental reporting process will be developed for operations personnel to document bird or bat carcasses during routine maintenance work and at other times they are within the Project Area. South Deuel Wind will provide operations personnel with a training describing the incidental reporting process and reporting resources.

5.3 Permits and Wildlife Handling Procedures

5.3.1 Permits

South Deuel Wind may elect to obtain federal and state collection permits. In general, carcasses will be left in place and not handled. If a permit is obtained, carcasses will be handled in accordance with the permit.

5.3.2 Wildlife Handling Procedure

All carcasses found will be documented 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 or other appropriate method and contact the appropriate authorities. If an injured bird or bat is found, Deuel Harvest may contact the wildlife rehabilitator, if appropriate.

6.0 Tier 5 - 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 Response

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

- 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

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

6.2.1 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 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 a mass casualty event is documented, South Deuel Wind will meet and confer with the USFWS and SDGFP as appropriate. If a particular cause can be identified, South Deuel Wind will develop specific mitigation measures in coordination 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 or state listed species' carcass or eagle carcass is found at the Project, South Deuel Wind 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 two business days 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, considering the new information

6.2.3 Discovery of a New and/or Active Eagle Nest

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

7.0 Key Resources

Resource	Phone Number
US Fish & Wildlife Service South Dakota Field Office	605-244-8693
South Dakota Department of Game, Fish, and Parks – Watertown Wildlife Office	605-882-5200
South Dakota Public Utilities Commission	800-332-1782
South Deuel Wind Operations & Maintenance	TBD

8.0 Literature Cited

Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Public Interest Energy Research Program (PIER) Final Project Report CEC-500-2006-022. Edison Electric Institute, APLIC, and the California Energy Commission. Washington D.C. and Sacramento, California.

American Wind Wildlife Institute. 2017. Wind Turbine Interactions with Wildlife and Their Habitats: A Summary of Research Results and Priority Questions. June 2017. 12 pp.

Bald and Golden Eagle Protection Act (BGEPA). 1940. 16 United States Code (USC) § 668-668d. June 8, 1940.

Bauman, P., Carlson, B., and Butler, T. 2016. Quantifying Undisturbed (Native) Lands in Eastern South Dakota: 2013. South Dakota State University. Open PRAIRIE: Open Public Research Access Institutional Repository and Information Exchange, Department of Natural Resource Management, South Dakota State University, Brookings, South Dakota. October 2016. Available online: https://openprairie.sdstate.edu/data_land-easternSD/1/#:~:text=In%20total%2C%20we%20identified%20962%2C734,adjacent%20to%20potentially%20undisturbed%20areas.

BHE Environmental, Inc. (BHE). 2010. Post-Construction Bird and Bat Mortality Study: Cedar Ridge Wind Farm, Fond Du Lac County, Wisconsin. Interim Report prepared for Wisconsin Power and Light, Madison, Wisconsin. Prepared by BHE Environmental, Inc. Cincinnati, Ohio. February 2010.

Bryce, S. A., Omernik, J. M., Pater, D. A., Ulmer, M., Schaar, J., Freeouf, J., Johnson, R., Kuck, P., and Azevedo, S. H. 1996. Ecoregions of North Dakota and South Dakota. (Color poster with map, descriptive text, summary tables, and photographs.) U.S. Geological Survey (USGS) map (map scale 1:1,500,000). USGS, Reston, Virginia. U.S. Environmental Protection Agency (USEPA). Available online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-39.

Burns & McDonnell. 2018a. Deuel County Wind Energy Project: South Deuel 2017 Bat Acoustic Study. A report prepared for DEUEL HARVEST WIND ENERGY SOUTH LLC.

Burns & McDonnell. 2021a. 2019 Raptor Nest Survey for Deuel Harvest South Wind. A report prepared for DEUEL HARVEST WIND ENERGY SOUTH LLC.

Burns & McDonnell. 2021b. Second Year Large Bird Use Study for the Deuel Harvest South Wind Farm. A report prepared for DEUEL HARVEST WIND ENERGY SOUTH LLC.

Burns & McDonnell. 2023a. South Deuel Wind 2023 Unbroken Grassland Assessment. A report prepared for DEUEL HARVEST WIND ENERGY SOUTH LLC.

Burns & McDonnell. 2023b. Deuel County Wind Energy Project: South Deuel Wind Expansion Areas Site Characterization Study Addendum. A report prepared for DEUEL HARVEST WIND ENERGY SOUTH LLC.

Burns & McDonnell. 2023c. South Deuel Wind Northern Long-eared Bat Habitat Assessment. A report prepared for DEUEL HARVEST WIND ENERGY SOUTH LLC.

Burns & McDonnell. 2023d. 2022 Raptor Nest Survey for South Deuel Wind. A report prepared for DEUEL HARVEST WIND ENERGY SOUTH LLC.

Burns & McDonnell. 2023e. 2023 Raptor Nest Survey for South Deuel Wind. A report prepared for DEUEL HARVEST WIND ENERGY SOUTH LLC.

Burns & McDonnell. 2023f. 2023 Bald Eagle Nest Monitoring Report for South Deuel Wind. A report prepared for DEUEL HARVEST WIND ENERGY SOUTH LLC.

Burns & McDonnell. 2023g. South Deuel Wind 2021-2022 Large Bird Use Survey. A report prepared for DEUEL HARVEST WIND ENERGY SOUTH LLC.

Burns & McDonnell. 2023h. South Deuel Wind 2022 Bat Acoustic Study. A report prepared for DEUEL HARVEST WIND ENERGY SOUTH LLC.

Burns & McDonnell. 2023i. South Deuel Wind 2023 Grassland Assessment. A report prepared for DEUEL HARVEST WIND ENERGY SOUTH LLC.

Burns & McDonnell 2023j. South Deuel Wind Wetland Delineation Report. A report prepared for DEUEL HARVEST WIND ENERGY SOUTH LLC.

Chodachek, K., Derby, C., Bruns Stockrahm, D., Rabie, P., Adachi, K., and Thorn, T. 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: https://apps.commerce.state.mn.us/eera/web/project-file?legacyPath=/opt/documents/MNDOC,%20Bat%20Fatality%20Study%20Year%201,%205.23.14.pdf.

Chodachek, K., Adachi, K., and DiDonato, G. 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.

Chodacheck, K., Suehring, A., Wilson, T. 2022. Post-Construction Bird and Bat Fatality Monitoring Study Crowned Ridge II Wind Farm Codington, Grant, and Deuel Counties, South Dakota. Prepared for Northern States Power, a Minnesota corporation, d/b/a/ Xcel Energy, Minneapolis, Minnesota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismark, North Dakota. April 27, 2022.

Derby, C., Dahl, A., Merrill, A., and Bay, K. 2010a. 2009 Post-Construction Monitoring Results for the Wessington Springs Wind-Energy Facility, South Dakota. Final Report. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 19, 2010.

Derby, C., Chodachek, K., Bay, K., and Merrill, A. 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.

Derby, C., Chodachek, K., Bay, K., and Merrill, A. 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.

Derby, C., Chodachek, K., Bay, K., and Merrill, A.. 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.

Derby, C., Dahl, A., Bay, K., and McManus, L. 2011. 2010 Post-Construction Monitoring Results for the Wessington Springs Wind Energy Facility, South Dakota. Final Report: March 9 – November 16, 2010. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. November 22, 2011.

Derby, C., Chodachek, K., and Sonnenberg, M. 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.

Derby, C., Chodachek, K., and Sonnenberg, M. 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.

Derby, C., Dahl, A., and Merrill, A. 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.

Derby, C., Dahl, A., and Fox, D. 2013. Post-Construction Fatality Monitoring Studies for the Prairiewinds Sd1 Wind Energy Facility, South Dakota. Final Report: March 2012 - February 2013. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. November 13, 2013.

eBird. 2023. eBird: An Online Database of Bird Distribution and Abundance. eBird, Cornell Lab of Ornithology, Ithaca, New York. Accessed September 2023. Available online: https://ebird.org/home.

Endangered Species Act (ESA). 1973. 16 United States Code (USC) § 1531-1544, Public Law (PL) 93-205, December 28, 1973, as amended, PL 100-478 [16 USC 1531 et seq.]; 50 Code of Federal Regulations (CFR) 402.

Erickson, W. P., G. D. Johnson, M. D. Strickland, K. J. Sernka, and R. E. Good. 2001. Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States. Prepared for the National Wind Coordinating Collaborative (NWCC). http://www.west-inc.com

Erickson, W. P., G. D. Johnson, D. P. Young, D. Strickland, R. Good, M. Bourassa, K. Bay, and K. Sernka. 2002. Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments. Technical report prepared for Bonneville Power Administration, Portland, Oregon by WEST, Inc., Cheyenne, Wyoming. December 2002. Available online: https://www.nrc.gov/docs/ML1409/ML14098A019.pdf.

Erickson, W. P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Annual Report: July 2001 - December 2003. Technical report peer-reviewed by and submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee. Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. December 2004. Available online: https://tethys.pnnl.gov/publications/stateline-wind-project-wildlife-monitoring-final-report-july-2001-december-2003.

Erickson, W., P. Rabie, K. Taylor, and K. Bay. 2014. Comparison of Avian Mortality Sources and Evaluation and Development of Compensatory Mitigation Options for Birds. Presented at the National Wind Coordinating Collaborative (NWCC), Wind Wildlife Research Meeting X, December 2-5, 2014, Broomfield, Colorado. Available online: https://nationalwind.org/wp-content/uploads/2014/04/34_Erikson.pdf.

Federal Emergency Management Agency (FEMA). 2022. National Flood Hazard Layer (NFHL). Available online: https://hazards-

fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd.

Fernley, J., S. Lowther, and P. Whitfield. 2006. A Review of Goose Collisions at Operating Wind Farms and Estimation of the Goose Avoidance Rate. Unpublished report. West Coast Energy, Hyder Consulting and Natural Research.

Flyways.us. 2016. Central Flyway. A collaborative effort of waterfowl managers across the continent. U.S. Fish and Wildlife Service (USFWS). Accessed August 2016. Available online: https://www.fws.gov/program/migratory-birds.

Gelman, A., J. B. Carlin, H. S. Stern, D. B. Dunson, A. Vehtari, and D. B. Rubin. 2013. Bayesian Data Analysis. CRC Press, London.

Gruver, J., M. Sonnenberg, K. Bay, and W. Erickson. 2009. Post-Construction Bat and Bird Fatality Study at the Blue Sky Green Field Wind Energy Center, Fond Du Lac County, Wisconsin July 21 - October 31, 2008 and March 15 - June 4, 2009. Unpublished report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 17, 2009.

Hale, A.M. 2016. Interpreting failure to reject null hypothesis of displacement from wind turbines in three species of grassland birds: response to Johnson (2016). The Condor. 118(3):676-679.

Hale, A.M., E.S. Hatchett, J.A. Meyer, and V.J. Bennett. 2014. No evidence of displacement due to wind turbines in breeding grassland songbirds. The Condor 11(3):472-482.

Henderson, L. E., Broders, H. G. 2008. Movements and Resource Selection of the Northern Long-eared Myotis (Myotis septentrionalis) in a Forest—Agriculture Landscape. Journal of Mammalogy. Volume 89, Issue 4.

Howe, R. W., W. Evans, and A. T. Wolf. 2002. Effects of Wind Turbines on Birds and Bats in Northeastern Wisconsin. Prepared by University of Wisconsin-Green Bay, for Wisconsin Public Service Corporation and Madison Gas and Electric Company, Madison, Wisconsin. November 21, 2002. 104 pp.

Hull, C. L. and S. Muir. 2010. Search Areas for Monitoring Bird and Bat Carcasses at Wind Farms Using a Monte-Carlo Model. Australasian Journal of Environmental Management 17(2): 77-87.

Huso, M. 2010. An Estimator of Wildlife Fatality from Observed Carcasses. Environmetrics 22(3): 318– 329. doi: 10.1002/env.1052.

Huso, M. M. P. and D. Dalthorp. 2014. Accounting for Unsearched Areas in Estimating Wind Turbine- Caused Fatality. Journal of Wildlife Management 78(2): 347-358. doi: 10.1002/jwmg.663.

Johnson, D.H. 2016. Comment on “No evidence of displacement due to wind turbines in breeding grassland songbirds”. The Condor 118:674-675.

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, and D. A. Shepherd. 2000. Final Report: Avian Monitoring Studies at the Buffalo Ridge Wind Resource Area, Minnesota: Results of a 4-Year Study. Final report prepared for Northern States Power Company, Minneapolis, Minnesota, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. September 22, 2000. 212 pp.

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, D. A. Shepherd, and S. A. Sarappo. 2003. Mortality of Bats at a Large-Scale Wind Power Development at Buffalo Ridge, Minnesota. American Midland Naturalist 150: 332-342.

Kerlinger, P., R. Curry, A. Hasch, and J. Guarnaccia. 2007. Migratory Bird and Bat Monitoring Study at the Crescent Ridge Wind Power Project, Bureau County, Illinois: September 2005 - August 2006. Final draft prepared for Orrick Herrington and Sutcliffe, LLP. May 2007.

Kochert, M. N., K. Steenhof, C. L. Mcintyre, and E. H. Craig. 2002. Golden Eagle (Aquila Chrysaetos). A. Poole, ed. The Birds of North America Online. Cornell Lab of Ornithology. Ithaca, New York. Available online: https://birdsoftheworld.org/bow/historic/bna/goleag/2.0/introduction; DOI: 10.2173/bna.684.

Korner-Nievergelt, F., P. Korner-Nievergelt, O. Behr, I. Niermann, R. Brinkmann, and B. Hellriegel. 2011. A New Method to Determine Bird and Bat Fatality at Wind Energy Turbines from Carcass Searches. Wildlife Biology 17: 350-363.

Kunz, T. H., E. B. Arnett, B. M. Cooper, W. P. Erickson, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007a. Ecological Impacts of Wind Energy Development on Bats: Questions, Hypotheses, and Research Needs. In press. Frontiers in Ecology and the Environment 5.

Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007b. Ecological Impacts of Wind Energy Development on Bats: Questions, Research Needs, and Hypotheses. Frontiers in Ecology and the Environment 5(6): 315-324.

Leddy, K.L., K.F. Higgins, and D.E. Naugle. 1999. Effects of wind turbines on upland nesting birds in Conservation Reserve Program grasslands. The Wilson Bulletin 111(1):100-104.

Liguori, J. 2005. Hawks from Every Angle: How to Identify Raptors in Flight. Princeton University Press, Princeton, New Jersey.

Loesch C.R., J.A. Walker, R.E. Reynolds, J.S. Gleason, N.D. Niemuth, S.E. Stephens, and M.A. Erickson. 2013. Effect of wind energy facilities on breeding duck densities in in the Prairie Pothole Region. Journal of Wildlife Management 77:587–598.

Manly, B. F. J. 1997. Randomization, Bootstrap, and Monte Carlo Methods in Biology. second Edition. Chapman and Hall, London.

National Research Council (NRC). 2007. Environmental Impacts of Wind-Energy Projects. National Academies Press, Washington, D.C. www.nap.edu.

Pardieck, K. L., D. J. Ziolkowski, Jr., M. A. R. Hudson, and K. Campbell. 2016. North American Breeding Bird Survey Dataset 1966 - 2015, Version 2015.1. U.S. Geological Survey, Patuxent Wildlife Research Center. Available online: www.pwrc.usgs.gov/BBS/RawData/.

Pedersen, M. B. and E. Poulsen. 1991. Impact of a 90m/2mw Wind Turbine on Birds: Avian Response to the Implementation of the Tjaereborg Wind Turbine at the Danish Wadden Sea. Dansek Vildundersogelser 47: 1-44.

Shaffer, J. and D. Buhl. 2016. Effects of wind-energy facilities on breeding grassland bird distributions. Conservation Biology, 30:59–71. doi: 10.1111/cobi.12569.

Shaffer, J.A. and D.H. Johnson. 2009. Displacement effects of wind developments on grassland birds in the Northern Great Plains. Pages 57-61 in Proceedings of the NWCC Wind Wildlife Research Meeting VII (PNWWRM VII), Milwaukee, WI. October 28-29, 2008. Prepared for the Wildlife Workgroup of the National Wind Coordinating Collaborative by RESOLVE, Inc., Washington, DC, Susan Savitt Schwartz, ed. 116 pp.

Shoenfeld, P. 2004. Suggestions Regarding Avian Mortality Extrapolation. Technical memo provided to FPL Energy. West Virginia Highlands Conservancy, HC70, Box 553, Davis, West Virginia, 26260. Available online: https://docplayer.net/104547431-Suggestions-regarding-avian-mortality-extrapolation.html.

South Dakota Game, Fish, and Parks (SDGFP). 2005. South Dakota Bald Eagle (Haliaeetus leucocephalus) Management Plan. Available online: https://gfp.sd.gov/UserDocs/nav/bald-eagle-plan.pdf.

SDGFP. 2009. Siting Guidelines for Wind Power Projects in South Dakota. Available online: https://gfp.sd.gov/userdocs/docs/wind-energy-guidelines.pdf.

SDGFP. 2023a. Siting Guidelines for Wind Power Projects in South Dakota. Accessed September 2023. Available online: https://gfp.sd.gov/userdocs/docs/wind-energy-guidelines.pdf.

SDGFP. 2023b. South Dakota Hunting Areas. Accessed September 2023. Available online: https://gfp.sd.gov/hunting-areas/.

SDGFP. 2023c. Natural Heritage Information System. Accessed 2017, 2022, and 2023. Available online: https://gfp.sd.gov/forms/heritagedata/.

Spaans, A., L. van den Bergh, S. Dirksen, and J. v. d. Winden. 1998. Windturbines En Volgels: Hoe Hiermee Om Te Gaan? (Wind Turbines and Birds: Can They Co-Exist?). De Levende Naturr 99(3): 115-121.

U.S. Department of Agriculture (USDA). 2020. National Agriculture Imagery Program (NAIP). Available online: https://naip-usdaonline.hub.arcgis.com/.

U.S. Fish and Wildlife Service (USFWS). n.d. "Bald Eagle Management Guidelines and Conservation Measures: Bald and Golden Eagle Protection Act."

USFWS. 2007. National Bald Eagle Management Guidelines. Available online: https://www.fws.gov/sites/default/files/documents/national-bald-eagle-management-guidelines_0.pdf.

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

USFWS. 2013. Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy, Version 2. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management. April 2013. 103 pp. + frontmatter. Available online: https://www.fws.gov/migratorybirds/pdf/management/eagleconservationplanguidance.pdf.

USFWS. 2016. National Wetlands Inventory (NWI). NWI Data Mapper. Updated October 13, 2016. Fort Snelling, Minnesota. Wetlands Mapper: http://www.fws.gov/wetlands/Data/Mapper.html.

USFWS. 2023a. Bald and Golden Eagle Protection Act. Available online: https://www.fws.gov/law/bald-and-golden-eagle-protection-act.

USFWS. 2023b. Information for Planning and Consultations. Available online: https://ipac.ecosphere.fws.gov/.

USFWS. 2023c. Rufa Red Knot. Available online: https://www.fws.gov/species/rufa-red-knot-calidris-canutus-rufa.

USFWS. 2023d. Northern Long-eared Bat. Available online: https://www.fws.gov/species/northern-long-eared-bat-myotis-septentrionalis.

USFWS. 2023e. Land-based Wind Energy Interim Voluntary Guidance for the Northern Long-eared Bat. Available online: https://www.fws.gov/sites/default/files/documents/Interim%20Wind%20Guidance%20NLEB_6Mar23.pdf.

U.S. Geological Survey (USGS). 2018. Map of Whooping Crane Corridor. Available online: https://www.usgs.gov/data/map-whooping-crane-migration-corridor.

USGS. 2019. National Land Cover Database (NLCD). Multi-Resolution Land Characteristics Consortium (MRLC), National Land Cover Database (NLCD). USGS Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota.

Weary, D. J. and D. H. Doctor. 2014. Karst in the United States: A Digital Map Compilation and Database. Us Geological Survey (USGS) Open-File Report 2014–1156. Report available online: http://pubs.usgs.gov/of/2014/1156/pdf/of2014-1156.pdf.

Western EcoSystems Technology, Inc. (WEST). 2016a. Breeding Bird Survey for the Deuel County Wind Energy Project, Deuel County, South Dakota. A report prepared for Deuel Wind Energy, LLC. Prepared by Western EcoSystems Technology, Inc.

Western EcoSystems Technology, Inc. (WEST). 2016b. Raptor Nest Survey for the Deuel County Wind Energy Project, Deuel County, South Dakota. A report prepared for Deuel Wind Energy, LLC. Prepared by Western EcoSystems Technology, Inc.

Western EcoSystems Technology, Inc. (WEST). 2016c. Bat Mist-netting Survey for the Deuel County Wind Energy Project, Deuel County, South Dakota. A report prepared for Deuel Wind Energy, LLC. Prepared by Western EcoSystems Technology, Inc.

Western EcoSystems Technology, Inc. (WEST). 2017a. Site Characterization Study South Deuel Area, Deuel County Wind Energy Project, Deuel County, South Dakota. Final Report. Prepared for Deuel Harvest Wind Energy, LLC. Prepared by Western EcoSystems Technology, Inc.

Western EcoSystems Technology, Inc (WEST). 2017b. Avian Use Study South Deuel Area Deuel County Wind Energy Project Deuel County, South Dakota. A report prepared for Deuel Wind Energy, LLC. Prepared by Western EcoSystems Technology, Inc.

Western EcoSystems Technology, Inc (WEST). 2017c. Bat Acoustic Study for the South Deuel Area Deuel County Wind Energy Project Deuel County, South Dakota. A report prepared for Deuel Wind Energy, LLC. Prepared by Western EcoSystems Technology, Inc.

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.

Winkelman, E. 1990. Impact of the Wind Park near Urk, Netherlands, on Birds: Bird Collision Victims and Disturbance of Wintering Fowl. International Ornithological Congress 20: 402-403.

Young, D.P., J.D. Jeffrey, W.P. Erickson, K.J. Bay, V.K, Poulton, K. Kronner, B. Gritski, and J. Baker. 2006. Eurus Combine Hills Turbine Ranch Phase 1: Post Construction Wildlife Monitoring First Annual Report, February 2004-February 2005. 49pp. Available online: http://wind.nrel.gov/public/library/young7.pdf.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