

**Site Characterization Study for the
Aurora Wind Energy Project
Williams County, North Dakota**

Final Report

Prepared for:

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EXECUTIVE SUMMARY

This report contains a biological site characterization of the Aurora Wind Energy Project (Project) in Williams County, North Dakota, in accordance with the Tier 2 site characterization study set forth in the US Fish and Wildlife Service's *Land-Based Wind Energy Guidelines*. The purpose of this report is to provide an initial characterization of the biological resources in the Project with respect to their potential importance for wind energy development at the site. This assessment was based on a comprehensive review of available technical literature and publicly available databases.

The Project encompasses about 54,316.1 acres (ac; 21,980.9 hectares [ha]) in Williams County, North Dakota. The Project falls within the Northwestern Glaciated Plains Level III Ecoregion. Much of the Northwestern Glaciated Plains region, which stretches from Saskatchewan, Canada in the north, along the Missouri River through the Dakotas, and south to northern Nebraska, was originally characterized by fescue grasslands, tall and short-grass prairie, scattered mixed trees and shrubs, and seasonal wetlands, but is now primarily farmland. Today, most of the area is a productive agricultural area with a variety of crops including wheat, corn, soybeans, and sunflowers. Though most of the Project is made up of cultivated cropland, there is some open water, shrub/scrub, woody wetlands, deciduous forest, and low intensity developed areas.

The Project has the potential to be utilized by migrating birds for stopover habitat. Given its location, the Project may also receive use by some sensitive bird species that migrate along the Missouri River, which is located to the south of the Project. In particular, the Missouri River might serve as a corridor that is used by migrating whooping cranes, piping plovers, rufa red knots, interior least terns, raptors, and other bird types. There is also some potential for impacts to individual birds of some species, particularly during the spring and fall migration seasons. Bald and golden eagles have the potential occur in the Project year-round.

The Project is likely to see increased waterfowl use during the spring and fall migration periods. However, high use of wind energy sites by water-associated birds has not been strongly correlated with fatalities, as evidenced by low waterbird fatalities at facilities in Minnesota, Wisconsin, Iowa, and Oregon, despite high use by waterfowl and waterbirds.

Given the species overall range, there is limited potential for the federally listed northern long-eared bat to forage and utilize forests, buildings, and bridges within the Project; however, suitable roosting habitat is limited within the Project. More suitable roosting habitat, consisting of larger connected tracts of forest habitat, exists along the White Earth and Missouri Rivers outside of the Project.

The development of a commercial wind energy facility in the proposed Project area is likely to generate relatively minor adverse impacts on a variety of birds, including songbirds. These impacts may include both collision mortality and displacement. Collision is relevant for a wide

variety of migratory species, and displacement is relevant for grassland-affiliated species. None of these potential impacts are expected to result in population-level effects to the species.

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REPORT REFERENCE

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INTRODUCTION

Knowledge of potential biological resource issues early in the development of wind energy facilities helps the industry identify, avoid, and minimize potential conflicts with wildlife. Aurora Wind Project, LLC, a subsidiary of Tradewind Energy, Inc., contracted Western EcoSystems Technology, Inc. (WEST) to describe the environmental resources at the proposed Aurora Wind Energy Project (Project). The purpose of this report is to describe biological resources present within and surrounding the proposed Project, identify potential risks to biological resources, recommend baseline monitoring studies, if warranted, and compare site characteristics with those at other wind energy facilities for which pre- and post-construction wildlife studies are publicly available. This report is meant to meet the guidance for a Tier 2 site characterization study as described by the US Fish and Wildlife Service's (USFWS) *Land-Based Wind Energy Guidelines* (WEG; USFWS 2012d).

STUDY AREA

The Project encompasses 54,318.0 acres (ac; 21,981.7 hectares [ha]) in Williams County, North Dakota (Figure 1). The Project falls within the Northwestern Glaciated Plains Level III Ecoregion (US Environmental Protection Agency 2010). Much of the Northwestern Glaciated Plains region was originally characterized by fescue grasslands, tall and short-grass prairie, mixed trees and shrubs, and seasonal wetlands, but is now primarily cultivated cropland (Griffith 2010). The Northern Glaciated Plains region is now a productive agricultural area with a variety of crops including wheat (*Triticum* spp), corn (*Zea mays*), soybeans (*Glycine max*), and sunflowers (*Helianthus sp*; Griffith 2010). The majority of the land use/land cover within the Project is cultivated crops, herbaceous grassland, developed open space, and emergent herbaceous wetlands (US Geological Service [USGS] National Land Cover Database [NLCD] 2011, Homer et al. 2015). Though most of the Project is made up of cultivated cropland, there is some open water, shrub/scrub, woody wetlands, deciduous forest, and low intensity developed areas (each making up less than 1% of the Project). Tom Berg Lake is within the Project area (Figure 2) and several larger lakes are within two miles (mi; 3.2 kilometers [km]) of the Project. According to the USGS National Elevation Dataset (NED), the topography of the Project is gently rolling hills (Figure 3) with elevation ranging from approximately 669 to 755 meters (m; 2,195 to 2,477 feet [ft]) above mean sea level (Figure 4; USGS NED 2012).

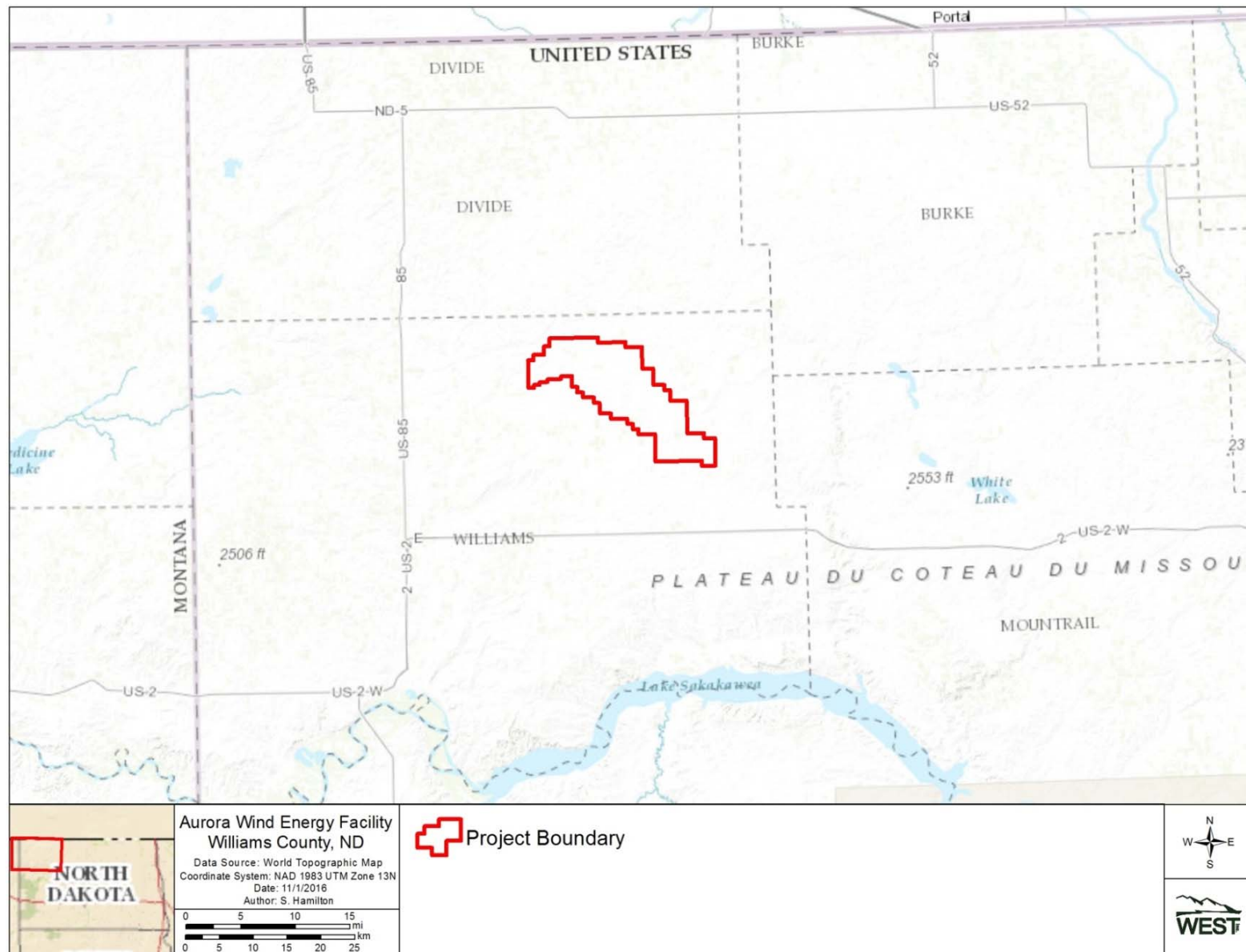


Figure 1. Location of the Aurora Wind Energy Project in Williams County, North Dakota.

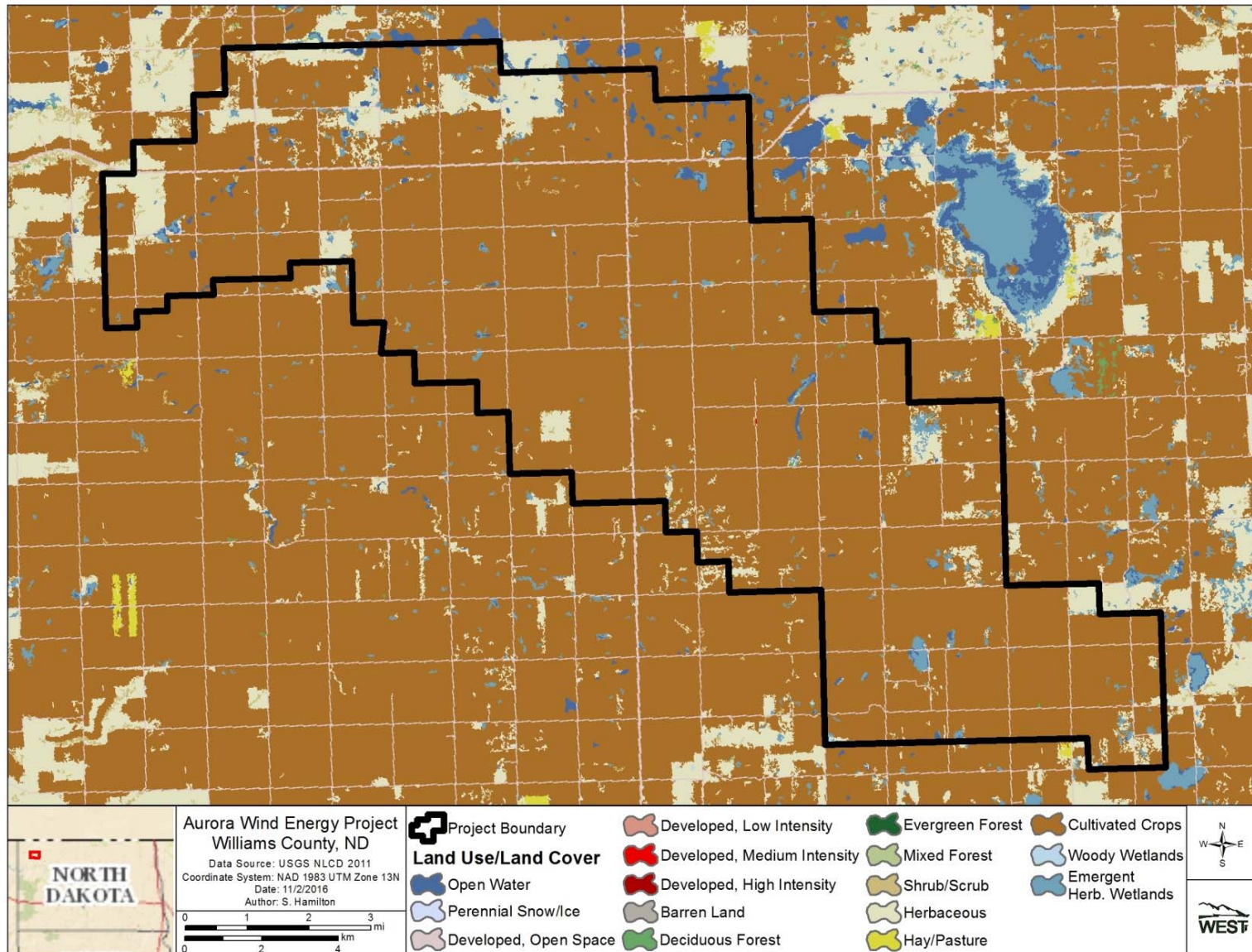


Figure 2. Land use/land cover types within the Aurora Wind Energy Project in Williams County, North Dakota (USGS NLCD 2011; Homer et al. 2015).

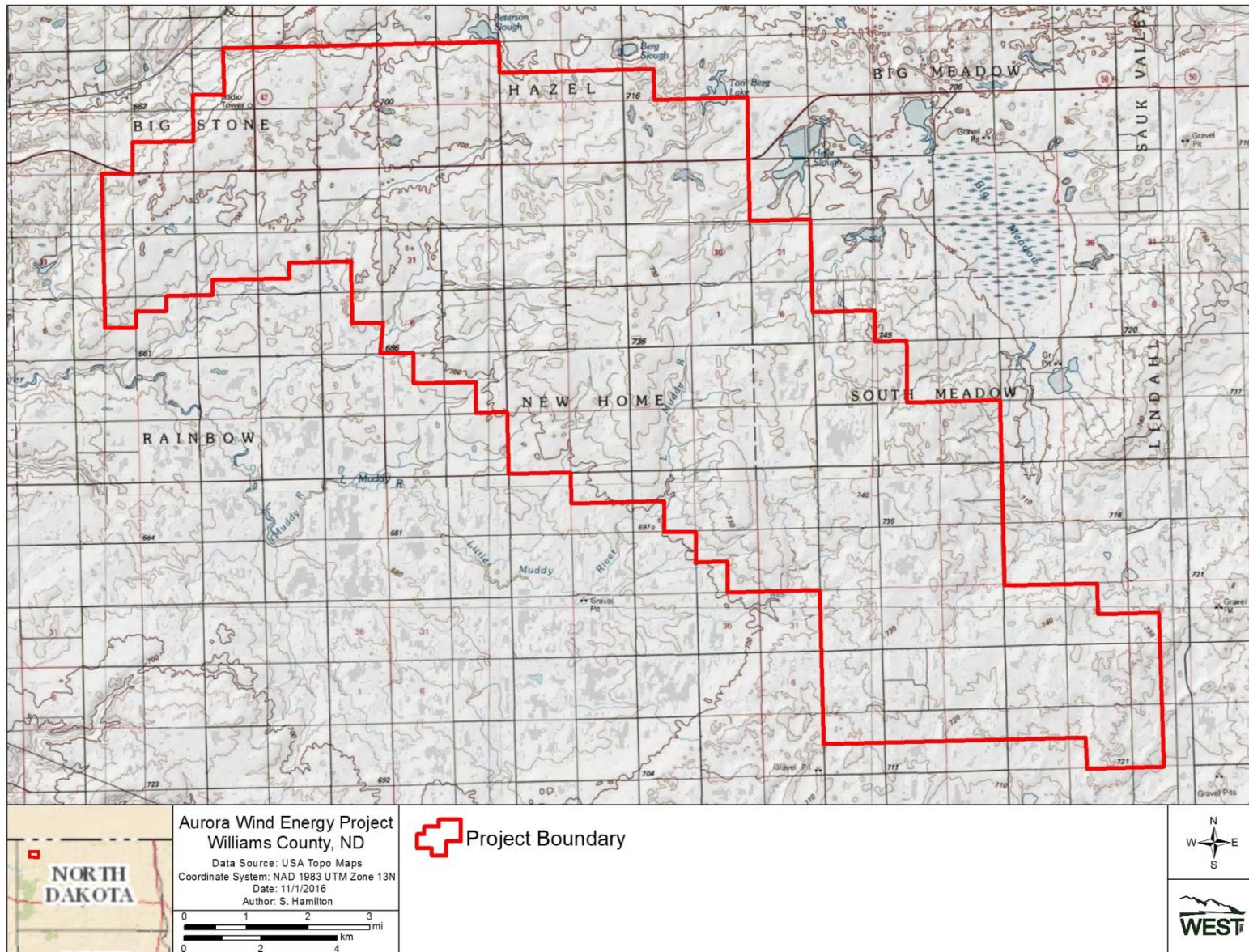


Figure 3. Topography of the Aurora Wind Energy Project in Williams County, North Dakota.

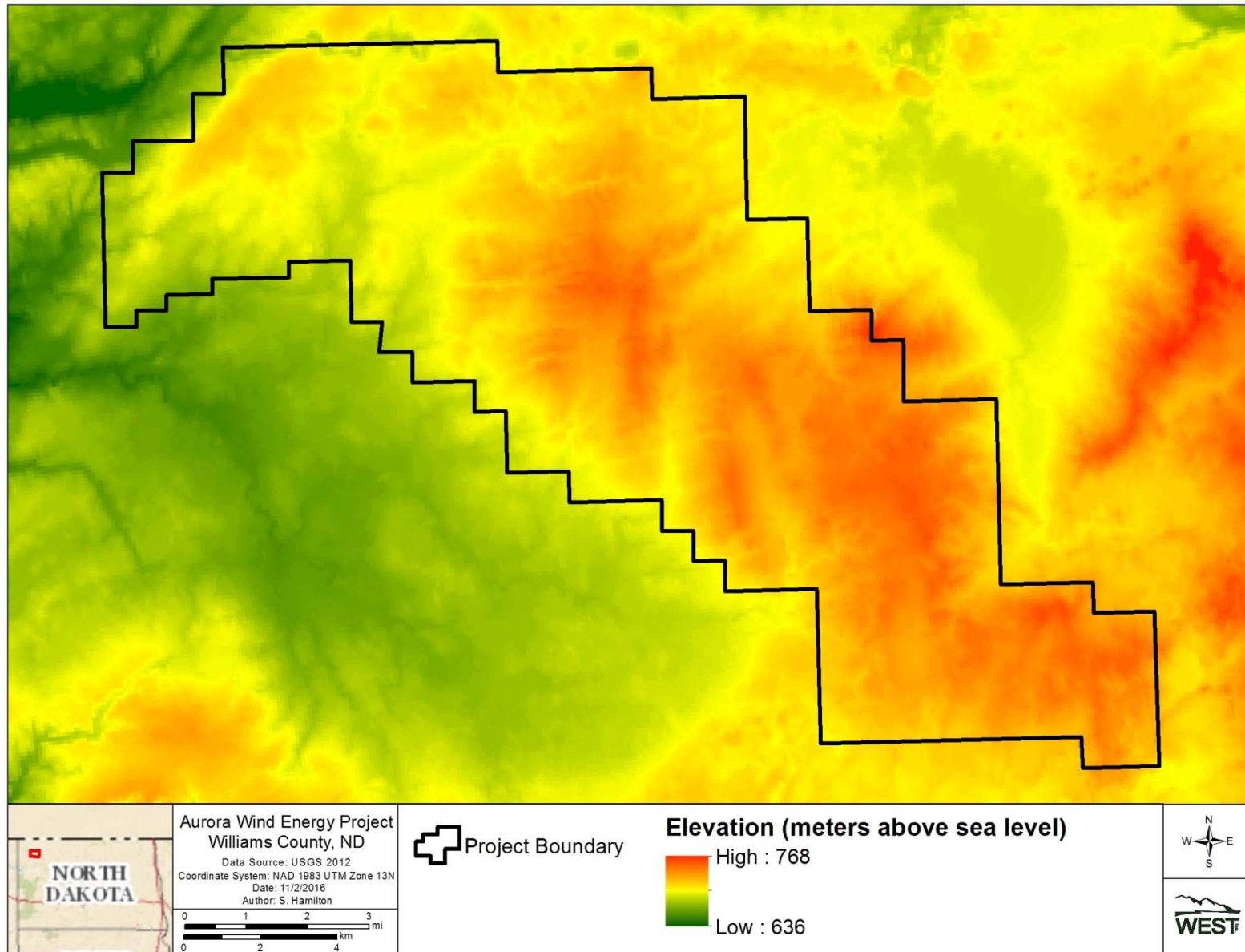


Figure 4. Elevation of the Aurora Wind Energy Project in Williams County, North Dakota (USGS 2012).

METHODS

Biological resources within the Project area were evaluated through a comprehensive desktop review of existing, publicly available data. Several sources of data were used in the desktop review including technical literature, field guides, and datasets. In addition to identifying biological resources within the Project area, this report presents existing information and results of studies conducted at other wind energy facilities from WEST's cumulative database of fatalities at wind energy facilities.

LAND USE/LAND COVER

According to the USGS NLCD (2011), the dominant cover type is cultivated crops which compose approximately 87% of the Project area. Herbaceous communities make up an additional 6.5% of the Project area, and may contain some native grassland (USGS NLCD 2011, Homer et al. 2015). Developed open space and emergent herbaceous wetlands cover about 4% and 2% of the Project area, respectively. Each of the other land cover types represents less than 1% of the Project (Table 1, Figure 2).

Table 1. Land use/land cover types present within the Aurora Wind Energy Project in Williams County, North Dakota.

Land Use/Land Cover	Acres	Percent Composition
Cultivated Crop	47,105.8	86.7
Herbaceous	3,555.7	6.5
Developed, Open Space	2,034.0	3.7
Emergent Herbaceous Wetlands	844.9	1.6
Open Water	488.8	<1
Shrub/Scrub	211.5	<1
Woody Wetlands	33.7	<1
Deciduous Forest	19.7	<1
Developed, Low Intensity	19.7	<1
Developed, Medium Intensity	1.1	<1
Mixed Forest	1.1	<1
Total	54,316.0	100

Source: USGS NLCD 2011

Wetlands and Riparian Areas

Formal wetland delineations for the Project have not been completed. USFWS National Wetland Inventory (NWI) data (USFWS NWI 2014) show approximately 1,401.5 ac (567.2 ha; 2.6 %) of the Project area is made up of wetlands (Table 2, Figure 5). According to the USFWS NWI (2014) freshwater emergent wetlands account for 1,281.5 ac (518.6 ha), followed by lakes that make up 59.8 ac (24.2 ha; Table 2). According to the National Hydrography Dataset (NHD), one named river, the Little Muddy River, that flows west from within the Project area (USGS NHD 2015). Several unnamed streams and lakes occur within the Project (Figure 5). Additionally, there is

potential for depressions within croplands and grasslands to be saturated and/or to hold water, which may provide stopover habitat for shorebirds or waterfowl during migration.

Table 2. National Wetland Inventory wetland types present within the Aurora Wind Energy Project in Williams County, North Dakota.

Wetland Type	Acres	Percent Composition
Freshwater Emergent Wetland	1,281.5	91.4
Lake	59.8	4.3
Freshwater Pond	51.6	3.7
Freshwater Forested/Shrub Wetland	4.9	0.3
Other	3.7	0.3
Total	1,401.5	100

Source: USFWS NWI 2014

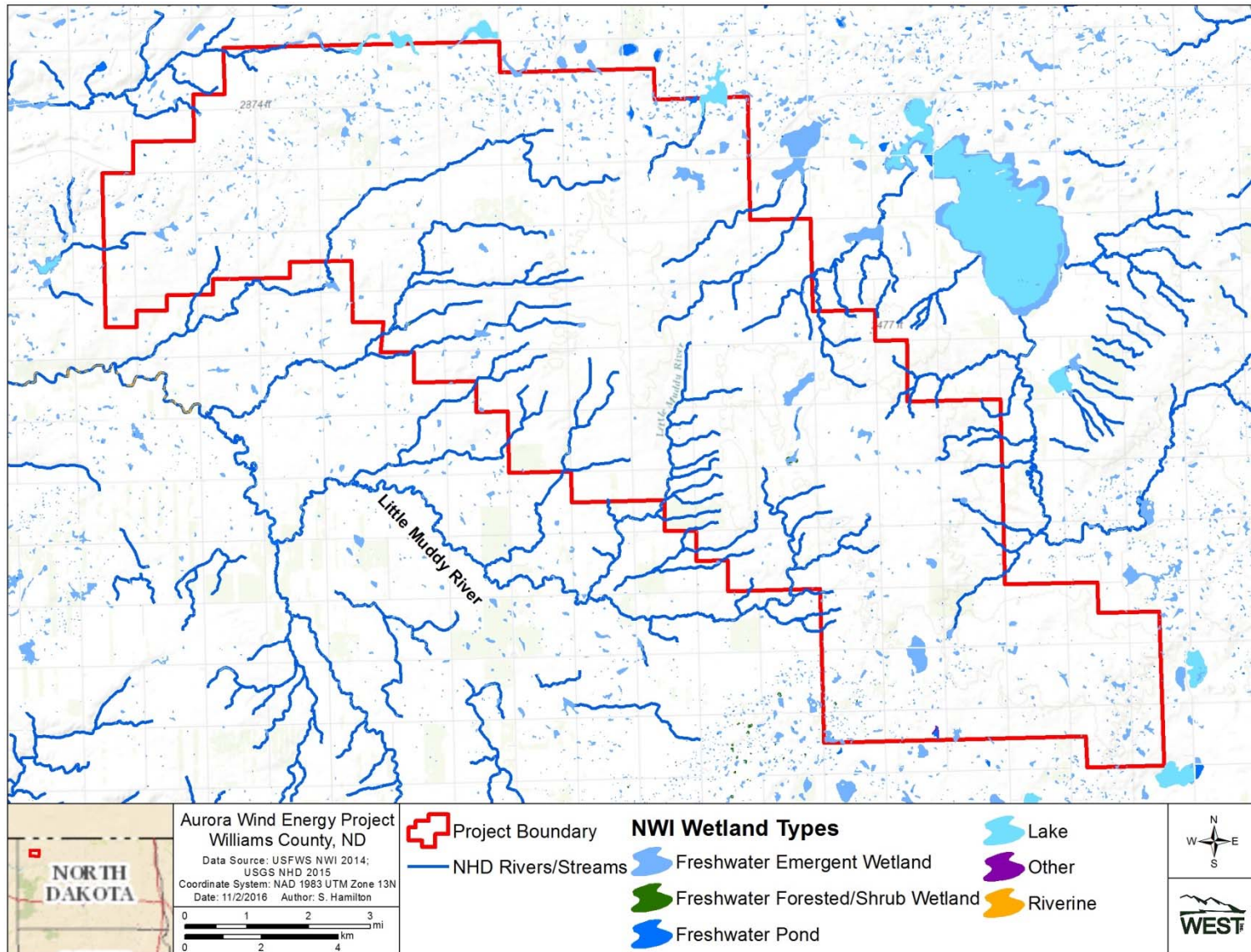


Figure 5. National Wetlands Inventory wetland types and National Hydrography Dataset rivers and streams within the Aurora Wind Energy Project in Williams County, North Dakota (USFWS NWI 2014, USGS NHD 2015).

Federal- and State-Managed Lands

Based on the Protected Areas Database of the United States (PADUS), there are three state-managed wildlife lands located within 10 mi (16.1 km) of the Project (Figure 6; USGS PADUS 2012). The closest state-managed lands to the Project are McGregor Dam Wildlife Management Area (WMA; located approximately 6.6 mi [10.6 km] east of the Project) and Blue Ridge WMA (located about 8.8 mi [14.2 km] west of the Project; Figure 6). While there are no federally owned lands within the Project area, there are three federally owned lands within 10 mi (16.1 km) of the Project (Figure 6). The closest federally owned land to the Project is Williams County Waterfowl Production Area (WPA; located about 0.5 mi [0.8 km] west of the Project; Figure 6). Additionally, there may be other lands protected through federal grassland and/or wetland easements.

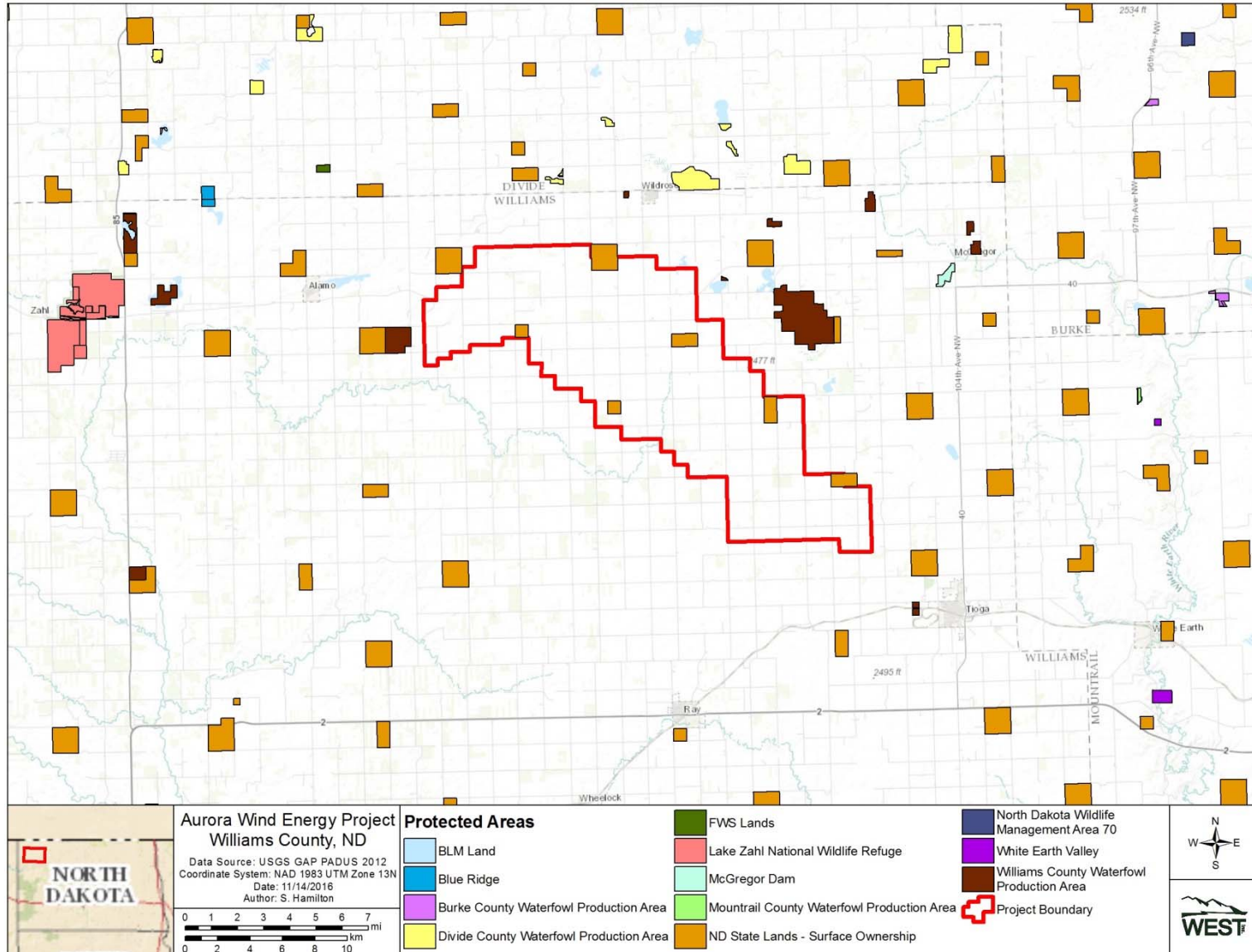


Figure 6. Federal, state, and locally managed lands within and adjacent to the Aurora Wind Energy Project in Williams County, North Dakota (USGS PADUS 2012).

FEDERAL- AND STATE-PROTECTED SPECIES

WEST reviewed the USFWS county distribution list of federally endangered, threatened, proposed, and candidate species to determine which species may occur in Williams County, North Dakota (USFWS 2016). The state of North Dakota does not have a state threatened and endangered species list; instead, the North Dakota Game and Fish Department (NDGFD) maintains a list of Species of Conservation Priority (SCP; Dyke et al. 2015). Species are classified into three levels according to their conservation need: Level I species are the highest level of conservation priority, Level II species are of a moderate level of conservation priority, and Level III species are also of a moderate level of conservation priority but are thought to be peripheral or non-breeding in North Dakota (Dyke et al. 2015). Table 3 lists threatened, endangered, and SCP with potential to occur in the Project area based on geographic range and habitat preferences (Dyke et al. 2015, USFWS 2016). Agency correspondence can be incorporated when available. For observation data of birds, WEST consulted the eBird database, a citizen-based bird observation network (Sullivan et al. 2014, eBird 2016a).

Table 3. Federally listed threatened and endangered species, and State Species of Conservation Priority, with known or potential occurrence in Williams County, North Dakota. Likelihood of occurrence within the Aurora Wind Energy Project in Williams County, North Dakota, is based on distribution ranges and habitat preferences.

Species	Status ¹	Habitat	Potential Occurrence within the Project
MAMMALS			
big brown bat <i>Eptesicus fuscus</i>	SCP Level I	Uses standing snags and hollow trees of coniferous and deciduous forests. Also uses bridges, buildings, and tunnels.	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
little brown bat <i>Myotis lucifugus</i>	SCP Level I	Generally uses buildings as roosts that are near feeding areas with flying insects	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Northern long-eared bat <i>Myotis septentrionalis</i>	FT; SCP Level I	Roosts and forages during spring and summer in mature forest interior and riparian areas. May roost in old buildings; typically avoids open habitats. Congregates in wooded areas surrounding caves and mines in autumn, and hibernates in caves and mines.	The study area is not likely to contain habitat for northern long-eared bat, although the winter distribution of northern long-eared bat reaches into Williams County.
BIRDS			
American bittern <i>Botaurus lentiginosus</i>	SCP Level I	Utilizes a variety of wetlands, but usually larger wetlands with tall emergent vegetation	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Baird's sparrow <i>Ammodramus bairdii</i>	SCP Level I	Large tracts of native mixed-grass prairie or pastures	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
black tern <i>Chlidonias niger</i>	SCP Level I	Uses shallow wetland complexes, usually larger than 20 hectares, with open water and emergent vegetation	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.

Table 3. Federally listed threatened and endangered species, and State Species of Conservation Priority, with known or potential occurrence in Williams County, North Dakota. Likelihood of occurrence within the Aurora Wind Energy Project in Williams County, North Dakota, is based on distribution ranges and habitat preferences.

Species	Status ¹	Habitat	Potential Occurrence within the Project
black-billed cuckoo <i>Coccyzus erythrophthalmus</i>	SCP Level I	Nests in trees and brush. Uses riparian zones, shelterbelts, and wooded areas.	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
chestnut-collared longspur <i>Calcarius ornatus</i>	SCP Level I	Mixed-grass and shortgrass prairie	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
ferruginous hawk <i>Buteo regalis</i>	SCP Level I	Large areas of native prairie	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Franklin's gull <i>Leucophaeus pipixcan</i>	SCP Level I	Large wetlands; often feeds in tilled agricultural fields	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
grasshopper sparrow <i>Ammodramus savannarum</i>	SCP Level I	Tall or mixed-grass prairie, hayfields, and meadows	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
greater sage-grouse <i>Centrocercus urophasianus</i>	SCP Level I	Sagebrush ecosystem	The Project is not likely to contain suitable habitat for this species.
horned grebe <i>Podiceps auritus</i>	SCP Level I	Wetlands and ponds with emergent vegetation and open area	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
lark bunting <i>Calamospiza melanocorys</i>	SCP Level I	Sagebrush ecosystems or mixed-grass prairie with shrubs and cropland interspersed	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
least tern – interior population <i>Sternula antillarum</i>	FE; SCP Level II	Nests on barren to sparsely vegetated sandbars along rivers, sand and gravel pits, and lake and reservoir shorelines	The Project may contain suitable habitat for this species. Least terns may pass through during migration.

Table 3. Federally listed threatened and endangered species, and State Species of Conservation Priority, with known or potential occurrence in Williams County, North Dakota. Likelihood of occurrence within the Aurora Wind Energy Project in Williams County, North Dakota, is based on distribution ranges and habitat preferences.

Species	Status ¹	Habitat	Potential Occurrence within the Project
long-billed curlew <i>Numerius americanus</i>	SCP Level I	Shrub-steppe prairie or short-grass prairie	The Project is on the edge of this species' range; therefore, the Project is not likely to contain suitable habitat for this species.
marbled godwit <i>Limosa fedoa</i>	SCP Level I	Utilize a variety of wetlands and nest in grazed native prairie	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Nelson's sparrow <i>Ammodramus nelsoni</i>	SCP Level I	Use shallow marshes, fens, and wet meadows	The Project is on the edge of this species' range; therefore, the Project is not likely to contain suitable habitat for this species.
red-headed woodpecker <i>Melanerpes erythrocephalus</i>	SCP Level I	Natural stands of mature deciduous trees	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Sprague's pipit <i>Anthus spragueii</i>	SCP Level I	Large areas of native mixed-grass prairie	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Swainson's hawk <i>Buteo swainsoni</i>	SCP Level I	Utilizes grassland and cropland with wooded thickets interspersed	The Project likely contains suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Wilson's phalarope <i>Phalaropus tricolor</i>	SCP Level I	Mudflats and shallow wetlands	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
yellow rail <i>Coturnicops noveboracensis</i>	SCP Level I	Wet meadows and fens	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
piping plover <i>Charadrius melodus</i>	FT; SCP Level II	In the Midwest, breeds on sparsely vegetated beaches of large lakes or sand spits	The Project may contain suitable habitat for this species, and piping plovers may pass through during migration.

Table 3. Federally listed threatened and endangered species, and State Species of Conservation Priority, with known or potential occurrence in Williams County, North Dakota. Likelihood of occurrence within the Aurora Wind Energy Project in Williams County, North Dakota, is based on distribution ranges and habitat preferences.

Species	Status ¹	Habitat	Potential Occurrence within the Project
rufa red knot <i>Calidris canutus rufa</i>	FT; SCP Level III	May occasionally be found on mudflats, sandbars, shallowly flooded areas, and pond margins along the Missouri River	The Project is not likely to contain suitable habitat for this species, although rufa red knots may pass through during migration.
whooping crane <i>Grus Americana</i>	FE; SCP Level III	Herbaceous wetlands and grasslands	The Project is within the known migration corridor for whooping cranes; therefore, occurrence within the Project is possible.
AMPHIBIANS			
Canadian toad <i>Anaxyrus hemiophrys</i>	SCP Level I	Prairies with relatively soft soil in or near water	The Project likely contains suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
plains spadefoot <i>Spea bombifrons</i>	SCP Level I	Dry grasslands with gravelly or sandy soil	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
REPTILES			
plains hog-nosed snake <i>Heterodon nasicus</i>	SCP Level I	Dry grasslands with gravelly or sandy soil	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
smooth green snake <i>Opheodrys vernalis</i>	SCP Level I	Grasslands and upland hills	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
FISH			
blue sucker <i>Cycleptus elongatus</i>	SCP Level I	Large rivers and lower parts of major tributaries	The Project may contain suitable habitat for this species.
pallid sturgeon <i>Scaphirhynchus albus</i>	FE	Inhabits the Missouri River	The study area is not likely to contain suitable habitat for this species.
sicklefin chub <i>Marchybopsis meeki</i>	SCP Level I	Primary channels of turbid, large rivers	The Project likely contains suitable habitat for this species.
sturgeon chub <i>Marchybopsis gelida</i>	SCP Level I	Medium to large, turbid rivers	The Project is not likely to contain suitable habitat for this species.

Table 3. Federally listed threatened and endangered species, and State Species of Conservation Priority, with known or potential occurrence in Williams County, North Dakota. Likelihood of occurrence within the Aurora Wind Energy Project in Williams County, North Dakota, is based on distribution ranges and habitat preferences.

Species	Status ¹	Habitat	Potential Occurrence within the Project
INSECTS			
monarch butterfly <i>Danaus plexippus</i>	SCP Level I	Open fields and meadows with milkweed	The Project likely contains suitable habitat for this species.

Sources: Dyke et al. 2015; USFWS 2016

¹ FE = Federally listed endangered; FT = Federally listed threatened species. North Dakota Species of Conservation Priority (SCP): Level I = Highest Level of Priority; Level II = Moderate Level of Priority; Level III = Lower Level of Priority.

Federally Listed Animals

Several federally listed species may occur in Williams County, North Dakota (USFWS 2016), including the northern long-eared bat (NLEB; *Myotis septentrionalis*), a federally threatened species throughout its range (USFWS 2013b). Habitats within the Project area might be used as stopover sites during migration for the federally endangered least tern (*Sternula antillarum*), the federally threatened piping plover (*Charadrius melodus*), and the federally threatened rufa red knot (*Calidris canutus rufa*). Additionally, the Project is within the known migration corridor for whooping cranes (*Grus americana*); therefore, their occurrence within the Project is possible (WEST 2016b). Finally, the federally endangered pallid sturgeon (*Scaphirhynchus albus*) is unlikely to occur within the Project due to a lack of suitable habitat, and will also likely be restricted to the Missouri River.

Northern Long-Eared Bat

Habitat for NLEB is limited in the Project area given the limited amount (approximately 54.5 ac [22.1 ha]) of forest and woodland cover; Table 1, Figure 2; USGS NLCD 2011); however NLEB may also use structures such as bridges, barns, and buildings available within the Project for roosting (USFWS 2014a). Although there is some potential for NLEB to make use of the Project during summer and migration, more suitable habitat, consisting of larger connected tracts of forest habitat along the White Earth and Missouri Rivers, exists outside of the Project (USGS NLCD 2011).

The NLEB is a forest-dependent species, generally relying on forest features for both foraging and roosting during the summer months (USFWS 2013b, 2014a). In particular, NLEB appears to be a forest interior species that requires adequate canopy closure for both roosting and foraging habitat (Lausen 2009). Additionally, riparian areas are considered critical resource areas for many species of bats because they support higher concentrations of prey, provide drinking areas, and act as unobstructed commuting corridors (Grindal et al. 1999). While NLEB is associated with forest habitats, it also occurs in agricultural settings where forest habitats have been highly

fragmented. During the summer, NLEB roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees (USFWS 2007, 2013a, 2014a).

Male and non-reproductive females NLEB may also roost in cooler places, like caves and mines. The NLEB seems opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices, and the species has also been found, rarely, roosting in structures like barns and sheds (USFWS 2014a). The NLEB is expected to be closely tied to intact forested habitats; for example, Henderson and Broders (2008) found that NLEB do not travel more than 255 ft (78 m) from the edge of intact forest structures. During the winter, NLEB hibernate in caves or occasionally abandoned mines (USFWS 2014a). No winter impacts on NLEB are expected in the Project as the species is not active during this time of year. There is no evidence of caves or mines within the Project based on desktop analysis (North Dakota Industrial Commission 2002, 2013); however, correspondence with the USFWS and NDGFD may be needed to determine that no hibernacula are known to be located within the Project.

Least Tern – Interior Population

There is some potential for the interior least tern to migrate through, or utilize, the wetlands and waterbodies present within and around the Project for stopover habitat. This species nests in barren and sparsely vegetated areas, usually near foraging areas where they hover and dive into standing or flowing water to catch small fish (All About Birds 2016). The breeding season for the interior least tern is April through August, with nesting occurring in small colonies. Breeding occurs in isolated areas along the Missouri, Mississippi, Ohio, Red, and Rio Grande river systems (Thompson et al. 1997, US Fish and Wildlife Service (USFWS) 2013c). Wintering occurs along coastal areas of Central and South America, and the Caribbean Islands (Thompson et al. 1997). There is one documented occurrence in Williams County and four documented observations in adjacent counties (eBird 2016b).

Piping Plover

There is potential for piping plovers to utilize wetlands and waterbodies near or within the Project area and/or to migrate through the Project. Critical habitat was designated in 2002 for the Northern Great Plains Breeding Population, which includes 19 critical habitat units in five states (Minnesota, Montana, Nebraska, North Dakota, and South Dakota; USFWS 2002b). There are three units of critical habitat within 20 mi (32.2 km) of the Project, with the nearest unit being 9.2 mi (14.8 km) west of the Project (Figure 7; USFWS 2002b). The Missouri River provides breeding habitat and may attract piping plovers during migration. There are six documented occurrences within Williams County according to the eBird database (eBird 2016b). The nearest sighting to the Project is approximately three mi (4.8 km) to the north in Divide County (eBird 2016). Additionally, the eBird database shows numerous piping plover observations at Lostwood National Wildlife Refuge (NWR) about 24.5 mi (39.4 km) east of the Project (eBird 2016). The Northern Great Plains population of piping plovers in Montana, North Dakota, South Dakota, and Nebraska (with limited locations in Minnesota and Colorado) nests on sandbar islands and shorelines of the Missouri, Platte, Niobrara, Loup, and Elkhorn rivers as well as in alkaline wetlands (USFWS 2012e).

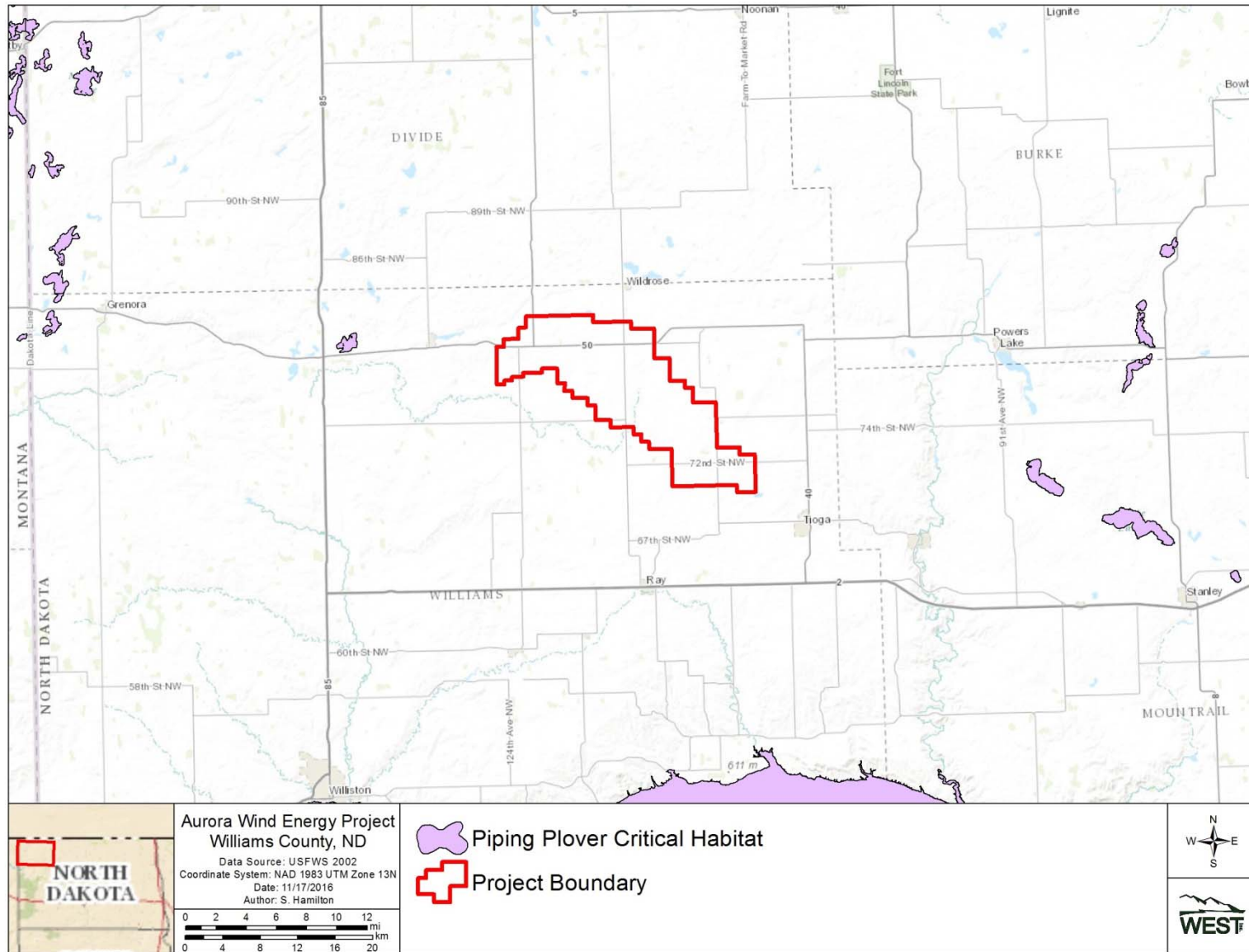


Figure 7. Critical habitat for the Northern Great Plains breeding population of the piping plover, in relation to the Aurora Wind Energy Project in Williams County, North Dakota (USFWS 2002b).

Rufa Red Knot

There is some potential for the rufa red knot to migrate through the Project or to utilize wetlands and waterbodies for stopover habitat. No critical habitat for this species has been designated at this time (USFWS 2015). There are no documented occurrences within Williams County (eBird 2016). The red knot is a medium-sized shorebird identified in the breeding season by red plumage. Red knots migrate from breeding grounds in the Canadian Arctic to multiple wintering regions in the southeast United States, northeast Gulf of Mexico, and as far south as Tierra del Fuego (Baker et al. 2013). During migration, they use stopover areas along the eastern coast of South America and the United States, and they also use stopovers in the Northern Plains of the Midwestern United States (Baker et al. 2013).

Whooping Crane

The Project is located within the federally endangered whooping crane migration corridor where approximately 75% of whooping crane observations have been recorded during migration (Figure 8; Cooperative Whooping Crane Tracking Project 2007, 2010). Therefore, it is possible that whooping cranes could utilize wetlands and waterbodies within the Project area for stopover habitat during migration. The whooping crane migrates from its breeding grounds in Wood Buffalo National Park, Canada, to its wintering areas in Aransas National Wildlife Refuge, Texas (USFWS 2013d). Threats to wild cranes include habitat destruction, chemical spills in its wintering habitat, lead poisoning, collisions with manmade objects such as fences and power lines, disease (e.g., avian cholera and parasites), and shooting (USFWS 2013d). Cranes typically utilize shallow wetlands and marshes, the edges and sandbars of shallow rivers, and agricultural fields near a water source during migration (USFWS 2013d). Thus, suitable whooping crane stopover habitat includes shallow livestock ponds surrounded by agricultural and grassland parcels and freshwater emergent wetlands. Some of these habitat features are scattered throughout the Project. Please see the Whooping Crane Habitat Review for more detailed information (WEST 2016b).

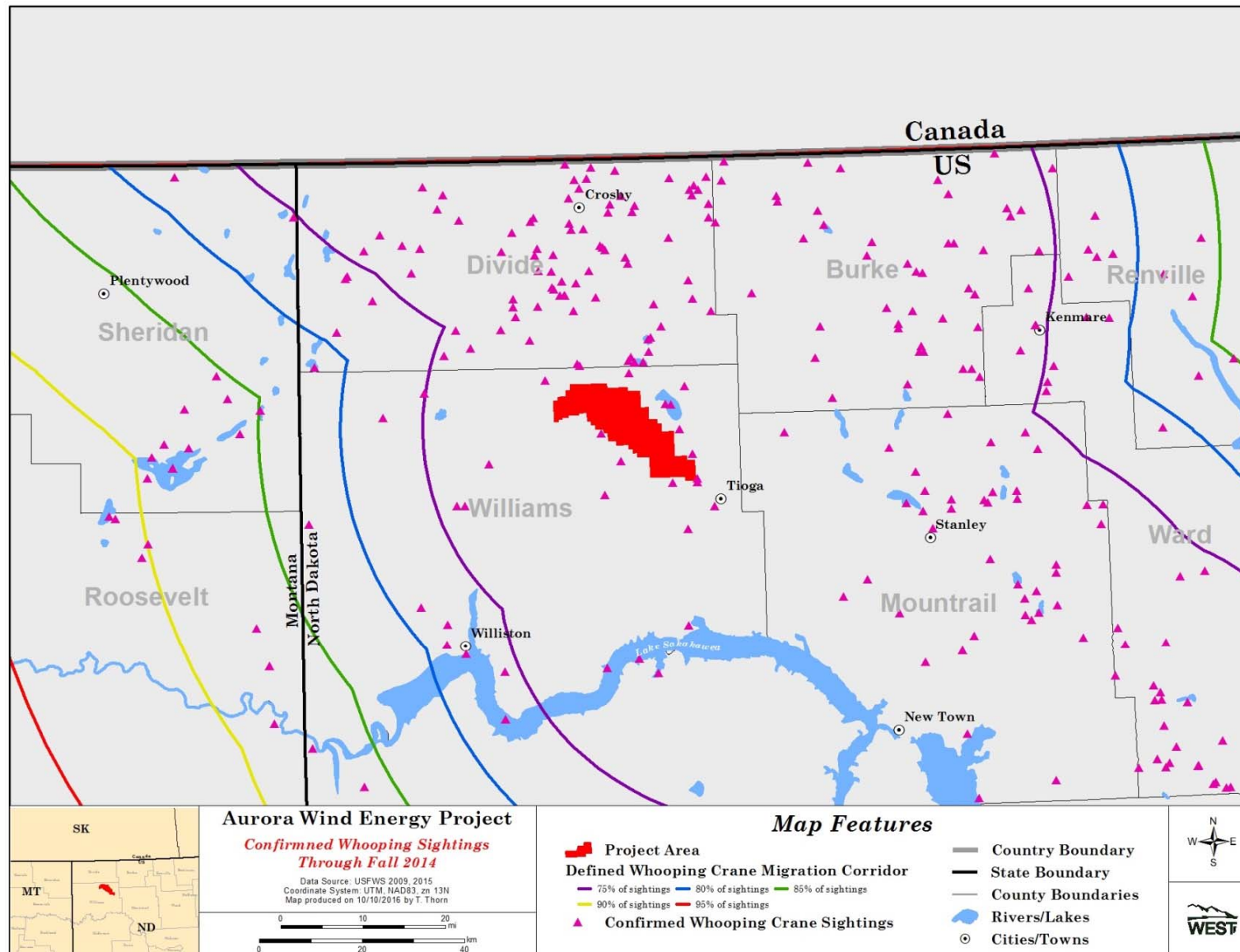


Figure 8. Whooping crane migration corridor in relation to the Aurora Wind Energy Project in Williams County, North Dakota.

Pallid Sturgeon

There is little potential for the pallid sturgeon to occur within the Project area. The pallid sturgeon feeds in river bottoms of the Missouri River and is no longer found in its historic range that extended into the smaller river tributaries (USFWS 2014b). Pallid sturgeons are identified by a flattened snout, long slender tail, and bony plates rather than scales. Pallid sturgeons are scarce in the upper Missouri River and slightly more common in the Mississippi and Atchafalaya rivers; they are absent from other tributaries (USFWS 1998).

Eagles

Bald (*Haliaeetus leucocephalus*) and golden (*Aquila chrysaetos*) eagles are both protected by the Bald and Golden Eagle Protection Act (1940) and the Migratory Bird Treaty Act (MBTA; 1918). Potential impacts to bald or golden eagles are a primary concern for most land-based wind energy facilities in the United States, as both species may spend substantial amounts of time flying at the rotor-swept altitudes of commercial wind turbine rotors, where they may be exposed to collision risk (Strickland et al. 2011). While there are no known bald or golden eagle nests within 10 mi (16 km) of the Project, there is potential for both species to use the Project area. Please see the Stage 1 Eagle Use/Risk Assessment for more detailed information on bald and golden eagle use (WEST 2016a).

GENERAL WILDLIFE

Birds

Raptors

Potential impacts to raptors other than eagles are a concern for most land-based wind energy facilities in the United States because of many raptors' tendency to spend significant portions of time flying at the rotor-swept altitudes of commercial wind turbine rotors where they may be exposed to collision risk (Strickland et al. 2011). Furthermore, all native species of raptors that occur in the United States are protected by the MBTA.

The majority of the Project is made up of tilled agriculture (86.7%), followed by herbaceous grassland/pasture (6.5%) and developed, open space (3.7%). However, there are several areas that may provide habitat and foraging opportunities for resident and migrating raptors. Forested areas are present throughout the Project area as woodlots and wooded riparian areas surrounding creeks, ponds, and drainages (Table 1, Figure 2). Based on the presence of forested habitat and foraging areas, the Project area will likely support nesting raptors. There is also potential for raptor species to fly over the Project during migration.

Areas of Potentially High Prey Density

Rodent and other prey populations present in the Project are likely to consist of mice, voles, rabbits, and ground squirrels. These are unlikely to be at high densities in agricultural fields, but may be more concentrated in grasslands and along edges of fields and roads. Densities, however,

are unlikely to be higher in the Project area than the surrounding area. Songbirds and insects are also prey for a number of raptor species and populations may increase in grassland areas in the summer.

Potential for Raptor Migration

Several factors influence the migratory pathways of raptors, the most significant of which is geography. Two geographical features are primarily used by raptors during migration: ridgelines and the shorelines of large bodies of water. Updrafts formed as the wind hits the ridges and thermals created over land, not water, make for energy-efficient travel over long distances (Liguori 2005). It is for this reason that raptors in migration tend to follow corridors or pathways such as prominent ridges with defined edges.

The general topography within the Project area is gently rolling hills. It is likely that raptors will migrate through the Project in a broad-front fashion as there are no prominent north-south ridges or valleys that would funnel migrants (HawkMountain 2016, Liguori 2005; Figures 2 and 3). There is also potential for raptor use within the Project area to be affected by the proximity to the Missouri River and associated WMAs, which may provide foraging areas for raptors using the river corridor.

Avian Migration

The Project is located within the Central Flyway (Flyways.us 2016), which is used by migrating waterfowl, waterbirds, shorebirds, songbirds, and raptors. It is likely that the 1,401.5 ac (567.2 ha) of NWI-mapped wetlands and open water found within the Project area (Table 2; USFWS NWI 2014), as well as flooded agricultural fields, provide foraging and stopover habitat for migrating waterfowl. Additionally, the nearby WMAs, the Missouri River, and the associated wetlands have the potential to increase waterfowl use in the Project area.

Important Bird Areas

Passerines are the most abundant bird group in most terrestrial ecosystems and are the most often reported fatalities at wind energy facilities (National Research Council [NRC] 2010). Areas that provide essential habitat for these and other bird species have been identified by the National Audubon Society (Audubon) as Important Bird Areas (IBAs; Audubon 2016). There are three global-level IBAs within 40 mi (64.4 km) of the Project: the Lostwood NWR IBA, located about 23 mi (37.0 km) east of the Project, the Medicine Lake NWR IBA, located about 36.6 mi (58.9 km) west of the Project, and the Westby Prairie-Wetland Complex IBA, located about 37.1 mi (59.7 km) northeast of the Project (Audubon 2016). These IBAs provide native habitats in an area that is largely cultivated (USGS NLCD 2011). The mosaic of native prairies and wetlands within these IBAs could provide key habitat for raptors, waterbirds, waterfowl, and songbirds (Audubon 2016).

USFWS Birds of Conservation Concern

The USFWS lists 27 species as Birds of Conservation Concern (BCC) within the Prairie Pothole Bird Conservation Region where the Project is located (USFWS 2008; Appendix B). These species do not receive special protection (unless they are also listed by the USFWS), but have been identified as vulnerable to population declines in the area by the USFWS (2002a, 2008). Most of these species utilize grasslands and wetlands and may be found within the Project area

(e.g., prairies and wetlands). Additionally, the proximity of the Missouri River to the Project provides potential for migrating birds to fly over the Project and to utilize stopover habitats such as lakes and wetland complexes.

USGS Breeding Bird Survey

One USGS Breeding Bird Survey (BBS) route, Wild Rose, is located within the Project and three additional routes are located within 40 mi (64.4 km) of the Project (Figure 9; USGS 2016). BBS routes are typically 24.5 mi (39.4 km) long and consist of 50, three-minute counts along the length of the route (USGS 2001). The BBS provides information about what species may occur in the Project area, either transiently or during the breeding season.

Along the Wild Rose BBS Route, a total of 86 species were observed from 2012 to 2015 (Pardieck et al. 2016). Nine of these species are listed as USFWS BCC (USFWS 2008, Pardieck et al. 2016; Appendix B): Baird's sparrow (*Ammodramus bairdii*), black tern (*Chlidonias niger*), chestnut-collared longspur (*Calcarius ornatus*), grasshopper sparrow (*Ammodramus savannarum*), horned grebe (*Podiceps auritus*), marbled godwit (*Limosa fedoa*), Sprague's pipit (*Anthus spragueii*), Swainson's hawk (*Buteo swainsoni*), and upland sandpiper (*Bartramia longicauda*). In 2015, 1,398 individual bird observations of 70 species were made on the Wild Rose Route (Pardieck et al. 2016). The most abundant birds observed that year were the red-winged blackbird (*Agelaius phoeniceus*), ring-billed gull (*Larus delawarensis*), yellow-headed blackbird (*Xanthocephalus xanthocephalus*), western meadowlark (*Sturnella neglecta*), and brown-headed cowbird (*Molothrus ater*). Eleven North Dakota Level I Species of Conservation Priority (Table 3) have been observed along the Wild Rose BBS Route, but no federally listed threatened or endangered species have been recorded during BBS surveys conducted along this Route.

Along the Powers Lake Route, 81 species were observed from 2012 to 2015 (Pardieck et al. 2016). Nine of these species are listed as USFWS BCC (USFWS 2008, Pardieck et al. 2016; Appendix A): American bittern (*Botaurus lentiginosus*), Baird's sparrow, black tern, chestnut-collared longspur, grasshopper sparrow, marbled godwit, short-eared owl (*Asio flammeus*), Sprague's pipit, and upland sandpiper. In 2015, 1,020 individual bird observations of 63 species were made on the Powers Lake Route (Pardieck et al. 2016). The most abundant bird species observed that year were the red-winged blackbird, brown-headed cowbird, western meadowlark, mallard (*Anas platyrhynchos*), and clay-colored sparrow (*Spizella pallida*). No federally listed threatened or endangered species have been recorded at the Powers Lake BBS Route.

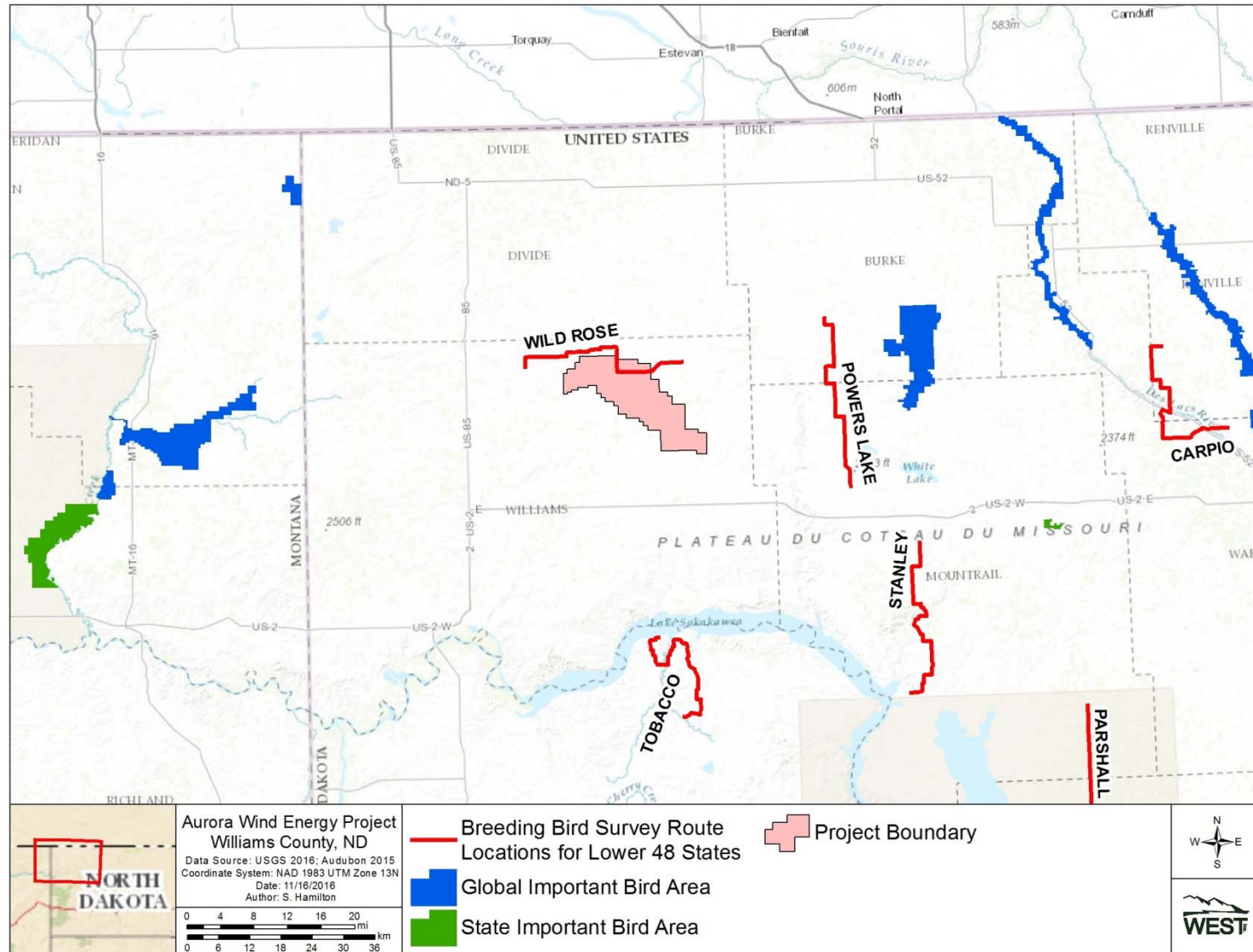


Figure 9. Breeding Bird Survey routes and Important Bird Areas near the Aurora Wind Energy Project in Williams County, North Dakota (Audubon 2016, USGS 2016).

Grassland-Dependent Bird Species of Concern

Indirect impacts of wind energy facilities have been raised as a general concern by the USFWS, for projects across the United States. In particular, the USFWS has expressed concern over the potential impacts of wind development on species of habitat fragmentation concern, including species that need large intact tracts of a particular habitat, such as grassland areas. Some grassland bird species are known or suspected to be susceptible to this effect, perhaps because of their behavioral aversion to trees and other tall structures (Strickland et al. 2011).

Displacement of grassland nesting birds is often one of the primary concerns of wildlife agencies in regards to the siting of wind facilities in and near grasslands. Recent research has focused on the potential displacement of grassland passerines at wind energy facilities, and some uncertainty currently exists over the effects of wind energy facilities on the breeding success of these birds. In Minnesota, researchers found that breeding passerine density on Conservation Reserve Program grasslands was reduced in the immediate vicinity of wind turbines (Leddy et al. 1999), but changes in density at broader scales were not detected (Johnson et al. 2000). Erickson et al. (2004) documented a decrease in density of some native grassland passerines, such as grasshopper sparrow, near wind turbines in Washington; however, it was not determined if the decreased density of grassland birds after the project was operating was the result of behavioral disturbance or habitat loss. Piorkowski (2006) conducted a displacement study at a wind energy facility in Oklahoma where, of the grassland species present in the wind resource area, only the western meadowlark showed significantly lower densities near wind turbines. Piorkowski (2006) suggested that habitat characteristics were more important to determining passerine breeding densities than the presence of wind turbines. More recent and complete research at several projects and over several years has indicated displacement of several species out to 984 ft (300 m; Shaffer and Buhl 2015).

The proposed Project contains grasslands, and sensitive grassland avian species are likely to be present. Sharp-tailed grouse (*Tympanuchus phasianellus*), Le Conte's sparrow (*Ammodramus leconteii*), chestnut-collared longspur, and bobolink (*Dolichonyx oryzivorus*) depend on large blocks of grasslands (Johnson and Igl 2001) and may occur in the Project area (Jennings et al. 2005). These species could be susceptible to the adverse effects of grassland habitat fragmentation if this type of disturbance occurs as a result of Project construction. Although grassland habitats within the Project have already been fragmented, primarily due to conversion to agriculture (Figure 2), grassland areas with the potential to support grassland birds are still present within the Project area, especially in the northwestern portion. Facility development in areas with limited native grasslands, wetlands, and shrublands would likely have lower direct (e.g., mortality or injury) and indirect (e.g., displacement) impacts to wildlife, particularly to grassland-nesting bird species. Limiting the footprint of any proposed improvements, as well as utilizing existing roads and/or transmission corridors, could help to minimize any additional fragmentation.

Data from publicly available fatality studies can be used to make general comparisons of possible fatality rates that may be found at the Project. The overall bird fatality rate at wind energy facilities

in the United States (with publicly available data) ranges between three to five birds per megawatt (MW) per year (MW/year; National Wind Coordinating Collaborative [NWCC] 2010). Annual wind energy facility-related bird fatalities likely make up 0.01% to 0.02% (e.g., one out of every 5,000 to 10,000 bird fatalities) of known anthropogenic sources of bird fatalities (Erickson et al. 2001). Bird fatalities related to wind energy facilities are unlikely to affect current population trends of most North American songbirds (NWCC 2010, Erickson et al. 2014). Although songbirds may collide with wind turbines at the Project, these collisions are not expected to result in any measurable change to local or regional songbird populations.

Bats

Bats are often directly impacted by wind energy facilities. The Project is located within the range of the following bat species: big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), little brown bat (*Myotis lucifugus*), long-eared myotis (*M. evotis*), long-legged myotis (*M. volans*), northern long-eared bat, silver-haired bat (*Lasionycteris noctivagans*), and western red bat (*L. blossevillii*; Bat Conservation International 2016).

Direct Impacts

Bat casualties have been reported from most wind energy facilities where post-construction fatality data are publicly available. Reported estimates of bat mortality at wind energy facilities have ranged from 0.02 – 53.3 bats/MW/year (Arnett et al. 2008).

To date, most bat casualties at wind energy facilities are of migratory species (e.g., hoary and eastern red bat), which conduct long fall migrations between summer roosts and winter areas (Gruver 2002, Johnson et al. 2003b). Based on publicly available data, at least 19 species of bats have been recovered during carcass searches at wind energy facilities throughout the United States (Anderson et al. 2004, Johnson 2005, Kunz et al. 2007, NRC 2007, Baerwald 2008, Chatfield et al. 2009, Jacques Whitford Stantec Limited 2009, Piorkowski and O'Connell 2010), seven of which are potential residents and/or migrants in the Project (Table 4). The highest numbers of bat fatalities found at wind energy facilities to date have occurred in eastern North America on ridge tops dominated by deciduous forests (NWCC 2004). However, Jain (2005), Barclay et al. (2007), and Gruver et al. (2009), have also reported relatively high fatality rates from facilities located in grassland and agricultural habitats in Iowa, Canada, and Wisconsin.

The majority of bat fatalities at Midwestern wind energy facilities have occurred during the post-breeding or fall migration season, typically between August and September (Johnson 2005, Arnett et al. 2008). Migratory tree-roosting species (e.g., eastern red, hoary, and silver-haired bats) account for approximately 75% of reported bats killed in the Midwest and nationally (Arnett et al. 2008; Gruver et al. 2009, 2011). Thus, fatality risk for bats in the Project is expected to be greatest for migrating tree-roosting bat species during the late summer or early fall. A recent paper by Frick et al. (2017) indicated that overall impacts to hoary bats from wind turbines could lead to population-level effects.

Table 4. Summary of bat fatalities, by species, from studies conducted at wind energy facilities in North America.

Common Name	Scientific Name	# Fatalities ¹	% Composition
hoary bat ²	<i>Lasiurus cinereus</i>	5,498	36.6
eastern red bat ²	<i>Lasiurus borealis</i>	3,711	24.7
silver-haired bat ²	<i>Lasionycteris noctivagans</i>	2,594	17.3
little brown bat ²	<i>Myotis lucifugus</i>	1,038	6.9
tri-colored bat ²	<i>Perimyotis subflavus</i>	644	4.3
big brown bat ²	<i>Eptesicus fuscus</i>	582	3.9
Mexican free-tailed bat	<i>Tadarida brasiliensis</i>	517	3.4
unidentified bat		326	2.2
unidentified <i>Myotis</i>	<i>Myotis</i> spp.	39	0.3
northern long-eared bat ²	<i>Myotis septentrionalis</i>	30	0.2
Seminole bat	<i>Lasiurus seminolus</i>	14	0.1
western red bat	<i>Lasiurus blossevillii</i>	13	0.1
evening bat	<i>Nycticeius humeralis</i>	7	<0.1
big free-tailed bat	<i>Nyctinomops macrotis</i>	6	<0.1
unidentified free-tailed bat		3	<0.1
western yellow bat	<i>Lasiurus xanthinus</i>	3	<0.1
eastern small-footed bat	<i>Myotis leibii</i>	2	<0.1
Indiana bat	<i>Myotis sodalis</i>	2	<0.1
pocketed free-tailed bat	<i>Nyctinomops femorosacca</i>	2	<0.1
unidentified <i>Lasiurus</i> bat	<i>Lasiurus</i> spp.	2	<0.1
canyon bat	<i>Pipistrellus hesperus</i>	1	<0.1
cave bat	<i>Myotis velifer</i>	1	<0.1
long-legged bat	<i>Myotis volans</i>	1	<0.1
Total	19 species	15,036	100

¹ These are raw data and are not corrected for searcher efficiency or scavenging.

² Potential resident or migrant in the Project (Bat Conservation International [BCI] 2016).

Note: Cumulative fatalities and species from data compiled by Western EcoSystems Technology, Inc. from publicly available fatality documents (listed in Appendix B).

Additional notes on bat species and numbers:

Indiana bat fatalities in this table are also reported by USFWS (2010, 2011a). Five additional Indiana bat fatalities have been reported in USFWS (USFWS 2011b, 2012a, 2012d; Pruitt and Okajima 2014), but these five are not included in this summary of bats found as fatalities.

One long-eared bat (*Myotis evotis*) was an incidental fatality recorded at Tehachapi, California (Anderson et al. 2004), but was not part of a formal search and is not included above.

An additional 677 bat fatalities (evening bat, eastern red bat, hoary bat, tricolored bat, Mexican free-tailed bat, and unidentified bat) have been found in Texas (Hale and Karsten 2010), but the number of fatalities by species is not reported.

Canyon bat, formerly known as western pipistrelle (*Pipistrellus hesperus*; BCI 2015a), and tri-colored bat, formerly known as eastern pipistrelle (*Pipistrellus subflavus*; BCI 2015b).

Indirect Impacts

Indirect impacts to bats are poorly understood due to their complex ecology and the inherent difficulty in monitoring bat populations. Indirect effects of wind energy facilities on bats largely occur from loss of habitat, such as clearing of forests or degradation of wetlands and riparian

habitats. Indirect impacts to bats at the Project are unlikely due to the limited amount of forest cover present and could be further reduced with selective siting of turbine locations.

TIER 2 and Stage 1 QUESTIONS

As described in the WEG (USFWS 2012d), Tier 2 studies help to identify potential issues that may need to be addressed before further actions can be taken with the development or operations of a Project. The following discussion provides answers to the WEG's Tier 2 questions for the proposed Project.

1. *Are there known species of concern present on the proposed site, or is habitat (including designated critical habitat) present for these species?*

The proposed Project is in the overall range of the NLEB, with small amounts of suitable summer habitat within the Project. The larger wooded tracks and smaller connected tracts of riparian woodland around creeks and drainages may provide habitat for the species.

There is potential for the Northern Great Plains breeding population of piping plovers to utilize wetlands and waterbodies near or within the Project and/or to migrate through the Project. Additionally, there are three piping plover critical habitat units within 20 mi (32.2 km) of the Project, with the closest one located 9.2 mi (14.8 km) west of the Project.

There is potential for the rufa red knot, whooping crane, and interior least tern population to migrate through or utilize the wetlands and waterbodies present within and around the Project as stopover habitat. There is also potential for bald and golden eagle use within the Project

2. *Does the landscape contain areas where development is precluded by law or designated as sensitive according to scientifically credible information?*

There is no state- or federal-owned land within the Project where wind development would be precluded. However, there are three units of Williams County WPA within two mi (3.2 km) of the Project, and these areas would preclude wind development. There is also potential for USFWS grassland and wetland easements within the Project.

3. *Are there plant communities of concern present or likely to be present at the site?*

There are no documented occurrences of federally listed plant species known to occur in within Williams County, North Dakota or the Project (USFWS 2016). However, native prairie and wetland habitats that may support sensitive plant species exist within the Project. Plant communities within the Project cannot be fully characterized based on the available data. Therefore, site-specific Tier 3 studies would be required to better address this question.

4. *Are there known critical areas of congregation of species of concern, including, but not limited to: maternity roosts, hibernacula, staging areas, winter ranges, nesting sites, migration stopovers or corridors, leks, or other areas of seasonal importance?*

There are state and federally owned and managed lands near or adjacent to the Project, as well as the Missouri River that may attract migrating waterfowl, sensitive bird species, and eagles year-round. Numerous piping plover observations have been documented at Lostwood NWR, about 24.5 mi (39.4 km) east of the Project. The northwestern portion of the Project may contain some suitable habitat, such as grasslands and pastures, for congregating species of concern. There is some potential for sharp-tailed grouse leks given the limited grassland areas.

5. *Using best available scientific information, has the relevant federal, state, tribal, and/or local agency independently demonstrated the potential presence of a population of a species of habitat fragmentation concern?*

In general, potentially suitable habitat types within the Project area are already highly fragmented but several grassland obligate avian species that show a wide range of area sensitivity could occur within the proposed Project area.

6. *Which species of birds and bats, especially those known to be at risk by wind energy facilities, are likely to use the proposed Project based on an assessment of site attributes?*

As discussed above, the Project is located within the potential range of the several bat species. No caves or hibernacula are known to occur within the Project based on publicly available information. There is some suitable summer and migratory habitat for NLEB.

The Project may be used year-round by eagles. Due to its proximity to the Missouri River, raptors and waterfowl use of the Project may be particularly high during migration. Fixed-point avian use surveys conducted to characterize bird species composition, distribution, and rates of use of the Project may provide data that could aid in designing the proposed Project to avoid or minimize impacts to birds.

7. *Is there a potential for significant adverse impacts to species of concern based on the answers to the questions above, and considering the design of the proposed Project?*

Design of the Project is not yet developed. The Project largely lacks features that may concentrate migrating birds. Given its location, the Project may receive use by some sensitive species during migration, such as the federally listed rufa red knot, whooping crane, and interior least tern. The potential exists for raptors to occur during some or all seasons. Raptor migration pathways are difficult to define in flat landscapes, and while use by migrating raptors is not expected to be concentrated, the Project will likely receive some use by migrating raptors. The Missouri River, a known migratory corridor for raptors, may influence raptor use of the Project.

SUMMARY AND CONCLUSIONS

Cultivated cropland and hay/pasture account for the majority (93.2%) of the Project area. The Project does not contain WPAs and WMAs, although there are three units of Williams County WPA within two mi (3.2 km) of the proposed Project. Herbaceous grasslands (3,555.7 ac [1,438.9 ha]), emergent herbaceous wetlands (844.9 ac [341.9 ha]), and deciduous and mixed forests

(20.8 acres [8.4 ha]) are present within the Project and may provide habitat for some wildlife species. Given the wildlife areas near the Project, and the Project's proximity to the Missouri River, use by some sensitive bird species is possible within the Project.

There is potential for year-round bald and golden eagle use of the Project due to the available foraging and nesting habitat provided by the Missouri River. Bald and golden eagles will likely occur in low numbers. The potential risk of bald and golden eagles interacting with wind turbines in the Project could be greater during the migratory season than the breeding season; however, no migration concentration sites have been documented or are thought to occur within the Project area. Based on available information, adverse impacts on eagle populations resulting from development of the proposed Project are not likely.

The IBAs, WPAs, and WMAs surrounding the Project are utilized by migrating birds for stopover habitat, and the nearby Missouri River is a known migration corridor for raptors and other bird types. There is potential for impacts to individuals, particularly during the spring and fall migration seasons. Based on eBird observations and BBS data, there is potential for species of concern to occur within the proposed Project. Waterfowl migrate through the Project along the Central Flyway (Flyways.us 2016); therefore, increased waterfowl use of stopover habitats within the Project is expected during migration.

Several bat species could occur within the Project area. Migratory tree-roosting species (e.g., eastern red, western red, hoary, and silver-haired bats) account for approximately 75% of reported bats killed in the Midwest and nationally (Arnett et al. 2008; Gruver et al. 2009, 2011). Thus, fatality risk for bat species is expected to be greatest for tree-roosting bats that are migrating through the Project during the late summer or early fall.

Suitable NLEB summer roosting habitat is more common along the White Earth and Missouri rivers and tributaries compared to the Project; however, there is some potential for the NLEB to occur within the Project area. Based on publicly available information, no hibernacula or caves are known to occur within the Project area.

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Appendix A. Bird Species of Conservation Concern within the Prairie Potholes Region

Appendix A. US Fish and Wildlife Service Birds of Conservation Concern within the Bird Conservation Region 11 (Prairie Potholes) and their presence/absence on Breeding Bird Surveys conducted in the vicinity of the Aurora Wind Energy Project in Williams County, North Dakota.

Species	Recorded from 2012 - 2015 on Wild Rose Breeding Bird Survey Route?	Recorded from 2012 - 2015 on Powers Lake Breeding Bird Survey Route?
horned grebe	yes	no
American bittern	no	yes
least bittern	no	no
bald eagle	no	no
Swainson's hawk	yes	no
peregrine falcon	no	no
yellow rail	no	no
mountain plover	no	no
solitary sandpiper	no	no
upland sandpiper	yes	yes
long-billed curlew	no	no
Hudsonian godwit	no	no
marbled godwit	yes	yes
buff-breasted sandpiper	no	no
short-billed dowitcher	no	no
black tern	yes	yes
black-billed cuckoo	no	no
short-eared owl	no	yes
red-headed woodpecker	no	no
Sprague's pipit	yes	yes
grasshopper sparrow	yes	yes
Baird's sparrow	yes	yes
Nelson's sharp-tailed sparrow	no	no
McCown's longspur	no	no
Smith's longspur	no	no
chestnut-collared longspur	yes	yes
dickcissel	no	no

Sources: Pardieck et al. 2016, USFWS 2008.

**Appendix B. Summary of Publicly Available Studies from North American Wind Energy
Facilities that Report Bat Fatality Data**

Appendix B. Summary of publicly available studies from North American wind energy facilities that report bat fatality data.

Data from the following sources:

Project, Location	Reference	Project, Location	Reference
Alite, CA (09-10)	Chatfield et al. 2010	Maple Ridge, NY (07-08)	Jain et al. 2009d
Alta Wind I, CA (11-12)	Chatfield et al. 2012	Maple Ridge, NY (12)	Tidhar et al. 2013a
Alta Wind I-V, CA (13-14)	Chatfield et al. 2014	Marengo I, WA (09-10)	URS Corporation 2010b
Alta Wind II-V, CA (11-12)	Chatfield et al. 2012	Marengo II, WA (09-10)	URS Corporation 2010c
Alta VIII, CA (12-13)	Chatfield and Bay 2014	Mars Hill, ME (07)	Stantec 2008
Barton I & II, IA (10-11)	Derby et al. 2011a	Mars Hill, ME (08)	Stantec 2009a
Barton Chapel, TX (09-10)	WEST 2011	McBride, Alb (04)	Brown and Hamilton 2004
Beech Ridge, WV (12)	Tidhar et al. 2013b	Melancthon, Ont (Phase I; 07)	Stantec Ltd. 2008
Beech Ridge, WV (13)	Young et al. 2014b	Meyersdale, PA (04)	Arnett et al. 2005
Big Blue, MN (13)	Fagen Engineering 2014	Milford I, UT (10-11)	Stantec 2011b
Big Blue, MN (14)	Fagen Engineering 2015	Milford I & II, UT (11-12)	Stantec 2012b
Big Horn, WA (06-07)	Kronner et al. 2008	Montezuma I, CA (11)	ICF International 2012
Big Smile, OK (12-13)	Derby et al. 2013b	Montezuma I, CA (12)	ICF International 2013
Biglow Canyon, OR (Phase I; 08)	Jeffrey et al. 2009a	Montezuma II, CA (12-13)	Harvey & Associates 2013
Biglow Canyon, OR (Phase I; 09)	Enk et al. 2010	Moraine II, MN (09)	Derby et al. 2010d
Biglow Canyon, OR (Phase II; 09-10)	Enk et al. 2011a	Mount Storm, WV (Fall 08)	Young et al. 2009b
Biglow Canyon, OR (Phase II; 10-11)	Enk et al. 2012b	Mount Storm, WV (09)	Young et al. 2009a, 2010b
Biglow Canyon, OR (Phase III; 10-11)	Enk et al. 2012a	Mount Storm, WV (10)	Young et al. 2010a, 2011b
Blue Sky Green Field, WI (08; 09)	Gruver et al. 2009	Mount Storm, WV (11)	Young et al. 2011a, 2012b
Buena Vista, CA (08-09)	Insignia Environmental 2009	Mountaineer, WV (03)	Kerns and Kerlinger 2004
Buffalo Gap I, TX (06)	Tierney 2007	Mountaineer, WV (04)	Arnett et al. 2005
Buffalo Gap II, TX (07-08)	Tierney 2009	Munnsville, NY (08)	Stantec 2009b
Buffalo Mountain, TN (00-03)	Nicholson et al. 2005	Mustang Hills, CA (12-13)	Chatfield and Bay 2014
Buffalo Mountain, TN (05)	Fiedler et al. 2007	Nine Canyon, WA (02-03)	Erickson et al. 2003
Buffalo Ridge, MN (94-95)	Osborn et al. 1996, 2000	Nine Canyon II, WA (04)	Erickson et al. 2005
Buffalo Ridge, MN (00)	Krenz and McMillan 2000	Noble Altona, NY (10)	Jain et al. 2011b
Buffalo Ridge, MN (Phase I; 96)	Johnson et al. 2000	Noble Altona, NY (11)	Kerlinger et al. 2011b
Buffalo Ridge, MN (Phase I; 97)	Johnson et al. 2000	Noble Bliss, NY (08)	Jain et al. 2009e
Buffalo Ridge, MN (Phase I; 98)	Johnson et al. 2000	Noble Bliss, NY (09)	Jain et al. 2010a
Buffalo Ridge, MN (Phase I; 99)	Johnson et al. 2000	Noble Bliss/Wethersfield, NY (11)	Kerlinger et al. 2011a
Buffalo Ridge, MN (Phase II; 98)	Johnson et al. 2000	Noble Chateaugay, NY (10)	Jain et al. 2011c
Buffalo Ridge, MN (Phase II; 99)	Johnson et al. 2000	Noble Clinton, NY (08)	Jain et al. 2009c
Buffalo Ridge, MN (Phase II; 01/Lake Benton I)	Johnson et al. 2004	Noble Clinton, NY (09)	Jain et al. 2010b
Buffalo Ridge, MN (Phase II; 02/Lake Benton I)	Johnson et al. 2004	Noble Ellenburg, NY (08)	Jain et al. 2009b
Buffalo Ridge, MN (Phase III; 99)	Johnson et al. 2000	Noble Ellenburg, NY (09)	Jain et al. 2010c
Buffalo Ridge, MN (Phase III; 01/Lake Benton II)	Johnson et al. 2004	Noble Wethersfield, NY (10)	Jain et al. 2011a
Buffalo Ridge, MN (Phase III; 02/Lake Benton II)	Johnson et al. 2004	NPPD Ainsworth, NE (06)	Derby et al. 2007
Buffalo Ridge I, SD (09-10)	Derby et al. 2010b	Oklahoma Wind Energy Center, OK (04; 05)	Piorkowski and O'Connell 2010
Buffalo Ridge II, SD (11-12)	Derby et al. 2012a	Pacific, CA (12-13)	Sapphos 2014
Casselman, PA (08)	Arnett et al. 2009	Palouse Wind, WA (12-13)	Stantec 2013a
Casselman, PA (09)	Arnett et al. 2010	Pebble Springs, OR (09-10)	Gritski and Kronner 2010b
Castle River, Alb. (01)	Brown and Hamilton 2006a	Pine Tree, CA (09-10)	BioResource Consultants 2010
Castle River, Alb. (02)	Brown and Hamilton 2006a	Pinnacle, WV (12)	Hein et al. 2013a
Cedar Ridge, WI (09)	BHE Environmental 2010	Pinnacle Operational Mitigation Study (12)	Hein et al. 2013b
Cedar Ridge, WI (10)	BHE Environmental 2011	Pinyon Pines I & II, CA (13-14)	Chatfield and Russo 2014
Cohocton/Dutch Hill, NY (09)	Stantec 2010	Pioneer Prairie I, IA (Phase II; 11-12)	Chodachek et al. 2012
Cohocton/Dutch Hills, NY (10)	Stantec 2011a	Pioneer Prairie II, IA (13)	Chodachek et al. 2014
Combine Hills, OR (Phase I; 04-05)	Young et al. 2006	Pioneer Trail, IL (12-13)	ARCADIS U.S. 2013
Combine Hills, OR (11)	Enz et al. 2012	Prairie Rose, MN (14)	Chodachek et al. 2015
Condon, OR	Fishman Ecological Services 2003	PrairieWinds ND1 (Minot), ND (10)	Derby et al. 2011c
Crescent Ridge, IL (05-06)	Kerlinger et al. 2007	PrairieWinds ND1 (Minot), ND (11)	Derby et al. 2012c
Criterion, MD (11)	Young et al. 2012a	PrairieWinds SD1 (Crow Lake), SD (11-12)	Derby et al. 2012d
Criterion, MD (12)	Young et al. 2013	PrairieWinds SD1 (Crow Lake), SD (12-13)	Derby et al. 2013a
Criterion, MD (13)	Young et al. 2014a	PrairieWinds SD1 (Crow Lake), SD (13-14)	Derby et al. 2014
Crystal Lake II, IA (09)	Derby et al. 2010a	Rail Splitter, IL (12-13)	Good et al. 2013b
Diablo Winds, CA (05-07)	WEST 2006, 2008	Record Hill, ME (12)	Stantec 2013b
Dillon, CA (08-09)	Chatfield et al. 2009	Record Hill, ME (14)	Stantec 2015
Dry Lake I, AZ (09-10)	Thompson et al. 2011	Red Canyon, TX (06-07)	Miller 2008
Dry Lake II, AZ (11-12)	Thompson and Bay 2012	Red Hills, OK (12-13)	Derby et al. 2013c
Elkhorn, OR (08)	Jeffrey et al. 2009b	Ripley, Ont (08)	Jacques Whitford 2009
Elkhorn, OR (10)	Enk et al. 2011b	Ripley, Ont (08-09)	Golder Associates 2010
Elm Creek, MN (09-10)	Derby et al. 2010c	Rollins, ME (12)	Stantec 2013c
Elm Creek II, MN (11-12)	Derby et al. 2012b	Rugby, ND (10-11)	Derby et al. 2011b
Foote Creek Rim, WY (Phase I; 99)	Young et al. 2003	Searsburg, VT (97)	Kerlinger 2002a
Foote Creek Rim, WY (Phase I; 00)	Young et al. 2003	Sheffield, VT (12)	Martin et al. 2013
Foote Creek Rim, WY (Phase I; 01-02)	Young et al. 2003	Sheffield Operational Mitigation Study (12)	Martin et al. 2013
Forward Energy Center, WI (08-10)	Grodsky and Drake 2011	Shiloh I, CA (06-09)	Kerlinger et al. 2009

Appendix B. Summary of publicly available studies from North American wind energy facilities that report bat fatality data.

Data from the following sources:

Project, Location	Reference	Project, Location	Reference
Fowler I, IN (09)	Johnson et al. 2010a	Shiloh II, CA (09-10)	Kerlinger et al. 2010
Fowler III, IN (09)	Johnson et al. 2010b	Shiloh II, CA (10-11)	Kerlinger et al. 2013a
Fowler I, II, III, IN (10)	Good et al. 2011	Shiloh III, CA (12-13)	Kerlinger et al. 2013b
Fowler I, II, III, IN (11)	Good et al. 2012	SMUD Solano, CA (04-05)	Erickson and Sharp 2005
Fowler I, II, III, IN (12)	Good et al. 2013c	Solano III, CA (12-13)	AECOM 2013
Goodnoe, WA (09-10)	URS Corporation 2010a	Spruce Mountain, ME (12)	Tetra Tech 2013
Grand Ridge I, IL (09-10)	Derby et al. 2010g	Stateline, OR/WA (01-02)	Erickson et al. 2004
Harrow, Ont (10)	Natural Resource Solutions 2011	Stateline, OR/WA (03)	Erickson et al. 2004
Harvest Wind, WA (10-12)	Downes and Gritski 2012a	Stateline, OR/WA (06)	Erickson et al. 2007
Hay Canyon, OR (09-10)	Gritski and Kronner 2010a	Steel Winds I, NY	Grehan 2008
Heritage Garden I, MI (12-14)	Kerlinger et al. 2014	Steel Winds I & II, NY (12)	Stantec 2013d
High Sheldon, NY (10)	Tidhar et al. 2012a	Stetson Mountain I, ME (09)	Stantec 2009c
High Sheldon, NY (11)	Tidhar et al. 2012b	Stetson Mountain I, ME (11)	Normandeau Associates 2011
High Winds, CA (03-04)	Kerlinger et al. 2006	Stetson Mountain I, ME (13)	Stantec 2014
High Winds, CA (04-05)	Kerlinger et al. 2006	Stetson Mountain II, ME (10)	Normandeau Associates 2010
Hopkins Ridge, WA (06)	Young et al. 2007	Stetson Mountain II, ME (12)	Stantec 2013e
Hopkins Ridge, WA (08)	Young et al. 2009c	Summerview, Alb (05-06)	Brown and Hamilton 2006b
Jersey Atlantic, NJ (08)	NJAS 2008a, 2008b, 2009	Summerview, Alb (06; 07)	Baerwald 2008
Judith Gap, MT (06-07)	TRC 2008	Top Crop I & II, IL (12-13)	Good et al. 2013a
Judith Gap, MT (09)	Poulton and Erickson 2010	Top of Iowa, IA (03)	Jain 2005
Kewaunee County, WI (99-01)	Howe et al. 2002	Top of Iowa, IA (04)	Jain 2005
Kibby, ME (11)	Stantec 2012a	Tuolumne (Windy Point I), WA (09-10)	Good et al. 2010
Kittitas Valley, WA (11-12)	Stantec Consulting 2012	Vansycle, OR (99)	Erickson et al. 2000
Kittitas Valley, WA (12-13)	Stantec Consulting 2013	Vantage, WA (10-11)	Ventus Environmental Solutions 2012
Klondike, OR (02-03)	Johnson et al. 2003a	Vasco, CA (12-13)	Brown et al. 2013
Klondike II, OR (05-06)	NWC and WEST 2007	Wessington Springs, SD (09)	Derby et al. 2010f
Klondike III (Phase I), OR (07-09)	Gritski et al. 2010	Wessington Springs, SD (10)	Derby et al. 2011d
Klondike IIIa (Phase II), OR (08-10)	Gritski et al. 2011	White Creek, WA (07-11)	Downes and Gritski 2012b
Lakefield Wind, MN (12)	Minnesota Public Utilities Commission (MPUC) 2012	Wild Horse, WA (07)	Erickson et al. 2008
Leaning Juniper, OR (06-08)	Gritski et al. 2008	Windy Flats, WA (10-11)	Enz et al. 2011
Lempster, NH (09)	Tidhar et al. 2010	Winnebago, IA (09-10)	Derby et al. 2010e
Lempster, NH (10)	Tidhar et al. 2011	Wolfe Island, Ont (May-June 09)	Stantec Ltd. 2010a
Linden Ranch, WA (10-11)	Enz and Bay 2011	Wolfe Island, Ont (July-December 09)	Stantec Ltd. 2010b
Locust Ridge, PA (Phase II; 09)	Arnett et al. 2011	Wolfe Island, Ont (January-June 10)	Stantec Ltd. 2011a
Locust Ridge, PA (Phase II; 10)	Arnett et al. 2011	Wolfe Island, Ont (July-December 10)	Stantec Ltd. 2011b
Madison, NY (01-02)	Kerlinger 2002b	Wolfe Island, Ont (January-June 11)	Stantec Ltd. 2011c
Maple Ridge, NY (06)	Jain et al. 2007	Wolfe Island, Ont (July-December 11)	Stantec Ltd. 2012
Maple Ridge, NY (07)	Jain et al. 2009a	Wolfe Island, Ont (January-June 12)	Stantec Ltd. 2014

Two Indiana bat fatalities are reported by USFWS (2010, 2011a), among other reports. Five additional Indiana bat fatalities have been reported (USFWS 2011b, 2012b, 2012c; Pruitt and Okajima 2014), but are not included in this list of public reports. One incidental long-eared bat (*Myotis evotis*) was recorded at Tehachapi, California (Anderson et al. 2004), but is not included in this list of public reports. Additional bat fatalities (evening bat, eastern red bat, hoary bat, tricolored bat, Mexican free-tailed bat, and unidentified bat) have been found in Texas (Hale and Karsten 2010), but the number of fatalities by species is not reported.

