Appendix A – Site Characterization Study

Site Characterization Study Report for the Crocker Wind Farm Clark County, South Dakota

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EXECUTIVE SUMMARY

This report contains a biological site characterization study (USFWS 2012b; Tier 2) of the Crocker Wind Farm (Project) in Clark County, South Dakota. 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, publicly available databases, and a site visit conducted on April 17, 2016.

The Project area encompasses approximately 31,130 acres (126 square kilometers [km^2], 48.6 square miles [mi^2]) in Clark County, South Dakota. The Project falls within the Northern Glaciated Plains Ecoregion, which encompasses north-eastern South Dakota (USEPA 2013). Much of the region was originally dominated by tall-grass prairie, riparian forest, and shrub and herbaceous wetlands. Today, most of the area has been cleared for farms producing corn, soybeans, hay, and livestock. The majority of the Project is composed of hay/pasture, herbaceous, grassland, and cultivated fields, with open water/wetland areas comprising approximately 10% of the area and very sparse forest patches.

Given the Project's geographic position in the prairie couteau, and the relative proximity to the Big Sioux River to east and James River to the west, the Project may receive use by some sensitive bird and bat species during migration. Similar to other wind energy projects in South Dakota, there is some potential for impacts to individual birds of some species, particularly during the spring and fall migration seasons, but there is little potential for significant adverse population-level impacts to any species. It is likely that bald eagle use at the Project is less than other projects in the Midwest, particularly in summer as there is limited habitat for nesting within the Project (closest documented eagle nest is 4 miles to the north), although some foraging could occur in some of the larger open water features. It would be expected for bald eagles to use the Project during migration but it is anticipated their presence would likely be transient. Winter use by bald eagles is expected to be relatively low, although there is some potential for foraging to occur in some of the larger open water features during warmer winters when ice cover is more limited; there is limited to no winter roosting sites for bald eagles within the Project.

Migratory waterfowl and shorebirds move through the region along a broad front. As such, the Project site is likely to see increased waterfowl use during the spring and fall migration periods. However, even 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 other waterbirds (Erickson et al. 2002b; Grodsky & Drake 2011; Johnson et al. 2002a, 2002b, 2003; Jain 2005).

There is some relatively low potential for the northern long-eared bat (NLEB; a species listed as threatened under the Endangered Species Act) within the Project, particularly outside of fall

migration. Suitable forested habitat is limited to two small areas in the east and southeast of the Project. Based on a lack of extensive forested and aquatic habitats and the fragmented pattern of existing units across the landscape, NLEB use of the Project is anticipated to be relatively limited.

Dakota skipper and Poweshiek's skipperling are federally protected butterfly species and the Project is within the range of both species. There is no designated critical habitat within or nearby the Project for either of these species. These butterflies are prairie obligate species, and Poweshiek's skipperling in particular is not tolerant of grazed grasslands. Based on the lack of extensive intact non-grazed native grasslands and prairies, suitable habitat for these species is anticipated to be relatively limited, but may occur in some grassland areas, particularly those with untilled, virgin sod.

The development of a commercial wind energy facility at the Project is likely to generate relatively minor adverse impacts on a wide variety of birds (other than raptors likely to occur at the site), including a wide variety of songbirds. These impacts may include both collision mortality and displacement. Collision is particularly relevant for a wide variety of migratory species, and displacement is especially relevant for grassland-affiliated species. None of these potential impacts are expected to be intense enough to generate population level effects in any species. Siting of project turbines and infrastructure to avoid native prairie habitats and minimize impacts to grazed grasslands would be expected to minimize the direct or indirect effects on listed or other sensitive species.

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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 impacts to those resources. Geronimo Energy, LLC (Geronimo) contracted Western EcoSystems Technology, Inc. (WEST) to identify the environmental resources at the proposed Crocker Wind Farm (Project) in Clark County, South Dakota (Figure 1). The purpose of this report is to describe biological resources present within and surrounding the proposed Project, compare site characteristics with those at other wind energy facilities where pre- and post-construction wildlife studies are publicly available, and identify potential risks to biological resources. This report follows the guidelines for a Tier 2 Site Characterization set forth in the U.S. Fish and Wildlife Service (USFWS) Land-Based Wind Energy Guidelines (USFWS 2012b).

STUDY AREA

The boundary of the proposed Project encompasses 31,130 acres (126 square kilometers [km^2], 48.6 square miles [mi^2]) in Clark County, South Dakota (Figure 1). The Project falls within the Northern Glaciated Plains Ecoregion, which encompasses eastern South Dakota (USEPA 2013). The Northern Glaciated Plains Ecoregion is composed of glaciated drift plains, glacial basins, and shallow river valleys with young drainage systems, level to undulating surfaces and deep soils. The Project is located on a lobe of the Prairie Couteau between the James River to the west and the Big Sioux to the east. Vegetation is dominated by short grass and tall-grass prairies, interspersed with lakes and herbaceous wetlands. Agricultural conversion was primarily from grassland to pasture where soils were rocky or rolling, or corn and soybeans where the land can be tilled.

The lands within the Project are characterized by rolling topography with an elevation range from 453.1 - 584.8 meters (1,486.3 – 1,918.6 feet [ft]) above sea level (Figure 2). The higher elevations in the couteau run from the north-northwest to south-southeast gently sloping to lower elevations in the west toward the James River valley.

METHODS

Biological resources within the Project were evaluated through a comprehensive “desktop” review of existing data. Several sources of available data were used in the desktop review including published technical literature, field guides, and public datasets. A data request from the South Dakota Game Fish and Parks (SDGFP), including a request for Natural Heritage Information System (NHIS) records for the Project was sent and the results, which were received on March 14, 2016, have been incorporated. Additionally, a WEST biologist conducted a site reconnaissance visit to the Project on April 17, 2016.

In addition to identifying biological resources within the Project, 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. Where possible, comparisons with regional and local studies were made.

HABITATS

Land Use / Land Cover

The majority (70%) of the Project consists of herbaceous cover and hay/pasture cover types (Table 1 and Figure 3) according to U.S. Geological Services (USGS) National Land Cover Database (NLCD); satellite imagery and the site visits suggest that much of the cover identified as herbaceous in the NLCD is currently grazed pasture. Cultivated crops cover 16% and wetlands and open water cover 11% of the Project. Deciduous forest and scrub habitats are <1% of the Project area, based on the NLCD; forested habitat is generally scattered and consists of fence rows, small woodlots or adjoins lakes. Appendix A shows photos of typical land cover in the Project.

Table 1. Land use/habitat types present within the Crocker Wind Farm (USGS NLCD 2006).

	Project	
Cover Type	**Acres**	**Percent (%)**
Hay/Pasture	11,441.2	36.8%
Herbaceous	10,357.0	33.3%
Cultivated Crops	5,030.2	16.2%
Open Water	3,253.6	10.5%
Developed, Open Space	697.9	2.2%
Deciduous Forest	140.5	0.5%
Emergent Herbaceous Wetlands	103.2	0.3%
Shrub/Scrub	83.4	0.3%
Developed, Low Intensity	16.6	0.1%
Developed, Medium Intensity	4.2	0.0%
Woody Wetlands	2.2	0.0%
Developed, High Intensity	1.0	0.0%
Total	31,131.1	100%

Wetlands and Riparian Areas

National Wetlands Inventory (NWI) data (USFWS NWI 2014) – developed from trained analysts reviewing aerial imagery show 2,533.4 total acres of wetlands within the Project (8.1% of the Project area; Table 2). Water features in the vicinity of the Project include freshwater emergent wetland, lakes, freshwater ponds, freshwater forested/shrub wetlands, and riverine areas (Figure 4). The National Hydrography Database (NHD) shows several low order streams which begin in the western portions of the Project, draining westward toward the James River valley. The estimates of wetland area, based on the NLCD (open water and emergent herbaceous wetlands = 10.8%), is slightly greater than the NWI estimates. Based on what was seen during

the site visits and given the climatic variability of wetlands and surficial water in these prairie systems, it is likely that the actual wetland/open water coverage on any given year varies to some extent around approximately 10% of the Project area.

Although wetlands and other waters of the U.S. (WoUS) occur in the area, and occupy a non-negligible percentage of the Project (~10%), formal wetland delineations have not yet been completed. The desktop NWI review identified wetlands in the western half of the Project that lie adjacent to or are within the riparian zone of waterbodies. These riparian zones have a significant nexus with traditional navigable waters, and therefore would be considered jurisdictional by the U.S. Army Corps of Engineers (USACOE). The status of this interpretation is consistent with the June 2015 Final Rule released by U.S. Environmental Protection Agency (EPA) and USACOE published the revised final rule, defining WoUS (WoUS rule) under the Clean Water Act (CWA) (US EPA 2015).

Impacts to wetlands and waters in South Dakota require compliance with EPA and USACOE regulation under CWA and revised final rule defining WoUS (US EPA 2015).

Table 2. National Wetlands Inventory (NWI) mapped wetlands within the Crocker Wind Farm.

Wetland Type	Acres	Percent of wetlands (%)
Freshwater Emergent Wetland	2,335.7	92.2%
Freshwater Pond	126.5	5.0%
Lake	48.4	1.9%
Freshwater Forested/Shrub Wetland	22.9	0.9%
Total	2,533.4	100%

http://www.fws.gov/wetlands/Data/Data-Download.html

Biologically Sensitive Areas

Undisturbed lands, areas never placed under cultivation, are important for retaining native species and characteristics of the once abundant grasslands on the Prairie Couteau (Bauman et al 2014). These areas, referred to as "virgin sod," include areas which may be grazed. Within the Project, lands identified as virgin sod, uncultivated grassland and woodland by South Dakota State University through assessment of aerial imagery and Farm Services Agency data total 13,981 acres (45% of the Project area; Figure 5). Areas that have been unbroken and ungrazed are expected to retain habitats for sensitive and protected resources, including federally protected species. Additional locations of potentially biological sensitive areas could be ephemeral and other types of wetlands. Wetlands exist throughout the Project, but are probably most intact where areas were undisturbed, less frequently grazed or hayed, or are not cropped up to the wetland boundary.

State Managed Lands

The State of South Dakota through Game, Fish and Parks (SDGFP) administers and manages several parcels within or near the Project (Figure 6). There is are two 80 acre game production aresa managed by the state located within the northern part of the Project, north of Highway 20.

Project. Additionally, there are several State Trust School and Public lands on the northwest and eastern boundaries. Two State-managed units adjoin the Project boundary on the eastern and southeastern side, with Sherwood Wildlife Management Area (WMA) at Round Lake (Photo 1 in Appendix A), and Bailey's Lake Public Shooting Area at Bailey's Lake. These units provide some suitable habitat for sensitive species near Project boundaries that might use lands within the Project boundaries. While there are no current State contracted Walk-In hunter access parcels within the Project, enrollment status may change on an annual basis. Current maps of parcels enrolled in the Walk-in program can be found here: http://gfp.sd.gov/wildlife/private-land/walk-in.aspx .

Federal Managed Lands

The US Fish and Wildlife Service (USFWS) manages multiple conservation easements located throughout the Project, skirting the edge of the Prairie Couteau; these mapped FWS easements comprise the Dakota Tallgrass Prairie Wildlife Management Areas (52, 53, 59, and 62) (Figure 6). There are several additional U.S. Natural Resource Conservation Service (NRCS) Floodplain Easements (in orange color, Figure 6) within the Project. These NRCS easements are generally closed to public access.

FEDERAL AND STATE PROTECTED SPECIES

Federal Listed Species

Although the habitats within Clark County have undergone much agricultural conversion, there remains potential for occurrence of six federally listed species, including one fish - the endangered Topeka shiner (*Notropis topeka*), two butterflies - the endangered Poweshiek skipperling (*Oarisma poweshiek)* and threatened Dakota skipper (*Hesperia dacotae*), two birds - the threatened Rufa Red Knot (Knot, *Calidris canutus rufa*) and the endangered whooping crane (*Grus americana*), and one mammal - the threatened northern long-eared bat (NLEB; *Myotis septentrionalis*) (USFWS 2016a). Correspondence from SDGFP indicated no known records for federally listed threatened or endangered species occurring within the Project boundary; there is one record of the Dakota skipper in the NHIS records, located over 6 miles to the north.

Certain species at risk of extinction, including many birds and bats, are protected under the federal Endangered Species Act (ESA) of 1973, as amended. The ESA 1973 defines and lists species as "endangered" and "threatened" and provides regulatory protection for the listed species. The federal ESA provides a program for conservation and recovery of threatened and endangered species. Section 9 of the federal ESA prohibits the "take" of species listed by USFWS as threatened or endangered. Take is defined as follows: "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such conduct." Section 10(a) of the federal ESA includes provisions for the authorization of take that is incidental to, but not the purpose of, otherwise lawful activities. Section 10(a)(1)(B) permits (Incidental Take Permits) may be issued if take is incidental and does not jeopardize the survival and recovery of the species. For species that are listed as threatened under the ESA, 4(d) rules can be implemented, which are used to incentivize conservation actions and streamline the regulatory

process for minor impacts, and usually include descriptions of what types of take of the species are and are not prohibited.

Following are details on each species and their habitat associations.

Topeka Shiner

Topeka shiner is a small minnow sized species found in drainages of six Great Plains states, including South Dakota. In the Federal Critical Habitat designation, Primary Constituent elements of habitat for this species include clear and cool headwater prairie streams (permanent, rarely intermittent), occasionally off-channel habitats with groundwater input, and full-life cycle habitats with sand, gravel, cobble and silt substrates (see Critical Habitat designation USFWS 2004). South Dakota drainages were excluded in the Critical Habitat designation, but may retain habitat suitable for Topeka Shiner, and Clark County is identified as having appropriate habitat. While Project operation is not likely to have direct impacts on shiners or their habitat, direct and indirect effects on habitat during construction will require particular attention to siting and best management practices, which would minimize water quality degradation downstream. Small streams on the western portion of the Project draining to the James River are of greatest potential concern, where the Primary Constituent Elements are observed and which feed into streams where Topeka shiner observations have been recorded downstream. There are no records of this species in the vicinity of the Project according to NHIS data.

Poweshiek Skipperling and Dakota Skipper

The Poweshiek skipperling and Dakota skipper are small butterflies that are associated with prairie remnants, particularly wet to dry native prairie that have not been plowed; they are typically not found in overgrazed and degraded prairie (USFWS 2015a). Habitats dominated by non-native grass are not suitable for Poweshiek skipperling (USFWS 2015a; MNDNR 2016a). While the Dakota skipper is not known to occur within Clark County, it is found just to the north in Day County (with the nearest documented occurrence located approximately 6.7 miles north of the Project boundary), and distributional knowledge for this species is not complete. Similarly, the Project falls within the distributional range of the Poweshiek skipperling but there are no designated Critical Habitats in or adjacent to the Project (USFWS 2015a), and no records of this species in the vicinity of the Project according to NHIS data. The presence of the species on the Project, irrespective of Critical Habitat designation would trigger consultation with the Service under the ESA, regardless of whether the projects occur on lands designated as critical habitat. Presence or absence within the Project has not been determined, but any remnant tall grass prairie habitat with abundant forbs retains potential. Dispersal of each species is believed to be ~1,000 m, and can occur through somewhat degraded habitat. Operation of the Project is not likely to impact this species, but avoidance of prairie remnant habitats is most important during construction.

Rufa Red Knot

The Knot was declared threatened under the ESA in 2015 (USFWS 2015b). This shorebird species breeds in the Arctic, and winters from the Caribbean to southern Argentina. During

migration, some pass through South Dakota, with documentation from May during spring migration, and from late July through September for the fall migration (SD Ornithologists' Union 2016). Similar to most shorebirds, Knots will stop opportunistically given appropriate habitat for foraging and roosting; shallow water (fresh or saline) with abundant invertebrates for foraging, and unvegetated margins for roosting. While they have been reported in Clark County, SD in 2014 (eBird 2016, SD Ornithologists' Union 2016), their occurrence is not predicable. While Knots do demonstrate migration stopover fidelity such as superabundant spring staging in Delaware Bay in response to horseshoe crab egg presence, no interior staging has been observed, nor are there food sources likely to support large aggregations in the Project vicinity. If Knots were to occur within the Project, it would likely be an isolated few individuals in spring or fall as migrants, stopping at ephemeral and permanent wetlands and ponds. Knot response to wind turbines is not well documented but it is expected to be similar to many waterbirds and shorebirds. Operation of a mid-continent wind farm is not likely to impact this species at the population level (USFWS 2015). There are no records of this species in the vicinity of the Project according to NHIS data.

Whooping Crane

Whooping cranes are listed as federally endangered under the ESA. They are very long-lived, surviving 22 to 24 years, but have a relatively low reproductive rate. South Dakota lies within the migration corridor for the Aransas/ Wood Buffalo population, with birds migrating between nesting habitats in Saskatchewan and wintering habitats on the Texas Gulf Coast near Aransas National Wildlife Refuge. Records from the SD Ornithologists Union and eBird indicate presence in the state from late March into May, and then in early fall. While whooping cranes are known to be annual migrants through central South Dakota, none have been documented in Clark County, the Project is outside of the 220-mile wide band where 95% of all whooping crane sightings have occurred, and the majority of sightings have been associated with the James and Missouri River valleys, with preferred stopover habitat being wide-shallow river areas. While possible, it is unlikely that whooping cranes would stop during migration within the Project. There are no records of this species in the vicinity of the Project according to NHIS data.

Northern Long-eared Bat

The NLEB is listed as a federal threatened species under the ESA and the species is commonly encountered in summer mist-net surveys throughout the majority of the Midwest (Federal Register 2013). NLEB will hibernate in caves, mines and sometimes buildings. At the time of this draft, the Project in Clark County, SD falls outside the white-nose syndrome zone (USFWS 2016b). It should be noted that the White-nose Syndrome Zone, defined as within 150 miles of positive counties, continues to expand and includes counties in western Minnesota (Yellow Medicine and Chippewa), and southeastern South Dakota (Union, Lincoln, Clay, Turner, Yankton and Bon Homme).

The NLEB is a forest dependent species, generally relying on forest features for both foraging and roosting during the summer months (USFWS 2013; USFWS 2007). Specifically, NLEB appear to be a forest interior species that require adequate canopy closure for both roost 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). Wing morphology of the NLEB makes them ideally suited for the high maneuverability required for gleaning-type foraging within a cluttered forest interior (Henderson and Broders 2008). Abundance of NLEB prey items, particularly beetles and moths, are typically higher in more closed forest stands than in openings, which supports studies which have found NLEB tend to avoid open habitats (Owen et al. 2003). While this species is associated with forest habitats, it also occurs in agricultural settings where forest habitats have been highly fragmented. In these areas, NLEB rely on woodlots and forested riparian corridors for both roosting and foraging.

During the summer, the NLEB roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees (USFWS 2007; USFWS 2013). Males and non-reproductive females may also roost in cooler places, like caves and mines. This bat seems opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. NLEB have also been found, rarely, roosting in structures like barns and sheds, and so may not always be associated with tree roosts.

During the summer months, NLEB is unlikely to cross over large open lands (i.e., land lacking suitable habitat) to search for foraging and roosting habitats, but rather to use tree-lined linear features as travel corridors to and from roosting and foraging habitats (USFWS 2014). These tree-lined corridors may be important for bats as navigational aids in agricultural landscapes, as protection from predators and wind, and may act to concentrate insect prey (Verboom and Huitema 1997). The NLEB is expected to be particularly tied to intact forested habitats; for example, Henderson and Broders (2008) found that NLEB did not travel more than 255 feet (78 meters) from the edge of intact forest structure. A study of nine female NLEBs using an intensively managed forest in West Virginia found this species forages in areas with forest patch sizes between 114 and 161 acres (46 and 65 hectares; Owen et al. 2003); however, studies in landscapes dominated by agricultural activities found NLEB can use woodlots and riparian zones with as little as 15 to 49 acres (6 to 20 hectares) of forest cover (Henderson and Broders 2008; Foster and Kurta 1999).

NLEB migrate between their summer habitat and winter hibernacula, typically between mid-August and mid-October in the fall, and between mid-March and mid-May in the spring. They are considered a short-distance migrant (typically 40-50 miles), although their known migratory distances can vary between 5 and 168 miles (USFWS 2014). Suitable fall swarming and spring staging habitat consists of a variety of forested/wooded habitats where they roost, forage and travel, which are most typically within 5 miles of a hibernaculum (USFWS 2014).

No winter impacts are expected as the species is not active during winter, there is no evidence of caves or mines within the Project based on desktop analysis, and the closest known hibernaculum is several hundred miles away in the Black Hills, South Dakota, eastern Nebraska or central Minnesota (USFWS 2015c). Based on the preliminary desktop habitat mapping and assessment there are approximately 348 acres (1.1%) of forested coverage in the Project (Figure 7). The only locations where suitable summer habitat occurs (defined as wooded

patches of > 15 acres, and/or wooded patches within 1,000 feet of 15+ acre wooded areas) are adjacent to Sherwood WMA and north of Bailey's Lake shooting area (Figure 7). During the site visit in April, the WEST's bat biologist noted that there is a general lack of suitable wooded habitat for the NLEB within the Project, although it should be noted that there are abandoned structures throughout the Project which might host NLEB or other bat species. There are no records of this species in the vicinity of the Project according to NHIS data.

State-Listed Wildlife Species

SDGFP identifies and lists wildlife species at risk as threatened or endangered; the SDGFP (2015) lists one wildlife species, the northern river otter (*Lontra canadensis)* with potential occurrence in Clark County. Otters prefer riparian and wetland habitats with abundant fish; habitat for this species within the Project is expected to be limited. Correspondence from SDGFP indicated no known records for state-listed threatened or endangered species occurring within the Project boundary or within 10 miles of the Project (Appendix B). Several records of non-listed species of concern to the SDGFP were documented within two miles of the Project boundary; these consisted of colonial nesting waterbirds including great blue heron, great egret, snowy egret and black-crowned night-heron. One other non-listed species, the regal fritillary (*Speyeria idalia*), has been documented greater than five miles from the Project.

Potential for state listed reptiles and amphibians to occur in the Project is relatively low given limited suitable habitat and documented ranges. There is potential for the majority of state listed birds to migrate through the Project or utilize the Project for stopover, and some potential for some species to use the Project's nesting habitat. Proper siting of turbines and infrastructure would avoid and minimize impacts to remnant prairie grasslands, riparian zones, and wetlands, minimizing direct disturbance to these habitats. Operational impacts to state species of concern are anticipated to be minimal, and limited primarily to birds.

Rare Plant Species

There are no documented federally threatened or endangered species in Clark County; the SDGFP does not list plant species as threatened or endangered but they do track rare plant species. One non-listed plant species, the wooly milkweed (*Asclepias lanuginose*), has been documented greater than five miles from the Project, according to NHIS records; no records of rare plants have been documented within the Project boundary.

As typical of other areas of the Prairie Couteau, native prairie habitat has largely been converted to agricultural production, with many areas grazed since the 1890s. The potential for rare plants to occur in the Project is considered relatively low given the predominant conversion to agriculture and pasture, but there is some potential for rare plants to occur in native prairie remnants or in wetland complexes that have not been negatively affected by agriculture. Proper siting of turbines and infrastructure which avoids impact to remnant prairie grasslands and wetlands would prevent disturbance to their habitats.

Eagles and Raptors

Bald and golden eagles are each protected by the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act (MBTA). Potential impacts to bald or golden eagles are a primary concern for most land-based wind projects in the U.S., as both species may spend significant 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; Pagel et al. 2013). However, there is some evidence that bald eagles are able to avoid turbines (Sharp et al. 2010). During a comparison of pre- and post-construction bald eagle use at a 3-turbine facility in Alaska, bald eagles have similar use between years and continued flying in the area, but avoided flying between turbines (Sharp et al. 2010).

Bald Eagle

Bald eagles typically nest in forested areas or mature trees adjacent to (usually within 2 km) to waterbodies large enough to forage in (Buehler 2000 There is potential for bald eagle use within the Project to be less than at other wind energy facilities in the Upper Midwest, because the Project is located in the Prairie Couteau, a landscape with limited eagle nesting or foraging habitat. The SD Ornithologist Union reports bald eagles only three times for Clark County, once each in July, October, and November (SD Ornithologists' Union; eBird). The closest nests documented during an aerial survey are 4 to 4.5 miles to the north and northeast of the Project. There is potential for eagles to forage at several of the large lakes near or within the Project, depending on ice cover, although they are more likely to occur along the Big Sioux and James Rivers outside of the Project in winter. Areas to the east and west of the Project along these major river corridors appear to have more use throughout the year than on the Prairie Couteau. While the Project has potential for wintering or migration use, the potential for breeding/nesting season use is somewhat limited by the absence of prime nesting substrates, although foraging during the breeding season could occur within some of the larger open water features within the Project.

Golden Eagle

Primary golden eagle nesting habitat includes mountainous canyon land, rim rock terrain of open desert and grassland areas of the western U.S.; golden eagles may also nest in riparian habitats, usually lacking densely forested corridors, in the eastern Great Plains (Kochert et al. 2002). Winter habitat in the Midwest includes reservoirs and wildlife refuges which provide foraging opportunities of waterfowl; golden eagles may also utilize riparian corridors associated with wetland complexes east of the Mississippi River (Kochert et al. 2002). Golden eagles are known to have a higher susceptibility to collisions with wind turbine rotors than bald eagles (Allison 2012). However, golden eagle use within the Project is likely limited to rare winter/non-breeding potential observations, as the breeding range is located in the western U.S. and few birds are known to winter in the Project's region. Golden eagles are year-round residents of areas west of the Missouri River; the Project is over 100 miles east of the Missouri River. The closest observation of a golden eagle in the vicinity of the Project was recorded near the town of Raymond in Clark County in March 2016 (eBird 2016), approximately 8 miles south of the Project; the SD Ornithologists' Union database reports no observations of golden eagles for

Clark County. Although incidental observations of golden eagles are always possible within the Project, the lack of golden eagle habitat and distance from breeding ranges limit the potential use of the Project and potential observations would likely be rare.

GENERAL WILDLIFE

Birds

Raptors

Potential impacts to raptors other than eagles are a concern for most land-based wind energy facilities in the U.S. 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), as well as the fact that all native species of raptors that occur in the U.S. are protected by the MBTA. Raptor collision fatality rates at the Project are predicted to be in the vicinity of U.S. nationwide averages, which is less than one raptor fatality/megawatt (MW)/year (NAS 2007, Strickland et al. 2011), and are expected to be comprised primarily of widespread and abundant species, with no federally listed raptor species at risk of collision.

Potential raptor nesting habitat in the Project includes deciduous forest, mainly in the form of small woodlots and shelterbelts surrounding farm buildings and residences, which composes 0.5% (141 acres) of the total area, according to USGS landcover mapping (USGS NLCD 2006) or up to 1.1% (348 acres) of the Project area, according to WEST's desktop analysis. The majority of the Project is composed of herbaceous, pasture, tilled agriculture, open water and developed areas, and potential raptor nesting is limited. Based on the low acreage of suitable habitat, it is unlikely that the Project supports high densities of nesting raptors. There is some potential for raptor species to fly over the Project during migration. However, raptor species are more likely to travel along and utilize stopover habitat present near the Big Sioux and James Rivers outside of the Project.

Areas of Potentially High Prey Density

Studies at some wind energy facilities indicate that individual raptor species appear to differ from one another in their susceptibility to collision (National Research Council [NRC] 2007). Results from the Altamont Pass Wind Energy Facility (APWRA) suggest that mortality for some species is not necessarily related to abundance, possibly implying that the variance in susceptibility may be in part due to behavioral differences between species (Orloff and Flannery 1992). Orloff and Flannery (1992, 1996) suggested that high golden eagle mortality at the APWRA was in part due to the apparently high densities of California ground squirrels (*Spermophilus beecheyi*) in the area (Thelander and Smallwood 2007). Continued research at APWRA revealed that the degree of aggregation of Botta's pocket gopher (*Thomomys bottae*) burrows around the turbines was positively correlated to red-tailed hawk (*Buteo jamaicensus)* fatality rates (Smallwood et al. 2001, Thelander and Smallwood 2007, Thelander et al. 2003).

Rodents likely to be present in the Project are populations of mice or voles. These are unlikely to be at high density in agricultural fields but may be concentrated along edges of fields and roads. Densities, however, are unlikely to be higher in the Project than the surrounding area. Songbirds and insects are the prey for a number of raptor species and numbers of these may be higher within grassland areas in the summer. Again, however, it is unlikely that numbers will be higher in the Project compared to the surrounding areas and therefore would not concentrate raptors in this area. Finally, bald eagles may hunt for fish in some of the larger open water lakes and wetlands in the Project, although there are larger lakes outside of the Project to the east.

Potential for Raptor Migration

The Project is located on gently rolling cultivated cropland, herbaceous grassland, and mixed pasture lands. Streams and open water are present, but the Project is largely lacking in forested and woodland areas. In addition, the Project area lacks defined topographic edges and does not contain features that are likely to concentrate migrating raptors.

Bald eagle migration patterns depend primarily on the age of the bird (immature or adult), location of the breeding site, breeding site climate, and food availability (Buehler 2000). Bald eagle migration is not as regular as with other migratory birds, as movements are often opportunistic, somewhat unpredictable, and widely dispersed in time (Buehler 2000). Bald eagles typically do not migrate in kettles or flocks, but concentrations of migrants may occur at communal feeding and roost sites (Buehler 2000). Fall migration occurs during August through January. In the Great Lakes region and adjacent areas in Canada, bald eagles often migrate south along major river systems like the Mississippi River in search of food (Buehler et al. 1991). In the spring, bald eagles may return to their breeding grounds as soon as the weather improves and food is available, again using major river valleys as migration corridors. The spring migratory period is generally considered to occur from January to March. Migration occurs during the day when thermals provide for opportunities to soar with limited energetic expense.

Eagles and raptors may pass through the Project in a broad-front fashion during migration, especially if there are food sources such as carrion available. Little information is available regarding the characteristics of stopover habitat used during migration. It is likely that the suitability of stopover habitat is most related to food availability rather than vegetative composition or structural characteristics. Stopover sites are usually areas with consistent fish-kills, concentrations of fish and waterfowl, or the presence of large mammals as carrion (McClelland et al. 1996). Roosts that most commonly see repeated use as stopover sites consist of clumps of mature deciduous trees in riparian areas protected from human disturbance and proximate to foraging opportunities. Locations within the Project that may serve as stopover sites for eagles are largely limited to the protected areas (WMAs) and tree-lined shores of lakes with foraging opportunities. Pasture land may attract bald eagles if carrion or small game is present.

Avian Migration

The Project is located in the central flyway which is used by migrating waterfowl, waterbirds, shorebirds, songbirds and raptors. Of these species groups, waterfowl and waterbirds have the greatest potential to migrate through the Project, as aquatic resources within the Project are pothole and ephemeral wetlands. Waterfowl migration corridors, within a broad front running through South Dakota including the general Project vicinity, are used by as many as three million dabbling ducks (USGS 2013). General avian use within the Project will occur year-round, with greater abundance of birds during the migration and breeding seasons; the April 17, 2016 site visit did document a relatively high abundance of waterfowl and waterbirds using the lakes and ponds in the Project. Migrating birds passing through the Project area may use the grasslands and wetlands as stopover habitat.

Data from publicly available fatality studies can potentially be used to make comparisons of possible fatality rates that may be found at the Project (Loss et al 2013). The overall bird fatality rate at wind energy facilities in the U.S. with publicly available data ranges between three to five birds per MW/year (NWCC 2010). Annual wind energy facility-related bird fatalities likely comprise 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) and wind energy facility related bird fatalities 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 site, these collisions are not expected to result in any measurable change to local or regional songbird populations.

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 (NRC 2010). The National Audubon Society (Audubon) has identified Important Bird Areas (IBAs) that provide essential habitat for one or more bird species (Audubon 2014) at state, continental, and international levels, following standardized criteria. The closest state IBA to the Project is the Troy Township Lakes state-level IBA, which overlaps the northern mile of the Project boundary (Figure 8). Troy Township Lakes IBA is important for waterfowl and colonial nesting waterbirds, including great blue heron (*Ardea herodias)*, cattle egret (*Bubulcus ibis*), snowy egret (*Egretta thula)*, and black-crowned night heron (*Nycticorax nycticorax)*. Sixteen miles to the southeast is the small state-level Blythe Slough, also known for nesting colonial nesting waterbirds. Bitter Lake IBA is a globally recognized IBA located 15 miles to the northeast of the Project. Bitter Lake hosts globally important assemblages of colonial nesting waterbirds, including tree nesting (white-faced ibis (*Plegadis chihi)*, double-crested cormorant (*Phalacrocorax auritus)*, great blue heron, and egrets (snowy, cattle, and great *(Ardea alba)*), and ground nesting species American white pelican (*Pelecanus erythrorhynchos)*, gulls (Franklin's (*Leucophaeus pipixcan)*, herring (*Larus argentatus)*, ring-billed (*L. delawarensis*), California (*L. californicus*), and terns (Caspian (*Hydroprogne caspia)*, Forster's (*Sterna forsteri)*, common (*S. hirundo*) and black (*Chlidonias niger*).

USFWS Birds of Conservation Concern

Although not listed under the ESA, many species of bird have been identified by the USFWS as Birds of Conservation Concern (BCC; USFWS 2008). These are "species, subspecies, and populations of migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973" (USFWS 2008). Virtually all birds listed as BCC are protected under the Migratory Bird Treaty Act (MBTA 1918), and eagle species are protected by the BGEPA (1940). The Project is in the Prairie Bird Conservation Region (BCR 11), and covered under the Prairie Pothole Joint Venture. This region encompasses the Tall and Mixed Grass Ecosystems. The USFWS lists a total of 27 species as BCC within BCR 11 (USFWS 2008), 22 of which breed in the region and 15 of those would be expected to potentially occur in the Project area. According to the nearby routes from the USGS North American Breeding Bird Survey (BBS) data, 10 of these expected 15 breeding BCC species for this region have been recorded along the Raymond and Turton routes located 1 to 5 miles from the Project. These species include American bittern (*Botaurus lentiginosus*), Swainson's hawk (*Buteo swainsoni*), upland sandpiper (*Bartramia longicauda*), marbled godwit (*Limosa fedoa*), black tern (*Chlidonias niger*), black-billed cuckoo (*Coccyzus erythropthalmus*), red-headed woodpecker (*Melanerpes erythrocephalus*), grasshopper sparrow (*Ammodramus savannarum*), chestnut-collared longspur (*Calcarius ornatus*), and dickcissel (*Spiza americana*). Specific occurrence of bird species within the Project during the migratory and breeding seasons can change, but is anticipated to be similar to those observed on these nearby BBS routes.

USGS Breeding Bird Survey

The USGS North American BBS is a collaborative effort between the USGS Patuxent Wildlife Research Center and Environment Canada's Canadian Wildlife Service. The objective of the survey is to monitor the status and trends of North American bird populations via a standardized protocol collected by participants along thousands of randomly established roadside routes throughout the continent. The closest BBS routes to the Project are the Raymond Route to the south, and the Turton Route to the west (Figure 8). The Raymond Route, in the Couteau, has had 18 surveys since 1966, with 11 annual surveys since 2005 and 54 to 67 species recorded in each year. The 10 most commonly recorded species in the last decade include common grackle (*Quiscalus quiscula*), ring-necked pheasant (*Phasianus colchicus*), red-winged blackbird (*Agelaius phoeniceus*), Canada goose (*Branta canadensis*), western meadowlark (*Sturnella neglecta*), mourning dove (*Zenaida macroura*), mallard (*Anas platyrhynchos*), brown-headed cowbird (*Molothrus ater*), killdeer (*Charadrius vociferous*), and yellow-headed blackbird (*Xanthocephalus xanthocephalus*). In contrast, the Turton Route has been completed only 6 times since 1966, but four years between 2007 and 2010. Located in the James River Valley, the most recent surveys documented 35 to 54 species in each year. The 10 most commonly recorded species from 2007 to 2010 included red-winged blackbird, common grackle, ring-necked pheasant, mallard, barn swallow (*Hirundo rustica*), mourning dove, brown-headed cowbird, western meadowlark, killdeer, and yellow-headed blackbird.

Avian Indirect Effects

Indirect impacts of wind energy facilities have also been raised as a general concern by the USFWS for wind energy facilities across the U.S. In particular, the USFWS (2012a) 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. Regionwide declines in many grassland associated birds species have been well documented using BBS data (Peterjohn and Sauer 1999; Sauer and Link 2011), although the causal mechanism for declines have been challenging to assess. A recent study focused on linking the conservation mechanisms associated with grassland management and policy decisions for avian population management (Drum et al. 2015). Some grassland specialist bird species are known or suspected to be susceptible to this effect, perhaps because of their behavioral aversion to trees and other tall structures (Shaffer and Buhl 2016; Strickland et al. 2011). Recent work on a smaller spatial scale documented wind turbine avoidance for several species of concern expected to be in the project area, including bobolink, grasshopper sparrow, and upland sandpiper (Shaffer and Buhl 2016). Based on location in the landscape, and publicly available databases (BBS, eBird, and SD Ornithologists' Union) use of the Project is expected for the following species including: bobolink, grasshopper sparrow, northern harrier, sedge wren, sharp-tailed grouse, and upland sandpiper. Three species would be less likely to use the Project area based on existing habitats and available data: chestnut-collared longspur, greater prairie chicken, and osprey. The majority of the land cover in the Project is pasture and tilled agriculture, so although these habitats may be used by grassland species for nesting, the potential for indirect impact beyond current use is expected to be relatively low. Siting of project turbines to avoid native prairie remnants, larger tracts of grasslands that have been identified as having intact virgin sod, and minimizing impacts to grazed grasslands would further minimize the potential for indirect impacts.

Bats

The Project is within the potential range of the following six bat species: hoary bat (*Lasiurus cinereus*), big brown bat (*Eptesicus fuscus*), little brown bat (*Myotis lucifugus*), eastern red bat (*Lasiurus borealis*), silver-haired bat (*Lasionycteris noctivagans*), and NLEB (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/ per MW/ per year (Arnett et al. 2008). Although some wind power facilities have comparatively high numbers of bat fatalities (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. 2003). Bat casualties have been reported from most wind energy faculties where post-construction fatality data are publicly available and 22 species of bats have been recorded to date as fatalities at wind energy facilities (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 forest (NWCC 2004). However, Gruver et al. (2009), Barclay et al. (2007), and Jain (2005) have also reported relatively high fatality rates from facilities in Wisconsin, Canada, and Iowa that were located in grassland and agricultural habitats.

Table 3. Summary of bat fatalities (by species) from wind energy facilities in North America.

Common Name	Scientific Name	# Fatalities[1]	% Composition
hoary bat[2]	*Lasiurus cinereus*	5,118	36.6
eastern red bat[2]	*Lasiurus borealis*	3,220	23.0
silver-haired bat[2]	*Lasionycteris noctivagans*	2,534	18.1
little brown bat[2]	*Myotis lucifugus*	1,127	8.1
tricolored bat[2]	*Perimyotis subflavus*	631	4.5
big brown bat[2]	*Eptesicus fuscus*	533	3.8
Mexican free-tailed bat	*Tadarida brasiliensis*	377	2.7
unidentified bat		330	2.4
unidentified *Myotis*	*Myotis* spp.	35	0.3
northern long-eared bat[2]	*Myotis septentrionalis*	27	0.2
Seminole bat	*Lasiurus seminolus*	12	0.1
western red bat	*Lasiurus blossevillii*	9	0.1
big free-tailed bat	*Nyctinomops macrotis*	5	<0.1
evening bat	*Nycticeius humeralis*	5	<0.1
western yellow bat	*Lasiurus xanthinus*	3	<0.1
eastern small-footed bat	*Myotis leibii*	2	<0.1
Indiana bat	*Myotis sodalis*	2	<0.1
pocketed free-tailed bat	*Nyctinomops femorosacca*	2	<0.1
canyon bat	*Pipistrellus hesperus*	1	<0.1
cave bat	*Myotis velifer*	1	<0.1
long-legged bat	*Myotis volans*	1	<0.1
unidentified free-tailed bat		1	<0.1
Total	**19 species**	**13,977**	**100**

[1] These are raw data and are not corrected for searcher efficiency or scavenging.
[2] Potential resident or migrant in the Project (BCI 2015).

Note: Cumulative fatalities and species from data compiled by Western EcoSystems Technology, Inc. from publicly available fatality documents (listed in Appendix B); Indiana bat fatalities reported by USFWS (2011a, 2011b).

Additional notes on bat species and numbers:

Indiana bat fatalities in this table are also reported by USFWS (2010, 2011b). Three additional Indiana bat fatalities have been reported in USFWS Press releases (2011a, 2012a, 2012c), but 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 2012a), and tricolored bat formerly known as eastern pipistrelle (*Pipistrellus subflavus*; BCI 2012b).

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) have comprised approximately 75% of reported bats killed in the Midwest and nationally (Arnett et al. 2008, Gruver et al. 2009). Thus, fatality risk at the Project is expected to be greatest for tree-roosting bat species that are migrating through the Project during the late summer or early fall. There is limited potential for the federally listed NLEB to occur in the Project to forage; however, the most suitable roosting habitat, albeit limited, exists at the southern and southeastern portions of the Project.

Precisely predicting the level of bat fatalities at the Project is difficult given the broad range of fatality rates observed at other wind energy facilities in the Midwest, and the lack of a direct link between pre-construction bat activity and post-construction fatality rates (Hein et al. 2013).

Indirect Impacts

Indirect impacts to bats are poorly understood due to the complex ecology of bats 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 forested area present (<2% according to WEST desktop assessment).

Tier 1 and Tier 2 Questions

As described in the Final Land-based Wind Energy Guidelines (USFWS 2012), Tier 1 and 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 objective of the Tier 1 study is to assist the developer in further identifying a potential wind site by providing a preliminary evaluation or screening of public data from federal, state, and tribal entities and offering early guidance about the sensitivity of the site in regards to flora and fauna; Tier 2 studies provide additional information gathered during a site visit and coordination with the agencies. The following discussion provides answers to the Tier 1 and 2 questions for the Crocker Project.

1. *Are there species of concern, or habitat for that species, present in the proposed Project area?*

There are substantial grassland areas in the Project which may provide suitable habitat for listed prairie-dependent species such as the Dakota skipper and Poweshiek skipperling, although grazing on many of the parcels has degraded the habitat. There is very limited forested habitat that could provide suitable summary foraging or roosting habitat for the NLEB. Bald eagles may occur in the Project, as well as other sensitive avian species, but habitat for these species does not appear to be higher density within the Project than in the surrounding landscape.

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

There are several federal easements adjacent to the Project (Figure 6) but no federally owned parcels within the Project. Several USFWS-managed easements are located adjacent to the Project (Figure 6) and it is possible that additional easements have been signed up within the Project; further coordination with the USFWS Wetland Management District is recommended to determine if there are any restrictions on wind development within these parcels. There are no designated Critical Habitat Units for Dakota skippers or Poweshiek's skipperling, or any other federally listed species, within the Project. There is one state-managed game production area within the Project boundary, and several state-owned and managed lands adjacent to the Project.

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

Cultivated cropland, grazed pasture, and water compose the majority of the Project area and suitable habitat for most plant species of concern is limited. It should be noted that much of the Project area is believed to retain unbroken sod (Figure 5), but that many of those areas are currently in pasture and have likely been degraded. Some isolated areas within these lands and any ungrazed grasslands may retain some of the prairie forbs associated with unbroken prairies.

4. Are there known critical areas of wildlife congregation in the proposed Project area?

There is some potential for species of wildlife to congregate within the Project area based on publicly available data, specifically around lakes and other open waterbodies during peaks in avian migration through the area. These resources do not appear to be in higher density in the Project area than the surrounding landscape.

5. Are there large areas of intact habitat with the potential for fragmentation, with respect to species of habitat fragmentation concern needing large contiguous blocks of habitat?

A large portion of the Project area is highly fragmented already and a mosaic of cultivated cropland, pasture and developed areas comprise the majority of the Project area. Aerial imagery and the site visit indicate that there are some relatively large areas of intact mixed herbaceous grasslands and pasture/hay within the Project, particularly on the western half of the Project. The relatively large areas of contiguous grasslands and pastures may be suitable for some species such as grasshopper sparrow, northern harrier, sedge wren, marbled godwit, and upland sandpiper.

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

Additional data from field studies would be necessary to adequately address potential presence of species of concern. The Project occurs within the known range of the NLEB, and occurrence is possible within the limited forested areas of the Project likely during the summer months as well as more generally during early fall migration throughout the area. Bald and golden eagles may also occur within the Project. Bald eagles may use the area year-round, although use is expected to be lower during winter and summer due to the lack of suitable nesting substrate and winter roost sites. Golden eagles are much less common in this area and are expected to occur as uncommon migrants passing through in a broad-front fashion. Additionally, species that utilize prairie and grassland areas may find suitable habitat in the relatively larger blocks of herbaceous grassland and pasture that are present within the Project.

7. Is there a potential for significant adverse impacts to species of concern based on the answers to the questions above?

Based on available information the potential for significant adverse impacts to species of concern from development of the project is low. There are no critical habitat areas within the Project and the landscape and habitat features present within the Project are similar to those in the surrounding landscape.

DISCUSSION

Cultivated cropland, pasture, and developed areas compose a majority (55%) of the Project and suitable habitat for most species of concern is limited in these areas. NLCD data indicates that up to 33% of the Project is herbaceous native prairie (although the site visit indicates that much of this mapped land cover is actually grazed pasture) and approximately 11% of the Project is wetlands or open water; these habitat types have the potential to provide habitat for some species of concern. Given the Project's relative proximity to the James and Big Sioux River valleys, the general area may receive use by some sensitive bird species during migration. Additionally, the state level Troy Township Lakes IBA overlaps the northern mile of the Project boundary; this IBA provides important habitat for waterfowl and colonial nesting waterbirds. However, higher use by migrating birds, including sensitive species, are expected to occur along the Missouri River valley 100 miles to the west, and population level impacts to these species are not expected from the Project. It is likely that bald eagle use at the Project is less than other projects in the Midwest, particularly in summer as there is limited habitat for nesting, although some foraging could occur in some of the larger open water features. It would be expected for bald eagles to use the Project during migration but it is anticipated that their presence would likely be transient. Winter use by bald eagles is expected to be relatively low, although there is some potential for foraging to occur in some of the larger open water features during warmer winters when ice cover is more limited; there is limited to no winter roosting sites for bald eagles within the Project. The Project has the potential to be utilized by migrating birds for stopover habitat and the creeks may provide some limited migration corridors for raptors as well as other bird groups. Similar to other wind-energy Projects in the region, there is some potential for impacts to individuals of certain species, particularly during the spring and fall migration seasons, but there is little potential for significant adverse population-level impacts to species of concern.

The Project is situated along a documented area used by migrating waterfowl and it is likely to see increased waterfowl use in the Project during migration. Given availability of wetland and permanent aquatic habitats in Project area, it is anticipated that waterfowl use will be equivalent to elsewhere in the Prairie or Missouri couteaus. However, even high use by water-associated birds has not been strongly correlated with fatalities of these species at wind energy facilities, as evidenced by low waterbird fatalities at facilities in Minnesota, Wisconsin, Iowa, and Oregon, despite high use by waterfowl and other waterbirds (Erickson et al. 2002b; Grodsky & Drake 2011; Johnson et al. 2002, 2003; Jain 2005).

Similar to every other wind energy facility in the region, the greatest potential exists for eastern red bat, hoary bat, and silver-haired bat fatalities to occur during operation of the Project. The size of eastern red, hoary, and silver-haired bat populations are not known. All three species

have broad ranges, and presumably relatively large population sizes. All three species are also commonly found as fatalities at Midwest wind energy facilities. The effects of wind energy-related fatalities on eastern red bat, hoary bat, and silver-haired bat populations are difficult to evaluate given the lack of knowledge regarding bat population sizes, and the slow reproductive rates for bat species.

Dakota skipper and Poweshiek's skipperling are federally protected butterfly species and the Project is within the range of both species. There is no designated critical habitat within or nearby the Project for either of these species. These butterflies are prairie obligate species, and Poweshiek's skipperling in particular is not tolerant of grazed grasslands. Suitable habitat for these species may occur in native prairie remnants, including within some of the larger intact grasslands that occur within the Project. If avoidance of potential habitat is not possible, additional assessments and surveys should occur.

There is potential for the NLEB (listed as Threatened under the ESA) to forage and utilize travel corridors within the Project; however, suitable roosting and summer foraging habitat is extremely limited within the Project. More suitable roosting habitat exists outside of the Project. Much of the potential NLEB habitat is composed of very small isolated forest patches at the eastern edge of the Project.

Surveys Underway:

- Fixed-Point Eagle and Other Large Bird Use Surveys - Large bird avian use surveys are designed to collect information on use, behavior, and timing of breeding birds, raptors, and any sensitive species that use the area. This survey effort is combined with eagle use surveys, which are designed to collect information about how eagles use the Project and support assessment of risk to eagles.
- Raptor and eagle nest surveys – to locate nests that may be subject to disturbance by project development and operation.
- Small fixed-point count surveys for passerines – to document spring migration for passerines.
- Lek surveys – to document lek locations by grouse species.
- Bat activity monitoring – to learn about spatial and temporal patterns in bat use.

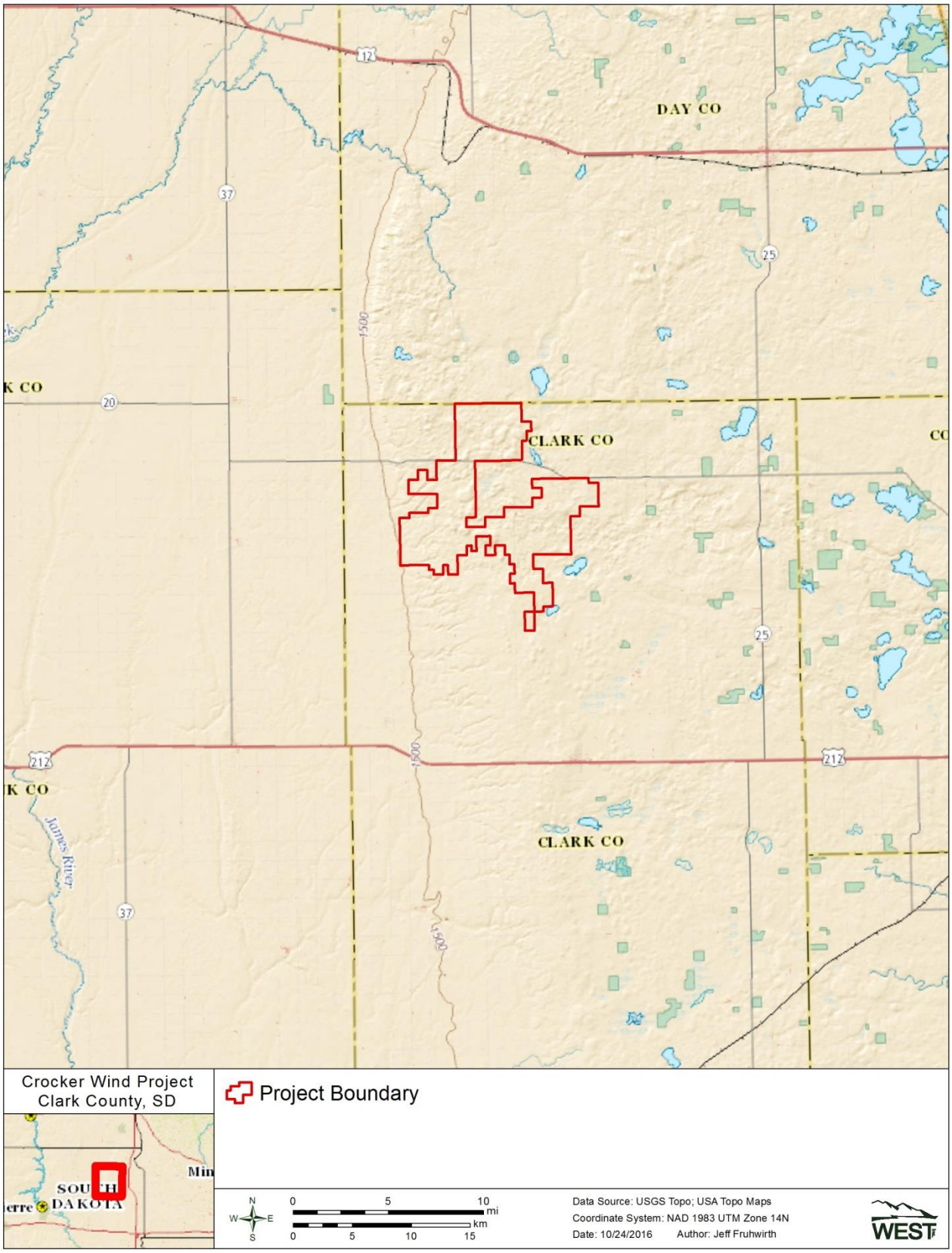

Figure 1. Location of the Crocker Wind Farm in Clark County, South Dakota.

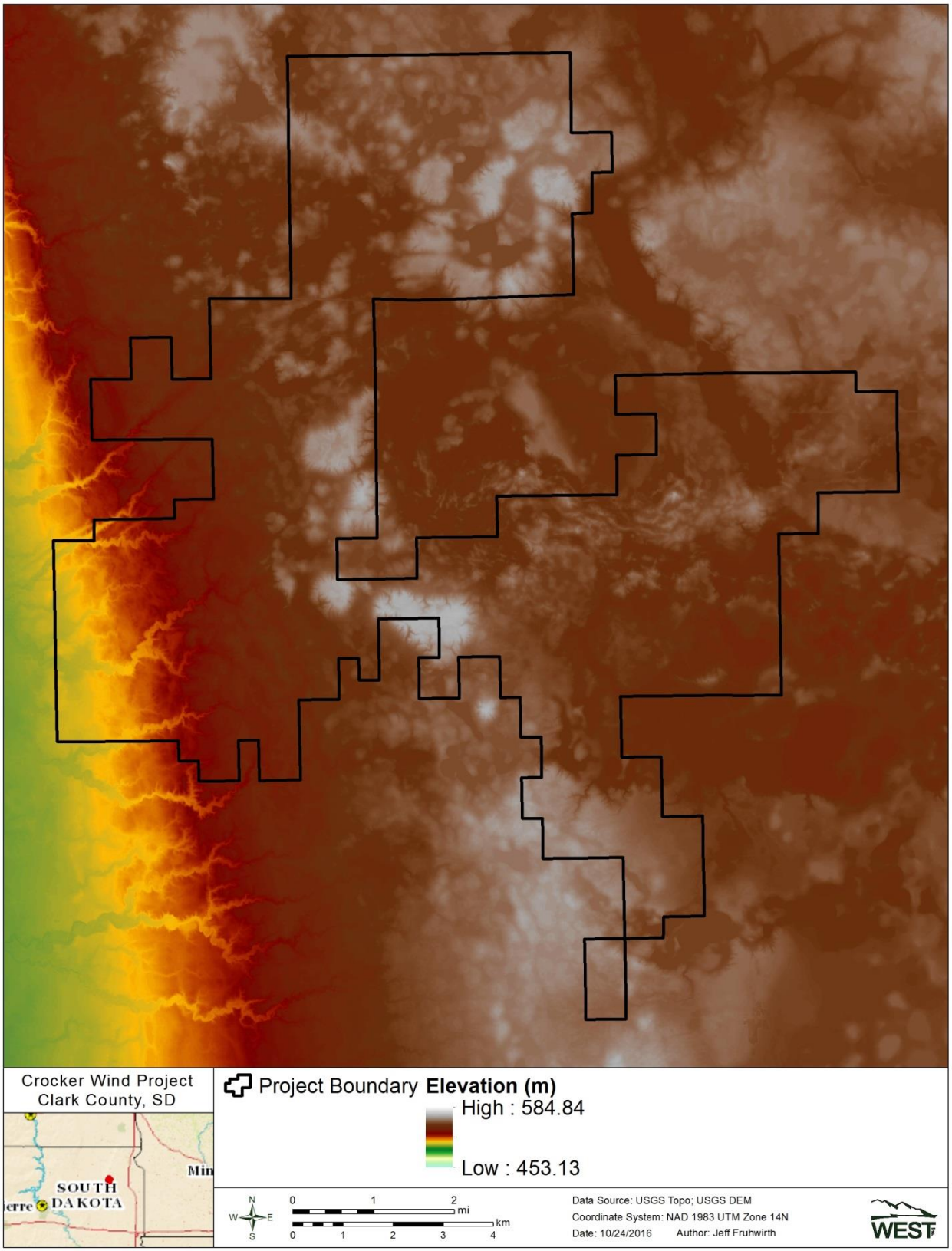

Figure 2. Digital elevation model of the Crocker Wind Farm.

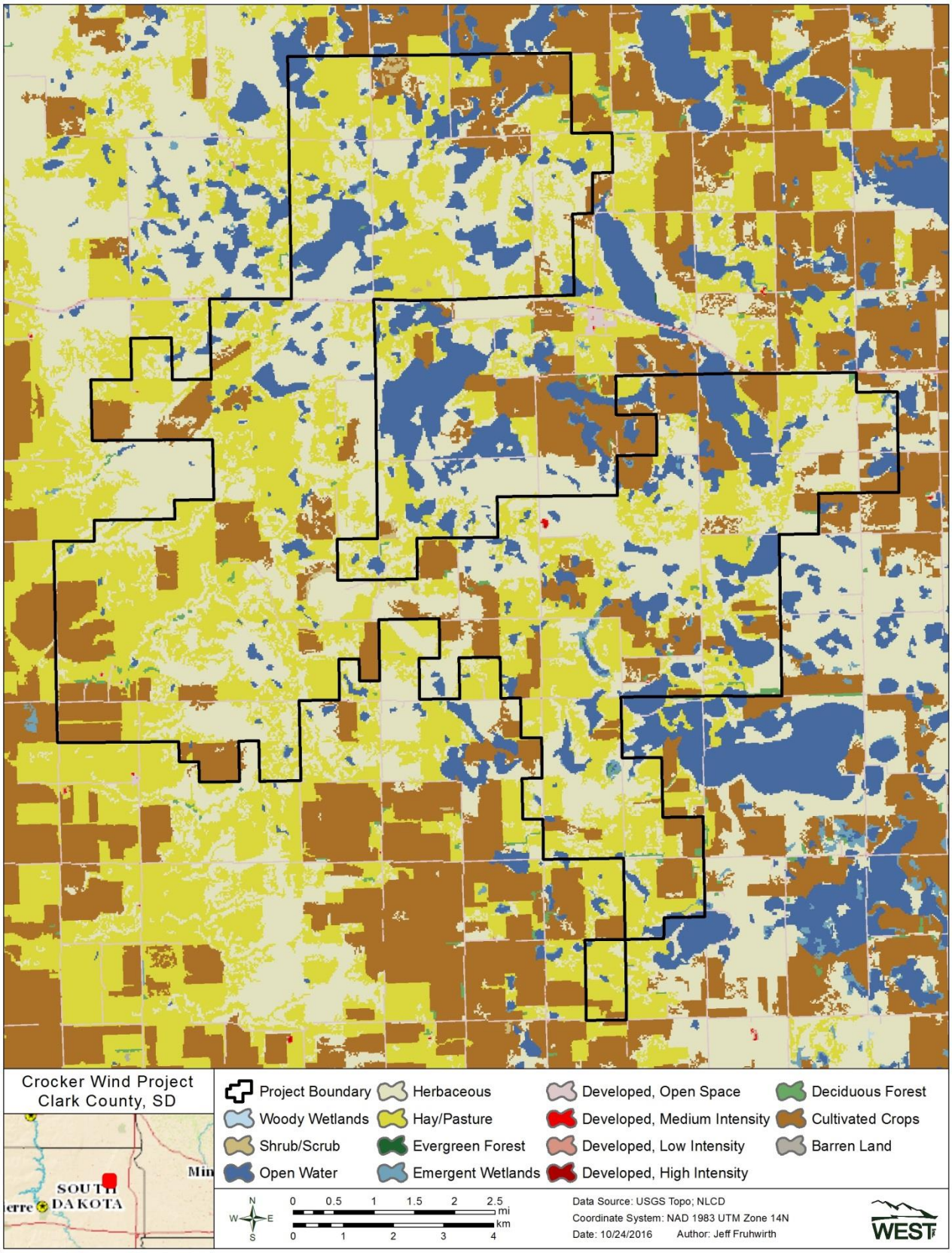

Figure 3. Land cover types within the Crocker Wind Farm (USGS NLCD 2011).

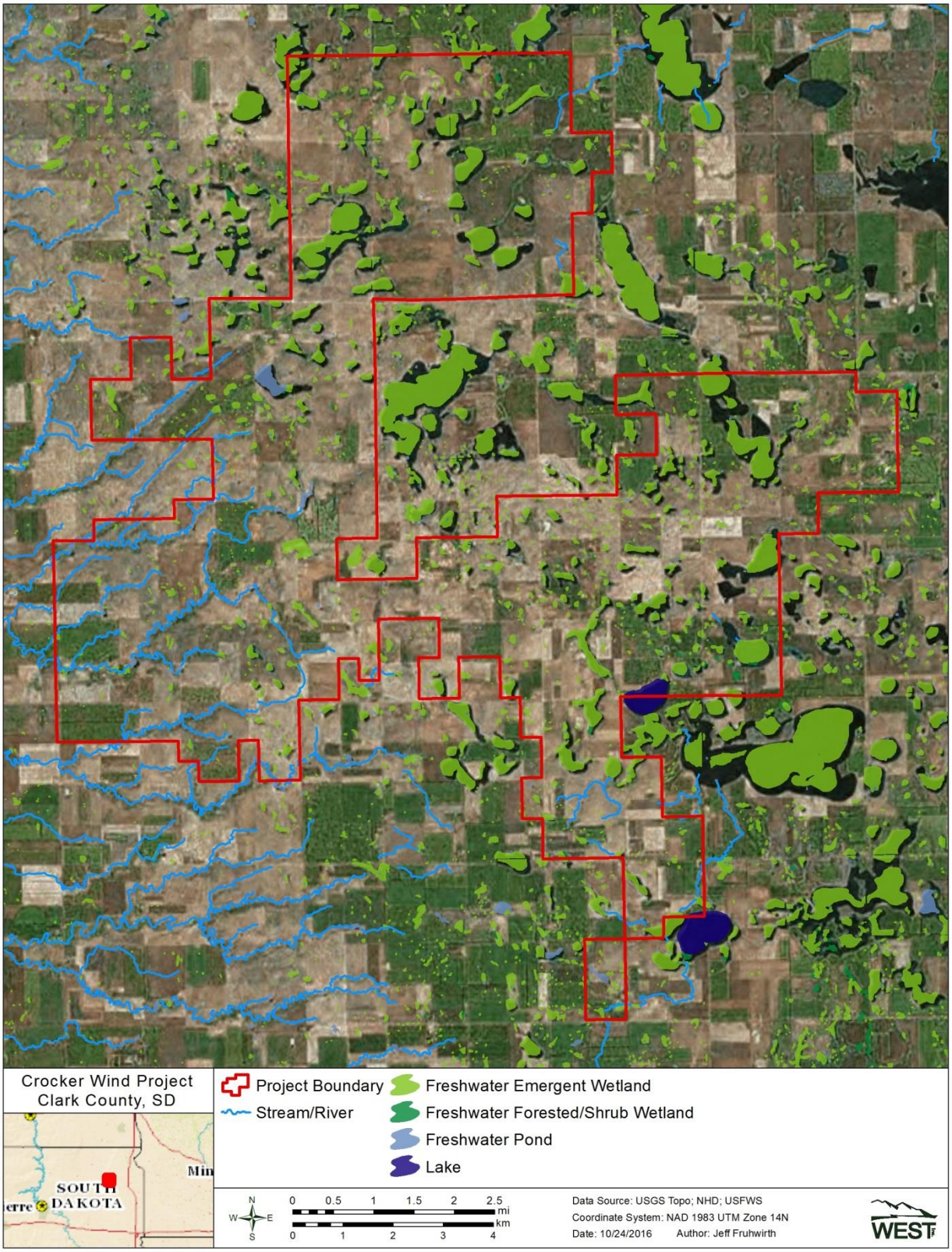

Figure 4. National Wetland Inventory (NWI) wetland types within and adjacent to the Crocker Wind Farm.

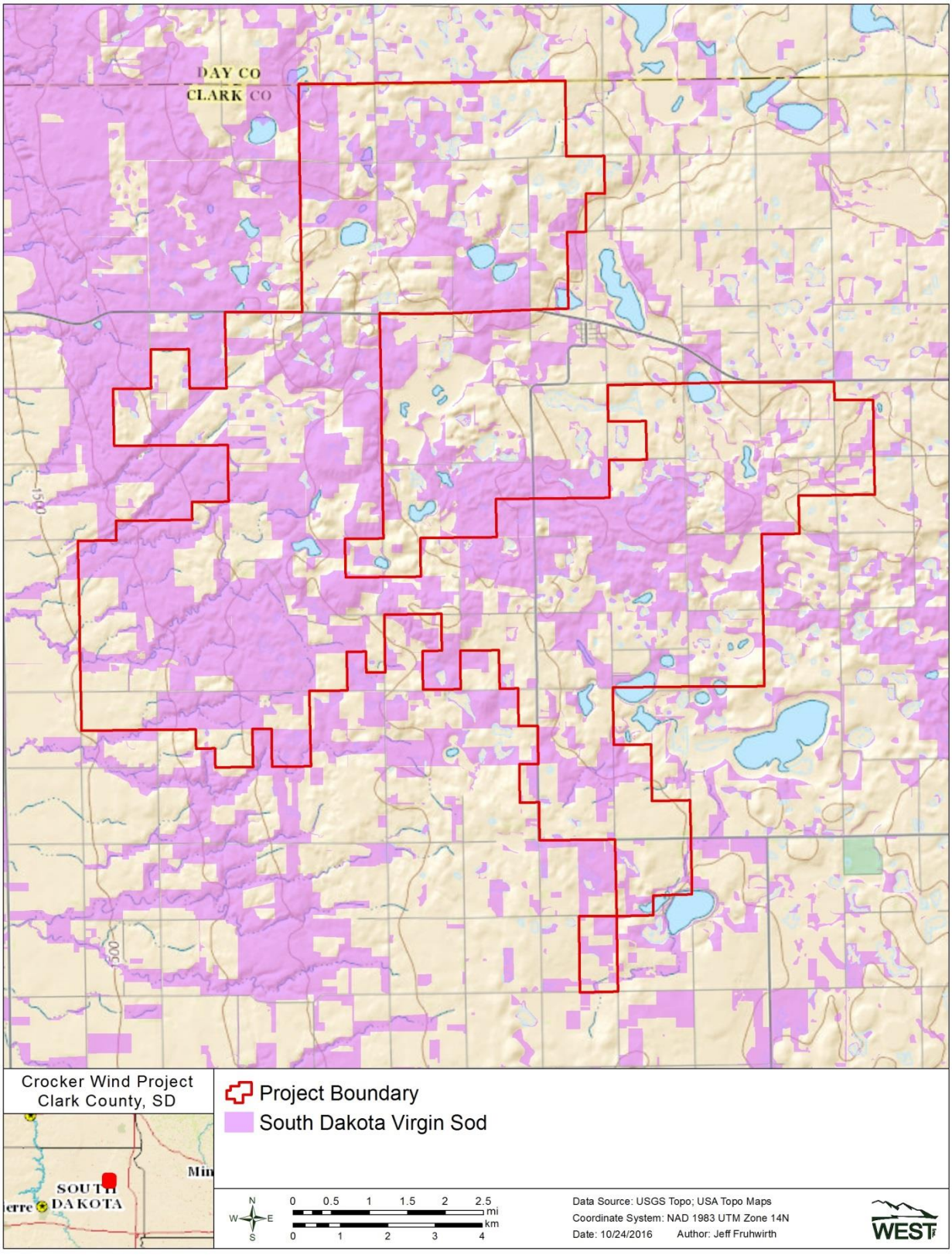

Figure 5. Uncultivated lands identified as likely "virgin sod" in relation to the Crocker Wind Farm.

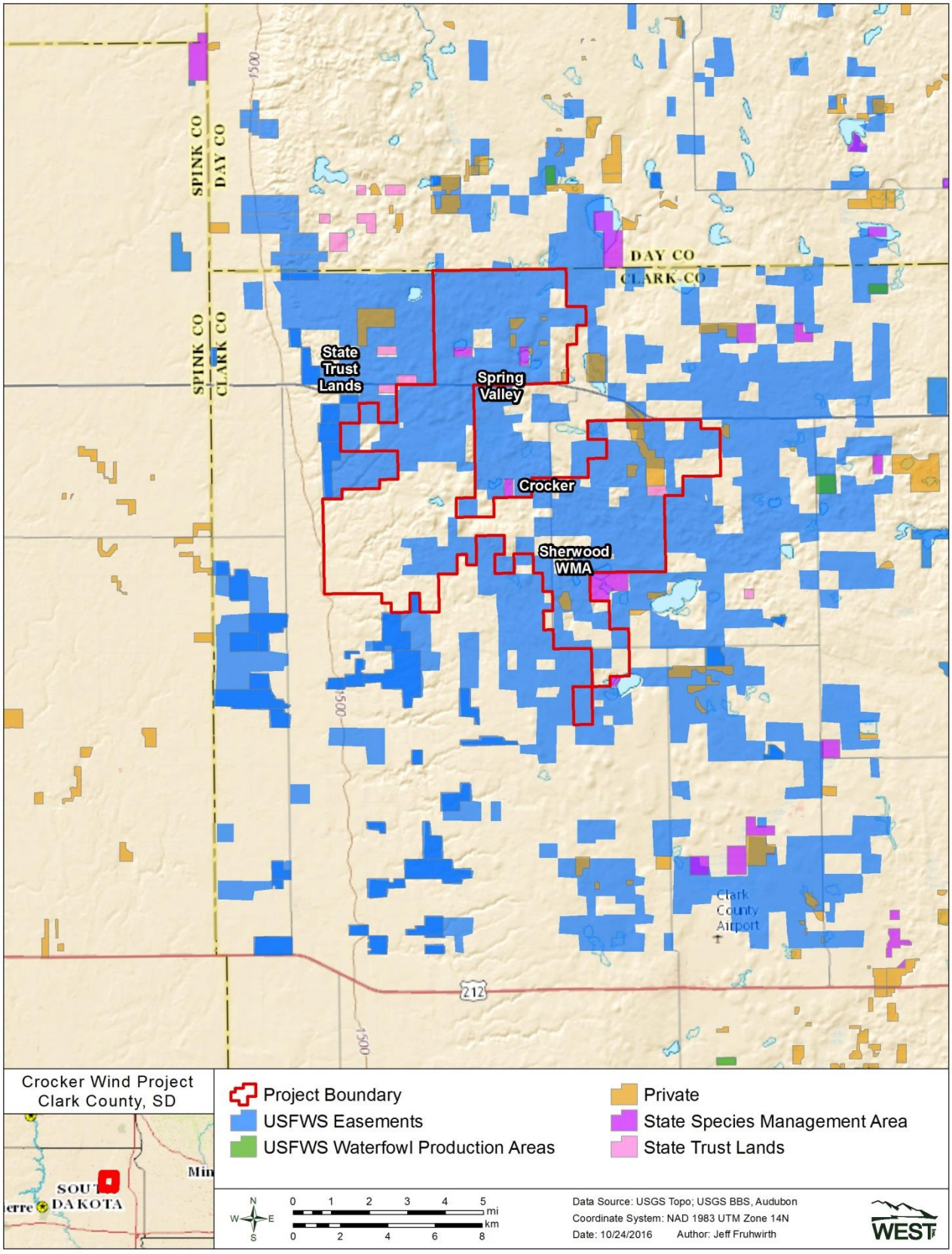

Figure 6. Protected lands in relation to the Crocker Wind Farm.

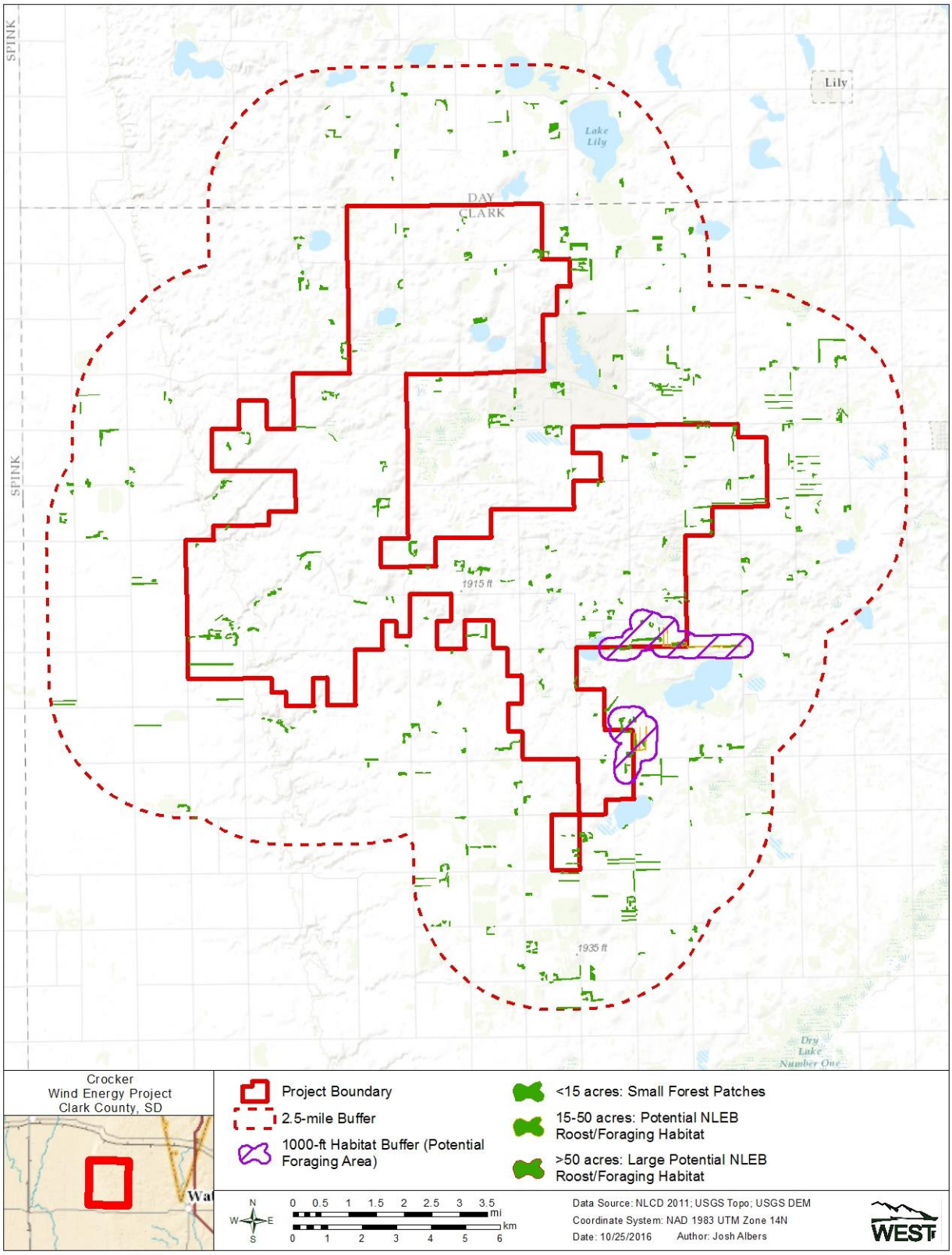

Figure 7. Potential northern long-eared bat habitat at the Crocker Wind Farm and within 2.5 miles.

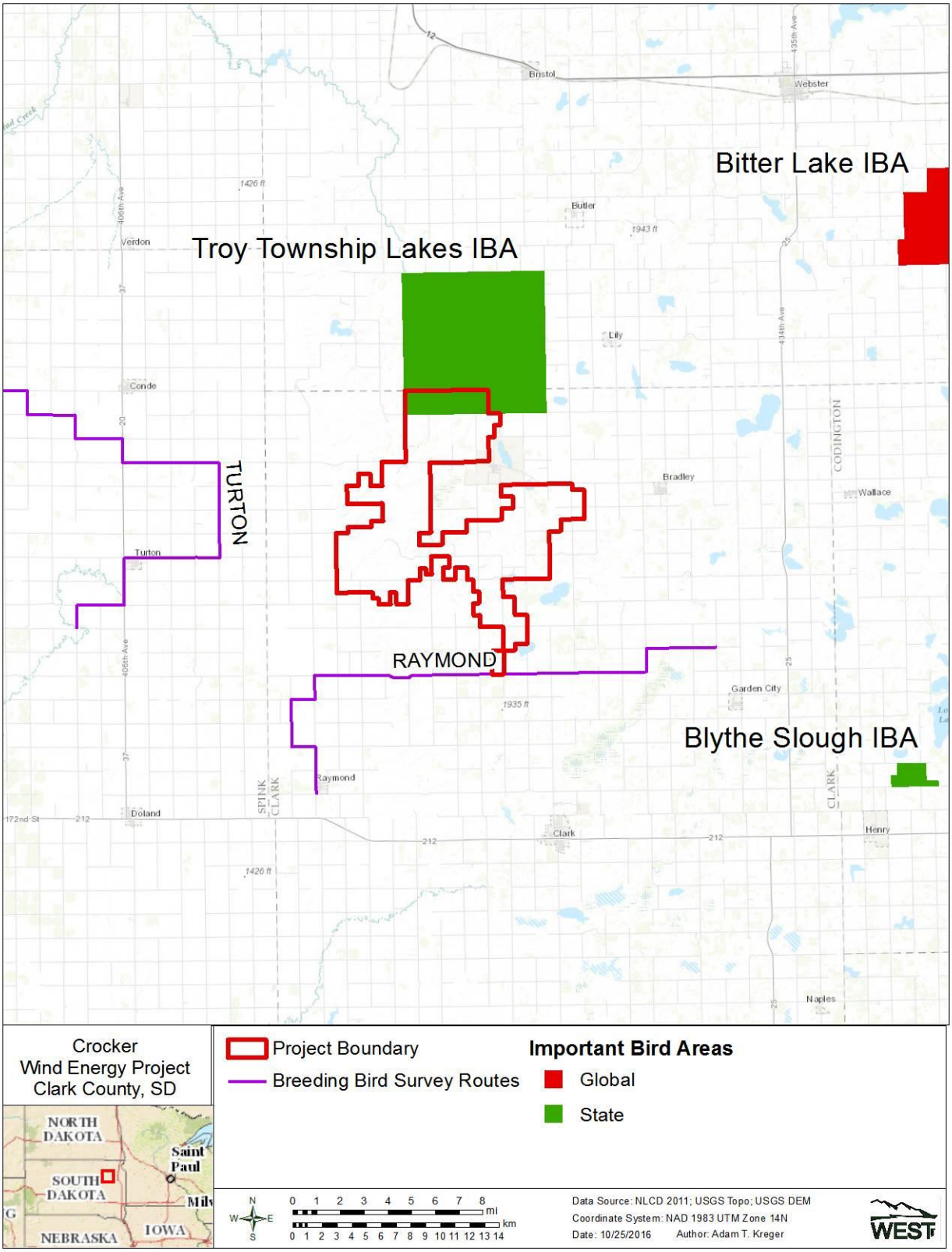

Figure 8. Breeding Bird Survey (BBS) routes and Important Bird Areas closest to the Crocker Wind Farm.

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