Pronghorn Flats

115-kilovolt Project

Final Environmental Assessment

Kimball and Banner Counties, Nebraska, and Goshen County, Wyoming

Western Area
Power Administration

DOE/EA-2139

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
°	degree
AADT	annual average daily traffic
AFB	Air Force Base
APE	area of potential effects
APLIC	Avian Power Line Interaction Committee
BBCS	Bird and Bat Conservation Strategy
BCC	Birds of Conservation Concern
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BMP	Best Management Practice
BUL	Biologically Unique Areas
CEQ	Council on Environmental Quality
CERT	Conservation and Environmental Review Tool
CFR	Code of Federal Regulations
CR	County Road
CRI	credible Interval
CRM	collision risk model
CWA	Clean Water Act of 1972
dBA	decibels
DOE	Department of Energy
EA	environmental assessment
ECPG	Eagle Conservation Plan Guidance
EIS	environmental impact statement
EMF	electric and magnetic fields
EMU	Eagle Management Unit
ESA	Endangered Species Act of 1973
F	Fahrenheit
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
ft	foot/feet
GE	General Electric
GHG	greenhouse gas
HAP	hazardous air pollutants
Hwy	Highway
I-80	Interstate 80
ICNIRP	International Commission on Non-ionizing Radiation Protection
IEEE	Institute of Electrical and Electronics Engineers
IPaC	Information for Planning and Consultation System
KOP	Key Observation Points
kV	kilovolt
L_{1h}	1-hour equivalent sound level
LAP	Local Area Population
Longspur	thick-billed longspur
MBTA	Migratory Bird Treaty Act
met	meteorological
mG	milliGauss
mi	mile
mi^2	Square mile
mph	miles per hour

Acronym	Meaning
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NEDEQ	Nebraska Department of Environmental Quality
NEDOT	Nebraska Department of Transportation
NEPA	National Environmental Policy Act of 1969
NGPC	Nebraska Game and Parks Commission
NHPA	National Historic Preservation Act of 1966
NIEHS	National Institute of Environmental Health Sciences
NNHP	Nebraska Natural Heritage Program
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
O&M	operations and maintenance
OATT	Open Access Transmission Tariff
Orchid	western prairie fringed orchid
Orion	Orion Wind Resources LLC
OST	Oglala Sioux Tribal
PEM	palustrine emergent
PM	particulate matter
Project	Pronghorn Flats 115-kV Project
PRRIP	Platte River Recovery Implementation Program
ROW	right-of-way
RSG	RSG, Inc.
SDWA	Safe Drinking Water Act
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Offices
SPCC	Spill Prevention, Control, and Countermeasures
SR	State Route
SWPPP	Stormwater Pollution Prevention Plan
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compounds
WAPA	Western Area Power Administration
WEST	Western EcoSystems Technology, Inc.
WGFD	Wyoming Game and Fish Department
WYDEQ	Wyoming Department of Environmental Quality
WYDOT	Wyoming Department of Transportation
WYNDD	Wyoming Natural Diversity Database

1.0 INTRODUCTION

Orion Wind Resources, LLC (Orion), has requested an interconnection agreement with Western Area Power Administration (WAPA) to allow a planned wind energy project to transmit electricity to a WAPA switchyard (the point of interconnection) and into the WAPA electric grid system. Orion, the Applicant, or a subsidiary or affiliate, plans to construct and operate the Pronghorn Flats 115-kilovolt (kV) Project (Project) in southwest Banner and northwest Kimball counties, Nebraska, and southeast Goshen County, Wyoming (Figure 1-1).

The Project is a stand-alone component of Orion's larger Pronghorn Flats Wind Farm Complex, which includes a second wind-energy project connecting at 230-kV. Orion has requested an interconnection agreement with WAPA for each of these projects. Orion's requests for two interconnections with WAPA's transmission system for the Pronghorn Flats Wind Farm Complex requires evaluation of each Project by WAPA in compliance with the National Environmental Policy Act of 1969 (NEPA). The projects are considered separate because each would interconnect to different WAPA transmission lines under separate interconnection agreements and could be built and operated independent of each other. The 230-kV project may be evaluated in a separate NEPA process when it is further along in development.

WAPA is a federal, power-marketing agency within the U.S. Department of Energy (DOE). WAPA operates and maintains electric transmission lines and associated facilities in accordance with its statutory duties, good utility practice and its Open Access Transmission Tariff (OATT). Under the OATT, WAPA offers an interconnection agreement to deliver electricity on its transmission system when capacity is available. WAPA offers interconnection to all eligible customers on a first-come, first-served basis, with a final decision based on technical system impact and feasibility studies and an environmental assessment (EA) or Environmental Impact Statement (EIS) that is compliant with the NEPA.

The Project includes construction of 30 to 48 wind turbines, producing between 2.5 and 4.2 megawatts (MW) each, plus access roads, electric collection system, substation, a fiber optics communication system, operations and maintenance (O&M) facilities, meteorological (met) towers, a 115-kV transmission line, a switchyard that serves as the point of interconnection with WAPA's transmission system, and related facilities and equipment. The interconnection agreement would permit the Project's 115-kV transmission line to connect and deliver energy produced by the wind energy facility into WAPA's Round Top–Stegall segment of the Stegall-Archer 115-kV transmission line for distribution to project customers (Figure 1-1). The indicative locations of certain Project facilities are shown in Figures 1-1 and 1-2.

This EA was prepared according to the Council on Environmental Quality's (CEQ's) 1978 regulations for implementing the procedural provisions of the NEPA (40 Code of Federal Regulations [CFR] §§1500–1508 [1970], as amended). The CEQ issued revised regulations for implementing the procedural provisions of the NEPA, effective September 14, 2020. The revised regulations, which are under review consistent with the Executive Order 13990 *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis,* provide the responsible official the option of conducting an environmental review under the 1978 regulations if the process was initiated prior to September 14, 2020 (40 CFR §1506.13 [1978], 85 Federal Register 137, p. 43,373, July 16, 2020). The public scoping process for this Project was initiated on March 26, 2020, prior to the implementation of the revised NEPA regulations, so this EA was prepared in accordance with the 1978 regulations.

1.1 Purpose and Need for Federal Action

WAPA needs to consider and respond to Orion's interconnection request in accordance with its OATT. The OATT contains terms for processing requests for the interconnection of generation facilities to WAPA's transmission system. In reviewing interconnection requests, WAPA must ensure that existing reliability and services are not degraded. The OATT provides for transmission and system studies to ensure that system reliability and service to existing customers are not adversely affected by new interconnections. These studies identify system upgrades or additions necessary to accommodate a proposed project and address whether the upgrades or additions are within a project's scope. Under WAPA's OATT, WAPA offers interconnection to all eligible customers on a first-come, first-served basis, with a final decision whether to make this offer subject to the system impact studies and an environmental review under the NEPA.

1.2 Orion's Goals and Objectives

Orion's goals and objectives for the proposed Project are to provide a reliable and cost-effective source of renewable energy to energy users. To accomplish these goals and objectives, the Project must be technically, environmentally, and economically feasible. To that end, Orion needs at least the following factors to be present:

- A reliable wind resource
- Landowners willing to participate in the Project
- Ecological conditions allowing the Project to comply with applicable environmental regulations at a relatively reasonable cost
- A generator interconnection agreement with WAPA to transmit power to a power purchaser
- A customer to purchase the power that is generated by the Project

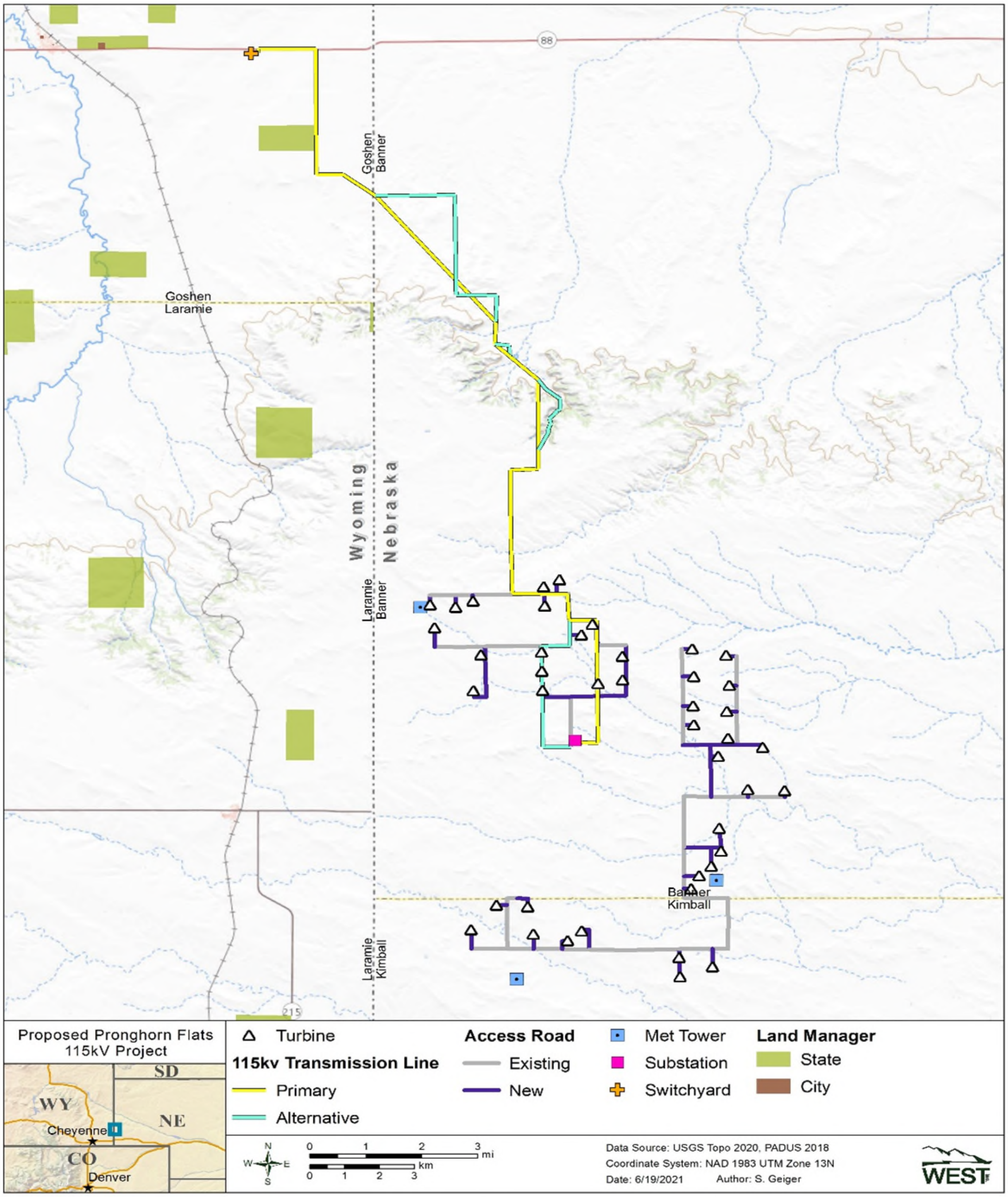

Figure 1-1. Overview of the Indicative Pronghorn Flats 115-kilovolt Project in Banner and Kimball counties, Nebraska, and Goshen County, Wyoming.

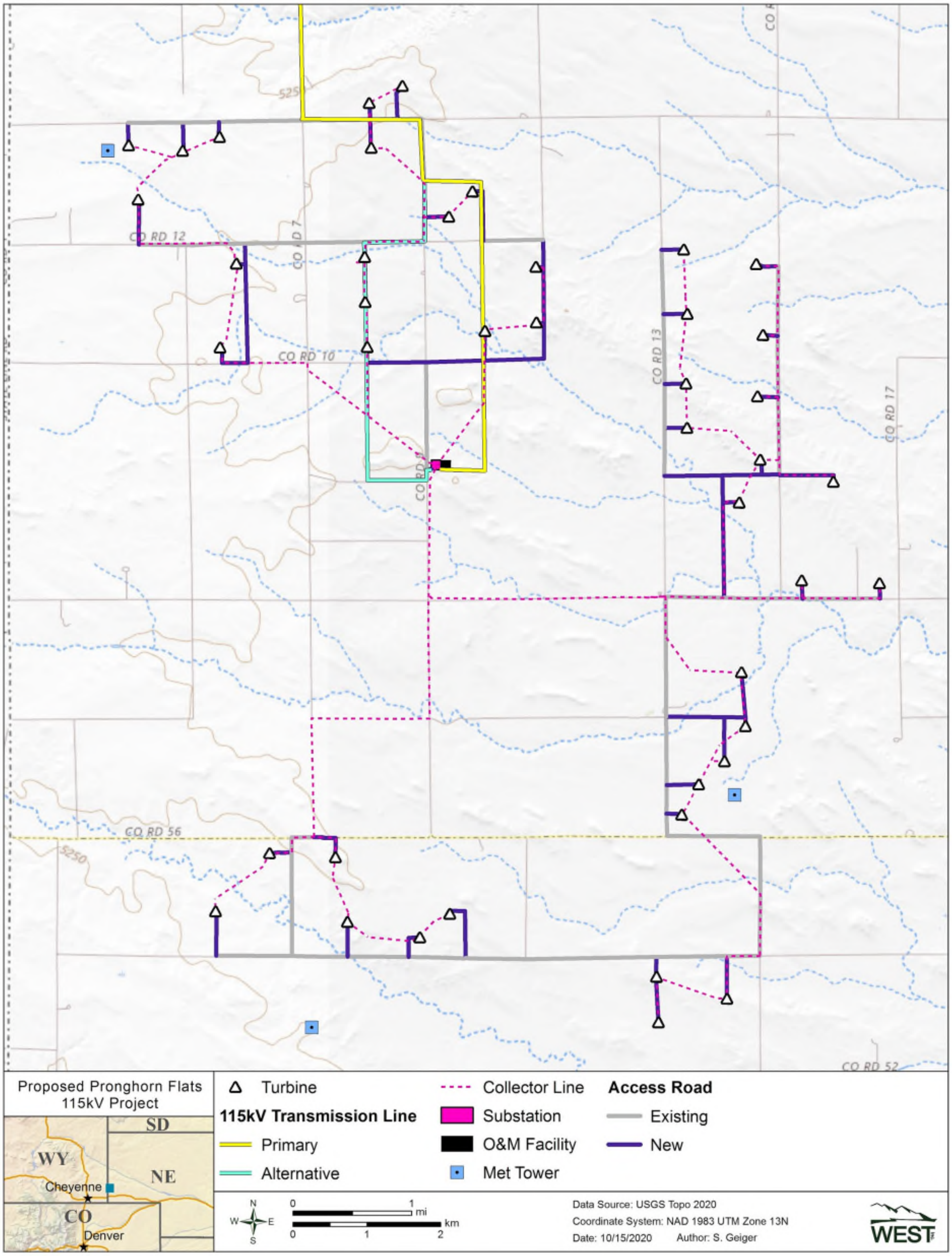

Figure 1-2. Indicative infrastructure layout for the Pronghorn Flats 115-kilovolt Project, Banner and Kimball counties, Nebraska.

2.0 DESCRIPTION OF PROPOSED ACTION AND NO-ACTION ALTERNATIVES

2.1 Proposed Action

2.1.1 Western Area Power Administration Proposed Action

WAPA's Proposed Action consists of approving the interconnection request, entering into an interconnection agreement and operating a new switchyard to facilitate and complete the physical interconnection of the Project to WAPA's transmission system.

2.1.2 Orion's Proposed Project

Orion's Proposed Project consists of construction, O&M, and decommissioning of the Project's wind turbines and associated infrastructure, the 115-kV transmission line, and the switchyard for interconnection to the WAPA transmission line system. (Figures 1-1 and 1-2).

2.1.2.1 Project Location

The turbines would be located on privately owned lands within Banner and Kimball counties, Nebraska (Figures 1-1 and 1-2). The 115-kV transmission line would be located on private land in Banner and Kimball counties, Nebraska, and Goshen County, Wyoming, and potentially within Banner County Road (CR) right-of-way (ROW; Figures 1-1 and 1-2). Road crossing agreements from Banner and Kimball counties, Nebraska Department of Transportation (NEDOT), and Wyoming Department of Transportation (WYDOT) would need to be acquired (Figures 1-1 and 1-2). The 115-kV transmission line would terminate at a switchyard constructed to interconnect the Project to the Round Top–Stegall segment of the Stegall-Archer 115-kV transmission line (Figure 1-1). Orion currently holds or is in late-stage discussions for land agreements with all of the landowners with proposed turbine locations and along the primary and alternative 115-kV transmission line routes.

2.1.2.2 Construction

The construction phase of the Project would require approximately nine to 14 months. The construction phase is expected to provide about 80 to 150 construction jobs. Water required for the concrete needed for the foundations of the turbines is estimated at one million gallons. Additional water would be needed for dust suppression on roads during construction and is estimated at 40,000 gallons/day. The contractor for construction would obtain temporary water sources from either landowners with wells or purchase water from the county or other water authorities. The estimated construction cost is between roughly $115 million and $125 million. Construction activities are expected to be in the following sequence:

- Orion would enter into road use agreements with the counties prior to commencing any construction activities

- Heavy equipment would arrive on site and commence preparation of a laydown area, road construction, and turbine foundations
- Turbines would be erected and connected via underground cables. Electric commissioning can take approximately two months after erection is complete
- Orion would complete the construction with site reclamation and restoration, including repairing roads pursuant to the road use agreements
- Best Management Practices (BMP) would be implemented to minimize impacts from Project construction. The BMPs are discussed in Section 2.2, Environmental Conservation Measures and Best Management Practices

2.1.2.3 Operation and Maintenance

The Project would operate for approximately 30 years with the possibility of extensions up to an additional 20 years. Maintenance activities would occur as necessary throughout the life of the Project. Any earth-disturbing activities would be scheduled to occur primarily April to November or when weather conditions allow. Operation and maintenance BMPs are discussed in Section 2.2, Environmental Conservation Measures and Best Management Practices.

2.1.2.4 Decommissioning

The Project is expected to operate approximately 30 years with the possibility of extensions up to an additional 20 years. Decommissioning would require approximately 12 to 18 months. General steps for decommissioning a wind farm include:

- Establishing temporary storage areas for dismantled components and other materials for recycling
- All turbines (including towers) would be dismantled and recycled, sold for scrap, or disposed of offsite
- Electric control devices would be recycled or disposed
- Transformers and other control devices would be sold, refurbished, or disposed
- Turbine foundations below approximately 3.5 feet (ft) and below-ground collector lines would likely remain in place
- On-site access roads, rock or gravel at the substation, and building foundations would be removed and recycled, except that access roads may remain in place if desired by landowners
- Disturbed land areas covered in rock or gravel and building/tower footprints would be restored to original grade

- Dismantlement of turbine towers, electric substations, and storage buildings would be inspected for industrial contamination and, if necessary, decontamination procedures would be followed
- BMPs are discussed in Section 2.2, Environmental Conservation Measures and Best Management Practices

2.1.2.5 Project Facilities and Components

Project facilities and components include the turbines, access roads, underground fiber-optic communication cables, electric collector lines, Project substation, met towers, O&M facilities, a 115-kV transmission line and structures, and a switchyard (Figures 1-1 and 1-2). Orion located the Project facilities and components for the indicative layout to avoid or reduce potential impacts to military, cultural and tribal, wetland, avian, visual, and vegetative resources and sound receptors to the greatest extent practicable while still keeping the Project commercially viable. Project facilities and components are discussed below and Table 2-1 summarizes their temporary and long-term footprint for the indicative layout. The values for the temporary footprint include the actual facility or component size plus an additional area to accommodate construction or decommissioning activities. The long-term footprints represent the anticipated dimension of each facility or component that would remain after construction. All Project facilities and components would be designed, built, and operated in compliance with federal, state, and local regulations, National Electrical Safety Code standards, and other applicable industry standards.

Changes to the indicative layout may be necessary during final design for various reasons, including geotechnical and environmental evaluation results, landowner input, military needs, or to avoid newly identified cultural or tribal resources. Orion anticipates that changes could include up to five additional turbines and potentially an increase of up to 25% in additional infrastructure that would increase the temporary and long-term impacts accordingly (Table 2-2). Orion has committed to doing additional biological and cultural surveys prior to construction for any infrastructure deviating from the temporary or long-term footprints for the indicative layout as defined in Table 2-1.

Table 2-1. Estimated footprint for the Pronghorn Flats 115-kilovolt Project based on the indicative layout.

Project Component	Assumptions	Construction & Decommissioning Footprint (Temporary)		Operational Footprint (Long Term)	
		Dimensions	Total Acreage	Dimensions	Total Acreage
Wind Facility					
Turbines	43 turbines	223-ft radius	154.2 acres (3.6 acres per turbine)	26-ft radius	2.10 acres (0.05 acre per turbine)

Table 2-1. Estimated footprint for the Pronghorn Flats 115-kilovolt Project based on the indicative layout.

Project Component	Assumptions	Construction & Decommissioning Footprint (Temporary)		Operational Footprint (Long Term)	
		Dimensions	Total Acreage	Dimensions	Total Acreage
Access roads for wind farm	Up to 38.7 miles. Approximately 16.4 miles of new roads and 22.2 miles of existing roads	50-ft wide	234.3 acres	16-ft wide	75 acres
O&M facility	One O&M facility	467 ft X 467 ft	5.0 acres	467 ft X 467 ft	5.0 acres
Electric collector lines	Up to 35.9 miles	15-ft wide	68 acres	--	--
Fiber optics communication cables	Up to 35.9 miles	Captured in the electric collector line footprint because the two systems will share the same trench.			
Meteorological (met) towers	3 met towers	1,000 ft^2 per tower	<0.100 acre (0.023 acre per tower)	25 ft^2 per tower; if guy-wires installed, 250-ft radius	<0.1000 acre (0.0006 acre per tower); guy-wires: 13.5 acre (4.5 acres per tower)
met tower connection to the nearest turbine or collector lines	Met tower 1 Met tower 2 Met tower 3	15-ft wide 15-ft wide 15-ft wide	1.63 0.58 0.33	--	--
Substation	One substation location	511 ft X 511 ft	6.0 acres	511 ft X 511 ft	6.0 acres
Subtotal Infrastructure Components[1]		**–**	**422 acres**	**–**	**88 acres**
Electric Transmission System					
115-kV transmission line	20 miles for the primary route; 21.3 miles for the alternative route	150-ft wide	349 acres for primary route; 387 acres for alternative route	100 ft easement as needed for maintenance activities	--
Structure	One structure spaced generally every 450 ft, estimated 226 structures for the primary route, 250 for the alternative route	This temporary footprint would be captured in the transmission line route corridors above		Structure radius is about 2.5 ft at base.	0.10–0.12 acre

Table 2-1. Estimated footprint for the Pronghorn Flats 115-kilovolt Project based on the indicative layout.

Project Component	Assumptions	Construction & Decommissioning Footprint (Temporary)		Operational Footprint (Long Term)	
		Dimensions	Total Acreage	Dimensions	Total Acreage
Switchyard	One switchyard	430 ft X 430 ft	4.3 acres	430 ft X 430 ft	4.3 acres
Subtotal 115-kV Transmission Line [1]		**--**	**353–391 acres**	**--**	**4.3 acre**

[1] This subtotal is a sum of each 115-kilovolt (kV) Project component's footprint. Some components will overlap. This subtotal has not been adjusted for these overlapping components. Therefore, this subtotal overstates the Project disturbance.

ft = foot/feet, ft^2 = square feet, O&M = operations and maintenance.

Table 2-2. Potential estimated footprint associated with five additional wind turbines and up to a 25% increase in associated infrastructure for the Pronghorn Flats 115-kilovolt Project.

Project Component	Assumptions	Construction & Decommissioning Footprint (Temporary) acres	Operational Footprint (Long Term) acres
Wind Facility			
Turbines	5 additional turbines	54	0.75
Access roads for wind farm	Up to 4.1 additional miles of new roads and 5.5 additional miles of existing roads	58.1	18.7
Electric collector lines	Up to 9 additional miles	16.3	
Fiber optics communication cables	up to 9 additional miles	Captured in the electric collector line footprint as the trench is shared	
Meteorological towers	up to 1 additional met tower	0.023	<0.1
Electric Transmission System			
115-kV transmission line	Up to 5 additional miles	91	--
Structure	Up to an additional 12 structures	This temporary footprint would be captured in the transmission line route corridors above	<0.1
Total potential additional footprint[1]		**224.9**	**19.5**

[1] This total is a sum of each 115-kilovolt (kV) Project component's footprint. Some components will overlap. This subtotal has not been adjusted for these overlapping components. Therefore, this subtotal overstates the Project disturbance.

2.1.2.5.1 Wind Turbines

The Project would consist of 30 to 48 wind turbines producing between 2.5 and 4.2 MW each, and would have a total interconnection capacity of up to approximately 115 MW. The Project may construct greater than 115 MW nameplate capacity to compensate for electric losses along the 115-kV transmission line and in other Project facilities. Currently, Orion anticipates that the Project would utilize 3.03-MW turbines, which would result in the construction of approximately

43 turbines. If a turbine of a lower megawatt capacity is selected, then up to five additional turbines may be required to produce the approximate 115 MWs. Conversely, if a larger megawatt capacity turbine is selected, then fewer turbines would be constructed. The make and model of the turbine would be selected closer to construction based on availability and the market. Figures 1-1 and 1-2 show an indicative layout for 43 turbines. If additional turbines are required, the turbines would be located within the indicative layout and utilize the road network and other proposed infrastructure to the greatest extent practicable.

Turbine heights would be determined upon selection of final turbine make and model. Orion expects that the wind turbine "hub height" (height from the base of the tower to the center of the rotor hub on top of the tower) may be up to approximately 370 ft, and the total wind turbine height (i.e., height of vertical blade-tip pointing straight up) may be up to approximately 600 ft. These heights are based on the upper range of turbine dimensions being considered for the Project and may overestimate final dimensions.

Each turbine would sit on a concrete foundation to provide structural support to the assembled turbine. Each turbine foundation area would measure approximately 0.05 acres. Except for roughly 2.50 ft that would remain aboveground, the turbine foundation would be underground. There are two types of foundations typically used for turbines, mat or pier. The type of foundation is determined based on subsurface information obtained during geotechnical investigations. The depth of the mat foundation has a relatively shallow excavation (typically 6.0 to 10.0 ft. below final grade) while the pier foundation involves excavations as great as 40.0 ft. below final grade. The turbine tower would typically be painted a non-glare white per Federal Aviation Administration (FAA) requirements. The temporary construction footprint would be roughly 3.6 acres per turbine to stage the wind turbine parts and to maneuver equipment during turbine assembly. The long-term operational footprint would be approximately 0.05 acre per turbine (Table 2-1). If an additional five turbines are used, footprints would increase accordingly (Tables 2-1 and 2-2).

2.1.2.5.2 Access Roads

The preliminary estimate of access roads for the Project is approximately 39.0 miles (mi), including approximately 16.4 mi of improved existing roads and approximately 22.2 mi of newly constructed access roads that would be developed across leased private land to allow access to individual turbines. During construction and decommissioning, the disturbance area for new access roads would be approximately 50.0 ft. After construction, the long-term operational footprint for the access roads would be the length of the road maintained at a width of approximately 16.0 ft. (Table 2-1). Existing public and private roads would be used whenever practicable. Existing roads may require improvements before, during, or following construction. Improvements might include adding gravel, widening, or repairing potholes.

2.1.2.5.3 Operations and Maintenance Facility

The O&M facility would be a single story building that would house personnel, offices, operations and communication equipment, parts storage, maintenance activities, and a vehicle parking area.

An area for outdoor storage of larger equipment and materials would also be included within a fenced area for safety and security. Either the existing rural water system or private water would provide running water into the O&M facility well. Both the temporary and long-term footprint of the O&M facility would likely be an approximately 5-acre parcel (Tables 2-1) directly adjacent to the Project substation.

2.1.2.5.4 Meteorological Towers

The Project would include up to three permanent met towers to monitor weather and wind conditions within the Project vicinity. The design and other specifications of the proposed met towers have not been determined at this time, but would be established as the Project evolves. The met towers would comply with FAA guidelines, *Obstruction Marking and Lighting*. With Change 2. Advisory Circular AC 70/7460-1L. (e.g., FAA 2018), and would be connected to the Project communication system. The temporary construction and decommissioning footprint would be approximately 0.023 acre per met tower. The long-term operational footprint would be negligible (Table 2-1). Met towers are currently planned to be free-standing, however, if it is determined that guy-wires are needed, 4.5 acres per met tower would be the operational (long term) footprint. Table 2-2 presents the footprints with an additional 25% increase.

2.1.2.5.5 Temporary Laydown/Stockpile Areas/Batch Plant Areas and Crane Path

Temporary facilities for the Project would include a concrete batch plant, crane paths for the construction of the wind farm, and a laydown yard to store construction materials. Construction tools, materials, equipment, and vehicles would be stored at the laydown yard until needed for construction activities. The laydown yard would be revegetated once construction is complete, except for a portion retained for the O&M facility (if the laydown yard and O&M facility are sited at the same location).

2.1.2.5.6 34.5-kilovolt Collection System and Fiber Optic Communication System

Inter-facility communications would connect each wind turbine through buried fiber optic communication cables. Additionally, buried 34.5-kV collector lines would transfer wind-generated energy from each wind turbine to the Project substation. The length of these cables and lines would be approximately 40 mi each (Table 2-1). The electric collector lines and communication cables would be located in the same trench and buried approximately three to four ft below the ground surface. Construction of the trench would require a temporary 15-ft corridor for construction and decommissioning work (Table 2-1). The land area used for the trench would be available for agricultural use after construction and during Project operation.

2.1.2.5.7 Project Substation

The Project substation (Figures 1-1 and 1-2) would include transformer(s) to step up the voltage of the collector lines from 34.5-kV to 115-kV, above-ground infrastructure to connect the substation components, breakers, relays, switchgear, communications and controls, and other related facilities required for delivery of wind-generated electric power to WAPA's electric grid.

Design of the substation is not finalized, but Orion expects the substation to be enclosed by a chain link fence and require up to approximately six acres.

2.1.2.5.8 115-kilovolt Transmission Line and Switchyard

A 115-kV transmission line would be constructed to connect the Project substation to the 115-kV switchyard and interconnect with WAPA and the grid (Figure 1-1). Figure 1-1 shows two route options called the primary route and alternative route. The routes run primarily north along Banner CR-7 from the Project substation, heading northwest through Bull Canyon into Goshen County, Wyoming, then turning north towards Wyoming State Highway (Hwy) 151. The proposed switchyard is located along Hwy 151, three to four mi east of La Grange, Wyoming. The primary route is approximately 20 mi in length while the alternative route is approximately 21 mi. While the exact route for the transmission line has not been determined, the potential impacts of the two likely routes have been evaluated in Section 3.0, Affected Environment and Environmental Consequences.

The proposed 115-kV transmission line would include steel lattice, steel or wood monopole, and wood H frame towers at heights shorter than the wind turbines. The 115-kV transmission line would connect to the grid through the 115-kV switchyard that would be enclosed similar to the fenced Project substation.

Construction of the 115-kV transmission line would require a temporary work ROW approximately 150-ft wide, for the entire length of the line, to accommodate structure installation, conductor stringing, and line pulling. Environmental conditions (e.g., soils and vegetation) in all temporary workspaces would be restored once construction is complete. The 115-kV transmission line structure placement would result in a total of 0.10 to 0.12 acres of long-term surface disturbance along the transmission line ROW, depending on the route. The operational ROW (i.e., the line easement) would be 100-ft wide and maintained to provide long-term access for ground-based inspections, general maintenance, and repair. Vegetation within the ROW would be managed and maintained to support line operation. The switchyard would have a long-term footprint of approximately four acres (Table 2-1).

2.2 Environmental Conservation Measures and Best Management Practices

Specific to Project construction, operation, and maintenance activities, Orion has developed conservation measures and applicable BMPs to avoid and minimize potential environmental impacts or concerns. Additionally, Orion has engaged in discussions with various state and federal agencies (e.g., Nebraska Game and Parks Commission [NGPC], Wyoming Game and Fish Department [WGFD], WYDOT, U.S. Fish and Wildlife Service [USFWS], and Department of Defense), that resulted in the relocation of certain turbines to avoid or minimize potential concerns. Below is a general review of the environmental conservation measures and BMPs that Orion has implemented during the planning phase and would commit to during construction, operation and decommissioning of the Project.

2.2.1 General Planning and Land Use

- The Project was designed to utilize existing roads and utility corridors to the maximum extent practicable, and to minimize the number and length/size of new roads, laydown areas, and borrow pit areas.
- "Good housekeeping" procedures would be developed to ensure that during operation the site would be kept clean of debris, garbage, fugitive trash, or waste; to prohibit scrap heaps and dumps; and to minimize storage yards.
- An access road siting and management plan would be prepared incorporating applicable standards regarding road design, construction, and maintenance.
- Access roads would be designed to minimize total length, avoid wetlands, and avoid or minimize stream and drainage crossings.

2.2.2 Soil Resources

General steps Orion will take for avoiding or minimizing impacts to soil resources include the following:

- Design the Project to avoid steep slope areas as practicable and minimize construction cut and fill work.
- Obtain permits under the National Pollutant Discharge Elimination System Industrial Storm Water General Permit issued by the Nebraska Department of Environment and Energy, and the Large Construction General Permit issued by the Wyoming Department of Environmental Quality (WYDEQ). These permits require development and implementation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP would be developed during civil engineering design of the Project and would include BMPs to control erosion and sedimentation.
- Minimize ground-disturbing activities, especially during the wet periods of the year.
- Surface new roads with aggregate materials, wherever appropriate.
- Restrict heavy vehicles and equipment to improved roads to the extent practicable.
- Control vehicle and equipment speed on unpaved surfaces.
- Stabilize disturbed areas that are not actively under construction using methods such as erosion matting or soil aggregation, as site conditions warrant.
- Regularly inspect access roads, utility and transmission line corridors, and tower site areas for damage from erosion, washouts, and rutting. Initiate corrective measures upon evidence of damage.
- Address drainage problems caused by construction to minimize damage to agricultural fields.

- Decompact soil to the extent practicable following completion of construction and during decommissioning.
- Salvage topsoil from all excavation and construction activities to the extent practicable, to reapply to disturbed areas once construction is completed.
- Dispose of excess excavation materials in approved areas to minimize erosion.
- Isolate excavated areas and soil piles from surface water bodies using silt fencing, bales, or other accepted methods to limit sediment transport by surface runoff.
- Use earthen dikes, swales, and lined ditches to divert local runoff around the construction site where practicable.
- Re-establish the original grade and drainage pattern to the extent practicable after construction is complete.

2.2.3 Water Resources

General steps Orion will take for avoiding or minimizing impacts to water resources include the following:

- A Spill Prevention, Control, and Countermeasures (SPCC) plan would be prepared for the Project to address accidental release of construction-related chemicals, fuels, or hydraulic fluid. Implementation of BMPs associated with the SPCC would minimize potential impacts on groundwater. BMPs for spill-related effects would include storing fuels within secondary containment devices, checking vehicles and equipment for leaks, performing refueling and equipment maintenance away from water wells and surface water resources, maintaining a spill response kit on-site, and appropriate reporting protocols for any spills.
- Apply standard erosion control BMPs to all construction activities and disturbed areas (e.g., sediment traps, water barriers, erosion control matting), as applicable, to minimize erosion and protect water quality.
- Apply erosion controls where it is probable soil erosion from vehicular traffic would occur.
- Construct drainage ditches only where necessary; use appropriate structures at culvert outlets to prevent erosion.
- Avoid or minimize alteration of existing drainage systems, especially in sensitive areas such as erodible soils or steep slopes.
- Clean and maintain catch basins, drainage ditches, and culverts as needed.
- Limit herbicide and pesticide use to non-persistent, immobile compounds and apply the chemicals using a properly licensed applicator in accordance with label requirements.
- Dispose of excess excavation materials in approved areas to minimize erosion and leaching of hazardous materials.

- Reestablish the original grade and drainage pattern to the extent practicable after construction is complete.

2.2.4 Air Quality

General steps Orion will take for avoiding or minimizing impacts to air quality include the following:

- Use access roads and parking lots surfaced with aggregates or that maintain compacted soil conditions to reduce dust generation where possible.
- Post and enforce speed limits on dirt and gravel access roads to minimize airborne fugitive dust.
- Minimize potential environmental impacts from the use of dust palliatives by taking measures to keep the chemicals out of sensitive terrestrial habitats and streams. The application of dust palliatives will comply with federal, state, and local laws and regulations.
- Heavy equipment will meet emission standards specified by State laws and regulations, and routine preventive maintenance will be conducted as required.
- Minimize idling of diesel equipment where practicable, unless necessary for proper operation.
- As practicable, stage construction activities efficiently to minimize the area of disturbed soils exposed at any particular time.
- Water unpaved roads, disturbed areas (e.g., scraped, excavated, backfilled, graded, and compacted), and loose materials generated during Project activities as practicable to minimize fugitive dust generation.
- Spray stockpiles of soils with water and/or treat the stockpiles with appropriate dust suppressants as reasonably necessary. Vegetative plantings may also be used to minimize dust generation for stockpiles that are expected to be inactive for relatively long periods.
- Train workers as necessary to comply with speed limits, use good engineering practices, minimize the drop height of excavated materials, and minimize disturbed areas where practicable.
- Cover vehicles transporting loose materials when traveling on public roads, and/or keep loads sufficiently wet and below the freeboard of the truck to minimize wind dispersal as practicable.
- Equipment would undergo routine inspection and preventative maintenance to minimize leaks.

2.2.5 Noise

General steps Orion will take for avoiding or minimizing noise include the following:

- A process will be established for documenting, investigating, evaluating, and resolving project construction-related noise complaints.
- All construction equipment will be maintained in good working order in accordance with manufacturer specifications and operate within applicable noise limits.
- Operate vehicles traveling within and around the Project in accordance with posted speed limits.
- When practicable, limit noisy construction activities to times of the day when nearby sensitive receptors are less likely to be disturbed.
- Locate stationary construction equipment (e.g., compressors or generators) as far as practicable from nearby sensitive receptors.
- In the event that blasting or pile driving would be needed during the construction period, notify nearby residents in advance.

2.2.6 Vegetation

General steps Orion will take for avoiding or minimizing impacts to vegetation include the following:

- Avoid siting infrastructure in wetlands and water bodies unless not practicable.
- Locate the 115-kV transmission line in areas where previous disturbance has occurred to the extent practicable, thereby minimizing impacts to trees, other vegetation, and associated wildlife.
- Minimize the area disturbed during the installation of met towers (i.e., the footprint needed for met towers and associated laydown areas) where possible.
- Minimize habitat disturbance by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.
- Restore and regrade disturbed soils to the extent practicable after construction. The construction contractor would coordinate with the landowner on native seed mixes, or other preferred species used for revegetation. The seed mixes and revegetation plan would be developed as part of the SWPPP for the Project.
- Develop a plan for control of noxious weeds and invasive plants that could occur as a result of new surface disturbance activities at the site. The plan would address monitoring, weed identification, the manner in which weeds spread, and methods for treating infestations.

2.2.7 Wildlife

General steps Orion will take for avoiding or minimizing impacts to wildlife include the following:

- Orion has elected not to apply for an Eagle Take Permit under the Bald and Golden Eagle Protection Act (BGEPA) at this time because this is a voluntary permit. Orion may consider this permit at a later date. When Orion has developed a final layout for the Project and before the Project is interconnected with WAPA, Orion will prepare an Eagle Management Plan to minimize potential collision risks for eagles. Should they later seek an Eagle Take Permit, this document would be updated to become an Eagle Conservation Plan that includes any required compensatory mitigation.
- When Orion has developed a final layout for the Project and before the Project is interconnected with WAPA, Orion will prepare and implement a Bird and Bat Conservation Strategy (BBCS) in accordance with the USFWS Wind Energy Guidelines to minimize impacts to avian and bat species during construction and operation of the Project.
- To the extent practicable, design and construct the 115-kV transmission line to minimize avian electrocution risk (as applicable to this voltage and structure design) and collision risks (as applicable to line location), based on guidelines outlined in the Avian Power Line Interaction Committee's (APLIC) *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* and *Reducing Avian Collisions with Power Lines: The State of the Art in 2012* (APLIC 2006, 2012).
- To the extent practicable, conduct biological surveys for species listed by the Endangered Species Act of 1973 (ESA), Migratory Bird Treaty Act (MBTA), or BGEPA prior to construction for any new area not previously surveyed, if necessary, to ensure compliance with these acts.
- Conduct pre-construction surveys in and around the wind turbine sites for mountain plover, thick-billed longspur (Longspur), ferruginous hawk, and burrowing owl nests, and swift fox dens, to ensure that denning and nesting species are not present within seven days prior to construction activities being initiated.
- Instruct employees, contractors, and site visitors to avoid harassment and to minimize disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons. Employee, contractor, and site visitor's pets would not be allowed on the Project.
- Establish temporary wind turbine buffer zones around active raptor nests during construction using the *U.S. Fish and Wildlife, Region 6 Wildlife Buffer Recommendations for Wind Energy Projects version 3* (USFWS 2021b).
- Conduct post-construction avian and bat fatality monitoring at wind turbines in accordance with the WEG.

- Any incident (defined as injury or mortality) involving a state- or federally listed threatened or endangered species, golden or bald eagle, or species protected by the MBTA, would be reported to the USFWS and the NGPC or WGFD (as appropriate) within 24 hours of confirmed identification by a qualified biologist. This includes impacts to active nests defined by the presence of eggs or chicks in the nest.
- If needed during construction, only use explosives within specified times and at specified distances from sensitive wildlife or surface waters, as established by the appropriate federal and state agencies.
- During Project operations, use designs for permanent met towers that do not require guy wires to the extent practicable.
- Promptly dispose of all garbage and human waste generated onsite in order to avoid attracting nuisance wildlife.
- Train O&M staff to recognize mortalities that may be sensitive species as well as to observe injured individuals to determine if they are sensitive species.

2.2.8 Visual Resources

General steps Orion Project will take for avoiding or minimizing impacts to visual resources include the following:

- For ancillary buildings and other structures, low-profile structures will be chosen whenever practicable to reduce their visibility.
- To the extent permitted by the FAA and by state and local permitting authorities, color selections for turbines will be made to reduce visual impact and will be applied uniformly to tower, nacelle, and rotor, unless gradient or other patterned color schemes are used. Recent studies suggest interspersed colored turbine blades may reduce the potential for avian collision. If supported by additional research, interspersed colored turbine blades may be considered where the permitting authority allows.
- To the extent allowed by the FAA and by state and local permitting authorities, grouped structures will all be painted the same color to reduce visual complexity and color contrast where practicable.
- Where possible for ancillary structures, materials and surface treatments may repeat and/or blend with the existing form, line, color, and texture of the landscape.
- Use non-reflective paints and coatings on wind turbines, visible ancillary structures, and other equipment to reduce reflection and glare wherever possible.

- Lighting for facilities will not exceed the minimum required for safety and security as established by the FAA, the Department of Defense, and state and local permitting authorities. If possible, where they are necessary, security lights shall be extinguished except when activated by motion detectors (e.g., only around the substation) or down-shielded to prevent lighting into the night sky.
- A site restoration plan will be in place prior to construction, and restoration of the construction areas will occur at the end of construction

2.2.9 Construction

General steps Orion will take for minimizing construction impacts include the following:

- Disturbed surfaces will be restored to the greatest extent practicable to their original contours and revegetated after construction. Orion will take reasonable action to limit erosion.
- Existing rocks, vegetation, and drainage patterns shall be preserved to the extent practicable.
- Care will be taken to minimize color and texture contrasts from new roads and the surrounding landscape where possible.
- The geometry of road ditch design will consider visual objectives where feasible.
- Areas for planting pockets will be included in designs where feasible.
- To the extent practical, topsoil from cut/fill activities will be spread on freshly disturbed areas to minimize impacts and aid revegetation. Best efforts will be used to not locate topsoil piles in sensitive viewing areas.
- Reasonable efforts will be used to minimize the impacts of excess cut/fill material and to be disposed of or relocate appropriately.
- Where feasible, construction on wet soils will be avoided or limited in order to reduce erosion.
- Communication cables and low or medium voltage utility power lines will be buried, where practicable.
- Culvert ends will be designed to minimize color contrasts with existing landscape as necessary.
- Signage will only be used where necessary and designed to minimize impact.
- The burning of trash will be prohibited during construction; trash will be stored in containers, hauled offsite or otherwise disposed of appropriately.
- Litter must be controlled and removed during construction.

2.2.10 Operations and Maintenance

General steps Orion will take for minimizing impacts from O&M processes include the following:

- Repair inoperable turbines as quickly as reasonably practicable with consideration to the Eagle Management Plan and the BBCS. Also repair and replace nacelle covers and rotor nose cones as quickly as reasonably practicable.
- Clean as reasonably practicable, nacelles and towers.
- Clean facilities and offsite surrounding areas of debris and wind farm related trash or waste on a regular basis.

2.2.11 Decommissioning

General steps Orion will take for minimizing impacts during decommissioning include the following:

- Remove as specified in landowner agreements, all aboveground and near-ground structures.
- Return as closely as practical, soil borrow areas, cut-and-fill slopes, berms, waterbars, and other disturbed areas to previous condition, or surrounding conditions.
- Use native species for revegetation, unless otherwise requested by the landowner. Take care to minimize the impacts to existing local vegetation and revegetation. Coordinated with local authorities, such as country extension services, landowners, weed boards, or land management agencies about seed mixes to be used.
- Remove or bury gravel and other surface treatments unless alternative treatment is agreed with the landowner.

2.2.12 Paleontological, Cultural, and Historic Resources

General steps Orion would take for avoiding or minimizing impacts to paleontological, cultural, and historic resources include the following:

- To the extent land access is practicable, conduct cultural surveys prior to construction for any infrastructure deviating from the proposed indicative layout.
- Cultural resources discovered during construction shall immediately be brought to the attention of WAPA and the State Historic Preservation Offices (SHPOs) in accordance with the concurrence letters from each SHPO. Work will be halted for a reasonable time in the vicinity of the find to avoid further disturbance of the resources while the find is being evaluated and appropriate mitigation plans are being developed.

- Prior to construction, Orion will determine whether paleontological resources exist in the area on the basis of the sedimentary context of the area; a records search of federal, state, and local inventories for past paleontological finds in the area; review of past paleontological surveys; and/or a paleontological survey. A paleontological resources management plan may be developed depending on the potential for paleontological material to be present.

2.2.13 Transportation

General steps Orion will take for minimizing transportation impacts include the following:

- A transportation plan for Project construction will be developed in coordination with local CRs departments. In addition, the process to be used will comply with unique state requirements and U.S. Department of Transportation requirements, and all necessary permits will be clearly identified and obtained.
- A traffic management plan for Project construction shall be prepared in coordination with local CRs departments. This plan shall incorporate measures such as informational signs, flaggers when equipment may result in blocked throughways, and traffic cones to identify any temporary changes in lane configuration as necessary and other items identified in agency discussions.

2.3 No-action Alternative

Under the No-action Alternative, WAPA would not enter into an interconnection agreement with Orion and would not allow the Project to interconnect to the WAPA transmission system. Although Orion could still build the Project and pursue an interconnection with a private utility, for comparison, this alternative assumes that the proposed Project would not be built.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section briefly describes the existing physical, social, and regulatory environment potentially affected by the Proposed Action (the Project) or the No-action Alternative and describes the potential consequences from these actions. Impacts to resources from the Project were evaluated within a defined analysis area for the wind turbine facility and the 115-kV transmission line routes (Figure 3-1), except where indicated otherwise. The analysis areas were based on the indicative layout and the Project footprints of the infrastructure facilities and components (Table 2-1). The turbine analysis area was delineated using a minimum convex polygon that encompassed the 43 turbines and met towers with a quarter-mi buffer. This area would include the access roads, substation, collector lines and communication cables. The transmission line analysis area was delineated based on landowner agreements and to allow flexibility to develop the most efficient route possible. Where footprints overlapped (i.e., a turbine footprint overlapping with an access road), the overlap was removed, thus the amount of potential impacts reported in the analysis is less than the footprints identified in Table 2-1. The Project may include up to an additional five turbines and up to a 25% increase in infrastructure, which would be located within the turbine analysis area and transmission line analysis area. The analysis areas (Figure 3-1) were established to evaluate a larger area within which Orion may adjust the final infrastructure layout or transmission line route as needed.

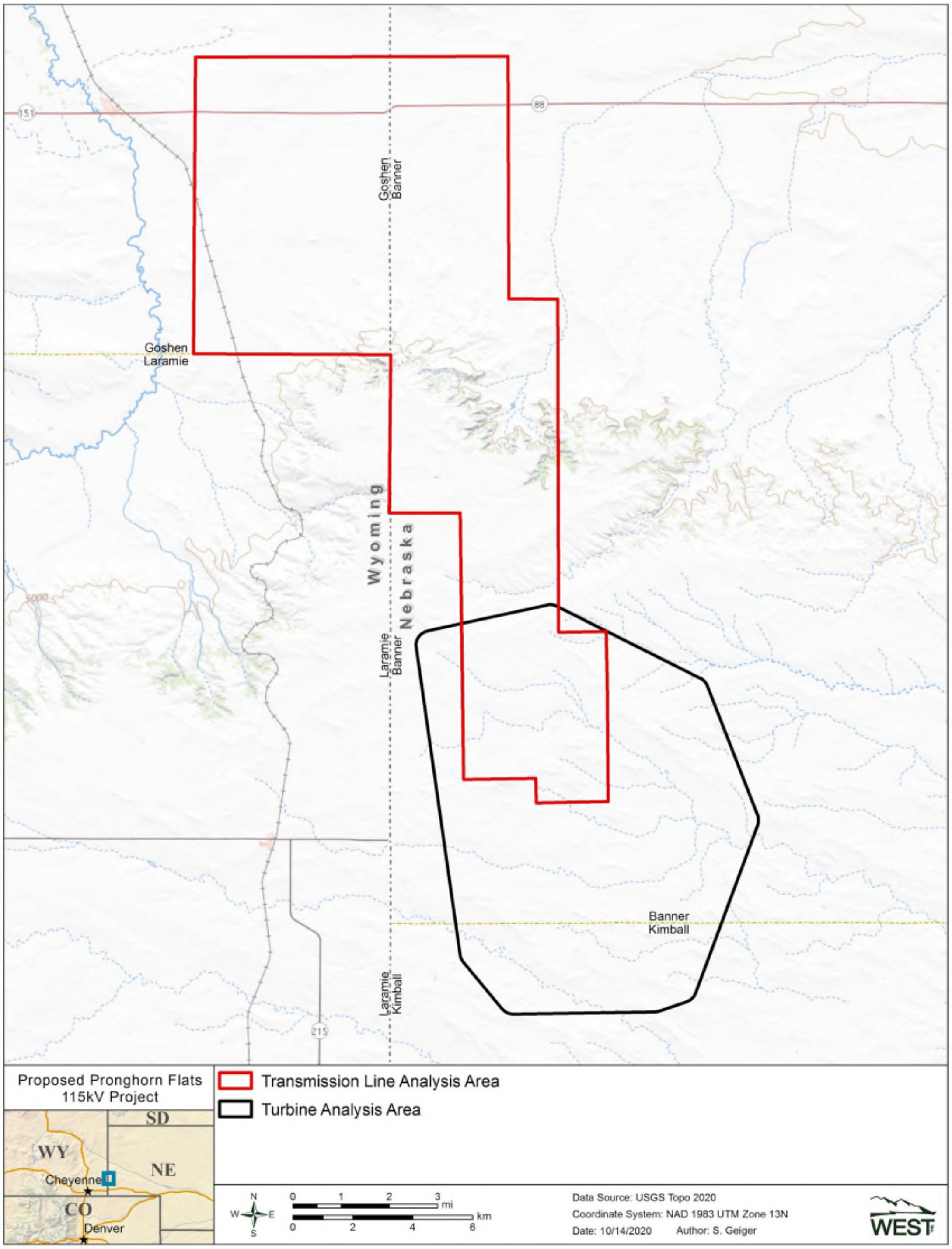

Figure 3-1. Turbine and 115-kilovolt transmission line analysis areas.

The analyses disclose the type and magnitude of potential impacts associated with the development of the indicative Project. If the final design results in any ground disturbing activities occurring outside of the indicative layout footprint, Orion has committed to conducting additional surveys for wetlands, biological resources, and cultural resources prior to construction to avoid impacting these resources.

3.1 Soil Resources

The majority of the analysis areas are located within the High Plains Section of the Great Plains Province of the Interior Plains. The Great Plains province is characterized by plateau-like flat plains with relatively little relief throughout the area. The soils within the analysis areas primarily consist of Entisols and Mollisols, which are moderately susceptible to erosion and generally good for crop production. Most soils in the analysis areas are well-drained (U.S. Department of Agriculture [USDA] Natural Resources Conservation Service [NRCS] 2006).

Fragile soils are areas rated as highly or severely erodible by wind or water, as described by the NRCS Soil Survey Report (USDA NRCS 2019). Water erosion is the detachment and movement of soil by water. Natural erosion rates depend on inherent soil properties, slope, soil cover, and climate. The water erosion hazards from unsurfaced roads and barren areas are based on soil factors such as slope, rock fragment content, and the K factor[1] (soil erosion factor). Water-erodible soils are rated as having a severe, moderate, or slight potential for water erodibility, all of which occur within the turbine and transmission line analysis areas (Figures 3-2 and 3-3). Approximately 4.5% of soils in the turbine analysis area have severe water erosion potential and almost half (47.5%) have moderate water erosion potential (Table 3-1). In the 115-kV transmission line analysis area, 11.5% of the soils have severe water erosion potential and 28.0% have moderate water erosion potential (Table 3-1).

Table 3-1. Water erosion potential risk class in the turbine analysis area and the transmission line analysis area.

Erosion Risk Class[1]	Turbine Analysis Area (Acres)	Transmission line Analysis Area (Acres)
Severe	1,326	4,983
Moderate	13,982	12,176
Slight	14,110	25,235
Not Evaluated	N/A	868
Total*	**29,418**	**43,260**

* Discrepancies due to rounding.

[1] Water erosion potential factors ratings <0.25 = Low, 0.25 to 0.40 = Moderate, 0.40+ = High.

[1] A soil erodibility factor (K-factor) used in the universal soil loss equation is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. Estimation of the factor takes various soil parameters into account, including soil texture, percent of sand greater than 0.10 millimeters in diameter, soil organic matter content, soil structure, soil permeability, clay mineralogy, and coarse fragments. K-factor values range from 0.02 to 0.64. Greater values indicate a higher susceptibility to erosion.

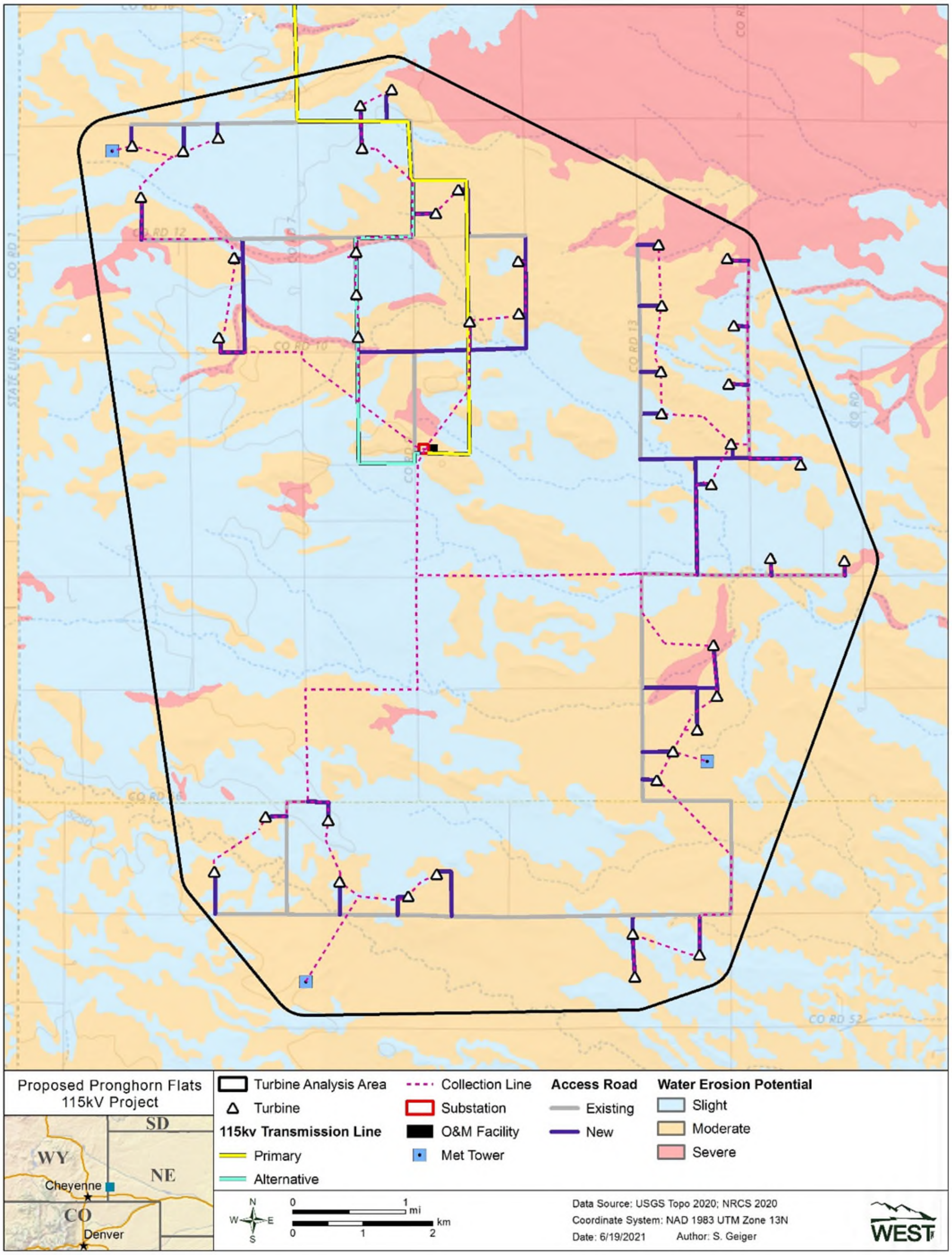

Figure 3-4. Water erosion potential soil ratings within the turbine analysis area.

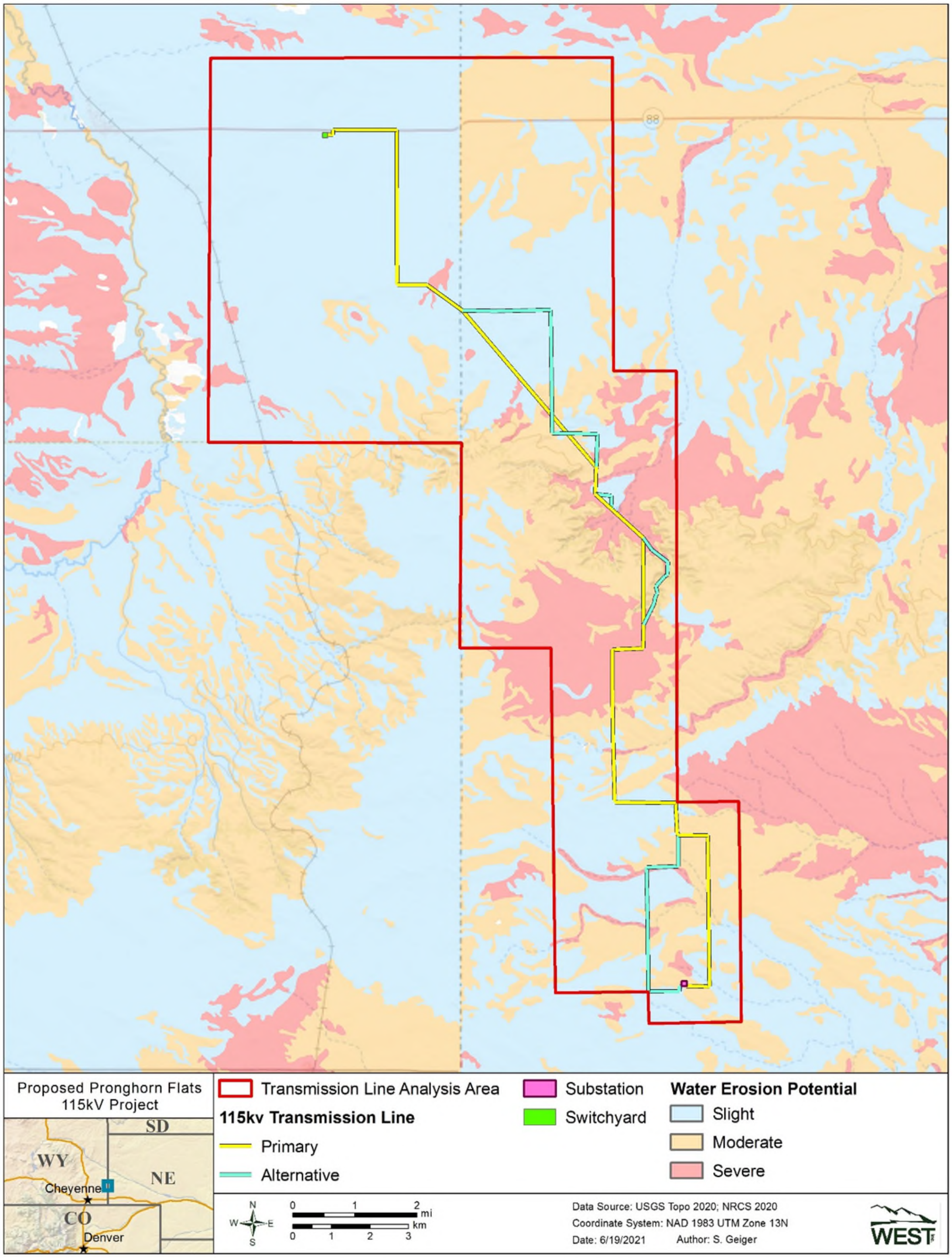

Figure 3-5. Water erosion potential soil rating within the transmission line analysis area.

Wind erosion is physical wearing of the earth's surface by wind, removing and redistributing soil. Small blowout areas may be associated with adjacent areas of deposition at the bases of plants or behind obstacles, such as rocks, shrubs, fencerows, and road banks. Wind erosion is a critical issue that results in the displacement or loss of topsoil in some areas, increased sediment deposition in other areas, and impacts to ambient air quality from elevated fugitive dust levels. The loss of topsoil can impact vegetation by reducing the A (topsoil) and B (subsoil) soil horizons, limiting productivity and soil moisture. Wind-erodible soils are rated as having a severe, moderate, or slight potential for wind erodibility, all of which occur within the analysis area (Figures 3-4 and 35). Over half (57.7%) of the soils in the turbine analysis area have severe wind erosion potential and 41.2% have moderate water erosion potential (Table 3-2). In the 115-kV transmission line analysis area a majority (80.1%) of the soils have severe wind erosion potential and 17.0% have moderate wind erosion potential (Table 3-2).

Table 3-2. Wind erosion potential risk class in the turbine analysis area and transmission line analysis area.

Erosion Risk Class[1]	Turbine Analysis Area (Acres)	Transmission Line Analysis Area (Acres)
Severe	16,983	34,656
Moderate	12,121	7,356
Slight	314	382
Not Evaluated	N/A	868
Total*	29,418	43,260

* Discrepancies due to rounding.

[1] Wind erodibility group ratings: 1–3 severe, 4–5 moderate, and 6–8 slight.

Soil compaction is another process affecting soils in the analysis areas, and compaction occurs when soil particles are pressed together, the pore spaces between the particles are reduced, and bulk density is increased. This results in decreased infiltration rates and increased runoff and erosion.

Important farmlands designated as either prime, unique, and/or land of statewide or local importance, are subject to protection under the Farmland Protection Policy Act of 1981 (7 U.S. Code [USC] 4201, *et seq*.], implementing regulations 7 CFR Part 658. Within the analysis areas there are the following farmland destinations: "farmland of statewide significance, if irrigated," "prime farmland if irrigated," and "not prime farmland." There are neither "farmlands of statewide importance" nor "prime farmlands" within the analysis areas (USDA NRCS 2019).

The risk of seismic activity in the vicinity of the analysis areas is relatively low. Available geologic mapping and information from the U.S. Geological Survey (USGS) Earthquake Hazards Program do not indicate any active or inactive faults within the analysis areas (USGS 2020a). No reclaimed or active mining operations, which could lead to subsidence or collapse, exist within the analysis areas. There are no active oil and gas operations within the analysis areas, however there are oil and gas activities in the Project vicinity.

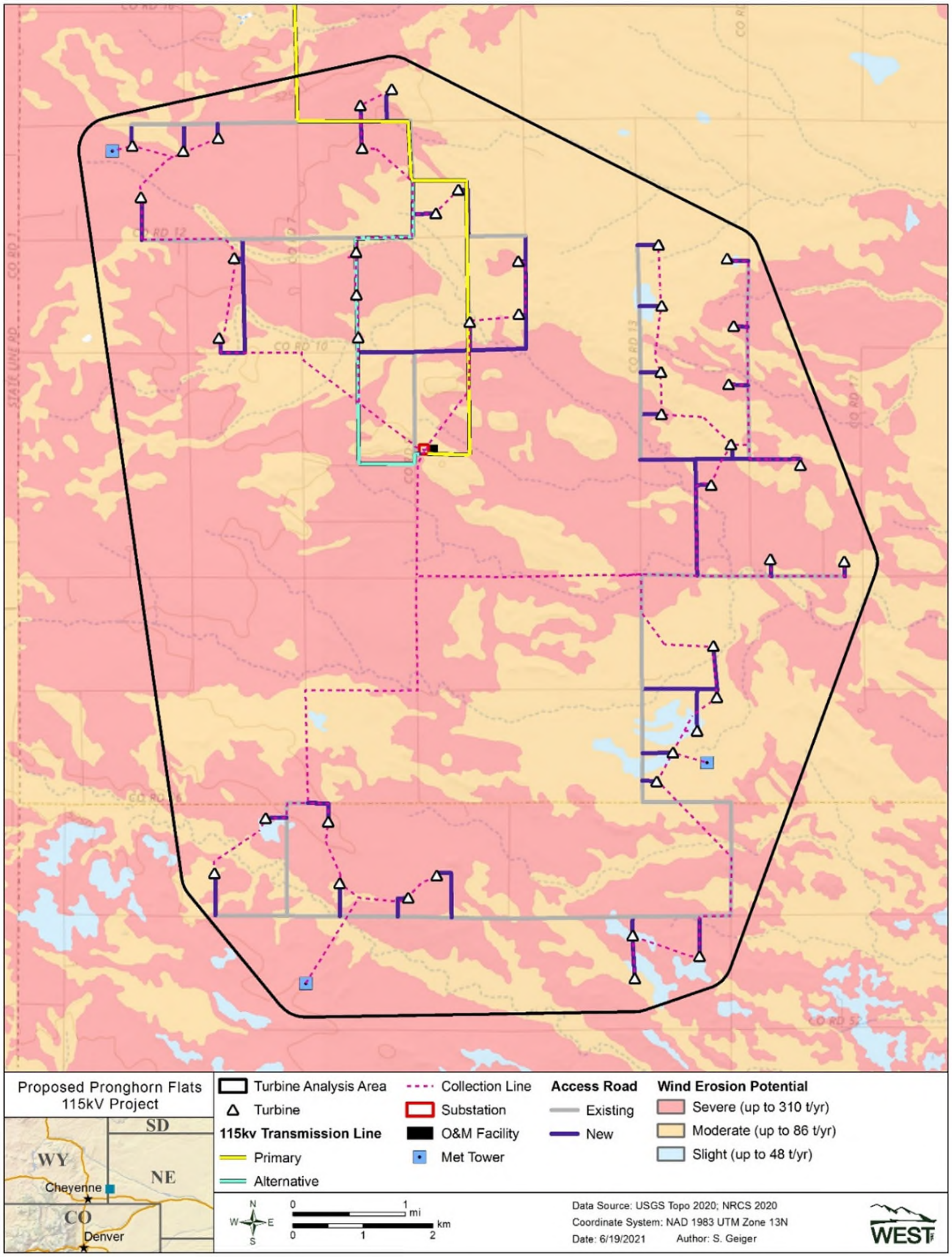

Figure 3-6. Wind erosion potential soil ratings in the turbine analysis area.

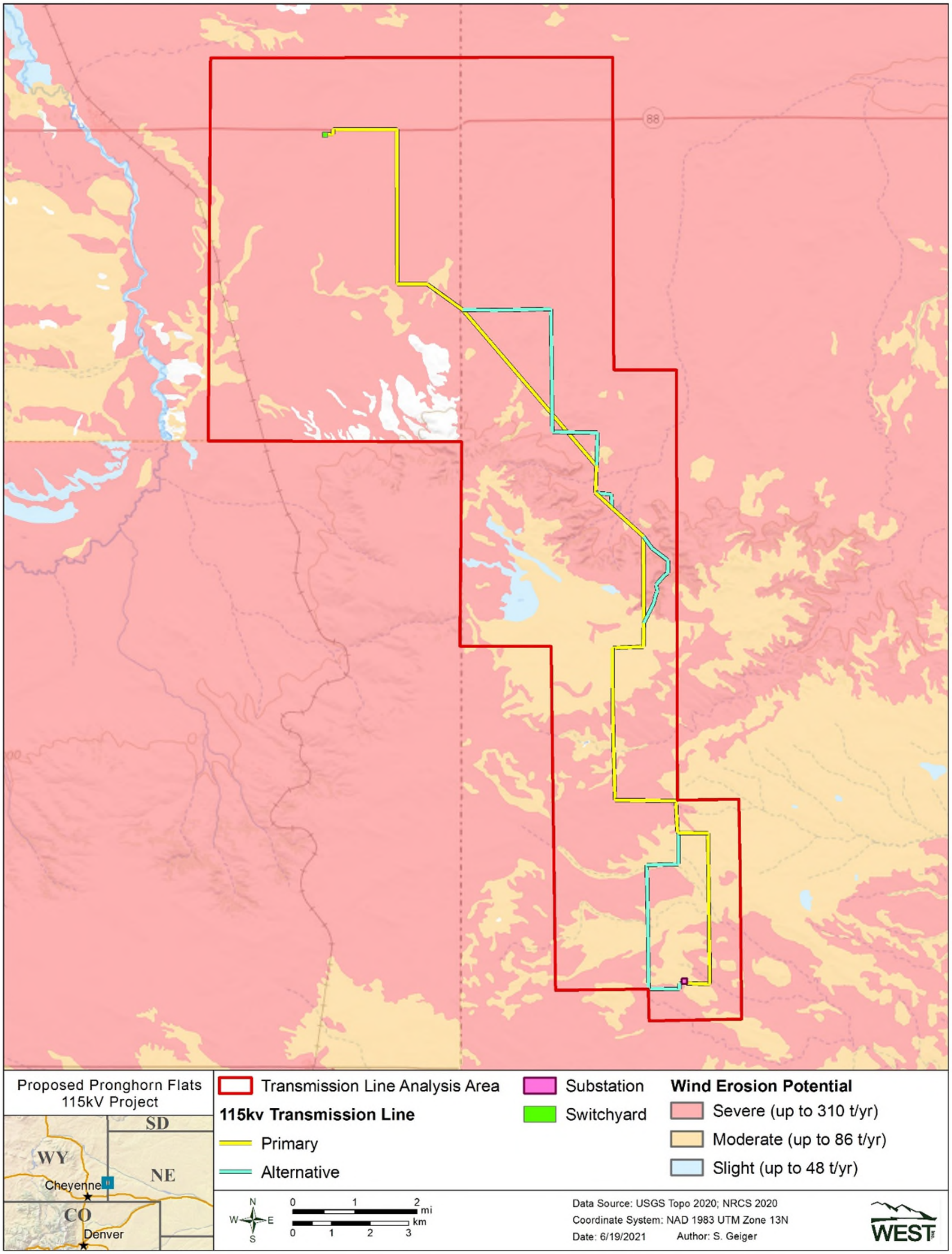

Figure 3-7. Wind erosion potential soil ratings in the 115-kilovolt transmission line analysis area.

3.1.1 Environmental Consequences—Proposed Action

Construction of the Project under the indicative layout of 43 turbines and including either transmission line route would temporarily impact approximately 789 to 827 acres of soils susceptible to wind or water erosion from road construction, foundation excavation, trenching for the collector lines and communication cables, laydown areas, and other construction activities (Tables 3-3 and 3-4). This range would increase with an additional five turbines, if built. Cranes and bucket trucks used for construction of wind turbines and transmission structures would travel along identified and prepared paths. Existing vegetation would be removed in the associated areas and staging pads potentially increasing the risk of wind and water erosion. The use of vehicles and heavy equipment would compact soils and could limit vegetative cover. Topsoil would be removed and segregated prior to construction to prevent mixing with subsoil, where practicable. Following construction, subsoil would be decompacted, where needed; salvaged topsoil would be replaced and soil would be stabilized either with new surfaces or vegetation where feasible. The long-term impacts from turbine infrastructure on moderate or severe soil erosion risks classes for wind and water would be approximately 82 and 55 acres, respectively (Table 3-3). The long-term impact from the turbines and infrastructure would be a loss of approximately 85 acres of soil resources, including up to around 62 acres of prime farmland, if irrigated, and less than an acre for the transmission line poles. The temporary and long-term impacts to soils would increase with each additional component.

Table 3-2. Approximate acreage potentially impacted by water and wind erosion due to turbine infrastructure in the Pronghorn Flats 115-kilovolt Project.

Erosion Risk Class	Wind Erosion Temporary(Acres)[1]	Wind Erosion Long Term (Acres)[1]	Water Erosion Temporary (Acres)[2]	Water Erosion Long Term (Acres)[2]
Severe	231	40	34	6
Moderate	187	42	243	49
Slight	22	3	163	31
Total*	**440**	**85**	**440**	**86**

[1] Wind erodibility group ratings: 1–3 severe, 4–5 moderate, and 6–8 slight.

[2] Water erosion potential factors ratings <0.25 = Low, 0.25–0.40 = Moderate, 0.40+ = High.

* Discrepancies due to rounding.

Source: U.S. Department of Agriculture Natural Resources Conservation Service 2019.

Table 3-3. Approximate acreage potentially impacted temporarily by water and wind erosion due to the primary and alternative transmission line routes in the Pronghorn Flats 115-kilovolt Project.

Erosion Risk Class	Wind Erosion Primary (Acres)[1]	Wind Erosion Alternative (Acres)[1]	Water Erosion Primary (Acres)[2]	Water Erosion Alternative (Acres)[2]
Severe	250	295	64	83
Moderate	99	93	102	80

Table 3-3. Approximate acreage potentially impacted temporarily by water and wind erosion due to the primary and alternative transmission line routes in the Pronghorn Flats 115-kilovolt Project.

Erosion Risk Class	Wind Erosion Primary (Acres)[1]	Wind Erosion Alternative (Acres)[1]	Water Erosion Primary (Acres)[2]	Water Erosion Alternative (Acres)[2]
Slight	0	0	183	225
Total*	**349**	**387**	**349**	**387**

[1] Wind erodibility group ratings: 1–3 severe, 4–5 moderate, and 6–8 slight.

[2] Water erosion potential factors ratings <0.25 = Low, 0.25–0.40 = Moderate, 0.40+ = High.

* Discrepancies due to rounding.

Source: U.S. Department of Agriculture Natural Resources Conservation Service 2019.

Areas with fragile soils where vegetation has been removed or where slopes are steep (greater than 10%) are vulnerable to disturbance and the displacement of soil particles by wind, water, or other natural and anthropogenic forces. Construction activities conducted during times of year with comparatively high soil moisture content (i.e., spring or after a recent precipitation event) could lead to rutting, compaction, accelerated runoff, erosion, and sedimentation to intermittent streams. Table 3-5 presents transmission line routes on slopes greater than 10%. There are no other planned Project components that intersect slopes greater than 10%.

Table 3-4. Potential impacts to land with slopes that have an incline greater than 10% along the proposed transmission line routes in the Pronghorn Flats 115-kilovolt Project.

Component	Temporary Impact (Acres)	Long-term Impact (Acres)
Primary	5	–
Alternative	2	–

Source: U.S. Department of Agriculture Natural Resource Conservation Service 2019.

3.1.2 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed; therefore, there would be no direct or indirect impacts on geological or soil resources from the Project. Ongoing land uses and existing activities (e.g., agricultural operations) would likely continue and result in the same type and level of impacts to these resources as currently exist in 2022.

3.2 Water Resources

The analysis areas cross two Hydrological Unit Code 8 watersheds. Project components, including wind turbines, transmission lines, collection and communication system, substation, operations buildings, and switchyard, are within the Lower Lodgepole, Pumpkin, and Horse watershed surface water drainage systems (Table 3-6). The depth to water table for the analysis areas is more than 6.5 ft (USDA NRCS 2019).

Table 3-5. Hydrological Unit Code 8 watersheds in the Pronghorn Flats 115-kilovolt Project analysis areas.

Watershed	Turbine Analysis Area (Acres)	Transmission Line Analysis Area (Acres)
Lower Lodgepole	25,590	5,922
Pumpkin	3,828	35,778
Horse	0	1,582
Total*	**29,418**	**43,282**

* Discrepancies due to rounding.

Source: U.S. Geological Survey 2019.

According to the Federal Emergency Management Agency (FEMA) Flood Map Service Center, FEMA has not completed a study to determine flood hazard in Banner or Kimball counties, Nebraska, or Goshen County, Wyoming, and flood maps have not been published at this time (FEMA 2020). Based on NRCS soils data, flooding in the analysis areas is not probable (flooding occurs less than once every 500 years) or rare (chance of flooding is 1% to 5% in any year) (USDA NRCS 2019).

Wetlands and streams were identified using desktop evaluations and follow up field surveys (Welsch 2020). For methodology relating to the desktop evaluation and field surveys, see the report in Appendix A. Three wetlands were delineated in the survey area and six sample points were collected (Figure 3-5, Table 3-7). All wetlands were palustrine emergent (PEM) within linear drainages. Two wetlands (w-mw-002e and w-mw-003e) occur at different locations along the same drainage. This area appears to receive ephemeral flow from the nearby bluffs. Another wetland (w-mw-001e) receives water from an overflowing stock tank fed by a groundwater pump. These three wetland features were delineated and are located within the primary and alternative transmission line routes.

Table 3-6. Wetlands and estimated acreages delineated in the Pronghorn Flats 115-kilovolt Project transmission line routes.

Wetland Identification	Wetland Classification	Acres
w-mw-001e	PEM	0.11
w-mw-002e	PEM	0.15
w-mw-003e	PEM	0.08
Total		**0.34**

PEM = palustrine emergent.

Figure 3-8. Delineated wetlands within the transmission line primary and alternative route associated with the Pronghorn Flats 115-kilovolt Project.

Six linear water features were identified during the field investigation. Four of these features were in the main section of Bull Canyon and determined to be intermittent streams, while two were in a side branch of Bull Canyon and are part of an ephemeral stream (Table 3-8, Figure 3-6). The features were three to six feet in width. Two intermittent stream features in the survey area were each bisected by a culvert under a road (s-mw-001 and s-mw-003; Figure 3-6). All stream features were along the alternative route of the proposed transmission line except s-mw-005, which is found within the primary transmission line route (Figure 3-6). One ephemeral open water was delineated within the proposed wind infrastructure temporary impact area (o-mw-001; Figure 3-7, Table 3-8).

Table 3-7. Waterbodies and acreages delineated in the Pronghorn Flats 115-kilovolt Project survey area.

Waterbody Identification	Waterbody Classification	Acres
s-mw-001	Intermittent	0.04*
s-mw-002	Intermittent	0.03
s-mw-003	Intermittent	0.07*
s-mw-004	Intermittent	0.04
s-mw-005	Ephemeral**	0.02
s-mw-006	Ephemeral**	0.01
o-mw-001	Ephemeral**	0.04
Total Intermittent Features		**0.14**
Total All Features		**0.25**

* Excluding culvert section.

** Ephemeral features are not considered Waters of the U.S. (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2020), but are presented here for reference.

3.2.1 Environmental Consequences—Proposed Action

The types of potential impacts on surface water resources relate to changes in water quality from erosion, sedimentation, and spills. Federal regulations that ensure the protection of water resources include the Safe Drinking Water Act of 1974 (SDWA) and the Clean Water Act of 1972 (CWA). The SDWA protects drinking water sources and requires strategies to prevent pollution of these sources. The CWA regulates pollutant discharge into streams, rivers, and wetlands. The U.S. Environmental Protection Agency (USEPA) has established primary and secondary standards to guarantee drinking water quality. The Nebraska Department of Environmental Quality (NEDEQ) maintains Nebraska Administrative Code Title 117, integrating federal standards and provides more specific information for waters within the State of Nebraska (NEDEQ 2019a). The Project would not substantially impact municipal or private water uses in the analysis areas.

Groundwater dewatering is not anticipated to be a major concern because wind turbines are typically placed at locations where the water table tends to be deeper. Should dewatering become necessary, Orion would obtain the necessary permits and properly handle groundwater to allow sediments to settle out and be removed before the water is discharged in order to minimize sedimentation of surface waters.

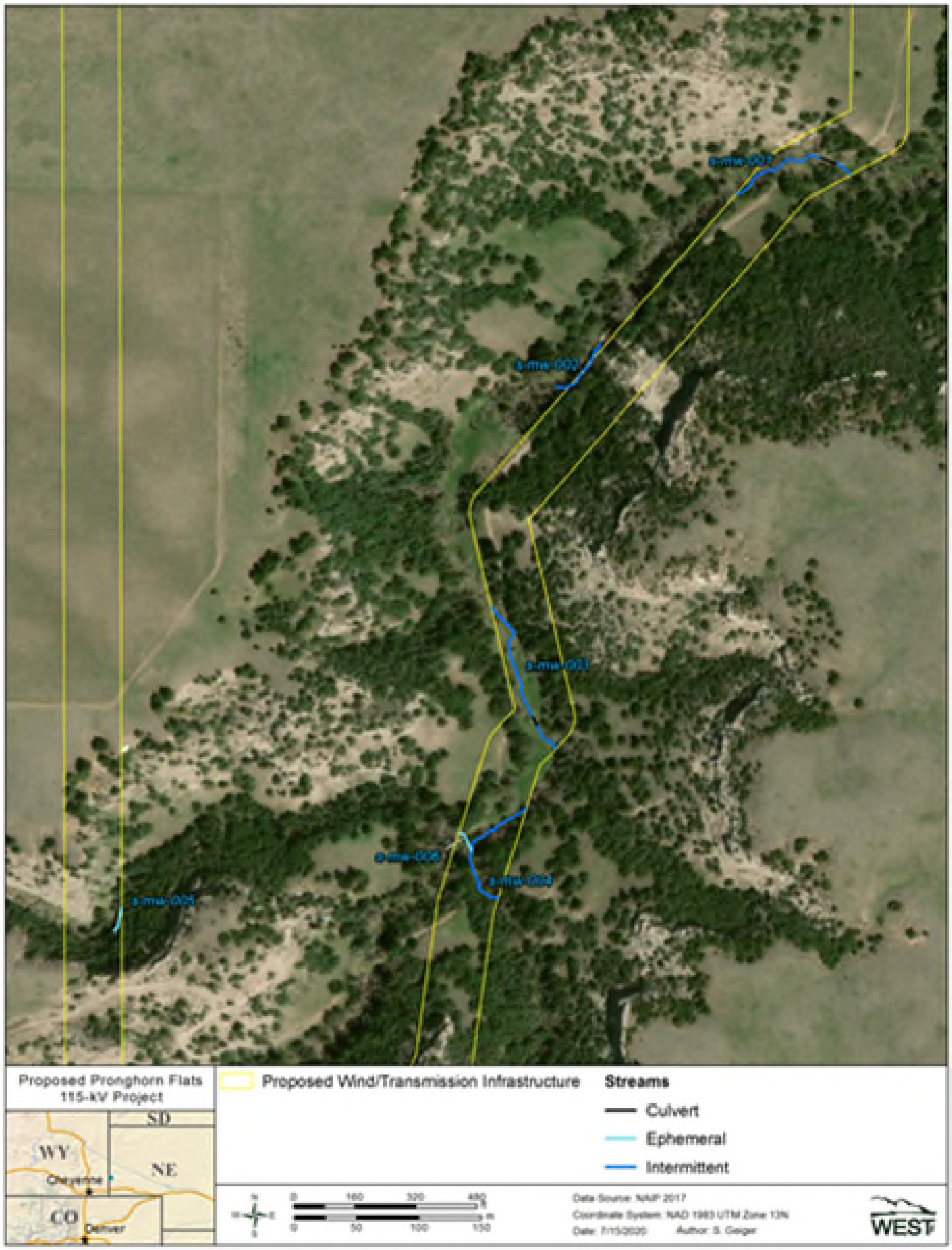

Figure 3-9. Linear waterbody features located within the transmission line primary and alternative routes associated with the Pronghorn Flats 115-kilovolt Project

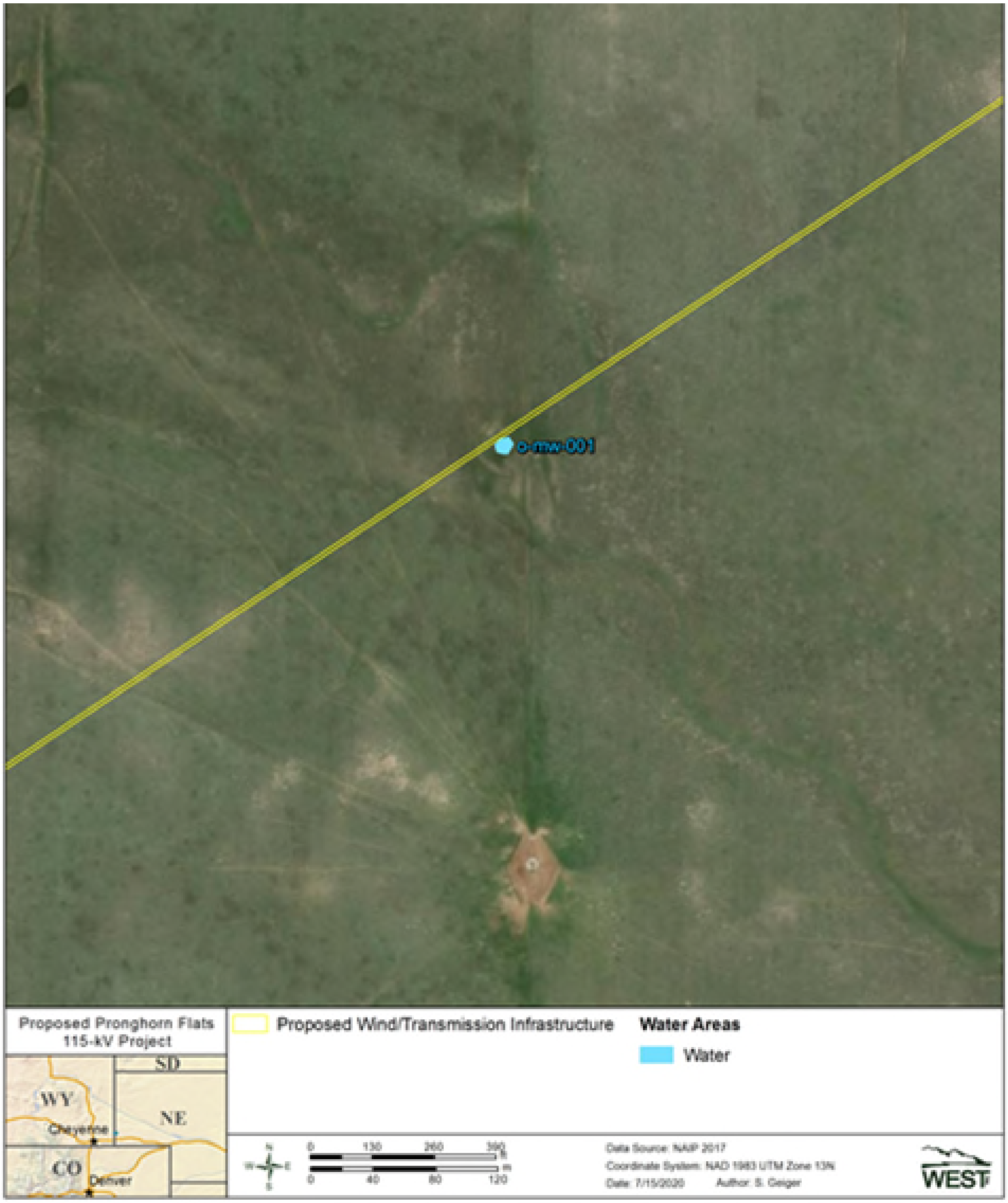

Figure 3-10. Ephemeral open waterbody delineated within the temporary footprint areas associated with the Pronghorn Flats 115-kilovolt Project.

Executive Order 11988 (1977), Floodplain Management, requires an evaluation of impacts to floodplains for all Federal actions and directs Federal entities to reduce impacts to floodplains and minimize flood risks to human safety. Further, the DOE is required under 10 CFR § 1022.11 (2021) to determine if a proposed action would be located in a floodplain. A FEMA flood hazard map is not available, however, considering the NRCS soils data, the Project is located in an area where flooding is not probable or rare, thus, the Project would have no impact on existing floodplains.

Based on the indicative layout, three PEM wetlands totaling approximately 0.34 acres were delineated in the transmission line survey area. Additionally, six linear water features were also delineated in Bull Canyon within the area surveyed for the transmission line. The wetlands were collocated along the same drainage as the linear water features. One ephemeral depression was recorded outside of the survey area but within a few feet of the surveyed corridor. Even though the depression is technically outside the survey corridor, it was included in results because the survey area used in this study is a representation of the project layout that could change in the future. No collected features have a clear connection to traditional navigable waters and, therefore, are likely not jurisdictional and would not be regulated by the U.S. Army Corps of Engineers (USACE) according to the final rule on the definition of ‘‘Waters of the United States,’’ finalized June 22, 2020 (USACE and USEPA 2020). All the features have intrinsic ecological value even if there is no regulatory coverage, especially wetland features, given their relatively high ecological quality. If changes to permitting regulations occur, these features should be re-evaluated to see if their likely jurisdictional status changes and if additional discussion with the USACE is needed. The construction of the transmission line could avoid potential impacts to wetlands and other linear water features by selecting the primary transmission line route as all the wetlands and linear water features identified were located on the alternative route, with the exception of one linear feature. If the alternate transmission line route is selected, wetlands would be avoided by careful pole placement.

The types of potential impacts to wetlands include changes to wetlands and natural flow systems. Wetland resources in the analysis areas consist of freshwater emergent, freshwater pond, and riverine wetlands. The NGPC has committed to work collaboratively across agencies to promote wetland protections and conservation with the *Wetland Program Plan for Nebraska 2019-2023* (NGPC 2019).

Once construction is completed, the original grade and drainage pattern of the analysis areas would be reestablished to the extent practicable. Disturbed areas would be revegetated to minimize erosion to surface water resources during Project operation. Herbicides, if used to control noxious weeds and vegetation growth around towers and access roads, could also degrade water quality in nearby surface water bodies and shallow aquifers.

Decommissioning would involve ground-disturbing activities that could increase the potential for soil compaction, soil erosion, surface runoff, and sedimentation of surface waterbodies. Standard erosion controls would be implemented to minimize sedimentation to offsite water bodies.

Culverts to allow for protection and continued water flow. The potential also exists for impacts to surface water quality from spills of contaminants and fluids (such as petroleum products) that may leave the Project during runoff to drainage systems or leaching into groundwater. The potential impacts would be reduced by the proposed measures identified in Section 2.2.3.

3.2.2 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed; therefore, there would be no direct or indirect impacts on water resources from the Project. Ongoing land uses and existing activities (e.g., agricultural operations) would likely continue.

3.3 Air Quality

The USEPA has set National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, particulate matter (PM), and lead. Volatile organic compounds (VOCs) can participate in photochemical reactions that form ozone, so VOC levels are also monitored (USEPA 2016). Primary and secondary NAAQS levels are set to protect public health and the environment with an adequate margin of safety (NEDEQ 2008).

The NEDEQ maintains Title 129, which adopts applicable primary and secondary ambient air quality standards in the State (NEDEQ 2019b). The WYDEQ-Air Quality Division set a goal to protect, conserve, and enhance the quality of Wyoming's air resource by maintaining NAAQS standards and practices (WYDEQ 2015).

The USEPA also tracks emissions of greenhouse gasses (GHGs). GHGs are emitted through natural processes and human activities, including the production, transport, and burning of fossil fuels; emissions from livestock and agricultural practices; burning of solid wastes and trees; and emissions from various industrial activities. Over the past 150 years, human activities have been responsible for most of the increases in GHGs (USEPA 2018).

An area where the concentration of these pollutants does not exceed the NAAQS levels is called an attainment area. Conversely, an area that is found to exceed this threshold may be classified as a nonattainment area (NEDEQ 2008). There are currently no, nonattainment areas in Nebraska (USEPA 2020b). In Wyoming, Goshen County is currently in attainment for all criteria pollutants (USEPA 2020c).

A significant amount of atmospheric dust can be generated from the mechanical disturbance of granular material exposed to the air. Dust generated from these open sources is referred to as fugitive dust. Common sources of fugitive dust include unpaved roads, agricultural tilling operations, aggregate storage piles, and heavy construction operations (USEPA 2019).

These sources of fugitive dust are caused by two basic phenomena:

- Pulverization and abrasion of surface materials by wheels, blades, etc.
- Wind erosion of an exposed surface by wind speeds over 12 mi per hour (mph; USEPA 2019)

The nearest active ambient air quality monitoring site to the Project is located in Scottsbluff, Nebraska, and measures PM smaller than 2.5 micrometers. Various other monitoring sites are located in or near Cheyenne, Wyoming, approximately 43 mi southwest of the Project (USEPA 2020a). In 2018, annual average daily traffic (AADT) flow through the Project was 2,920 trips along State Route- (SR-) 71; 280 trips along South CR-88; and 670 trips along North CR-88 (NEDOT 2020b). The AADT along CR-14/17 Mile Road was 30 trips in 2019 (NEDOT 2020a). Air quality monitoring in Scottsbluff and Cheyenne and the relatively constant winds at the Project, support the assumption that current conditions should not exceed state or NAAQS.

3.3.1 Climate

The analysis areas have a typical interior continental climate with hot summers and cold winters that vary in temperature seasonally and annually. Mean temperatures typically range from the upper teens in degrees (°) Fahrenheit (F) in colder months to the upper 70s °F in summer months, though extreme temperatures have fallen below -40 °F and have exceeded 115 °F. Because of its geographic position within the continent, weather in the Project is subject to frequent, dramatic changes due to interacting air masses. Much of the precipitation in late spring and summer is produced by thunderstorms forming in warm, moist air and can result in flooding (National Oceanic and Atmospheric Administration 2006). The average annual wind speed in Banner County, based on data collected from 1980 to 2010, is 21.75 mph (USA.com 2020).

3.3.2 Global Climate Change

Global climate change has manifested as increased global average temperatures, as well as changes to other regional aspects, such as precipitation patterns. Weather patterns at the Project typically result from wind and precipitation moving in from the Rocky Mountains to the west. Warmer temperatures in the Rocky Mountains are resulting in changes to a variety of the precipitation-related patterns, specifically earlier snowmelts and earlier runoff maxima. These changes can potentially lead to extended growing seasons and potential ecological effects. For instance, relatively early snow melts encourage premature plant development, and may alter the mix of plant species, especially in sensitive environments (Fleishman *et al.* 2013).

3.3.3 Environmental Consequences—Proposed Action

The types of impacts to air quality during construction of the wind turbines, transmission line, switchyard and Project substation would be similar and would primarily result from equipment emissions and generation of PM, including fugitive dust. Construction activities could release air emissions of criteria pollutants, VOCs, GHGs (including carbon dioxide), and relatively small amounts of hazardous air pollutants (HAPs). During construction of the Project, fugitive dust emissions would temporarily increase due to truck and equipment traffic, particularly on dirt and gravel roads and surfaces. A minor amount of fugitive dust generation is expected during construction from the concrete batch plant but would be minimized to levels below federal or state standards by implementation of Orion's BMPs. Additionally, there would be relatively short-term emissions from diesel trucks and construction equipment. Air quality effects caused by fugitive dust would be relatively short term, limited to the periods of construction and decommissioning, and would not result in NAAQS exceedances or measurably contribute to GHG emissions. Estimated equipment use for construction of this Project is summarized in Table 3-9.

Table 3-8. Estimated equipment to be used during construction of the Pronghorn Flats 115-kilovolt Project.

Equipment	Purpose
Bulldozers	On-site construction
Graders	On-site construction
Rollers	On-site construction
Compactors	On-site construction
Trenching machines	On-site construction
Cranes—both light and heavyweight	On-site construction
Cement trucks	On-site construction
Drill rigs	On-site construction
Hydraulic forklifts	On-site construction
Semitrailers	Haulage, materials transportation
Water trucks	Haulage, materials transportation
Gravel Haulers	Haulage, materials transportation
Pickup trucks	Worker transportation
All-terrain vehicles	Worker transportation

Construction of the Project would bring approximately 10 heavy truck loads of materials per wind turbine. Additionally 50 vehicles trips during early phases of construction would be required. Approximately 75 personal vehicle trips would occur each day, assuming two passengers per vehicle. The emissions from this activity would not exceed air quality standards.

The types of impacts to air quality during maintenance of the wind turbines, transmission line, and substation would be similar and would primarily result from equipment emissions and generation of PM, including fugitive dust. Operating wind turbines, transmission lines, and other Project infrastructure would not directly result in air emissions because no fossil fuels would be combusted. Relatively negligible amounts of dust, vehicle exhaust emissions, and combustion-related emissions from diesel emergency generators would occur during O&M activities. These emissions would not cause exceedances of air quality standards. Operation of the substation could produce comparatively minute amounts of ozone and nitrogen oxide emissions as a result of atmospheric interactions with the energized conductors. Impacts on ambient air quality from these emissions during O&M of the Project would be relatively negligible.

The proposed substation may employ sulfur hexafluoride-filled circuit breakers, which are used in substations for all voltages. Sulfur hexafluoride is a GHG; therefore, equipment leaks could contribute to air quality impacts. Equipment would undergo routine inspection and preventative maintenance to minimize such leaks.

Global climate change is partly affected by the levels of GHGs in the atmosphere. The only relatively short-term contribution of the Project that could potentially affect climate change is equipment exhaust, primarily during construction. Emissions generated during O&M of the Project would primarily result from vehicles and machinery used to repair or maintain the Project infrastructure. These emissions would not make measurable negative contributions to global climate change. The Project would avoid considerable amounts of criteria pollutants, GHG, and HAP emissions that would otherwise have been generated from power plants burning fossil fuels to generate the equivalent electricity. Operation of the Project would offset total coal-generated emissions in Nebraska by approximately 552 short tons of sulfur dioxide, 263 short tons of nitrogen oxide, and 283,920 metric tons of carbon dioxide annually (U.S. Energy Information Administration 2020). These numbers were calculated assuming a 115 MW capacity as a proportion of the Nebraska 2019 Electricity Profile.

Activities required to decommission the Project would be similar to those for construction, but on a more limited scale and for a shorter duration. During decommissioning, the types of potential effects on ambient air quality and global climate change would be similar, but correspondingly less than those during construction activities.

Control techniques for fugitive dust sources generally involve watering, chemical stabilization, or reduction of surface wind speed with windbreaks or source enclosures. Watering is the most common and, generally, least expensive method, but provides only temporary dust control. The use of chemicals to treat exposed surfaces provides longer dust suppression, but may be costly, have adverse effects on plant and animal life, or contaminate the treated material. Windbreaks and source enclosures are often impractical because of the size of fugitive dust sources. The reduction of source extent and the incorporation of process modifications or adjusted work practices, both of which reduce the amount of dust generation, are preventive techniques for the control of fugitive dust emissions. Other mitigation measures entail the periodic removal of dust-producing material. Examples of mitigation control measures include clean-up of spillage on paved or unpaved travel surfaces and clean-up of material spillage at conveyor transfer points (USEPA 2019).

3.3.4 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed; therefore, there would be no direct or indirect impacts on air quality or global climate change from the Project. Ongoing land uses and existing activities (e.g., agricultural operations) would likely continue to result in similar emissions levels with the resulting impacts to air quality. Incremental contributions to global climate change from these activities would continue or increase, depending on future land uses.

3.4 Noise

The largest contributors to the existing sound sources within the general area of the Project are from farming activities and vehicular traffic. Section 18.03(7) of Kimball County Zoning and Subdivision Regulations (Kimball County 2010) indicates a noise standard of 50 decibels (dBA; metric not stated) at residences, and no noise limit is specified in Banner County. The Project has a self-imposed 45 dBA 1-hour equivalent sound level (L_{1h}) noise limit at residences (RSG, Inc. [RSG] 2020). There are no federal or state, or other county noise regulations applicable to this Project.

3.4.1 Environmental Consequences—Proposed Action

Construction of the Project is expected to take multiple months to a year or more from beginning to end. Construction of the Project would typically occur in several stages, and each stage would have a specific equipment mix. Most construction equipment would have sound levels ranging from 76 to 89 dBA at a distance of 50 ft. (Epsilon Associates, Inc. 2019, as cited by WAPA 2019). Most construction activities would occur during the day, when higher background sounds mask construction-related noise. However, concrete foundation work and turbine erection work could extend into the overnight hours depending on the weather and timing of a concrete pour, which must be continuous. Construction sound at any one location would only occur for a few days because as turbine construction in one area is completed, construction activities move to the next location.

During operation, the Project's wind turbines and substation would be a long-term source of sound. RSG conducted a sound propagation model for the Project (Appendix B, RSG 2020). Sound modeling software was used to estimate Project-generated operational sound at 30 discrete receivers, representing all homes within 1.2 mi of any wind turbine. The sound level assessment assumed 43 General Electric (GE) 3.03-140 low-noise trailing edges turbines with a hub height of 360 ft. For modeling sound from the substation transformer, sound emission data from the National Electronic Manufacturers Association Technical Report 1 Standard with spectral information from a transformer test was used.

The Project is modeled to produce a maximum sound level of 45 dBA L_{1h} or lower at residences in Kimball County and Banner County. It is expected that no adverse noise impact is expected to occur and the Project would meet any county noise standards.

The 115-kV transmission line would be a relatively minor source of noise typical of background sound levels in a rural environment. Based on a prior study of a 230-kV transmission line, 115-kV transmission line noise would be below 39 dBA at the edge of the ROW, even during wet weather (Lee *et al.* 1996 as cited by WAPA 2019). The collector lines would be underground and would not be a source of audible noise. Infrequent (about two hours once per month) operation of a diesel generator for testing at the O&M facility would be another source of sound; however, this would be intermittent, relatively short-term noise similar to construction activities. During decommissioning, sound levels would be similar to those used for construction, but on a more limited scale and for a shorter duration.

Human health effects sometimes alleged to wind farm noise and infrasound include sleep disturbance, vertigo, and stress. However, reliable evidence has not provided a link between infrasound and these adverse health effects. An independent expert panel for Massachusetts (Ellenbogen *et al.* 2012, as cited by WAPA 2019) found insufficient evidence that the noise from wind turbines directly cause human health effects. Instead, studies have linked the experience of adverse human health effects to individual perceptions and attitudes about wind farms. Thus, while studies have not reliably shown that wind farms cause direct health effects, negative attitudes about wind farms have been correlated with health effects such as sleep disturbance (Ellenbogen *et al.* 2012, as cited by WAPA 2019).

3.4.2 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed; therefore, there would be no direct or indirect impacts on the existing sound levels from the Project. Ongoing land uses and existing activities (e.g., agricultural operations) would likely continue to result in similar sound levels.

3.5 Vegetation

The analysis areas in Nebraska and Wyoming are located in the shortgrass prairie ecosystem (Schneider *et al.* 2005, WGFD 2017). The plant communities in this ecosystem include shortgrass, mixedgrass, sandsage prairie types, sparsely vegetated badlands, coniferous forest and playa wetlands. Shortgrass prairie is dominated by short grasses (e.g., buffalo grass, blue grama, side-oats grama, and purple threeawn) with hundreds of forb species interspersed. Mixedgrass prairie in this region is typically dominated by blue grama, prairie sandreed, threadleaf sedge, needle-and-thread, little bluestem, and western wheatgrass. Shrubs may be interspersed and may include yucca, fringed sage, broom snakeweed and skunkbush sumac. Similarly to the shortgrass prairie, hundreds of forbs are found in the mixedgrass prairie, including western ragweed, prairie coneflower, scarlet globemallow, scarlet gaura, and broom snakeweed.

Most of the turbine analysis area has been converted from shortgrass prairie to various land cover and uses (Table 3-10); however relatively large portions of the 115-kV transmission line analysis area contain shortgrass prairie that is used for livestock operations (Table 3-11). Cultivated crops cover approximately 18,871 acres (64%) of the turbine analysis area. Herbaceous vegetation (plants without woody stems), representing the shortgrass prairie ecosystem, is approximately 9,404.4 acres (31.9%), while 849.2 acres (2.9%) have been converted to developed, open space (e.g., roads) within the turbine analysis area (Table 3-10, Figure 3-8). Hay and pasture land use composes 282.2 acres (Table 3-10, Figure 3-8). Developed land covers are defined as areas characterized by a high percentage of constructed materials (e.g., asphalt, concrete, buildings) such as roads. The developed open space category has less than 20% impervious surface and the developed low intensity category has 20% to 49% impervious surface.

Table 3-9. Land cover within the Pronghorn Flats 115-kilovolt Project turbine analysis area

Land Cover Type	Acres	Percent
Cultivated Crops	18,871	64
Herbaceous	9,404	32
Developed, Open Space	849	3
Hay/Pasture	282	1
Developed, Low Intensity	5	<0.1
Barren Land	5	<0.1
Woody Wetlands	2	<0.1
Developed, Medium Intensity	0.2	<0.1
Total*	**29,418**	**100**

* Discrepancies due to rounding.

Source: National Land Cover Database 2016.

The dominant land cover type in the 115-kV transmission line analysis area is herbaceous vegetation at approximately 29,998.4 acres (69.3%; Table 3-11, Figure 3-8). The next most abundant land cover type is cultivated crops at approximately 11,190.4 acres (25.9%), followed by developed, open space at approximately 1,005.8 acres (2.3%). Hay/Pasture, evergreen forest, and barren land collectively compose approximately 1,029.3 acres or 2.4% of the transmission line analysis area.

Table 3-10. Land cover within the Pronghorn Flats 115-kilovolt Project transmission line analysis area.

Land Cover Type	Acres	Percent
Herbaceous	29,998.0	69.0
Cultivated Crops	11,190.0	26.0
Developed, Open Space	1,006.0	2.0
Hay/Pasture	647.0	2.0
Evergreen Forest	304.0	0.7
Barren Land	79.0	0.2
Developed, Low Intensity	29.0	0.1
Shrub/Scrub	15.0	<0.1
Emergent Herbaceous Wetlands	4.0	<0.1
Woody Wetlands	2.0	<0.1
Developed, Medium Intensity	0.2	<0.1
Open water	0.2	<0.1
Total*	**43,276.0**	**100**

* Discrepancies due to rounding.

Source: National Land Cover Database 2016.

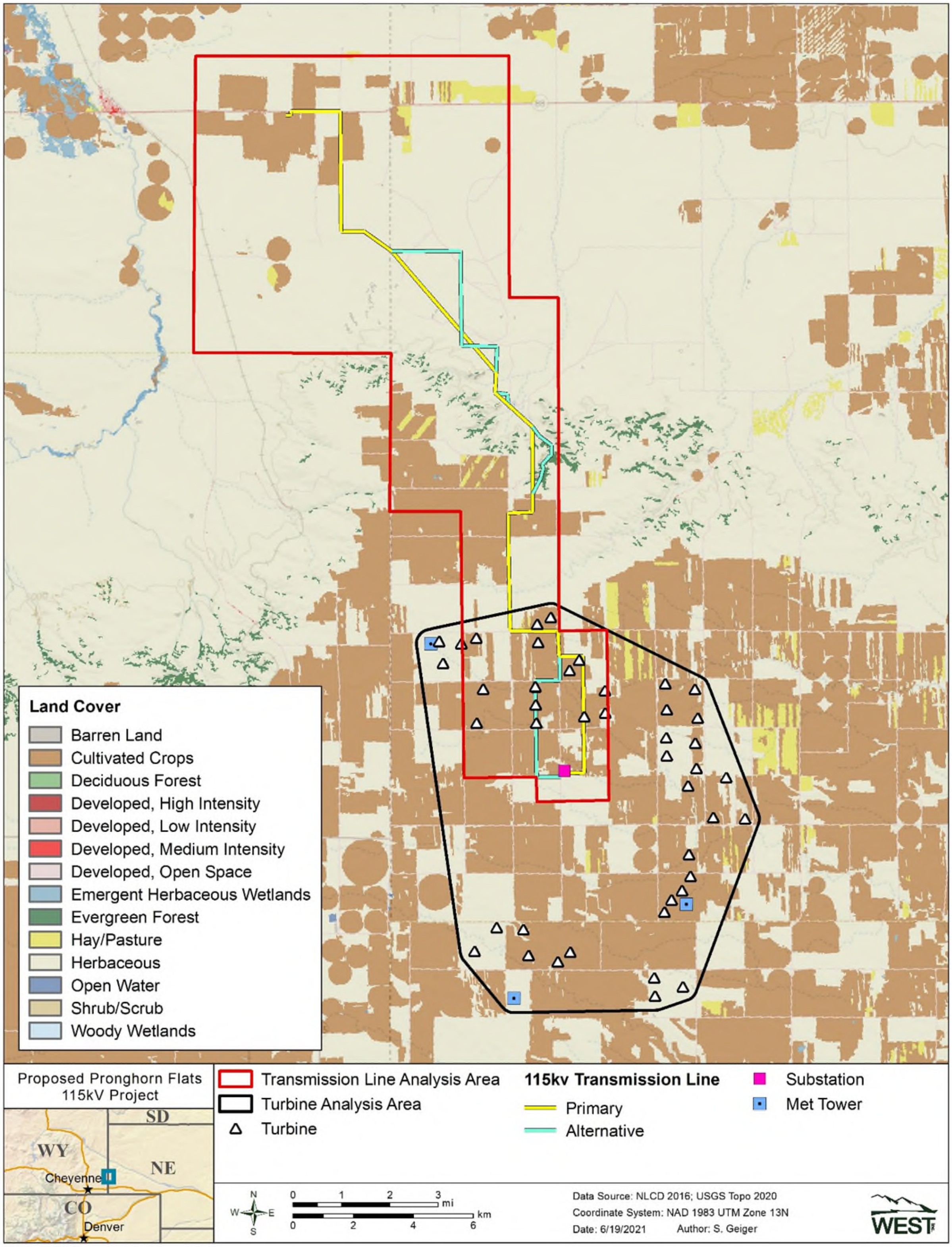

Figure 3-11. Land cover in the Pronghorn Flats 115-kilovolt (kV) analysis areas.

The Project's 115-kV transmission line routes falls within two Nebraska special vegetative communities. The Nebraska Natural Legacy Project identifies Biologically Unique Areas (BUL), which are areas that offer the best opportunities for the conservation of biological diversity. The 115-kV transmission line routes transverses the southwest portion of the Wildcat Hills South BUL (Figure 3-10). There are approximately 30 and 37 acres of the BUL within the primary and alternative transmission line routes, respectively. Additionally, Nebraska's Conservation and Environmental Review Tool (CERT; NGPC 2020a) identified that within the 115-kV transmission line routes (both primary and alternative) there are Level 2 "large intact blocks of habitat for at-risk species" (NGPC 2020a).

Plant species noted as noxious weeds are identified for the Nebraska and Wyoming analysis areas. The Nebraska Weed Control Association's (2020) noxious weed list includes saltcedar, purple loosestrife, phragmites, leafy spurge, Canada thistle, musk thistle, plumeless thistle, spotted knapweed, diffuse knapweed, Japanese knotweed, giant knotweed, and sericea lespedeza. These noxious weeds are identified by Nebraska's invasive species program as present in the Shortgrass Prairie ecoregion, which includes Banner and Kimball counties (Nebraska Invasive Species Program 2020). The State of Wyoming designates 30 plants as noxious weed species (Wyoming Weed and Pest Council 2020). Of those, the Goshen County Weed and Pest Control District (2020) identifies puncturevine, wild licorice, palmer amaranth, and horseweed as species that will have negative impacts in Goshen County.

3.5.1 Environmental Consequences—Proposed Action

Construction of the Project under the indicative layout of 43 turbines would have a temporary effect on approximately 439 acres of vegetation and a long-term impact on approximately 85 acres of vegetation (Table 3-12). The land cover type that will be impacted most is approximately 192 acres of cultivated crops, followed by 126 acres of herbaceous vegetation, and 120 acres of developed open space. Cultivated crops and herbaceous land covers comprise approximately 72% of the total acres temporarily impacted. While developed open space and herbaceous land cover comprise approximately 73% of the land cover that is impacted long term. Using the timescale on Google maps it appears most of the area impacted by the indicative layout has been cultivated between 1985 and the present.

Table 3-11. Approximate acres of land cover potentially impacted from turbines and turbine infrastructure at the Pronghorn Flats 115-kilovolt Project.

Land Cover Type	Temporary (acres)	Long term (acres)
Cultivated Crops	192	23
Herbaceous	126	26
Developed, Open Space	120	36
Developed, Low Intensity	1.0	0.3
Hay/Pasture	0.2	0.1
Total*	**439**	**85**

* Discrepancies due to rounding.

Source: National Land Cover Database 2016.

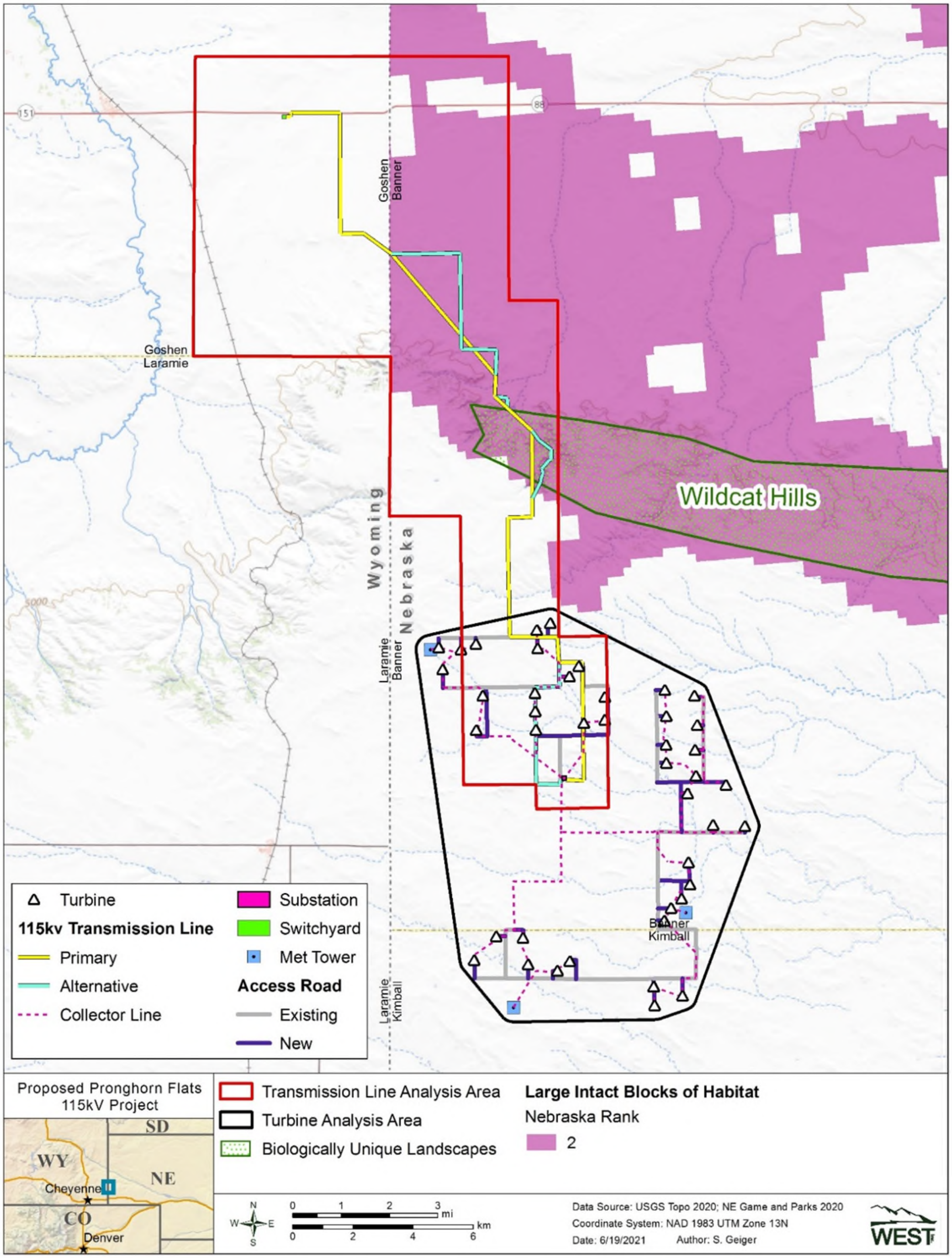

Figure 3-12. Level 2 "Large Intact Blocks of habitat for at risk species" within the Pronghorn Flats 115-kilovolt (kV) Project.

The primary and alternative transmission line routes would have approximately 349 and 387 acres of temporary impacts to vegetation types, respectively (Tables 3-13 and 3-14). The plant community herbaceous land cover will be impacted the most in the primary and alternative transmission line routes (approximately 194 and 200 acres, respectively), followed by cultivated crops (approximately 94 and 98 acres, respectively). Following construction, in either of the transmission line routes, the temporary impact areas would be reclaimed to pre-construction land uses. Thus, the long-term loss of vegetation from both the turbine infrastructure and primary transmission line combined would be approximately 85 acres. The potential for an additional five turbines and infrastructure (Table 2-2) would increase these impacts, but would likely occur within the cultivated crop or developed open space land cover.

Table 3-12. Approximate acreage of land cover potentially impacted from the 115-kilovolt primary transmission line route at the Pronghorn Flats 115-kilovolt Project.

Land Cover Type	Temporary	Long term
Herbaceous	194	negligible, <0.1 ac
Cultivated Crops	94	negligible
Developed, Open Space	51	negligible
Developed, Low Intensity	3	negligible
Evergreen Forest	3	negligible
Hay/Pasture	3	negligible
Barren Land	1	negligible
Total*	**349**	

* Discrepancies due to rounding.

Source: National Land Cover Database 2016.

Table 3-13. Approximate acreage of land cover potentially impacted from the 115-kilovolt alternative transmission line route at the Pronghorn Flats 115-kilovolt Project.

Land Cover Type	Temporary	Long term
Herbaceous	200.0	negligible, <0.1 ac
Cultivated Crops	98.0	negligible
Developed, Open Space	78.0	negligible
Evergreen Forest	4.0	negligible
Developed, Low Intensity	3.5	negligible
Hay/Pasture	2.8	negligible
Barren Land	0.7	negligible
Total*	**387.0**	

* Discrepancies due to rounding.

Source: National Land Cover Database 2016.

The proposed 115-kV transmission line routes would impact the Wildcat Hills South BUL and large intact blocks of Level 2 habitat for at-risk species. There are approximately 109 and 144 acres of the Level 2 blocks within the primary and alternative transmission line routes, respectively. In both transmission line routes and both the BUL and Level 2 habitat, herbaceous land cover was the dominant land cover type.

Isolated trees and shrubs may potentially need to be cleared as part of construction of the primary route 115-kV transmission line where approximately 3.0 acres of evergreen forest scattered/existing along the route. There are approximately 4.0 acres of evergreen forest scattered/existing along the alternative transmission line route. Tree removal would be limited to individual trees in the proposed transmission line route. Impacted trees would be replanted to achieve maturity within five to 10 years.

Construction activities have the potential to result in the spread of noxious weed species through site clearing activities exposing open soil. Weed establishment then can occur by construction equipment introducing seeds into new areas, wind-blown seed deposits, or erosion or sedimentation in the construction areas. Implementation of environmental commitments (Section 2.2) would reduce the potential for the introduction of noxious weeds.

The Project would be decommissioned at the end of the Project's operating life. The Project infrastructure would be removed in accordance with the wind lease, applicable state regulations, and county agreements, unless otherwise agreed to by the landowner. Disturbed surfaces would be graded, reseeded, and restored as closely as possible to the pre-construction conditions. Impacts from decommissioning would be similar to those for construction.

3.5.2 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed; therefore, there would be no direct or indirect impacts on the existing vegetation from the Project. Ongoing land uses and existing activities (e.g., agricultural operations) would likely continue to result in the same type and level of impacts to the vegetation as currently exist in 2020.

3.6 Wildlife

Potential impacts on wildlife and their habitats from the development of a utility-scale wind energy facility are well documented in a number of documents including the *Upper Great Plains Wind Energy Final Programmatic Environmental Impact Statement* (WAPA and USFWS 2015). Birds and bats are generally affected more than other wildlife and, thus, the focus of the analysis for this Project. Various wildlife studies were completed for the Project. These studies are included in Appendix C and are summarized in the subsections that follow.

3.6.1 Birds

3.6.1.1 Raptor Nest Surveys

Aerial raptor nest surveys were completed March 8 to March 12 and April 24 to April 25, 2017 (Fritchman 2017), and in 2019, on March 20 to March 24 with a follow up survey conducted on May 2, 2019 (Fritchman 2020), to locate and characterize the raptor nesting community in the area (Appendix C). The surveys yielded no occupied nor active raptor nests, including eagle, within the turbine analysis area. The closest and active eagle nest was approximately three mi from the nearest proposed turbine, which is outside of the expected territory size for nesting eagles. The USFWS indicates that surveys out to 2.0 mi from a project boundary sufficiently evaluates a project's impact to nearby nesting eagles (USFWS 2020). As indicated by the USFWS, risk becomes unlikely for nests greater than 2.0 mi of a wind energy project (USFWS 2020), therefore, impacts to nesting eagles at the Project are unlikely. There was one inactive raptor nest recorded in the turbine analysis area.

Three active raptor nests within the transmission line analysis area were recorded during the 2017 and 2019 surveys (Table 3-15). Ferruginous hawk, prairie falcon, and red-tail hawk active nests were recorded during 2017 surveys. One occupied but inactive (no nesting) golden eagle nest was also recorded. During 2019, there were two occupied and active ferruginous hawk nests and one active golden eagle recorded. Additionally in 2019, three golden eagle nests were recorded but only one was active.

Table 3-15. Summary of Raptor Nests along the Primary and Alternative Transmission Line Route

Year	Occupied (Species)	Status	Distance (mile) from Primary Transmission Line Route	Distance (mile) from Alternative Transmission Line Route
2017	Ferruginous hawk	Active	0	0.1
	Prairie falcon	Active	0.5	0.6
	Red-tailed hawk	Active	0.9	0.7
	Golden eagle	Not Active	0.6	0.6
2019	Ferruginous hawk	Active	<0.1	0.1
	Ferruginous hawk	Active	0.2	0.1
	Golden eagle	Active	0.4	0.4
	Golden eagle	Not Active/Occupied	0.3	0.4
	Golden eagle	Not Occupied	0.6	0.6

3.6.1.2 Avian Use Surveys

Avian use surveys for both large birds and small birds (e.g., passerines such as songbirds) were conducted from April 1, 2019 to March 11, 2020 and April 25, 2020 to May 26, 2021 (Fritchman and Taylor 2021). While the survey area has changed slightly between the survey years, survey points have maintained the required (30%) coverage in compliance with the USFWS *Land-based Wind Energy Guidelines* (USFWS 2012) within the current turbine analysis area.

During the 2019 to 2020 surveys, there were 24 large bird species recorded during surveys. Waterfowl and doves/pigeons accounted for most of the large bird observations throughout the study period, with Canada goose observed most frequently. Three bald eagle observations, 12 golden eagle observations, and two unidentified eagle observations were recorded during scheduled survey times. Bald eagle observations were only recorded in spring (1) and fall (2), while golden eagle observations were recorded during all seasons. Twenty-one species of small birds, all passerines, were recorded during surveys. The most commonly observed small birds were horned lark, Lapland longspur and lark bunting. These species are typical of this region and are widespread and abundant. Overall, the species composition, seasonal abundance, and spatial use patterns documented during these surveys are considered typical for birds in this region (Fritchman and Taylor, 2021). The majority of species observed are relatively common and abundant within the region (Fritchman and Taylor, 2021). Comparatively large flocks of waterfowl and/or shorebirds can be infrequently abundant during migration seasons, although stopover habitat that can potentially concentrate these species is generally rare within the analysis areas. No federal listed threatened or endangered species were observed during surveys or incidentally. No state-protected species were observed.

During the 2020 to 2021 surveys, 21 large bird species were recorded with waterfowl (sandhill crane; 144) and doves/pigeons (mourning dove; 164) most observed. Diurnal raptors were also the most frequently occurring group of birds during spring, fall, and winter with northern harrier (26), and Swainson's hawk (25) the most observed. Two golden eagles were observed during large bird surveys and one golden eagle was observed incidentally. Two golden eagle observations occurred in the fall. No bald eagles were observed during the 2020 to 2021 surveys. Twenty-five species of small birds were recorded during surveys. Passerines and woodpeckers accounted for all identifiable species of small birds. No federally threatened or endangered species were observed incidentally or during the 2020 to 2021 surveys (more information on listed species presented in Section 3.7). However, four individuals of Longspur, a Nebraska state-threatened species, were observed over the course of the year-long survey. Overall, the species composition, seasonal abundance, and spatial use patterns documented during the 2019 to 2020 surveys are considered typical for birds in this region and the majority of species observed are relatively common and abundant within the region (Fritchman and Taylor 2021). Over the course of the 2-year study, one bald eagle and three golden eagle were observed incidentally, outside of survey periods.

The turbine and transmission line analysis areas do not overlap with any Important Bird Areas, as identified by the National Audubon Society (2019), in Banner and Kimball counties, Nebraska, or Goshen County, Wyoming. The analysis areas also do not overlap with any Grassland Bird Conservation Area in Nebraska (USDA NRCS 2017).

3.6.2 Bats

Bat species whose range occurs, or that have documented observations in the analysis areas include: Townsend's big-eared bat, big brown bat, silver-haired bat, eastern red bat, hoary bat, long-legged myotis, western small-footed bat, little brown bat, fringed myotis, tri-colored bat (i.e., eastern pipistrelle), Mexican free-tailed bat, long-eared myotis, and pallid bat (Hester and Grenier 2005, University of Nebraska 2016). Species are either year-round residents, seasonal residents or noted as rare. The *Bat Assessment Guidance for Wind Energy Facilities in Nebraska* (University of Nebraska 2016) indicates wind energy is of special concern to many of these species.

Potential roosting habitat within the analysis areas in the form of trees, buildings, rocky cliffs, and rock outcrops was documented during a site visit (Baumgartner *et al.* 2014). Bats generally forage over water and open spaces such as agricultural fields, grasslands, streams, and wetlands/ponds. Agricultural fields and grasslands are common throughout the turbine analysis area, but streams, wetlands, and pools are uncommon. Bats may forage over the entire analysis area, although the extent of use is not known. However, little data are available from Nebraska on the foraging behavior, diet, and range of bats, with little knowledge of specific habitat use or seasonal requirements in the state.

Geluso *et al.* (2013) documented the western small-footed bat, silver-haired bat, fringed myotis, little brown bat, and eastern red bat in the Wildcat Hills South BUL, which the primary and alternative route for the 115-kV transmission line traverses a small portion of (Figure 3-9). Geluso *et al.* (2013) also presented studies documenting the presence of the tri-colored bat in eastern Wyoming and the long-legged myotis near Torrington, Goshen County, Wyoming.

3.6.3 Environmental Consequences—Proposed Action

Potential impacts to wildlife from the Project may result from direct mortality, habitat loss, and wildlife disturbance. Direct mortality is the result of collisions with turbines, met towers, overhead power lines, and substation structures. Habitat loss is due to the footprint of turbine pads, other infrastructure, and roads. Wildlife disturbance is the loss of the use of seemingly suitable habitat because of human activity in the vicinity. Orion would follow conservation measures noted in Section 2.2 of this EA to minimize impacts to wildlife populations.

Ground disturbance impacts would include temporary and long-term loss of habitats for wildlife. The turbine construction and associated infrastructure would result in approximately 411 acres of temporary and 85 acres of long-term impacts predominantly occurring (about 75%) within cultivated crops and developed open space land cover (Table 3-12). The construction of the transmission line would result in additional temporary impacts ranging from 353 to 391 acres and permanent impact of 0.10 to 0.12 acres from the transmission line structures (Table 3-13 and 3-14) predominantly occurring within herbaceous land cover. The potential for an additional five turbines and infrastructure (Table 2-2) would increase these impacts, but would likely occur within the cultivated crop or developed open space land cover. Long-term impacts include loss of habitat and habitat fragmentation due to the presence of the Project, as well as regular disturbance from humans during periodic maintenance. Specific impacts on wildlife are discussed below.

The general wildlife habitats within the turbine analysis area and the transmission line analysis area are representative of the region. Therefore, the potential effects from the development and operation of a wind energy facility is not likely to have any significant impact on the local mammals, reptile, or amphibian populations. They may experience a direct loss of potential habitat and individual fatalities due to collisions with increased vehicles in the area during construction. However, based on the number of long-term acres lost due to the presence of infrastructure and the relative abundance of these habitats on a regional scale the amount of impact is not expected to be significant.

Impacts to big game are expected to be minimal because the land is primarily cultivated crop and developed open space and is subject to regular human activity from farming activities. Impacts to big game could include direct mortality due to collisions with vehicles, loss of foraging habitat, and displacement from portions of the proposed Project area during construction due to human presence or noise. Mortality due to collisions with vehicles would be minimal. Forage distribution has already been substantially altered by past and current agricultural activities, and the footprint of the proposed wind Project likely would be unnoticeable within this larger agricultural environment. Big game using the area likely would habituate to the turbines and operation activities in time, although they may avoid roads as occurs at oil and gas development projects (Bureau of Land Management [BLM] 2008). Mule deer also are fairly tolerant of human activities (Reed 1981, Irby *et al.* 1981), and there is already frequent human presence due to farming activities, so it is probable that any displacement would likely be temporary and displacement effects would be minimal. Impacts to small mammals and carnivores include an increase in vehicle kills with increased roads and traffic, and some loss of habitat. The impacts are anticipated to be minimal overall.

Impacts to other mammals, amphibians, and reptiles are expected to be minimal. Mammals are relatively mobile, amphibians and reptiles are a little less so, and, while mortality due to collisions with vehicles or during excavation is possible, these occurrences are anticipated to be infrequent. As with big game, the overall agricultural environment already strongly influences forage/prey availability, therefore the loss of habitat from the Project footprint would probably have a minimal impacts on other mammals and reptiles.

3.6.3.1 Birds

3.6.3.1.1 Construction and Decommissioning

During Project construction and decommissioning, direct impacts to birds would include displacement (short term or long term), injuries or fatalities from collisions with construction equipment, vehicles, or Project components being installed or removed at the site. Displacement impacts are expected to be minimal since construction activities are localized, of short duration, and specific to individual birds present in the area; population level impacts are not expected. Species in the area are highly mobile and can temporarily move into the adjacent habitat to avoid localized and short-term construction activity.

Based on the raptor nest surveys conducted by Fritchman (2017, 2020) the closest occupied and active eagle nest is over 2.0 mi from the nearest proposed turbine, which is outside of the expected territory size for nesting eagles so the effect of displacement on nesting raptors is anticipated to be relatively minimal in the turbine analysis area. Additionally, Orion has identified BMPs that establish temporary wind turbine buffer zones around active raptor nests during construction in accordance with the *U.S. Fish and Wildlife, Region 6 Wildlife Buffer Recommendations for Wind Energy Projects version 3* (USFWS 2021b). Similarly, construction impacts to wetlands can lead to displacement of local birds in the Project area. The comparatively small amount of wetlands impacted by the Project during construction minimizes the potential impact to birds using these habitats.

3.6.3.1.2 Operations

During the long-term operational phase impacts may arise from maintenance activities and effects from, or interactions with, Project facilities and components. Maintenance activities may temporarily disturb birds. However, this impact would be localized, of short duration, and specific to individual birds present in the area; population level impacts are not expected. Wildlife that would be disturbed would be expected to temporarily move to surrounding habitat.

Effects from, or interactions with, Project facilities and components used for the operation of the Project may impact local birds due to habitat alteration. Habitat alteration from transmission line structures on the landscape would increase available perching and nesting sites for raptors (APLIC 2006). Perches in this open landscape would increase potential predation pressure on other wildlife.

Displacement of grassland nesting birds is often one of the primary concerns wildlife agencies express, regarding the placement of wind facilities in and near grassland areas. 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 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 turbines in Washington; however, they could not determine if a decrease in post-construction density was the result of behavioral disturbance or a loss of habitat. 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 turbines. Piorkowski (2006) suggested that habitat characteristics were more important to determining passerine breeding densities than the presence of wind turbines. Shaffer and Johnson (2009) documented some avoidance by grasshopper sparrows out to 492 ft at a wind energy facility in northern South Dakota. Shaffer and Buhl (2016) looked at indirect effects of wind-energy on breeding grassland birds in the mixed grass-prairie of North Dakota and South Dakota. Shaffer and Buhl observed displacement, attraction and null effects on nine species of grassland birds. The authors note that displacement could be localized (within 328 to 984 ft) or could result in site abandonment. Seven of nine grassland-breeding birds displayed localized displacement behavior, with several species relocating territories farther from turbines without abandoning the sites completely. Displacement impacts could potentially not be realized at the population level in part because displaced birds are not precluded from breeding elsewhere (WAPA 2019). The proposed turbine analysis area and transmission line analysis area contains grassland/herbaceous cover, with the potential to support grassland sensitive species that have the potential to be impacted by development. Species potentially impacted include several grassland obligate species and area sensitive species such as the mountain plover, burrowing owl, lark bunting, and Longspur; however, grassland/herbaceous cover is prevalent throughout the region, therefore, significant adverse impacts to these species are not anticipated.

Some bird mortality would be expected at met towers, especially if guy wires are required. Derby (2006) found very few bird mortalities at unguyed and unlit cellular communication towers that ranged in height from 150 to 195 ft. Young *et al.* (2003) reported that the average bird mortality rate for guyed met towers at the Foote Creek Rim wind facility was 7.5 birds per tower per year. Extrapolating data from Foote Creek Rim and the proposed use of three met towers, it is estimated that the bird mortality at the Project would be 22.5 birds per year if guyed towers are used.

Fatalities from collisions with wind turbines or electrocution and collision with transmission lines could occur. Based on a review of other wind projects in the region, fatalities estimates, resulting from wind turbine collisions, for all birds (including waterfowl) ranged between 0.3 to 3.4 fatalities/MW/year (Western EcoSystems Technology, Inc. [WEST] 2021). The overall magnitude of the population impact is relatively low, particularly for passerines, because most (approximately 62%) of the documented avian fatalities in continental North America are passerines, with individual species experiencing small (less than 0.05%) direct impacts from collisions with wind turbines (Erickson *et al.* 2014, WAPA 2019).

Bald and golden eagles were observed on site during the avian surveys as described in Section 3.6.1. Bald eagles were only observed during the fall, while golden eagles were observed during all seasons. Breeding bald eagles prefer habitat with large trees, such as cottonwood trees, coupled with larger bodies of water or rivers. These features are not available in the turbine analysis area or the transmission analysis area. Breeding golden eagles prefer habitat with cliffs and large rock outcrops, coupled with open grassland. While the turbine analysis area generally lacks nesting habitat it does contain open grasslands that may provide foraging opportunities; however, prairie dog colonies, which increase the likelihood of eagles foraging in the area, were not recorded during avian surveys. There is a stretch of the transmission analysis area that offers some cliffs that could be used by golden eagles.

The USFWS has developed a collision risk model (CRM) in the Bayesian framework to predict annual take of bald and golden eagles (USFWS 2013). The CRM framework uses prior distributions for exposure rate and collision rate of eagles. Prior distributions are intended to model exposure rate and collision rate of eagles at a range of wind energy facilities. Project specific data are used to update the exposure rate distribution. The prior distributions were defined in New *et al.* 2018 and accepted by the USFWS in May 2021 (86 Federal Register 23978 [May 5, 2021]).

For additional consideration, WEST developed an additional take prediction for golden eagles that includes the exposure rate prior distribution developed by the USFWS and an alternative collision rate prior distribution for golden eagles presented in Bay *et al.* 2016. Project specific data are used to update the exposure rate prior distribution. However, for this alternative take prediction, the collision rate prior distribution developed in Bay *et al.* (2016) was used and includes data collected on golden eagle exposure and fatalities from 26 facilities with modern turbine specifications across North America.

USFWS recommends using the 60th credible interval (CRI) for bald eagles and the 80th CRI for golden eagles to predict take and uses these upper credible limits to be conservative (USFWS 2021). Using the 60th CRI, the take predictions using the USFWS exposure rate and collision rate prior distributions developed for bald eagles is 0.26 bald eagles per year. Using the 80th CRI, the take predictions using the USFWS exposure rate and collision rate prior distributions developed for golden eagles is 1.14 golden eagles per year. The predicted annual golden eagle fatality rate at the 80th CRI is 0.48 golden eagles per year using the USFWS exposure rate prior distributions for golden eagles and the collision probability prior distribution presented in Bay *et al.* 2016. These levels correspond with a Category 2[2], high or moderate, collision risk according to the Eagle Conservation Plan Guidance (ECPG; USFWS 2013).

The estimated level of take attributed to the Project needs to be considered in combination with other impacts to eagles in the area (USFWS 2013). When considering the cumulative impact of a Project the USFWS considers the density of the bald and golden eagles in the Eagle Management Unit (EMU) and the potential take within Local Area Populations (LAP). The LAP is calculated using an 86-mi buffer for bald eagles and 109-mi buffer for golden eagles around the Project footprint. The USFWS has established a 1% threshold for take within the Central Flyway EMU in which the Project is located. The USFWS has also identified take rates of up to 5% of the estimated total eagle population size at the LAP scale as the upper benchmark according to the BGEPA preservation standard (USFWS 2013).

For bald eagles, the local area encompasses 25,293 square mi (mi^2), all within the Central Flyway EMU. The LAP size, calculated using the density estimate for the Central Flyway EMU (0.027 bald eagle/mi^2), is approximately 682 bald eagles. The upper 5% benchmark would be about 34 bald eagles/year, and the LAP 1% benchmark would be six bald eagles/year (Table 3-16). The annual estimated take rate at the Project is below the 1% LAP benchmark and the upper 5% benchmark, suggesting that the estimate of take is within the preservation standard set forth under the BGEPA.

For golden eagles, the local area encompasses 39,993 mi^2, all within the Central Flyway EMU. The LAP size, calculated using the density estimate for the Central Flyway EMU (0.014 golden eagle/mi^2), is approximately 558 golden eagles. The upper 5% benchmark would be about 27 golden eagles/year, and the LAP 1% benchmark would be five golden eagles/year (Table 3-16). The annual estimated take rate at the Project is below the 1% LAP benchmark and the upper 5% benchmark. It should be noted that under the preservation standard, the USFWS has set take thresholds for golden eagles to zero with any permitted take requiring compensatory mitigation. However, as stated above, the predicted take would likely be below the 5% benchmark

[2] As defined in the ECPG, a project is in Category 2 – High or moderate risk to eagles if it: 1) has an important eagle-use area or migration concentration site within the project area but not in the project footprint, 2) has a species-specific uncertainty-adjusted fatality estimate between 0.03 eagles per year and 5% of the estimated species-specific local-area population size, or 3) causes cumulative annual take of the species-specific local-area population of less than 5% of the estimated local-area population size.

that was evaluated under the Eagle Rule Programmatic EIS suggesting that the USFWS would likely be able to issue a permit as long as the take is offset by compensatory mitigation

Table 3-16. Estimated thresholds and take estimates for bald and golden eagles for the Central Flyway Eagle Management Unit (EMU) and Local Area Population for the Pronghorn Flats Wind Project, Banner County, Nebraska.

Region	Species	Estimated Population Size	1% Threshold	5% Threshold	Estimated Annual Take (CRM Model)	% of Regional Population
Central Flyway EMU	Bald Eagle	26,253	262	1,313	0.26	0.001
Local Area Eagle Population		682	6	34	0.26	0.038
Central Flyway EMU	Golden Eagle	13,210	132	660	1.14	0.009
Local Area Eagle Population		558	5	27	1.14	0.204

CRM = Collison Risk Model.

These predictions indicate that there is a high or moderate risk to both bald and golden eagles. The Eagle Management Plan would be developed to avoid and minimize potential impacts to bald or golden eagles in accordance with the ECPG prior to construction.

Avian electrocution and collision with transmission lines are direct, long-term impacts that can also occur during the operational phase. Electrocution risk to birds on power line structures is directly related to a number of structural and biological variables, including voltage, structure size, structure material and configuration, and area bird species likely to perch on the structures (APLIC 2006). A perching bird's dimensions are integral in assessing the potential for it to make phase-to-phase (i.e., energized-to-energized) or phase-to-ground (i.e., energized-to-ground or to a neutral) contact with a power line structure. Typically, 115-kV transmission voltage would not present an electrocution risk to perching raptors; however, the structure material (e.g., wood, steel), distances between potential contact points, and structure configuration can vary and both are important in assessing potential risks to avian species.

Avian collision risk with overhead lines is not uniform, and determining the relative risk or exposure to birds is generally governed by the type of electric infrastructure in proximity to bird species potentially present and site-specific factors, such as habitat, line orientation to use areas, topography, weather, bird morphology, flight characteristics, and level of human influences (Olendorff and Lehman 1986; Bevanger and Brøseth 2001; Harness *et al.* 2003; Mojica *et al.* 2009, 2020; APLIC 2012; Bernardino *et al.* 2018). Biological variables that influence a bird species' susceptibility to line collision includes bird size and maneuverability, flight characteristics, vision, and behavior (Anderson 1978; Beaulaurier *et al.* 1982; Faanes 1987; Bevanger 1994; Janss 2000; Bevanger and Brøseth 2001; Harness *et al.* 2003; Mojica *et al.* 2009, 2020; Rollan *et al.* 2010; APLIC 2012; Bernardino *et al.* 2018).

Flight characteristics can be important, including a bird's altitude and flight speed when approaching an overhead line (Beaulaurier *et al.* 1982). During daily movements, crossing power lines at low altitudes several times a day puts birds at a greater exposure for potential line collision (Willard 1978), as does flying in low light or during inclement weather (Faanes 1987, Morkill and Anderson 1991, APLIC 2012). Other factors important in assessing avian collision risk include power line configuration and the number of horizontal planes to navigate by flying birds. The overhead ground wire(s) and/or optical ground wire(s) on transmission structures is not energized but is smaller in diameter than the electric conductors, which reduces the overhead/optical ground wire line visibility and increases collision risk (APLIC 2012).

Based on these factors, species of large, heavy-bodied birds with large wingspans and lower maneuverability, such as cranes, herons, swans, pelicans, and geese, have been shown to be more susceptible to power line collisions. Other susceptible species include smaller, heavy-bodied birds that are fast fliers with short, wide wings, such as ducks, rails, coots, and grebes (APLIC 2012). Therefore, waterfowl and waterbirds are generally considered to be higher at-risk species of overhead power line collisions, as compared to other bird species. During the 2019 to 2020 survey, waterfowl (primarily Canada goose) accounted for a majority of the large bird observations, most notably in spring, but also in fall (Fritchman and Taylor 2021). Canada goose is common, geographically abundant, and likely to be unaffected by potential power line collisions associated with the proposed transmission line.

Few studies have documented eagle and other raptor collisions with overhead power lines. Research has suggested bald eagle collisions are more likely to occur where lines intersect with commonly used movement corridors and where birds are flying lower in altitude, such as near nest sites, winter concentration roosts, and along foraging sites (Olendorff and Lehman 1986; Harness *et al.* 2003; Mojica *et al.* 2009, 2020). Specific to golden eagle collisions with overhead power lines, input from some western electric utilities has indicated collisions with overhead lines are infrequent and appear to be random in location. Formal data compilation both in the U.S. and internationally documented nine golden eagle collisions with overhead power lines (Olendorff *et al.* 1986). Another study reported three golden eagle carcasses found mid-span below distribution power lines in Colorado and an additional 21 golden eagle carcasses found mid-span under a utility's power lines in Montana (Harness *et al.* 2003). While most of the birds in Montana were isolated cases, three carcasses were located near an active golden eagle nest, less than 1.0 mi from a prairie dog colony (Harness *et al.* 2003). Another carcass was found in a position indicative of pursuing prey (Harness *et al.* 2003). Although the sample size is low, these results suggest similar collision risk factors for golden eagles as bald eagles.

Implementation of environmental conservation measures (Section 2.2) during all phases of the Project would reduce the potential for avian mortality, indirect effects, and population-level effects. A BBCS and an Eagle Management Plan will be prepared that identify post-construction monitoring to confirm the pre-construction risk analyses and will include adaptive management measures, if needed, in consultation and coordination with agencies.

3.6.3.2 Bats

3.6.3.2.1 Construction and Decommissioning

During Project construction and decommissioning, direct impacts to bats could include displacement (short term or long term), fatalities from collisions with construction equipment, vehicles, or Project components being installed or removed at the site. Displacement impacts are expected to be minimal, and roosting habitats are not likely to be affected by the Project; population level impacts are not expected. Species in the area are highly mobile and can temporarily move into the adjacent habitat to avoid localized and short-term construction activity. Construction and operation of the Project would include both direct and indirect impacts to bats. Limited bat habitat is present within the turbine analysis area. Therefore, potential direct impacts to bat habitat would be minor. While the Project is likely to result in some bat mortality during operations, it is expected that the mortality rate would be within the average range of bat mortalities found throughout the U.S. based on general vegetation and landscape characteristics. Bat mortality at other Wyoming and Nebraska facilities ranges from 1.05 to 3.96 bat fatalities/MW/year (WEST 2021). Bat fatalities due to collisions with met towers at wind energy facilities appear to be very low to nonexistent (Johnson *et al.* 2004). Derby (2006) found no bat mortalities at unguyed and unlit cellular communication towers that ranged in height from 150 to 195 ft.

The Project also would potentially result in indirect impacts, such as habitat loss and/or alteration and the displacement or disturbance of bat species. However, because there is limited bat habitat within the turbine analysis area, the potential indirect impacts from the turbines and associated infrastructure would be limited. Bat habitat does exist within the transmission line analysis area; however, the potential impacts would primarily be related to construction, which would be a temporary impact. Impacts from Project decommissioning would be similar to those temporary aspects described for wildlife during construction.

Orion would follow conservation measures, noted in Section 2.2 of this EA, to minimize impacts to bat populations. Additionally, conservation measures for avoidance, minimization and mitigation listed in the *Bat Assessment Guidance for Wind Energy Facilities in Nebraska* (University of Nebraska 2016) and would be considered and implemented as practicable.

3.6.4 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed; therefore, there would be no direct or indirect impacts on wildlife from the Project. Ongoing land uses and existing activities (e.g., agricultural operations) would likely continue to result in the same type and level of impacts to the wildlife as currently exist.

3.7 Threatened and Endangered Species

3.7.1 Federally Threatened and Endangered Species

A formal request for an official list of species recognized as threatened or endangered under the ESA that could occur in the Project location, and/or possibly be affected by the Project, was made to the USFWS Information for Planning and Consultation System (IPaC; USFWS 2022). The report issued by both the Wyoming and Nebraska USFWS Ecological Services Field Office are provided in Appendix D. The report identified piping plover (threatened), whooping crane (endangered), pallid sturgeon (endangered), and the western prairie fringed orchid (Orchid; threatened) as species possibly occurring or known to occur within or be affected by the Project. No critical habitat has been designated for these species within the Project's analysis areas. These species are also the primary focus for the Platte River Recovery Implementation Program (PRRIP) established in 2006. The PRRIP implements actions designed to assist in the conservation and recovery of the target species and their associated habitats along the central and lower Platte River in Nebraska through a basin-wide cooperative approach agreed to by the States of Colorado, Nebraska, and Wyoming, and the U.S. Department of the Interior (PRRIP 2006). The PRRIP addresses the adverse impacts of existing and certain new, water-related activities on the Platte River target species and associated habitats, and ESA compliance for effects to the listed target species and whooping crane critical habitat from such activities including avoidance of any prohibited take of such species (PRRIP 2006). The water use for this Project would not require new or additional permits, but rather the Project will obtain temporary agreements with private landowners, the counties, or other water providers in the area. Water use will be consistent with the PRRIP and, therefore, there would be no new effects to the target species.

3.7.1.1 Piping Plover

Piping plovers in Nebraska are closely associated with the Platte River east of Lake McConaughy and lower reaches of other major rivers. In Nebraska, piping plovers breed along the Missouri, Platte, Elkhorn, Loup, and Niobrara rivers. The distance between the Project and the Platte River reduces the potential for their onsite occurrence during migration, breeding, or dispersal. Because of the distance between the Project and the associated rivers in Nebraska, lack of habitat within the analysis areas, and the review of state databases (NGPC 2020c, Wyoming Natural Diversity Database [WYNDD] 2020) it was determined the presence of and potential for the Project to affect the piping plover would be unlikely. Therefore, the piping plover was eliminated for further analysis.

3.7.1.2 Whooping Crane

The Project area is over 100 mi west of the documented migration corridor of the Aransas/Wood Buffalo population of whooping cranes. There have been no confirmed sittings in Banner or Kimball County, Nebraska (Silcock and Jorgensen 2021b). Based on the location of the Project relative to the migration corridor and the lack of sightings in the counties, it was determined the presence of and potential for the Project to affect the whooping crane would be unlikely. Therefore, the whooping crane was eliminated for further analysis.

3.7.1.3 Pallid Sturgeon

A small number of pallid sturgeon have been captured along the lower reaches of the Platte River in Nebraska. The lower reaches of the Platte River, a more than 30-mi stretch from the Elkhorn River to its confluence with the Missouri River, is believed to have suitable spawning habitat for pallid sturgeon. While the pallid sturgeon does not occur within the analysis areas, effects from potential changes in water depletions need to be considered to comply with the PRRIP and ESA. Water use will be consistent with the PRRIP and, therefore, there would be no new effects to the target species.

3.7.1.4 Western Prairie Fringed Orchid

The Orchid occurs most frequently in sedge meadows and remnant tallgrass native prairies that often include big bluestem, little bluestem, switchgrass, indiangrass, and northern reedgrass assemblages. The Orchid requires a constant source of reliable hydrology, such as sub-irrigated sedge meadows that rely on near-surface groundwater and its estimated current range is primarily northcentral Nebraska that does not include Kimball or Banner counties (Nebraska Natural Heritage Program [NNHP] 2019). The analysis areas are not located within the range of this species, thus the presence of and potential for the Project to affect the Orchid would be unlikely. Therefore, the Orchid was eliminated for further analysis.

Therefore, no species listed under the ESA are considered further in this analysis.

3.7.2 Species of Special Concern

Species of special concern for this Project include USFWS Birds of Conservation Concern (BCC; USFWS 2008), identified through the USFWS IPaC report, and Nebraska and Wyoming Species of Greatest Conservation Need (SGCN; WGFD 2017, Schneider *et al.* 2018). The BCC are bird species recognized by USFWS as having high conservation priority and are likely to become candidates for listing under the ESA without conservation actions. At a state-level, the Longspur (aka: McCown’s longspur), mountain plover and swift fox are identified by both, or either, WGFD and the NGPC as SGCN, and have the potential to occur in the analysis areas (NGPC and NNHP2017).

3.7.2.1 Thick-billed Longspur

The Longspur is state-listed threatened in Nebraska with a significant conservation concern throughout its range (Panella and Jorgensen 2018). The Longspur is noted to be a locally common breeder in the western panhandle of Nebraska (Silcock and Jorgensen 2021a), which includes most of Kimball County and southern Banner County. The Longspur is a bird of the shortgrass prairie and is found using areas with little vegetative cover or bare ground, e.g. agricultural fields, grazed shortgrass prairie and prairie dog towns (NGPC 2018). This species has documented occurrences within one mile (NGPC 2020a) of the Project analysis areas and within the turbine analysis area during the 2020 to 2021 avian use surveys. In Wyoming, it is considered a regular summer inhabitant of Goshen County, however, there are no documented occurrences listed in the WYNDD (2021) within at least one mile of the transmission line analysis area.

3.7.2.2 Mountain Plover

The range of the mountain plover is distributed throughout the Shortgrass Prairie Ecoregion, which includes the analysis area in Nebraska and Wyoming (NNHP 2011). Mountain plovers use shortgrass agricultural fields, prairie dog towns, and areas with very low-stature vegetation and extensive bare ground (NGPC 2020c). Mountain plovers are noted as relatively common breeders, and spring and fall migrants, in Kimball County and southwest Banner County, Nebraska (Silcock and Jorgensen 2020). NGPC (2020c) indicate that in Nebraska, at least 90% of mountain plover nest on cultivated land. While no observations occurred during the 2019 to 2020 avian use surveys (Fritchman and Taylor 2021), CERT reported documented occurrences within one mi of the Project (NGPC 2020a). There are also observations recorded on eBird in the Project vicinity as recent as 2020 (eBird 2020). The breeding season runs approximately from April through July (Silcock and Jorgensen 2020). Within Wyoming, no observations have been recorded in the WYNDD in or near the transmission line analysis area. However, the species has been observed elsewhere in Goshen County, Wyoming (WYNDD 2020).

3.7.2.3 Swift Fox

Swift foxes are the smallest wild canine in North America and are about half the size of red foxes. While the historical range of the swift fox was the entire Great Plains region, the species is now limited to just the western edge of this range (NGPC 2020b). Swift foxes use the Shortgrass Prairie ecoregion where there are relatively few shrubs and trees. Swift foxes will use a den year-round, switching den sites throughout the year and often using the dens of prairie dogs and badgers. Often, swift foxes will also den in road ditches because coyotes (a major predator of the swift fox) do not typically inhabit road ditches (NGPC 2020b). The main part of this species' diet includes small mammals (prairie dogs and ground squirrels), birds, reptiles, amphibians, fish, and insects. In Nebraska, the population of swift foxes exists only in the southwest corner of the state and in the panhandle, which includes Banner and Kimball County, Nebraska. CERT reported documented occurrences within one mi of the Project (NGPC 2020a). In Wyoming, recent observations are documented in Goshen County (WYNDD 2020); however, these observations were not in the immediate analysis area.

3.7.2.4 Other Species of Special Concern

Other state SGCN includes the Colorado butterfly plant, which could occur in Kimball County, but is not expected to occur in the analysis areas (NGPC 2020a) and WGFD (A. Losch, WGFD, pers. comm., June 26, 2020; WGFD 2020) identified an additional six SGCN species with modeled distribution in the analysis areas: upland sandpiper, ferruginous hawk, long-billed curlew, burrowing owl, Preble's meadow jumping mouse, and western small-footed myotis.

3.7.3 Environmental Consequences—Proposed Action

3.7.3.1 Thick-billed Longspur

Direct mortality due to collisions are possible since there are some documented occurrences within the turbine analysis area (WYNDD 2020). Indirect effects from habitat fragmentation or loss of breeding/nesting habitat have probably already occurred to some degree as a result of agricultural development in the area. The Longspur has been documented nesting in agricultural fields in Kimball County, Nebraska (Snyder and Bly 2009 in Panella and Jorgensen 2018). It is unknown if the Project would result in compromising the security or recovery of the Longspur; however, Erickson *et al.* (2014), estimated levels of passerine fatalities at wind projects are such that impacts to any individual passerine species would not likely affect overall population levels. Surveys in and around the wind turbine sites to ensure species are not present prior to construction activities are included as Environmental Conservation Measures and Best Management Practices (Section 2.2) reducing the potential for direct impacts during construction.

3.7.3.2 Mountain Plover

Overall, it is unknown if the Project would result in compromising the security or recovery of the Nebraska state-listed threatened, mountain plover. Direct mortality due to collisions are possible since there are documented mountain plover occurrences within one mi of the analysis areas (WYNDD 2020). Orion commits to following the BMPs in Section 2.2 to reduce any potential impact to mountain plover during construction, operations, and decommissioning. The WGFD and NGPC recommends conducting surveys for mountain plover prior to construction activities to ensure breeding and nesting individuals are not present (A. Losch, pers. comm., June 26, 2020; WGFD 2020, NGPC 2021). If an active nest is located during the surveys, Orion will consult with either the WGFD or NGPC to determine appropriate measures to be implemented. Measures typically include applying an appropriate buffer (based on topography and type of disturbance) around the active nest for the duration of the breeding season (approximately April to July) within which disturbance would be restricted. Indirect effects due to loss of breeding/nesting habitat is expected to be low as agricultural fields are widespread in the analysis areas. While prairie dog colonies are not present in Kimball and Banner counties (McCarthy 2020), there are sizeable populations of prairie dogs in neighboring counties (Cheyenne, Morrill, and Scotts Bluff). Therefore, this infers that within Banner and Kimball counties, presently there is limited nesting habitat in prairie dog colonies for mountain plovers.

3.7.3.3 Swift Fox

Overall, the Project is not expected to compromise or enhance the security or recovery of the swift fox. Direct fatalities due to collision with vehicles could occur during construction, operations, and decommissioning. Indirect effects are expected to be relatively low since the Project's effect to native habitat would be incremental to the historic loss of suitable habitat (shortgrass prairie) through conversion to agricultural lands. While prairie dog colonies are not present in Kimball and Banner counties (McCarthy 2020), there are sizeable populations of prairie dogs in neighboring counties (Cheyenne, Morrill, and Scottsbluff). Therefore, this infers that within Banner and Kimball counties, presently there is limited swift fox habitat

3.7.4 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed; therefore, there would be no direct or indirect impacts on federally or state-listed threatened or endangered species from the Project. Ongoing land uses and existing activities (e.g., agricultural operations) would likely continue to result in the same type and level of impacts to the threatened and endangered species as currently exist in 2020.

3.8 Visual Resources

Visual resources refer to all objects (man-made and natural) and features (e.g., landforms and water bodies) visible on a landscape. The analysis area for visual resources is the area within a 30-mi radius of the Proposed Action wind turbines, which is considered the outer limit of visual effects under normal circumstances (Sullivan *et al.* 2012). This visual resource analysis area is the same whether the primary or alternative transmission line route is selected, and is inclusive of the indicative Project layout.

Visibility is considered very high and visual absorption capacity is comparatively low in the analysis area due to the relatively flat to rolling terrain and the uniformity of relatively low-growing vegetation. Exceptions are relatively low drainages where most settlements are concentrated, and areas screened by the Wildcat Hills in the north and northeast portions of the analysis area. The primary viewing platforms are Interstate 80 (I-80), Hwy 85, Hwy 88, Hwy 71, Hwy 30; state wildlife and recreation areas in the Wildcat Hills (Carter Canyon Ranch, Montz Point, Cedar Canyon, and Wildcat Hills); and the relatively small towns of Bushnell, Kimball, Dix, Harrisburg, Nebraska, and La Grange, Hawk Springs, Albin, Hillsdale, Burns, Pine Bluffs, and Carpenter, Wyoming. Outside of these towns, population density is considered very low. Table 3-17 describes 12 representative Key Observation Points (KOPs) selected to indicate public viewing locations from a stationary (e.g., recreational site or cemetery) or a linear (e.g., Hwy or trail) location.

Table 3-1714. Key Observation Points (KOP).

KOP Number. Name	Viewer Sensitivity–Special Designation (High, Moderate, Low, Negligible)	Viewer Number	Visual Quality	Degree of Impact	Distance from Nearest Turbine(mi)	Distance from Transmission Line (mi)
1. Pine Bluffs, WY	High–Shrine	Moderate	Low	Moderate	14	Not Visible
2. Salem Cemetery, WY	High–Cemetery	Low	Moderate	High	7	Not Visible
3. Albin, WY	High–Town	Moderate	Moderate	High	3	5
4. Albin Cemetery, WY	High–Cemetery	Moderate	Moderate	High	0.75	Not Visible
5. Epworth Cemetery, NE	High–Cemetery	Low	Moderate	High	2.5	1
6. La Grange, WY	High–Town	Moderate	Low	Moderate	13	Not Visible
7. La Grange Cemetery, WY	High–Cemetery	Moderate	Moderate	Moderate	13	Not Visible

Table 3-1714. Key Observation Points (KOP).

KOP Number. Name	Viewer Sensitivity–Special Designation	Viewer Number	Visual Quality	Degree of Impact	Distance from Nearest Turbine(mi)	Distance from Transmission Line (mi)
	(High, Moderate, Low, Negligible)					
8. Gabe Rock Cemetery	High–Cemetery	Moderate	Moderate	High	8	Not Visible
9. Brauer Reservoir	Low–None	Low	High	High	3	Not Visible
10. Carter Canyon 1	Moderate–Recreation	Moderate	High	None	Not Visible	Not Visible
11. Carter Canyon 2	Moderate–Recreation	Moderate	High	Moderate	19	Not Visible
12. Murray Lake	Low–None	Low	Moderate	Moderate	18	Not Visible

mi = miles.

Viewer sensitivity, or the estimated level of public concern to noticeable visual changes to the landscape, varies widely. Local public scoping comments and national preference studies indicate strong attitudes both for and against wind energy on account of visual effects (Hoen *et al.* 2018, Gross 2020). The special designations above, and the larger populations near Scottsbluff, Nebraska, indicate that viewer sensitivity is higher in the north and northeast. Conversely, the lack of similar special designations, tourist and recreation destinations, and smaller populations in the remainder of the analysis area indicates lower visual sensitivity.

The Project is located in the Western High Plains ecoregion, which is characterized by a semi-arid to arid climate, with annual precipitation ranging from 13 to 20 inches. The scenic qualities that contribute to its landscape character are green and brown flat to rolling plains, timbered drainages and bluffs, and in the northeast, bluffs, escarpments, and areas of exposed bedrock (Omernik 1987, USEPA 2000). The analysis area consists of rural settlements with ranching and farming associated structures, as well as energy extraction and transmission dotting the region. The road network is typically a gridded pattern, and roadways are predominantly composed of gravel. Despite the lack of generally striking features, the analysis area overall has moderate to high visual coherence, that is, integrity in its cultural order and intactness of the natural and human-built landscape in its freedom from encroaching elements.

3.8.1 Shadow Flicker

Potential visual impacts from Project operation could result from shadow flicker. Shadow flicker occurs when wind turbine blades pass in front of the sun to create recurring shadows on an object. Such shadows occur only under very specific conditions influenced by sun position, wind direction, time of day, and other similar factors. Shadow flicker becomes less noticeable with increasing distance from a wind turbine. Shadow flicker at distances greater than 10 rotor diameters (i.e., about 4,490 ft or 0.85 mi) is generally relatively low intensity and considered imperceptible. At such distances, shadow flicker is typically only caused at sunrise or sunset, when cast shadows are sufficiently long and are generally greater in the winter months due to the angle of the sun. Shadow flicker impacts are not currently regulated in applicable state or federal law. The general practice is to limit shadow flicker resulting from wind turbines to 30 hours per year at any residence (Haley and Partner 2020).

3.8.2 Environmental Consequences—Proposed Action

The wind turbines would change the aesthetics of the landscape with the addition of relatively tall, white towers, rotating blades, and red blinking lights at night. The substation, access roads, overhead transmission line, O&M buildings, met towers, and vehicles would also be visible in the analysis area to varying degrees. Various factors can influence the degree of contrast that a project can have on the landscape and on viewer response. Factors accounted for in the impact evaluation (BLM 1986) include:

- Distance—the farther away the facilities are, the less contrast the structures will have.
- Angle of Observation—viewing a project from different angles, such as from above or below the project, can greatly affect the apparent size of a project and the resulting level of contrast.
- Length of Time in View—the longer a project is in view, the more contrast it will create.
- Relative Size or Scale—the contrast created by a project is directly related to its size and scale compared to the surrounding landscape.
- Lighting Conditions—the direction and angle of the sun affects the color, intensity, shadow, reflection, form, and texture of visual aspects of a landscape.
- Motion—Movement, such as spinning wind turbine blades, draws attention to a project and increases the amount of contrast.

Construction activities could potentially result in visual impacts from vegetation clearing and grading; road building/upgrading; construction and use of staging and laydown areas; construction of facilities; vehicular, equipment, and worker presence and activity; dust; and emissions. In particular, because of the relatively large size of wind turbine towers, blades, and other components, the transport and installation of wind turbines and associated dust clouds are visually conspicuous activities. Large, and in some cases unusual, vehicles are required to transport some components, and the sight of these components on local roads would be memorable. In general, construction visual impacts would vary in frequency and duration throughout the course of construction. There would be periods of comparatively intense activity followed by periods with less activity, and associated visual impacts would vary in accordance with construction activity levels. Site monitoring, adherence to standard construction practices, and restoration activities would reduce many of these potential visual construction impacts.

The primary direct visual impacts associated with operation of the Project would result from the introduction of the numerous vertical lines of the up to 48 wind turbines into the generally horizontal landscape found in the analysis area. Shadow flicker and blade glinting, as well as turbine marker lights and other lighting on other Project facilities, would also result in visual impacts.

The magnitude of impacts from an up to 600-ft tall wind turbine is largely proportional to distance. A conservative analysis suggests that, to the unaided eye and under optimal viewing conditions, wind turbines would be discernible beyond the 30-mi radius analysis area, though at this distance the impact would be considered negligible. Wind turbine blade movement would be visible and unlikely to be missed by casual observers at 20 mi. Wind turbines would be a major focus of visual attention and begin to dominate the visual experience at 10 to 12 mi (Sullivan et. al. 2012). These distances are highlighted on the Proposed Action wind turbine viewshed map (Figure 3-11), with visibility screened in some locations by topography and landscape features. The wind turbines would be visible from Albin, Pine Bluffs, and La Grange, Wyoming, and Bushnell, Kimball, Dix, and Harrisburg, Nebraska. Wind turbines would not be visible from the lower elevations in Scottsbluff, Terrytown, or Gering, Nebraska. Segments of the California, Oregon, Mormon Pioneer, and Pony Express National Historic Trails, and the associated Western Trails Scenic Byway and Gold Rush Scenic Byway, would also not have a view of the Project. The tips of the blades (at up to 600 ft. tall), though not the center of the rotor hub (at 360 ft. tall), would be seen at additional locations and further distances, such as the highest points in the southern portion of Scotts Bluff National Monument.

Current FAA requirements for wind turbine lighting (FAA 2018) typically includes red, simultaneously pulsating nighttime lighting and no daytime lighting (as white towers are sufficiently conspicuous to pilots). Orion is preparing a lighting plan to meet FAA requirements while minimizing the number of lights for the Project. Typically, not all turbines would be lit; rather, turbines at the end of each string and the third or fourth turbine in a string would be lit.

It is assumed that standard, simultaneously pulsating, red, nighttime lights would be necessary per FAA requirements (FAA 2018), and that an Aircraft Detection Lighting System would not be used. Aircraft Detection Lighting Systems temporarily activate red nighttime lights only when aircrafts enter the airspace and remain lit until approximately 30 seconds after the aircraft leaves the airspace. Night-sky contrasts would be relatively substantial in the rural, undeveloped analysis area because there are comparatively few other light sources, no similar simultaneous pulsating red lights, and a generally featureless dark background. The lights can potentially be visible for more than 20 mi, depending on atmospheric conditions, and the lights can create comparatively strong long-term visual impacts (Sullivan *et al.* 2012).

At least two 115-kV, one 230-kV, and a 345-kV transmission line cross the analysis area, converging near La Grange, Wyoming (National Renewable Energy Laboratory 2005, Hamerlinck 2016). The existing transmission lines feature steel lattice, steel monopole, and wood H-frame towers at heights shorter than the wind turbines. The proposed primary 115-kV transmission line (20-mi long) or alternative 115-kV transmission line (21-mi long) would be a new visual feature in the landscape. The magnitude of impacts from an approximately 115-ft tall transmission line is largely proportional to distance from a point of view. A conservative analysis suggests that the unaided eye and under optimal viewing conditions, transmission lines would be discernible beyond eight mi, though at this distance the impact would be considered negligible. At 3.5 mi, the transmission line would be clearly visible and would have a moderate level of impact. At 1.5 mi, there would be a relatively major visual impact, with the transmission line dominating the landscape (Sullivan et. al. 2012). Visual impacts within eight mi of the primary 115-kV transmission line versus the alternative 115-kV transmission line are depicted in Figure 3-12. The visual impacts are considered very comparable between the two routes for the 115-kV transmission line.

Decommissioning impacts would be similar to the impacts described above for construction; however, the impacts would be of lesser magnitude and limited to approximately six months.

The visual contrast between each KOP listed in Table 3-15 has a unique visual impact depending on the topography and the distance from the turbines and transmission line. The KOPs were selected based on where people likely congregate and where visual impacts can potentially be the highest. Towns, recreation sites, and sensitive cultural sites were all considered when determining the KOP locations. Table 3-17 describes each KOP based on viewer sensitivity, viewer number, visual quality, the approximate distance from the nearest turbine/transmission line, and also shows a summarized degree of impact at each location.

Each KOP was surveyed on April 24, 2020. A 52-millimeter equivalent lens was used to capture a panorama of photographs from a stationary point. This lens most closely approximates the human field of vision and does not distort the apparent size or scale of objects in the scene.

Visual simulations were created for three KOP locations to help visualize the impacts to the existing landscape shown in Figures 3-13, 3-14, and 3-15. The three KOP locations (Albin Epworth, and La Grange) were chosen based off the severity of the visual impact at varying distances as illustrated in Table 3-17.

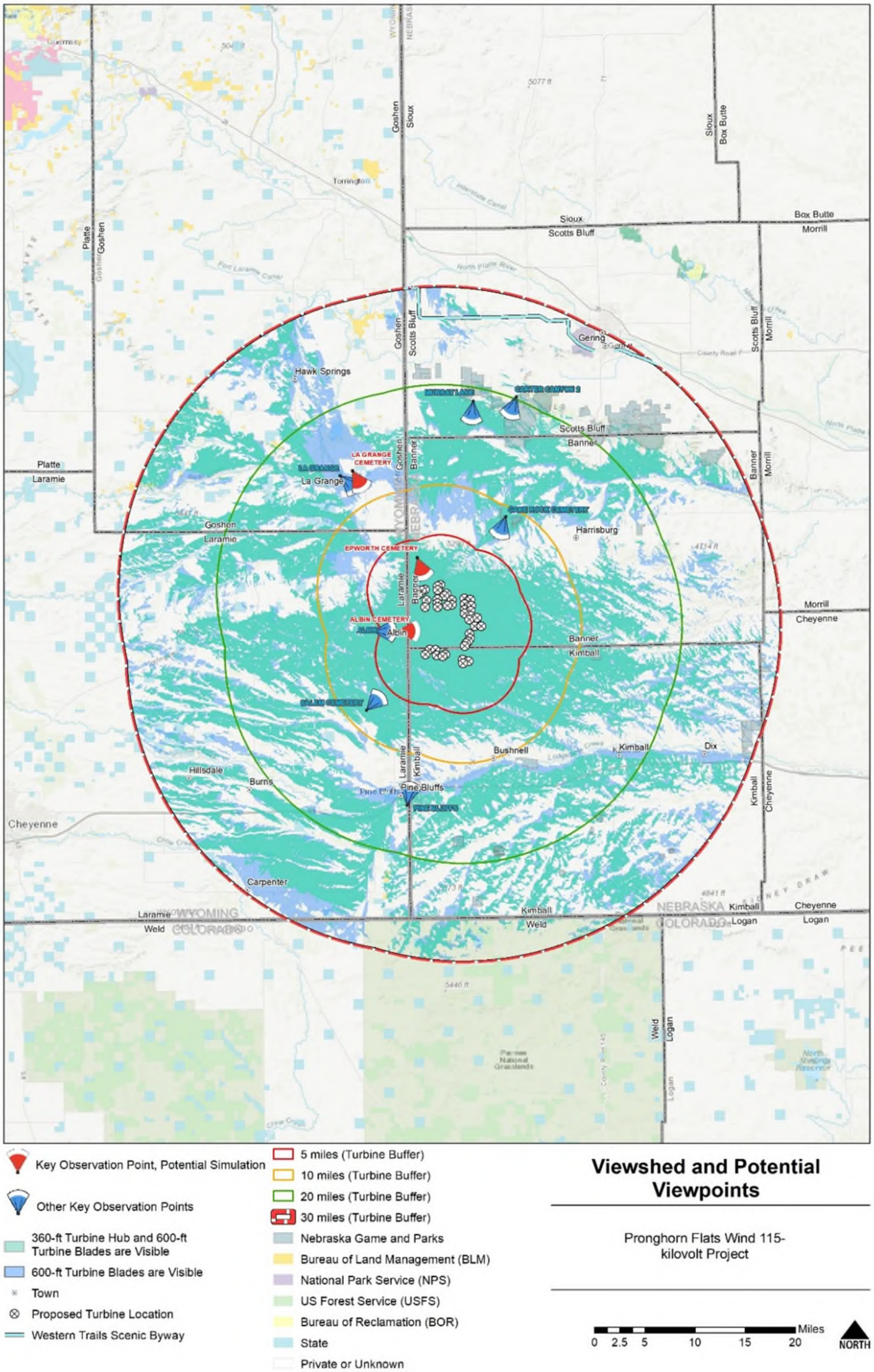

Figure 3-11. Visibility of the wind turbines at varying distances.

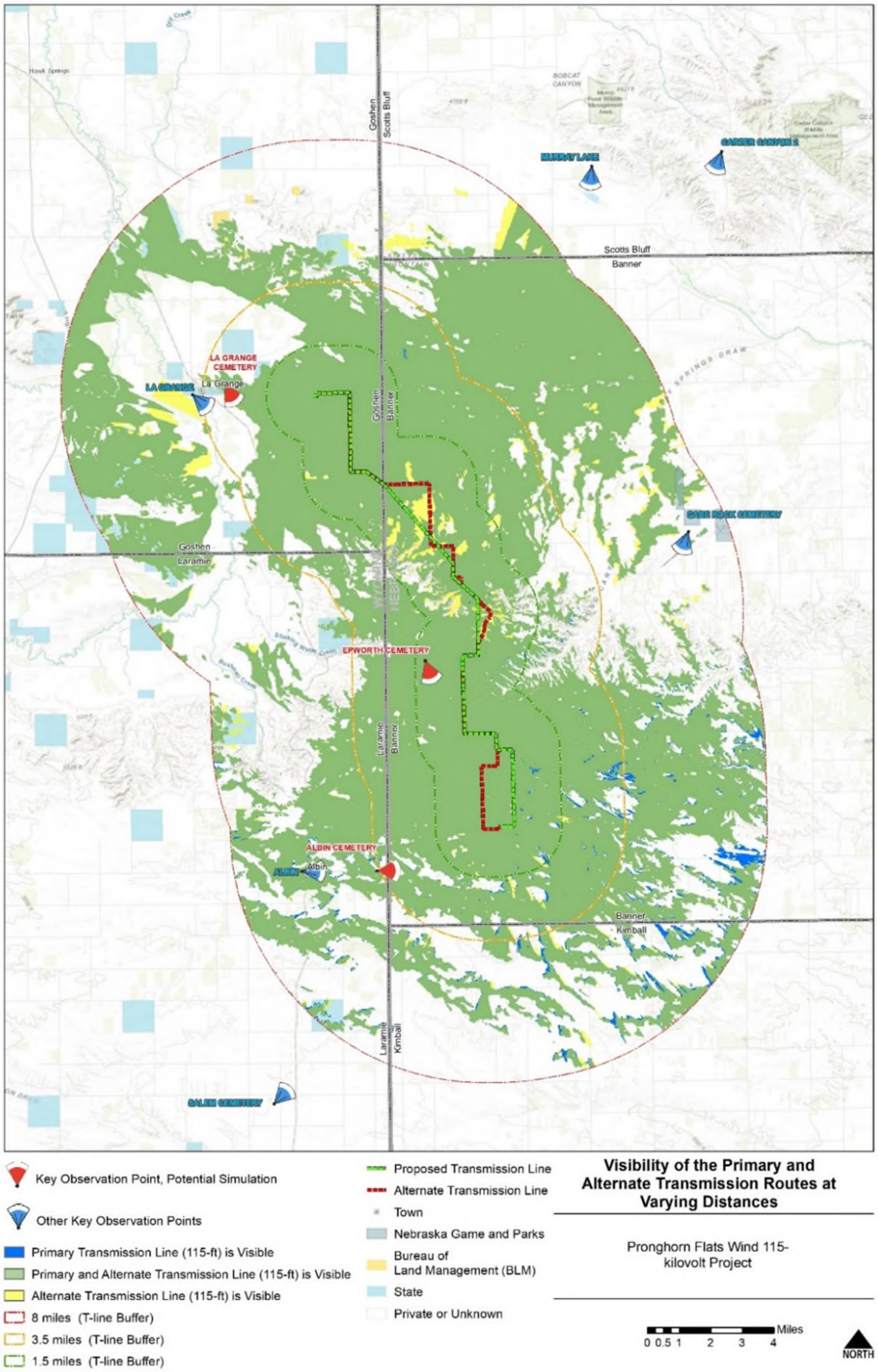

Figure 3-12. Visibility of the primary and alternative transmission routes at varying distances.

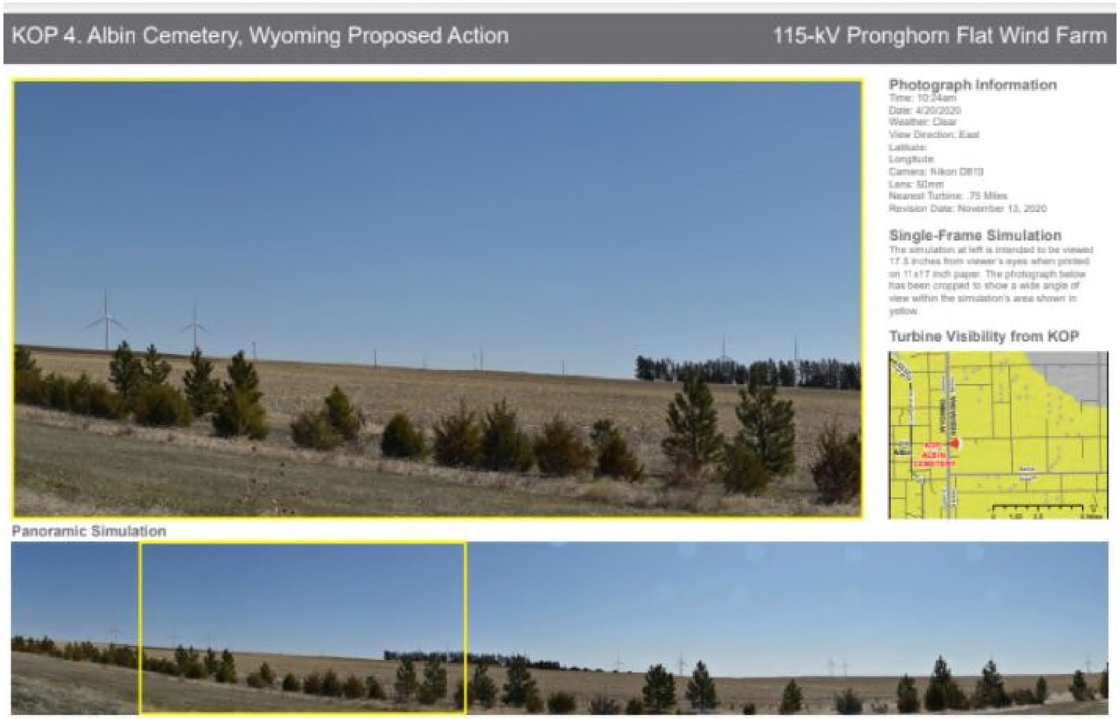

Figure 3-13. The Albin Cemetery key observation point to help visualize the impacts to the existing landscape, Wyoming.

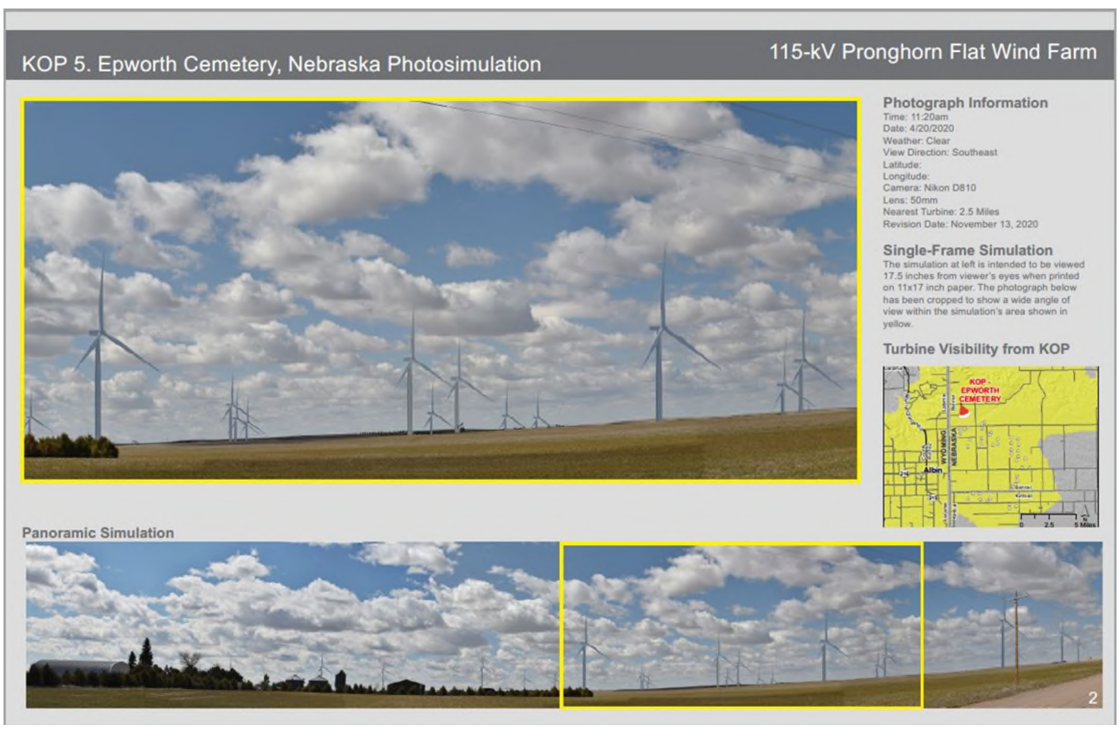

Figure 3-14. The Epworth cemetery key observation point to help visualize the impacts to the existing landscape, Nebraska

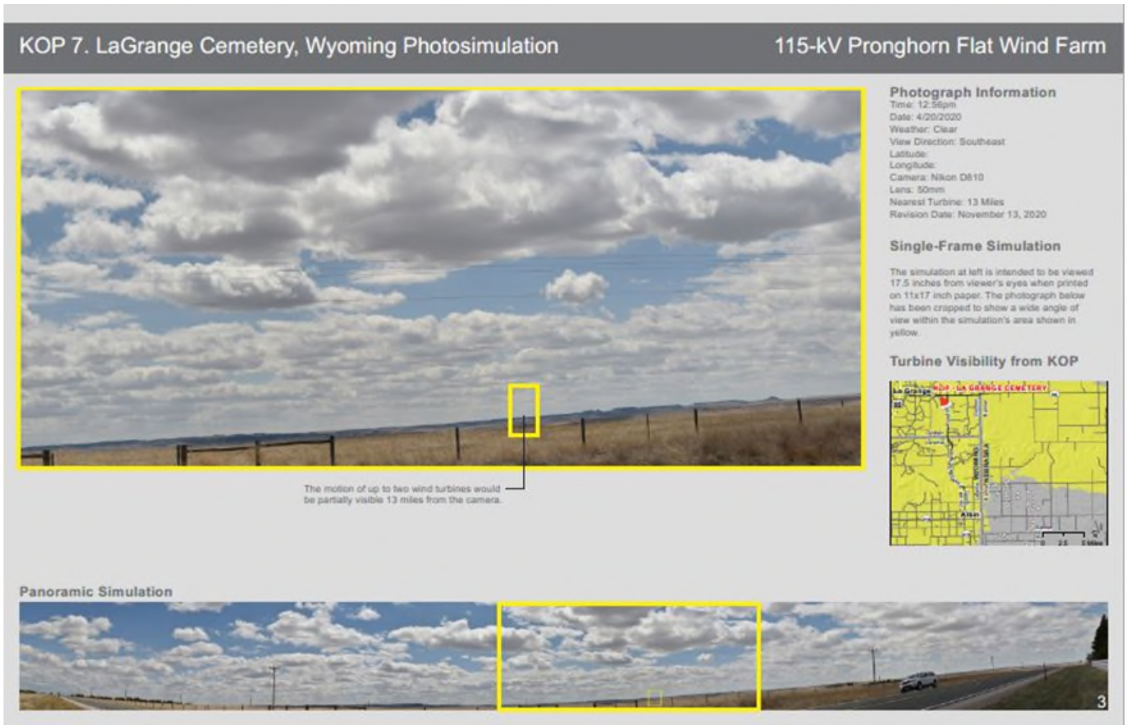

Figure 3-15. The LaGrange cemetery key observation point to help visualize the impacts to the existing landscape, Wyoming.

Shadow flicker is the effect of the sun (low on the horizon) shining through the rotating blades of a wind turbine, casting a moving shadow. It will be perceived as a “flicker” due to the rotating blades repeatedly casting the shadow. Although in many cases shadow flicker occurs only a few hours in a year, it can potentially create a nuisance for homeowners in close proximity to turbines. Computer models can accurately predict when, where, and to what degree this problem will occur, so wind project developers can mitigate this impact during the site selection process. In addition, many local ordinances incorporate language addressing shadow flicker to minimize any potential impact on neighbors (Office of Energy Efficiency and Renewable Energy 2020).

A shadow flicker analysis for the Project conducted by EAPC Wind Energy (Figure 3-16, Appendix E; Haley and Partner 2020) conservatively estimated Project-generated shadow flicker at 30 dwellings within 1.25 mi of a wind turbine associated with the Project. Modeling was based on the GE 3.03-140 turbine with a 322-ft hub height. The shadow flicker modeling results for all potential turbine locations indicate that for the 30 dwellings modeled, the highest amount of shadow flicker per year, would be approximately 28 hours and 15 minutes per year (5NP on Figure 3-16).

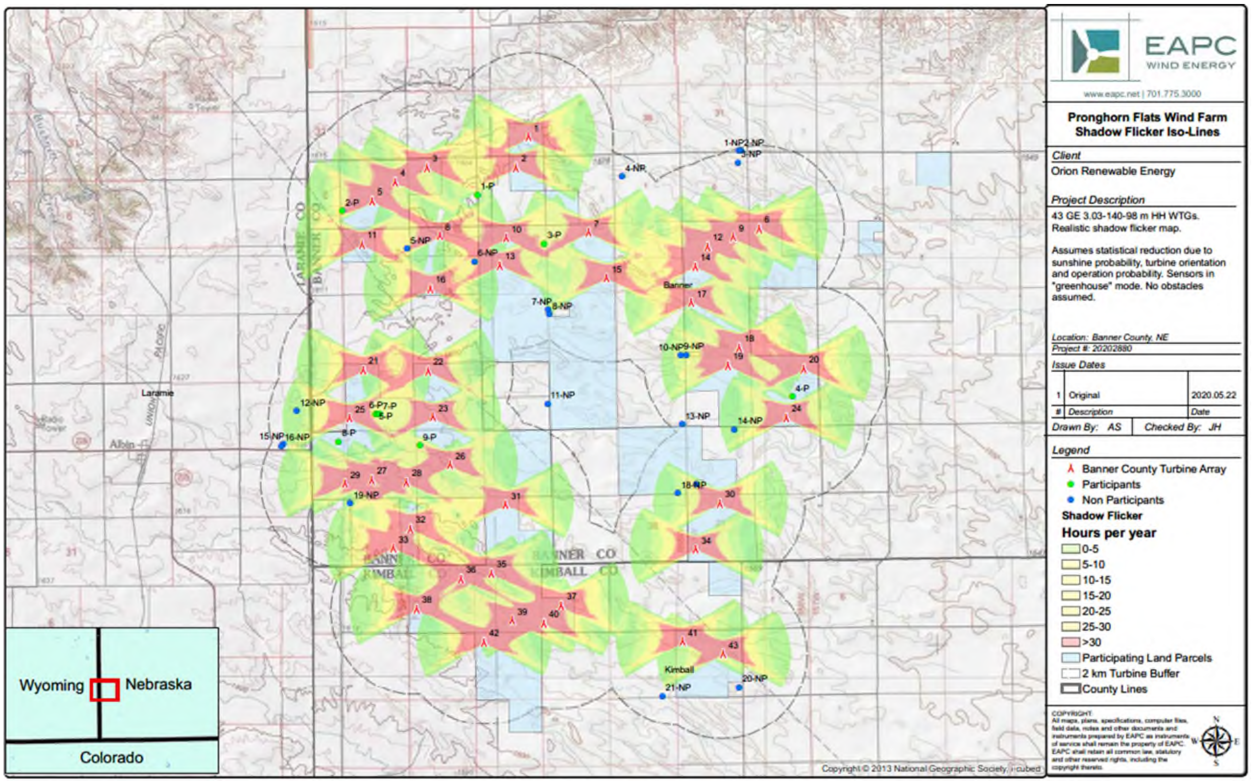

Figure 3-136. Results of the shadow flicker analysis for the Pronghorn Flats 115-kilovolt Project.

3.8.3 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed. Therefore, no specific Project-related changes to visual resources would occur within the analysis area. Furthermore, under the No-action Alternative, other visual resource impacts could occur because private landowners may choose to develop agricultural or undeveloped properties for more intensive land uses.

3.9 Cultural Resources

Centennial Archaeology conducted an intensive Class III cultural resource inventory in Banner and Kimball counties, Nebraska, and Goshen County, Wyoming, following the initial primary and alternative transmission line routes (Gensmer *et al.* 2020). The inventory was conducted for compliance with Section 106 of the National Historic Preservation Act of 1966 (NHPA) due to WAPA's lead federal agency role in this Project. The area surveyed consists of linear corridors for the proposed access roads, cabling, and transmission lines, and block survey surrounding turbine locations, met towers, substation, and switchyard. An 85% sample survey of the area of potential effects (APE) was conducted. The surveyed area encompasses approximately 3,920 acres of land, including 3,623 acres in Nebraska and 297 acres in Wyoming. The fieldwork was conducted between July and August 2020. Approximately 3,370 acres of private property and 42.2 acres of state-owned land in Wyoming were subjected to systematic pedestrian survey. The transmission line route was altered since the surveys were conducted and approximately four mi of the adjusted transmission line route in Wyoming has not been surveyed.

In compliance with Section 106 of the NHPA, adverse effects from visual impacts from renewable resources must be considered for each historic property. The indirect visual APE was established prior to the initiation of Project work and was determined by WAPA through consultation with the SHPOs of Wyoming and Nebraska. In Nebraska, this area was defined as a buffer extending two mi from all Project elements as proposed. In Wyoming, the SHPO required a more complex buffer based on the individual project elements. For this Project, the required distances were 10 mi from the turbine locations, eight mi from the transmission line locale, and two mi from all other elements. However, given the proposed layout, the 10-mi buffer for the turbines exceeded the smaller buffers for the other elements and, since it extended the furthest, was the one used for this Project. The same buffer applies to both historic and archaeological resources. As a result of Class I literature searches in the area and in coordination with the Wyoming and Nebraska SHPO, a list of 15 historic sites with standing structures that were likely to be visually impacted by the Project undertaking was assembled (Table 3-18). These sites were included in a Visual Analysis performed by Centennial Archaeology.

Table 3-18. Sites included in the Visual Analysis.

State	Site Number	NRHP Status	Criteria	Integrity	Age	Description
NE	BN00-030	Needs Data	Not Stated	Not Stated	1900	Farmhouse
NE	BN00-031	Needs Data	Not Stated	Not Stated	1910	Abandoned Farmstead
NE	BN00-032	Eligible/Reconnaissance	A, C	Not Stated	1880	Log House
NE	BN00-033	Needs Data	Not Stated	Not Stated	1910	Epworth Church&Cemetery
NE	BN00-034	Needs Data	Not Stated	Not Stated	1900	Abandoned Farmstead
NE	BN00-036	Needs Data	Not Stated	Not Stated	1910	Barn
NE	BN00-083	Needs Data	Not Stated	Not Stated	1920	Abandoned Farmhouse
NE	BN00-084	Needs Data	Not Stated	Not Stated	1920	Farmstead
NE	BN00-085	Needs Data	Not Stated	Not Stated	1915	Abandoned Farmstead
NE	BN00-086	Needs Data	Not Stated	Not Stated	1915	Farmhouse
NE	KM00-046	Needs Data	Not Stated	Not Stated	1890	Abandoned Farmhouse
NE	KM00-052	Needs Data	Not Stated	Not Stated	1920	Farmstead
NE	KM00-053	Needs Data	Not Stated	Not Stated	1920	Farmstead
WY	GO42	Not Evaluated	Not Stated	Not Stated	Historic	Texas Trail Monument
WY	LA540	Not Evaluated	Not Stated	Not Stated	Historic	La Cavalier Homestead

NE = Nebraska; WY = Wyoming; NRHP = National Register of Historic Places.

3.9.1 Environmental Consequences—Proposed Action

This inventory resulted in the documentation of 39 sites and 13 isolated finds (Nebraska)/isolated resources (Wyoming). The Banner County portion of the Project contained 31 sites and 12 isolated finds, while eight sites are located in Kimball County, and one isolated resource was recorded in Goshen County. Of the sites, three are previously recorded, and 36 were newly recorded for this Project. The three previously recorded sites are all historic architectural properties. All newly recorded sites are archaeological resources, 10 of which are prehistoric in age, 21 are historic, and five contain both prehistoric and historic components. All but one of the isolated resources are prehistoric in age, while the remaining isolated resource is historic. The prehistoric sites and isolates consist of lithic scatters, open camps, and single lithic artifacts. One diagnostic projectile point resembling a Middle Archaic period McKean lanceolate style was recorded. A second projectile point midsection was too fragmentary to assign to a specific typology but, based on size and overall morphology, is tentatively identified as Archaic in age. The historic sites include abandoned homesteads, foundations, stock dams, rock inscriptions, debris scatters, and abandoned agricultural equipment. The historic sites all date to the late-19th through the mid-20th centuries. Centennial Archaeology recommends that six of them are eligible for National Register of Historic Places (NRHP) inclusion, and the remaining 33 sites are not eligible. None of the isolated resources are considered eligible (Gensmer *et al.* 2020).

Based on the results of this survey, future archaeological research should focus on studying the prehistoric land-use patterns, focusing on the occupation of the bluffs and canyons in the northern portion of the surveyed area. Subsurface excavations of archaeological sites should attempt to determine whether and where intact cultural horizons might exist below plow zones. Historic archaeological research should attempt to define the primary period of settlement and occupation of homesteads prior to abandonment, as well as examining economic changes on these properties over the course of the occupations.

3.9.1.1 Management Recommendations

Significance evaluations are presented on a site-by-site basis in the cultural survey report (Gensmer *et al.* 2020). No further work is recommended for the 33 sites and the 13 isolated resources determined by WAPA and the SHPOs as not eligible for the NRHP listing (WY 10/11/21:DBPR_WY-2021-937; NE 9/24/21: HP#2006-097-01). Of the six sites evaluated as eligible, four of these were considered eligible due to inferred research value. The six sites that are evaluated as eligible for NRHP listing are considered significant because these sites are believed to yield important information, or because access to the property was not granted and the potential for additional archaeological data could not be evaluated. Impacts to these sites should be avoided. Should avoidance of these sites not be possible, additional research is recommended within the specific footprint of anticipated impact areas for any future projects to assess the nature of potential subsurface components and evaluate integrity and research value. In the event that previously undocumented archaeological or historical materials are encountered during construction, all work should cease in the immediate area of the discovery, and the discovery locale should be protected until its NRHP significance can be assessed by a qualified archaeologist.

3.9.1.2 Visual Analysis

The purpose of this Visual Analysis was to determine the line-of-sight visibility of the wind turbines and their maximum blade height from an observer's perspective from the location of each of the sites listed in Table 3-18. At a height of 360 ft, at least one turbine is visible for 14 of the 15 cultural sites. 48GO42 was the sole site from which no turbines were visible. With the target heights representing the maximum blade height of 600 ft, at least one target was visible from all 15 observer locations. Figure 3-17 shows the results of the viewshed process for the turbine locations. The viewshed analysis was performed at both 360 ft and 600 ft from the turbine locations to represent the turbine height and the blade height, respectively. The resulting map graphic shows the extent of the area in which the turbines and blades are visible within the Class I study area. Both the turbines and blades are visible to a large portion of the southern half of the Class I study area due to the proximity and relatively flat topography. Figure 3-18 shows the viewshed analysis for the proposed transmission line route. This operation was performed on the transmission line centerline at a height of 115 ft.

3.9.2 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed; therefore, there would be no direct or indirect impacts on cultural resources from the Project. Ongoing land uses and existing activities (e.g., agricultural operations) would likely continue to result in the same type and level of impacts to cultural resources as they exist in 2020.

3.10 Land Use and Public Facilities

Agriculture, with few residences scattered throughout, is the primary land use in the vicinity of the Project. Within Banner County, Harrisburg is an unincorporated community that serves as the county seat and is located approximately 12 mi northeast of the Project. There are no incorporated municipalities in Banner County. While there is a public school located in Harrisburg, most community facilities and services near the Project are located in the towns of Scottsbluff and Gering, Nebraska, which are approximately 50 mi northeast of the Project, and Kimball, Nebraska, which is approximately 30 mi to the southeast. Scottsbluff, Gering, and Kimball contain medical, police, fire and ambulance services, schools, places of worship, and parks and recreational facilities. No community facilities are located within the analysis areas.

3.11 Public Lands

The analysis areas within Nebraska do not include any state or federal public lands. A NGPC statewide effort called “The Open Fields and Waters Program” focuses on finding hunter and angler access to private lands. Based on this program, the analysis areas do not contain any privately owned land leased for public hunting access (referred to as Public Access Atlas Areas). Additionally, there are no other types of public hunting areas in the analysis areas. Within Wyoming, state land falls within the analysis area but outside of the transmission line route (Figure 1-1).

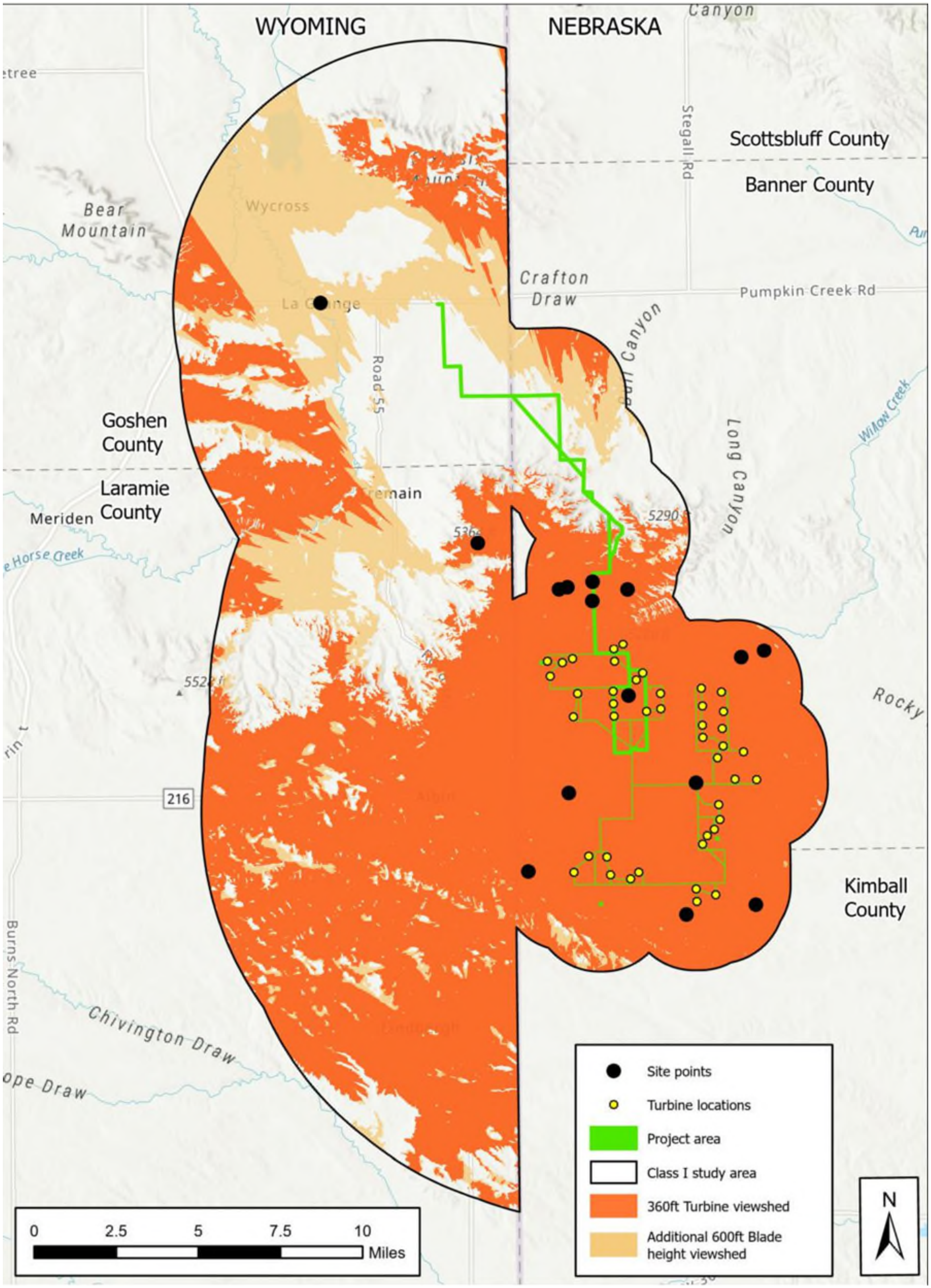

Figure 3-17. Viewshed map showing areas where proposed turbines and blades are visible within the Class I study area.

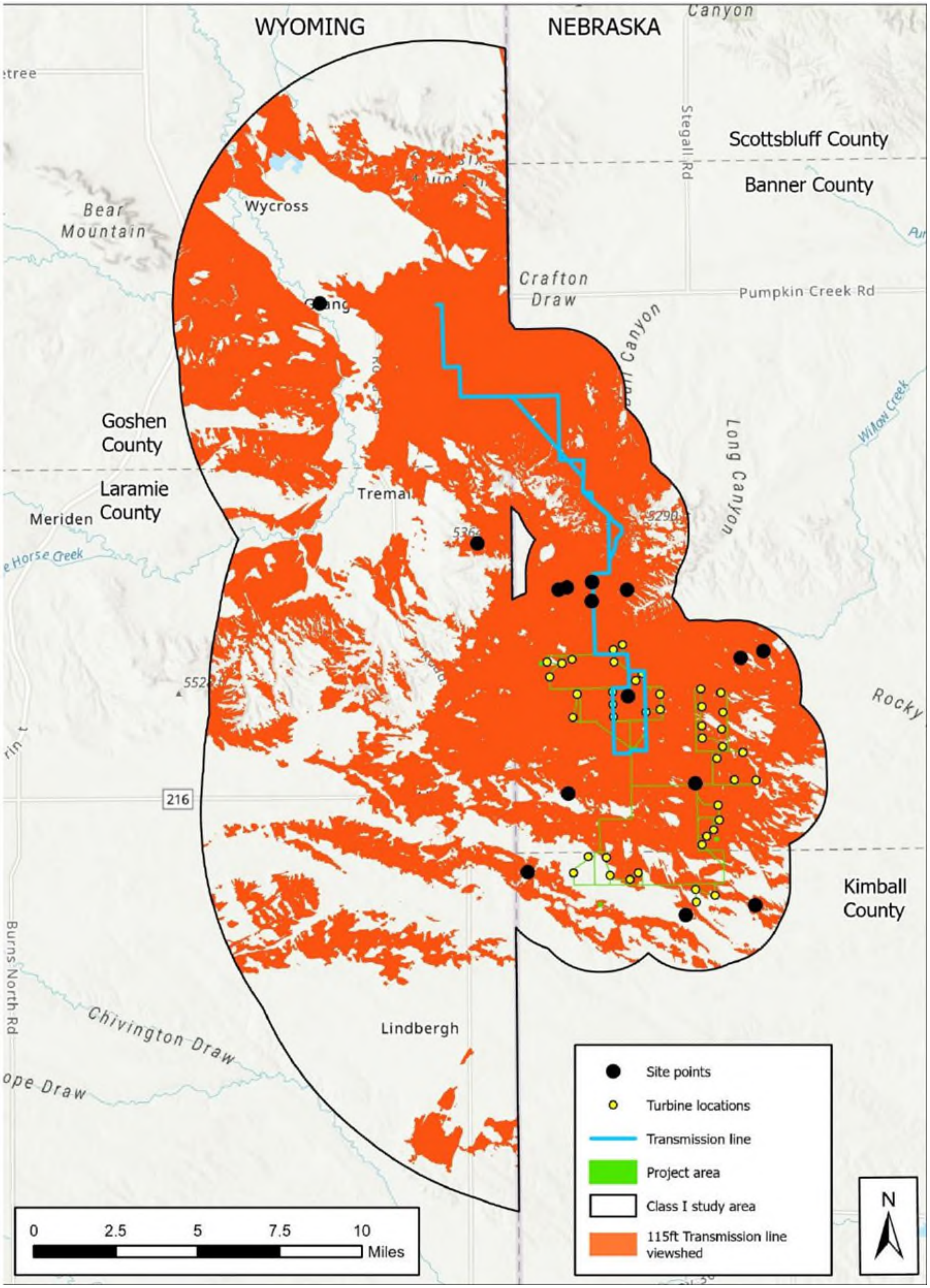

Figure 3-18. Viewshed map showing areas where the proposed transmission line is visible within the Class I Study area.

3.11.1 Environmental Consequences—Proposed Action

Based on the indicative layout of wind turbines, access roads, collector lines, and associated facilities, no residences or businesses would be displaced due to construction of the Project. Approximately 663 acres would be temporarily impacted by Project construction for up to 12 to 18 months. Following construction, approximately 93 acres would be used for long-term operations of the Project and approximately 570 acres would be returned to pre-construction land uses, which primarily consist of cultivated crops, herbaceous vegetation, and developed open space. There may be some improvements to gravel roads and temporary impacts to local roads during the construction phase of the Project, as required. Improvements could include adding gravel, widening, and repairing potholes. The Project will seek to obtain road haul agreements with Banner, Kimball, and Goshen counties and to minimize and mitigate the impacts to area transportation.

Project operation would have minimal long-term impacts on agricultural land. Agricultural activities could occur up to the edge of access roads and turbine pads. Access roads and turbine pads would not be fenced off, except for gates/cattle guards installed in landowner fences. Livestock and the landowners would be able to cross access roads and move about unimpeded. The buried underground collector system would not alter agricultural activities in the long term. Decommissioning impacts would be the same as those described for the construction phase.

3.11.2 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed; therefore, there would be no direct or indirect impacts on public lands from the Project. Ongoing land uses and existing activities (e.g., agricultural operations) would likely continue to result in the same type and level of impacts to the public lands as currently exists.

3.12 Transportation

The scope of the transportation analysis area includes the roads that access the Project and new and/or existing roads within the Project. The wind turbine site would be accessed from Banner CR-6, CR-14, and CR-15, by way of I-80 and SR-71, or other roads identified in the Transportation Plan. The Project would connect the turbine substation to the electric grid, with the point of interconnection located at a proposed WAPA switchyard. The switchyard is expected to be located near Wyoming State Hwy 151/NE, SR-88, and 2.5 mi west of CR-40. The substation would be located approximately 1.25 mi north of CR-6, adjacent to CR-9. The closest community is Harrisburg, Nebraska, approximately 12.00 mi northeast of the Project.

Based on the indicative layout, it is estimated that there would be approximately 38.7 mi of access roads, of which approximately 16.4 mi would be new roads and 22.2 mi would be existing roads. Table 3-19 provides a list of roads likely to be used by the Project, including surface type, width, and number of lanes.

Table 3-19. Access roads within the Pronghorn Flats 115-kilovolt Project.

Road	Surface Type[1]	Surface Width[2]	Total Lanes[3]
SR-71	Asphalt	48 feet	4
SR-88	Asphalt	24 feet	2
CR-6	Gravel, crushed rock	24 feet	2
CR-7	Gravel, crushed rock	24 feet	2
CR-9	Gravel, crushed rock	18 feet	2
CR-10	Gravel, crushed rock	18 feet	2
CR-12	Gravel, crushed rock	18 feet	2
CR-13	Gravel, crushed rock	18 feet	2
CR-14	Gravel, crushed rock	24 feet	2
CR-15	Gravel, crushed rock	24 feet	2
CR-18	Gravel, crushed rock	24 feet	2
CR-40	Gravel, crushed rock	24 feet	2
CR-54	Gravel, crushed rock	24 feet	2
CR-56	Gravel, crushed rock	18 feet	2
Road 244	Gravel, crushed rock	24 feet	2

[1] Surface type was determined using available aerial imagery.

[2] Surface width was determined through geographic information system measurement using available aerial imagery, assuming a lane width of 12 feet for rural and high-speed municipal roadways.

[3] Where the total number of lanes was not obvious from aerial imagery, the number of lanes was determined based on surface width estimate.

CR = County Road, SR = State Route.

Sources: Nebraska Department of Transportation 2016, U.S. Census Bureau 2019.

The AADT flow for many roads is available from the NEDOT. Available AADT data for roads within the analysis area is presented in Table 3-20.

Table 3-20. Access roads within the Pronghorn Flats 115-kilovolt Project.

Road	AADT (Number of Trips)
SR-71	2,920
South CR-88	280
North CR-88	670
CR-14/17 Mile Road	30

CR = County Road, SR = State Route; AADT = annual average daily traffic.

Sources: Nebraska Department of Transportation 2020a, 2020b.

No airports are located within the analysis area. The closest airports within Nebraska are the Robert E. Arraj Field, located approximately 20 mi to the southeast, and the Western Nebraska Regional Airport William B. Hellig Field, located approximately 33 mi to the northeast. The nearest military air installation is the F. E. Warren Air Force Base (AFB) in Cheyenne, Wyoming, located approximately 43 mi west of the Project. The nearest air military installation in Nebraska is the Offutt AFB, south of Belleview, located approximately 417 mi east of the Project. The nearest Air National Guard installation is the Wyoming Air National Guard in Cheyenne, located approximately 43 mi west of the Project. The closest Air National Guard installation in Nebraska is the 155th Air Refueling Wing, located approximately 381 mi east of the Project at the Lincoln Municipal Airport in Lincoln.

3.12.1 Environmental Consequences—Proposed Action

Under the Proposed Action, construction would occur over a nine- to 14-month period for the indicative layout of 43 turbines and other components. However, with the potential additional five turbines, the Project would increase in size and, therefore, the construction period may be extended, but still within the 14-month total. Potential impacts to existing road use during Project construction are expected to be minor due to current relatively low AADT counts on roads within the analysis area. Other vehicle traffic would likely remain similar to current levels during the construction period, but could experience a decrease if the construction activity deters other travelers. At times, materials and equipment transportation to and from the Project may impede existing road use. Materials required for construction would be delivered by a variety of trucks, trailers, or other vehicles capable of transporting large and heavy loads.

Construction of the Project would bring, on average, 10 heavy truck loads of materials per wind turbine. Approximately, an additional 50 vehicles trips would be required during the earliest phase of construction. Up to approximately 75 personal vehicle trips would occur each day, assuming two passengers per vehicle. The emissions from this activity would not exceed air quality standards.

Project construction would require the temporary storage of materials, equipment, and parking for worker and delivery vehicles. The need for expanded storage, and the activities associated with developing staging areas could contribute to temporary constraint along road corridors. Project use of existing ROWs would be coordinated with appropriate state, county, and local authorities.

Long-term impacts to local transportation are expected to be comparatively minor. Visitation levels to the Project for O&M would not change substantially once Project construction is completed. Where roads were not improved for construction of the Project, no long-term detriment to existing roads would be expected.

The turbines and transmission lines would be constructed and operated in accordance with FAA regulations. No impacts to air traffic would be anticipated from the Project.

3.12.2 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed; therefore, there would be no direct or indirect impacts on roads or transportation from the Project. Existing traffic levels, patterns, and trends would likely continue. As land use in the area changes, so would the associated road use. Maintenance and repair of roads would occur based on existing plans.

3.13 Socioeconomics

The analysis area for socioeconomic impacts includes Banner and Kimball counties, Nebraska, and Goshen County, Wyoming. The closest community to the Project is Harrisburg, Nebraska, a census-designated community of approximately 65 residents, according to the 2018 American Community Survey 5-year estimates (U.S. Department of Commerce 2020).

The largest nearby communities to the Project include:

- Scottsbluff, Nebraska, located 50 mi northeast of the Project in Scotts Bluff County, with a population of 14,805
- Kimball, Nebraska, located 30 mil southeast of the Project in Kimball County, with a population of 2,762
- La Grange, Wyoming, 20 mi northwest of the Project in Goshen County, with a population of 361 (U.S. Department of Commerce 2020).

Between the years of 2010 and 2018, the population in Banner and Kimball counties dropped by 3.3% and 3.9%, respectively. However, the Nebraska state population grew at a rate of 5.9%. Similarly, the Wyoming state population grew by 6.6%; however, Goshen County grew at a rate of 4.6% during this same time period (U.S. Department of Commerce 2020).

The median age of residents in these three counties is approximately 46 years; Banner County has the highest median age of 48.5 years. The median age in these counties is older than in the states of Nebraska (36.4 years) and Wyoming (37.3 years), and the U.S. population (37.9 years). See additional information on race, ethnicity, and income level in Section 3.14 (Environmental Justice).

The following economic and financial statistics, unless otherwise noted, are provided by Headwater Economics' Economic Profile System (Headwaters Economics 2019), which uses published statistics from federal data sources, including the U.S. Department of Commerce and the U.S. Department of Labor, Bureau of Labor Statistics.

In 2018 in the analysis area, the three, industry sectors providing the largest number of jobs were government (1,994 jobs), farming/agricultural (1,557 jobs), and healthcare and social assistance (968 jobs; Figure 3-19). From 2001 to 2018, the three industry sectors that added most new jobs were government (224 new jobs), finance and insurance (156 new jobs), and transportation and warehousing (147 new jobs). From 2001 to 2018, jobs in service-related industries grew from 5,041 to 5,194 (a 3% increase) and government jobs grew by 13% (from 1,770 to 1,994). Employment in Banner County consists of 41.6% agricultural jobs, including livestock production. This is a significantly higher rate of agricultural employment than the other counties in the analysis area and the state average.

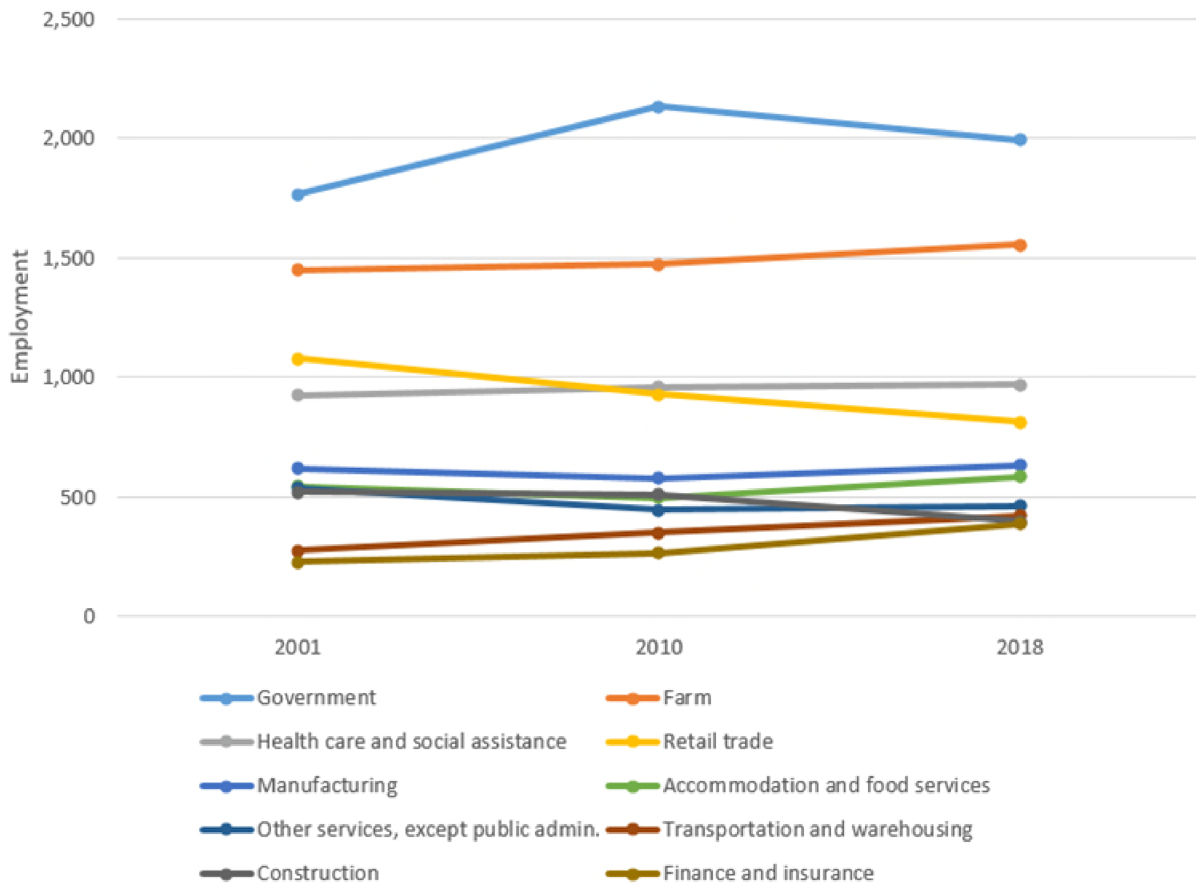

Figure 3-19. Employment by industry for the analysis area for the top 10 industries, 2001 to 2018.

Per capita incomes for the analysis area and reference geographies are presented in Table 3-21. Incomes in Banner County are higher than the state and U.S. averages. However, incomes in Kimball County, Nebraska, and Goshen County, Wyoming, are lower than the respective state averages. See additional information on poverty levels in Section 3.14 (Environmental Justice).

Unemployment is defined as the number of people who are jobless, looking for jobs, and available for work. The unemployment rate of residents across the analysis area is relatively consistent, with Kimball County having the lowest unemployment rate at 2.6% in 2018. For the three combined counties, unemployment peaked in 2009 during the Great Recession at just over 5% and has steadily dropped since to pre-recession levels.

Table 3-21. Income characteristics in the socioeconomic analysis area, 2018.

Income Characteristic	Goshen County, Wyoming	Banner County, Nebraska	Kimball County, Nebraska	Nebraska	Wyoming	US
Per capita income	$43,348	$58,252	$44,069	$53,263	$60,361	$54,446
Unemployment rate	3.3%	3.4%	2.6%	2.8%	4.1%	3.9%
Agricultural employment	12.7%	41.6%	15.9%	4.1%	3.6%	1.3%

Sources: U.S. Bureau of Economic Analysis (2019), U.S. Department of Commerce (2019), U.S. Bureau of Labor Statistics (2019a), as reported by Headwater Economics (2019).

3.13.1 Environmental Consequences—Proposed Action

Environmental commitments for air quality, noise, visual resources, and health and safety would apply to the analysis area. Specific socioeconomic environmental commitments are not identified for the Project.

The Project is expected to create both short-term and long-term beneficial impacts to the local and state economies. Short-term impacts to employment and socioeconomics would result from direct payments to landowners who host turbines, construction and maintenance activities, and eventually from decommissioning activities. Local businesses in nearby communities, such as restaurants, grocery stores, hotels, and fuel stations, would likely see increased business from construction-related workers. Local industrial businesses, including aggregate and concrete suppliers, welding and industrial suppliers, hardware stores, automotive and heavy equipment repair services, electric contractors, and maintenance providers, would also likely benefit from construction of the Project.

The Project would generate direct economic benefits for local landowners, local counties, and the states of Nebraska and Wyoming over the 30-year life of the Project. Wind lease payments to all landowners hosting wind turbines would be approximately $500,000 annually, on average. Nebraska has a centralized assessment method for wind turbines assessed by the Nebraska Department of Revenue, but proceeds are paid to the county treasurer where the facility is located. Additionally, counties assess the roads, turbine pads, and O&M buildings separately. Based on the nameplate capacity tax of $3,518/MW, the Project would have a Nebraska state assessment of approximately $404,570 per year if 115 MW are commissioned (https://nebraskalegislature.gov/laws/statutes.php?statute=77-6203). Additional benefits include county assessments, as well as local spending on O&M needs, such as automotive repair, tires, and fuel.

Construction of the Project would require skilled labor, such as foremen, ironworkers, electricians, and heavy equipment operators, as well as unskilled laborers. This diverse workforce would be needed to install the Project components, including wind turbines, access roads, underground collector lines, an O&M building, switchyard, 115-kV transmission line, and Project substation. More specialized jobs would likely be recruited from across the country, while laborers and truck drivers could be hired locally as temporary positions. The Project is expected to employ approximately 80 to 150 temporary workers over the 9- to 14-month construction period, and approximately four to six full-time employees for the life of the Project. The construction period would range from approximately 115,200 to 336,000 temporary full-time worker hours and 5,760 to 13,440 full-time worker hours for permanent positions annually, based on a 40-hour work week. The estimated number of construction jobs by classification and annual employment expenditures during construction are included in Table 3-22.

Table 3-22. Anticipated construction-related positions and employment expenditures.

Job Classification	Estimated Annual Salary
Electricians (47-2111)	$46,100
Truck drivers (53-3033, 53-3032)	$37,940–$45,890
Engineers (47-2073)	$39,410
Construction management (11-9021)	$112,180
Ironworkers (47-2221)[1]	$40,320
Laborers (47-2061)	$34,730
Turbine commissioning specialist (49-9081)[2]	$58,000

[1] Exact numbers are not available for regional data. State average is used.

[2] National average.

Source: U.S. Bureau of Labor Statistics 2019b.

After construction is complete and the Project is commissioned, the number of employees needed to operate and maintain Project components would be substantially less than required for construction (Table 3-23). Although many of the construction employees would likely come from outside the analysis area, long-term O&M employees may be, or become, local residents. Due to the relatively small size of the development, one of the O&M technicians would also be the Site and Health & Safety Manager.

Table 3-23. Anticipated operation-related positions and employment expenditures.

Job Classification	Estimated Annual Salary
Turbine Operation and Maintenance Technicians (49-9081)[1]	$58,000

[1.] National average.

Source: U.S. Bureau of Labor Statistics 2019b.

3.13.2 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed; therefore, there would be no direct or indirect impacts on socioeconomic conditions from the Project. Ongoing land uses and existing activities (e.g., agricultural operations) would likely continue to contribute to local and state economies at a similar level.

3.14 Environmental Justice

The analysis area for environmental justice impacts includes Goshen County, Wyoming, and Banner County and Kimball County, Nebraska. Demographic data is collected by census tract;

however, Banner and Kimball counties, Nebraska, are included in only one census tract. Therefore, this analysis includes reporting for both Banner and Kimball counties. Census Tract 9580 (U.S. Department of Commerce 2020) is used for the analysis area in Goshen County, Wyoming. Tables 3-24 and 3-25 summarize minority and low-income population data in the analysis area and the reference geographies of Goshen County and the States of Wyoming and Nebraska, based on a 5-year estimate for 2014 to 2018 (U.S. Department of Commerce 2019, 2020).

Low-income populations are determined by the U.S. Census Bureau based upon poverty thresholds developed each year. Unlike minority populations, the CEQ does not provide specific criteria for assessing effects to low-income populations. The populations in the analysis area geographies are mostly white (between 97.6% and 95.1%) and not Hispanic (between 94.0 and 89.2 %). In the States of Wyoming and Nebraska, a slightly smaller proportion of the population was white (91.4% and 87.5%, respectively) and not Hispanic (90.2% and 89.3%, respectively).

Table 3-24. Minority populations (American Community Survey 5-Year Estimate, 2014 to 2018).

Location	Total Population	Percent Minority[1]	Percent Hispanic
Goshen County, Wyoming	13,438	6.9	10.6
Census Tract 9580	2,556	3.9	10.8
Banner County, Nebraska	696	2.4	6.0
Kimball County, Nebraska	3,667	4.9	10.7
State of Wyoming	581,836	8.6	9.8
State of Nebraska	1,904,760	12.5	10.7

[1] Minority data are calculated by adding the populations for all non-white races.

Sources: U.S. Department of Commerce 2019, 2020.

The analysis area geographies report between 9.5% and 12.1% of individuals below the poverty level (Table 3-25). In Wyoming, the percentage of residents below the poverty level overall poverty level (11.1%) is slightly lower than Goshen County (Census Tract 9580); however, in Nebraska, the percentage of residents below the poverty level (11.6%) is slightly higher than Kimball and Banner counties (U.S. Department of Commerce 2019, 2020).

Table 3-25. Low-income populations (American Community Survey 5-Year Estimate, 2014 to 2018).

Location	Total Population for whom Poverty Status is Determined[1]	Percentage of Residents Below the Poverty Level
Goshen County, Wyoming	12,849	11.6
Census Tract 9580	2,449	12.1
Banner County, Nebraska	694	9.7
Kimball County, Nebraska	3,608	9.5
State of Wyoming	567,950	11.1
State of Nebraska	1,850,245	11.6

[1] Poverty status is determined for all people except those institutionalized, in military group quarters, in college dormitories, and unrelated individuals less than 15 years old. The total population in the poverty table is slightly smaller than the overall population.

Sources: U.S. Department of Commerce 2019, 2020.

As indicated in Table 3-21 and 3-22, the percentages of minority and low-income residents in the analysis area do not exceed 50%, nor do they exceed county or state levels by greater than 20 percentage points. Therefore, according to CEQ guidance (1997), no environmental justice populations reside in the analysis area.

3.14.1 Environmental Consequences—Proposed Action

Environmental requirements and commitments for air quality, noise, visual resources, and health and safety would apply to the entire residential population in the vicinity of the Project, including any minority or low-income residents. Separate environmental justice environmental commitments are not identified.

No distinct minority or low-income populations have been identified in the analysis area; thus, no disproportionately high and adverse human health or environmental effects are expected from construction, O&M, or decommissioning of the Project.

3.14.2 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed; therefore, there would be no direct or indirect impacts on environmental justice from the Project. Ongoing land uses and existing activities (e.g., agricultural operations) would likely continue. The trend toward conversion of undeveloped land to agriculture would likely continue, and these types of activities would not be expected to result in an environmental justice impact.

3.15 Health and Safety

The following sections describe electric and magnetic fields (EMFs) and physical hazards in the analysis area.

3.15.1 Electric and Magnetic Fields

Natural and man-made sources of EMFs are commonplace in the U.S. and exist within the analysis area. Electric fields exist wherever an electric charge exists. A magnetic field exists when that charge is in motion (i.e., the flow of electrons to produce an electric current). Man-made sources include fossil fuel power plants, wind farms, substations, and power lines, as well as ordinary household appliances such as hairdryers, electric shavers, computers, wireless networks, cell phones, microwaves, and remote controls. The strength of an EMF decreases substantially with increasing distance from the source (National Institute of Environmental Health Sciences [NIEHS] 2018).

Potential health effects from EMF have been extensively studied (NIEHS 1999, World Health Organization 2007). The studies found a weak correlation between EMF exposure and a slightly increased risk of childhood leukemia. Studies that have been conducted on adults show no evidence of a link between EMF exposure and adult cancers, such as leukemia, brain cancer, and breast cancer (NIEHS 2018).

There are currently no federal or state regulations on maximum EMF intensity. However, the International Commission on Non-ionizing Radiation Protection (ICNIRP) and the Institute of Electrical and Electronics Engineers (IEEE) have issued guidelines for exposure to EMF (ICNIRP 1998, IEEE 2002).

3.15.2 Physical Hazards

The analysis area is subject to physical safety hazards typical of a rural agricultural area, such as storms and vehicle accidents. In addition, wind turbines can present physical safety hazards including ice buildup on a blade that is then thrown off, and the potential of a rotor blade breaking and parts being thrown off. Blade throw historically has rarely occurred and ice throw occasionally occurs in the winter/spring months.

3.15.3 Environmental Consequences—Proposed Action

3.15.3.1 Electric and Magnetic Fields

EMFs can exist within substations and switchyards of the wind farm and along the 115-kV transmission line. The substation and switchyard locations would be located on private property and are not accessible to the general public; however, the public would have greater accessibility to 115-kV transmission line-related locations because some locations would be located on public ROWs or accessible for agricultural uses. The USEPA recommends limiting exposure to 0.5 milliGauss (mG) to 2.5 mG (USEPA 1992).

EMF levels decrease sharply with increasing distance. As Table 3-26 shows, the magnetic field of a sample 115-kV transmission line decreases by 97% (from 1.0 to 0.07-kV) at 100 ft away from the transmission line.

Table 3-26. Example EMF Levels with increasing distance from a power transmission line.

Transmission Line Voltage (kV)	Electric Field (kV)[a]				Average Magnetic Field (mG)[a]			
	At the Source	100 Feet Away	200 Feet Away	300 Feet Away	At the Source	100 Feet Away	200 Feet Away	300 Feet Away
115	1.0	0.07	0.01	0.003	29.7	1.7	0.4	0.2

EMF = electric and magnetic fields, kV = kilovolt, mG = milliGauss.

Source: Bonneville Power Administration 1994.

The nearest occupied residence/building to the centerline of the primary 115-kV transmission line route would be approximately 155 ft away; thus, the EMF exposure would be less than 1.0 mG at the closest residence, based on data extrapolated from Table 3-26.

3.15.3.2 Physical Hazards

As with any wind farm, the Project would present potential risks from natural disasters (e.g., earthquakes, storms), mechanical failure, human error, sabotage, cyber-attack, or deliberate destructive acts. The Project would not present unusual intrinsic system vulnerabilities or especially high potential for an event or threat. Thus, the proposed Project is not anticipated to be at an unusual risk for natural disasters, mechanical accidents, or acts of sabotage or terrorism during Project construction, O&M, or decommissioning.

Project wind turbines could potentially have a rotor blade break and be thrown from the turbine. Historically, blade breakage is a relatively rare event, and the probability of a fragment hitting a person is even lower (Hau 2000, Manwell *et al.* 2002). Current quality control standards for utility-scale wind turbine manufacture suggest that blade throw will continue to be a relatively rare occurrence.

Project wind turbines also could potentially throw ice from a rotating blade. Ice throw is a rare event because either ice pieces simply fall down off a blade or turbine control software triggers a turbine to stop rotating if ice buildup occurs. Contemporary turbine design limits the extent to which ice buildup can occur because as ice begins to form, blade balance would be altered, and monitoring devices would stop the blade rotation. Thus, ice throw also will likely continue to be a rare occurrence. To further lessen the potential for ice throw, wind farms establish a safety zone or setback from residences, roads, and other public access areas; such safety zones are often required by permitting agencies (Manwell *et al.* 2002). The suggested setback for the turbine model proposed for the Project, which will include turbine control software to control for ice throw, is 1.1 times tip height (GE Renewable Energy 2018).

Project construction and decommissioning activities would not generate risk from rotor blade break or ice throw because the turbine blades would not be moving.

3.15.4 Environmental Consequences—No-action Alternative

Under the No-action Alternative, WAPA would not provide an interconnection and it is assumed the Project would not be developed; therefore, no specific Project-related health or safety concerns would occur within the analyzed area. Ongoing land uses and existing activities (e.g., agricultural operations) would likely continue. The trend toward conversion of undeveloped land to agriculture would likely continue, and other health or safety impacts could occur because private landowners can choose to develop agricultural or undeveloped properties for more intensive land uses.

4.0 CUMULATIVE IMPACTS

Cumulative impacts are those that result from incremental impacts of a project when added to other past, present, and reasonably foreseeable future actions within the vicinity of a Proposed

Action. Cumulative impacts can result from individually minor, but collectively significant actions that take place over a period of time.

Past, present, and reasonably foreseeable future actions are considered in the general context of the Proposed Action for Kimball and Banner counties, Nebraska, and Goshen County, Wyoming. The area surrounding the Project is primarily under private ownership with scattered state lands. The past and present actions consist mostly of agricultural production. It is reasonable to assume these practices will continue into the future and maintain the current conditions. One existing wind project, the Kimball Wind Project, is located slightly north of Kimball, Nebraska, which is approximately 30 mi from the proposed Project. As for foreseeable future actions, there are two wind energy developments under consideration in the vicinity of the Project, including the Orion Energy 230-kV project and the Invenergy LLC project.

The proposed Orion 230-kV project is part of the Pronghorn Flats Wind Complex (Chapter 1.0). The 230-kV project would be developed in close proximity to the 115-kV project, but would pursue a different interconnection agreement with WAPA; thus, it would be evaluated in a subsequent NEPA process. The development of the 230-kV project would have additional temporary and long-term impacts similar to those described for the Proposed Action.

The Invenergy LLC project is projected to be a 500 MW project utilizing between 150 and 200 turbines located in Banner County, Nebraska. As of fall 2020, it is uncertain what transmission line this project would connect with to deliver the energy. If there is an interconnection with WAPA, the project would undergo a NEPA process. It is anticipated that many of the temporary and long-term impacts described for the 115-kV project would occur in the development and operation of the Invenergy LLC project.

The greatest impact to the public would likely be the visual impact from these three projects. Each of these projects would contribute an incremental shift from a rural landscape to one with vertical structures. However, due to the predominantly private property ownership of the area, the visual impacts would occur to scattered residents in the area and travelers on CRs and Hwys.

With the implementation of BMPs and Avoidance and Minimization Measures, the Proposed Action would avoid or minimize potential impacts and not measurably contribute to cumulative effects on resources from other past, present, and reasonably foreseeable future actions.

5.0 COORDINATION

5.1 Public Scoping

To engage potential stakeholders and request concerns regarding the proposed Project, WAPA and Orion have conducted two public scoping efforts by publishing announcements in the local papers, mailing letters to landowners and federal and state agencies, and posting notices on the WAPA website.

Comments from the public and agencies were submitted by mail, email and phone. Each comment was reviewed, considered, and responded to. A summary of comments is provided in Appendix F. All the comments helped define the scope and analysis presented in this EA.

This EA was presented to the public for review from April 7, 2022 through May 7, 2022. Announcement for this review was published in three local papers, emailed to applicable federal and state agencies, and notices posted on the WAPA website. No comments were received on this EA.

5.2 Federal Agencies

The federal agencies that were contacted for the purpose of the EA scoping process are:

- F. E Warren AFB, Cheyenne, Wyoming
- U.S. DOE WAPA Rocky Mountain, Loveland, Colorado
- USFWS, Region 6, Ecological Services, Lakewood, Colorado
- USEPA, Office of Intergovernmental Affairs-Office of the Regional Administrator

5.3 State and Local Agencies

The state and local agencies that were contacted for the purpose of the EA scoping process are:

- Banner County Clerk's Office, Harrisburg, Nebraska
- Banner County Commissioner, Harrisburg, Nebraska
- Nebraska Department of Environment and Energy, Lincoln, Nebraska
- Nebraska Department of Natural Resources, Lincoln, Nebraska
- Nebraska SHPO, Lincoln, Nebraska
- NGPC, Lincoln, Nebraska
- Nebraska State Historical Society, Lincoln, Nebraska
- Office of Governor Mark Gordon, Cheyenne, Wyoming
- WGFD, Cheyenne, Wyoming
- Wyoming State Parks and Cultural Resources, Cheyenne, Wyoming
- Wyoming SHPO, Cheyenne, Wyoming

5.4 Native American Tribes and Associated Bodies

5.4.1 Tribal Consultation

As the lead federal agency under the NEPA and NHPA Section 106 review and per the agency's government-to-government consultation responsibility, WAPA contacted Native American tribes to identify locations of traditional or cultural importance within the Project vicinity of the proposed Project. None of the tribes expressed interest in consulting on the proposed project. On 9/30/21, the Pawnee Nation notified WAPA that "the proposed project/s should not affect the cultural landscape of the Pawnee Nation." Tribes that were contacted included:

- Shoshone-Bannock Tribes, Fort Hall Reservation and Cultural Resources/Heritage Tribal Office
- Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation
- Cheyenne River Sioux Tribal Council
- Santee Sioux Nation of Nebraska
- Yankton Sioux Tribe
- Crow Creek Sioux Tribe of the Crow Creek Reservation
- Crow Creek Reservation
- Oglala Sioux Tribal (OST) Council
- OST Cultural Affairs and Historic Preservation Office
- Lower Brule Sioux Tribe
- Sisseton-Wahpeton Oyate Tribes
- Rosebud Sioux Tribe
- Northern Arapaho Tribe
- Eastern Shoshone Tribe of the Wind River Reservation
- Cheyenne and Arapaho Tribes
- Pawnee Nation of Oklahoma

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Appendix A. Technical Memorandum: Aquatic Resources Inventory at the Pronghorn Flats 115-kilovolt Wind Project, Western Ecosystems Technology, Inc.

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TECHNICAL MEMORANDUM

Date: November 5, 2020

To: Steve Blazek, Western Area Power Administration

From: Melissa Welsch, WEST, Inc.

Subject: Aquatic Resource Inventory

INTRODUCTION

Orion contracted Western EcoSystems Technology, Inc. (WEST), to conduct a ground-level assessment of potential wetlands and waters for the Pronghorn Flats Wind Energy Project (Project; formerly known as Banner County), located on approximately 11,395 acres (ac) in Banner County, Nebraska (Figure 1). The Project will consist of up to 132 wind turbine generators plus two transmission lines (115 kilovolt [kV] and 230 kV) connected to the electric grid, as well as associated infrastructure (i.e., operations and maintenance facility, access roads, underground collector lines, and project substations). Land use at the Project is livestock grazing along the transmission line, including in the canyon area known as Bull Canyon, and cultivated agriculture in the turbine area. The Project may contain aquatic resources considered jurisdictional by the U.S. Army Corps of Engineers (Corps) and provided regulatory protection under the Clean Water Act. The State of Nebraska has no state regulations on wetlands; however, they do have a voluntary regulatory program (see Wetland Program Plan for Nebraska, 2019-2023 Update [Nebraska Game and Parks Commission 2019]). This program allows the applicant to work with Nebraska to avoid a violation of state water quality standards.

The purpose of this memo is to provide results of a formal aquatic resource inventory conducted at the Project, which may be used to support future project planning.

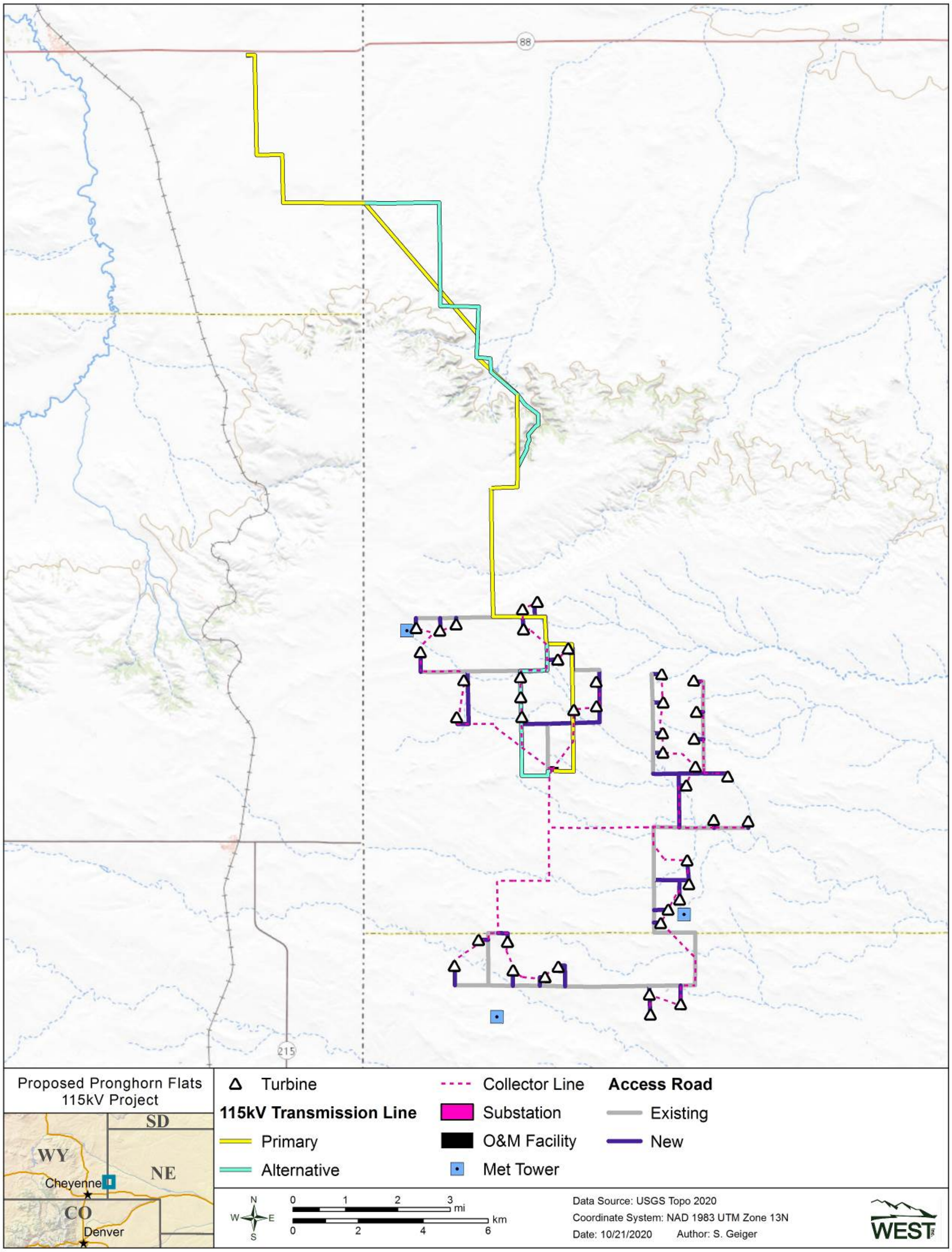

Figure 1. Location of the proposed Pronghorn Flats Wind Energy Project in Banner County, Nebraska.

METHODS

Prior to conducting fieldwork, a review of all potential aquatic resources intersecting the Project infrastructure (i.e., United States [US] Fish and Wildlife Service National Wetlands Inventory [NWI], US Geological Survey National Hydrography Datasets [NHD], and aerial signatures) was completed by visually assessing the project layout from May 27, 2020, on Google Earth satellite imagery, along with NWI and NHD layers. Any location of potential wetlands and waters were recommended for field surveys. These areas included locations where potential features overlapped proposed infrastructure and the associated buffer area of footprint, which is as follows: 150-foot [ft] wide corridor centered on transmission line, 75 ft corridor centered on wind access roads, 328 ft radius around turbine locations, 7.5 ft corridor centered on collection lines).

Wetlands were delineated in accordance with the 1987 Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains (Version 2.0; USACE 2010). The 1987 manual outlines a three parameter approach for an area to be considered a wetland, in which all three parameters must be met. Hydrophytic plants must be the dominant vegetative cover, hydric soils must be present, and wetland hydrology must be present.

All drainage features were evaluated to determine if they are potential waters of the U.S. (WUS). Potential WUS are defined by the presence of an ordinary high water mark (OHWM). The Corps regulations define OHWM as the line on the shore or waterway established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the banks, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas (USACE 2005).

Field surveys were conducted on June 4-5, 17, and 23, 2020. Sample points were established at each suspected wetland, and the Corps regional data forms were completed for each sample point via the Wetforms application on a tablet. Paired sample points (i.e., upland and wetland) were examined for potential wetlands, as appropriate. In most cases, upland sample points were named w-mw-###_u and wetland sample points were named w-mw-###_w. Each delineated wetland was assigned a unique identifier similar to the sample point naming (w-mw-###). A new wetland identification number was assigned for each wetland observed. Photographs were taken to document general site conditions and sample points. Wetland limits and sample points were surveyed using a Trimble R1 GNSS Receiver (global positioning system [GPS]) with sub-meter accuracy paired with the Arc Collector software application on a tablet.

For areas that met waters criteria, a polygon or line (representing the centerline) was captured in ArcCollector. The water type (e.g., stream or open), regime, width, and other relevant characteristics were recorded.

If wetland or water conditions were not present at the pre-determined assessment areas a “no-point” was captured on the ArcCollector tablet (e.g. no-mw-###) and photos were taken. In some cases the NHD/NWI feature as presented on Arc Collector did not match field conditions. In these situations, no-points were collected at the nearest lowest elevation location (e.g. closest swale) since that was a more logical location for any potential feature.

RESULTS

Three wetlands were delineated in the survey area and six sample points were collected (Figures 2-3; Table 1; Appendices A-B). All wetlands were palustrine emergent (PEM) within linear drainages. Wetlands w-mw-002e and w-mw-003e occur at different locations along the same drainage. This area appears to receive ephemeral flow from the nearby bluffs. Wetland w-mw-001e also receives water from an overflowing stock tank fed by a groundwater pump. Wetland features were delineated along both the proposed and alternate routes of the transmission line. The wetlands were of relatively high quality: they contained clear water, diverse plant species, no aggressive invasive plant species, frogs, and many tadpoles and dragonflies.

Six linear water features were identified in the survey area of which four were in the main section of Bull Canyon and determined to be intermittent streams, while two were in a side branch of Bull Canyon and are part of an ephemeral stream (Table 2; Figures 2 and 4; Appendix C). The features were 3-6 feet in width. Two intermittent stream features in the survey area were each bisected by a culvert under a road and are labeled in Figure 4 (s-mw-001 and s-mw-003). All stream features were along the alternative route of the proposed transmission line except s-mw-005. One ephemeral open water feature was delineated outside the survey area, but within a few feet of the proposed wind infrastructure corridor (Figure 5).

Thirty-four no-points were collected at NWI and NHD mapped areas. These consisted of swales or low areas that were vegetated or in crop fields. All no-point locations lacked a defined bed and bank for waterbodies or lacked wetland characteristics. A revised layout was provided on August 25, 2020, after the field surveys were completed, and it was also reviewed on Google Earth in a similar fashion; no new potential features were identified as needing in-field verification.

Table 1. Wetlands and acreages delineated in the Pronghorn Flats Project survey area.

Wetland ID	Wetland Classification	Acres
w-mw-001e	PEM	0.11
w-mw-002e	PEM	0.15
w-mw-003e	PEM	0.08
Total		0.34

Table 2. Waterbodies and acreages delineated in the Pronghorn Flats Project survey area.

Waterbody ID	Waterbody Classification	Acres
s-mw-001	Intermittent	0.04[1]
s-mw-002	Intermittent	0.03
s-mw-003	Intermittent	0.07[1]
s-mw-004	Intermittent	0.04
s-mw-005	Ephemeral[2]	0.02
s-mw-006	Ephemeral[2]	0.01
o-mw-001	Ephemeral[2, 3]	0.04
Total Intermittent Features		**0.14**
Total All Features		**0.25**

[1] Excluding culvert section

[2] Ephemeral features are not considered waters of the United States (USACE and USEPA 2020), but they are presented here for reference.

[3] This waterbody is outside the survey area

CONCLUSIONS

Based on the infrastructure layouts provided in May and August 2020, three PEM wetlands totaling 0.34 acres were delineated in the survey area in the transmission line section. Six linear water features were also delineated in the transmission section, located in Bull Canyon. The wetlands were collocated along the same drainage as the linear water features. One ephemeral depression was recorded outside of the survey area but within a few feet of the surveyed collection line corridor. Even though the depression is technically outside the survey corridor, it was included in results because the survey area used in this study is a representation of the project layout which could change in the future. No collected features have a clear connection to traditional navigable waters and therefore are likely not jurisdictional and would not be regulated by the Corps according to the recent final rule on the definition of ‘‘Waters of the United States,’’ finalized June 22, 2020 (USACE and USEPA 2020). All the features have intrinsic ecological value even if there is no regulatory coverage, especially the wetland features, given their relatively high ecological quality. If changes to permitting regulations occur, these features should be re-evaluated to see if their likely jurisdictional status changes and if additional discussion with the Corps is needed.

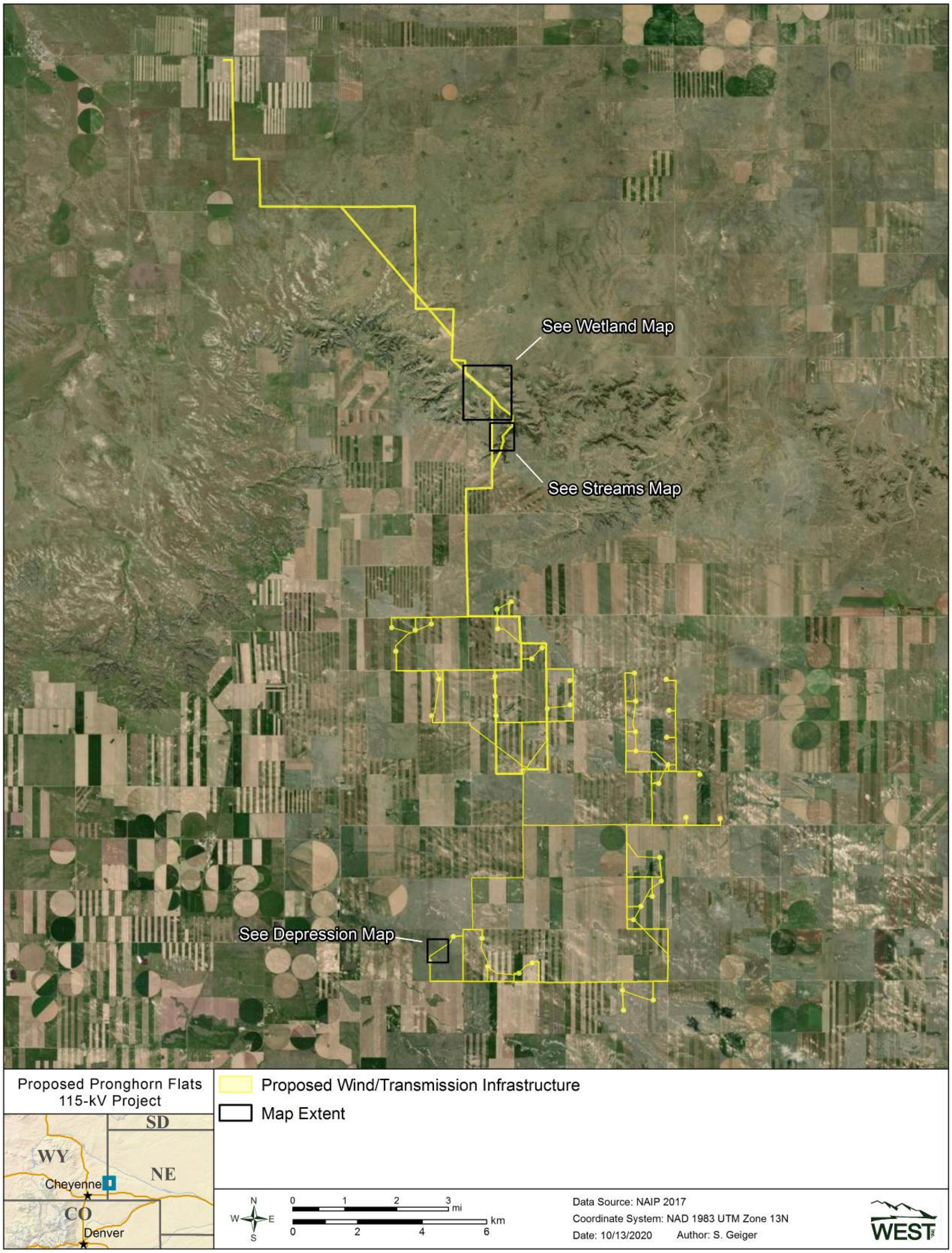

Figure 2. Overview of 2020 aquatic resources inventory for the Pronghorn Flats Wind Energy Project, Banner County, Nebraska.

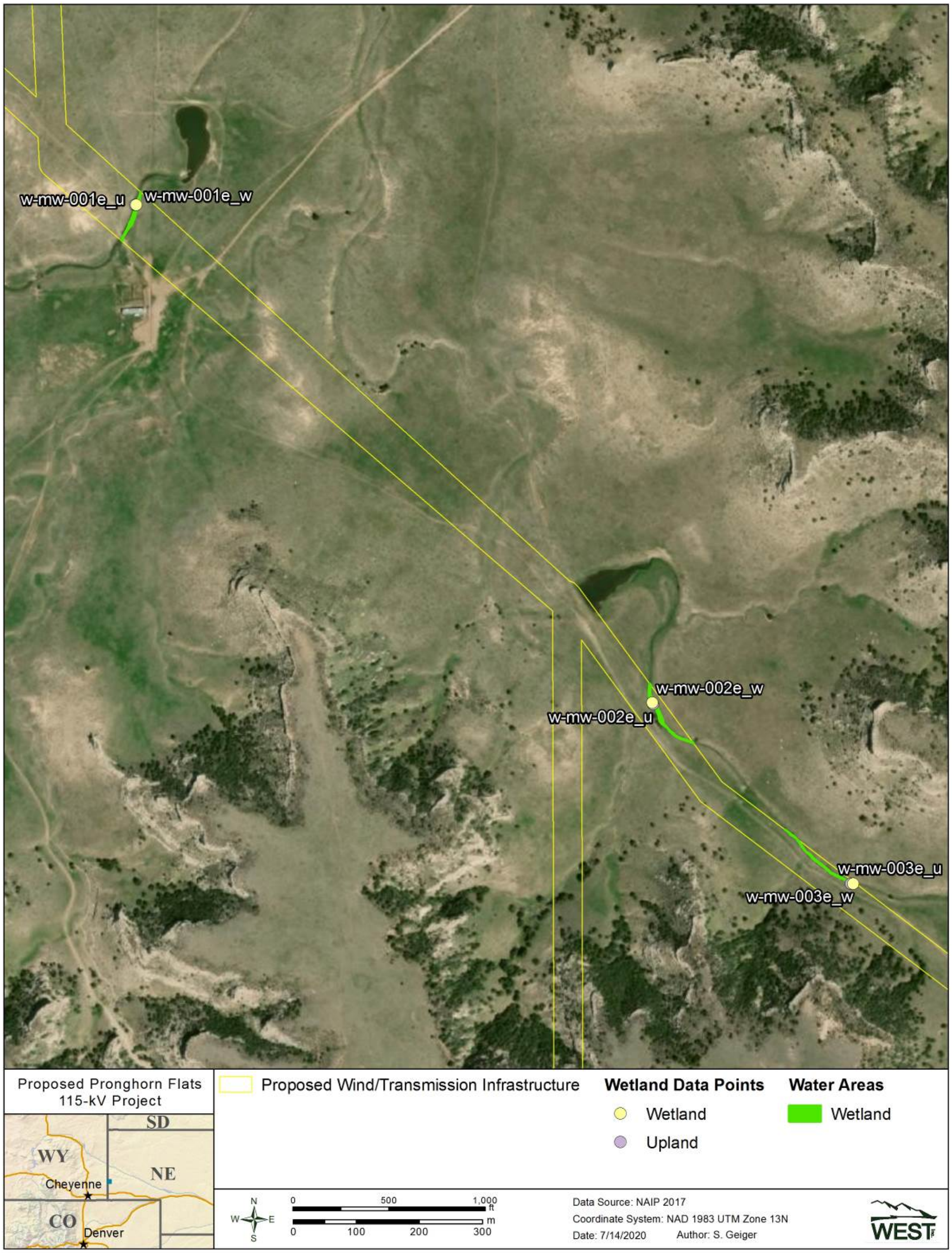

Figure 3. Wetland results for the 2020 aquatic resources inventory at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska, including Bull Canyon.

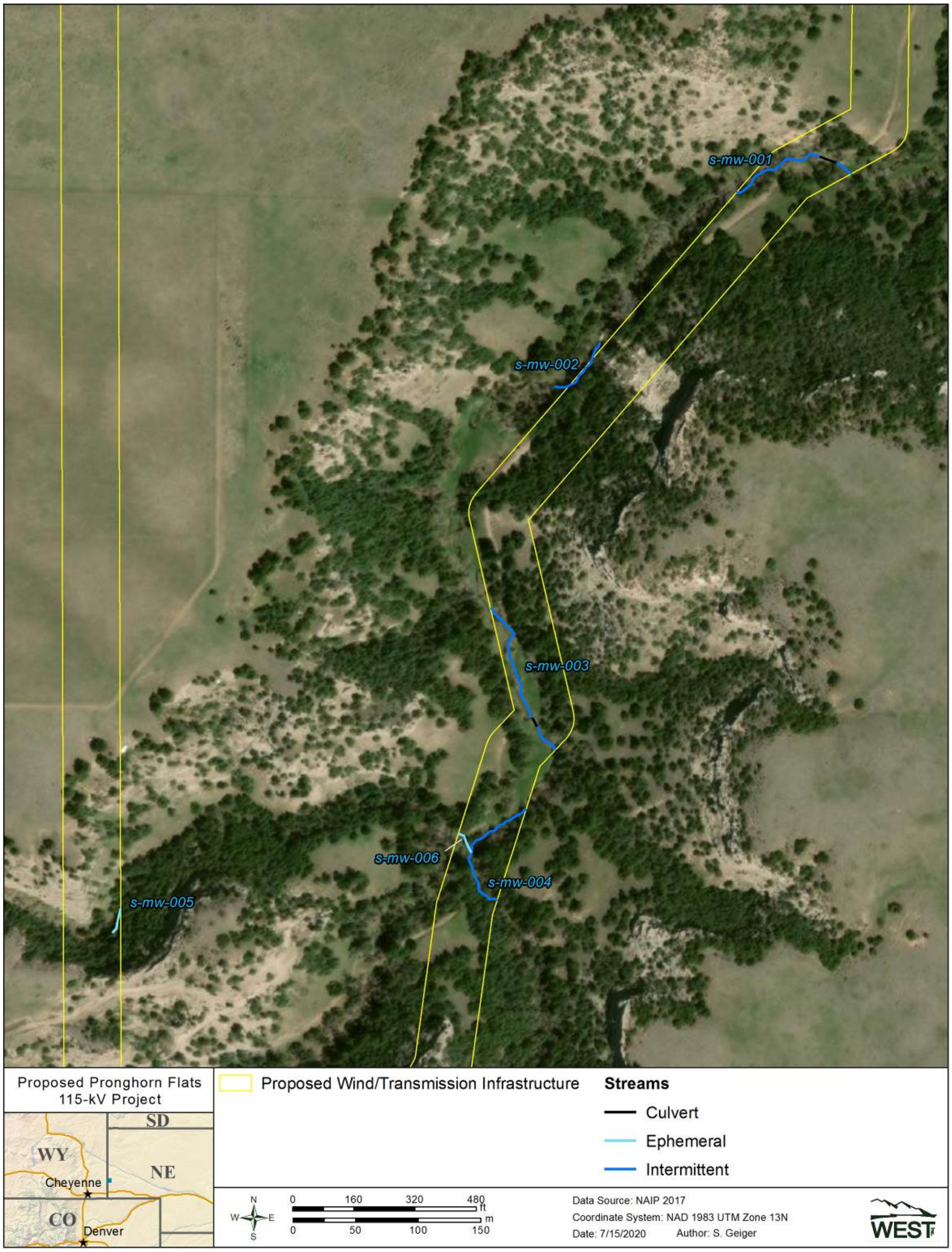

Figure 4. Linear waterbody results for the 2020 aquatic resources inventory at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska.

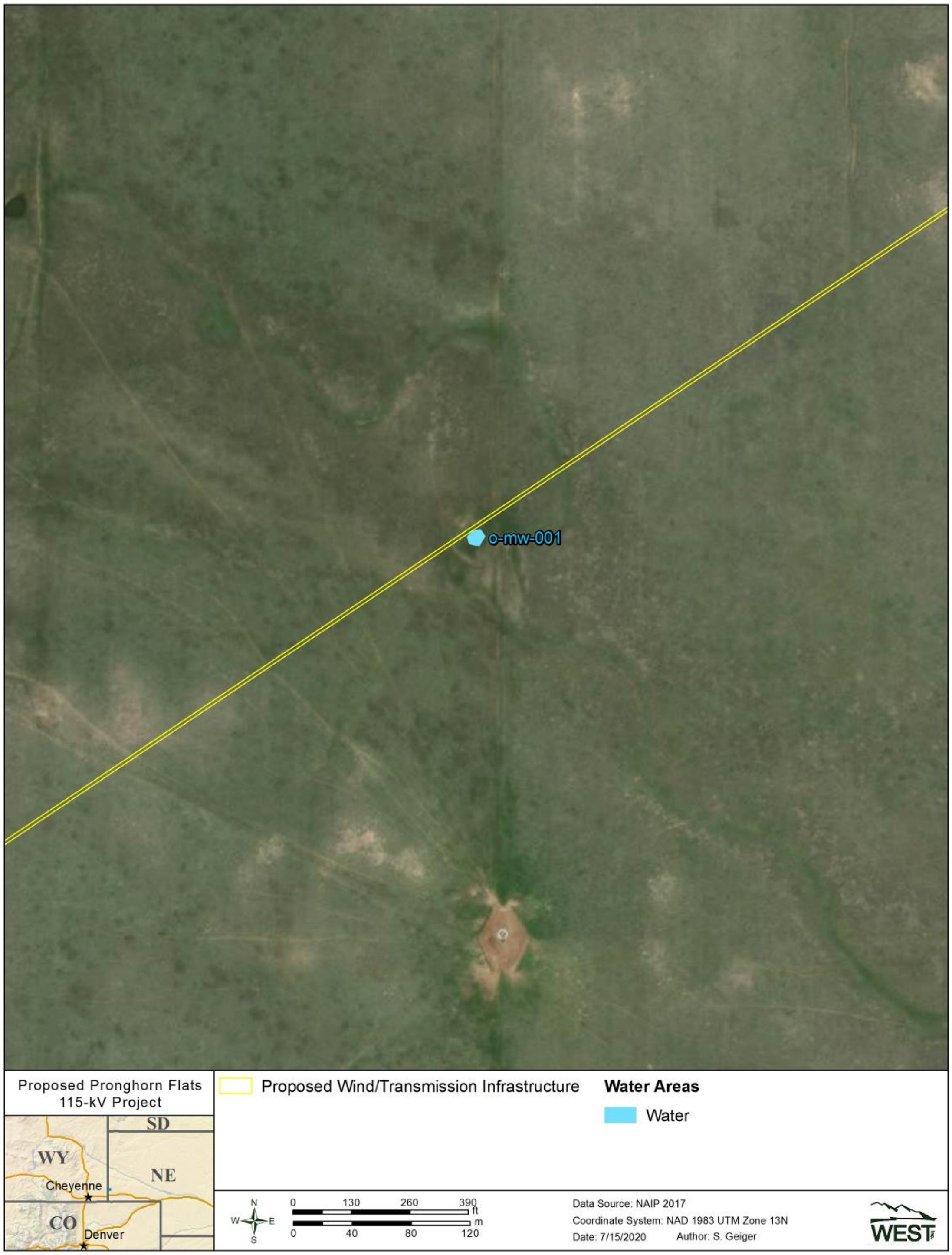

Figure 5. Waterbody polygon results for the 2020 aquatic resources inventory at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska. Feature o-mw-001 is outside survey corridor but within a few feet of corridor.

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APPENDIX A

Wetland General Conditions Photographs

w-mw-001e

Facing south

w-mw-002e

Facing south

w-mw-003e

Facing south

APPENDIX B
Regional Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM - Great Plains Region

Project/Site: Pronghorn Flats **City/County:** Banner County **Sampling Date:** 17-Jun-20

Applicant/Owner: Orion **State:** Nebraska **Sampling Point:** w-mw-001e_w

Investigator(s): MW **Section, Township, Range:** S 10 T 18N R 58W

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** concave **Slope:** 2.0 % / 1.1 °

Subregion (LRR): LRR G **Lat.:** 41.54781881 **Long.:** -104.00417534 **Datum:** WGS84

Soil Map Unit Name: Otero-Epping complex, 9 to 60 percent slopes **NWI classification:** PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ( )	**Is the Sampled Area within a Wetland?** Yes (•) No ( )
Hydric Soil Present?	Yes (•) No ( )	
Wetland Hydrology Present?	Yes (•) No ( )	

Remarks:
Meets wetland criteria.

VEGETATION - Use scientific names of plants

FWS Region: -1

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
1.	0	☐	
2.	0	☐	
3.	0	☐	
4.	0	☐	
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1.	0	☐	
2.	0	☐	
3.	0	☐	
4.	0	☐	
5.	0	☐	
	0	= Total Cover	
Herb Stratum (Plot size: 5ftx10ft)			
1. Carex nebrascensis	60	☑ 73.2%	OBL
2. Eleocharis palustris	20	☑ 24.4%	OBL
3. Schoenoplectus pungens var. pungens	2	☐ 2.4%	OBL
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
6.	0	☐ 0.0%	
7.	0	☐ 0.0%	
8.	0	☐ 0.0%	
9.	0	☐ 0.0%	
10.	0	☐ 0.0%	
	82	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.	0	☐	
2.	0	☐	
	0	= Total Cover	
% Bare Ground in Herb Stratum 18			

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	82	x 1 =	82
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	82 (A)		82 (B)

Prevalence Index = B/A = 1

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present.**

Hydrophytic Vegetation Present? Yes (•) No ( )

Remarks:

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: w-mw-001e_w

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR	3/2	100						Loam	
7-15	10YR	4/2	95	5YR	4/6	5	C	M	Loam	

1Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR F)
- ☐ 1 cm Muck (A9) (LRR F,G,H)
- ☑ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR F)
- ☐ Sandy Gleyed Matrix S4
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)
- ☐ High Plains Depressions (F16)
  (MLRA 72 and 73 of LRR H)

Indicators for Problematic Hydric Soils [3]:

- ☐ 1 cm Muck (A9) (LRR I, J)
- ☐ Coastal Prairie Redox (A16) (LRR F, G, H)
- ☐ Dark Surface (S7) (LRR G)
- ☐ High Plains Depressions (F16)
  (LRR H outside of MLRA 72 and 73)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☑ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Dry Season Water Table (C2)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
  (where not tilled)
- ☐ Presence of Reduced Iron (C4)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
  (where tilled)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☑ FAC-neutral Test (D5)
- ☐ Frost Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present?	Yes ◉	No ○	Depth (inches):	5
Water Table Present?	Yes ○	No ◉	Depth (inches):	0
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

leopard frogs, dragonflies

Plot ID: **w-mw-001e_w**

Photo Path: C:\WetForm\Pronghorn Flats\Photos\

Photo File: **20200617_1344** Orientation: -facing

Long/Easting: Lat/Northing:

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Long/Easting: Lat/Northing:

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Long/Easting: Lat/Northing:

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Long/Easting: Lat/Northing:

Description:

WETLAND DETERMINATION DATA FORM - Great Plains Region

Project/Site: Pronghorn Flats **City/County:** Banner County **Sampling Date:** 17-Jun-20

Applicant/Owner: Orion **State:** Nebraska **Sampling Point:** **w-mw-001e_u**

Investigator(s): MW **Section, Township, Range:** **S** 10 **T** 18N **R** 58W

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** none **Slope:** 3.0 % / 1.7 °

Subregion (LRR): LRR G **Lat.:** 41.54782165 **Long.:** -104.00419464 **Datum:** WGS84

Soil Map Unit Name: Otero-Epping complex, 9 to 60 percent slopes **NWI classification:** upland

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:
Doesn't meet wetland criteria.

VEGETATION - Use scientific names of plants

FWS Region: 0

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)				
1.	0	☐		
2.	0	☐		
3.	0	☐		
4.	0	☐		
	0	= Total Cover		
Sapling/Shrub Stratum (Plot size:)				
1.	0	☐		
2.	0	☐		
3.	0	☐		
4.	0	☐		
5.	0	☐		
	0	= Total Cover		
Herb Stratum (Plot size: 10ftx10ft)				
1. Glycyrrhiza lepidota	50	☑	51.0%	FACU
2. Poa pratensis	47	☑	48.0%	FACU
3. Bromus tectorum	1	☐	1.0%	UPL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	98	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐		
2.	0	☐		
	0	= Total Cover		

% Bare Ground in Herb Stratum 2

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	0.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	97	x 4 =	388
UPL species	1	x 5 =	5
Column Totals:	98 (A)		393 (B)

Prevalence Index = B/A = 4.010

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present.**

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks:

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: w-mw-001e_u

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR	4/3	100					Silt Loam	

1Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR F)
- ☐ 1 cm Muck (A9) (LRR F,G,H)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR F)
- ☐ Sandy Gleyed Matrix S4
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)
- ☐ High Plains Depressions (F16)
  (MLRA 72 and 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR I, J)
- ☐ Coastal Prairie Redox (A16) (LRR F, G, H)
- ☐ Dark Surface (S7) (LRR G)
- ☐ High Plains Depressions (F16)
  (LRR H outside of MLRA 72 and 73)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Dry Season Water Table (C2)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
  (where not tilled)
- ☐ Presence of Reduced Iron (C4)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
  (where tilled)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ FAC-neutral Test (D5)
- ☐ Frost Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): 0
Water Table Present?	Yes ○	No ◉	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): 0

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Doesnt meet hydrology criteria

Plot ID: **w-mw-001e_u** Photo Path: C:\WetForm\Pronghorn Flats\Photos\

Photo File: **20200617_1436** Orientation: -facing

Lat/Long or UTM : Long/Easting: Lat/Northing:

Description:

No Photo

Photo File: **none.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: Lat/Northing:

Description:

Plot ID: **w-mw-001e_u**

Photo Path: C:\WetForm\Pronghorn Flats\Photos\

Photo File: **20200617_1436** Orientation: -facing

Long/Easting: Lat/Northing:

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Long/Easting: Lat/Northing:

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Long/Easting: Lat/Northing:

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Long/Easting: Lat/Northing:

Description:

WETLAND DETERMINATION DATA FORM - Great Plains Region

Project/Site: Pronghorn Flats **City/County:** Banner County **Sampling Date:** 23-Jun-20

Applicant/Owner: Orion **State:** Nebraska **Sampling Point:** w-mw-002e_w

Investigator(s): MW **Section, Township, Range:** S 10 T 18N R 58W

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** concave **Slope:** 1.0 % / 0.6 °

Subregion (LRR): LRR G **Lat.:** 41.54072004 **Long.:** -103.99436061 **Datum:** WGS84

Soil Map Unit Name: Otero-Epping complex, 9 to 60 percent slopes **NWI classification:** PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) (If no, explain in Remarks.)

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes (•) No ( )	**Is the Sampled Area within a Wetland?** Yes (•) No ( )
Hydric Soil Present? Yes (•) No ( )	
Wetland Hydrology Present? Yes (•) No ( )	

Remarks:
Meets wetland criteria.

VEGETATION - Use scientific names of plants

FWS Region: -1

	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)			
1.	0	☐	
2.	0	☐	
3.	0	☐	
4.	0	☐	
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1.	0	☐	
2.	0	☐	
3.	0	☐	
4.	0	☐	
5.	0	☐	
	0	= Total Cover	
Herb Stratum (Plot size: 10ftx3ft)			
1. Carex nebrascensis	50	☑ 50.0%	OBL
2. Eleocharis palustris	50	☑ 50.0%	OBL
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
6.	0	☐ 0.0%	
7.	0	☐ 0.0%	
8.	0	☐ 0.0%	
9.	0	☐ 0.0%	
10.	0	☐ 0.0%	
	100	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.	0	☐	
2.	0	☐	
	0	= Total Cover	
% Bare Ground in Herb Stratum 0			

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	100	x 1 =	100
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		100 (B)

Prevalence Index = B/A = 1

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present.**

Hydrophytic Vegetation Present? Yes (•) No ( )

Remarks:

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: w-mw-002e_w

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR	3/2	100					Sandy Loam	
7-10	10YR	4/2	100					Sandy Loam	

1Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains   ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☑ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR F)
- ☐ 1 cm Muck (A9) (LRR F,G,H)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR F)
- ☐ Sandy Gleyed Matrix S4
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)
- ☐ High Plains Depressions (F16)
  (MLRA 72 and 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR I, J)
- ☐ Coastal Prairie Redox (A16) (LRR F, G, H)
- ☐ Dark Surface (S7) (LRR G)
- ☐ High Plains Depressions (F16)
  (LRR H outside of MLRA 72 and 73)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☑ Hydrogen Sulfide Odor (C1)
- ☐ Dry Season Water Table (C2)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
  (where not tilled)
- ☐ Presence of Reduced Iron (C4)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
  (where tilled)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ FAC-neutral Test (D5)
- ☐ Frost Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present?	Yes ◉	No ○	Depth (inches): 5
Water Table Present?	Yes ◉	No ○	Depth (inches): 3
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Plot ID: **w-mw-002e_w** Photo Path: C:\WetForm\Pronghorn Flats\Photos\

Photo File: **IMG_0142.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: Lat/Northing:

Description:

Photo File: **IMG_0143.JPG** Orientation: -facing

Lat/Long or UTM: Long/Easting: Lat/Northing:

Description:

WETLAND DETERMINATION DATA FORM - Great Plains Region

Project/Site: Pronghorn Flats **City/County:** Banner County **Sampling Date:** 23-Jun-20

Applicant/Owner: Orion **State:** Nebraska **Sampling Point:** w-mw-002e_u

Investigator(s): MW **Section, Township, Range:** S 10 T 18N R 58W

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** none **Slope:** 2.0 % / 1.1 °

Subregion (LRR): LRR G **Lat.:** 41.54070229 **Long.:** -103.99435287 **Datum:** WGS84

Soil Map Unit Name: Otero-Epping complex, 9 to 60 percent slopes **NWI classification:** upland

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) (If no, explain in Remarks.)

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( ) No (●)	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes ( ) No (●)	

Remarks:
Doesn't meet wetland criteria.

VEGETATION - Use scientific names of plants

FWS Region: 0

	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)			
1.	0	☐	
2.	0	☐	
3.	0	☐	
4.	0	☐	
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1.	0	☐	
2.	0	☐	
3.	0	☐	
4.	0	☐	
5.	0	☐	
	0	= Total Cover	
Herb Stratum (Plot size: 10ftx10ft)			
1. Poa pratensis	90	☑ 90.0%	FACU
2. Pascopyrum smithii	10	☐ 10.0%	FACU
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
6.	0	☐ 0.0%	
7.	0	☐ 0.0%	
8.	0	☐ 0.0%	
9.	0	☐ 0.0%	
10.	0	☐ 0.0%	
	100	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.	0	☐	
2.	0	☐	
	0	= Total Cover	

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	0.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	100	x 4 =	400
UPL species	0	x 5 =	0
Column Totals:	100 (A)		400 (B)

Prevalence Index = B/A = 4

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present.**

Hydrophytic Vegetation Present? Yes ( ) No (●)

Remarks:

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: w-mw-002e_u

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR	4/2	100					Silt Loam	

1Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains   ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR F)
- ☐ 1 cm Muck (A9) (LRR F,G,H)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR F)
- ☐ Sandy Gleyed Matrix S4
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)
- ☐ High Plains Depressions (F16)
  (MLRA 72 and 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR I, J)
- ☐ Coastal Prairie Redox (A16) (LRR F, G, H)
- ☐ Dark Surface (S7) (LRR G)
- ☐ High Plains Depressions (F16)
  (LRR H outside of MLRA 72 and 73)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____

Depth (inches): ____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Dry Season Water Table (C2)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
  (where not tilled)
- ☐ Presence of Reduced Iron (C4)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
  (where tilled)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ FAC-neutral Test (D5)
- ☐ Frost Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	0
Water Table Present?	Yes ○	No ◉	Depth (inches):	0
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):	0

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Plot ID: **w-mw-002e_u** Photo Path: C:\WetForm\Pronghorn Flats\Photos\

Photo File: **IMG_0144.jpg** Orientation: -facing

Lat/Long or UTM : Long/Easting: Lat/Northing:

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: Lat/Northing:

Description:

WETLAND DETERMINATION DATA FORM - Great Plains Region

Project/Site: Pronghorn Flats **City/County:** Banner County **Sampling Date:** 23-Jun-20

Applicant/Owner: Orion **State:** Nebraska **Sampling Point:** w-mw-003e_w

Investigator(s): MW **Section, Township, Range:** S 10 T 18N R 58W

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** concave **Slope:** 1.0 % / 0.6 °

Subregion (LRR): LRR G **Lat.:** 41.53814112 **Long.:** -103.99054623 **Datum:** WGS84

Soil Map Unit Name: Otero-Epping complex, 9 to 60 percent slopes **NWI classification:** PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) (If no, explain in Remarks.)

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:
Meets wetland criteria.

VEGETATION - Use scientific names of plants

FWS Region: -1

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)				
1.	0	☐		
2.	0	☐		
3.	0	☐		
4.	0	☐		
	0	= Total Cover		
Sapling/Shrub Stratum (Plot size:)				
1.	0	☐		
2.	0	☐		
3.	0	☐		
4.	0	☐		
5.	0	☐		
	0	= Total Cover		
Herb Stratum (Plot size: 10ftx3ft)				
1. Carex nebrascensis	40	☑	40.0%	OBL
2. Eleocharis palustris	60	☑	60.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	100	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐		
2.	0	☐		
	0	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	100	x 1 =	100
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		100 (B)

Prevalence Index = B/A = 1

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present.**

Hydrophytic Vegetation Present? Yes (●) No ( )

Remarks:

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: w-mw-003e_w

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR	4/2	100						Silt Loam	
7-14	10YR	4/2	95	10YR	4/6	5	C	M	Silt Loam	

1Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5) (LRR F)
- [ ] 1 cm Muck (A9) (LRR F,G,H)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Muck Mineral (S1)
- [ ] 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- [ ] 5 cm Mucky Peat or Peat (S3) (LRR F)
- [ ] Sandy Gleyed Matrix S4
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox depressions (F8)
- [ ] High Plains Depressions (F16)
  (MLRA 72 and 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR I, J)
- [ ] Coastal Prairie Redox (A16) (LRR F, G, H)
- [ ] Dark Surface (S7) (LRR G)
- [ ] High Plains Depressions (F16)
  (LRR H outside of MLRA 72 and 73)
- [ ] Reduced Vertic (F18)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

Believe there is hydric soil based on vegetaton, hydrology, and redox even though it's <1" lower than is required for F3 indicator. There is a potential depleted matrix (F3) indicator, but due to saturated soils hard to view redox.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- [x] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Salt Crust (B11)
- [ ] Aquatic Invertebrates (B13)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Dry Season Water Table (C2)
- [ ] Oxidized Rhizospheres on Living Roots (C3)
  (where not tilled)
- [ ] Presence of Reduced Iron (C4)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Drainage Patterns (B10)
- [ ] Oxidized Rhizospheres on Living Roots (C3)
  (where tilled)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [x] FAC-neutral Test (D5)
- [ ] Frost Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present?	Yes (●)	No ( )	Depth (inches): 4
Water Table Present?	Yes (●)	No ( )	Depth (inches): 7
Saturation Present? (includes capillary fringe)	Yes (●)	No ( )	Depth (inches): 1

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

abundant tadpoles, dragonflies

Plot ID: **w-mw-003e_w** Photo Path: C:\WetForm\Pronghorn Flats\Photos\

Photo File: **IMG_0148.jpg** Orientation: -facing

Lat/Long or UTM : Long/Easting: Lat/Northing:

Description:

Photo File: **IMG_0149.jpg** Orientation: -facing

Lat/Long or UTM: Long/Easting: Lat/Northing:

Description:

WETLAND DETERMINATION DATA FORM - Great Plains Region

Project/Site: Pronghorn Flats **City/County:** Banner County **Sampling Date:** 23-Jun-20

Applicant/Owner: Orion **State:** Nebraska **Sampling Point:** **w-mw-003e_u**

Investigator(s): MW **Section, Township, Range:** S 10 T 18N R 58W

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** none **Slope:** 1.0 % / 0.6 °

Subregion (LRR): LRR G **Lat.:** 41.53814182 **Long.:** -103.99058875 **Datum:** WGS84

Soil Map Unit Name: Otero-Epping complex, 9 to 60 percent slopes **NWI classification:** upland

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:
Doesn't meet wetland criteria.

VEGETATION - Use scientific names of plants

FWS Region: 0

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)				
1.	0	☐		
2.	0	☐		
3.	0	☐		
4.	0	☐		
	0	= Total Cover		
Sapling/Shrub Stratum (Plot size:)				
1.	0	☐		
2.	0	☐		
3.	0	☐		
4.	0	☐		
5.	0	☐		
	0	= Total Cover		
Herb Stratum (Plot size: 10ftx10ft)				
1. Poa pratensis	93	☑	97.9%	FACU
2. Pascopyrum smithii	2	☐	2.1%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	95	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐		
2.	0	☐		
	0	= Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	0.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	95	x 4 =	380
UPL species	0	x 5 =	0
Column Totals:	95 (A)		380 (B)

Prevalence Index = B/A = 4

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present.**

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks:

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: w-mw-003e_u

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-10	10YR	4/2	100						Silt Loam	

1Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (LRR F)
- ☐ 1 cm Muck (A9) (LRR F,G,H)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR F)
- ☐ Sandy Gleyed Matrix S4
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)
- ☐ High Plains Depressions (F16)
  (MLRA 72 and 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR I, J)
- ☐ Coastal Prairie Redox (A16) (LRR F, G, H)
- ☐ Dark Surface (S7) (LRR G)
- ☐ High Plains Depressions (F16)
  (LRR H outside of MLRA 72 and 73)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Dry Season Water Table (C2)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
  (where not tilled)
- ☐ Presence of Reduced Iron (C4)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
  (where tilled)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ FAC-neutral Test (D5)
- ☐ Frost Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches): 0
Water Table Present?	Yes ○	No ◉	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches): 0

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

No hydrologic indicators

Plot ID: **w-mw-003e_u** Photo Path: C:\WetForm\Pronghorn Flats\Photos\

Photo File: **IMG_0150.jpg** Orientation: -facing

Lat/Long or UTM : Long/Easting: Lat/Northing:

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: Lat/Northing:

Description:

APPENDIX C
Waterbody Photographs

s-mw-001

Facing northwest (downstream of culvert)

s-mw-002

Facing southwest

s-mw-003

Facing south (upstream of culvert)

s-mw-004

Facing southwest

s-mw-005

Facing south (at upslope terminus)

s-mw-006

Photo not available

o-mw-001

Facing north

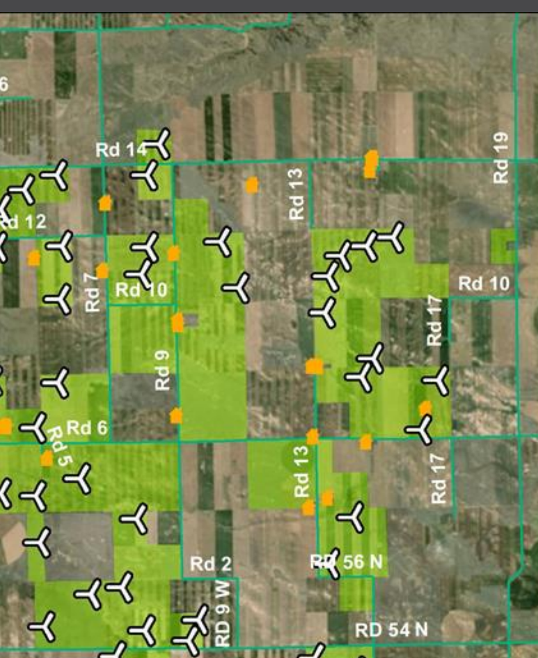
Appendix B. Pronghorn Flats 115-kilovolt Wind Project Sound Modeling Report

the science of insight

ORION WIND RESOURCES, LLC

PRONGHORN FLATS WIND FARM SOUND MODELING

Report | June 10, 2020



PREPARED FOR:
ORION WIND RESOURCES, LLC

SUBMITTED BY:
RSG

55 Railroad Row
White River Junction, VT 05001
802.295.4999
www.rsginc.com

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 EXECUTIVE SUMMARY

The Pronghorn Flats Wind Farm project (the “Project”) is an approximately 120 MW nameplate capacity wind power generation facility proposed for Banner and Kimball Counties, Nebraska.

The Project is subject to a Kimball County noise standard of 50 dBA measured at the dwelling. There are no noise standards in Banner County nor at the state or federal levels that apply to this project. However, for those homes in Banner County, we have established a Project design goal of 45 dBA L_{1h}. This guideline was established by reviewing relevant research and recommendations made with respect to wind turbine sound.

To assess the noise impacts of the project, RSG has conducted sound propagation modeling of the planned turbine layout. We used the internationally accepted methodology, ISO 9613-2, with parameters specific to wind turbines.

The modeling results show that project sound levels at all homes are at or below 37 dBA L_{1h} in Kimball County and 44 dBA L_{1h} in Banner County. Of the 17 homes between 40 dBA and 44 dBA, nine are on land leased for the Project.

2.0 INTRODUCTION

The Pronghorn Flats Wind Farm project (the “Project”) is an approximately 120 MW nameplate capacity wind power generation facility proposed for Banner and Kimball Counties, Nebraska. As part of the project’s Environmental Assessment (EA), RSG conducted sound propagation modeling for the proposed turbine array to assess compliance with the Kimball County noise standard of 50 dBA (metric not stated) and a self-imposed 45 dBA L_{1h} noise design goal in Banner County.

Included in this report are:

1. A project description,
2. An overview of ordinances and standards that apply to the project,
3. The establishment of a noise design goal based on relevant research and recommendations,
4. A description of sound propagation modeling procedures,
5. Sound propagation modeling results, and,
6. Conclusions.

A primer on acoustical terminology is provided in Appendix A.

Acoustical issues specific to wind turbine noise are described in Appendix B.

3.0 PROJECT DESCRIPTION

As noted above, the Pronghorn Flats Wind Farm project (the “Project”) is a proposed approximately 120 MW wind power generation facility located in the southwestern portion of Banner County and northwest corner of Kimball County, Nebraska (Figure 1: Pronghorn Flats Wind Farm – Project Area Map). The western boundary of the Project is the Wyoming state line. The northern, eastern, and southern extent of the project lands are bounded by Rd 14, Rd 19, and Rd 52 N, respectively. Land within the project area is rural and is primarily used for agriculture with some residences interspersed. The terrain is relatively flat.

The Project is modeled using General Electric (GE) 3.03 MW turbines with 140-meter rotor diameters, 98-meter hub heights, and low-noise trailing edges (LNTE). Other turbine models are also being considered. Two turbines are currently being proposed for Kimball County and 41 are being proposed for Banner County.

A single transformer at the collector substation connects the turbine array to the electric grid.

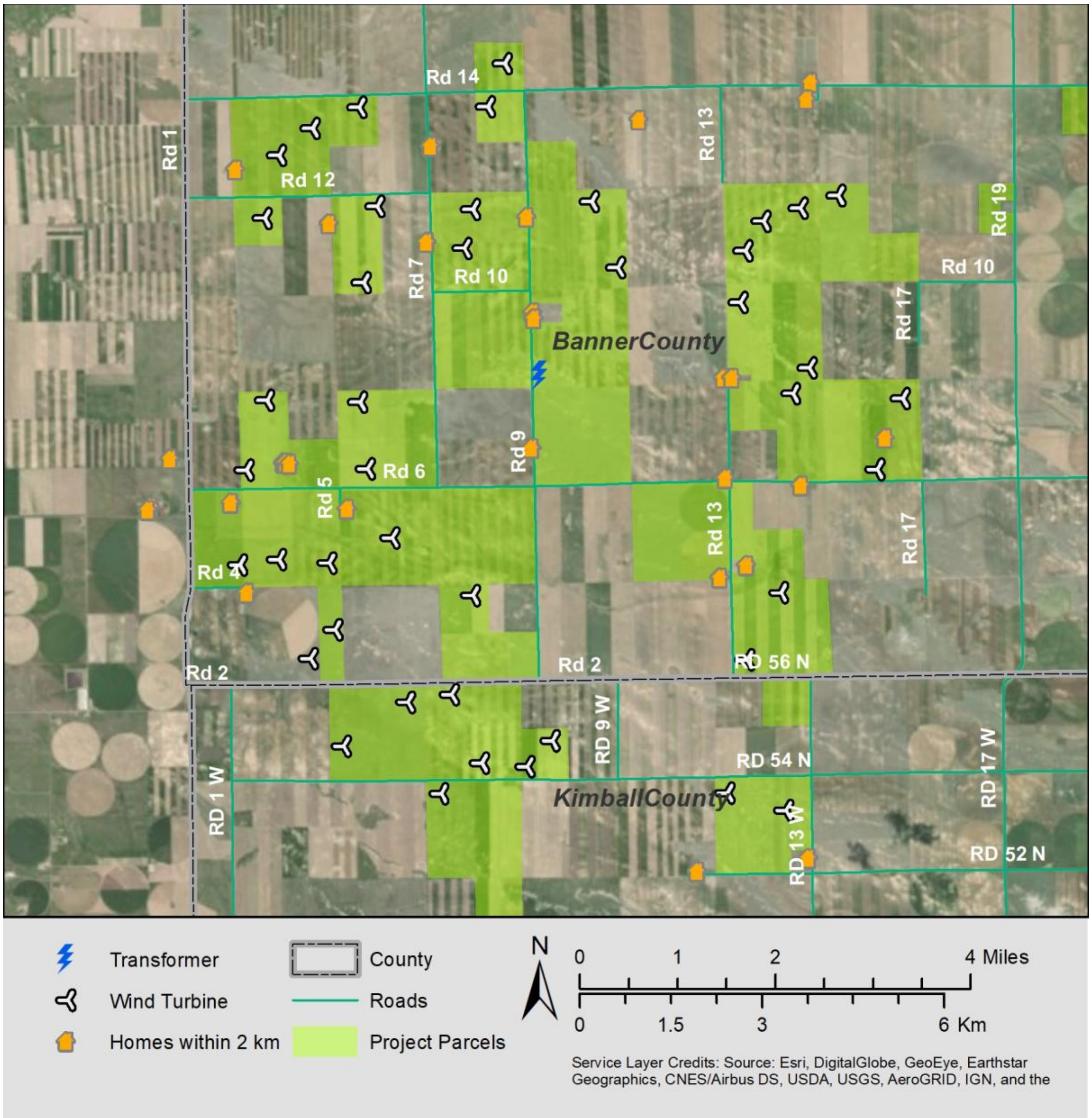


FIGURE 1: PRONGHORN FLATS WIND FARM – PROJECT AREA MAP

4.0 NOISE STANDARDS & GUIDELINES

There are no federal or state noise regulations applicable to the Project.

Kimball County has a wind energy ordinance in Section 18.03(7) of its Zoning and Subdivision Regulations. Paragraph "A" states that "No commercial WES shall exceed 50 dBA at the nearest occupied dwelling." However, this standard has no metric no averaging time and is thus ambiguous.

Section 18.03(9)(A) paragraph 11 of the Kimball County Zoning and Subdivision Regulations requires that "An Acoustical analysis that certifies that the noise requirements within this regulation can be met." This noise study is intended as that certification. The study was prepared by Mr. Kenneth Kaliski, who is Board Certified through the Institute of Noise Control Engineering (INCE). His stamp is affixed at the end of this document.

Banner County has no zoning ordinance or any other ordinance that limits the noise from wind turbines. Since there are no regulatory noise standards that apply to this project there, we have investigated several guidelines from other organizations that could be used to set a project-specific noise design goal. In particular, we have reviewed the guidelines of the U.S. EPA and Bureau of Land Management, as well as research into the effects of wind turbine sound on people. This review is detailed in Appendix C.

Given the scientific evidence regarding sleep disturbance and other impacts, the project is being designed to not exceed 45 dBA L_{1h} outside any Banner County residence. This would not apply to areas that have transient uses such as camps, driveways, trails, farm fields, barns, sheds, and parking areas. This level is more stringent than the BLM federal guidelines for wind turbines and is below the level that can cause hearing impairment, sleep disturbance, and speech interference. Note that at this sound level, the wind turbines may be audible at times, but that most people do not find this level of wind turbine sound to be highly annoying.

To protect against moderately perceptible noise-induced vibration and rattle, we are using a design goal of 65 dBZ in the 31.5 Hz, and 63 Hz low-frequency octave bands. This is consistent with ANSI S12.9 Part 4 Annex D and is conservative as it assumes no transmission loss from outside to inside the structure, even though some would be expected.[1]

[1] RSG, et al. "Massachusetts study on wind turbine acoustics." Prepared for MassCEC and MassDEP, February 2016.

5.0 SOUND PROPAGATION MODELING

5.1 PROCEDURES

Modeling for the Project was performed in accordance with the standard ISO 9613-2, “Acoustics – Attenuation of sound during propagation outdoors, Part 2: General Method of Calculation.” The ISO standard states,

> This part of ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level … under meteorological conditions favorable to propagation from sources of known sound emissions. These conditions are for downwind propagation … or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs at night.

The model takes into account source sound power levels, surface reflection and absorption, atmospheric absorption, geometric divergence, meteorological conditions, walls, barriers, berms, and terrain. The acoustical modeling software used here was CadnaA® Version 2020 from Datakustik GmbH. CadnaA® is a widely accepted acoustical propagation modeling tool, used by many noise control professionals in the United States and internationally.

ISO 9613-2 also assumes downwind sound propagation between every source and every receiver. Consequently, all wind directions, including the prevailing wind directions, are taken into account. The project area was modeled with hard ground (G=0). Otherwise, no reflections (such as due to buildings) were considered. Foliage attenuation was not modeled. Atmospheric absorption was based on 10˚C and 70% relative humidity and source contributions were considered up to 10,000 meters (6.2 miles) from each receiver.

Turbines were modeled with the manufacturer specified apparent sound power. All turbine data used is the most recent available from the manufacturer.

A 20-meter by 20-meter grid of 4 meter (13.1 feet) high receivers was set up in the model, covering approximately 1,078 sq. km. (416 sq. mi.) in and around the project area. The model was laid over the USGS Digital Terrain Model to give accurate elevations throughout.

A total of 30 discrete receivers, representing all homes within 2 km (1.2 mi.) of any wind turbine, were included in the model at a 4-meter (13 foot) height. Locations of these receivers are shown in Appendix E.

Results calculated with these parameters represent the highest one-hour equivalent sound level (L_{1h}) that will be emitted by the Project. The parameters used in this model combine to take into account wind turbine sound power and modeling uncertainty. As such, the results are likely to overestimate the measured sound levels.

5.2 SOUND SOURCES

Wind Turbines

The 43 preliminary wind turbine locations shown in Figure 1: Pronghorn Flats Wind Farm – Project Area Map were included in the sound propagation model. The wind turbine assumed was the GE 3.03-140 LNTE, although other models are currently being considered. If a different wind turbine is selected, revised sound modeling will be produced for that model. Details of the wind turbine modeled are found in Appendix D.

Project Transformer

The proposed 34.5 kV to 115 kV 130 MVA collector substation transformer will be located in the center of the project area (see Figure 1: Pronghorn Flats Wind Farm – Project Area Map).

The sound emissions data used for modeling is from the NEMA TR 1 standard (“Transformers, Step Voltage Regulators, and Reactors, NEMA TR 1-2013”), with spectral information taken from a transformer test performed by RSG for a similarly sized transformer. The transformer will be specified to have the highest sound level 5 dB below the NEMA TR-1 standard.

The transformer will have cooling fans. Cooling fan operation is usually a function of electric load and ambient air temperature. As a conservative assumption, we model the transformer with fans on. The fans-off cooling mode is specified by NEMA TR 1 as having sound pressure levels that are 3 dB lower.

5.3 RESULTS

Modeling results are shown in Figure 2. In this figure, the Banner County 45 dBA design goal is shown as a thick orange line. All homes are modeled to be below that project design goal. Detailed information for each receiver is provided in Appendix D.

TABLE 1: MAXIMUM PROJECT SOUND LEVELS AT ANY HOME (L_{1H})

		Octave Band	
	Overall	**31.5 Hz**	**63 Hz**
Design goal	45 dBA	65 dBZ	65 dBZ
Maximum Modeled Sound Level	44 dBA	59 dBZ	55 dBZ

In Kimball County, the maximum modeled sound level is 37 dBA L_{1h}. As noted above, the Kimball County noise standard does not have a metric or averaging time, and thus is ambiguous. We modeled for the L_{1h}, as it is commonly used for environmental noise and can be modeled and measured with a high degree of reliability. The worst-case interpretation of the standard would be some type of instantaneous maximum. In that case, the highest sound level could be up to 10 dB higher than the L_{1h}.[2] However, even with this extreme interpretation of the standard, the highest Project sound level at any Kimball County dwelling would by 47 dBA L_{max}, and would still meet the noise standard.

[2] This is the potential difference from the maximum L_{max} over a year. The different between the Lmax and L_{1h} for a given wind power project is dependent on a variety of factors which are difficult to impossible to determine at this stage. Measurements of short-term metrics such as the L_{max} can also be unreliable.

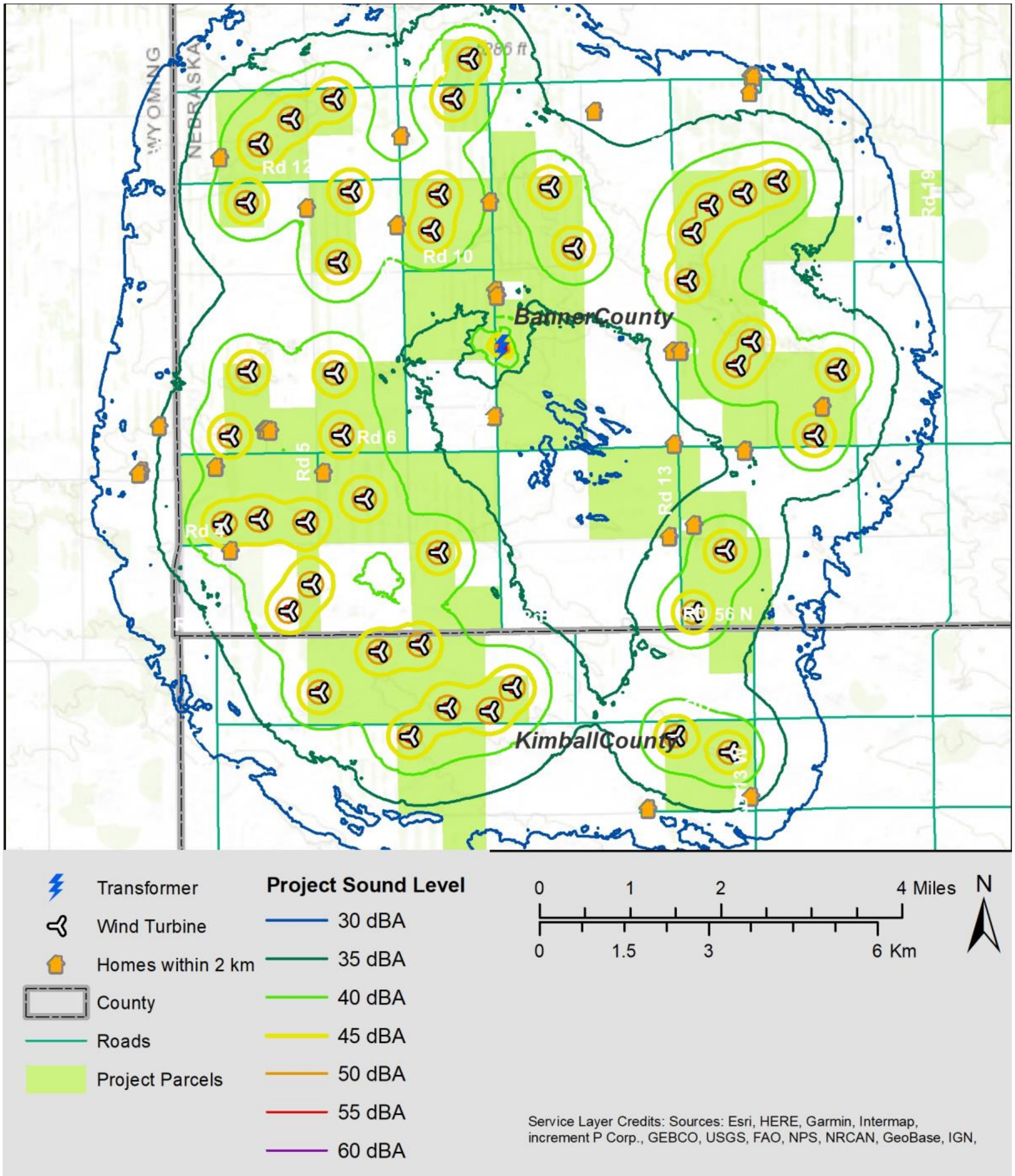


FIGURE 2: SOUND PROPAGATION MODELING RESULTS

Tonality

Figure 3 shows the tonal prominence of the GE 3.03-140 LNTE turbine compared with the ANSI S12.9 Part 4 tonality criteria. This indicates that sound power spectrum of the wind turbine does not have a tonal prominence.

The transformer in the Project substation has the potential to generate prominent discrete tones, especially at 120 Hz and its first few harmonics. Tones are always generated by a transformer but are often masked when cooling fans are operating. In addition, as one moves away from the substation, the sound is further masked by background sound (including the wind turbines).

Under ANSI S12.9 Part 4, if tonal sounds are present, 5 dB is added to the tonal sound as a penalty. In this case, the maximum sound level from the transformer is 39 dBA. Assuming it is tonal sound and not masked, adding 5 dB would bring the transformer sound to 44 dB. Thus, even with a tonal penalty, the substation sound would meet the Project design goal.

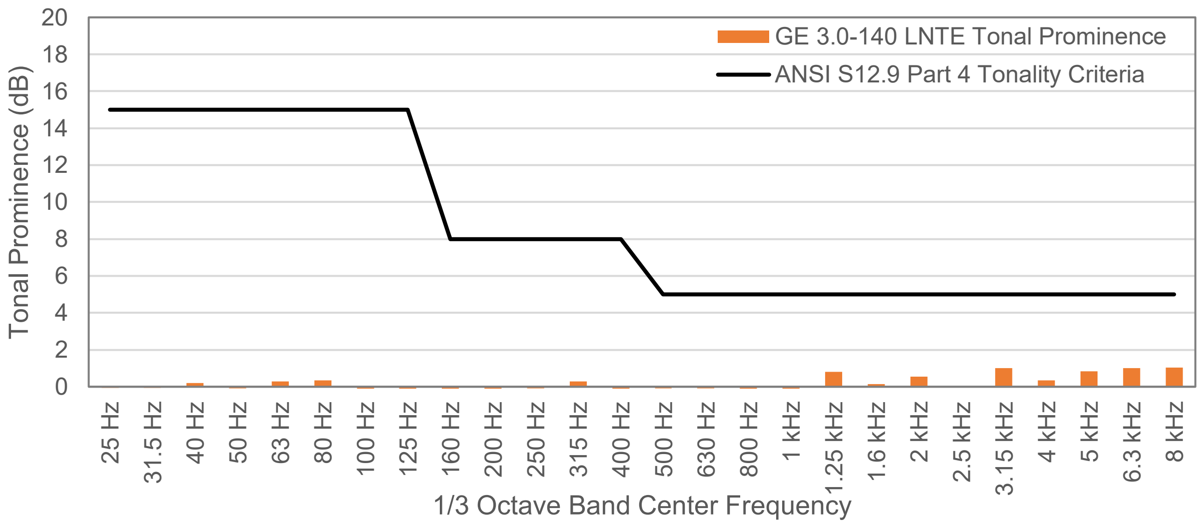


FIGURE 3: REPORTED 1/3 OCTAVE BAND TONAL PROMINENCE COMPARED TO ANSI S12.9 PART 4 TONALITY CRITERIA

6.0 CONCLUSIONS

RSG performed sound propagation modeling of the proposed Pronghorn Flats Wind Farm project as part of an Environmental Assessment. The project will be capable of generating approximately 120 MW. The modeled array consists of 43 GE3.03-140 LNTE wind turbines on a 98-meter tower, though other hub heights and turbine models are being be considered.

The Project is subject to a Kimball County 50 dBA (no metric) noise standard and a self-imposed Banner County noise design goal of 45 dBA L_{1h}, 65 dBZ L_{1h} at 31.5 Hz, and 65 dBZ L_{1h} at 63 Hz at any dwelling.

Sound propagation modeling was performed ISO 9613-2, implemented in the Cadna/A modeling package. The project model used parameters have been shown to represent conservatively accurate L_{1h} sound levels.

The results of the modeling show that all homes in the Project area, including those on Project lands, will be at 37 dBA L_{1h} or lower in Kimball County and 44 dBA L_{1h} or lower in Banner County.

As a result, no undue adverse noise impact is expected to occur, and the Kimball County noise standard and Banner County project noise design goals are modeled to be met.

Institute of Noise Control Engineering
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4002
January 31, 2022
Verify at inceusa.org
of the United States of America

APPENDIX A. PRIMER ON SOUND

Expressing Sound in Decibel Levels

Normal human hearing is sensitive to sound fluctuations over an enormous range of pressures, from about 20 micropascals (the “threshold of audibility”) to about 20 pascals (the “threshold of pain”).[3] This factor of one million in sound pressure difference is challenging to convey in engineering units. Instead, sound pressure is converted to sound “levels” in units of “decibels” (dB, named after Alexander Graham Bell). Once a measured sound is converted to dB, it is denoted as a level with the letter “L” (such as “L_{eq}”).

The conversion from sound pressure in pascals to sound level in dB is a four-step process. First, the sound wave’s measured amplitude is squared and the mean is taken. Second, a ratio is taken between the mean square sound pressure and the square of the threshold of audibility (20 micropascals) at 1 kHz. Third, using the logarithm function, the ratio is converted to factors of 10. The final result is multiplied by 10 to give the decibel level. By this decibel scale, sound levels range from 0 dB at the threshold of audibility to 120 dB at the threshold of pain.

Typical sound sources, and their sound pressure levels, are listed on the scale in Figure 4. Typical ambient nighttime sound levels around wind turbine locations, in the absence of wind turbines, is shown in Figure 5.

Human Response to Sound Levels: Apparent Loudness

For every 20 dB increase in sound level, the sound pressure increases by a *factor* of 10; the sound *level* range from 0 dB to 120 dB covers 6 factors of 10, or one million, in sound *pressure*. However, for an increase of 10 dB in sound *level* as measured by a meter, humans perceive an approximate doubling of apparent loudness: to the human ear, a sound level of 70 dB sounds about “twice as loud” as a sound level of 60 dB. Smaller changes in sound level, less than 3 dB up or down, are generally not perceptible.

[3] The pascal is a measure of pressure in the metric system. In Imperial units, they are themselves very small: one pascal is only 145 millionths of a pound per square inch (psi). The sound pressure at the threshold of audibility is only 3 one-billionths of one psi: at the threshold of pain, it is about 3 one-thousandths of one psi.

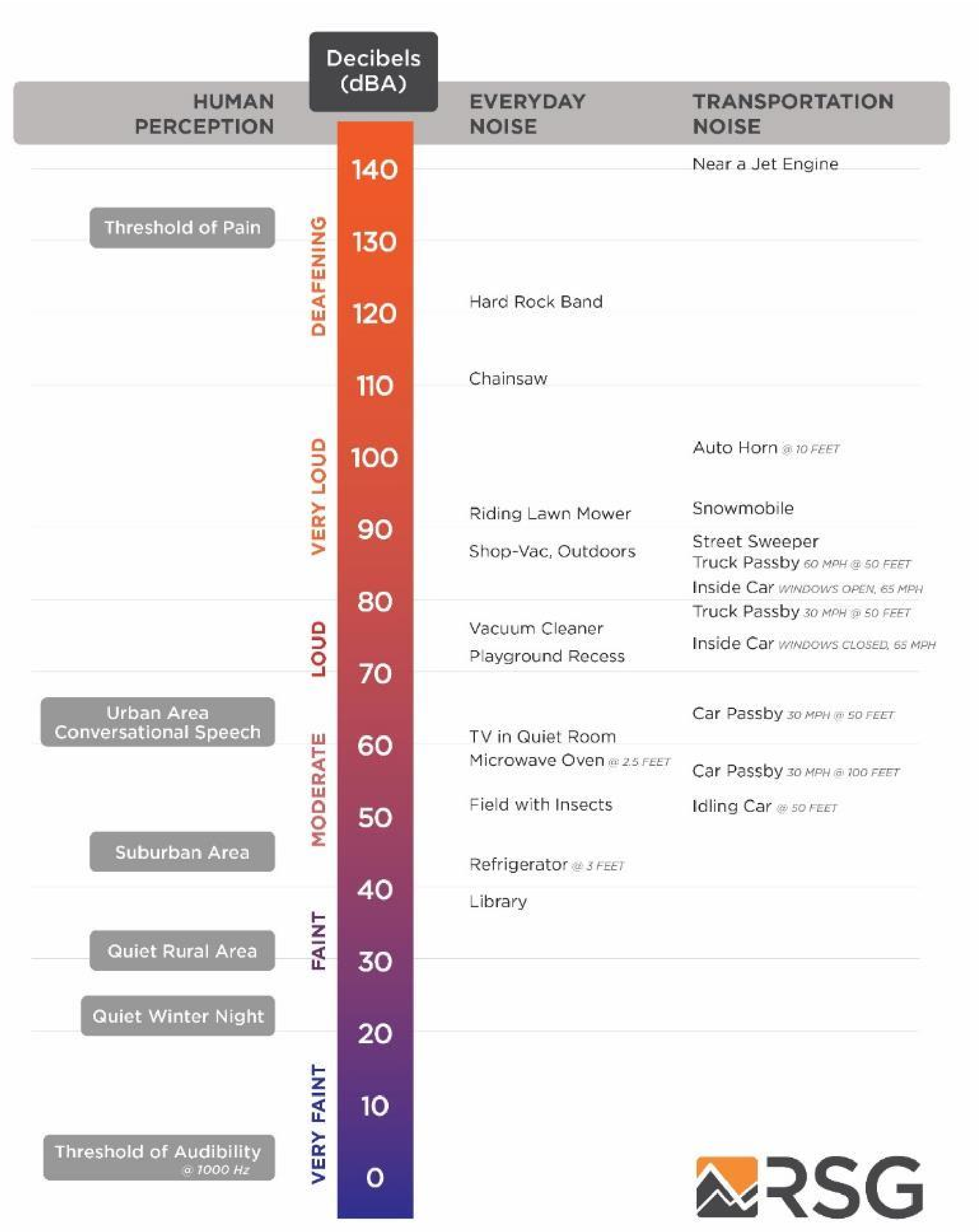

FIGURE 4: A SCALE OF SOUND PRESSURE LEVELS FOR TYPICAL SOUND SOURCES

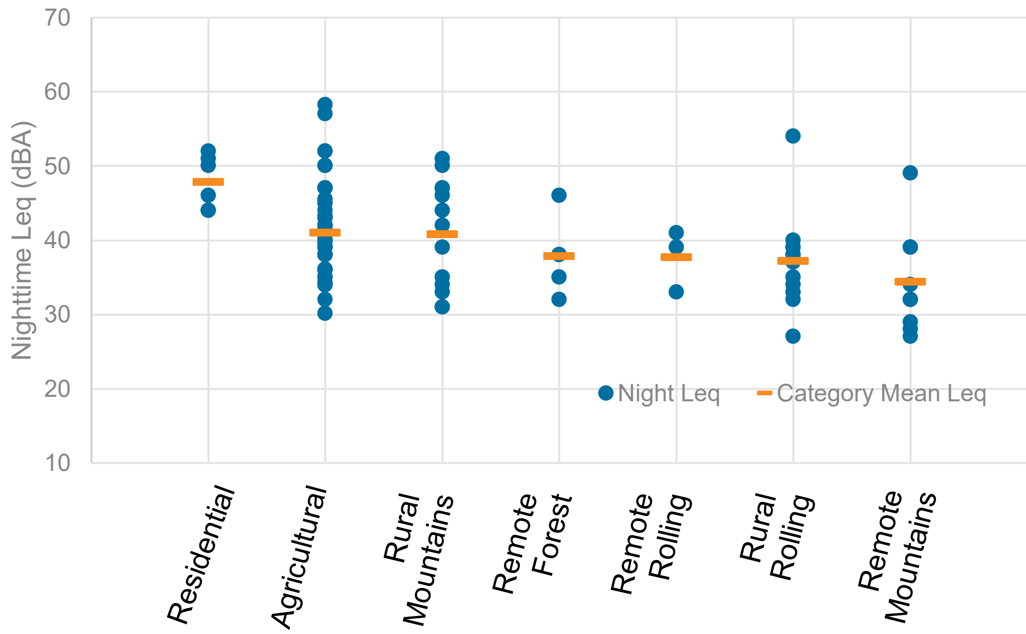

FIGURE 5: BACKGROUND NIGHTTIME L_{eq} AT 102 LOCATIONS AT POTENTIAL WIND TURBINE SITES ACROSS THE U.S. BY LAND USE CATEGORY[4]

Frequency Spectrum of Sound

The "frequency" of a sound is the rate at which it fluctuates in time, expressed in Hertz (Hz), or cycles per second. Very few sounds occur at only one frequency: most sound contains energy at many different frequencies, and it can be broken down into different frequency divisions, or bands. These bands are similar to musical pitches, from low tones to high tones. The most common division is the standard octave band. An octave is the range of frequencies whose upper frequency limit is twice its lower frequency limit, exactly like an octave in music. An octave band is identified by its center frequency: each successive band's center frequency is twice as high (one octave) as the previous band. For example, the 500 Hz octave band includes all sound whose frequencies range between 354 Hz (Hertz, or cycles per second) and 707 Hz. The next band is centered at 1,000 Hz with a range between 707 Hz and 1,414 Hz. The range of human hearing is divided into 10 standard octave bands: 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1,000 Hz, 2,000 Hz, 4,000 Hz, 8,000 Hz, and 16,000 Hz. For analyses that require finer frequency detail, each octave-band can be subdivided. A commonly-used subdivision creates three smaller bands within each octave band, or so-called 1/3-octave bands.

Human Response to Frequency: Weighting of Sound Levels

The human ear is not equally sensitive to sounds of all frequencies. Sounds at some frequencies seem louder than others, despite having the same decibel level as measured by a sound level meter. In particular, human hearing is much more sensitive to medium pitches (from about 500 Hz to about 4,000 Hz) than to very low or very high pitches. For example, a tone measuring 80 dB at 500 Hz (a medium pitch) sounds quite a bit louder than a tone measuring

[4] From Kaliski, K., Bastasch, M., and O'Neal, R., "Regulating and Predicting Wind Turbine Sound in the U.S.," Proceedings of InterNoise2018, Institute of Noise Control Engineering, 2018

80 dB at 60 Hz (a very low pitch). The frequency response of normal human hearing ranges from 20 Hz to 20,000 Hz. Below 20 Hz, pitch perception is greatly reduced and sound may be "felt" as much as "heard". Frequencies below 20 Hz are known as "infrasound". Likewise, above 20,000 Hz, sound can no longer be heard by humans; this is known as "ultrasound". As humans age, they tend to lose the ability to hear higher frequencies first; many adults do not hear very well above about 16,000 Hz. Most natural and man-made sound occurs in the range from about 40 Hz to about 4,000 Hz. Some insects and birdsongs reach to about 8,000 Hz.

To adjust measured sound pressure levels so that they mimic human hearing response, sound level meters apply filters, known as "frequency weightings", to the signals. There are several defined weighting scales, including "A", "B", "C", "D", "G", and "Z". The most common weighting scale used in environmental noise analysis and regulation is A-weighting. This weighting represents the sensitivity of the human ear to sounds of low to moderate level. It attenuates sounds with frequencies below 1000 Hz and above 4000 Hz; it amplifies very slightly sounds between 1000 Hz and 4000 Hz, where the human ear is particularly sensitive. The C-weighting scale is sometimes used to describe louder sounds. The B- and D- scales are seldom used. All of these frequency weighting scales are normalized to the average human hearing response at 1000 Hz: at this frequency, the filters neither attenuate nor amplify. G-weighting is a standardized weighting used to evaluate infrasound.

When a reported sound level has been filtered using a frequency weighting, the letter is appended to "dB". For example, sound with A-weighting is usually denoted "dBA" or "dB(A)". When no filtering is applied, the level is denoted "dB" or "dBZ". The letter is also appended as a subscript to the level indicator "L", for example "L_A" for A-weighted levels.

Time Response of Sound Level Meters

Because sound levels can vary greatly from one moment to the next, the time over which sound is measured can influence the value of the levels reported. Often, sound is measured in real time, as it fluctuates. In this case, acousticians apply a so-called "time response" to the sound level meter, and this time response is often part of regulations for measuring sound. If the sound level is varying slowly, over a few seconds, "Slow" time response is applied, with a time constant of one second. If the sound level is varying quickly (for example, if brief events are mixed into the overall sound), "Fast" time response can be applied, with a time constant of one-eighth of a second.[5] The time response setting for a sound level measurement is indicated with the subscript "S" for Slow and "F" for Fast: L_S or L_F. A sound level meter set to Fast time response will indicate higher sound levels than one set to Slow time response when brief events are mixed into the overall sound, because it can respond more quickly.

In some cases, the maximum sound level that can be generated by a source is of concern. Likewise, the minimum sound level occurring during a monitoring period may be required. To measure these, the sound level meter can be set to capture and hold the highest and lowest levels measured during a given monitoring period. This is represented by the subscript "max", denoted as "L_{max}". One can define a "max" level with Fast response L_{Fmax} (1/8-second time

[5] There is a third time response defined by standards, the "Impulse" response. This response was defined to enable use of older, analog meters when measuring very brief sounds; it is no longer in common use.

constant), Slow time response L_{Smax} (1-second time constant), or Continuous Equivalent level over a specified time period $L_{1h\text{-}max}$ (maximum one-hour L_{eq}).

Accounting for Changes in Sound Over Time

A sound level meter's time response settings are useful for continuous monitoring. However, they are less useful in summarizing sound levels over longer periods. To do so, acousticians apply simple statistics to the measured sound levels, resulting in a set of defined types of sound level related to averages over time. An example is shown in Figure 6. The sound level at each instant of time is the grey trace going from left to right. Over the total time it was measured (1 hour in the figure), the sound energy spends certain fractions of time near various levels, ranging from the minimum (about 27 dB in the figure) to the maximum (about 65 dB in the figure). The simplest descriptor is the average sound level, known as the Equivalent Continuous Sound Level or L_{eq}. Statistical levels are used to determine for what percentage of time the sound is louder than any given level. These levels are described in the following sections.

Equivalent Continuous Sound Level - L_{eq}

One straightforward, common way of describing sound levels is in terms of the Continuous Equivalent Sound Level, or L_{eq}. The L_{eq} is the average sound pressure level over a defined period of time, such as one hour or one day. L_{eq} is the most commonly used descriptor in noise standards and regulations. L_{eq} is representative of the overall sound to which a person is exposed. Because of the logarithmic calculation of decibels, L_{EQ} tends to favor higher sound levels: loud and infrequent sources have a larger impact on the resulting average sound level than quieter but more frequent sounds. For example, in Figure 6, even though the sound levels spends most of the time near about 34 dBA, the L_{eq} is 41 dBA, having been "inflated" by the maximum level of 65 dBA and other occasional spikes over the course of the hour.

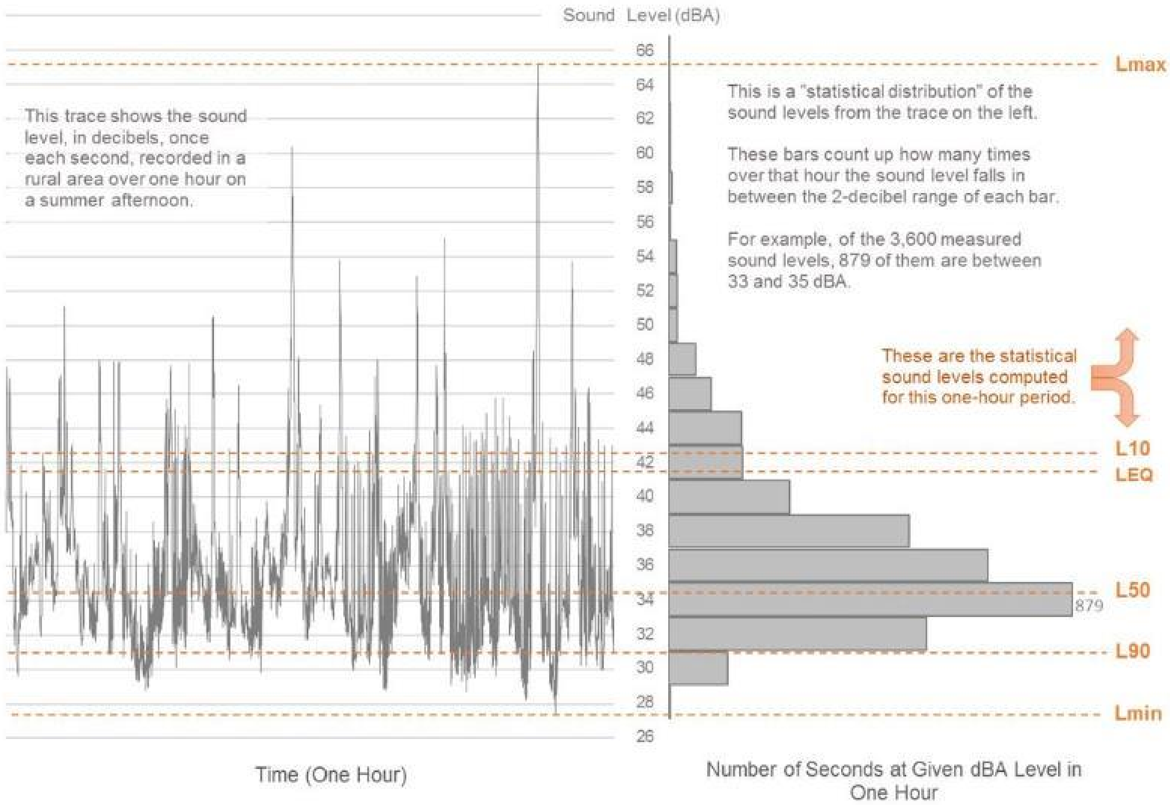

FIGURE 6: EXAMPLE OF DESCRIPTIVE TERMS OF SOUND MEASUREMENT OVER TIME

Percentile Sound Levels – L_n

Percentile sound levels describe the statistical distribution of sound levels over time. "L_n" is the level above which the sound spends "N" percent of the time. For example, L_{90} (sometimes called the "residual base level") is the sound level exceeded 90% of the time: the sound is louder than L_{90} most of the time. L_{10} is the sound level that is exceeded only 10% of the time. (the "median level") is exceeded 50% of the time: half.

L_{90} is often a good representation of the "ambient sound" in an area. This is the sound that persists for longer periods, and below which the overall sound level seldom falls. It tends to filter out other short-term environmental sounds that are not part of the source being investigated. L_{10} represents the higher, but less frequent, sound levels. These could include such events as barking dogs, vehicles driving by and aircraft flying overhead, gusts of wind, and work operations. L_{90} represents the background sound that is present when these event sounds are excluded.

Note that if one sound source is very constant and dominates the soundscape in an area, all of the descriptive sound levels mentioned here tend toward the same value. It is when the sound is varying widely from one moment to the next that the statistical descriptors are useful.

APPENDIX B. WIND TURBINE ACOUSTICS

Sources of Sound Generation by Wind Turbines

Wind turbines generate two principal types of noise: aerodynamic noise, produced from the flow of air around the blades, and mechanical noise, produced from mechanical and electrical components within the nacelle.

Aerodynamic noise is the primary source of noise associated with wind turbines. These acoustic emissions can be either tonal or broad band. Tonal noise occurs at discrete frequencies, whereas broadband noise is distributed with little peaking across the frequency spectrum.

While unusual, tonal noise can also originate from unstable air flows over holes, slits, or blunt trailing edges on blades. Most modern wind turbines have upwind rotors designed to prevent blade impulsive noise. Therefore, the majority of audible aerodynamic noise from wind turbines is broadband at the middle frequencies, roughly between 200 Hz and 1,000 Hz.

Wind turbines emit aerodynamic broadband noise as the spinning blades interact with atmospheric turbulence and as air flows along their surfaces. This produces a characteristic “whooshing” sound through several mechanisms (Figure 7):

- Inflow turbulence noise occurs when the rotor blades encounter atmospheric turbulence as they pass through the air. Uneven pressure on a rotor blade causes variations in the local angle of attack, which affects the lift and drag forces, causing aerodynamic loading fluctuations. This generates noise that varies across a wide range of frequencies but is most significant at frequencies below 500 Hz.
- Trailing edge noise is produced as boundary-layer turbulence as the air passes into the wake, or trailing edge, of the blade. This noise is distributed across a wide frequency range but is most notable at high frequencies between 700 Hz and 2 kHz.
- Tip vortex noise occurs when tip turbulence interacts with the surface of the blade tip. While this is audible near the turbine, it tends to be a small component of the overall noise further away.
- Stall or separation noise occurs due to the interaction of turbulence with the blade surface.

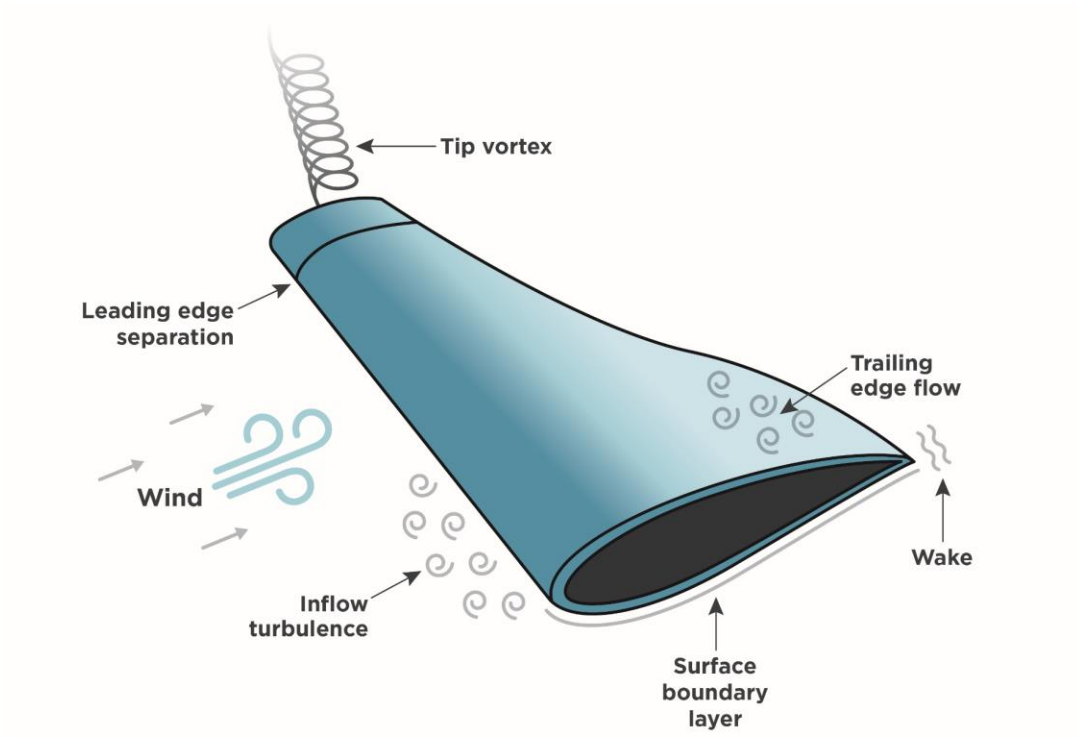

FIGURE 7: AIRFLOW AROUND A ROTOR BLADE

Mechanical sound from machinery inside the nacelle tends to be tonal in nature but can also have a broadband component. Potential sources of mechanical noise include the gearbox, generator, yaw drives, cooling fans, and auxiliary equipment. These components are housed within the nacelle, whose surfaces, if untreated, radiate the resulting noise. However modern wind turbines have nacelles that are designed to reduce internal noise, and rarely is the mechanical noise a significant portion of the total noise from a wind turbine.

Amplitude Modulation

Amplitude modulation (AM) is a fluctuation in sound level that occurs at the blade passage frequency. No consistent definition exists for how much of a sound level fluctuation is necessary for blade swish to be considered AM, however sound level fluctuations in A-weighted sound level can range up to 10 dB. Fluctuations in individual 1/3 octave bands are typically more and can exceed 15 dB. Fluctuations in individual 1/3 octave bands can sometimes synchronize and desynchronize over periods, leading to increases and decreases in magnitude of the A-weighted fluctuations. Similarly, in wind farms with multiple turbines, fluctuations can synchronize and desynchronize, leading to variations in AM depth.[6] Most amplitude modulation is in the mid frequencies and most overall A-weighted AM is less than 4.5 dB in depth.[7]

Many confirmed and hypothesized causes of AM exist, including: blade passage in front of the tower, blade tip sound emission directivity, wind shear, inflow turbulence, and turbine blade yaw

[6] McCunney, Robert, et al. "Wind Turbines and Health: A Critical Review of the Scientific Literature." *Journal of Occupational and Environmental Medicine.* 56(11) November 2014: pp. e108-e130.
[7] RSG, et al., "Massachusetts Study on Wind Turbine Acoustics," Massachusetts Clean Energy Center and Massachusetts Department of Environmental Protection, 2016

error. It has recently been noted that although wind shear can contribute to the extent of AM, wind shear does not contribute to the existence of AM in and of itself. Instead, there needs to be detachment of airflow from the blades for wind shear to contribute to AM.[8] While factors like the blade passing in front of the tower are intrinsic to wind turbine design, other factors vary between turbine designs, local meteorology, topography, and turbine layout. Mountainous areas, for example, are more likely to have turbulent airflow, less likely to have high wind shear, and less likely to have turbine layouts that allow for blade passage synchronization for multiple turbines. AM extent varies with the relative location of a receiver to the turbine. AM is usually experienced most when the receiver is between 45 and 60 degrees from the downwind or upwind position and is experienced least directly with the receiver directly upwind or downwind of the turbines.

Meteorology

Meteorological conditions can significantly affect sound propagation. The two most important conditions to consider are wind shear and temperature lapse. Wind shear is the difference in wind speeds by elevation and temperature lapse rate is the temperature gradient by elevation. In conditions with high wind shear (large wind speed gradient), sound levels upwind from the source tend to decrease and sound levels downwind tend to increase due to the refraction, or bending, of the sound (Figure 8).

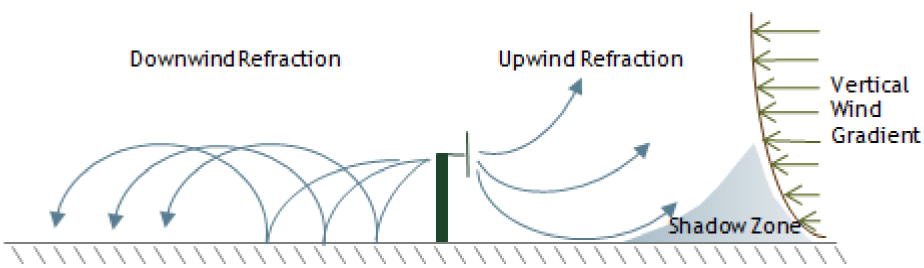

FIGURE 8: SCHEMATIC OF THE REFRACTION OF SOUND DUE TO VERTICAL WIND GRADIENT (WIND SHEAR)

With temperature lapse, when ground surface temperatures are higher than those aloft, sound will tend to refract upwards, leading to lower sound levels near the ground. The opposite is true when ground temperatures are lower than those aloft (an inversion condition).

High winds and high solar radiation can create turbulence which tends to break up and dissipate sound energy. Highly stable atmospheres, which tend to occur on clear nights with low ground-level wind speeds, tend to minimize atmospheric turbulence and are generally more favorable to downwind propagation.

In general terms, sound propagates along the ground best under stable conditions with a strong temperature inversion. This tends to occur during the night and is characterized by low ground-level winds. As a result, worst-case conditions for wind turbines tend to occur downwind under

[8] “Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effect.” *RenewableUK.* December 2013.

moderate nighttime temperature inversions. Therefore, this is the default condition for modeling wind turbine sound.

Masking

As mentioned above, sound levels from wind turbines are a function of wind speed. Background sound is also a function of wind speed, i.e., the stronger the winds, the louder the resulting background sound. This effect is amplified in areas covered by trees and other vegetation.

The sound from a wind turbine can often be masked by wind noise at downwind receivers because the frequency spectrum from wind is similar to the frequency spectrum from a wind turbine. Figure 9 compares the shape of the sound spectrum measured during a 5 m/s wind event to that of the GE 3.0-140 LNTE wind turbine. As shown, the shapes of the spectra are similar at lower frequencies. At higher frequencies, the sounds from the masking wind noise are higher than the wind turbine. As a result, the masking of turbine noise occurs at higher wind speeds for some meteorological conditions. Masking will occur most, when ground wind speeds are relatively high, creating wind-caused noise such as wind blowing through the trees and interaction of wind with structures.

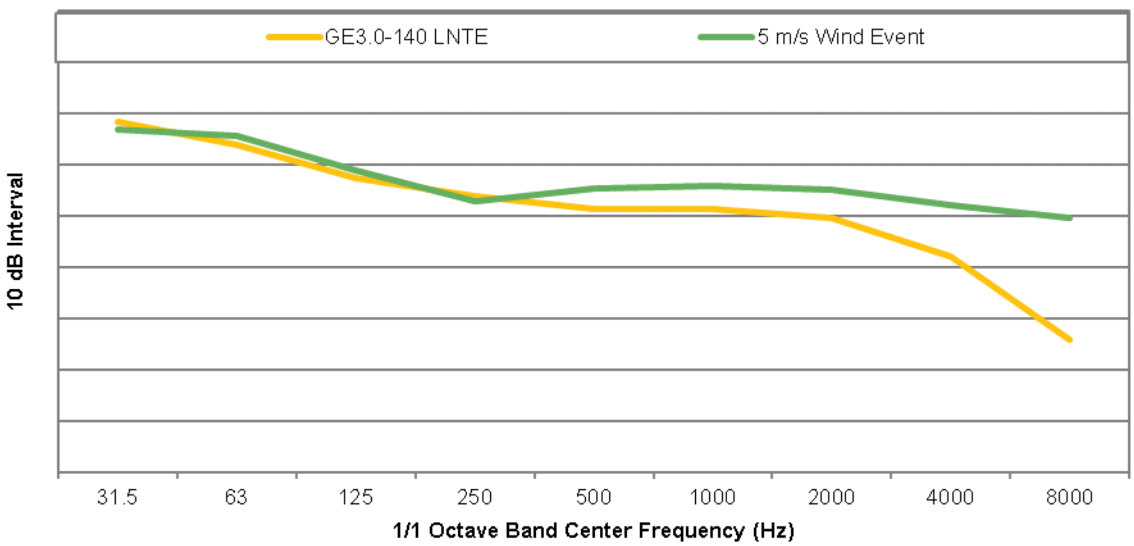

FIGURE 9: COMPARISON OF NORMALIZED FREQUENCY SPECTRA MEASURED FROM A 5 M/S WIND EVENT AND THE SOUND POWER SPECTRA FROM THE GE 3.0-140 LNTE[9]

It is important to note that while winds may be blowing at turbine height, there may be little to no wind at ground level. This is especially true during strong wind gradients (high wind shear), which mostly occur at night. This can also occur on the leeward side of ridges where the ridge blocks the wind.

[9] The purpose of this Figure is to show the shapes to two spectra relative to one another and not the actual sound level of the two sources of sound. The level of each source was normalized independently.

APPENDIX C. NOISE DESIGN GOALS FOR WIND TURBINES

Federal Guidelines

Many federal agencies have adopted guidelines and standards that apply to other types of facilities. A summary of some of these standards is shown in Table 2. Note that these standards are in terms of L_{eq}, L_{dn}, or L_{10}. The L_{eq} is the pressure weighted average sound level, over a specified period of time. The L_{dn} is the A-weighted day-night L_{eq}, where a penalty of 10 dB is applied to nighttime sound. The L_{10} is the 10^{th} percentile sound level. It is the level that is exceeded 10% of the time, and thus represents the higher sound levels over a period of time.

The United States Department of the Interior, Bureau of Land Management (BLM) has developed a Programmatic Environmental Impact Statement (PEIS) for Wind Energy Development on BLM Lands in the Western United States. Noise is addressed in several sections of the PEIS. Several relevant points made in the PEIS are listed below:

- From Section 4.5.1: "at many wind energy project sites on BLM-administered lands, large fluctuations in broadband noise are common, and even a 10-dB increase would be unlikely to cause an adverse community response. In addition, noise containing discrete tones (tonal noise) is much more noticeable and more annoying at the same relative loudness level than other types of noise, because it stands out against background noise."
- From Section 4.5.2: "In general, background noise levels (i.e., noise from all sources not associated with a wind energy facility) are higher during the day than at night. For a typical rural environment, background noise is expected to be approximately 40 dB(A) during the day and 30 dB(A) at night (Harris 1979), or about 35 dB(A) as DNL (Miller 2002)."
- From Section 4.5.4: "The EPA guideline recommends an L_{dn} of 55 dB(A) to protect the public from the effect of broadband environmental noise in typically quiet outdoor and residential areas (EPA 1974). This level is not a regulatory goal but is 'intentionally conservative to protect the most sensitive portion of the American population' with 'an additional margin of safety.' For protection against hearing loss in the general population from non-impulsive noise, the EPA guideline recommends an L_{eq} of 70 dB(A) or less over a 40-year period."

TABLE 2: SUMMARY OF FEDERAL GUIDELINES AND STANDARDS FOR EXTERIOR NOISE

Agency	Applies to	Standard (dBA)
Environmental Protection Agency	Guideline to protect public health and welfare with an adequate margin of safety	55 dB L_{dn}
Environmental Protection Agency	Level of intermittent noise identified to protect against hearing loss	70 dB L_{24h}
Environmental Protection Agency	100 percent speech intelligibility indoors and 99 percent speech intelligibility outdoors at 1 meter (3.3 feet)	55 dB L_{dn}
Occupational Safety and Health Administration	Maximum allowable sound level for an 8-hour work day	90 dB L_{8h}
Bureau of Land Management (BLM)	Guidelines for the development of wind turbines on federal lands managed by BLM	Refers to the EPA 55 dB L_{dn} guideline.
Federal Energy Regulatory Commission (FERC)	Compressor facilities under FERC jurisdiction	55 dB L_{dn}
Federal Highway Administration (FHWA)	Federally funded highway projects. For "Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential for the area to continue to serve its intended purpose."	57 dBA L_{eq} or 60 dBA L_{10} during peak traffic noise hour.
	For residential, active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings	67 dBA L_{eq} or 70 dBA L_{10} during the peak traffic noise hour
Federal Interagency Task Force	This Taskforce is set up to develop consistency of noise standards among federal agencies	55 to 65 dB L_{dn} for impacts on residential areas

- From Section 5.5.3.1: "aerodynamic noise is the dominant source from modern wind turbines (Fégeant 1999)."
- From Section 5.5.3.1: "Considering geometric spreading only, this results in a sound pressure level of 58 to 62 dB(A) at a distance of 50 m (164 ft.) from the turbine, which is about the same level as conversational speech at a 1 m (3 ft.) distance. At a receptor approximately 2,000 ft. (600 m) away, the equivalent sound pressure level would be 36

to 40 dB(A) when the wind is blowing from the turbine toward the receptor. This level is typical of background levels of a rural environment (Section 4.5.2). To estimate combined noise levels from multiple turbines, the sound pressure level from each turbine should be estimated and summed. Different arrangements of multiple wind turbines (e.g., in a line along a ridge versus in clusters) would result in different noise levels; however, the resultant noise levels would not vary by more than 10 dB."

- From Section 5.5.3.1: "In general, the effects of wind speed on noise propagation would generally dominate over those of temperature gradient."
- From Section 5.5.3.1: "Wind-generated noise would increase by about 2.5 dB(A) per each 3 ft./s (1 m/s) wind speed increase (Hau 2000); the noise level of a wind turbine, however, would increase only by about 1 dB(A) per 3 ft./s (1 m/s). In general, if the background noise level exceeds the calculated noise level of a wind turbine by about 6 dB(A), the latter no longer contributes to a perceptible increase of noise. At wind speed of about 33 ft./s (10 m/s), wind-generated noise is higher than aerodynamic noise. In addition, it is difficult to measure sound from modern wind turbines above a wind speed of 26 ft./s (8 m/s) because the background wind-generated noise masks the wind turbine noise at that speed (DWIA 2003)."
- From Section 6.4.1.6: "Noise generated by turbines, substations, transmission lines, and maintenance activities during the operational phase would approach typical background levels for rural areas at distances of 2,000 ft. (600 m) or less and, therefore, would not be expected to result in cumulative impacts to local residents."

These statements from the BLM's Wind Energy Development PEIS do not represent a regulatory standard itself, but they do provide some insight on how one federal agency is approaching noise generated from wind turbine projects.

The EPA discussed speech intelligibility relative to a day-night exterior sound level of 55 dBA (55 dBA L_{dn} is the EPA's guideline sound level to protect public health). 55 dBA L_{dn} is equivalent to a 45 dBA L_{eq} sound level at night and 55 dBA L_{eq} sound level during the day. Or alternatively a sound level of 48.6 dBA L_{eq} through the night and day. The EPA states that on average this will yield 100 percent speech intelligibility indoors, with a 5 dB margin of safety and 99 percent speech intelligibility at 1 meter (3.3 feet) outdoors.

World Health Organization Guidelines

The United Nation's World Health Organization (WHO) has published "Guidelines for Community Noise" (1999) which uses research on the health impacts of noise to develop guideline sound levels for communities. The foreword of the report states, "The scope of WHO's effort to derive guidelines for community noise is to consolidate actual scientific knowledge on the health impacts of community noise and to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments."

Table 4.1 of the WHO's "Guidelines for Community Noise" (1999) provides guideline values for community noise in specific environments. The WHO guidelines suggest a daytime and nighttime protective noise level. During the day, the levels are 55 dBA $L_{eq(16)}$, that is, an average over a 16-hour day, to protect against serious annoyance and 50 dBA $L_{eq(16)}$ to protect against moderate annoyance.

During the night, the WHO recommends limits of 45 dBA L_{8h}[10] and an instantaneous maximum of 60 dBA L_{Fmax} (fast response maximum). These are to be measured outside the bedroom window. These guidelines are based on the assumption that sound levels indoors would be reduced by 15 dBA with windows partially open. That is, the sound level inside the bedroom that is protective of sleep is 30 dBA L_{8h}. So long as the sound levels outside of the house remains at or below 45 dBA, sound levels in the bedroom will generally remain below 30 dBA. Given the climate in this region, this is essentially a summertime standard, since residents are less likely to have their windows open during other times of the year. By closing windows, an additional ~10 dB of sound attenuation will result. In addition to protection against annoyance, these guidelines are intended to protect against speech intelligibility, sleep disturbance, and hearing impairment. Of these factors, protection against annoyance and sleep disturbance require the lowest limits.

The WHO suggest that full-sentence intelligibility requires a signal-to-noise ratio of about 15 dB. For speech volume of 50 dBA, this would indicate some speech interference as low as 35 dBA for “smaller rooms.” Although speech interference is influenced by the spectrum of the masking sound, no particular guidance is given to adjust the WHO’s guidelines for sound sources of different frequency content. Since speech may range from 100 Hz to 6 kHz, there will be overlap between the spectra of wind turbine noise and speech. This guideline is generally intended for classrooms and so includes corrections for the hearing impaired, reverberation, children, and lack of language proficiency. 50 dBA is also a low sound level for speech at close distances, with most normal speech being 60 dBA at close distances, as is stated in ANSI 12.65-2011 (Figure 10).

The WHO long-term guideline to protect against hearing impairment is 70 dBA L_{24h} over a lifetime exposure, and higher for occupational or recreational exposure.

The WHO indicates that sound sources with high levels of low-frequency sound can be more intrusive. The guidelines do not include specific limits and instead state:

> “When noise is continuous, the equivalent sound pressure level should not exceed 30 dB(A) indoors, if negative effects on sleep are to be avoided. For noise with a large portion of low-frequency sound a still lower guideline is recommended.”

No specific definition is given for what entails a “large portion” of low-frequency sound. The WHO recommends doing a frequency analysis if the difference between the C- and A-weighted sound levels exceeds 10 dB. As WHO indicates, this only gives “crude information” about low-frequency content, and is not an indicator in and of itself.

[10] This is the equivalent average sound level, averaged over eight nighttime hours, measured outside the bedroom window.

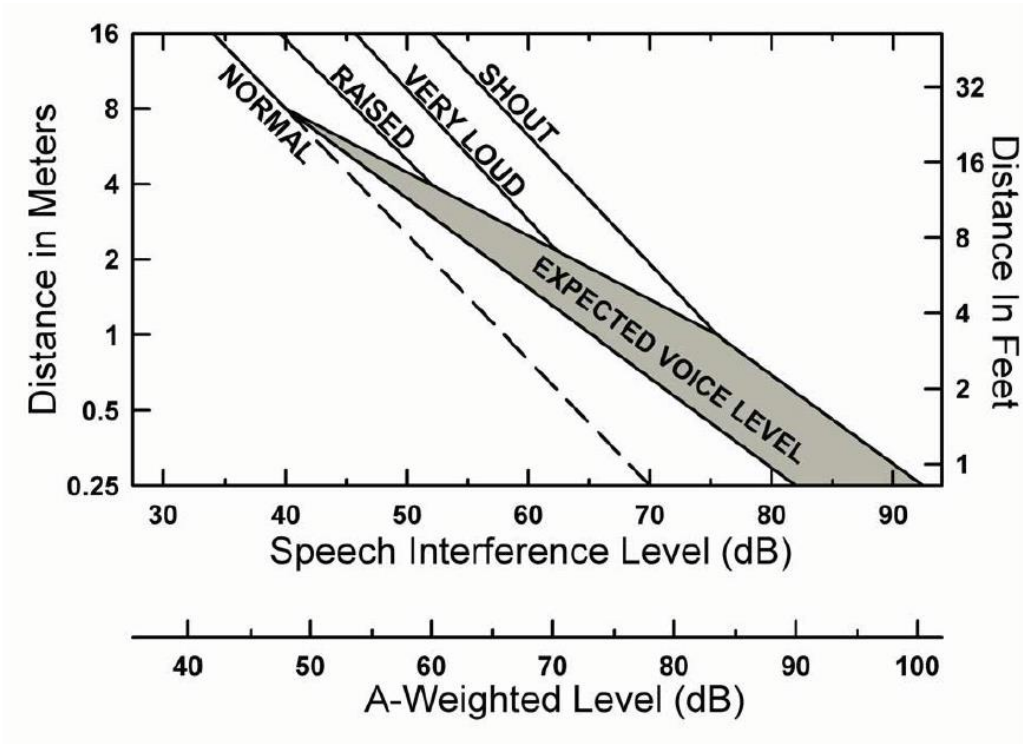

FIGURE 10: SOUND PRESSURE LEVEL OF SPEECH (FROM ANSI S12.65-2011)

Since the WHO guidelines were developed to protect human health, all suggested limits apply to sound levels at residences or areas where humans typically frequent. For example, the guidelines reflective of sleep disturbance are specified to be measured outside the bedroom window.

In October 2009, WHO Europe conducted an updated literature review and built upon WHO's guidelines for nighttime noise in Europe. They added an *annual average* nighttime guideline level to protect against adverse effects on sleep disturbance. This guideline is 40 dBA $L_{night, outside}$, measured outside the bedroom window.

Neither the 1999 nor 2009 guidelines were developed specifically for wind turbine noise.

In 2018, WHO Europe developed a "conditional" recommendation of 45 dB L_{den} (day evening night level)[11] limit for wind turbines. This recommendation was based on the exterior turbine-only sound level where 10 percent of a population is highly annoyed to wind turbine noise indoors. The 10% criterion is not based on any systemic health studies on wind turbine sound. Recent work of Hübner et al on a sample of U.S. residences around wind turbines found that "assessing annoyance alone is imprecise as it does not accurately reflect the small subset of residents who experience psychological and physical symptoms." The authors concluded that

[11] The L_{den} is the annual average equivalent continuous sound level, with the evening weighted with +5 dB and night with +10 dB.

annoyance that leads to stress was not a function of wind turbine sound level, but rather due to a perception of a lack of fairness in the permitting process and other subjective factors.[12]

WHO Europe considers annoyance a “health endpoint”, which is not widely recognized in the U.S. That is, annoyance is not considered a disease. WHO Europe did not find evidence of the correlation of wind turbine noise with ischemic heart disease (IHD), hypertension, sleep disturbance, hearing impairment, and delayed learning in children. Each of these has been found in relation to excessive environmental noise from other sources such as highways and transit.

We do not recommend the WHO Europe guideline for wind turbine sound be used in a regulation or permit limit. The first issue is that the WHO considers the recommendation “conditional.” The term conditional means that:

> …recommendation requires a policy-making process with substantial debate and involvement of various stakeholders. There is less certainty of its efficacy owing to lower quality of evidence of a net benefit, opposing values and preferences of individuals and populations affected or the high resource implications of the recommendation, meaning there may be circumstances or settings in which it will not apply.

They label the guideline conditional because of the limited amount of evidence found and the fact that they considered this evidence to be poor (2018 WHO Guidelines at p. 78).

The guidelines do not include some of the more recent studies that have been performed on this subject, due to no studies being included after 2014. This includes the comprehensive Health Canada study (Michaud et al, 2015 and 2016) and the Danish Cancer Society study (Poulsen et al, 2018 and 2019). As a result, the literature review is already out-of-date. For example, both Health Canada and the Danish Cancer Society looked at sleep disturbance due to wind turbine noise and found no impacts at the levels considered as design goals in this report.

The WHO Europe guideline uses the L_{den} (annual average day-evening-night equivalent continuous sound level) metric. This is not a reasonable regulatory metric in the U.S. Given that it is an annual average, to assess compliance with the L_{den} metric would require measurement of turbine-only sound levels during all times of day and during all meteorological and operational conditions. Due to number of other sound sources present at most sites, this will be difficult, if not impossible as it would require constantly shutting off the wind power project to account for the contribution from the wind power project. The use of the L_{den} might be justifiable if it were proven to best predict human response to wind turbine noise, but as the WHO Europe guideline states, “Based on all these factors, it may be concluded that the acoustical description of wind turbine noise by means of L_{den} or L_{night} may be a poor characterization of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes.” (2018 WHO Guidelines at p. 86) The reasoning for the WHO’s use of this metric is due to its specification in the European Noise Directive (END) for use in noise mapping (2018 WHO Guidelines at p. 86).

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[12] Hübener, G., Pohl, J., Hoen, B., Firestone, B., Rand, J., Elliott, D., Haac, R. “Monitoring annoyance and stress effects of wind turbines on enarby residents: A comparison of U.S. and European samples,” Environment International, V132, 105090, 2019.

Wind Turbine Community Complaint Potential

Many sound level standards and guidelines are based on research conducted for transportation noise. There have been some studies that conclude that wind turbine noise is more intrusive to some listeners than a transportation source of equivalent magnitude. Suggested reasons for increased annoyance include amplitude modulation, tonality, low-frequency content, and the newness of wind turbine noise as an environmental noise source.

The following subsection of this report reviews these studies that have been performed comparing human response to audible sound and infrasound from wind turbines.

Response in the Normal Hearing Range

Studies of human response to wind turbine sound were performed in Sweden (in 2000 and 2005) and The Netherlands (2007) by Eja Pederson and other authors (Waye, Lassman, etc.).[13,14,15,16] There have been several papers about these studies, including a summary written by Janssen et al (2011) that included a combined dose-response curve.[17] The Pederson studies were performed by sending self-reporting surveys to respondents living in and around wind farms and comparing responses from these surveys to modeled sound levels at those residences. A total of 1,830 people responded to these surveys.

The Janssen dose-response curve shows that for sound at 45 dBA L_{eq} (calculated outdoors), there is an annoyance rate of approximately 40 percent for residents outdoors and 21 percent for residents indoors. The highly annoyed rate is 23 percent outdoors and 11 percent indoors for this sound level. Note that some sound levels were calculated using the equations of the Swedish Environmental Protection Agency and assumes that receptors are always downwind of the source and others were calculated using ISO 9613-2; although, Janssen reported that the results between the two models were similar.[18]

A common finding among the various studies is that annoyance was lower among residents who benefited economically from the wind turbines. Annoyance also increases with age, visibility of the turbines from the residence, and noise sensitivity.

Health Canada studied health indicators among populations exposed to wind turbine sound.[19] Just as with Pedersen's studies, self-reporting surveys were distributed to participants (1,238 in

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13 Pedersen, Eja and Waye, Kerstin. "Perception and annoyance due to wind turbine noise - a dose-response relation." Journal of the Acoustical Society of America. 116(6). pp. 3460-3470.
14 Pedersen, Eja, et al. "Response to wind turbine noise in the Netherlands." Acoustics 2008. Paris, France.: 29 June – 4 July 2008.
15 Pedersen, Eja and Persson Waye, Kerstin. "Wind turbines-low level noise sources interfering with restoration?" Environ. Res. Lett. 3 (January-March 2008). 11 January 2008.
16 Pedersen, Eja and Larsman Pernilla. "The impact of visual factors on noise annoyance among people living in the vicinity of wind turbines." Journal of Environmental Psychology. 28(2008). pp. 379-389.
17 Janssen, Sabine, et al. "A comparison between exposure-response relationships for wind turbine annoyance and annoyance due to other noise sources." *J. Acoust. Soc. Am.* 130(6). December 2011. pp. 3746-3753.
18 The values shown in Janssen et al are the L_{DEN} or day-evening-night sound level. The values shown in this paper have been adjusted to represent a median hourly value.
19 Michaud, David. "Wind Turbine Noise and Health Study: Summary of Results." *6th International Meeting on Wind Turbine Noise.* Glasgow, Scotland: 20-23 April 2015.

total). Correlations were found between wind turbine modeled sound levels and annoyance toward noise, shadow-flicker, turbine visibility, blinking lights, and vibration. Although C-weighted sound levels were calculated for the study, A-weighted levels were primarily assessed, due to the high correlation between A-weighted and C-weighted levels (R^2=0.88). The rate of highly annoyed residents due to wind turbine noise was found to be approximately 18 percent at sound levels between 40 and 46 dBA L_{eq}. This sound level assumes wind turbines emissions at an 8 m/s wind speed measured at a height of 10 meters. Also note, that the Health Canada study assumed a ground absorption factor of G=0.7 with no uncertainty factor added to the wind turbine sound power, so levels modeled by Health Canada will be about 3 dB lower than the equivalent scenario modeled in this report. Therefore, the 18 percent highly annoyed would be equivalent to a range of 43 to 49 dBA, using the modeling parameters used in this report.

A Japanese study also looked at the relative annoyance of residents surrounding wind farms, compared with the $L_{eq,n}$, or average of the A-weighted 10-minute sound levels from each hour over the night with the wind turbine(s) at their rated capacity.[20] The $L_{eq,n}$ measured by the study is lower, on average, than the sound level downwind with the 10-meter wind speed at 8 m/s, due to the directionality of turbines. Due to differences in wind farm layouts (single turbine, grid layout, ridgeline layout, etc.), this difference was not readily determined. The authors estimated that, on average, the $L_{eq,n}$ will be about 6 dB less than the L_{dn}. Using this assumption, the authors found that wind turbine noise is between 6 and 9 dB more annoying than road traffic noise. The study found that between 41 and 45 dB $L_{eq,n}$ approximately 14 percent of respondents were extremely annoyed, and 19 percent were moderately annoyed.[21] Other findings included that visual disturbance was well correlated with wind turbine noise disturbance, and that insomnia, though low in incidence overall, was more prevalent near wind turbine sites. Insomnia was also found to be related to visual disturbance. Wind turbine noise was also found to have an effect on sleep disturbance, when audible, and particularly when sound levels were greater than 40 dB $L_{eq,n}$.

Old, et al. analyzed the modeling metrics used in the Janssen, Michaud, and Kuwano dose-response curves and found that they were not directly comparable.[22] That is, they used different metrics and/or averaging times. He normalized the dose-response curves of the three authors to a common median one-hour L_{eq}, with a mixed ground factor and four-meter receptor height. No uncertainty factor was added to the manufacturer mean sound power level.

Haac, et al. is the only dose response study done in the U.S. The study was sponsored by the U.S. Department of Energy and conducted through a contract with the Lawrence Berkley National Laboratory, RSG, and researchers at three universities. This study found that less than half of all respondents (41%) could hear the wind turbines inside their homes at sound levels between 40 and 45 dBA ($L_{1h\ max}$). About two thirds (69%) could hear the wind turbines outside their homes at the same level. Less than 20% of nonparticipants surveyed (19%) were highly

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[20] Kuwano, Sonoko, et al. "Social Survey on Wind Turbine Noise in Japan." *Noise Control Engr. J. 62(6). November-December 2014. pp. 503-520.*
[21] Yano, Takashi, et al. "Dose-response relationships for wind turbine noise in Japan." *Internoise 2013.* Innsbruck, Austria: 15-18 September 2013.
[22] Old, I., Kaliski, K., "Wind turbine noise dose response – Comparison of recent studies," Proceedings of the 7th International Conference of Wind Turbine Noise, May 2017.

annoyed by sound levels between 40 and 45 dBA. The three most significant factors leading to annoyance were “like the look of the project”, “noise sensitive”, and “prior attitude”. The level of annoyance is lower when project participants are included.

The noise-annoyance dose-response curves for the studies mentioned above are shown in Figure 11.

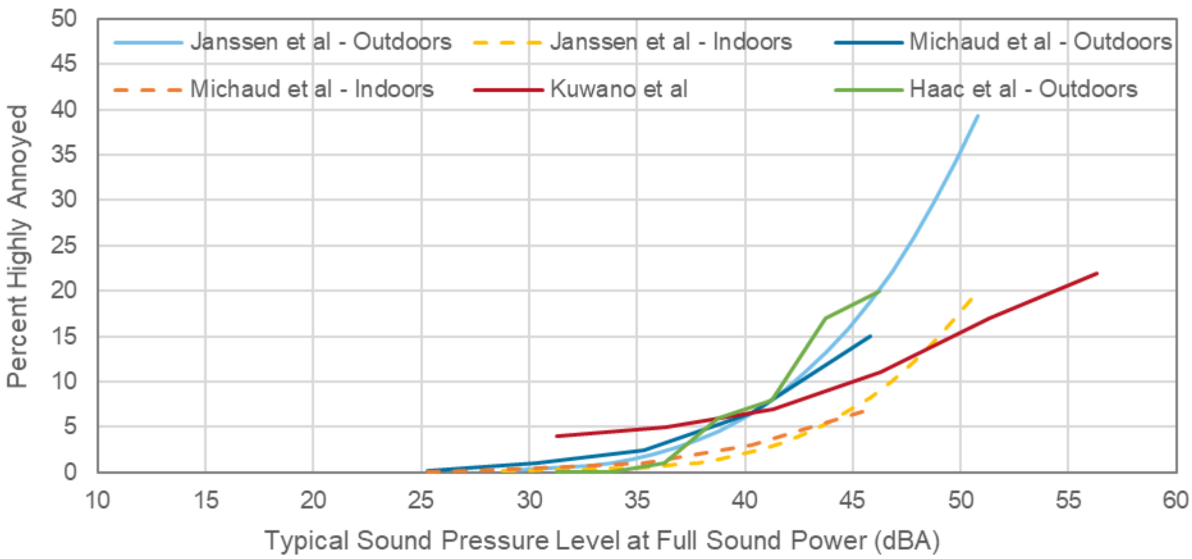

FIGURE 11: WIND TURBINE NOISE DOSE-RESPONSE CURVES FOR NONPARTICIPANTS NORMALIZED TO 1-HOUR L_{eq}, G=0.5+2 dB, 4-METER HEIGHT ADAPTED FROM OLD & KALISKI (2017) AND HAAC ET AL. (2019)

Hübner, et al. took a slightly different approach, using data from dose response studies in the United States, Germany, and Switzerland and then adding criteria, to better asses how many people, who actually hear wind turbine noise are highly annoyed, and how many of those experience some kind of stress related symptom or used some kind of strategy to mitigate symptoms.[23] Results found that a total of five-percent of the total people surrounding the wind power projects and ten-percent of those who were able to hear wind turbine noise found it strongly annoying. Annoyance was correlated with perceived fairness of the planning process and how the residents considered the wind power project in general.

Infrasound

Infrasound is generally defined as the portion of the frequency spectrum below 20 Hz which is nominally inaudible to humans. Low-frequency sound is in the lower portion of the audibility range and is generally considered in the frequency range from 20 Hz to 200 Hz.

Measurements of infrasound at distances from wind turbines typical of their nearest residential neighbors have consistently found that infrasound levels are below published audible human perception limits. O’Neal et al. measured sound from wind projects that used the GE 1.5 sle and Siemens SWT 2.3-93 model wind turbines. They found that at typical receptor distances away

[23] Hübner, Gundula, et al. “Monitoring Annoyance and Stress Effects of Wind Turbines on Nearby Residents: A comparison of U.S. and European Samples.” *Environment International.* V132, 2019.

from a wind turbine, more than 1,000 feet away, wind turbine sound exceeds audibility thresholds starting at 50 Hz.[24]

Tachibana et al. measured sound levels from 34 wind projects around Japan over a three-year period.[25] They found that infrasound levels were "much lower than the criterion curve" proposed by Moorehouse et al.[26] RSG et al. studied infrasound levels at two wind turbine projects in the northeastern U.S. Both indoor and outdoor measurements were made.[27] Comparisons between turbine-on periods and adjacent turbine shutdown periods indicated the presence of wind-turbine-generated infrasound, but well below ISO 389-7[28] and Watanabe et al.[29] perception limits. In their review of several wind turbine measurement studies (including O'Neal and Tachibana), McCunney et al. did not find evidence of audible or perceptible infrasound levels at typical residential distances from wind projects.[30]

Authors Salt, Pierpont, and Schomer have theorized that infrasound from wind farms can be perceived by humans and cause adverse reactions, even when it is below measured audibility thresholds.[31,32,33] Some of these theories have focused on the human vestibular system, hypothesizing that subaudible infrasound could stimulate the vestibular system, upsetting the human body's manner of determining balance and causing symptoms such as dizziness, nausea, and headaches, along with disruptions in sleep. More recently Schomer has stated that the hypothesis that subaudible wind turbine infrasound causes adverse health effects can almost be ruled out, though he has not fully abandoned the hypothesis.[34] In response, McCunney et al. and Leventhall contend that there has been no demonstration that humans can perceive subaudible infrasound, citing the relative insensitivity of the inner ear (where the

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[24] O'Neal, R. et al. "Low frequency noise and infrasound from wind turbines." Noise Control Engineering J. 59 (2), 2011.
[25] Tachibana, et al. "Nationwide field measurements of wind turbine noise in Japan." Noise Control Engr. J. 62 (2) 2014.
[26] Moorehouse, A. T. "A procedure for the assessment of low frequency noise complaints." J. Acoust. Soc. Am. 126 (3) 2009.
[27] RSG, et al. "Massachusetts study on wind turbine acoustics." Prepared for MassCEC and MassDEP, February 2016.
[28] *Acoustics -- Reference zero for the calibration of audiometric equipment -- Part 7: Reference threshold of hearing under free-field and diffuse-field listening conditions,* International Standards Organization, ISO 389-7:2005, last reviewed 2013
[29] Watanabe, T., and Moller, H., "Low frequency hearing thresholds in pressure field and in free field," *J. Low Freq. Noise Vib., Vol. 9(3), 106-115.*
[30] McCunney, Robert, et al. "Wind Turbines and Health: A Critical Review of the Scientific Literature." *Journal of Occupational and Environmental Medicine.* 56(11). November 2014. pp. e108-e130.
[31] Salt, Alec and Hullar, Timothy. "Responses of the Ear to Low-Frequency Sounds, Infrasound, and Wind Turbines." *Hear Res.* 268(2010). pp. 12-21.
[32] Pierpont, Nina. "Wind Turbine Syndrome: A Report on a Natural Experiment." *K-Selected Books*: Santa Fe, New Mexico: 2009.
[33] Schomer, Paul, et al. "A Theory to Explain Some Physiological Effects of the Infrasonic Emissions at Some Wind Farm Sites." *J. Acoust. Soc. Am.* 137(3). March 2015. pp. 1357-1365.
[34] Hessler, George, et al. "Health Effects from Wind Turbine low Frequency noise and Infrasound- Do Wind Turbines Make People Sick? That is the Issue." *Sound and Vibration*. January 2017. pp. 34-44.

vestibular system is located) to airborne sound and the presence of other low to moderate magnitude infrasound sources in the body and the environment.[35,36]

Yokoyama et al. conducted laboratory experiments with subjects exposed to synthesized infrasound from wind turbines. In one experiment, synthesized wind turbine sound was filtered to eliminate high-frequency sound at 10 different cutoff frequencies from 10 Hz to 125 Hz.[37] The results indicate that when all sound above 20 Hz was filtered out, none of the respondents could hear or sense the wind turbine sound. In a second experiment correlating subject response of wind turbine sound to different frequency-weighting schemes, they found that the subjective loudness of wind turbine sound was best described by the A-weighted sound level rather than other weightings that focused on low-frequency sound or infrasound.[38]

Hansen et al. compared subjective response to infrasound and “sham” infrasound.[39] In one case, recordings of wind turbine noise, filtered to exclude sound above 53 Hz, were presented to subjects with the infrasonic content present, with only the infrasonic content present, and with the infrasonic content removed. Results showed that adverse response to the sound, was determined by the low frequency, not infrasonic content of the sound. A study by Walker, et al. found that feelings of nausea and annoyance were more correlated with audible frequency blade swish than infrasonic components.[40]

Research by Tonin, et al. found that response to infrasound was more determined by information the subject had received about the effects of infrasound than the presence of infrasound in a sound signal.[41]

Most recently, Maijala, et al. measured infrasound at two locations near wind power projects that had been the subject of infrasound complaints, did a survey of the prevalence of symptoms attributed to infrasound, and performed a infrasound detection and annoyance test on both those that did and those that did not attribute their symptoms to wind turbine infrasound. They found that under most conditions, infrasound was below perception thresholds, but it could approach previously measured perception thresholds under some conditions. Infrasound was at a similar level to average urban areas. During listening tests, no subjects could reliably differentiate between wind turbine sound recordings that did or did not include infrasound even at levels that approached perception thresholds. There was also no difference in annoyance between recordings that did and did not include infrasound and there were no differences in

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[35] McCunney, Robert, et al. “Wind Turbines and Health: A Critical Review of the Scientific Literature.” *Journal of Occupational and Environmental Medicine.* 56(11). November 2014. pp. e108-e130.
[36] Leventhall, Geoff. “Infrasound and the ear.” *Fifth International Conference on Wind Turbine Noise*. Denver, Colorado: 28-30 August 2013.
[37] Yokoyama S., et al. “Perception of low frequency components in wind turbine noise.” Noise Control Engr. J. 62(5) 2014.
[38] Yokoyama et al. “Loudness evaluation of general environmental noise containing low frequency components.” Proceedings of InterNoise2013, 2013
[39] Hansen, K, et al. “Perception and Annoyance of Low Frequency Noise Versus Infrasound in the Context of Wind Turbine Noise.” *6th International meeting on Wind Turbine Noise*. Glasgow, Scotland: 20-23 April 2015.
[40] Walker, Bruce and Celano, Joseph. “Progress Report on Synthesis of Wind Turbine Noise and Infrasound.” *6th International Meeting on Wind Turbine Noise*. Glasgow, Scotland: 20-23 April 2015.
[41] Tonin, Renzo and Brett, James. “Response to Simulated Wind Farm Infrasound Including Effect of Expectation.” *6th International Meeting on Wind Turbine Noise*. Glasgow, Scotland: 20-23 April 2015.

autonomic nervous system response (indicated through heart rate and skin electrical conductivity). Subjects that attributed health effects to wind turbine infrasound were not more able to detect infrasound. Some of those that previously attributed their symptoms to infrasound negatively reacted to clips that they were told would contain infrasound, but which actually did not. The study concludes that the symptoms specified by respondents could not have been caused by infrasound, but instead were due to either expectations of adverse health effects to wind turbine noise or were an attribution of conditions with other causes to wind turbine infrasound.[42]

While infrasound from wind farms has not been shown to be audible by humans, infrasound and low-frequency sound can create noise-induced vibration in lightweight structures. ANSI S12.2-2008 Table 3 lists low-frequency noise criteria to prevent "perceptible vibration and rattles in lightweight wall and ceiling structures."[43] These criteria are shown in Table 3. While these are interior levels, the equivalent exterior sound levels will be higher due to building noise reduction. [44, 45, 46] Outside to inside noise reduction is a function of sound frequency and whether windows are open or closed.

ANSI S12.9 Part 4 addresses the annoyance of sounds with strong low-frequency content. Table 4 shows the "Annex D" criteria for minimal annoyance. Annex D suggests that sounds at these frequencies are similar indoors and outdoors as any transmission loss of the walls and windows can be offset by modal resonance amplification in enclosed rooms.

For comparison, Moorehouse's proposed *interior* criteria for infrasound and low-frequency sound are 94 dB, 69 dB, and 52 dB for the 16 Hz, 31.5 Hz, and 63 Hz octave bands, respectively.[47]

TABLE 3: ANSI S12.2 SECTION 6 – INTERIOR SOUND LEVELS FOR PERCEPTIBLE VIBRATION AND RATTLES IN LIGHTWEIGHT WALL AND CEILING STRUCTURES

1/1 OCTAVE BAND CENTER FREQUENCY	16 HZ	31.5 HZ	63 HZ
Clearly perceptible vibration and rattles likely	75 dB	75 dB	80 dB
Moderately perceptible vibration and rattle likely	65 dB	65 dB	70 dB

[42] Maijala, Panu, et al. "Infrasound and Health of Wind Turbines." (*Finnish) Government Policy Brief.* 2020. This study has only been released preliminarily and only in the Finnish language.
[43] "American National Standard Criteria for Evaluating Room Noise", American National Standards Institute ANSI/ASA S12.2-2008, Acoustical Society of America, (2008).
[44] O'Neal, R. et al. "Low frequency noise and infrasound from wind turbines." Noise Control Engineering J. 59 (2), 2011.
[45] RSG, et al. "Massachusetts study on wind turbine acoustics." Prepared for MassCEC and MassDEP, February 2016.
[46] Delta Electronics Light & Acoustics, *Low frequency noise from large wind turbines, Summary and conclusions on measurements and methods,* Danish Energy Authority, EFP-06 Project, 19 December 2008
[47] Moorehouse, A., et al. "Proposed criteria for the assessment of low frequency noise disturbance," Acoustics Research Centre, Salford University DEFRA NANR45, 2005.

TABLE 4: ANSI S12.9 PART 4 ANNEX D – LOW-FREQUENCY SOUND LEVELS BELOW WHICH ANNOYANCE IS MINIMAL

1/1 OCTAVE BAND CENTER FREQUENCY	16 HZ	31.5 HZ	63 HZ
Sound Level Below Which Annoyance is Minimal	65 dB	65 dB	65 dB

APPENDIX D. SOURCE INFORMATION

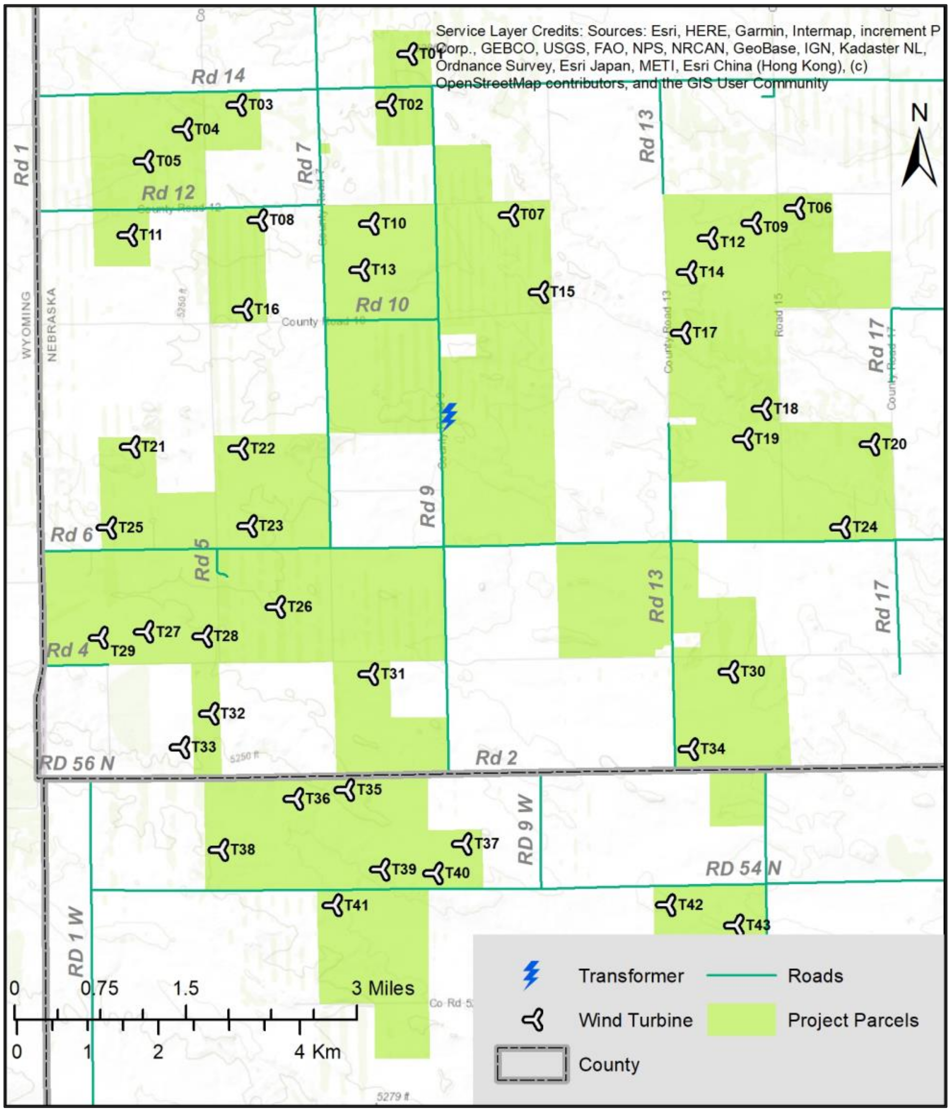

FIGURE 12: WIND TURBINE LOCATION MAP

TABLE 5: WIND TURBINE INFORMATION TABLE

Turbine ID	Turbine Type	Hub Height (m)	Coordinates (UTM NAD83 Z13N)		
			X (m)	Y (m)	Z (m)
1	GE 3.0-140 LNTE	98	584,353	4,593,073	1,603
2	GE 3.0-140 LNTE	98	584,060	4,592,357	1,708
3	GE 3.0-140 LNTE	98	581,945	4,592,354	1,694
4	GE 3.0-140 LNTE	98	581,185	4,592,008	1,713
5	GE 3.0-140 LNTE	98	580,639	4,591,557	1,715
6	GE 3.0-140 LNTE	98	589,829	4,590,897	1,713
7	GE 3.0-140 LNTE	98	585,782	4,590,801	1,669
8	GE 3.0-140 LNTE	98	582,240	4,590,725	1,695
9	GE 3.0-140 LNTE	98	589,212	4,590,689	1,698
10	GE 3.0-140 LNTE	98	583,820	4,590,676	1,671
11	GE 3.0-140 LNTE	98	580,400	4,590,520	1,690
12	GE 3.0-140 LNTE	98	588,603	4,590,473	1,706
13	GE 3.0-140 LNTE	98	583,675	4,590,025	1,675
14	GE 3.0-140 LNTE	98	588,311	4,589,994	1,691
15	GE 3.0-140 LNTE	98	586,205	4,589,712	1,680
16	GE 3.0-140 LNTE	98	582,026	4,589,469	1,696
17	GE 3.0-140 LNTE	98	588,219	4,589,136	1,696
18	GE 3.0-140 LNTE	98	589,355	4,588,063	1,693
19	GE 3.0-140 LNTE	98	589,091	4,587,642	1,683
20	GE 3.0-140 LNTE	98	590,892	4,587,562	1,668
21	GE 3.0-140 LNTE	98	580,433	4,587,531	1,678
22	GE 3.0-140 LNTE	98	581,970	4,587,504	1,712
23	GE 3.0-140 LNTE	98	582,091	4,586,408	1,702
24	GE 3.0-140 LNTE	98	590,476	4,586,398	1,704
25	GE 3.0-140 LNTE	98	580,104	4,586,388	1,662
26	GE 3.0-140 LNTE	98	582,495	4,585,270	1,712
27	GE 3.0-140 LNTE	98	580,637	4,584,913	1,699
28	GE 3.0-140 LNTE	98	581,457	4,584,856	1,710
29	GE 3.0-140 LNTE	98	579,995	4,584,828	1,701
30	GE 3.0-140 LNTE	98	588,894	4,584,354	1,709
31	GE 3.0-140 LNTE	98	583,813	4,584,321	1,669
32	GE 3.0-140 LNTE	98	581,549	4,583,761	1,695
33	GE 3.0-140 LNTE	98	581,143	4,583,285	1,710
34	GE 3.0-140 LNTE	98	588,328	4,583,260	1,702
35	GE 3.0-140 LNTE	98	583,474	4,582,687	1,671
36	GE 3.0-140 LNTE	98	582,750	4,582,562	1,710
37	GE 3.0-140 LNTE	98	585,133	4,581,926	1,694
38	GE 3.0-140 LNTE	98	581,694	4,581,844	1,689
39	GE 3.0-140 LNTE	98	583,966	4,581,564	1,696

Turbine ID	Turbine Type	Hub Height (m)	Coordinates (UTM NAD83 Z13N)		
			X (m)	Y (m)	Z (m)
40	GE 3.0-140 LNTE	98	584,718	4,581,506	1,694
41	GE 3.0-140 LNTE	98	583,297	4,581,056	1,691
42	GE 3.0-140 LNTE	98	588,013	4,581,065	1,686
43	GE 3.0-140 LNTE	98	588,971	4,580,778	1,685

TABLE 6: TRANSFORMER INFORMATION TABLE

Source ID	**Modeled Sound Power (dBA)**	**Source Height (m)**	**Coordinates (UTM NAD83 Z16N)**		
			X (m)	**Y (m)**	**Z (m)**
Transformer (Fans On)	102	3	584,944	4,587,947	1,603

APPENDIX E. RECEIVER LEVEL RESULTS

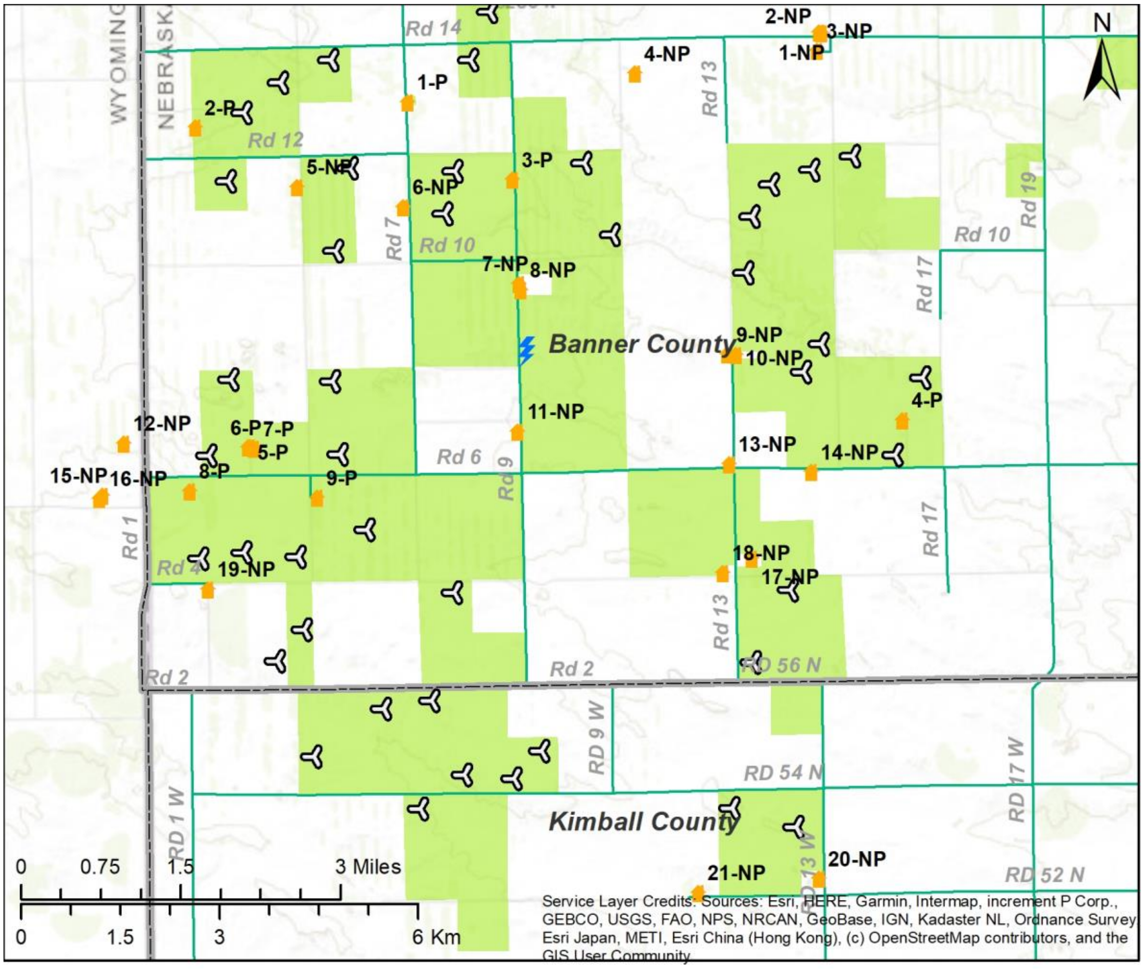

FIGURE 13: RECEIVER MAP

TABLE 7: RECEPTOR SOUND LEVEL RESULTS AND COORDINATES

	Sound Level Results			Coordinates (UTM Zone 13N, NAD 83)		
Receptor	Overall Level (dBA)	31.5 Hz Level (dBZ)	63 Hz Level (dBZ)	X (m)	Y (m)	Z (m)
1-NP	32	51	47	589,357	4,592,764	1,574
2-NP	31	50	47	589,396	4,592,754	1,573
3-NP	33	52	48	589,326	4,592,481	1,576
4-NP	34	53	49	586,575	4,592,140	1,583
5-NP	41	57	53	581,470	4,590,430	1,610
6-NP	42	58	54	583,071	4,590,125	1,602
7-NP	40	54	50	584,822	4,588,968	1,598
8-NP	40	53	49	584,844	4,588,871	1,599
9-NP	38	55	51	587,967	4,587,899	1,573
10-NP	38	56	52	588,099	4,587,891	1,573
11-NP	35	53	48	584,805	4,586,738	1,589
12-NP	35	53	49	578,853	4,586,557	1,622
13-NP	34	53	49	587,999	4,586,245	1,573
14-NP	36	54	50	589,242	4,586,129	1,569
15-NP	33	52	48	578,528	4,585,772	1,614
16-NP	34	53	49	578,486	4,585,724	1,616
17-NP	39	56	52	588,339	4,584,816	1,575
18-NP	36	55	50	587,902	4,584,603	1,578
19-NP	44	59	55	580,120	4,584,359	1,614
20-NP	37	53	49	589,353	4,579,990	1,582
21-NP	33	51	47	587,533	4,579,776	1,570
1-P	39	56	52	583,141	4,591,710	1,604
2-P	40	56	52	579,933	4,591,328	1,625
3-P	40	57	53	584,726	4,590,540	1,594
4-P	43	58	54	590,621	4,586,911	1,574
5-P	42	58	54	580,727	4,586,498	1,614
6-P	42	58	54	580,760	4,586,498	1,614
7-P	42	58	54	580,820	4,586,479	1,613
8-P	42	58	54	579,851	4,585,838	1,616
9-P	42	58	54	581,771	4,585,740	1,610

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Appendix C. Wildlife Studies at the Pronghorn Flats (Banner County) Wind Farm Complex

Site Characterization Study
Banner County, Nebraska
Wind Energy Area of Interest

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September 18, 2014

WEST Inc.

EXECUTIVE SUMMARY

The proposed Banner County, Nebraska, Wind Energy Area of Interest (AOI) is located in Banner County in western Nebraska. The purpose of this report is to characterize the proposed project area, to evaluate the project area based on sensitive species and habitats, and to address implications for project development. The AOI was evaluated during a site visit conducted from public roads on August 7, 2014, during which biological features and overall potential wildlife habitat, plant communities, topography features, and potential raptor nesting habitat were identified.

The AOI is located in the Western High Plains Level III Ecoregion, a smooth to slightly irregular plain characterized by a semi-arid to arid climate, with dryland agriculture constituting the primary land use. The majority of the AOI consists of herbaceous landcover (63.4%) and cultivated crops (31.4%). Forests, hay/pasture, wetlands and open water, shrub/scrub, and developed areas represent a small percentage of the total study area.

Sensitive habitats within the AOI include shortgrass and mixedgrass prairie, ponderosa pine woodlands, and the Wildcat Hills South Biologically Unique Landscape (BUL). Several sensitive wildlife species associated with these have the potential to occur in the AOI. The US Fish and Wildlife Service (USFWS) Information, Planning, and Conservation (IPaC) system lists five federally-protected animal species that may occur in Banner County, including one endangered mammal (black-footed ferret), one endangered fish (pallid sturgeon) and three avian species (two endangered [whooping crane and interior least-tern], and one threatened [piping plover]). However, according to the USFWS Environmental Conservation Online System (ECOS), only the black-footed ferret has the potential to occur in Banner County, Nebraska. The last specimen of black-footed ferret in Nebraska was collected in 1949, and no known extant populations exist in Nebraska. Bald and golden eagles, protected under the federal Bald and Golden Eagle Protection Act (BGEPA), are also considered in this document. The Nebraska Game and Parks Commission (NGPC) lists state threatened and endangered species, two of which have the potential to occur in the AOI, and the Nebraska Natural Legacy Program (NNLP) maintains a list of Tier 1 species, several of which have some potential to occur in the AOI.

The USFWS does not list any federally endangered, threatened or candidate plant species that have the potential to occur in the AOI. The Nebraska Natural Heritage Program (NNHP) and NGPC list sensitive plant species by county, none of which have the potential to occur in the AOI.

Fourteen species of raptors, eight species of owls, and one species of vulture might be found within or near the AOIA throughout the year, including one resident special status species (golden eagle), two USFWS birds of conservation concern (prairie falcon and burrowing owl), and two NNLP Tier 1 species (burrowing owl and ferruginous hawk). Three raptor species were observed during the site visit, none of which were species of concern. Potential nest structures for above ground nesting species were also present in the form of living and dead trees and cliff faces;

grassland areas could also provide nesting habitats for ground-nesting raptors, such as the northern harrier.

No colonial rodents (such as prairie dogs), which are known to attract feeding raptors, were observed during the site visit. However, due to the limited access on public roads, it is unknown if these prey species are available on the AOI. Additionally, raptor use is generally not expected to be influenced by the topography in the AOI due to the east-west orientation of the ridge lines and lack of large, perennial waterbodies. It is likely that birds migrate through the proposed AOI, including passerines, raptors, and waterfowl; however, the AOI does not contain features that would be expected to concentrate avian migrants.

Ten bat species are likely to occur in the AOI. None of the species listed by the USFWS occur on the AOI; however, two NNLP Tier 1 species have the potential to occur (fringed bat and little brown bat). Eight of the bats with the potential to occur in the AOI are year-round residents in the region; however, these species all hibernate in the winter. Two additional bat species are likely to be present in spring, summer, and fall, and potentially breed in the area. Potential roosting habitat within the AOI is found in the form of trees, buildings, rocky cliffs, and rock outcrops. Although the operation of the proposed wind energy facility will likely result in the mortality of some bats, the magnitude of these fatalities and the degree to which bat species will be affected is difficult to predict.

Two state-listed species and 18 state Tier 1 species have some potential to occur in the project area. In addition, both bald and golden eagle have some potential to occur in the AOI. Of these species, golden eagle, Brewer's sparrow, loggerhead shrike, pinyon jay, swift fox, Rocky Mountain bighorn sheep, fringed bat, little brown bat, and sagebrush lizard are most likely to occur within the AOI. Areas that occur within and in the vicinity of the AOI that should be avoided include the Wildcat Hills South BUL. Habitats such as the high quality matrix of grasslands and ponderosa pine woodlands found in the northwest portions of the AOI should be avoided or minimized to minimize impacts. Some areas of the AOI are characterized by extensive agricultural production, offering already disturbed habitats with potential for project development, and with proper project siting, potential impacts to wildlife could be greatly reduced.

To characterize the species composition and abundance of the site's avifauna prior to project development, standardized year-round fixed-point bird use surveys should be conducted to detect common and rare species that occur in the site, and to determine which species of concern may be adversely affected by the project by collecting vertical as well as horizontal flight data to identify levels and patterns of activity within the turbine's rotor-swept zones. Breeding bird surveys should occur in habitats where species listed by the NPGC and NNLP Tier 1 species have the potential to nest. Aerial raptor nest and sharp-tailed grouse lek surveys should be conducted within the project and a surrounding buffer as recommended by NGPC. Due to the potential occurrence of swift fox (state endangered) and mountain plovers (state threatened), consultation with the NGPC should begin early in project development to determine whether species-specific surveys are warranted. Prairie dog town surveys are also recommended because several species of concern with the potential to occur on the AOI are dependent on the presence of prairie dog towns.

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INTRODUCTION

Wind power is the world's most rapidly growing source of energy, and the challenges facing this industry are complex, due in part to concerns related to the impact of wind farms on wildlife species (Government Accountability Office [GAO] 2005). Knowledge of biological resource issues, early in the development phase of wind energy facilities helps the industry identify, avoid, and minimize future problems.

The objectives of this report are: a) to characterize the proposed Banner County, Nebraska Wind Energy Area of Interest (AOI) at the landscape and local levels, describing the biological resources present within and around the proposed area; b) to evaluate the project area based on sensitive species, assessing site-specific characteristics in terms of potential risks to wildlife and habitats, and comparing these characteristics with those at other wind facilities; and c) to address implications for project development, making recommendations for baseline monitoring studies. This Site Characterization Study (SCS) is intended to meet the requirements of a Tier 2 Site Characterization as described in Chapter 3 of the US Fish and Wildlife Service (USFWS) Land-Based Wind Energy Guidelines (WEG; USFWS 2012b).

The area evaluated for potential biological resources includes the AOI and the area within a two-mile buffer of the AOI (Evaluation Area). This report focuses on the following issues, as described in the WEG:

- Presence of areas where development is precluded or should be avoided
    - Areas precluded by law
    - Areas where critical, sensitive, or highly valuable habitat exists
    - Areas of congregation of species
- Presence of plant and animal species of concern and/or their habitat
- Presence of species of habitat fragmentation concern
- Presence of species known to be at risk by wind energy facilities

METHODS

Biological resources within the AOI were evaluated through a desktop search of existing data and a site visit conducted from public roads. Available datasets used to identify biological resources within the project area included topographical and aerial maps, land use/land cover or gap data, elevation data, data publicly available from several state, federal, and non-governmental agencies, published literature, and field guides. Request letters were sent to state and federal agencies; response letters from these agencies can be found in Appendix A.

Site-specific biological features and potential wildlife habitat, including plant communities, topographic features, suitable nesting and roosting habitat, and potential prey populations, were assessed during the reconnaissance-level site visit (August 7, 2014). All wildlife species observed during the site visit were recorded and photographs were taken of the AOI (Appendix B). Observations were made from public roads only, and accessibility to the AOI largely determined how much of the project area was surveyed.

Information about presence (potential or verified) and location of sensitive species was obtained from publicly available information on several websites, including the Nebraska Game and Parks Commission (NGPC 2013, 2014b), the Nebraska Natural Legacy Project (NNLP; Schneider et al. 2005, NNLP 2014b), the Nebraska Bird Library (2014), the United States Fish and Wildlife Service (USFWS 2014b, 2014a), and US Geological Survey Breeding Bird Survey (USGS 2013). Information about each species' conservation status was gathered from NGPC, NNLP, and USFWS websites. Survey recommendations were developed based on information collected in the resources described above, and recommendations in the WEG and The Nebraska Wind and Wildlife Working Group (NWWWG) Guidelines for Wind Energy and Wildlife Resource Management in Nebraska (NWWWG 2013).

SITE CHARACTERISTICS AND LANDCOVER

The AOI is located on private land in central Banner County in the panhandle of western Nebraska (Figure 1). The AOI is located in the Western High Plains Level III Ecoregion, a smooth to slightly irregular plain characterized by a semi-arid to arid climate, with dryland agriculture constituting the primary land use (US Environmental Protection Agency [USEPA] 2014). Topography is generally flat to rolling hills in the southwest portion of the AOI, with topographic variability increasing to the northern and eastern parts of the study area. Elevations in the AOI range from 1,304 to 1,630 meters (m; 4,278 to 5,348 feet [ft]) above mean sea level (Figure 2). The two primary Level IV Ecoregions that compose the AOI are the Flat to Rolling Plains Ecoregion in the southwest portion of the study area and the Pine Bluffs and Hills Ecoregion in the north and east; very little of the northern-central edge of the AOI is in the Platte Valley and Terraces Ecoregion (Figure 3). The Flat to Rolling Plains Ecoregion is primarily composed of dryland farming with areas of irrigated cropland agriculture, while the Pine Bluffs and Hills Ecoregion is characterized by bluffs, escarpments, and areas of exposed bedrock (Chapman et al. 2001). The rangeland and woodland vegetation of the Pine Bluffs and Hills Ecoregion contrast the dryland and irrigated cropland agriculture of the Flat to Rolling Plains Ecoregion (Chapman et al. 2001).

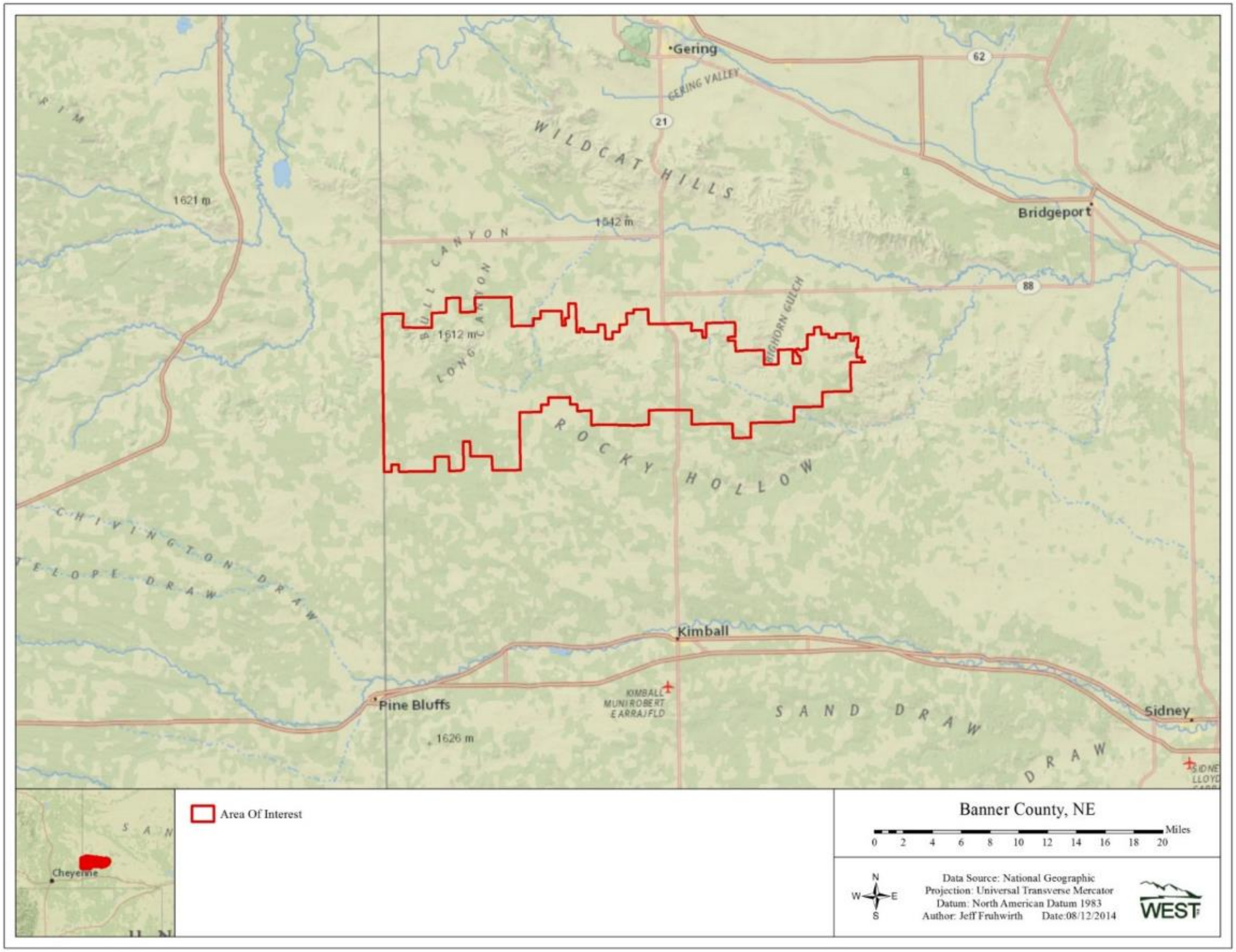


Figure 1. Location of the Banner County, Nebraska, Wind Energy Area of Interest.

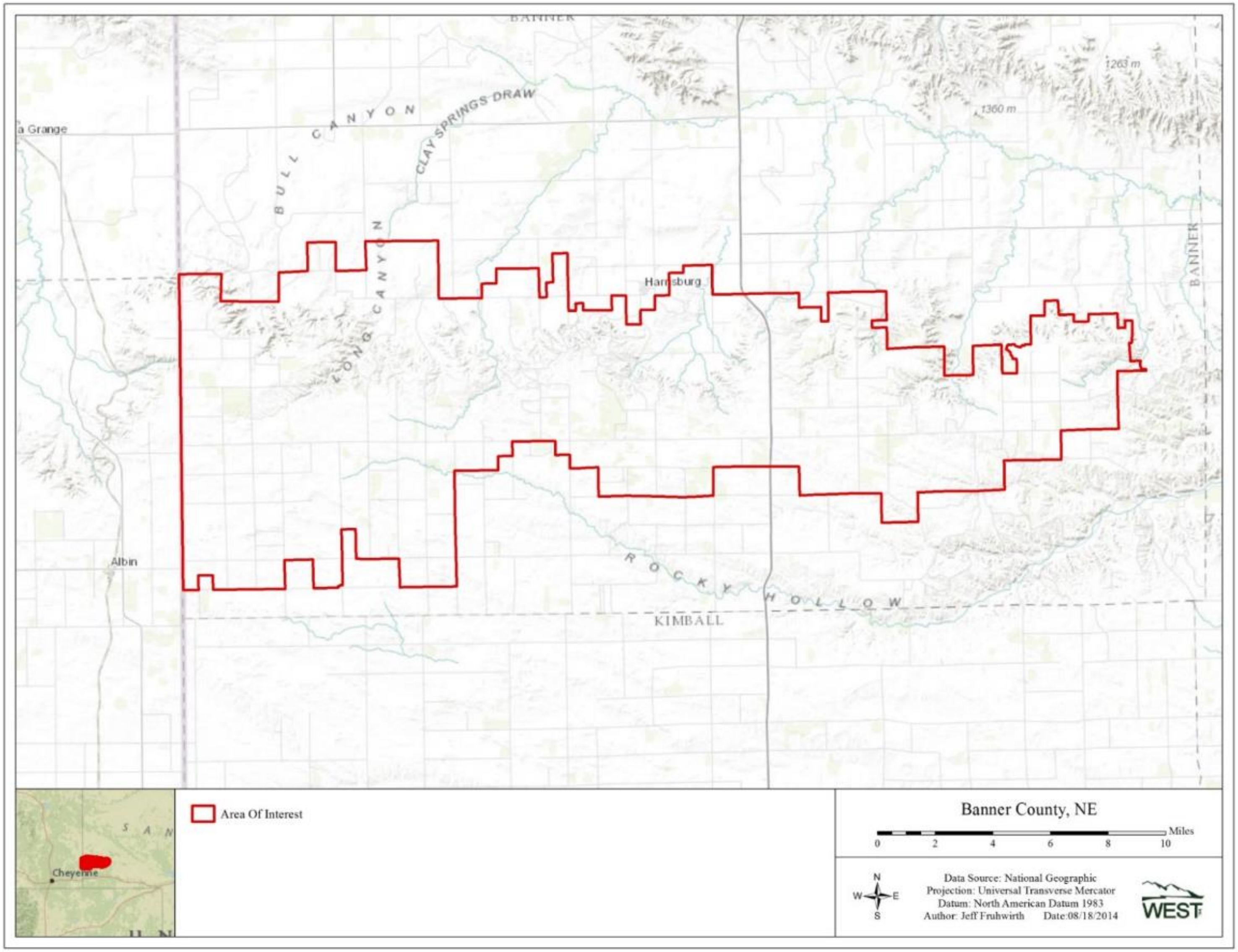


Figure 2. Topography of the Banner County, Nebraska, Wind Energy Area of Interest.

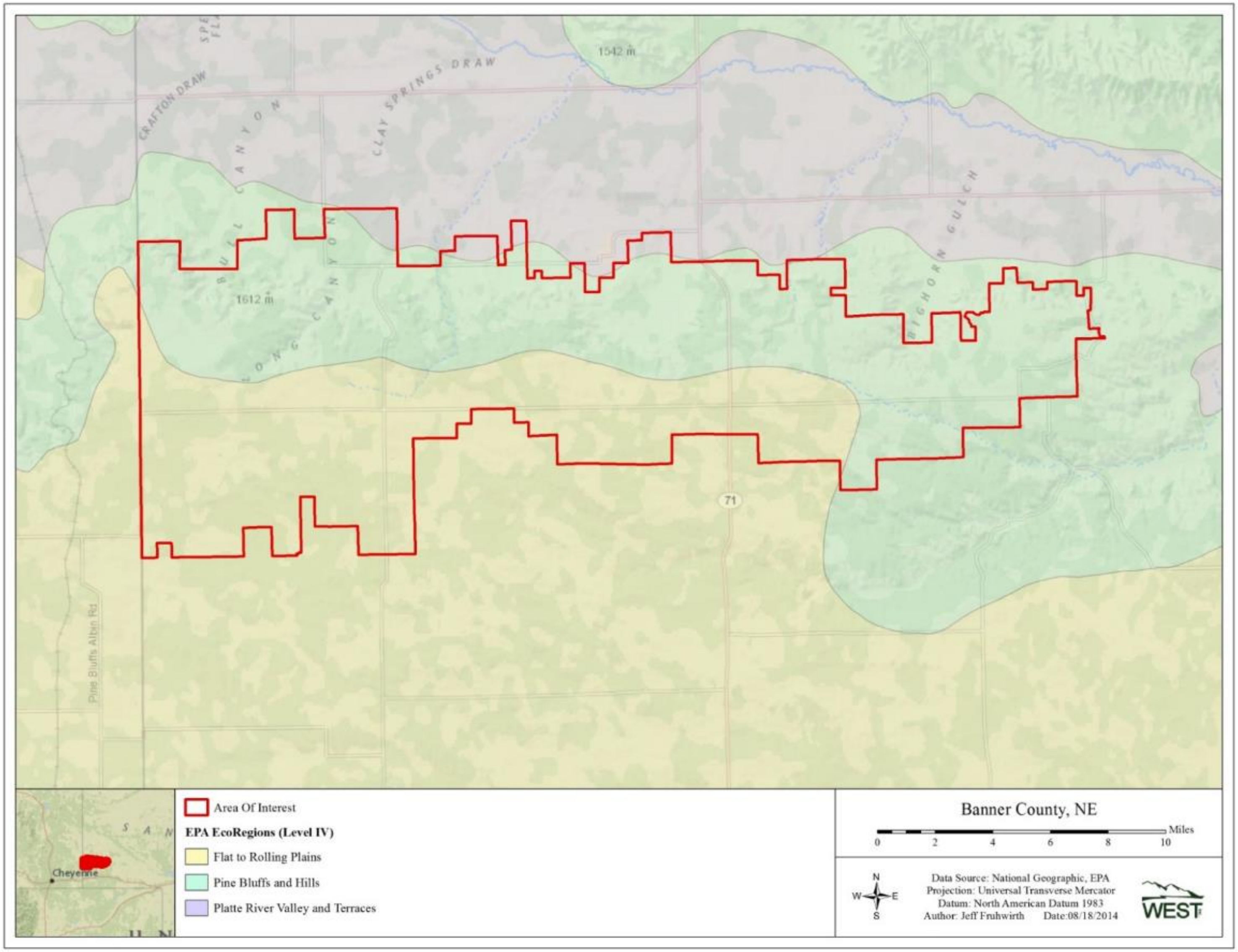


Figure 3. Ecoregions found within the Banner County, Nebraska, Wind Energy Area of Interest.

Land Use and Land Cover

According to the US Geological Service National Land Cover Dataset (NLCD), the majority of the AOI consists of herbaceous landcover (63.4%) and cultivated crops (31.4%; USGS NLCD 2011; Table 1, Figure 4). A small percent of the project is developed open space (2.1%), hay/pasture (1.5%), and evergreen forests (1.2%). The remaining landcover types each account for 0.2% of landcover or less. The distribution of landcover in the Evaluation Area is nearly the same as in the AOI (Table 1, Figure 4).

Landcover in the southwestern and southern portion of the AOI is dominated with dryland and some irrigated agriculture. Tree cover in this portion of the study area is generally restricted to deciduous, conifer, or mixed tree rows or small stands associated with occupied or abandoned homesteads. Tree species observed during the site visit included locust (*Gleditsia* or *Robinia* spp.), ash (*Fraxinus* spp.), cottonwood (*Populus* spp.), elm (*Ulmus* spp.), boxelder (*Acer negundo*), red cedar (*Juniperus* spp.), willow (*Salix* spp.), and ponderosa pine (*Pinus ponderosa*). In the northwest portion of the project, the landscape surrounding Bull Canyon and Long Canyon is marked by rugged hills with bluffs, escarpments, and exposed bedrock. Forested habitat is typically composed of conifer species (pines and junipers [*Pinus* and *Juniperus* spp.]). Open forests are prevalent in the lower elevations, and more dense stands of forest are located at higher elevations. The understory vegetation is primarily tall or mixed grassland, with some shrubby understory. Yucca (*Yucca glauca*) is typical species present in the open forests of the lower elevations. In the eastern portion of the AOI, some herbaceous cover is present in the open ponderosa pine forests, and this land is primarily used for cattle grazing.

Table 1. Land use/land cover types present within the Banner County, Nebraska Wind Energy Area of Interest and Evaluation Area (USGS NLCD 2011).

	Area of Interest		Evaluation Area	
Land Cover/Use	**Acres**	**%**	**Acres**	**%**
Herbaceous	95,887.04	63.4	229,280.50	64.1
Cultivated Crops	47,429.29	31.4	111,874.10	31.3
Developed, Open Space	3,228.85	2.1	7,722.39	2.2
Hay/Pasture	2,203.19	1.5	3,090.42	0.9
Evergreen Forest	1,877.84	1.2	4,072.17	1.1
Woody Wetlands	295.81	0.2	420.65	0.1
Developed, Low Intensity	118.71	0.1	289.58	0.1
Barren Land	68.07	0.1	257.85	0.1
Deciduous Forest	40.98	<0.1	80.44	<0.1
Shrub/Scrub	36.68	<0.1	127.65	<0.1
Open Water	26.48	<0.1	66.24	<0.1
Developed, Medium Intensity	13.38	<0.1	40.71	<0.1
Emergent Herbaceous Wetlands	2.59	<0.1	116.99	<0.1
Mixed Forest	1.49	<0.1	2.45	<0.1
Developed, High Intensity	0	0	4.39	<0.1
Total	**151,230.39**	**100**	**357,446.53**	**100**

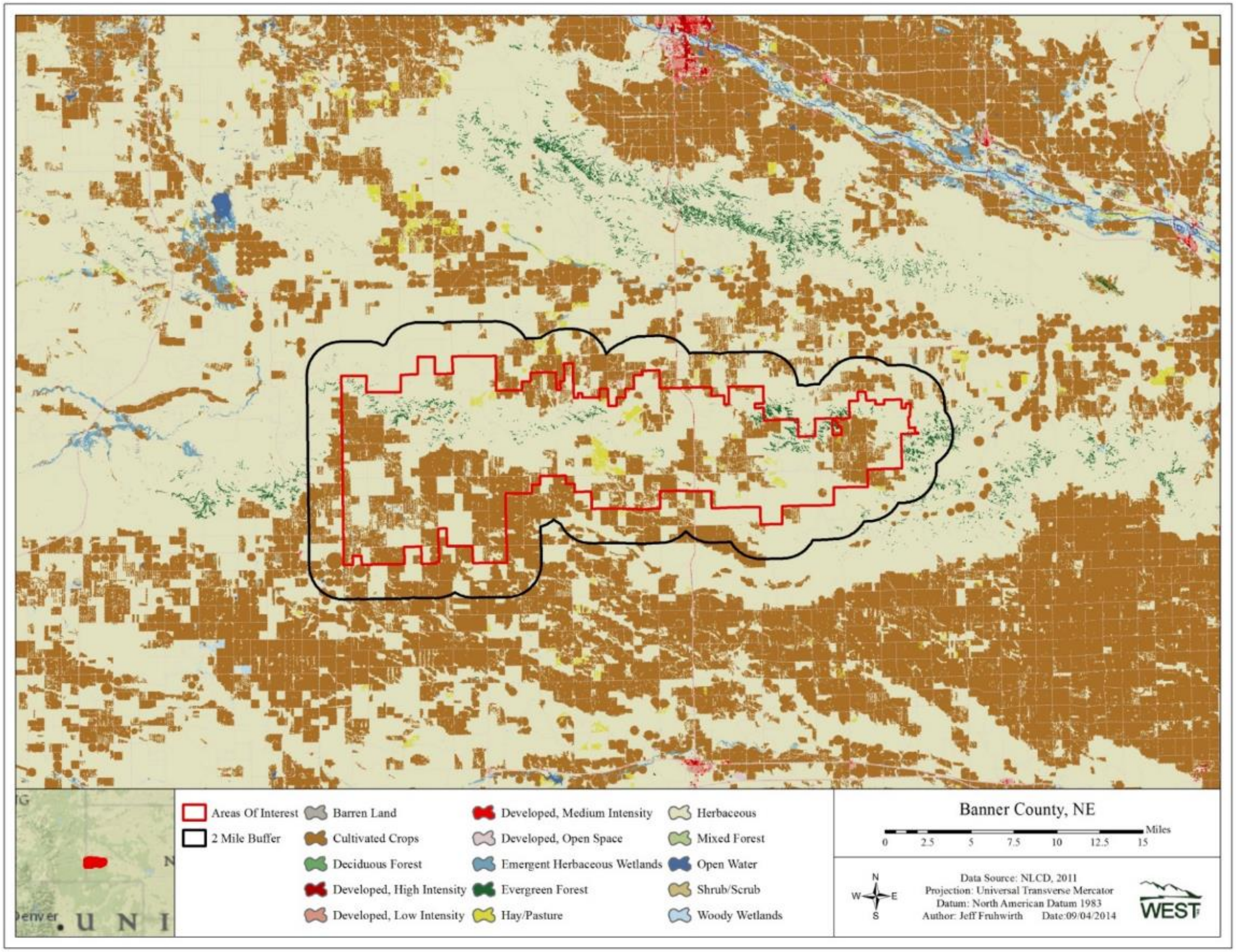


Figure 4. Land cover/land use types in the Banner County, Nebraska, Wind Energy Area of Interest.

National Wetland Inventory

During the site visit, several dry creek beds were observed, as well as a small stock pond. According to the National Wetland Inventory (NWI), the AOI contains 272 acres of wetland (0.2% of total landcover; Table 2, Figure 5). Approximately 236 acres of freshwater emergent wetlands, 15.5 acres of freshwater ponds, and 20.5 acres of other wetland types are found in the AOI. The Evaluation Area contains approximately 544 acres of wetland, which is about 0.2% of total landcover. Four hundred acres of freshwater emergent wetlands are found in the Evaluation Area. The Evaluation area also contains 75 acres of riverine habitat, 38 acres of other wetland types, and 30 acres of freshwater pond (Table 2, Figure 5).

Table 2. Wetland types present within the Banner County, Nebraska Wind Energy Area of Interest and Evaluation Area (USFWS NWI 1984[a]).

	Area of Interest		Evaluation Area	
Wetland Type	**Acres**	**%**	**Acres**	**%**
Freshwater Emergent Wetland	235.93	86.7	400.19	73.6
Other	20.55	7.6	38.21	7.0
Freshwater Pond	15.52	5.7	30.40	5.6
Riverine	0	0	75.24	13.8
Total	**272.00**	**100**	**544.03**	**100**

[a] AOI has not been resurveyed since the 1984 National Wetland Inventory surveys.

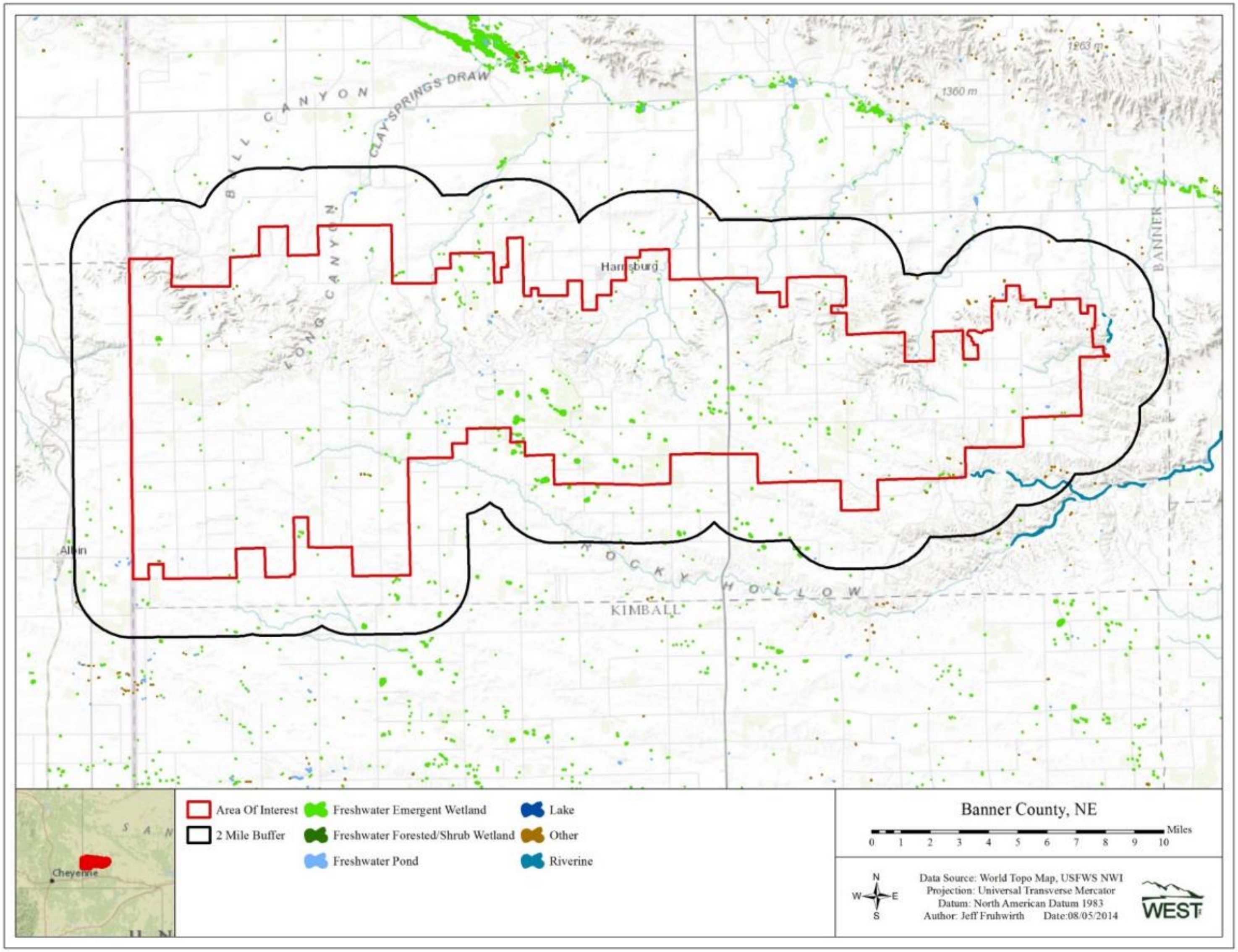


Figure 5. Wetland types in the Banner County, Nebraska, Wind Energy Area of Interest.

Sensitive Habitats

Habitat loss and fragmentation are often assumed to negatively impact bird populations due to increased predation, reduced suitable nesting and stopover areas, decreased habitat suitability, and alteration of prey availability. Potential negative effects of the proposed project include habitat fragmentation and loss from construction and placement of turbines and associated access roads. These changes to the landscape would reduce the size of contiguous patches of habitat and likely cause changes in vegetation structure and composition, which would subsequently decrease and alter suitable habitat for sensitive species.

According to the NNLP, Banner County is located in the shortgrass prairie ecosystem of Nebraska (Schneider et al. 2005). Though named the shortgrass prairie ecosystem, this area has a high diversity of habitats, including shortgrass, mixedgrass, and sandsage prairies; sparsely vegetated badlands, coniferous forest and playa wetlands. The AOI contains shortgrass prairie in the northwest, and mixedgrass prairie through the remainder of the area classified as herbaceous by the NLCD (Figure 4). Coniferous forest occurs on the upper elevations of the ridge that extends across the northern portion of the AOI (Figure 4).

The NNLP also describes Biologically Unique Landscapes (BUL), which are landscapes that offer the best opportunities for conserving the full array of biological diversity (Schneider et al. 2005). The AOI overlaps with the Wildcat Hills South BUL (Figure 6). The Wildcat Hills BUL, including Wildcat Hills North and Wildcat Hills South, is described below.

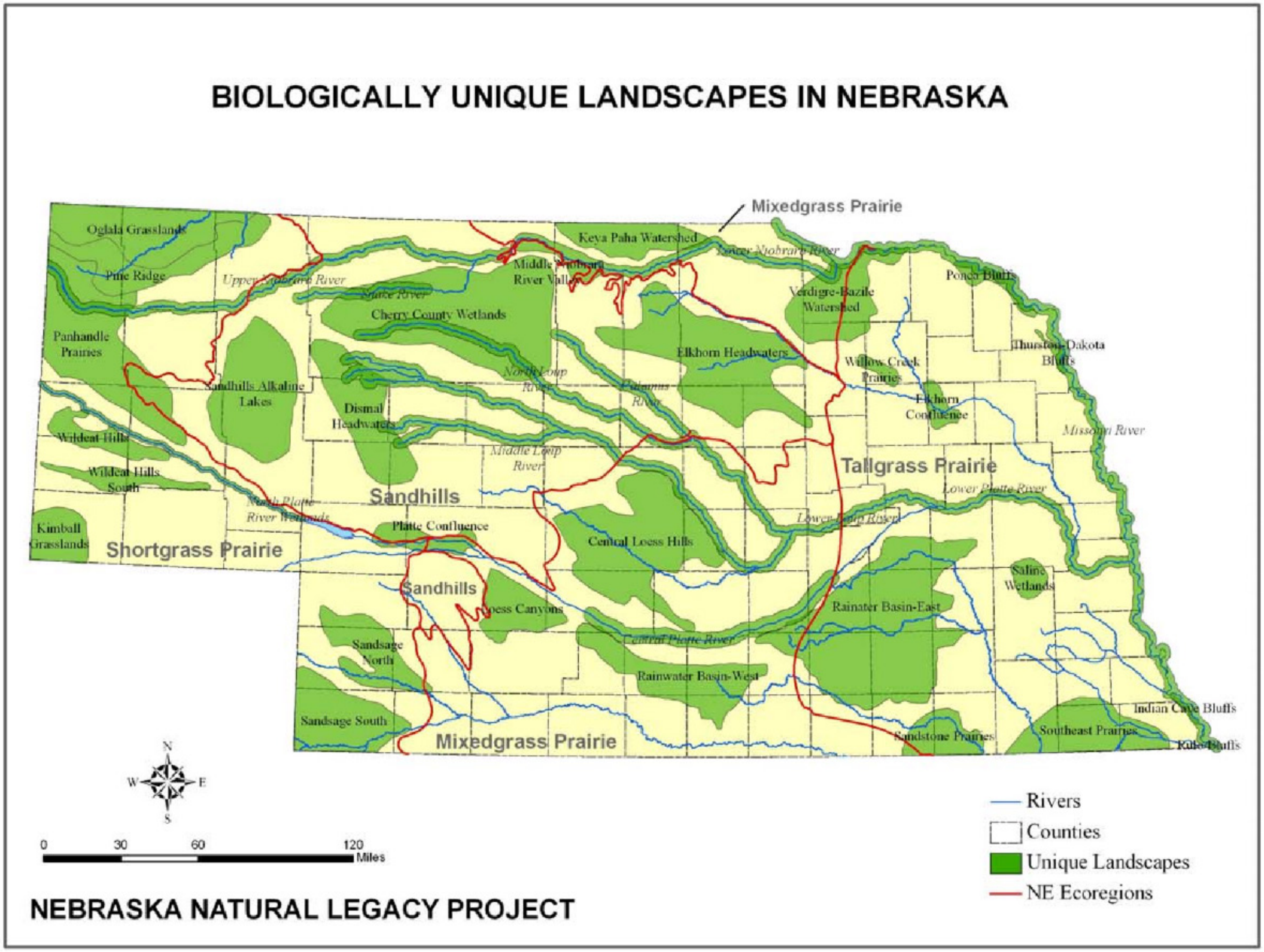


Figure 6. Biological Unique Landscapes identified in Nebraska's Natural Legacy Program (taken from Schneider et al. 2005).

Shortgrass Prairie

Shortgrass prairie is dominated by short grasses (e.g., buffalograss [*Bouteloua dactyloides*], blue grama [*B. gracilis*], side-oats grama [*B. curtipendula*], and purple threeawn [*Aristida purpurea*]), with forbs often interspersed with grasses (Schneider et al. 2005). Grasses rarely exceed 10 inches (25 centimeters [cm]) in height in shortgrass prairie, typically due to low precipitation and grazing (Schneider et al. 2005). Shortgrass prairie is primarily found in the eastern and northwestern portions of the AOI.

Mixedgrass Prairie

Mixedgrass prairie in this regions is typically dominated by blue grama, prairie sandreed (*Calamovilfa longifolia*), threadleaf sedge (*Carex filifolia*), needle-and-thread (*Stipa comata*), little bluestem (*Schizachyrium scoparium*), and western wheatgrass (*Pascopyrum smithii*), and grasses can reach 18 to 24 inches (46 to 61 cm) in height (Schneider et al. 2005). Shrubs may be interspersed in mixedgrass prairie, including yucca, fringed sage (*Artemisia frigida*), skunkbush sumac (*Rhus trilobata*), and ragweed (*Ambrosia* spp.). Forbs found in mixedgrass prairie include western ragweed (*Ambrosia psilostachya*), fringed sage, prairie coneflower (*Ratibida pinnata* or *R. columnifera*), scarlet globemallow (*Sphaeralcea coccinea*), scarlet guara (*Gaura coccinea*), and broom snakeweed (*Gutierrezia sarothrae*). Mixedgrass prairie is prevalent through much of the AOI, particularly along the ridge that runs east-west along the northern portion of the study area.

Ponderosa Pine Woodlands

Ponderosa pine dominates ponderosa pine woodlands, but quaking aspen (*Populus tremuloides*) and green ash (*Fraxinus pennsylvanica*) may be found in the subcanopy (Schneider et al. 2005). Shrubs of the ponderosa pine woodlands include Saskatoon serviceberry (*Amelanchier alnifolia*), chokecherry (*Prunus virginiana*), dwarf juniper (*Juniperus* spp.), fragrant sumac (*Rhus aromatica*), mountain mahogany (*Cercocarpus* spp.), and wolfberry (*Symphoricarpos occidentalis*). The herbaceous layer of ponderosa pine woodlands is sparse and includes Kentucky bluegrass (*Poa pratensis*) and littleseed ricegrass (*Oryzopsis micrantha*) (Schneider et al. 2005). Ponderosa pine woodlands are found along the ridge that runs east-west along the northern portion of the study area, particularly in the northwestern and eastern portions of the AOI.

Wildcat Hills Biologically Unique Landscape (BUL)

The NNLP describes BULs, which are landscapes that offer the best opportunities for conserving the full array of biological diversity. The AOI overlaps with the Wildcat Hills South BUL. The Wildcat Hills is a rocky escarpment composed of sandstone, siltstone, and volcanic ash that rises several hundred feet on the south side of the North Platte River. Deep canyons cut into the bluff on the north side and are covered with stands of mountain mahogany, eastern red cedar (*Juniperus virginiana*), and Rocky Mountain juniper (*J. scopulorum*). North facility slopes support ponderosa pine woodlands, and mixedgrass prairie, rock outcrops, and sandsage (*Artemisia filifolia*) cover the remainder of the Wildcat Hills. The intact mosaic of pine woodlands and mixed grass support one of the largest stands of mountain mahogany in Nebraska. The Wildcat Hills

South BUL does not contain any protected lands; however, the Wildcat Hills North BUL, located north of the AOI, contains the Wildcat Hills State Recreation Area (SRA) and Wildlife Management Area (WMA), Buffalo Creek WMA, Cedar Canyon WMA, Platte River Basin Environ's Bead Mountain Ranch, and Scottsbluff National Monument.

Sensitive and Special Status Plant Species

According to the NNHP and NGPC list of sensitive species by county, no state- or federally-listed plant species have the potential to occur in the AOI (NNHP 2013).

WILDLIFE

The most common wildlife species observed during the site visit were those associated with dryland agriculture, croplands, and herbaceous land cover. A total of 21 avian and two mammal species were recorded during the site visit to the AOI (Table 3). The most abundant avian species recorded during the site visit were horned larks (*Eremophila alpestris*), lark buntings (*Calamospiza melanocorys*), western meadowlarks (*Sturnella neglecta*), and western kingbirds (*Tyrannus verticalis*). American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis*), and Swainson's hawk (*B. swainsoni*) were the only raptor species observed during the site visit. One great blue heron (*Ardea herodias*) was observed at a pond located in the eastern portion of the AOI. An adult and juvenile sharp-tailed grouse (*Tympanuchus phasianellus*) was observed in the northwestern portion of the AOI. Mule deer (*Odocoileus hemionus*) and pronghorn (*Antilocapra americana*) were also observed at the AOI. No federal- or state-listed sensitive species were observed during the site visit. Loggerhead shrike (*Lanus ludovicianus*) is listed as an NNLP Tier 1 species (see NNLP 2014c).

Table 3. Wildlife species observed during the site visit to the Banner County, Nebraska, Wind Energy Area of Interest, August 7, 2014.

Common Name	Scientific Name
Birds	
great blue heron	*Ardea herodias*
red-tailed hawk	*Buteo jamaicensis*
Swainson's hawk	*Buteo swainsoni*
American kestrel	*Falco sparverius*
turkey vulture	*Cathartes aura*
sharp-tailed grouse	*Tympanuchus phasianellus*
mourning dove	*Zenaida macroura*
American crow	*Corvus brachyrhynchos*
American goldfinch	*Spinus tristis*
barn swallow	*Hirundo rustica*
cliff swallow	*Petrochelidon pyrrhonota*
eastern kingbird	*Tyrannus tyrannus*
grasshopper sparrow	*Ammodramus savannarum*
horned lark	*Eremophila alpestris*
house wren	*Troglodytes aedon*
loggerhead shrike	*Lanius ludovicianus*
lark bunting	*Calamospiza melanocorys*
lark sparrow	*Chondestes grammacus*
savannah sparrow	*Passerculus sandwichensis*

Table 3. Wildlife species observed during the site visit to the Banner County, Nebraska, Wind Energy Area of Interest, August 7, 2014.

Common Name	Scientific Name
unknown thrush	
unknown warbler	
western kingbird	*Tyrannus verticalis*
western meadowlark	*Sturnella neglecta*
Mammals	
mule deer	*Odocoileus hemionus*
pronghorn	*Antilocapra americana*

Federal- or State-Listed Wildlife Species

No lands owned by US Forest Service and Bureau of Land Management occur in the AOI, therefore species of concern listed by these agencies were not considered in this analysis.

In lieu of an official response from the USFWS or NGPC regarding the potential of federally- or state-listed endangered or threatened species to occur in Banner County, the USFWS Information, Planning, and Conservation System (IPaC); the USFWS Environmental Conservation Online System (ECOS) species profiles; and the NGPC list of sensitive species and range maps were used to determine the potential occurrence of endangered and threatened species (USFWS 2014a, USFWS 2014b, NGPC 2013). According to the IPaC and NGPC list of sensitive species, seven federally- or state-listed wildlife species have the potential to occur in Banner County, Nebraska: four bird species, two mammal species, and one fish (Table 4). The three federally-listed bird species are unlikely to occur in the AOI: interior least tern (*Sterna antillarum*), piping plover (*Charadrius melodus*), whooping crane (*Grus americana*) (Figures 7 and 8). Due to the concern regarding whooping cranes in Nebraska, this species will be discussed in detail below, despite being unlikely to occur in the AOI; the remaining federally-listed bird species are not discussed in detail. According to USFWS ECOS species profile, the black-footed ferret (*Mustella nigripes*; federally-listed endangered) has the potential to occur in Banner County. However, the last confirmed specimen of black-footed ferret was collected in 1949, and no known extant populations exist in Nebraska (NGPC 2014c); therefore, black-footed ferret will not be discussed in detail. The federally-endangered pallid sturgeon (*Scaphirhynchus albus*) was listed by the USFWS IPaC as having the potential to occur in Banner County; however, according to the NNHP and USFWS ECOS, this species is associated with the Missouri River and its tributaries and only occurs in eastern Nebraska (Figure 9). Therefore, the pallid sturgeon was not considered further in this analysis. The two state-listed species with the potential to occur on the AOI are described below.

Table 4. Federally- and state-listed endangered and threatened animal species with the potential for occurrence in the Banner County, Nebraska, Wind Energy Area of Interest.

Species	Federal/ State Status	Habitat Requirements	Potential for Occurrence within the Area of Interest
BIRDS			
interior least tern *Sterna antillarum*	FE/SE	Nests in sandpits along rivers in Nebraska. Remains near rivers prior to migration.	**Unlikely.** Suitable habitat is not present in the AOI.
mountain plover *Charadrius montanus*	ST	Shortgrass, fallow fields, prairie-dog towns; very short stature vegetation.	**Possible.** During breeding season. Availability of prairie dog towns on the AOI unknown.
piping plover *Charadrius melodus*	FT/ST	Nests in sandpits along rivers in Nebraska. Remains near rivers prior to migration.	**Unlikely.** Suitable habitat is not present in the AOI
whooping crane *Grus americana*	FE/SE	Sandbars and shallow water in rivers, wetlands, wet meadows.	**Unlikely.** Suitable habitat not available in AOI. No confirmed sighting in Banner County; however, confirmed sightings in Scotts Bluff, Morrill, and Cheyenne Counties (NNHP 2011e).
Mammals			
black-footed ferret *Mustella nigripes*	FE/SE[a]	Prairie dog colonies.	**Unlikely**. The species is likely extirpated throughout the state. Availability of prairie dog colonies in the AOI is unknown.
swift fox *Vulpes velox*	SE	Shortgrass and mixedgrass prairie habitats and prairie dog towns.	**Likely.** Suitable habitat is present in the AOI; availability of prairie dog towns unknown

Range from NGPC 2014b. Species habitat requirements from All About Birds 2014. Status information from NGPC 2013, USFWS 2014d

[a] historical occurrence in Nebraska, but no known extant populations

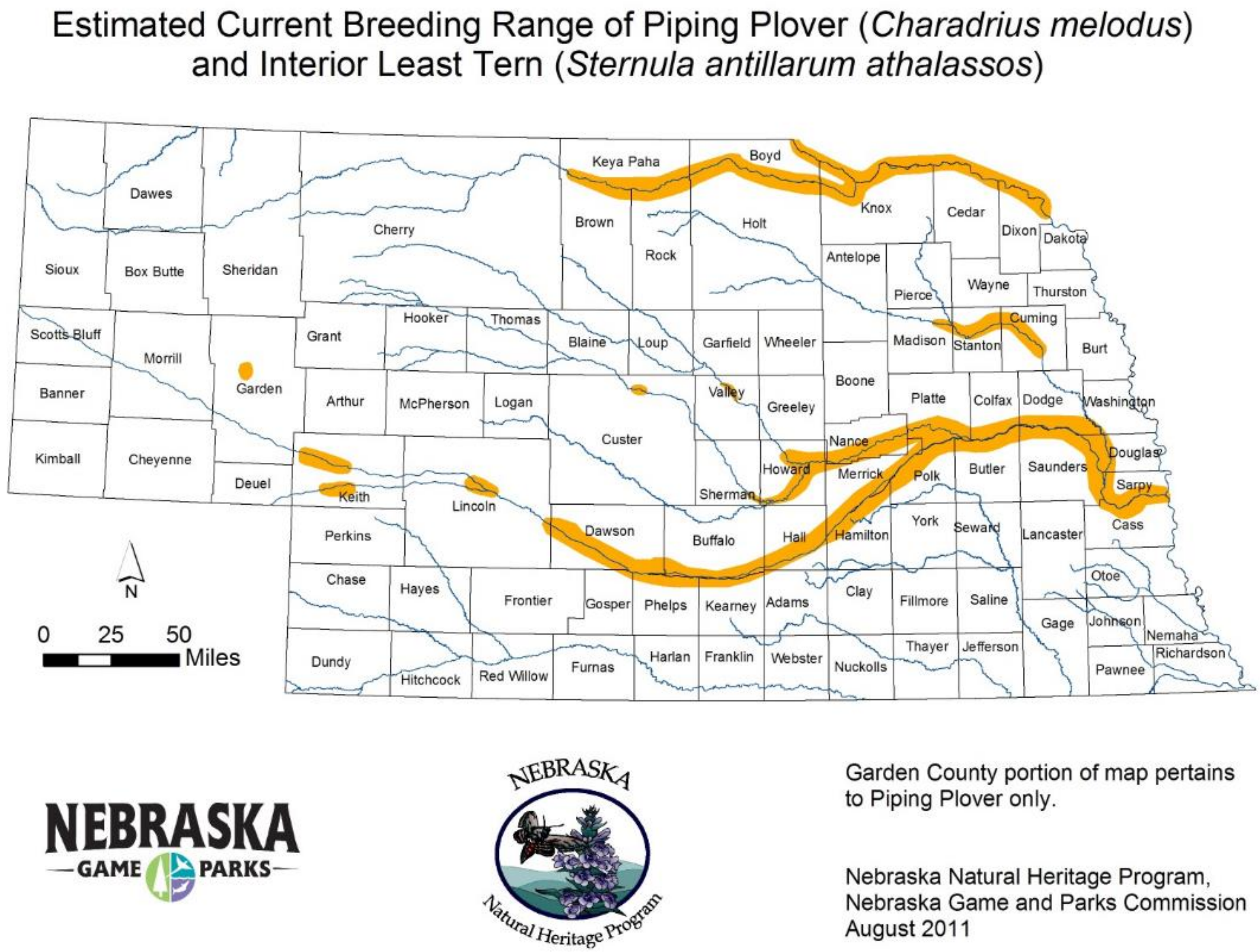


Figure 7. Distribution of the interior least tern and piping plover in Nebraska (NNHP 2011a).

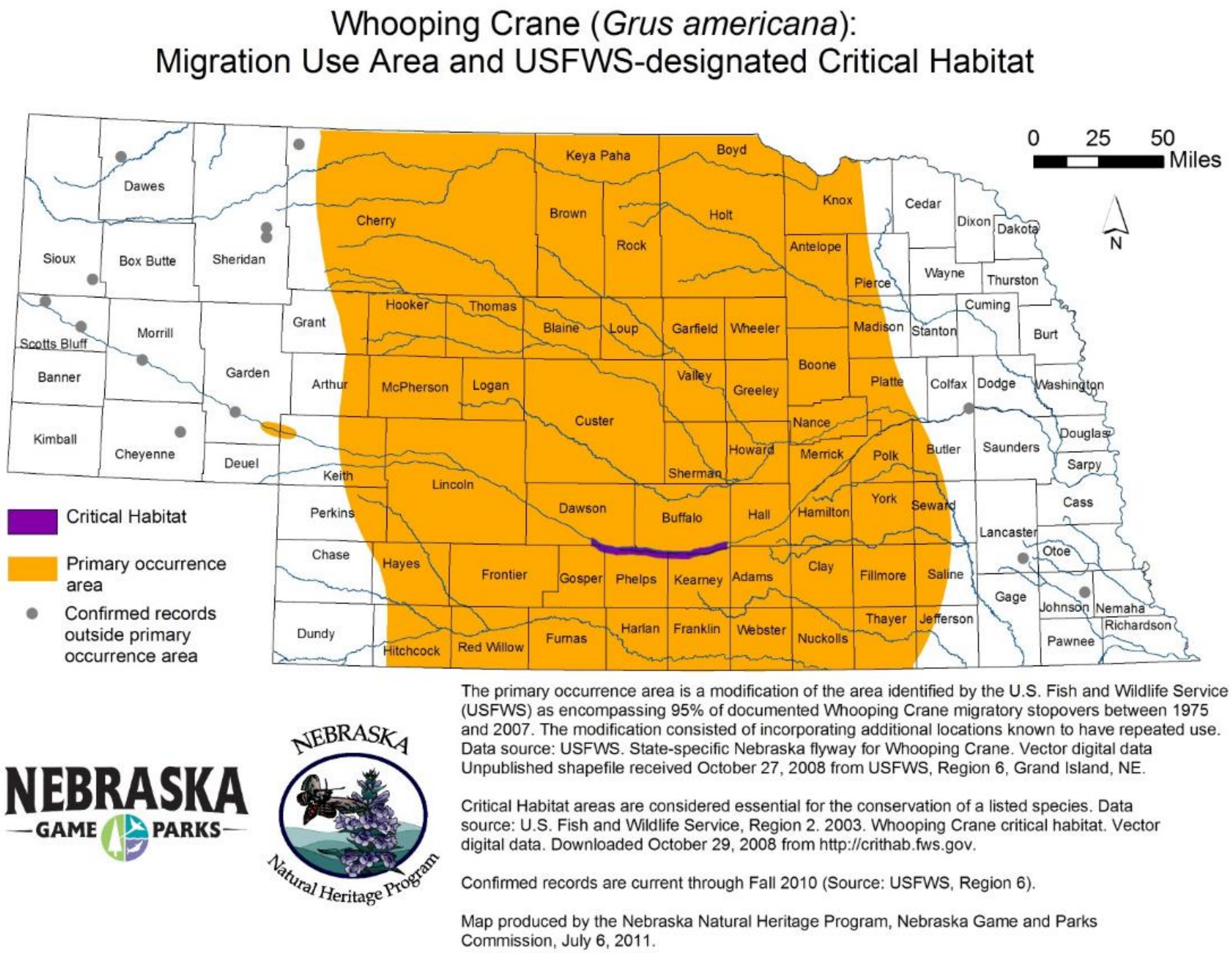


Figure 8. Distribution of the whooping crane in Nebraska (NNHP 2011e).

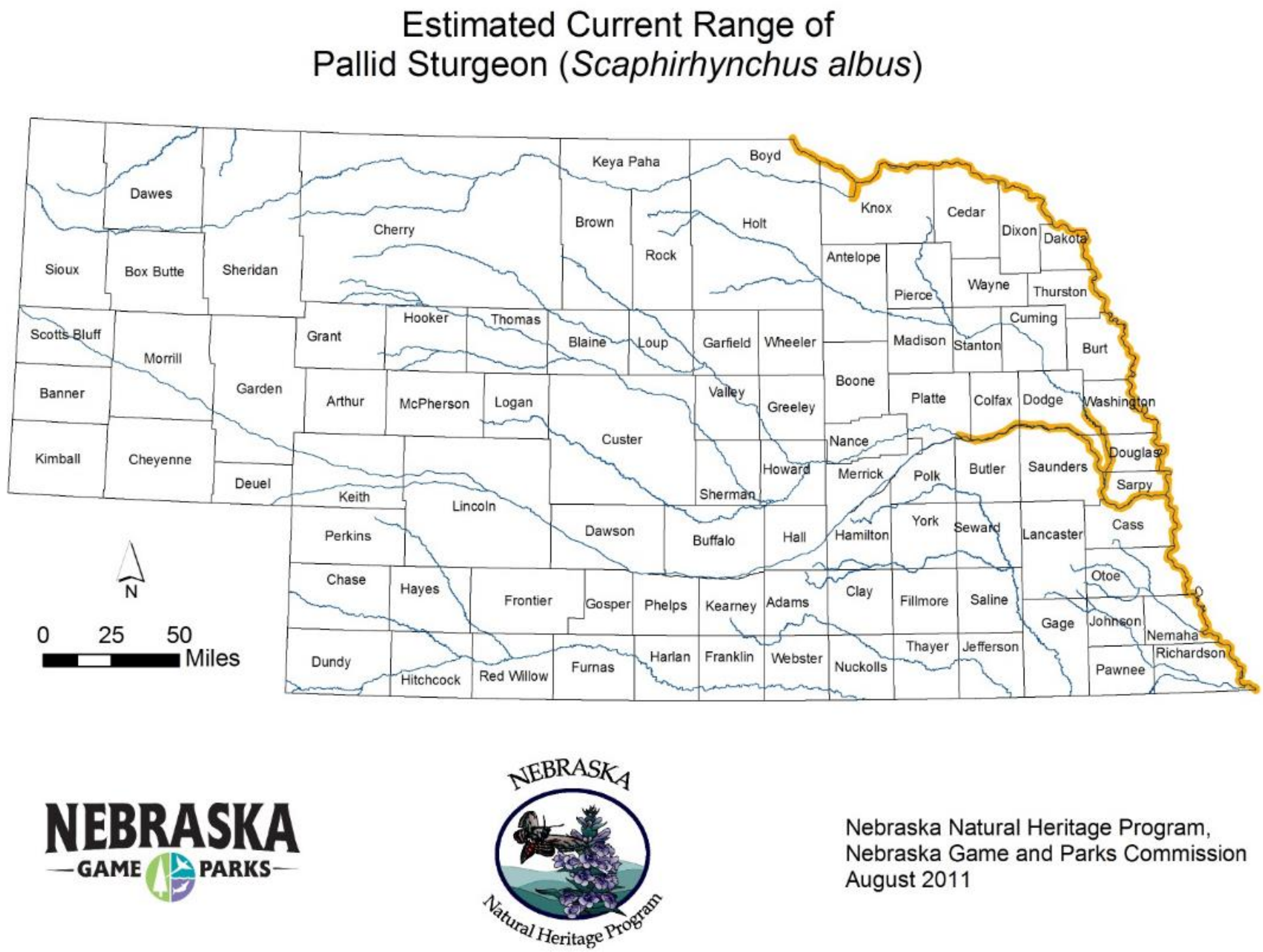


Figure 9. Distribution of the pallid sturgeon in Nebraska (NNHP 2011c).

Whooping Crane

Whooping cranes are federally-listed as endangered (USFWS 2014d, 2014e). Whooping cranes spend the winter at Aransas National Wildlife Refuge, Matagorda Island National Wildlife Refuge, and adjacent private lands in Texas, USA, and breed at Wood Buffalo National Park on the border of Alberta and the Northwest Territories in Canada. The fall migration during October and early November follows the Central Flyway corridor, with stopover sites in the Platte River in central Nebraska as well as other locations in Nebraska (Lewis 1995). The spring migration follows the same route north in April and early May. Whooping cranes use numerous habitats, including cropland and pastures; wet meadows; marshes; shallow portions of rivers, lakes, reservoirs, and stock ponds; freshwater and alkaline basins for feeding and resting during their spring and fall migration; and shallow water for roosting sites. These habitats are not largely available in the AOI. Critical habitat for this species has been designated (43 Federal Register [FR] 20938-20942) and includes locations along the migration route along the Platte River in central Nebraska, but well outside the AOI and Evaluation Area (Figure 8). While the USFWS IPaC system identified the whooping crane as potentially occurring in Banner County, the USFWS ECOS species profile and Threatened and Endangered Species System (TESS) do not include Banner County as an area of potential occurrence of whooping cranes (USFWS 2014b, 2014d 2014e), and occurrences have not been documented in Banner County (Figure 10). In addition, the AOI is located well outside of the migration corridor, as mapped by the USFWS (Figure 8). Impacts to whooping cranes are unlikely if the project is constructed.

Mountain Plover

Mountain plover (*Charadrius montanus*) is listed as threatened in Nebraska (NGPC 2013). Much of the AOI is located within the range of mountain plover (Figure 11). Mountain plovers occur in arid shortgrass prairie dominated by blue grama and buffalograss. Nesting sites occur in areas where vegetation is very short and bare ground is plentiful, and this species selectively nests in prairie dog (*Cynomys* spp.) towns, where available. In addition, mountain plovers will nest in agricultural land; however, these nesting attempts are often unsuccessful. Habitat in the majority of the AOI is unsuitable for nesting mountain plovers; however areas of short vegetation occur in the northwestern portion and southeastern portion of the study area. Agricultural land is widespread in the AOI. The availability of prairie dog colonies in the AOI is unknown. Mountain plovers may occur in the AOI during breeding season; however, with the exception of agricultural land, suitable habitat is limited.

Swift Fox

Swift fox is listed as endangered in Nebraska (NGPC 2013). Swift foxes (*Vulpes velox*) are small canids, about half the size of red fox (*V. vulpes*). All of Banner County is located within the swift fox range (Figure 12). Swift fox habitat is open shortgrass prairie, and sometimes mixedgrass prairie, with few shrubs and trees. Prairie dog colonies and badger (*Taxidea taxus*) dens are often used during breeding season, and swift fox use dens year-round. While shorter grasslands were observed in the northwest and southeast portions of the AOI, these areas also included shrubs and woodlands, which may preclude use by swift fox. Much of the grassland habitat observed during the site visit contained grasses that were too tall to support use by swift fox; however, interannual and seasonal variation in grass height may enable swift fox to use larger proportions of the AOI in some years.

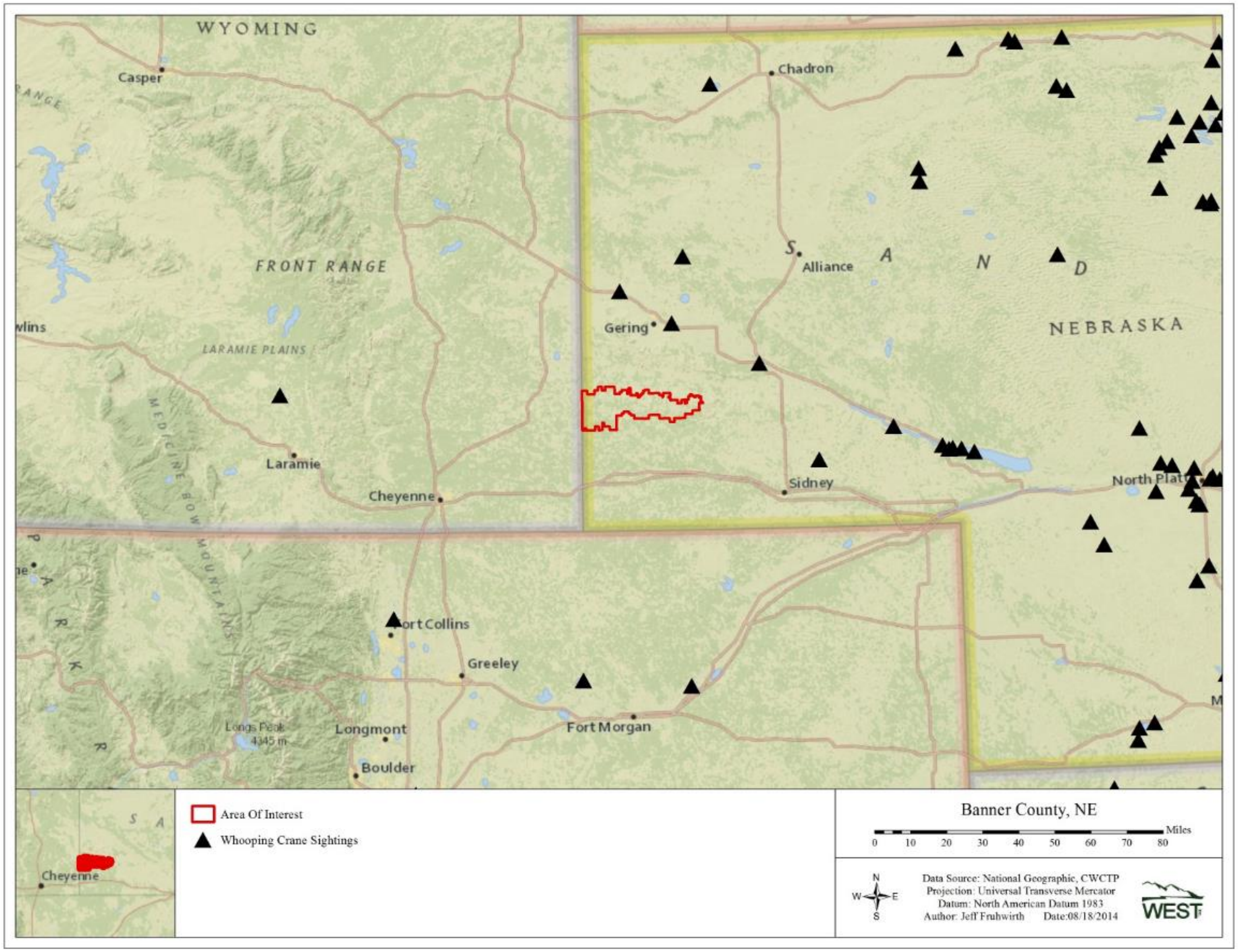


Figure 10. Whooping crane sightings in the area surrounding the Banner County, Nebraska, Wind Energy Area of Interest (Cooperative Whooping Crane Tracking Project [CWCTP] 2009).

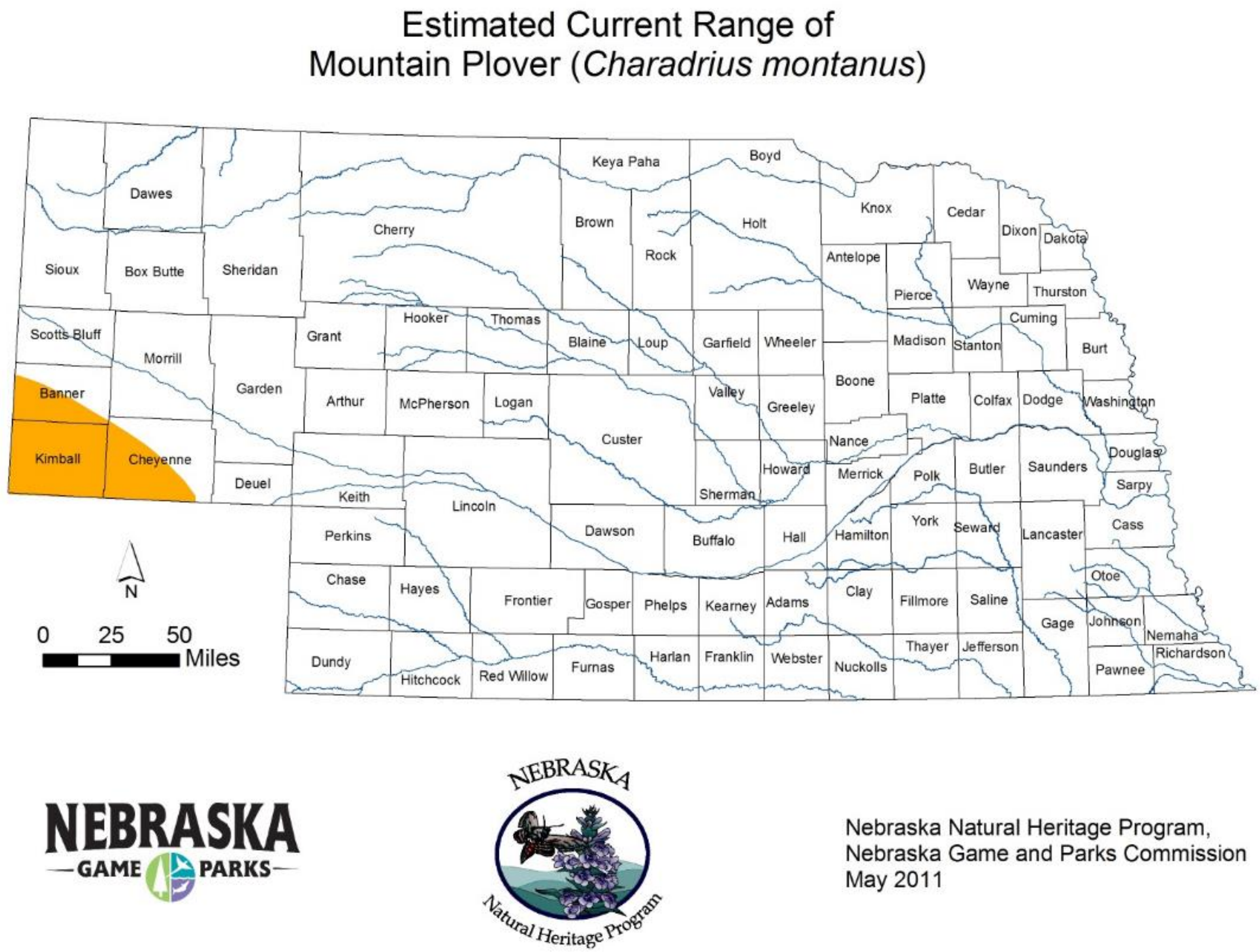


Figure 11. Distribution of the mountain plover in Nebraska (NNHP 2011b).

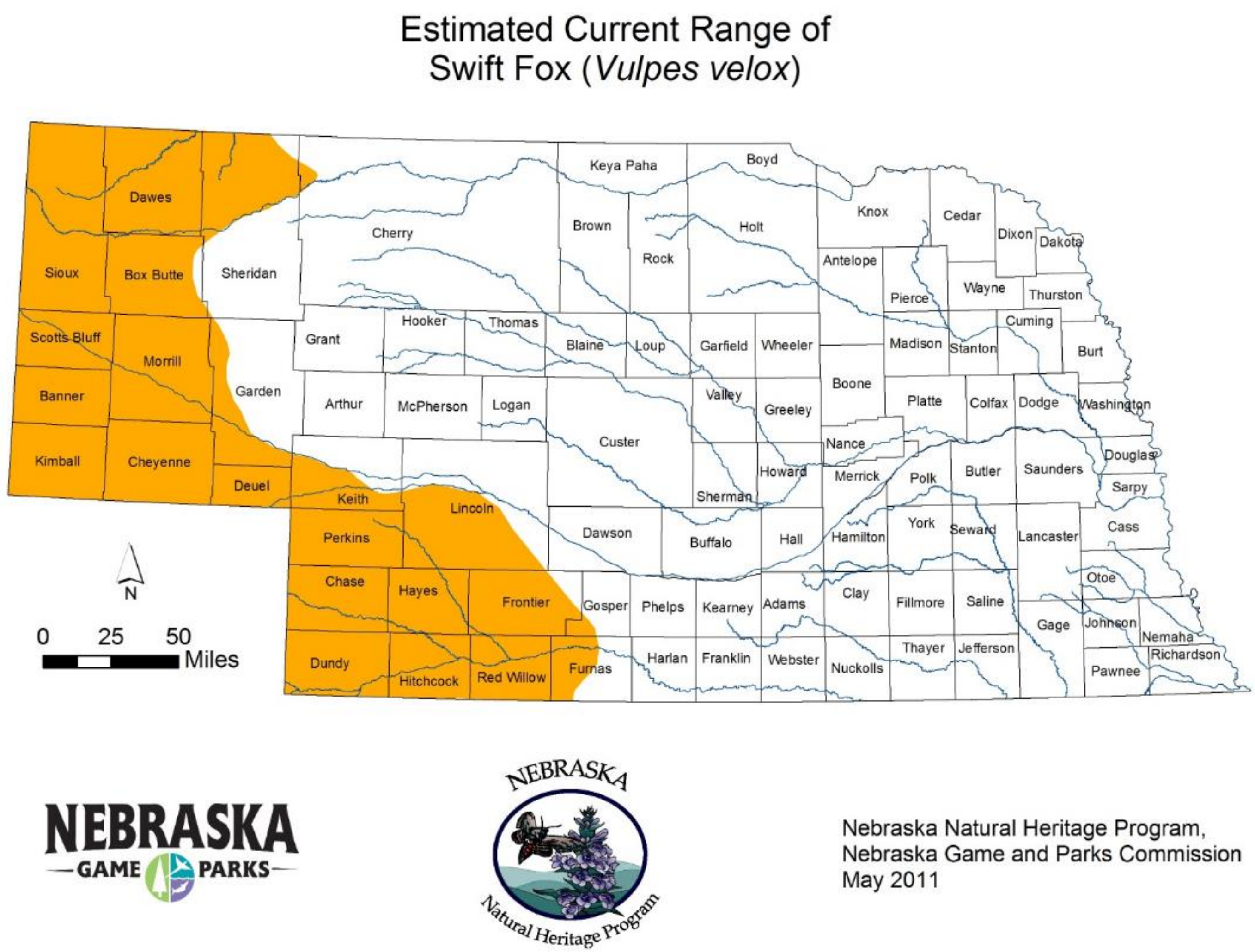


Figure 12. Distribution of the swift fox in Nebraska (NNHP 2011d).

Nebraska Natural Legacy Program Tier 1 Species

Nebraska Natural Legacy Program Tier 1 Species are those species that occur in Nebraska and are globally or nationally most at risk of extinction (NNLP 2014a). The Tier 1 Species list does not have legal or regulatory ramifications; rather, the list is designed to help prioritize conservation planning and actions. Tier 1 Species meet one or more of the following criteria: 1) state- or federally-listed species, 2) heritage ranked species, 3) declining species, 4) endemic species, and/or 5) species with disjunct populations (NNLP 2014a). Tier 1 species with the potential to occur in the shortgrass prairie ecoregion of Nebraska in general are listed in Table 5, and species likely to occur in the AOI are described in detail below. Mountain plover and swift fox are described in the state-listed species section above.

Table 5. Nebraska Natural Legacy Program Tier 1 animal species occurring in the Shortgrass Prairie Ecoregion and the potential for occurrence in or near the Banner County, Nebraska, Wind Energy Area of Interest.

Species	Habitat Requirements	Potential for Occurrence within the AOI
Birds		
Baird's sparrow *Ammodramus bairdii*	Prairies, natural grasslands, weedy fields; prefers open areas, such as native prairie mixed with forbs.	**Possible.** Potential to occur during migration; does not breed or winter in Nebraska.
Bell's vireo *Vireo bellii*	Dependent on shrubs; thickets near streams or rivers; second-growth scrub, forest edges, and brush patches.	**Probable.** Potential to occur during migration, but unlikely during breeding season. More likely to occur in the Wildcat Hills North BUL.
Brewer's sparrow *Spizella breweri*	Dependent on shrubs; sandsage prairie, shortgrass, mixedgrass with a sandsage, shrub association.	**Likely.** May occur in the shrubby lands and open ponderosa pine woodlands in the northwestern and southeastern portions of the AOI.
burrowing owl *Athene cunicularia*	Prairie dog towns, shortgrass prairies, mixedgrass prairies, heavily grazed grassland.	**Probable.** During breeding season. Prairie habitat plentiful; availability of prairie-dog towns unknown.
chestnut-collared longspur *Calcarius ornatus*	Shortgrass and mixedgrass prairie; native grasslands.	**Probable.** Potential to occur during breeding season and migration.
ferruginous hawk *Buteo regalis*	Rock outcrops, shortgrass prairies, prairie dog towns.	**Probable.** Shortgrass habitat limited in AOI. Availability of prairie dog towns unknown.
greater prairie-chicken *Tympanuchus cupido*	Sandsage prairie, tallgrass prairie, loess mixedgrass prairie.	**Unlikely.** Range of greater prairie-chicken typically east and south of the AOI.

Table 5. Nebraska Natural Legacy Program Tier 1 animal species occurring in the Shortgrass Prairie Ecoregion and the potential for occurrence in or near the Banner County, Nebraska, Wind Energy Area of Interest.

Species	Habitat Requirements	Potential for Occurrence within the AOI
loggerhead shrike *Lanius ludovicianus*	Grasslands with at least some scattered trees or shrubs.	**Present.** Suitable habitat is plentiful in AOI; likely to occur during breeding season.
long-billed curlew *Numenius americana*	Mixedgrass and shortgrass prairie; habitats with trees or high densities of sagebrush avoided.	**Possible.** During breeding season and migration. AOI contains some areas of prairie with no trees and few shrubs, by most prairie on the AOI is interspersed with trees and/or shrubs.
McCown's longspur *Rhynchophanes mccownii*	Mixedgrass and shortgrass prairie; prairie dog towns.	**Probable.** During breeding season and migration. Suitable habitat plentiful in the AOI. Availability of prairie dog towns unknown
pinyon jay *Gymnorhinus cyanocephalus*	Foothills and mid-elevations; pinion-juniper woodlands, ponderosa and Jeffery pine (*Pinus jeffreyi*) forests.	**Likely.** During breeding season and migration. Suitable habitat is found in the northwest portion of the AOI and along the higher elevation of the ridge running across east-west across the northern portion of the AOI.
short-eared owl *Asio flammeus*	Open grasslands with standing cover and little disturbance.	**Possible.** Potential to occur in winter.
trumpeter swan *Cygnus buccinator*	Deep water wetlands. Densely vegetated marsh lakes.	**Unlikely.** Suitable habitat not available in the AOI.
wood thrush *Hylocichla mustelina*	Deciduous or mixed forests; interior or edge species; moderate subcanopy and shrub density.	**Unlikely.** AOI is well west of species' range; rare occurrence may be possible in the woodlots associated with occupied or abandoned farmsteads.
Mammals		
northern pocket gopher (Cheyenne and Pierre subpopulations) *Thomomys talpoides*	Deep soils in cultivated fields and meadows.	**Unlikely.** Range of these subpopulations does not occur in the AOI.
northern river otter *Lontra canadensis*	Along rivers and streams with backwater areas, marshes, lakes, ponds.	**Unlikely.** Suitable waterbodies and streams are not present in the AOI.
Rocky Mountain bighorn sheep *Ovis canadensis canadensis*	Rocky buttes.	**Likely.** Habitat available in the northwest portion of the AOI. Population is known to occur in the Wildcat Hills North BUL, just north of the AOI.

Table 5. Nebraska Natural Legacy Program Tier 1 animal species occurring in the Shortgrass Prairie Ecoregion and the potential for occurrence in or near the Banner County, Nebraska, Wind Energy Area of Interest.

Species	Habitat Requirements	Potential for Occurrence within the AOI
fringed bat *Myotis thysanodes*	Ponderosa pine forests and woodlands, green ash-elm bottomland woodlands.	**Likely.** Habitat present in the upper elevations of the AOI and plentiful in the northwest and southeastern portions of the AOI.
little brown bat *Myotis lucifugus*	Roosts in buildings, trees, under rock or wood; forage over water, meadows, farmland, cliff faces, forest trails.	**Likely.** Trees, rocky outcrops, and abandoned farmstead buildings provide roosting opportunities throughout the AOI.
Reptiles		
sagebrush lizard *Sceloporus graciosus*	Open, rocky shortgrass prairie; sagebrush; higher elevations.	**Likely.** Potential to occur in the shortgrass prairie in the northwestern portion of the AOI.
Fish		
blacknose shiner *Notropis heterolepis*	Headwater streams, spring fed, clear water, quiet waters.	**Unlikely.** AOI is outside of species' range. Habitat not present.
northern redbelly dace *Chrosomus eos*	Spring fed, clear, headwater streams.	**Unlikely.** AOI is outside of species' range. Habitat not present.
plains topminnow *Fundulus sciadicus*	Vegetative backwaters and headwaters; shallow parts of rivers and streams.	**Unlikely.** Habitat no present in AOI.

Tier 1 Species list from NNLP 2014c, Schneider et al. 2005; Habitat and range information from Schneider et al. 2005, Bat Conservation International (BCI) 2014, and NGPC 2014b

Brewer's Sparrow

Brewer's sparrow (*Spizella breweri*) breeding habitat includes shrublands, typically where big sagebrush (*Artemesia tridentata*) is the dominant species. This species may also occur in large parks within open conifer forests. Suitable habitat is found primarily at the higher elevations in the project area and in the open ponderosa pine woodlands in the northwestern and southeastern portions of the AOI.

Loggerhead Shrike

Loggerhead shrikes prefer open habitat with scattered trees or shrubs, fencerows, and open woodlands. Nesting typically occurs near isolated trees or large shrubs. Suitable loggerhead shrike habitat can be found throughout the AOI. Loggerhead shrikes were observed on the AOI during the site visit.

Pinyon Jay

Pinyon jays (*Gymnorhinus cyanocephalus*) are found in foothills and mid-elevations pinyon-juniper (*Pinus edulis-Juniperus* spp.) woodlands, and are also found in ponderosa pine forests. Within the AOI, the ponderosa pine and juniper woodlands provide suitable nesting and foraging habitat.

Rocky Mountain Bighorn Sheep

Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) live in steep, mountainous habitat. Bighorn sheep eat grass and inhabit the rocky buttes of the Wildcat Hills. Rocky Mountain bighorn sheep are likely to be found in the area surrounding Long Canyon in the northwest portion of the AOI.

Fringed Bat

Fringed bat (*Myotis thysanodes*) is a widespread species that uses both woodlands and grasslands. Roosting habitat includes caves, mines, and abandoned buildings. Habitat for this species is more plentiful in the northern part of the AOI, and the AOI contains abandoned buildings for roosting throughout the study area.

Little Brown Bat

Little brown bats (*Myotis lucifugus*) are found in a variety of forest habitats, and roost in tree cavities and crevices, as well as buildings and other man-made structures. Foraging habitat includes open water, cliff faces, meadows, and farmland. Forested habitat is more plentiful in the northern part of the AOI, and abandoned buildings for roosting are scattered throughout the study area.

Sagebrush Lizard

Sagebrush lizards (*Sceloporus graciosus*) are found in sagebrush and other types of shrublands. Pinyon-juniper and open pine woodlands also provide habitat. Areas occupied by sagebrush lizards are typically have some open ground and low bushes. Sagebrush lizards are likely to occur in the open ponderosa pine woodlands in the northwest and eastern portions of the AOI.

USFWS Birds of Conservation Concern

Birds of Conservation Concern (BCC) are listed by Bird Conservation Regions (BCR; see USFWS 2008); the AOI is located within BCR 18 (Shortgrass Prairie). Of the 16 BCC species in BCR 18, two have the potential to occur on the AOI as year-round residents: golden eagle (*Aquila chrysaetos*) and prairie falcon (*Falco mexicanus*). An additional seven BBC species have some potential to nest on the AOI: mountain plover, upland sandpiper (*Bartramia longicauda*), long-billed curlew (*Numenius americana*), burrowing owl (*Athene cunicularia*), lark bunting, McCown's longspur (*Rhynchophanes mccownii*), and chestnut-collared longspur (*Calcarius ornatus*). Large numbers of lark buntings were observed during the site visit. Bell's vireo (*Vireo bellii*), a Tier 1 species, has the potential to occur on the AOI during migration, and bald eagle (*Haliaeetus leucocephalus*) has the potential for rare occurrences on the AOI in winter and during migration. All of the BCC species with the potential to occur on the AOI are protected under the Migratory

Bird Treaty Act (MBTA 1918), and bald and golden eagles are further protected under the Bald and Golden Eagle Protection Act (BGEPA 1940).

Eagles

Golden Eagle

Golden eagles' breeding range intersects western Nebraska, including the entire AOI (Figure 13); however, some golden eagles are year-round residents. Golden eagles often are usually found in open country, prairies, arctic and alpine tundra, open wooded country and barren areas, especially in hilly or mountainous regions. Preferred nesting habitat (nesting occurs from March-August) includes rock outcrops, cliff ledges, and trees, while foraging habitat includes prairies, sagebrush, and open woodlands and prairie. Suitable nesting and foraging habitat is found primarily in the northwestern portion of the AOI.

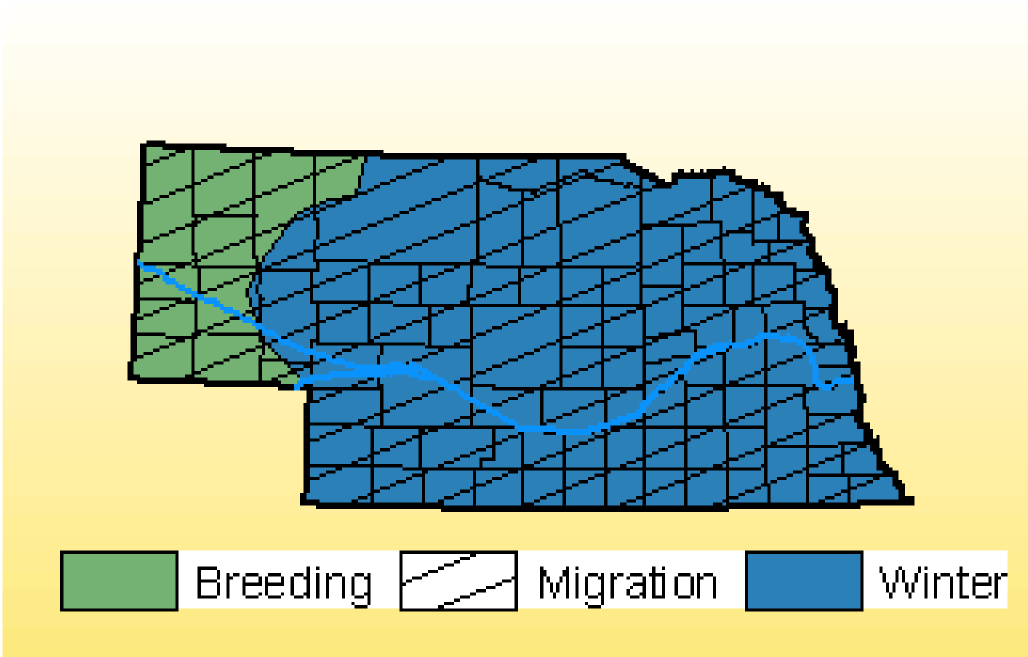
Bald Eagle

Bald eagles have a year-round range throughout Nebraska (Figure 13). Bald eagles are known to nest along the Platte River, north of the AOI (Figure 14); however, suitable breeding habitat is not present in the AOI. Bald eagles are typically associated with forested riparian areas. During migration and in winter, bald eagles may forage over land, typically in search of carrion. There is a potential for bald eagles to occur on the AOI in winter and during migration.

Sharp-tailed Grouse

Sharp-tailed grouse are species of concern for the NGPC, which has developed protocol to manage for sharp-tailed grouse at wind energy facilities. Sharp-tailed grouse are found in relatively open landscapes, such as shrub steppe, meadow steppe, mountain shrub, and brushy grassland; however, subclimax brush-grasslands are preferred (Natural Resource Conservation Service [NRCS] 2007). Breeding occurs on leks, where males gather and perform courtship displays to attract females. Leks are typically located on elevated areas, such as knolls or hilltops, in rangeland, cropland, plowed areas, or other areas that provide sparse, open vegetation cover. Sparse shrubs are often present near leks. Nesting typically occurs within one mile of leks, and the female nests, incubates, and rears the young (brood). Nests are located under shrubs, typically in vegetative cover that is denser than in the surrounding areas. Brooding habitat contains abundant and diverse vegetation, as well as abundant insects. Sharp-tailed grouse migrate short distances in late November to woody habitats; the timing of migration to winter habitat is strongly influenced by snow cover (NRCS 2007). Sharp-tailed grouse were observed in mixedgrass prairie intersperse with shrubs and forbs located in the northwest portion of the AOI, indicating suitable lek and brooding habitat is available in this area. Sharp-tailed grouse winter habitat is plentiful in the northwest and eastern portions of the AOI and along the ridge found in the northern portion of the AOI. The mixedgrass prairie-conifer matrix of the Wildcat Hills South BUL provide ample habitat for sharp-tailed grouse year round.

Golden Eagle Range



Bald Eagle Range

Figure 13. Distribution of the golden eagle (top) and bald eagle (bottom) in Nebraska (Nebraska Bird Library 2014).

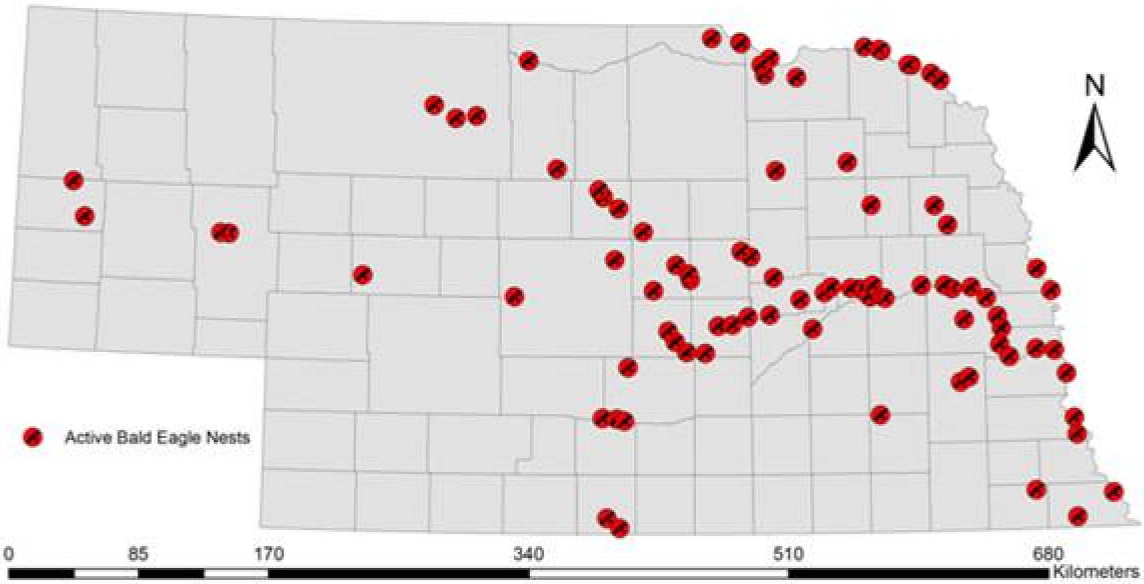


Figure 14. Active bald eagle nests in Nebraska found in 2010 (NGPC 2014a).

Raptors

Species Likely to Occur in the Area

Based on maps of distribution (Nebraska Bird Library 2014), 14 species of diurnal raptors, eight species of owls, and one species of vulture can be found within or near the AOI (Table 6). Of the total of 23 species, 13 have the potential to breed in the area, including golden eagle (BGEPA), prairie falcon (BCC), ferruginous hawk (*Buteo regalis*;Tier 1 Species), and burrowing owl (Tier 1 Species, BCC). Three raptor species were observed during the site visit (Table 3). No threatened, endangered, or other special status species were observed.

An old nesting structure and suitable nesting habitat were observed during the site visit. Potential nest structures included trees, cliffs, and man-made structures, including electric poles, and abandoned buildings; grassland areas could also provide nesting habitats for ground-nesting raptors, such as the northern harrier (*Circus cyaneus*). Species with the potential to breed in the AOI include red-tailed hawk, Swainson's hawk, ferruginous hawk, prairie falcon, American kestrel, northern harrier, and golden eagle. Five owl species have the potential to breed in the AOI: northern saw-whet owl (*Aegolius acadicus*), burrowing owl, great horned owl (*Bubo virginianus*), eastern screech-owl (*Megascops asio*), and barn owl (*Tyto alba*). Turkey vulture (*Cathartes aura*) is also a summer resident. Species that may occur within the AOI outside of the breeding season (migration, winter, or post-breeding dispersal), include merlin (*Falco columbarius*), peregrine falcon (*F. peregrinus;* rare migrant), rough legged hawk (*Buteo lagopus*), Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), osprey (*Pandion haliaetus;* rare migrant), and bald eagle. Three owl species have the potential to occur in the AOI during winter: short-eared owl (*Asio flammeus*), long-eared owl (*Asio otus*), and snowy owl (*Bubo scandiacus*).

Table 6. Diurnal raptors, owls, and vultures with potential to occur in the Banner County, Nebraska, Wind Energy Area of Interest throughout the year, based on distribution maps (Nebraska Bird Library 2014). YR = Year-round, S = Summer, W = Winter, M = Migration.

Scientific Name	Common Name	YR	S	W	M	Status
Diurnal Raptors						
Falco columbarius	merlin			x	x	
Falco mexicanus	prairie falcon	x				BCC
Falco peregrinus	peregrine falcon				x	
Falco sparverius	American kestrel	x				
Accipiter cooperii	Cooper's hawk				x	
Accipiter striatus	sharp-shinned hawk			x	x	
Buteo jamaicensis	red-tailed hawk	x				
Buteo lagopus	rough-legged hawk			x		
Buteo regalis	ferruginous hawk	x				Tier 1 Species
Buteo swainsoni	Swainson's hawk		x		x	
Circus cyaneus	northern harrier	x				
Pandion haliaetus	osprey				x	
Aquila chrysaetos	golden eagle	x				BGEPA; BCC
Haliaeetus leucocephalus	bald eagle			x	x	BGEPA; BCC
Owls						
Aegolius acadicus	northern saw-whet owl	x				
Asio flammeus	short-eared owl			x		Tier 1 Species
Asio otus	long-eared owl			x		
Athene cunicularia	burrowing owl		x			Tier 1 Species; BCC
Bubo scandiacus	snowy owl			x		
Bubo virginianus	great horned owl	x				
Megascops asio	eastern screech-owl	x				
Tyto alba	barn owl		x			
Vultures						
Cathartes aura	turkey vulture		x		x	

BGEPA = Bald and Golden Eagle Protection Act 1940; Tier 1 species = NNLP 2014a and 2014c; BCC = Birds of Conservation Concern, USFWS 2008.

Potential for Raptor Migration in the Area

Several factors influence the migratory pathways of raptors, the most significant of which is geography. Two geographical features often used by raptors during migration are ridgelines and the shorelines of large bodies of water (Liguori 2005). Updrafts formed as the wind hits the ridges, and thermals created over land and not water, make for energy-efficient travel over long distances (Liguori 2005), and it is for this reason that raptors sometimes follow corridors or pathways, for example along prominent ridges with defined edges, during migration. It is likely that raptors migrate through the proposed AOI in a broad-front fashion because there are no prominent north/south ridges or valleys that are likely to funnel migrants through the project area (Liguori 2005; Figure 2). A ridge transverses the AOI in an east-west orientation and would generally not provide the orographic lift that might attract migrating raptors. Trees and shrubs may provide some stopover habitat for migrating raptors, and the abundant grassland is likely to provide foraging opportunities; however, the AOI does not contain any features likely to concentrate migrating raptors.

Potential Raptor Nesting Habitat

Suitable raptor nesting habitat observed during the site visit included open ponderosa pine woodlands, cliffs and escarpments, shelter belts, and wooded farmsteads. Nesting habitat was often intermixed with open grasslands or agricultural areas. Grassland areas could provide nesting habitat for ground-nesting raptors, as well as foraging habitat for tree-nesting species (discussed below). The project generally lacks riparian habitat, though dry creek beds observed during the site visit indicate the presences of ephemeral streams. A single pond was the only waterbody observed during the site visit.

Potential Prey

Potential raptor prey includes small mammals, reptiles, and birds. No prairie dog colonies were observed during the site visit; however, this may be due to access being limited to public roads. With roost sites and food available, it is likely that raptors will use the area, but there were no extensive prey sources observed that might attract raptors to the AOI compared to the surrounding areas.

Does the Topography of the Site Increase the Potential for Raptor Use?

At wind energy facilities located on prominent ridges with defined edges, raptors often fly along the rim edges, using updrafts to maintain altitude while hunting, migrating, or soaring (Johnson et al. 2000b, Hoover and Morrison 2005). The AOI includes a ridge that crosses the northern edge of the AOI from east to west. The ridge is dissected by a canyon in the northwest portion of the AOI. This area of the AOI contains ridges and cliffs that might produce updrafts used by raptors to aid soaring flight. Topography in other areas of the AOI is flat to rolling.

Migratory and Breeding Birds

Although many species of passerines migrate at night and may collide with tall man-made structures, few large mortality events on the same scale as those seen at communication towers have been documented at wind energy facilities in North America (National Wind Coordinating

Collaborative [NWCC] 2004). Large numbers of passerines have collided with lighted communication towers and buildings when foggy conditions occur during spring and fall migration. Birds appear to become confused under these circumstances, flying lower and in circles around lighted structures until they become exhausted or collide with the structure (Erickson et al. 2001). Most collisions at communication towers are attributed to the guy wires on these structures, which wind turbines do not have. Additionally, the large mortality events observed at communication towers have occurred at structures greater than 500 feet (ft; 152 meters [m]) in height (Erickson et al. 2001), likely because most small birds migrate at elevations of 500 to 1,000 ft (152 to 305 m) above the ground (USFWS 1998), which is higher than most modern turbines. Migrating passerines are likely more at risk of turbine collision when using stopover habitats or during foggy conditions.

It is likely that passerines, raptors, and waterfowl migrate through the proposed AOI. Woodlands, grasslands, and cropland, which are found throughout the AOI may provide stopover habitat for migrants or individuals during post-breeding dispersal. The combination of open ponderosa pine woodlands and grasslands found in the project area may be attractive to broader suite of birds than when only one of these land cover types occurs. Harvested crops, such hay and wheat (*Triticum* spp.) fields, which were observed during the site visit, could serve as feeding areas for migrating cranes and waterfowl. These types of land cover are found throughout the region and therefore their presence in the AOI should not concentrate bird use in the project area as compared to adjacent areas.

No US Geological Survey (USGS) Breeding Bird Survey (BBS) routes intersect with the AOI; however, the Murray Lake and Kimball Routes are located to the north and south of the AOI and are generally representative of the habitat available in the AOI (Figure 15; USGS 2001, 2014). Each BBS route is about 24.5 miles (39.4 km) long; all birds seen or heard are tallied for a 3-minute period every half-mile (0.8 km) along the route (USGS 1998).

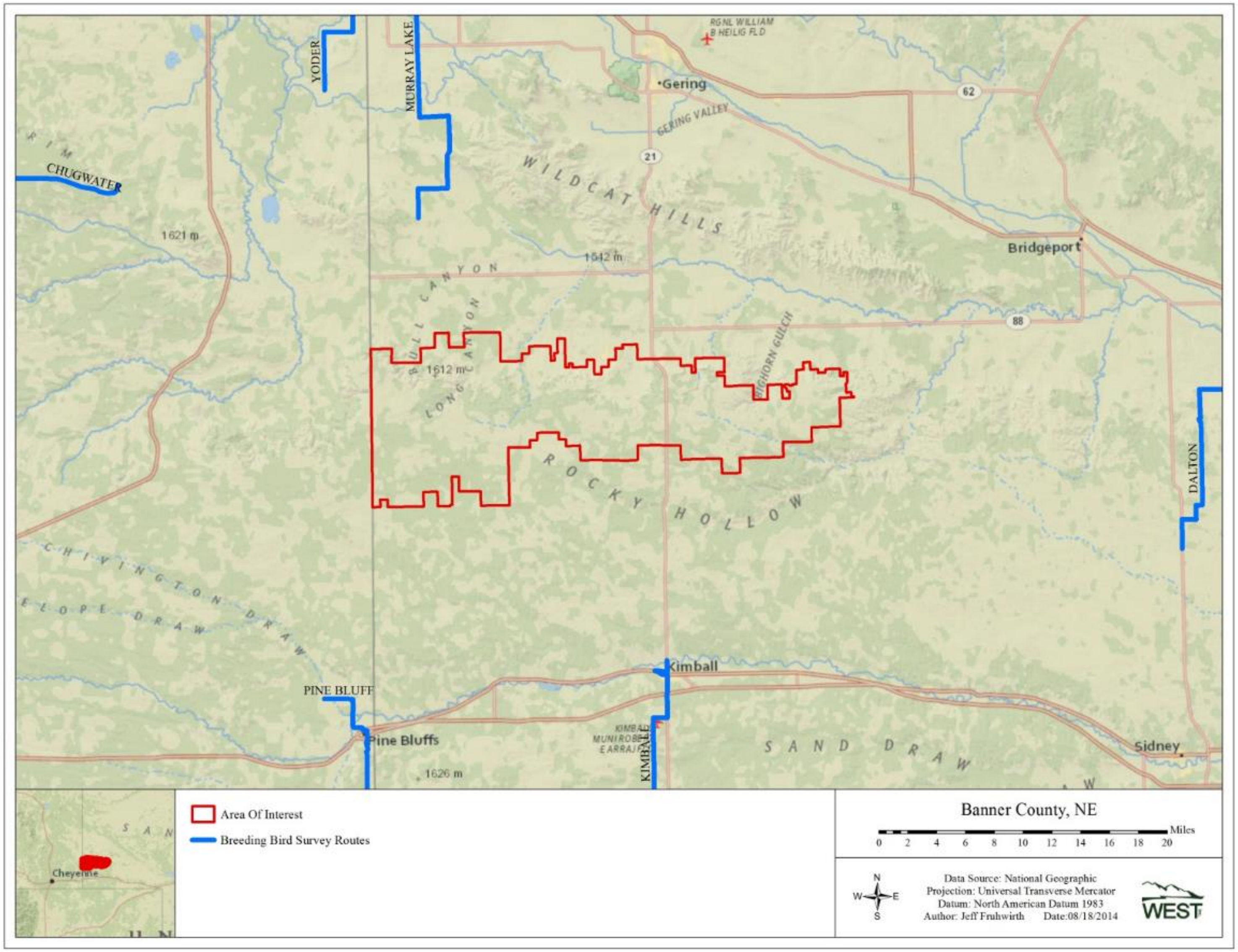


Figure 15. Location of the nearest US Geological Survey Breeding Bird Survey routes near the Banner County, Nebraska, Wind Energy Area of Interest (USGS 2001, 2014).

Overall, 94 bird species have been recorded along the Murray Lake BBS Route between 2003 and 2013 (Sauer et al. 2014). This list includes five Tier 1 species and six USFWS BCC, including golden eagle. Three of these species (lark bunting, upland sandpiper, and burrowing owl) were observed in the BBS data for this route in 2013, the most recent one for which data and results are publicly available (Sauer et al. 2014). A total of 46 bird species have been recorded along the Kimball BBS Route between 2003 and 2013 (Sauer et al. 2014), including one state-listed species (mountain plover), seven Tier 1 species (including mountain plover) and five USFWS BCC. Four of these species (lark bunting, loggerhead shrike, mountain plover upland sandpiper, and chestnut-collared longspur) were observed in the BBS data for this route in 2012, the most recent one for which data and results are publicly available (Sauer et al. 2014). The most abundant species at the Murray Lake BBS Route were western meadowlark, cliff swallow (*Petrochelidon pyrrhonota*), horned lark, and lark bunting. At the Kimball BBS Route, lark bunting and mourning dove (*Zenaida macroura*) were the most abundant species.

Displacement of grassland nesting birds is often one of the primary concerns wildlife agencies express, regarding the placement of wind facilities in and near grassland areas. 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 (CRP) grasslands was reduced in the immediate vicinity of turbines (Leddy et al. 1999), but changes in density at broader scales were not detected (Johnson et al. 2000a). Erickson et al. (2004) documented a decrease in density of some native grassland passerines, such as grasshopper sparrow (*Ammodramus savannarum*), near turbines in Washington; however, they could not determine if a decrease in post-construction density was the result of behavioral disturbance or a loss of habitat. 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 turbines. Piorkowski (2006) suggested that habitat characteristics were more important to determining passerine breeding densities than the presence of wind turbines. Shaffer and Johnson (2009) documented some avoidance by grasshopper sparrows out to 492 ft (150 m) at a wind energy facility in northern South Dakota. The proposed AOI contains a considerable amount of grassland/herbaceous cover, with the potential to support grassland sensitive species that have the potential to be affected by development. Species potentially affected include several grassland obligate species and area sensitive species such as the mountain plover, burrowing owl, lark bunting, and McCown's longspur; however, grassland/herbaceous cover is prevalent throughout the region, therefore significant adverse impacts to these species are not anticipated.

Bats

There has been growing concern in recent decades regarding the status of bats throughout North America, partly because of a general lack of basic natural history information (Hayes 2003), and also because a variety of habitats traditionally used by bats for roosting and foraging have been subjected to widespread disturbance, alteration, reduced availability, or complete removal (Fenton 1997, Pierson 1998). This lack of information regarding life history traits and basic biology has made it even more difficult to further any conservation and management efforts.

Although none of the bat species listed by the USFWS occur in Nebraska, two species of bats with verified or potential occurrence in the AOI are Tier 1 species in the State (Table 6). These include fringed bat and little brown bat, which are discussed above. Eight additional species can be found in the area based on distribution maps (Harvey et al. 1999, Bat Conservation International [BCI] 2014; Table 7). Eight of the bats with the potential to occur in the AOI are year-round residents in the region, and two additional species potentially breed in the area.

Table 7. Bat species with the potential to occur in the Banner County, Nebraska, Wind Energy Area of Interest, based on range and distribution maps (Bat Conservation International 2014, Harvey et al. 1999).

Scientific Name	Common Name	Habitat	Range
Corynorhinus townsendii	Townsend's big-eared bat	Arid western scrub and pine forests. Roosts in mines caves or buildings. Hibernates in caves or mines.	Year-round
Eptesicus fuscus	big brown bat	Common in most habitats, abundant in deciduous forests and suburban areas with agriculture, maternity colonies beneath bark, tree cavities, buildings, barns, bridges	Year-round
Lasionycteris noctivagans	silver-haired bat	Common bat in forested areas, particularly Old Growth; maternity colonies in tree cavities or hollows; hibernates in forests or cliff faces.	Year-round
Lasiurus borealis	eastern red bat	Abundant tree bat, roosts in trees, solitary	Summer
Lasiurus cinereus	hoary bat	Abundant tree bat, roosts in trees, solitary	Summer
Myotis volans	long-legged bat	Occurs mostly in forested mountain regions and river bottoms, also at high elevations. Roosts in trees, rock crevices, fissures in stream banks, and abandoned buildings. Hibernacula include caves and mines.	Year-round
Myotis ciliolabrum	western small-footed bat	Mesic and arid conifer forest, associated with rock outcrops, clay banks; and riparian woodlands. Roosts in rock outcrops, clay banks, loose bark, buildings, bridges, caves, and mines. Hibernacula include caves and mines.	Year-round
Myotis evotis	long-eared bat	Occupies a wide range of rocky and forested habitats over a broad elevation gradient (Jones et al. 1973). Summer day roosts include abandoned buildings, bridges, hollow trees, stumps, under loose bark, and rock fissures. Hibernacula include caves and abandoned mines.	Year-round
Myotis lucifugus	little brown bat	Roosts in buildings, trees, under rock or wood; forage over water, meadows, farmland, cliff faces, forest trails.	Year-round
Myotis thysanodes	fringed bat	Ponderosa pine forests and woodlands, green ash-elm bottomland woodlands.	Year-round

The northern long-eared bat (*Myotis septentrionalis*), a species proposed to be listed as endangered (see USFWS 2013b), deserves special mention. According to the USFWS species profile (USFWS2014c), the distribution range of this species does not include the AOI, but its range includes the northern panhandle of Nebraska. Therefore, conclusive data on the likelihood of this species to occur in the AOI is not available and further studies may be needed in order to determine its presence on the AOI.

At least 19 bat species have been documented as fatalities at wind energy facilities throughout the US (Table 8) and, of these, six species are likely to occur in the AOI based on range maps (Harvey et al. 1999, BCI 2014).

Potential roosting habitat within the AOI is found in the form of trees, buildings, rocky cliffs, and rock outcrops; all of these attributes were observed during the site visit. Woodlands, forests and rocky outcrops were present across the northern portion of the AOI. Rocky cliffs are found in the northwestern portion of the AOI, and abandoned buildings were observed throughout the project area.

Bats generally forage over water and open spaces such as agricultural fields, grasslands, streams, and wetlands/ponds. According to our site visit, agricultural fields and grasslands were common throughout the AOI, but streams, wetlands, and pools are uncommon in the project area. Bats may forage over the entire AOI, although the extent of use is not known. However, little data are available from Nebraska on the foraging behavior, diet, and range of bats, with little knowledge of specific habitat use or seasonal requirements in the state.

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 0.01 – 47.5 fatalities per turbine per year (0.9 – 43.2 bats per megawatt [MW] per year) in the US, with an average of 3.4 per turbine or 4.6 per MW (NWCC 2004). The majority of the bat casualties at wind energy facilities to date are migratory species which conduct long migrations between summer roosts and winter areas. The species most commonly found as fatalities at wind energy facilities include hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), and eastern red bat (*Lasiurus borealis*; Johnson 2005). 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), BHE Environmental (2010, 2011), Barclay et al. (2007), Good et al. (2011, 2012), and Jain (2005) recently reported relatively high fatality rates from facilities in Wisconsin, Canada, Indiana, and Iowa that were located in grassland and agricultural habitats. Unlike the eastern US wind energy facilities that reported higher bat fatality rates, the Wisconsin, Alberta, Indiana, and Iowa facilities are in open grasslands and crop fields.

Table 8. 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*	5,027	36.5
eastern red bat[2]	*Lasiurus borealis*	3,179	23.1
silver-haired bat[2]	*Lasionycteris noctivagans*	2,500	18.2
little brown bat[2]	*Myotis lucifugus*	1,121	8.1
tricolored bat	*Perimyotis subflavus*	625	4.5
big brown bat[2]	*Eptesicus fuscus*	517	3.8
Mexican free-tailed bat	*Tadarida brasiliensis*	377	2.7
unidentified bat		325	2.4
unidentified myotis		32	0.2
northern long-eared bat	*Myotis septentrionalis*	15	0.1
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 femorosaccus*	2	<0.1
canyon bat	*Parastrellus hesperus*	1	<0.1
cave bat	*Myotis velifer*	1	<0.1
long-legged bat[2]	*Myotis volans*	1	<0.1
unidentified free-tailed bat		1	<0.1
Total	**19 species**	**13,763**	**100**

[1] These are raw data and are not corrected for searcher efficiency or scavenging.
[2] Potential resident or migrant in the AOI (Harvey et al. 1999, BCI 2014).
Cumulative fatalities and species from data compiled by Western EcoSystems Technology, Inc. from publicly available fatality documents (listed in Appendix C).
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 (USFWS 2011a, 2012a, 2012c), but are not included in this summary of bats found as fatalities.
One long-eared bat (*Myotis evotis*), a species that may also potentially be found in the AOI, 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.
Evening bat (*Nycticeius humeralis*) has also been reported as a fatality (Hale and Karsten 2010), but the number of fatalities is not known.
Canyon bat formerly known as western pipistrelle (*Pipistrellus hesperus*; BCI 2012a), and tricolored bat formerly known as eastern pipistrelle (*Pipistrellus subflavus*; BCI 2012b).

Development on the AOI is likely to result in some bat mortality. The magnitude of these fatalities and the degree to which bat species will be affected is difficult to determine, but it is likely that the mortality rate and species composition will be within the average range of bat mortalities found throughout the US based on general vegetation and landscape characteristics.

CONCLUSIONS

Two state-listed species and 18 state Tier 1 species have some potential occurrence in the project area. In addition, both bald and golden eagle have some potential to occur in the AOI. Of these species, golden eagle, Brewer's sparrow, loggerhead shrike, pinyon jay, swift fox, Rocky Mountain bighorn sheep, fringed bat, little brown bat, and sagebrush lizard are most likely to occur within the AOI. Areas that occur within and in the vicinity of the AOI that should be avoided include the Wildcat Hills South BUL. Habitats such as the good quality tracts of grasslands and ponderosa pine woodlands found in the northwest portions of the AOI should be avoided to minimize impacts. A summary of the wildlife and habitat issues likely to occur in the project area is presented in Table 9.

Table 9. Summary of the potential for wildlife and habitat conflicts at the Banner County, Nebraska, Wind Energy Area of Interest. VH = Very High, H = High, M = Medium, and L = Low

Issue	VH	H	M	L	Notes
Areas to be avoided			✓		High quality, contiguous mixedgrass prairie; ponderosa pine woodlands and prairie matrix.
Potential for raptor nest sites		✓			Tree rows, woodlots, forests, cliffs.
Concentrated raptor flight potential				✓	Topography provides some potential for concentrated raptor flight; however, impact can be avoided by proper siting of turbines.
Potential for migratory pathway				✓	Stopover habitats available for grassland and forest edge species. However, these characteristics are not unique to AOI and are found elsewhere across the region.
Potential for raptor prey species			✓		Suitable habitat for small to mid-sized mammals exists.
Potential for federally-protected bird species to occur				✓	Federally-protected bird species generally unlikely to occur. Potential for golden eagles to occur year round; bald eagles have the potential for rare occurrence.
Potential for State issues		✓			The AOI overlaps the Wildcat Hills South BUL; likely state species issues exist as well (e.g., swift fox and possibly mountain plover). Several Tier 1 species have the potential to occur on the AOI.
Uniqueness of habitat at wind energy facility			✓		Grasslands are commonly found in the region; however, the ponderosa woodlands/grassland matrix is a unique feature of the Wildcat Hills BUL. The Wildcat Hills North BUL, just north of the AOI, is more extensive and contains similar habitats and protected lands. Displacement of grassland animals; however, similar habitat is found in the vicinity of the AOI.
Potential for rare plants to occur				✓	Rare plants of Nebraska are typically not found in the AOI.
Potential for use by bats		✓			Trees, buildings, grasslands, agricultural land, rocky cliffs and rocky outcrops occur in the AOI.

To characterize the species composition and abundance of the site's avifauna prior to project development, standardized year-round fixed-point bird use surveys should be conducted to detect common and rare species that occur in the site, and to determine which species of concern are most likely to be affected by the project. Bird use surveys should be designed to collect vertical and horizontal flight data to identify levels and patterns of activity within the turbine's rotor-swept zones. The USFWS' Eagle Conservation Plan (USFWS 2013a) recommends at least two years of repeated 800-m (2,625-ft) radius point counts surveys in the project footprint, nesting surveys in the project area, and utilization assessments within the project footprint to determine important eagle use areas and assist with project planning decisions. Due to the potential occurrence of Tier 1 sensitive breeding bird and grassland obligate species, breeding bird surveys are recommended to determine densities and habitat use within the AOI; however, these surveys may be conducted in conjunction with the year-round bird use surveys. Aerial sharp-tailed grouse lek surveys should be conducted within the project, in conjunction with aerial raptor nest surveys. Due to the potential occurrence of swift fox (state endangered) and mountain plovers (state threatened), consultation with the NGPC should begin at least two years prior to development to determine if species-specific surveys are warranted. Prairie dog town surveys are also recommended because several species of concern with the potential to occur on the AOI are dependent on the presence of prairie dog towns. Due to the potential occurrence of resident and breeding and the uncertainty regarding their distribution and abundance, passive acoustic surveys to determine an index of bat use are recommended.

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Young, D.P. Jr., C. Nations, M. Lout, and K. Bay. 2013. 2012 Post-Construction Monitoring Study, Criterion Wind Project, Garrett County, Maryland. April - November 2012. Prepared for Criterion Power Partners, LLC, Oakland, Maryland. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Waterbury, Vermont. January 15, 2013.

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Appendix A. Correspondence with the Nebraska Game and Parks Commission and US Fish and Wildlife Service

WEST Inc.
ENVIRONMENTAL & STATISTICAL CONSULTANTS
4007 State Street, Suite 109, Bismarck, ND 58503
Phone: 701-250-1756 • www.west-inc.com • Fax: 701-250-1761

BUSINESS CONFIDENTIAL

August 20, 2014

Michelle Koch
Nebraska Game and Parks Commission
2200 North 33rd Street
Lincoln, NE 68503-0370

Subject: **Banner County, Nebraska, Wind Energy Project**
Sensitive Species/Sensitive Habitat Review Request

Dear Ms. Koch:

I am currently assisting a wind energy development client in evaluating the feasibility of developing a wind energy project in western Nebraska (see attached map). The client is looking at a very large area within which a wind development may be placed and is utilizing wildlife related data to help inform overall project siting within the large overall area being considered.

As it is very early in development of the project, specific attributes such as total project size, turbine types, and construction dates are not yet known.

Please review the proposed project area and surrounding areas and provide us with any information about listed, proposed and candidate species (including plants) or sensitive environmental areas and other sensitive wildlife (e.g., eagle nest locations) that could potentially be affected by the project and thus should be considered in this early stage planning. This information will be treated as confidential and will be used for project purposes only.

This request is made pursuant to the U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines (March 2012), as part of the Site Characterization step (Tier 2).

We consider this request privileged and confidential business information and ask that you keep it confidential to the maximum extent allowed by law.

Thank you for your assistance. If you have any questions or require additional information, please contact me at 701-250-1756 or cderby@west-inc.com.

Sincerely,

Clayton Derby
Senior Manager

ENVIRONMENTAL & STATISTICAL CONSULTANTS
4007 State Street, Suite 109, Bismarck, ND 58503
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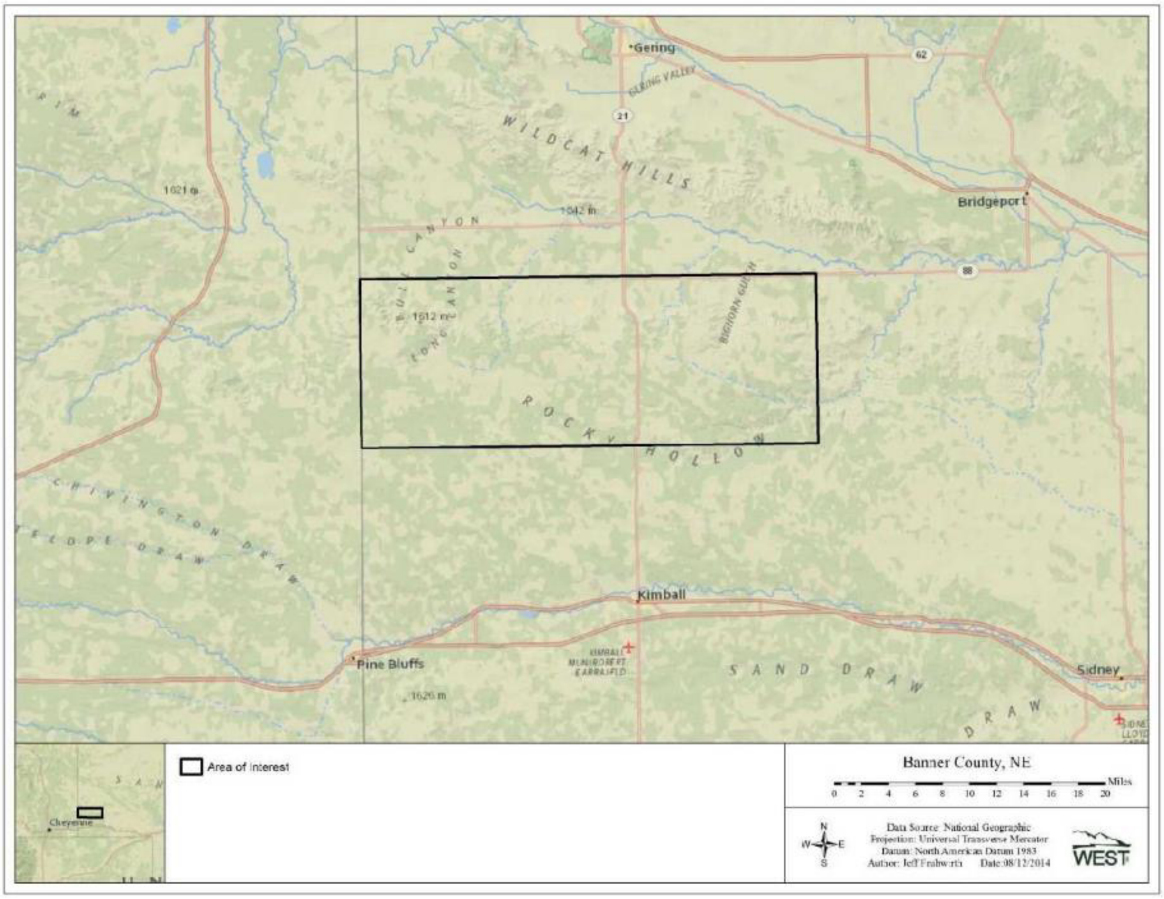

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BUSINESS CONFIDENTIAL

August 20, 2014

Eliza Hines
USFWS Ecological Services
Nebraska Field Office
203 West Second Street
Grand Island, NE 68801

Subject: **Banner County, Nebraska, Wind Energy Project**
Sensitive Species/Sensitive Habitat Review Request

Dear Ms. Hines:

I am currently assisting a wind energy development client in evaluating the feasibility of developing a wind energy project in western Nebraska (see attached map). The client is looking at a very large area within which a wind development may be placed and is utilizing wildlife related data to help inform overall project siting within the large overall area being considered.

As it is very early in development of the project, specific attributes such as total project size, turbine types, and construction dates are not yet known.

Please review the proposed project area and surrounding areas and provide us with any information about listed, proposed and candidate species (including plants) or sensitive environmental areas and other sensitive wildlife (e.g., eagle nest locations) that could potentially be affected by the project and thus should be considered in this early stage planning. This information will be treated as confidential and will be used for project purposes only.

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Thank you for your assistance. If you have any questions or require additional information, please contact me at 701-250-1756 or cderby@west-inc.com.

Sincerely,

Clayton Derby
Senior Manager

WEST Inc.

BUSINESS CONFIDENTIAL

ENVIRONMENTAL & STATISTICAL CONSULTANTS

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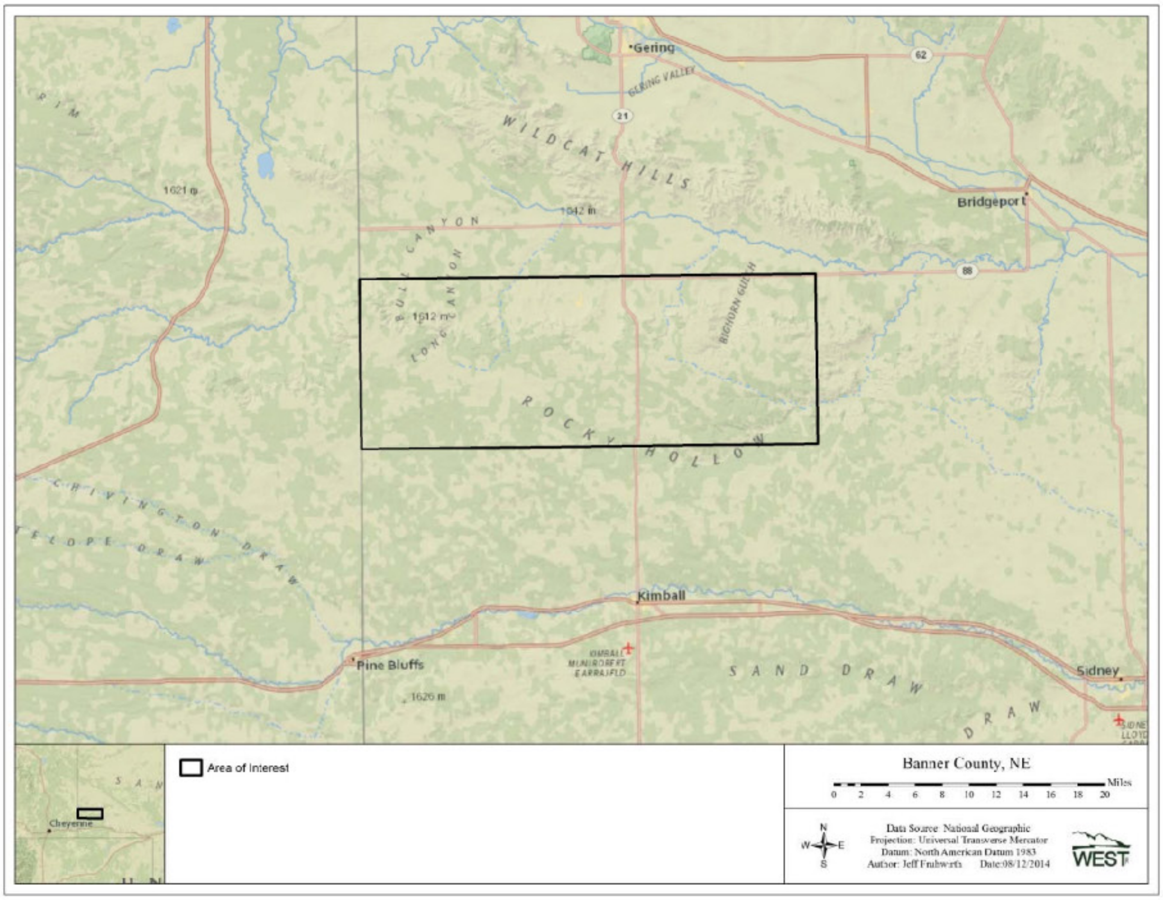

Appendix B. Photographs of the Banner County, Nebraska, Wind Energy Area of Interest

Photo 1. Rye and sunflower found in patches of tilled agriculture in the south-central portion of the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 2. Nonnative mixedgrass prairie of the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 3. Farmstead and woodlot in agricultural landcover at the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 4. Irrigated cropland (corn) at the Banner County, Nebraska, Wind Energy Area of Interest.


Photo 5. Irrigated cropland and rangeland at the Banner County, Nebraska, Wind Energy Area of Interest.


Photo 6. Rolling mixedgrass prairie at the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 7. Mixed grass prairie and yucca shrubs at the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 8. Conifer tree row at the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 9. Unknown raptor nest on cliff face in the northeastern portion of the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 10. Sandstone outcrops in grasslands at the Banner County Wind Energy Area of Interest.

Photo 11.Agriculture at the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 12. Abandoned farmstead at the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 13. Ponderosa pine forest and grassland/herbaceous matrix in the southeastern portion of the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 14. Rangeland and shortgrass prairie in eastern portion of the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 15. Stock pond in eastern portion of the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 16. Shrub/scrub and rocky outcroppings at the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 17. North-facing escarpment of the ridge that transverses the northern portion of the Banner County, Nebraska, Wind Energy Area of Interest.

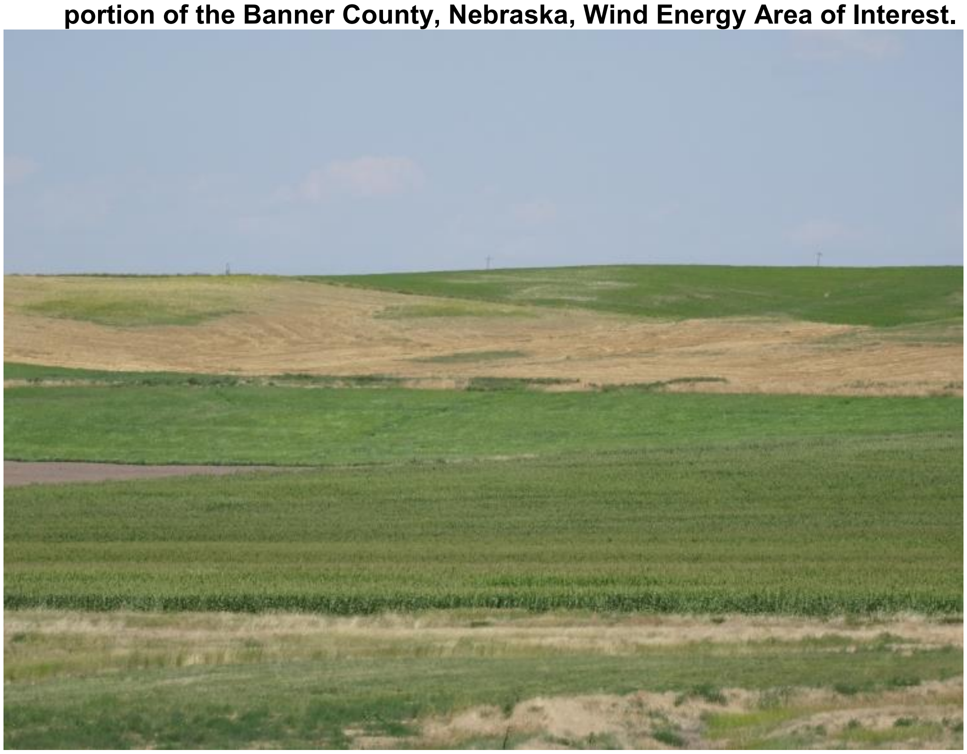

Photo 18. Agricultural landscape in the southeast portion of the Banner County, Nebraska, Wind Energy Area of Interest.

Photo 19. Drainage off the north-facing slope of the ridge that transverses the Banner County, Nebraska, Wind Energy Area of Interest.

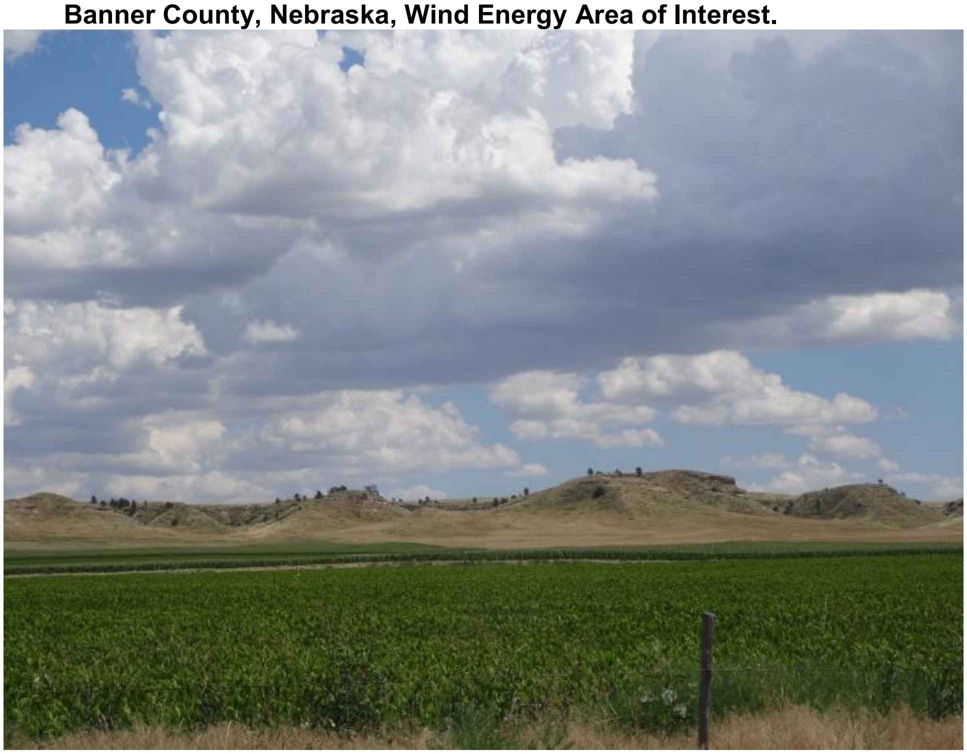

Photo 20. Rolling hills in the northwestern portion of the Banner County, Nebraska, Wind Energy Area of Interest. Mixedgrass prairie with sparse ponderosa pine in background; agriculture in foreground.

Photo 21. Rugged terrain in small canyon on northwest portion of the Banner County, Nebraska, Wind Energy Area of Interest.

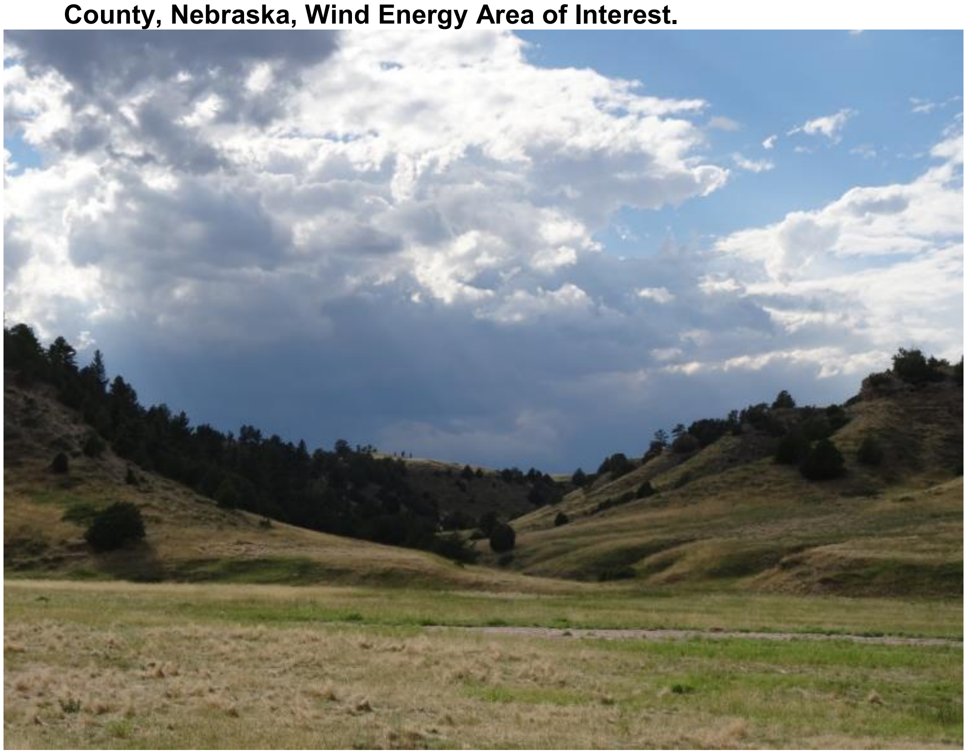

Photo 22. Rolling ridge terrain and ponderosa pine forest of the northeast portion of the Banner County, Nebraska, Wind Energy Area of Interest.

Appendix C. List of Wind Energy Facilities with Publicly-Available Bat Fatality Data

Appendix C. List of wind energy facilities with publicly-available bat fatality data.
Data from the following sources:

Project, Location	Reference	Project, Location	Reference
Alite, CA (09-10)	Chatfield et al. 2010	Klondike II, OR (05-06)	NWC and WEST 2007
Alta Wind I, CA (11-12)	Chatfield et al. 2012	Klondike III (Phase I), OR (07-09)	Gritski et al. 2010
Alta Wind II-V, CA (11-12)	Chatfield et al. 2012	Klondike IIIa (Phase II), OR (08-10)	Gritski et al. 2011
Barton I & II, IA (10-11)	Derby et al. 2011a	Leaning Juniper, OR (06-08)	Gritski et al. 2008
Barton Chapel, TX (09-10)	WEST 2011	Lempster, NH (09)	Tidhar et al. 2010
Beech Ridge, WV (12)	Tidhar et al. 2013	Lempster, NH (10)	Tidhar et al. 2011
Big Horn, WA (06-07)	Kronner et al. 2008	Linden Ranch, WA (10-11)	Enz and Bay 2011
Big Smile, OK (12-13)	Derby et al. 2013a	Locust Ridge, PA (Phase II; 09)	Arnett et al. 2011
Biglow Canyon, OR (Phase I; 08)	Jeffrey et al. 2009a	Locust Ridge, PA (Phase II; 10)	Arnett et al. 2011
Biglow Canyon, OR (Phase I; 09)	Enk et al. 2010	Madison, NY (01-02)	Kerlinger 2002b
Biglow Canyon, OR (Phase II; 09-10)	Enk et al. 2011a	Maple Ridge, NY (06)	Jain et al. 2007
Biglow Canyon, OR (Phase II; 10-11)	Enk et al. 2012b	Maple Ridge, NY (07)	Jain et al. 2009a
Biglow Canyon, OR (Phase III; 10-11)	Enk et al. 2012a	Maple Ridge, NY (07-08)	Jain et al. 2009d
Blue Sky Green Field, WI (08; 09)	Gruver et al. 2009	Marengo I, WA (09-10)	URS Corporation 2010b
Buena Vista, CA (08-09)	Insignia Environmental 2009	Marengo II, WA (09-10)	URS Corporation 2010c
Buffalo Gap I, TX (06)	Tierney 2007	Mars Hill, ME (07)	Stantec 2008
Buffalo Gap II, TX (07-08)	Tierney 2009	Mars Hill, ME (08)	Stantec 2009a
Buffalo Mountain, TN (00-03)	Nicholson et al. 2005	McBride, Alb (04)	Brown and Hamilton 2004
Buffalo Mountain, TN (05)	Fiedler et al. 2007	Melancthon, Ont (Phase I; 07)	Stantec Ltd. 2008
Buffalo Ridge, MN (94-95)	Osborn et al. 1996, 2000	Meyersdale, PA (04)	Arnett et al. 2005
Buffalo Ridge, MN (00)	Krenz and McMillan 2000	Moraine II, MN (09)	Derby et al. 2010d
Buffalo Ridge, MN (Phase I; 96)	Johnson et al. 2000a	Mount Storm, WV (Fall 08)	Young et al. 2009b
Buffalo Ridge, MN (Phase I; 97)	Johnson et al. 2000a	Mount Storm, WV (09)	Young et al. 2009a, 2010b
Buffalo Ridge, MN (Phase I; 98)	Johnson et al. 2000a	Mount Storm, WV (10)	Young et al. 2010a, 2011b
Buffalo Ridge, MN (Phase I; 99)	Johnson et al. 2000a	Mount Storm, WV (11)	Young et al. 2011a, 2012b
Buffalo Ridge, MN (Phase II; 98)	Johnson et al. 2000a	Mountaineer, WV (03)	Kerns and Kerlinger 2004
Buffalo Ridge, MN (Phase II; 99)	Johnson et al. 2000a	Mountaineer, WV (04)	Arnett et al. 2005
Buffalo Ridge, MN (Phase II; 01/Lake Benton I)	Johnson et al. 2004	Munnsville, NY (08)	Stantec 2009b
Buffalo Ridge, MN (Phase II; 02/Lake Benton I)	Johnson et al. 2004	Nine Canyon, WA (02-03)	Erickson et al. 2003
Buffalo Ridge, MN (Phase III; 99)	Johnson et al. 2000a	Noble Altona, NY (10)	Jain et al. 2011b

Appendix C. List of wind energy facilities with publicly-available bat fatality data.
Data from the following sources:

Project, Location	Reference	Project, Location	Reference
Buffalo Ridge, MN (Phase III; 01/Lake Benton II)	Johnson et al. 2004	Noble Bliss, NY (08)	Jain et al.2009e
Buffalo Ridge, MN (Phase III; 02/Lake Benton II)	Johnson et al. 2004	Noble Bliss, NY (09)	Jain et al. 2010a
Buffalo Ridge I, SD (09-10)	Derby et al. 2010b	Noble Chateaugay, NY (10)	Jain et al. 2011c
Buffalo Ridge II, SD (11-12)	Derby et al. 2012a	Noble Clinton, NY (08)	Jain et al. 2009c
Casselman, PA (08)	Arnett et al. 2009	Noble Clinton, NY (09)	Jain et al. 2010b
Casselman, PA (09)	Arnett et al. 2010	Noble Ellenburg, NY (08)	Jain et al. 2009b
Castle River, Alb. (01)	Brown and Hamilton 2006a	Noble Ellenburg, NY (09)	Jain et al. 2010c
Castle River, Alb. (02)	Brown and Hamilton 2006a	Noble Wethersfield, NY (10)	Jain et al. 2011a
Cedar Ridge, WI (09)	BHE Environmental 2010	NPPD Ainsworth, NE (06)	Derby et al. 2007
Cedar Ridge, WI (10)	BHE Environmental 2011	Oklahoma Wind Energy Center, OK (04; 05)	Piorkowski and O'Connell 2010
Cohocton/Dutch Hill, NY (09)	Stantec 2010	Pebble Springs, OR (09-10)	Gritski and Kronner 2010b
Cohocton/Dutch Hills, NY (10)	Stantec 2011	PGC site 6-3 (07)	Capouillez and Librandi-Mumma 2008, Librandi-Mumma and Capouillez 2011
Combine Hills, OR (Phase I; 04-05)	Young et al. 2006	Pine Tree, CA (09-10)	BioResource Consultants 2010
Combine Hills, OR (11)	Enz et al. 2012	Pioneer Prairie I, IA (Phase II; 11-12)	Chodachek et al. 2012
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	Prince Wind Farm, Ont (06)	Natural Resource Solutions 2009
Crystal Lake II, IA (09)	Derby et al. 2010a	Prince Wind Farm, Ont (07)	Natural Resource Solutions 2009
Diablo Winds, CA (05-07)	WEST 2006, 2008	Prince Wind Farm, Ont (08)	Natural Resource Solutions 2009
Dillon, CA (08-09)	Chatfield et al. 2009	Red Canyon, TX (06-07)	Miller 2008
Dry Lake I, AZ (09-10)	Thompson et al. 2011	Red Hills, OK (12-13)	Derby et al. 2013b
Dry Lake II, AZ (11-12)	Thompson and Bay 2012	Ripley, Ont (08)	Jacques Whitford 2009
Elkhorn, OR (08)	Jeffrey et a. 2009b	Ripley, Ont (08-09)	Golder Associates 2010
Elkhorn, OR (10)	Enk et al. 2011b	Rugby, ND (10-11)	Derby et al. 2011b
Elm Creek, MN (09-10)	Derby et al. 2010c	Searsburg, VT (97)	Kerlinger 2002a
Elm Creek II, MN (11-12)	Derby et al. 2012b	Shiloh I, CA (06-09)	Kerlinger et al. 2009
Foote Creek Rim, WY (Phase I; 99)	Young et al. 2003	Shiloh II, CA (09-10)	Kerlinger et al. 2010
Foote Creek Rim, WY (Phase I; 00)	Young et al. 2003	SMUD Solano, CA (04-05)	Erickson and Sharp 2005

Appendix C. List of wind energy facilities with publicly-available bat fatality data.
Data from the following sources:

Project, Location	Reference	Project, Location	Reference
Foote Creek Rim, WY (Phase I; 01-02)	Young et al. 2003	Stateline, OR/WA (01-02)	Erickson et al. 2004
Forward Energy Center, WI (08-10)	Grodsky and Drake 2011	Stateline, OR/WA (03)	Erickson et al. 2004
Fowler I, IN (09)	Johnson et al. 2010a	Stateline, OR/WA (06)	Erickson et al. 2007
Fowler III, IN (09)	Johnson et al. 2010b	Stetson Mountain I, ME (09)	Stantec 2009c
Fowler I, II, III, IN (10)	Good et al. 2011	Stetson Mountain I, ME (11)	Normandeau Associates 2011
Fowler I, II, III, IN (11)	Good et al. 2012	Stetson Mountain II, ME (10)	Normandeau Associates 2010
Fowler I, II, III, IN (12)	Good et al. 2013	Summerview, Alb (05-06)	Brown and Hamilton 2006b
Goodnoe, WA (09-10)	URS Corporation 2010a	Summerview, Alb (06; 07)	Baerwald 2008
Grand Ridge I, IL (09-10)	Derby et al. 2010g	Top of Iowa, IA (03)	Jain 2005
Harrow, Ont (10)	Natural Resource Solutions 2011	Top of Iowa, IA (04)	Jain 2005
Harvest Wind, WA (10-12)	Downes and Gritski 2012a	Tuolumne (Windy Point I), WA (09-10)	Enz and Bay 2010
Hay Canyon, OR (09-10)	Gritski and Kronner 2010a	Vansycle, OR (99)	Erickson et al. 2000
High Sheldon, NY (10)	Tidhar et al. 2012a	Vantage, WA (10-11)	Ventus Environmental Solutions 2012
High Sheldon, NY (11)	Tidhar et al. 2012b	Wessington Springs, SD (09)	Derby et al. 2010f
High Winds, CA (03-04)	Kerlinger et al. 2006	Wessington Springs, SD (10)	Derby et al. 2011d
High Winds, CA (04-05)	Kerlinger et al. 2006	White Creek, WA (07-11)	Downes and Gritski 2012b
Hopkins Ridge, WA (06)	Young et al. 2007	Wild Horse, WA (07)	Erickson et al. 2008
Hopkins Ridge, WA (08)	Young et al. 2009c	Windy Flats, WA (10-11)	Enz et al. 2011
Jersey Atlantic, NJ (08)	NJAS 2008a, 2008b, 2009	Winnebago, IA (09-10)	Derby et al. 2010e
Judith Gap, MT (06-07)	TRC 2008	Wolfe Island, Ont (May-June 09)	Stantec Ltd. 2010a
Judith Gap, MT (09)	Poulton and Erickson 2010	Wolfe Island, Ont (July-December 09)	Stantec Ltd. 2010b
Kewaunee County, WI (99-01)	Howe et al. 2002	Wolfe Island, Ont (January-June 10)	Stantec Ltd. 2011a
Kibby, ME (11)	Stantec 2012	Wolfe Island, Ont (July-December 10)	Stantec Ltd. 2011b
Kittitas Valley, WA (11-12)	Stantec Consulting 2012	Wolfe Island, Ont (January-June 11)	Stantec Ltd. 2011c
Klondike, OR (02-03)	Johnson et al. 2003	Wolfe Island, Ont (July-December 11)	Stantec Ltd. 2012

Two Indiana bat fatalities are reported by USFWS (2010, 2011b), among other reports. Three additional Indiana bat fatalities have been reported (2011a, 2012a, 2012c), 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 evening bat (*Nycticeius humeralis*) fatalities have also been reported (Hale and Karsten 2010), but the number of fatalities is not known.

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June 07, 2017

Michael Kurnik
Orion Renewable Energy Group, LLC
155 Grand Avenue, Suite 706
Oakland, California 94612

RE: Banner County Area of Interest 2017 Raptor Nest Survey Results

Dear Mr. Kurnik,

Orion Wind Resources LLC (Orion) requested that Western EcoSystems Technology, Inc. (WEST) conduct aerial raptor nest surveys, including golden eagle (*Aquila chrysaetos*) and other non-eagle raptors (hereafter, raptor) nests observed within an Area of Interest (AOI), called the Banner County AOI, located in Banner, Kimball, and Morrill Counties, Nebraska, and Goshen and Laramie Counties, Wyoming. This memo describes the methodologies and results of the survey. Raptors include accipiters, buteos, harriers, eagles, falcons, and owls.

The aerial survey was conducted in accordance with the guidance provided in the United States Fish and Wildlife Service's (USFWS) *Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2* (ECPG; USFWS 2013)[1] and the USFWS *Interim Golden Eagle Inventory and Monitoring Protocols; and Other Recommendations* (Pagel et al. 2010)[2]. The results of the aerial nest survey are documented below.

The purpose of the surveys was to identify raptor nest locations, determine the status (i.e. active and inactive) of nests, and determine species.

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[1] US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance. Module 1 - Land-Based Wind Energy. Version 2. Division of Migratory Bird Management, USFWS. April 2013. Available online at: http://www.fws.gov/migratorybirds/Eagle_Conservation_Plan_Guidance-Module%201.pdf

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

An aerial raptor nest survey was conducted from a Robinson R44 helicopter by a qualified biologist and pilot March 8 – March 12, 2017, and April 24 – April 25, 2017. The surveys were timed to occur before leaf out and to coincide with the period when golden eagles and most other non-eagle raptors were likely incubating eggs or tending young.

The helicopter was flown approximately 46 – 61 m (150 – 200 ft) above ground level at airspeeds of approximately 60-75 mi (97-121 km) per hour. The helicopter was positioned to allow thorough visual inspection of the habitat. When a potential nest was spotted, the helicopter approached slowly and was positioned such that the nest could be clearly seen. All eagle and raptor nests detected within suitable habitat (e.g., rocky outcrops, wooded areas, riparian corridors) within the AOI were recorded (Figure 1).

Data recorded for each observed nest site included a unique nest ID, species occupying the nest (when possible), nest condition (i.e. poor, fair, good, excellent), nest substrate, nest status (i.e., occupied or unoccupied, number of adults and young present), nest location (marked with a hand-held global positioning system unit), and any relevant information about the nest or raptor sightings and behavior nearby. Photographs were taken of all nests and are available to you upon request.

Categories used to describe nest status were consistent with the definitions contained in the ECPG. Nests were classified as occupied if any of the following were observed at the nest structure: 1) an adult in an incubating or brooding position; 2) eggs; 3) nestlings or fledglings; 4) occurrence of a pair of adults or sub-adults; 5) a newly constructed or refurbished stick nest in the area where territorial behavior of a raptor had been observed early in the breeding season; or 6) a recently repaired nest with fresh sticks (clean breaks) or fresh boughs on top, and/or droppings and/or molted feathers on its rim or underneath. Occupied nests were further classified as active if one or more eggs had been laid or nestlings or fledglings were observed, or inactive if no eggs or chicks were present. A nest that did not meet the above criteria for occupied was classified as unoccupied. In order for a nest to be considered unoccupied a minimum of two surveys must be conducted.

A total of 91 golden eagle or potential golden eagle nests were identified during aerial surveys of the AOI. For the purposes of this memo a potential golden eagle nest is defined as a large stick nest that is potentially suitable for use by an eagle. These nests were classified as follows: eight occupied active nests, six occupied inactive nests and 77 unoccupied potential golden eagle nests (Figures 1, 2 and 3; Table 1). Nest #'s 84, 99, 139 and 148 were considered occupied inactive based on observations seen during the first round of surveys. No activity was observed at these three nests during the second round of surveys. These nests are considered occupied inactive for the 2017 nesting season. Nest # 156 was considered occupied active based on observations seen during the first round of surveys. No activity was observed at this nest during the second round of surveys. This nest is considered occupied active for the 2017 nesting season.

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A total of 159 non-eagle raptor nests representing six species were documented within the AOI (Figures 1, 2, and 3; Table 2). The identified raptor nests were categorized as follows for the 2017 nesting seaon: one occupied American kestrel (*Falco sparverius*) nest, four occupied ferruginous hawk (*Buteo* regalis) nests, seven occupied great horned owl (*Bubo virginianu*) nests, five occupied active prairie falcon (*Falco mexicanus*) nests, 29 occupied red-tailed hawk (*Buteo jamaicensis*) nests, eight occupied Swainson's hawk (*Buteo swainsoni*) nests, one occupied unknown raptor nest and 101 unoccupied unknown raptor nests (Figures 1, 2, and 3; Table 2).

Sincerely,

Chris Fritchman
Project Manager

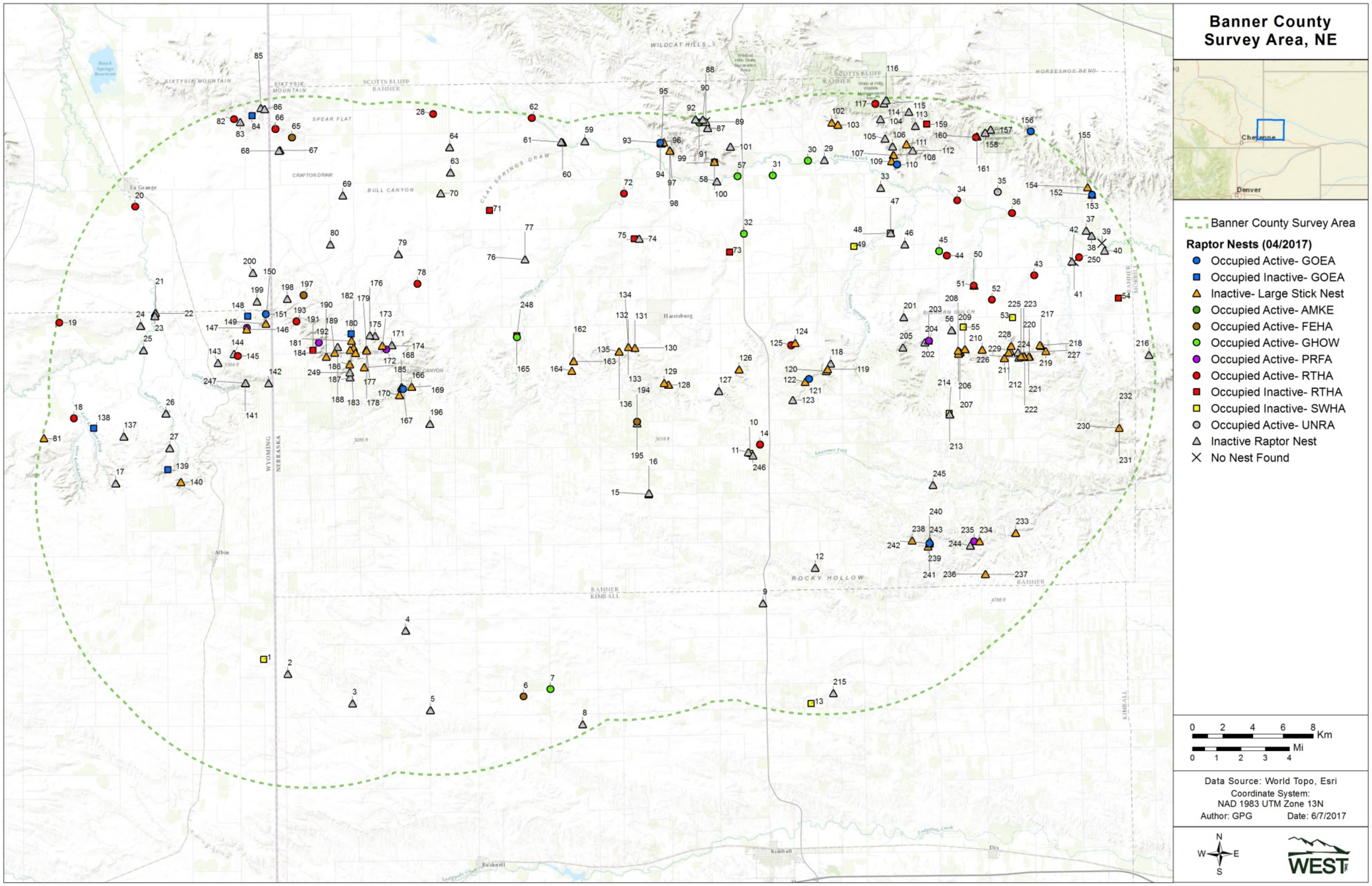

Figure 1. Results of golden eagle and raptor nest surveys of the Banner County AOI.

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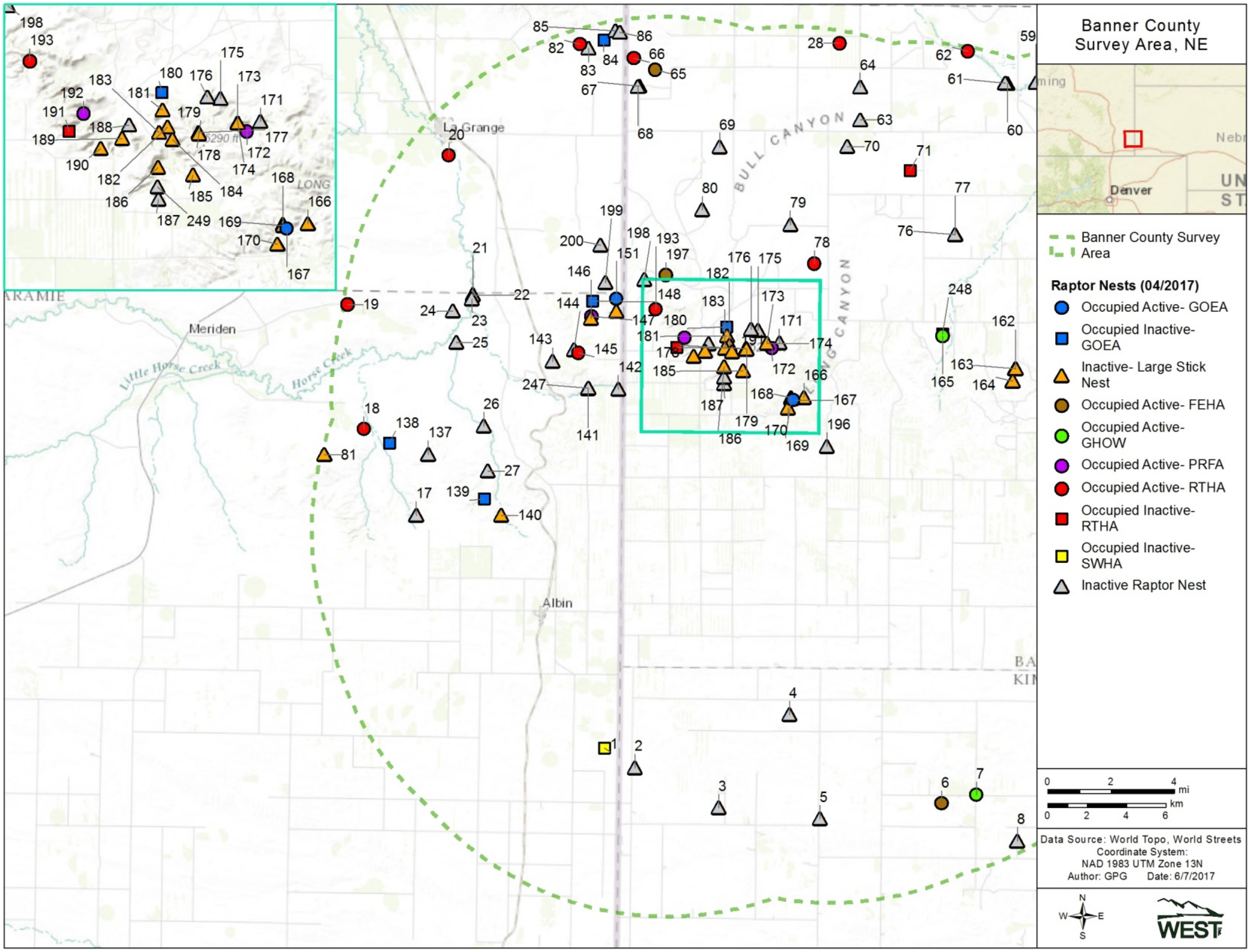

Figure 2. Results of golden eagle and raptor nest surveys within the western half of the Banner County AOI.

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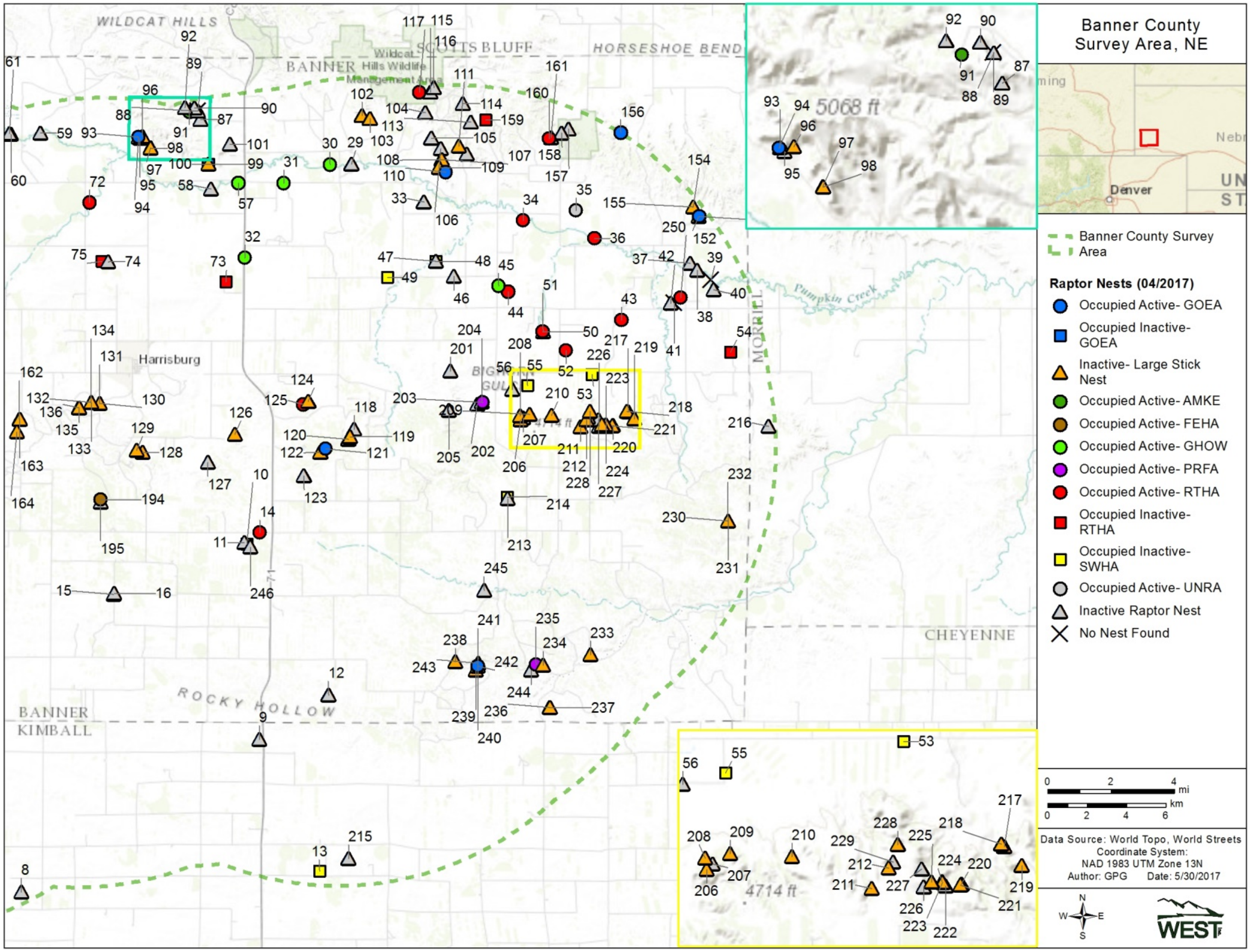

Figure 3. Results of golden eagle and raptor nest surveys within the eastern half of the Banner County AOI.

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Table 1. Golden eagle or potential golden eagle nests identified during aerial surveys in March and April 2017 within the Banner County AOI. Unique ID (ID), locations (NAD83, Zone 13), and nest features are included.

ID	Species[1]	Northing	Easting	Status	Condition	Substrate
81	GOEA[2]	4593343	563892	Unoccupied	Fair	Cliff
84	GOEA[3]	4614751	577700	Occupied-Inactive	Fair	Cliff
93	GOEA[2]	4612955	604775	Unoccupied	Good	Cliff
94	GOEA	4612949	604760	Occupied-Active	Good	Cliff
96	GOEA[2]	4612974	604974	Unoccupied	Fair	Cliff
97	GOEA[2]	4612422	605391	Unoccupied	Poor	Cliff
98	GOEA[2]	4612414	605394	Unoccupied	Good	Cliff
99	GOEA[3]	4611663	608351	Occupied-Inactive	Good	Cliff
100	GOEA[2]	4611668	608360	Unoccupied	Good	Cliff
102	GOEA[2]	4614279	616126	Unoccupied	Fair	Cliff
103	GOEA[2]	4614136	616531	Unoccupied	Fair	Cliff
108	GOEA[2]	4612126	620236	Unoccupied	Poor	Cliff
109	GOEA[2]	4611722	620097	Unoccupied	Good	Cliff
110	GOEA	4611506	620445	Occupied-Active	Good	Cliff
111	GOEA[2]	4612848	621083	Unoccupied	Fair	Cliff
119	GOEA[2]	4597925	615862	Unoccupied	Poor	Cliff
121	GOEA	4597271	614618	Occupied-Active	Good	Cliff
122	GOEA[2]	4597085	614361	Unoccupied	Fair	Cliff
124	GOEA[2]	4599666	613695	Unoccupied	Good	Cliff
126	GOEA[2]	4597911	609984	Unoccupied	Poor	Cliff
128	GOEA[2]	4596896	605306	Unoccupied	Fair	Cliff
129	GOEA[2]	4597013	605006	Unoccupied	Poor	Cliff
130	GOEA[2]	4599350	603084	Unoccupied	Fair	Cliff
131	GOEA[2]	4599350	603084	Unoccupied	Fair	Cliff
132	GOEA[2]	4599403	602653	Unoccupied	Fair	Cliff
133	GOEA[2]	4599403	602653	Unoccupied	Fair	Cliff
134	GOEA[2]	4599403	602652	Unoccupied	Fair	Cliff
135	GOEA[2]	4599098	602021	Unoccupied	Poor	Cliff
136	GOEA[2]	4599090	602040	Unoccupied	Good	Cliff
138	GOEA	4594011	567200	Occupied-Inactive	Good	Cliff
139	GOEA[3]	4591264	572103	Occupied-Inactive	Good	Cliff
140	GOEA[2]	4590445	572978	Unoccupied	Fair	Cliff
146	GOEA[2]	4600562	577342	Unoccupied	Good	Cliff
148	GOEA[3]	4601452	577400	Occupied-Inactive	Good	Cliff
149	GOEA[2]	4600943	578616	Unoccupied	Good	Cliff
150	GOEA[2]	4600943	578616	Unoccupied	Good	Cliff
151	GOEA	4601584	578616	Occupied-Active	Good	Cliff
152	GOEA[2]	4609510	633377	Unoccupied	Good	Cliff
153	GOEA	4609510	633387	Occupied-Active	Good	Cliff
154	GOEA[2]	4609995	633085	Unoccupied	Poor	Cliff
155	GOEA[2]	4609995	633085	Unoccupied	Good	Cliff
156	GOEA[4]	4613698	629313	Occupied-Active	Good	Cliff
162	GOEA[2]	4598464	599009	Unoccupied	Good	Cliff
163	GOEA[2]	4598458	599016	Unoccupied	Good	Cliff
164	GOEA[2]	4597814	598888	Unoccupied	Good	Cliff
166	GOEA[2]	4596765	588274	Unoccupied	Good	Cliff
167	GOEA	4596614	587704	Occupied-Active	Good	Cliff
168	GOEA[2]	4596736	587604	Unoccupied	Fair	Cliff

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Table 1. Golden eagle or potential golden eagle nests identified during aerial surveys in March and April 2017 within the Banner County AOI. Unique ID (ID), locations (NAD83, Zone 13), and nest features are included.

ID	Species[1]	Northing	Easting	Status	Condition	Substrate
169	GOEA[2]	4596693	587618	Unoccupied	Poor	Cliff
170	GOEA[2]	4596194	587461	Unoccupied	Poor	Cliff
173	GOEA[2]	4599475	586329	Unoccupied	Good	Cliff
174	GOEA[2]	4599479	586332	Unoccupied	Good	Cliff
177	GOEA[2]	4599213	585262	Unoccupied	Poor	Cliff
178	GOEA[2]	4599178	585285	Unoccupied	Good	Cliff
179	GOEA[2]	4599164	585283	Unoccupied	Good	Cliff
180	GOEA	4600276	584258	Occupied-Inactive	Fair	Cliff
181	GOEA[2]	4599809	584279	Unoccupied	Good	Cliff
182	GOEA[2]	4599341	584416	Unoccupied	Fair	Cliff
183	GOEA[2]	4599194	584188	Unoccupied	Fair	Cliff
184	GOEA[2]	4599008	584557	Unoccupied	Fair	Cliff
185	GOEA[2]	4598052	585133	Unoccupied	Poor	Cliff
186	GOEA[2]	4598248	584173	Unoccupied	Good	Cliff
189	GOEA[2]	4599015	583176	Unoccupied	Fair	Cliff
190	GOEA[2]	4598744	582605	Unoccupied	Poor	Cliff
206	GOEA[2]	4598956	624533	Unoccupied	Fair	Cliff
208	GOEA[2]	4599163	624506	Unoccupied	Good	Cliff
209	GOEA[2]	4599254	624963	Unoccupied	Fair	Cliff
210	GOEA[2]	4599222	626100	Unoccupied	Fair	Cliff
211	GOEA[2]	4598656	627574	Unoccupied	Poor	Cliff
212	GOEA[2]	4599039	627873	Unoccupied	Fair	Cliff
217	GOEA[2]	4599474	629996	Unoccupied	Good	Cliff
218	GOEA[2]	4599516	629936	Unoccupied	Poor	Cliff
219	GOEA[2]	4599127	630320	Unoccupied	Fair	Cliff
220	GOEA[2]	4598770	629221	Unoccupied	Fair	Cliff
221	GOEA[2]	4598755	629199	Unoccupied	Good	Cliff
223	GOEA[2]	4598793	628874	Unoccupied	Good	Cliff
225	GOEA[2]	4598796	628672	Unoccupied	Good	Cliff
228	GOEA[2]	4599473	628034	Unoccupied	Fair	Cliff
230	GOEA[2]	4594024	635185	Unoccupied	Fair	Cliff
231	GOEA[2]	4594024	635185	Unoccupied	Good	Cliff
232	GOEA[2]	4594026	635188	Unoccupied	Fair	Cliff
233	GOEA[2]	4587065	628331	Unoccupied	Good	Cliff
234	GOEA[2]	4586502	625928	Unoccupied	Good	Cliff
236	GOEA[2]	4584335	626313	Unoccupied	Good	Cliff
237	GOEA[2]	4584329	626322	Unoccupied	Fair	Cliff
238	GOEA[2]	4586565	621462	Unoccupied	Good	Cliff
239	GOEA[2]	4586167	622508	Unoccupied	Fair	Cliff
240	GOEA[2]	4586361	622606	Unoccupied	Fair	Cliff
241	GOEA	4586381	622611	Occupied-Active	Good	Cliff
242	GOEA[2]	4586381	622611	Unoccupied	Good	Cliff
243	GOEA[2]	4586513	622624	Unoccupied	Fair	Cliff

[1] GOEA: golden eagle (*Aquila chrysaetos*),[2] denotes potential golden eagle nest (defined as a large stick nest that is potentially suitable for use by an eagle); [3] denotes golden eagle nest that was considered occupied-inactive for the 2017 nesting season based on observations during the first round of surveys; [4] denotes golden eagle nest that was considered occupied-active for the 2017 nesting season based on observation during the first round of surveys

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Table 2. Non-eagle raptor nests identified during aerial surveys conducted in March and April 2017 within the Banner County AOI. Nest Unique ID (ID), locations (NAD83, Zone 13), and nest features are included.

ID	Species[1]	Northing	Easting	Status	Condition	Substrate
1	SWHA	4578691	578465	Occupied-Inactive	Good	Tree
2	Unknown	4577706	580056	Unoccupied	Fair	Tree
3	Unknown	4575755	584357	Unoccupied	Fair	Tree
4	Unknown	4580578	587875	Unoccupied	Fair	Tree
5	Unknown	4575302	589524	Unoccupied	Good	Tree
6	FEHA	4576218	595705	Occupied-Active	Good	Tree
7	GHOW	4576707	597471	Occupied-Active	Good	Tree
8	Unknown	4574379	599614	Unoccupied	Fair	Tree
9	Unknown	4582406	611568	Unoccupied	Good	Tree
10	SWHA	4592352	610706	Occupied-Inactive	Good	Tree
11	Unknown	4592424	610593	Unoccupied	Poor	Tree
12	Unknown	4584748	615030	Unoccupied	Fair	Powerline
13	SWHA	4575760	614761	Occupied-Inactive	Good	Tree
14	RTHA	4592931	611362	Occupied-Active	Good	Tree
15	Unknown	4589630	603988	Unoccupied	Poor	Tree
16	Unknown	4589696	604001	Unoccupied	Poor	Tree
17	Unknown	4590349	568650	Unoccupied	Poor	Cliff
18	RTHA	4594681	565890	Occupied-Active	Good	Tree
19	RTHA	4601021	564919	Occupied-Active	Good	Tree
20	RTHA[2]	4608718	569931	Occupied-Active	Good	Tree
21	Unknown	4601651	571286	Occupied-Inactive	Good	Tree
22	Unknown	4601633	571287	Occupied-Inactive	Good	Tree
23	Unknown	4601437	571252	Unoccupied	Fair	Tree
24	Unknown	4600798	570295	Unoccupied	Fair	Tree
25	Unknown	4599191	570492	Unoccupied	Fair	Tree
26	Unknown	4594975	571993	Unoccupied	Fair	Tree
27	Unknown	4592691	572239	Unoccupied	Good	Tree
28	RTHA	4614856	589701	Occupied-Active	Good	Tree
29	Unknown	4611805	615645	Unoccupied	Good	Tree
30	GHOW	4611769	614541	Occupied-Active	Good	Tree
31	GHOW	4610783	612218	Occupied-Active	Good	Tree
32	GHOW	4606927	610317	Occupied-Active	Fair	Tree
33	Unknown	4609958	619377	Unoccupied	Good	Tree
34	RTHA	4609123	624447	Occupied-Active	Good	Tree
35	UNRA	4609680	627133	Occupied-Active	Good	Tree
36	RTHA	4608291	628080	Occupied-Active	Good	Tree
37	Unknown	4607121	632993	Unoccupied	Good	Tree
38	Unknown	4606769	633353	Unoccupied	Fair	Tree
39	Unknown[5]	4606269	634066	Unoccupied	Good	Tree
40	Unknown	4605794	634220	Unoccupied	Good	Tree
41	Unknown[5]	4605061	632216	Unoccupied	Fair	Tree
42	Unknown	4605069	632050	Unoccupied	Good	Tree
43	RTHA	4604159	629549	Occupied-Active	Good	Tree
44	RTHA	4605471	623750	Occupied-Active	Good	Tree
45	GHOW[2]	4605763	623254	Occupied-Active	Fair	Tree
46	Unknown	4606198	620972	Unoccupied	Good	Tree
47	Unknown	4606950	620036	Unoccupied	Fair	Tree
48	SWHA	4606950	620028	Occupied-Inactive	Good	Tree
49	SWHA	4606076	617595	Occupied-Inactive	Good	Tree

Table 2. Non-eagle raptor nests identified during aerial surveys conducted in March and April 2017 within the Banner County AOI. Nest Unique ID (ID), locations (NAD83, Zone 13), and nest features are included.

ID	Species[1]	Northing	Easting	Status	Condition	Substrate
50	RTHA	4603472	625554	Occupied-Active	Good	Tree
51	Unknown	4603472	625561	Unoccupied	Good	Tree
52	RTHA	4602543	626753	Occupied-Active	Good	Tree
53	SWHA	4601360	628115	Occupied-Inactive	Good	Tree
54	RTHA	4602649	635138	Occupied-Inactive	Good	Tree
55	SWHA	4600732	624851	Occupied-Inactive	Good	Tree
56	Unknown	4600503	624072	Unoccupied	Good	Tree
57	GHOW	4610718	609887	Occupied-Active	Good	Tree
58	Unknown	4610390	608505	Unoccupied	Fair	Tree
59	Unknown	4613040	599753	Unoccupied	Fair	Tree
60	Unknown	4612976	598277	Unoccupied	Good	Tree
61	Unknown	4613004	598192	Unoccupied	Good	Tree
62	RTHA	4614591	596239	Occupied-Active	Good	Tree
63	Unknown	4610968	590845	Unoccupied	Fair	Tree
64	Unknown	4612637	590789	Unoccupied	Poor	Tree
65	FEHA	4613297	580338	Occupied-Active	Good	Rock
66	RTHA	4613873	579241	Occupied-Active	Good	Cliff
67	Unknown	4612447	579549	Unoccupied	Fair	Tree
68	Unknown	4612414	579476	Unoccupied	Fair	Tree
69	Unknown	4609448	583702	Unoccupied	Fair	Tree
70	Unknown	4609600	590210	Unoccupied	Good	Tree
71	RTHA	4608454	593438	Occupied-Inactive	Good	Tree
72	RTHA	4609578	602360	Occupied-Active	Good	Tree
73	RTHA[4]	4605691	609357	Occupied-Inactive	Fair	Tree
74	Unknown	4606584	603358	Unoccupied	Fair	Tree
75	RTHA[3]	4606579	603037	Occupied-Inactive	Good	Tree
76	Unknown	4605217	595790	Unoccupied	Fair	Tree
77	Unknown	4605222	595791	Unoccupied	Fair	Tree
78	RTHA	4603604	588661	Occupied-Active	Good	Tree
79	Unknown	4605551	587385	Unoccupied	Fair	Tree
80	Unknown	4606209	582890	Unoccupied	Fair	Tree
82	RTHA	4614515	576484	Occupied-Active	Good	Cliff
83	Unknown	4614315	576911	Unoccupied	Poor	Cliff
85	Unknown	4615256	578276	Unoccupied	Poor	Rock
86	Unknown	4615182	578514	Unoccupied	Fair	Rock
87	Unknown	4613911	607908	Unoccupied	Poor	Rock
88	Unknown	4614339	607776	Unoccupied	Poor	Cliff
89	Unknown[5]	4614339	607771	Unoccupied	Poor	Cliff
90	Unknown	4614480	607585	Unoccupied	Poor	Cliff
91	AMKE[5]	4614301	607329	Occupied-Active	Good	Cliff
92	Unknown	4614494	607097	Unoccupied	Fair	Cliff
95	Unknown	4612899	604837	Unoccupied	Good	Cliff
101	Unknown	4612683	609417	Unoccupied	Good	Cliff
104	Unknown	4614510	619357	Unoccupied	Good	Cliff
105	Unknown	4613221	619667	Unoccupied	Fair	Cliff
106	Unknown	4612701	620161	Unoccupied	Fair	Cliff
107	Unknown	4612123	620204	Unoccupied	Good	Cliff
112	Unknown	4612438	621489	Unoccupied	Fair	Cliff
113	Unknown	4614064	621665	Unoccupied	Good	Cliff
114	Unknown	4614992	621244	Unoccupied	Good	Cliff

Table 2. Non-eagle raptor nests identified during aerial surveys conducted in March and April 2017 within the Banner County AOI. Nest Unique ID (ID), locations (NAD83, Zone 13), and nest features are included.

ID	Species[1]	Northing	Easting	Status	Condition	Substrate
115	Unknown	4615558	619589	Unoccupied	Good	Cliff
116	Unknown	4615777	619739	Unoccupied	Good	Cliff
117	RTHA	4615541	619013	Occupied-Active	Good	Cliff
118	Unknown	4598311	616062	Unoccupied	Poor	Cliff
120	Unknown	4597794	615774	Unoccupied	Poor	Cliff
123	Unknown	4595880	613549	Unoccupied	Poor	Cliff
125	RTHA	4599528	613432	Occupied-Active	Good	Cliff
127	Unknown	4596465	608639	Unoccupied	Good	Cliff
137	Unknown	4593465	569189	Unoccupied	Good	Cliff
141	Unknown	4596989	577245	Unoccupied	Good	Cliff
142	Unknown	4596993	578793	Unoccupied	Good	Cliff
143	Unknown	4598342	575432	Unoccupied	Fair	Cliff
144	Unknown	4598939	576500	Unoccupied	Fair	Cliff
145	RTHA	4598802	576739	Occupied-Active	Good	Cliff
147	PRFA	4600672	577352	Occupied-Active	Fair	Cliff
157	Unknown	4613807	626665	Unoccupied	Fair	Cliff
158	Unknown	4613617	626306	Unoccupied	Fair	Cliff
159	RTHA[4]	4614184	622420	Occupied-Inactive	Good	Cliff
160	RTHA	4613305	625684	Occupied-Active	Fair	Cliff
161	Unknown	4613358	625761	Unoccupied	Poor	Cliff
165	GHOW	4600041	595253	Occupied-Active	Good	Cliff
171	Unknown	4599531	586952	Unoccupied	Fair	Cliff
172	PRFA	4599244	586589	Occupied-Active	Fair	Cliff
175	Unknown	4600132	585850	Unoccupied	Fair	Cliff
176	Unknown	4600177	585493	Unoccupied	Poor	Cliff
187	Unknown	4597381	584196	Unoccupied	Good	Cliff
188	Unknown	4599393	583366	Unoccupied	Fair	Cliff
191	RTHA[4]	4599190	581732	Occupied-Inactive	Good	Cliff
192	PRFA	4599685	582132	Occupied-Active	Good	Cliff
193	RTHA	4601101	580633	Occupied-Active	Good	Cliff
194	FEHA	4594452	603219	Occupied-Active	Good	Tree
195	Unknown	4594334	603218	Unoccupied	Poor	Tree
196	Unknown	4594299	589485	Unoccupied	Good	Tree
197	FEHA	4602845	581108	Occupied-Active	Good	Rock
198	Unknown	4602595	580021	Unoccupied	Fair	Cliff
199	Unknown	4602421	578024	Unoccupied	Fair	Rock
200	Unknown	4604320	577750	Unoccupied	Good	Cliff
201	Unknown	4601381	620903	Unoccupied	Fair	Rock
202	Unknown	4599700	622300	Unoccupied	Fair	Cliff
203	PRFA	4599819	622568	Occupied-Active	Fair	Cliff
204	Unknown	4599833	622534	Unoccupied	Fair	Cliff
205	Unknown	4599357	620850	Unoccupied	Poor	Cliff
207	Unknown	4599055	624640	Unoccupied	Good	Cliff
213	Unknown	4594935	623944	Unoccupied	Fair	Tree
214	SWHA	4594999	623921	Occupied-Inactive	Good	Tree
215	Unknown	4576431	616241	Unoccupied	Fair	Tree
216	Unknown	4598886	637160	Unoccupied	Good	Tree
222	Unknown	4598727	628923	Unoccupied	Poor	Cliff
224	Unknown	4598808	628865	Unoccupied	Fair	Cliff
226	Unknown	4598704	628526	Unoccupied	Good	Cliff

ENVIRONMENTAL & STATISTICAL CONSULTANTS

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Table 2. Non-eagle raptor nests identified during aerial surveys conducted in March and April 2017 within the Banner County AOI. Nest Unique ID (ID), locations (NAD83, Zone 13), and nest features are included.

ID	Species[1]	Northing	Easting	Status	Condition	Substrate
227	Unknown	4599032	628484	Unoccupied	Good	Cliff
229	Unknown	4599154	627954	Unoccupied	Poor	Cliff
235	PRFA	4586516	625561	Occupied-Active	Good	Cliff
244	Unknown	4586220	625324	Unoccupied	Fair	Cliff
245	Unknown	4590236	622841	Unoccupied	Poor	Cliff
246	Unknown	4592198	610895	Unoccupied	Good	Tree
247	Unknown	4597003	577271	Unoccupied	Fair	Cliff
248	RTHA	4600151	595250	Occupied-Inactive	Good	Cliff
249	Unknown	4597719	584170	Unoccupied	Good	Cliff
250	RTHA	4605351	632535	Occupied-Active	Good	Cliff

[1] AMKE: American kestrel (*Falco* sparverius), FEHA: ferruginous hawk (*Buteo regalis*), GBHE: great blue heron (*Ardea* Herodias), GHOW: great-horned owl (*Bubo virginianus*), PRFA: prairie falcon (*Falco* mexicanus), RTHA: red-tailed hawk (*Buteo jamaicensis*), SWHA: Swainson's hawk (*Buteo swainsoni*), UNRA: unidentified raptor; [2] denotes nest that was occupied-active great horned owl during first set of surveys but was considered unoccupied during the second round of surveys therefore the data in Table 2 is reflective of the overall status for the 2017 nesting season, [3] denotes nest that was occupied-active great horned owl during first set of surveys but was considered an occupied inactive RTHA nest based on observations during the second round of surveys therefore the data in Table 2 is reflective of the current status, [4] denotes nest that was occupied-inactive red-tailed hawk during first set of surveys but was considered unoccupied during the second round of surveys therefore the data in Table 2 is reflective of the overall status for the 2017 nesting season,; [5]denotes that nest wasn't able to be located during the second round of surveys – species, status, condition and substrates are reflective of the first round of surveys

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August 6, 2020

Michael Kurnik
Orion Renewable Energy Group, LLC
155 Grand Avenue, Suite 706
Oakland, California 94612

RE: Pronghorn Flats 2019 Aerial Eagle and Raptor Nest Survey Results

Dear Mr. Kurnik,

Orion Wind Resources LLC (Orion) requested that Western EcoSystems Technology, Inc. (WEST) conduct aerial eagle and raptor nest surveys for the proposed Pronghorn Flats Wind Energy Project (Project), formerly known as Banner County, located in Banner County, Nebraska. In addition to Banner County, the nest survey included portions of Kimball, County, Nebraska, and Goshen and Laramie Counties, Wyoming. The aerial survey was conducted in accordance with the guidance provided in the United States Fish and Wildlife Service's (USFWS) *Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2* (ECPG; USFWS 2013) and the USFWS *Interim Golden Eagle Inventory and Monitoring Protocols; and Other Recommendations* (Pagel et al. 2010). The purpose of the surveys was to identify raptor nest locations, determine the status (i.e. occupied and unoccupied; active and inactive) of nests, determine species, and determine whether the nest is potentially suitable for use by an eagle. This memorandum describes the methodologies and results of the 2019 surveys.

Surveys were conducted within a 10-mile buffer of the proposed turbine layout minimum convex polygon (MCP) provided by Orion in March 2019 (Figure 1), resulting in a survey area of 425 acres. An aerial nest survey was conducted from a Robinson R44 helicopter by a qualified biologist and pilot from March 20, 2019, to March 24, 2019, and a follow up survey was conducted on May 2, 2019. The Department of Defense (DOD) required a two nautical mile setback from missile silos, and as such, changes to the Project's turbine layout occurred in May 2020 following the completion of surveys (Figure 2).

The helicopter was flown approximately 46 – 61 m (150 – 200 ft) above ground level at airspeeds of approximately 60-75 mi (97-121 km) per hour. The helicopter was positioned to allow thorough visual inspection of the habitat. When a potential nest was spotted, the helicopter approached slowly and was positioned such that the nest could be clearly seen. All eagle and raptor nests detected within suitable habitat (e.g., rocky outcrops, wooded areas, riparian corridors) within the survey area were recorded (Figure 1).

Data recorded for each observed nest site included a unique nest ID, species occupying the nest (when possible), nest condition (i.e. poor, fair, good, excellent), nest substrate, nest status (i.e., occupied or unoccupied, number of adults and young present), nest location (marked with a hand-held global positioning system unit), and any relevant information about the nest or raptor sightings and behavior nearby. Photographs were taken of all nests and are available upon request.

Categories used to describe nest status were consistent with the definitions contained in the ECPG. Nests were classified as occupied if any of the following were observed at the nest structure: 1) an adult on the nest; 2) eggs; 3) nestlings or fledglings; 4) occurrence of a pair of adults or sub-adults; 5) a newly constructed or refurbished stick nest in the area where territorial behavior of a raptor had been observed early in the breeding season; or 6) a recently repaired nest with fresh sticks (clean breaks) or fresh boughs on top, and/or droppings and/or molted feathers on its rim or underneath. Occupied nests were further classified as active if one or more eggs had been laid or nestlings or fledglings were observed, or inactive if no eggs or chicks were present. A nest that did not meet the above criteria for occupied during a minimum of two surveys, was classified as unoccupied. Furthermore, a nest was classified as undetermined if it was only observed during one survey.

A total of 80 nest structures were identified during the two rounds of surveys in 2019. Of the 80 total nests, 68 golden eagle (*Aquila chrysaetos*) or large stick nests were identified during aerial surveys. Large stick nests are classified as an unoccupied or undetermined nest potentially suitable for use by an eagle.

The 68 eagle or large stick nests were classified as follows: seven occupied active golden eagle nests (Nest IDs 131, 138, 150, 169, 181, 257, and 292), four occupied inactive golden eagle nests (Nest IDs 130, 151,189, and 256), three unoccupied golden eagle nests (Nest IDs 167, 180, 193), two undetermined large stick nests (Nest ID 190, 262), and 52 unoccupied large stick nests (Figure 2, Tables 1 and 3).

A total of 12 other raptor nests representing three species and two unidentified species were documented within the study area (Figure 2; Tables 2 and 3). The identified other raptor nests were categorized as follows: two occupied active ferruginous hawk (*Buteo regalis*) nests, one unoccupied prairie falcon (*Falco mexicanus*) nest, four red-tailed hawk nests (two occupied active and two unoccupied), five unidentified raptor nests (four unoccupied, one undetermined Figure 2; Tables 2 and 3). Of the 12, three nests, all unidentified raptor nests, were within the MCP for the March 2019 layout. Those nests were either unoccupied (n=2) or undetermined (n=1). Only one unidentified unoccupied raptor nest occurs within the currently proposed MCP based on the May 2020 layout.

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Sincerely,

Chris Fritchman
Project Manager

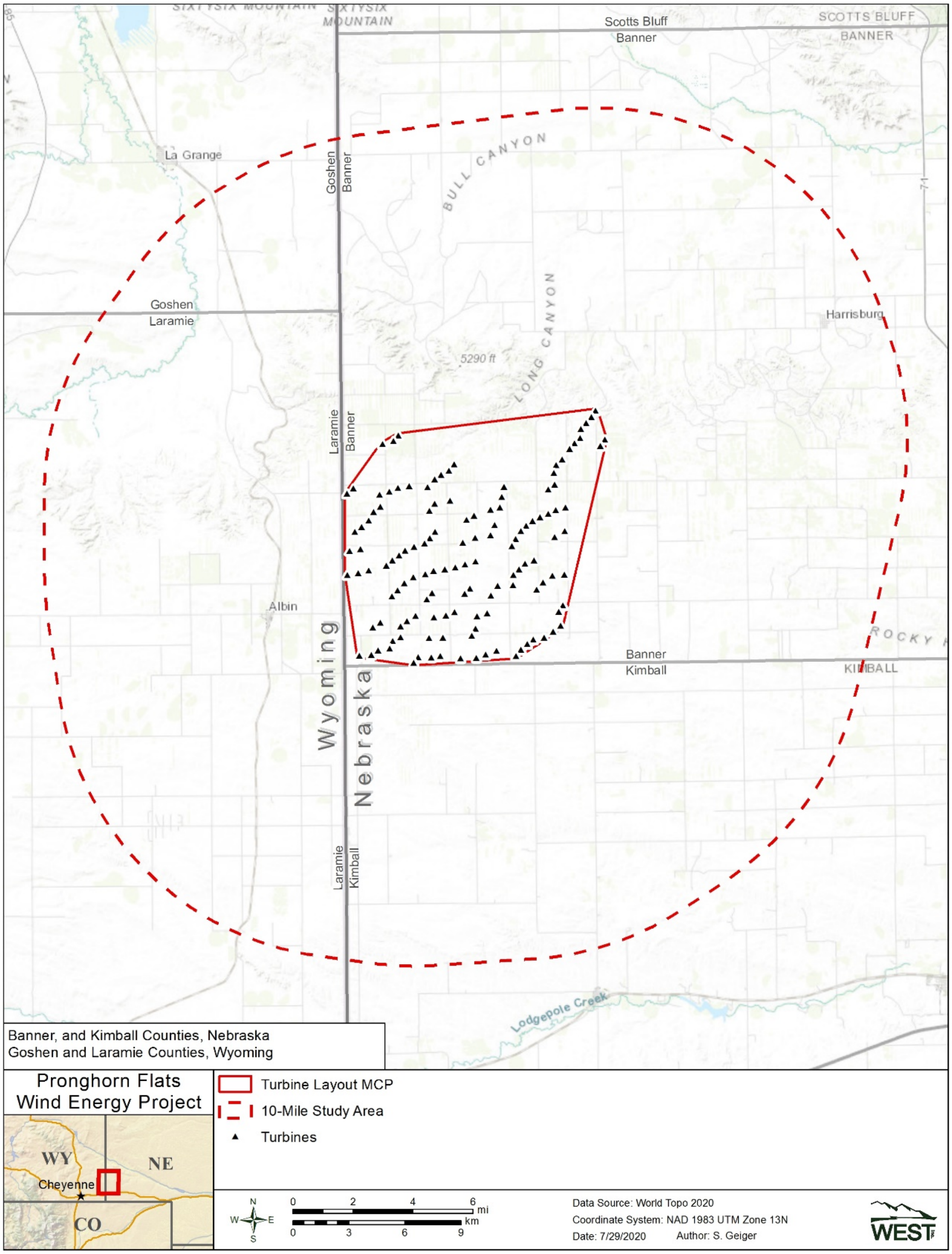

Figure 1. Aerial eagle and raptor nest survey area for the Pronghorn Flats Wind Energy Project in Banner, and Kimball counties, NE, Goshen and Laramie counties, WY. The turbine layout depicted was from March 2019.

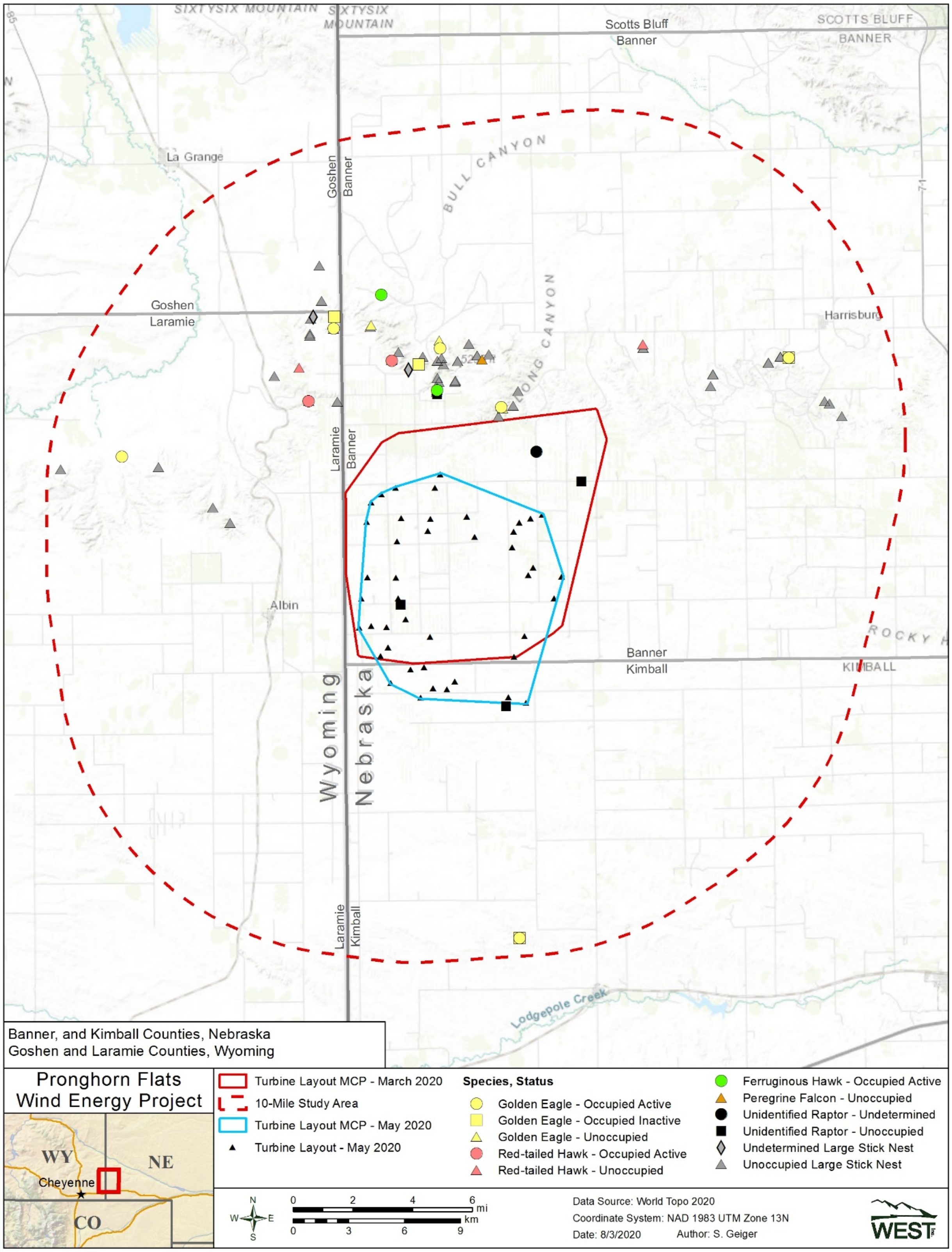

Figure 2. Results of the 2019 eagle and raptor nest surveys of the Pronghorn Wind Energy Project survey area in Banner, and Kimball counties, NE, Goshen and Laramie counties, WY.

Table 1. Golden eagle and large stick nests nests identified during aerial surveys in March and May 2019 within the Pronghorn Flats study area in Banner, and Kimball counties, NE, Goshen and Laramie counties, WY. Unique ID (ID), locations (NAD83, Zone 13), and nest features are included.

ID	Species[1]	Northing	Easting	Status	Condition	Substrate
81	UNKN	4593338	563914	Unoccupied Large Stick Nest	Fair	Cliff
128	UNKN	4596895	605288	Unoccupied Large Stick Nest	Poor	Cliff
129	UNKN	4597014	605028	Unoccupied Large Stick Nest	Poor	Cliff
130	GOEA	4599344	603087	Occupied Inactive	Fair	Cliff
131	GOEA	4599344	603087	Occupied Active	Good	Cliff
135	UNKN	4599094	602002	Unoccupied Large Stick Nest	Fair	Cliff
136	UNKN	4599092	602008	Unoccupied Large Stick Nest	Good	Cliff
137	UNKN	4593470	569177	Unoccupied Large Stick Nest	Good	Cliff
138	GOEA	4594025	567207	Occupied Active	Good	Cliff
139	UNKN	4591278	572100	Unoccupied Large Stick Nest	Good	Cliff
140	UNKN	4590455	573019	Unoccupied Large Stick Nest	Fair	Cliff
142	UNKN	4596989	578806	Unoccupied Large Stick Nest	Fair	Cliff
143	UNKN	4598374	575420	Unoccupied Large Stick Nest	Poor	Cliff
146	UNKN	4600554	577328	Unoccupied Large Stick Nest	Good	Cliff
147	UNKN	4600652	577323	Unoccupied Large Stick Nest	Fair	Cliff
148	UNKN	4601447	577367	Unoccupied Large Stick Nest	Good	Cliff
149	UNKN	4600916	578604	Unoccupied Large Stick Nest	Good	Cliff
150	GOEA	4600922	578603	Occupied Active	Good	Cliff
151	GOEA	4601545	578631	Occupied Inactive[2]	Good	Cliff
162	UNKN	4598465	599009	Unoccupied Large Stick Nest	Good	Cliff
163	UNKN	4598457	599019	Unoccupied Large Stick Nest	Good	Cliff
164	UNKN	4597821	598891	Unoccupied Large Stick Nest	Good	Cliff
166	UNKN	4596772	588265	Unoccupied Large Stick Nest	Poor	Cliff
167	GOEA	4596627	587704	Unoccupied	Good	Cliff
168	UNKN	4596748	587614	Unoccupied Large Stick Nest	Fair	Cliff
169	GOEA	4596694	587616	Occupied Active	Good	Cliff
170	UNKN	4596215	587480	Unoccupied Large Stick Nest	Poor	Cliff
171	UNKN	4599528	586955	Unoccupied Large Stick Nest	Fair	Cliff
173	UNKN	4599479	586319	Unoccupied Large Stick Nest	Fair	Cliff
174	UNKN	4599483	586325	Unoccupied Large Stick Nest	Good	Cliff
175	UNKN	4600110	585885	Unoccupied Large Stick Nest	Fair	Cliff
178	UNKN	4599175	585277	Unoccupied Large Stick Nest	Good	Cliff
179	UNKN	4599170	585283	Unoccupied Large Stick Nest	Good	Cliff
180	GOEA	4600275	584295	Unoccupied	Fair	Cliff
181	GOEA	4599850	584320	Occupied Active	Good	Cliff
182	UNKN	4599335	584415	Unoccupied Large Stick Nest	Good	Cliff
183	UNKN	4599202	584188	Unoccupied Large Stick Nest	Poor	Cliff
184	UNKN	4598994	584511	Unoccupied Large Stick Nest	Fair	Cliff
185	UNKN	4598068	585129	Unoccupied Large Stick Nest	Good	Cliff
186	UNKN	4598259	584183	Unoccupied Large Stick Nest	Good	Cliff
188	UNKN	4599418	583392	Unoccupied Large Stick Nest	Fair	Cliff
189	GOEA	4598989	583169	Occupied Inactive	Good	Cliff
190	UNKN	4598710	582630	Undetermined Large Stick Nest[3]	Poor	Cliff
192	UNKN	4599656	582097	Unoccupied Large Stick Nest	Good	Cliff
193	GOEA	4601118	580621	Unoccupied	Fair	Cliff
247	UNKN	4597009	577271	Unoccupied Large Stick Nest	Fair	Cliff
249	UNKN	4597734	584162	Unoccupied Large Stick Nest	Good	Cliff
255	UNKN	4568100	588600	Unoccupied Large Stick Nest	Fair	Cliff
256	GOEA	4568091	588605	Occupied Inactive	Fair	Cliff
257	GOEA	4568096	588602	Occupied Active	Good	Cliff

Table 1. Golden eagle and large stick nests nests identified during aerial surveys in March and May 2019 within the Pronghorn Flats study area in Banner, and Kimball counties, NE, Goshen and Laramie counties, WY. Unique ID (ID), locations (NAD83, Zone 13), and nest features are included.

ID	Species[1]	Northing	Easting	Status	Condition	Substrate
258	UNKN	4604324	577821	Unoccupied Large Stick Nest	Good	Cliff
260	UNKN	4602420	577961	Unoccupied Large Stick Nest	Fair	Rock
262	GOEA	4601553	577500	Undetermined Large Stick Nest[3]	Poor	Cliff
266	UNKN	4600999	580572	Unoccupied Large Stick Nest	Poor	Cliff
268	UNKN	4599216	581735	Unoccupied Large Stick Nest	Fair	Cliff
269	UNKN	4599271	581742	Unoccupied Large Stick Nest	Poor	Cliff
277	UNKN	4598060	584263	Unoccupied Large Stick Nest	Fair	Cliff
280	UNKN	4598129	585148	Unoccupied Large Stick Nest	Fair	Cliff
281	UNKN	4597624	584164	Unoccupied Large Stick Nest	Fair	Cliff
283	UNKN	4597520	584151	Unoccupied Large Stick Nest	Fair	Cliff
285	UNKN	4597554	588525	Unoccupied Large Stick Nest	Poor	Cliff
286	UNKN	4599876	595259	Unoccupied Large Stick Nest	Fair	Cliff
287	UNKN	4599876	595255	Unoccupied Large Stick Nest	Fair	Cliff
289	UNKN	4599405	602648	Unoccupied Large Stick Nest	Good	Cliff
290	UNKN	4599405	602648	Unoccupied Large Stick Nest	Good	Cliff
291	UNKN	4599405	602648	Unoccupied Large Stick Nest	Fair	Cliff
292	GOEA	4599344	603087	Occupied Inactive	Fair	Cliff
293	UNKN	4596204	605963	Unoccupied Large Stick Nest	Fair	Cliff

[1] GOEA: golden eagle (*Aquila chrysaetos*); UNKN: unidentified raptor,; [2] denotes golden eagle nest that was active during the 2017 aerial raptor nest survey;; [3] denotes nest that was first identified during the second round survey.

Table 2. Non-eagle raptor nests identified during aerial surveys conducted in March and May 2019 within Pronghorn Flats study area in Banner, and Kimball counties, NE, Goshen and Laramie counties, WY. Nest Unique ID (ID), locations (NAD83, Zone 13), and nest features are included.

ID	Species[1]	Northing	Easting	Status	Condition	Substrate
4	UNRA	4580587	587888	Unoccupied	Poor	Coniferous tree
141	RTHA	4597010	577251	Occupied Active	Good	Cliff
145	RTHA	4598808	576734	Unoccupied	Poor	Cliff
172	PRFA	4599250	586598	Unoccupied	Poor	Cliff
187	UNRA	4597401	584167	Unoccupied	Good	Cliff
191	RTHA	4599189	581729	Occupied Active	Good	Cliff
196	UNRA	4594295	589520	Undetermined	Fair	Deciduous tree
248	RTHA	4600088	595243	Unoccupied	Fair	Cliff
252	UNRA	4586066	582204	Unoccupied	Good	Deciduous tree
253	UNRA	4592692	591928	Unoccupied	Good	Deciduous tree
259	FEHA	4602744	581166	Occupied Active	Good	Rock
282	FEHA	4597594	584161	Occupied Active	Good	Cliff

[1] FEHA: ferruginous hawk (*Buteo regalis*), PRFA: prairie falcon (*Falco mexicanus*), RTHA: red-tailed hawk (*Buteo jamaicensis*), UNRA: unidentified raptor

Table 3. Number of each classification type of raptor nests identified during the 2019 aerial nest surveys within the Pronghorn Flats study area in Banner, and Kimball counties, NE, Goshen and Laramie counties, WY.

Species[1]	# Occupied-active	# Occupied-inactive	# Unoccupied	# Undetermined	# Undetermined Large Stick Nest	# Unoccupied Large Stick Nest
GOEA	7	4	3	-	2	52
FEHA	2	-	-	-	-	-
PRFA	-	-	1	-	-	-
RTHA	2	-	2	-	-	-
UNRA	-	-	4	1	-	-

[1] GOEA: Golden Eagle, FEHA: ferruginous hawk, PRFA: prairie falcon, RTHA: red-tailed hawk, UNRA: unidentified raptor

Avian Use Study
Pronghorn Flats Wind Energy Project
Banner County, Nebraska

Final Report
April 2019 – May 2021

Prepared for:

Orion Wind Resources LLC
Banner County Transmission LLC

155 Grand Avenue, Suite 706
Oakland, California 94612

Prepared by:

Chris Fritchman and Kenton Taylor

Western EcoSystems Technology, Inc.
415 West 17th Street, Suite 200
Cheyenne, Wyoming 82001

December 20, 2021

WEST

EXECUTIVE SUMMARY

Western EcoSystems Technology, Inc. completed more than two years of avian use surveys for the proposed Pronghorn Flats Wind Energy Project (Project) in Banner County, Nebraska. The objective of surveys was to evaluate species composition and seasonal and spatial use of the Project area by birds, with a particular focus on eagles and special status species. The survey methods were consistent with recommendations in the US Fish and Wildlife Service's (USFWS) 2012 *Final Land-Based Wind Energy Guidelines*, Appendix C(1)(a) of the 2013 USFWS *Eagle Conservation Plan Guidelines* (ECPG), and the USFWS *Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests* (2016 Final Eagle Rule, USFWS 2016).

During the first 12 months of surveys (Year 1), monthly surveys were completed at 25 established points in the Project area from April 1, 2019 to March 11, 2020. During the 14 months of surveys (Year 2) following Year 1, monthly surveys were completed at 21 established points in the Project area from April 25, 2020 to May 26, 2021. Surveys consisted of 10-minute counts of small birds within 100-meter (m, 328-foot) radius plots, followed by 60 min counts recording large birds, including eagles, within 800-m (2,625-foot) radius plots. Observations of special status species (defined as species afforded protection under the Endangered Species Act of 1973, Bald and Golden Eagle Protection Act of 1940, and listed as threatened and endangered by the state of Nebraska), were recorded any time they were observed.

No federally listed threatened or endangered species were observed during surveys or incidentally. The only state listed species observed during the course of more than two years of surveys was the thick-billed longspur, a state-listed threatened species. During Year 1, three individual bald eagle, 12 individual golden eagle, and two unidentified eagle observations were recorded during 300 hours of surveys. These observations resulted in 11 risk minutes (flight minutes within 800 m and below 200 m) for bald eagles and 33 risk minutes for golden eagles. Bald eagles were observed in spring and fall, while golden eagles were observed during all seasons. During Year 2, two individual golden eagle observations, both during the fall, were recorded during 232 hours of surveys. These observations resulted in five risk minutes for golden eagles. Bald eagles were not observed during the Year 2 surveys.

During Year 1, twenty-four large bird species were recorded during surveys. Waterfowl and doves/pigeons accounted for most of the observations throughout the study period. Diurnal raptors were the most frequently occurring group of birds during spring, fall, and winter. Twenty-one species of small birds were recorded during surveys. Passerines accounted for all identifiable species of small birds. During Year 2, twenty-one large bird species were recorded during surveys. Similar to Year 1, waterfowl and doves/pigeons accounted for most of the observations throughout the study period. Diurnal raptors were also the most frequently occurring group of birds during spring, fall, and winter. Twenty-five species of small birds were recorded during surveys. Passerines and woodpeckers accounted for all identifiable species of small birds.

Overall, the species composition, seasonal abundance, and spatial use patterns documented during surveys are considered typical for birds in this region. The majority of species observed are common and abundant within the region. Large flocks of waterfowl and/or shorebirds may occur during migration seasons, although stopover habitat for these species is limited within the Project area.

STUDY PARTICIPANTS

Chris Fritchman	Project Manager and Report Writer
Kenton Taylor	Senior Reviewer
Guy DiDonato	Statistician
Stuart Geiger	GIS Technician
Carissa Goodman	Technical Editor
Shawn Opitz	Field Supervisor

REPORT REFERENCE

Fritchman, C. and Taylor, K. 2021. Avian Use Study, Pronghorn Flats Wind Energy Project, Banner County, Nebraska. Final Report: April 2019 – May 2021. Prepared for Orion Wind Resources LLC, Oakland, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 20, 2021.

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INTRODUCTION

Orion Wind Resources LLC and its subsidiary, Banner County Transmission LLC (Orion), are developing the proposed Pronghorn Flats Wind Energy Project (Project) in Banner County, Nebraska (Figure 1). At this time, Orion is considering two potential options for the Project: an approximately 115 megawatt (MW) project and an approximately 250 MW project. To support the development of the Project, Orion contracted Western EcoSystems Technology, Inc. (WEST) to complete avian use surveys from April 2019 through May 2021 within the Project area. The surveys covered the entire 115 MW project area and a portion of the 250 MW project area. The objective of the surveys was to evaluate species composition and seasonal and spatial use of the Project by birds, with a particular focus on eagles and special status species. Special status species are defined as species afforded protection under the Endangered Species Act of 1973 (ESA), Bald and Golden Eagle Protection Act of 1940 (BGEPA), or listed as threatened and endangered by the state of Nebraska (Nebraska Game and Parks Commission [NGPC] 2021). Survey protocols were consistent with recommendations outlined in the US Fish and Wildlife Service (USFWS) *Land-Based Wind Energy Guidelines* (WEG, USFWS 2012), the USFWS *Eagle Conservation Plan Guidance* (ECPG; USFWS 2013), and the USFWS *Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests* (2016 Final Eagle Rule, USFWS 2016).

PROJECT AREA

The proposed wind turbines are located in Banner and Kimball Counties, Nebraska, approximately 28.1 kilometers (km; 17.5 miles [mi]) northeast of Kimball, Nebraska (Figure 1). The study area, is defined as the minimum convex polygon (MCP) around the proposed turbine locations during each year of surveys (Year 1 MCP and Year 2 MCP), respectively. The Year 1 MCP encompassed approximately 15,471 hectares (38,230 acres), while the Year 2 MCP encompassed 9,764 hectares (24,128 acres, Table 1). Both MCPs fall within the Level III Western High Plains Ecoregion, which encompasses much of the Nebraska panhandle (US Environmental Protection Agency [USEPA] 2016). The Western High Plains Level III Ecoregion consist of smooth to slightly irregular plains and is a mostly arid and dry climate. Natural land cover is dominated by shortgrass and mixed grass prairie, but current land cover is largely dominated by dryland agriculture. (USEPA 2016).

According to the National Land Cover Database (2016), approximately 95% of the land cover of both MCPs is dominated cultivated crops (58.1% within the Year 1 MCP, and 70.9% within the Year 2 MCP) and herbaceous land cover (36.9% within the Year 1 MCP, and 25.2% within the Year 2 MCP, Table 1, Figure 2). All other land cover types account for the last 5% of the Project area and include developed, open space, hay/pasture, evergreen forest, developed, low intensity, barren land, shrub/scrub, woody wetlands, and developed, medium intensity (Table 1, Figure 2).

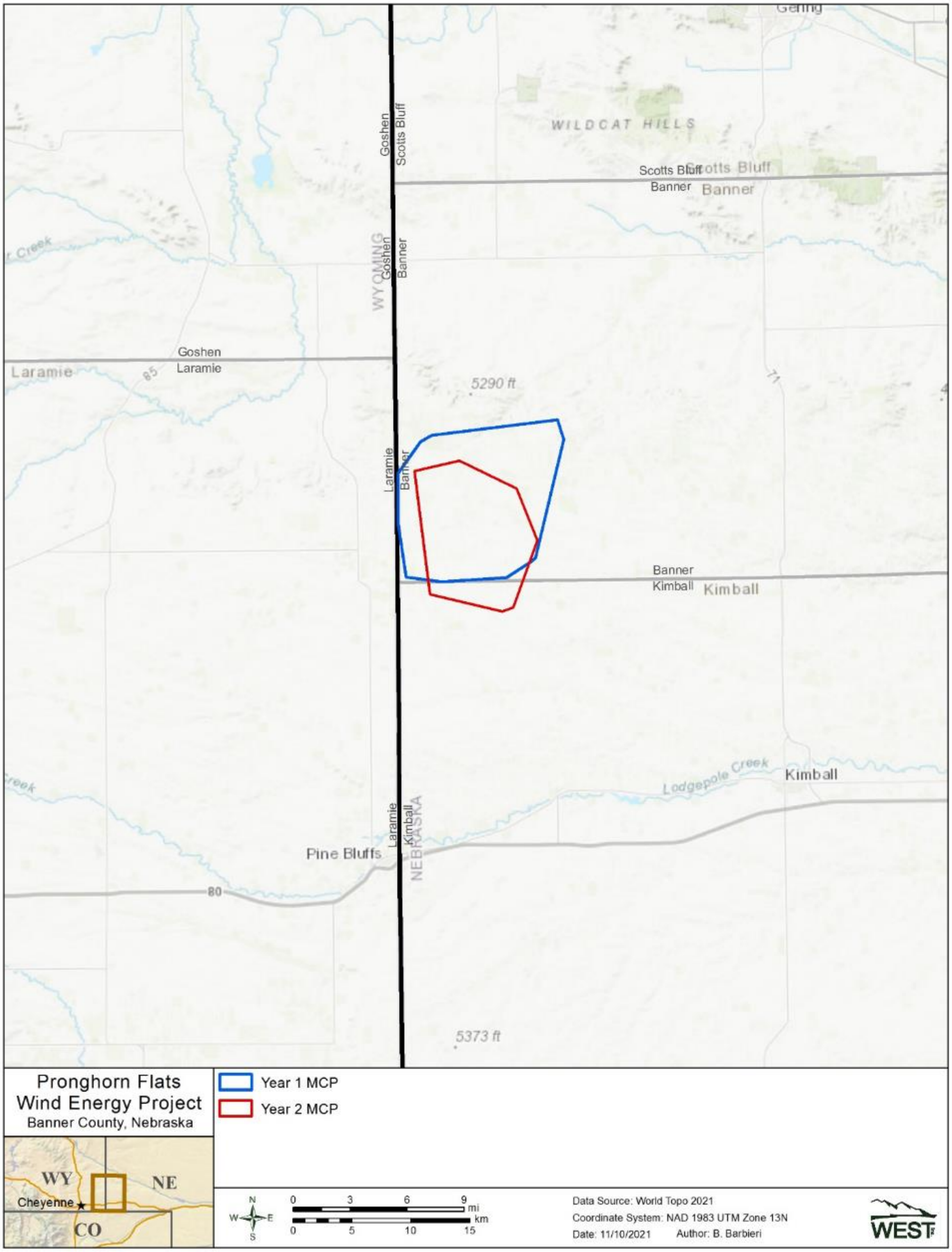

Figure 1. Location of the Pronghorn Flats Wind Energy Project, Banner County, Nebraska.

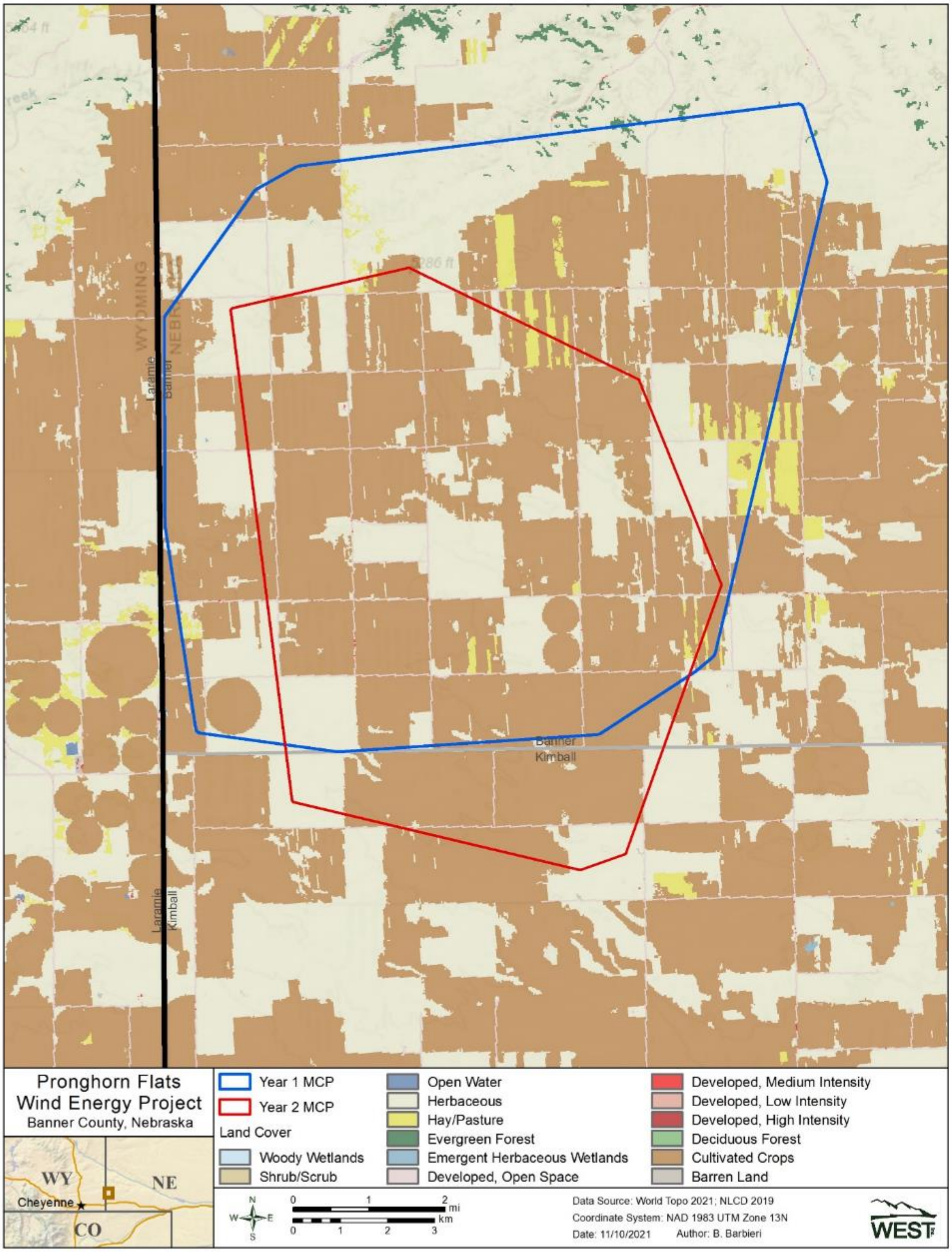

Figure 2. Land cover within the minimum convex polygons for the Pronghorn Flats Wind Energy Project in Banner County, Nebraska.

Table 1. Land cover, coverage, and percent (%) composition within the minimum convex polygons for the Pronghorn Flats Wind Energy Project in Banner County, Nebraska.

	Year 1		
Land Cover Type	**Cover (Hectares)**	**Cover (Acres)**	**Percent Composition**
Cultivated Crops	8,983.56	22,198.87	58.1
Herbaceous	5,704.03	14,094.97	36.9
Developed, open space	408.61	1,009.69	2.6
Hay/pasture	357.35	883.04	2.3
Evergreen forest	12.76	31.54	0.1
Developed, low intensity	1.84	4.55	<0.1
Barren land	1.08	2.67	<0.1
Shrub/scrub	0.99	2.44	<0.1
Woody wetlands	0.90	2.22	<0.1
Developed, medium intensity	0.09	0.22	<0.1
Total	**15,471.22**	**38,230.22**	**100**
	Year 2		
Land Cover Type	**Cover (Hectares)**	**Cover (Acres)**	**Percent Composition**
Cultivated Crops	6,924.69	17,111.28	70.9
Herbaceous	2,458.82	6,075.88	25.2
Developed, Open Space	295.72	730.74	3.0
Hay/Pasture	76.60	189.28	<0.1
Developed, Low Intensity	5.49	13.56	<0.1
Developed, Medium Intensity	2.25	5.56	<0.1
Woody Wetlands	0.72	1.78	<0.1
Barren Land	0.09	0.22	<0.1
Total	**9,764.37**	**24,128.29**	**100**

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

Sources: National Land Cover Database 2016.

METHODS

The study design and survey methods for the study primarily followed guidance in the ECPG and the 2016 Final Eagle Rule because of the need to collect information on eagles, while also following guidance from the WEG to collect information on other birds including those that are listed as threatened and endangered by the state of Nebraska. Methods described below, therefore, are common for all birds (i.e., large and small birds, eagles, and other species of concern) except as noted.

For the purposes of the study, large birds are defined as waterbirds, waterfowl, shorebirds, diurnal raptors (i.e., accipiters, buteos, eagles, falcons, northern harrier, and other raptors), owls, vultures, upland game birds, doves/pigeons, large corvids, and goatsuckers. Small birds are defined as passerines, including blackbirds/orioles, flycatchers, grassland/sparrows, swallows, shrikes, thrushes, warblers, woodpeckers and unidentified small birds.

Study Design

The study area was revised after the first 12 months of surveys, so the number of survey plots was modified to meet ECPG recommendations that survey plots cover at least 30% of each year's MCP. In total, 33 unique survey plots were established, with 25 survey plots occurring within the

Year 1 MCP (32.2% coverage), and 21 survey plots occurring within the Year 2 MCP (38.2%, Figures 3a and 3b). Survey plots were randomly selected, along a public roadway, using a spatially balanced sampling procedure as recommended in the 2016 Final Eagle Rule (Brown et al. 2015). Each survey plot consisted of an 800-meter (m; 2,625-foot [ft]) radius for large birds (including eagles) and 100-m (328-ft) radius for small birds (Reynolds et al. 1980, USFWS 2013, 2016).

Surveys were conducted once per month from April 1, 2019 to March 11, 2020, and from April 25, 2020 to May 26, 2021, as specified in the ECPG and 2016 Final Eagle Rule (USFWS 2013, 2016). Seasons for both years were defined as spring (March 1 to May 31), summer (June 1 to August 31), fall (September 1 to November 30), and winter (December 1 to February 28). Surveys were conducted during daylight hours and survey times at survey plots were randomized to cover all daylight hours during a season. Surveys were conducted under all weather conditions except when visibility was less than 800 m (2,625 ft) horizontally and/or 200 m (656 ft) vertically.

Figure 3a. Avian use survey points and plots at the Pronghorn Flat Wind Energy Project in Banner County, Nebraska from April 1, 2019 to March 11, 2020 (Year 1).

Figure 3b. Avian use survey points and plots at the Pronghorn Flat Wind Energy Project in Banner County, Nebraska from April 25, 2020 to May 26, 2021 (Year 2).

Survey Methods

All Birds

Surveys at each point were conducted for a period of 70 minutes (min), with only small birds recorded during the first 10 min of the survey period out to a 100-m radius, and only large birds (including eagles) recorded for the remaining 60 min of the survey period out to a 800-m radius. Special status species were recorded whenever observed. Biologists recorded the following information for each survey: date, start and end time, and weather (i.e., temperature, wind speed, wind direction, precipitation, and percent cloud cover). Additionally, the following data were recorded for each group of birds observed:

- Observation number
- Species (or best possible identification)
- Number of individuals
- Sex and age class (if possible)
- Distance from survey plot center to the nearest 5-m (16-ft) interval (first & closest)
- Flight height above ground level (AGL) to the nearest 5-m interval (first, lowest, and highest)
- Flight direction (first observed)
- Habitat
- Activity (e.g., flying, perched)
- Observation type (visual or aural)
- Flight paths and perch locations of eagles and other species of concern

Eagles

Data were collected based on the recommendations in the ECPG and the 2016 Final Eagle Rule if a golden eagle, bald eagle, or unidentified eagle was observed during the survey period (USFWS 2013, 2016). Biologists recorded eagle behavior (i.e., flight height, distance from observer, activity) each minute (eagle minute), at the beginning of the minute, to provide an instantaneous count for every eagle observed, whether or not the eagle was flying below 200 m AGL and within 800 m of the survey location at any time during the minute, and age class (juvenile [first year], immature or sub-adult [second to fourth year], adult [at least fifth year]).

Incidental Observations

Incidental observations are records of wildlife seen outside the standardized avian use surveys, but within the Project area, and were focused on special status species. Data recorded for incidentally observed species were similar to that recorded during scheduled surveys.

Data Management

Quality Assurance and Quality Control

WEST implemented quality assurance and quality control (QA/QC) measures at all stages of the study, including in the field, during data entry and analysis, and report writing. Following surveys, biologists were responsible for inspecting data forms for completeness, accuracy, and legibility. If errors or anomalies were found within the data, follow-up measures were implemented including discussions and review of field data with field technicians and/or Project Managers. If any errors, omissions, or problems were identified in later stages of analysis, they were traced back to the raw data forms where appropriate changes and measures were implemented, no matter what stage of analysis. Multiple reviews were conducted as QA/QC measures.

Data Compilation and Storage

A Microsoft® SQL database was specifically developed to store, organize, and retrieve survey data. Project data were keyed into the electronic database using a pre-defined format to facilitate subsequent QA/QC and data analysis. WEST retained all data forms and electronic data files for reference.

Statistical Analysis

A *visit* was defined as sequentially surveying all of the survey plots once within the Project area and a visit could occur across multiple dates, but could not overlap another visit and had to be completed in a single season (e.g., spring).

A *survey* was defined as a single 10-min or 60-min count of birds. In some cases, a count of bird observations may represent repeated observations of the same individual. Only observations within the survey plot were included for statistical analysis.

Species Richness

Species richness was illustrated by the total number of unique species observed. Species lists (with the number of observations and the number of groups) were generated by season for large birds detected within 800 m. An *Index to species richness* was calculated for each season by first averaging the total number of species observed within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. An overall index to species richness was also calculated as a weighted average of seasonal values by the number of days in each season for each survey type. Indices to species richness were compared among seasons within respective survey types.

Mean Use, Percent of Use, and Frequency of Occurrence

Mean use is the average number of birds observed per plot per survey for small or large birds. Small bird use (per 100-m radius plot per 10-min survey) and large bird use (per 800-m radius plot per 60-min survey) was calculated by: 1) summing birds per plot per visit, 2) averaging number of birds over plots within a visit, and 3) averaging number of birds across visits within a season. Overall mean use was calculated as a weighted average of seasonal values by the number of days in each season. *Percent of use* was calculated as the percentage of small or large bird use that was attributable to a particular bird type or species. *Frequency of occurrence* was calculated as the percent of surveys in which a particular bird type or species was observed.

Mean use and frequency of occurrence describe different aspects of relative abundance, in that mean use is based on the number of birds (i.e., large groups can produce high estimates), whereas frequency of occurrence is based on the number of groups (i.e., it is not influenced by group size). Qualitative comparisons were made with these metrics among bird types, seasons, and survey points to help illustrate temporal and spatial avian use of the Project. The top five bird groups were depicted graphically to show the dominant patterns in mean use, percent of use, and frequency of occurrence.

Flight Height

Flight heights are important metrics to assess relative potential exposure to turbine blades and were used to calculate the percentage of large birds, small birds, and eagles observed flying within the rotor-swept height (RSH) of proposed turbines. Although no decisions have yet been made regarding the RSH of turbines to be installed in the Project, an RSH of 25 to 150 m (82 to 492 ft) AGL was assumed for the purpose of the analysis. Flight height recorded during the initial observation was used to calculate the percentage of birds flying within the RSH and mean flight height.

Spatial Variation

Mean use was calculated by survey plot for eagles, large birds, and small birds to make spatial comparisons among the survey plots. Additionally, flight paths and perched locations of large birds and eagles were mapped during large bird use surveys to qualitatively show potential areas of concentrated flight paths and/or consistent flight patterns within the Project area compared to Project area characteristics (e.g., topographic features).

Eagles

Data collected during each minute eagles were observed were examined to count eagle risk minutes, defined by the ECPG as the number of minutes an eagle was observed in flight within the risk cylinder (defined as the area within 800 m of the survey point and below 200 m AGL during the 60-min survey periods) and total minutes, defined as the amount of time eagles were observed inside and outside the risk cylinder. The eagle risk minutes per observation hour were reported by survey plot and month, to enable spatial and temporal assessments of eagle risk minutes recorded in the Project area. Data collected on perched eagles and those outside of survey plots were not considered eagle risk minutes; however, they were included in the total eagle minutes. The perch locations and flight paths of all eagles were mapped to qualitatively assess areas of eagle use within the Project area.

RESULTS

During Year 1, three hundred avian use surveys were conducted for large birds and small birds (Table 2a). Twenty-four species of large birds and 21 species of small birds totaling 45 species were recorded during the first year study (Table 2a). Study results are summarized below, supplemented by the appendices, which present species-level detail on the following: scientific names and numbers of groups and observations seen during surveys, but not limited to viewshed (Appendix A), avian use, percent of use, and frequency of occurrence by season (Appendix B), and mean use by survey plot (Appendix C).

During Year 2, two hundred thirty-two avian use surveys were conducted for large birds and small birds (Table 2b). Twenty-one species of large birds and 25 species of small birds totaling 46 species of birds were recorded during the Year 2 study (Table 2b). Study results are summarized below, supplemented by the appendices, which present species-level detail on the following: scientific names and numbers of groups and observations seen during surveys, but not limited to viewshed (Appendix A), avian use, percent of use, and frequency of occurrence by season (Appendix B), and mean use by survey plot (Appendix C).

Table 2a. Summary of index to species richness and sample size by season and overall during the fixed-point bird use surveys at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska, from April 1, 2019 to March 11, 2020 (Year 1).

				Index to Species Richness (species/plot[a]/60-minute survey)
Season	**# Visits**	**# Surveys Conducted**	**Species Richness**	**Large Birds**
Spring	3	75	19	1.23
Summer	3	75	13	1.81
Fall	3	75	16	1.09
Winter	3	75	8	0.35
Overall	**12**	**300**	**24**	**1.12**
				Index to Species Richness (species/plot[a]/10-minute survey)
Season	**# Visits**	**# Surveys Conducted**	**Species Richness**	**Small Birds[b]**
Spring	3	75	15	1.97
Summer	3	75	12	2.19
Fall	3	75	6	0.64
Winter	3	75	2	0.71
Overall	**12**	**300**	**21**	**1.38**

Species Richness: The total number of unique species observed within viewshed during avian use surveys.

Index to Species Richness: Average number of species observed within the observer viewshed/plot/visit within seasons.

[a] 800-meter (m; 2,625-foot [ft]) radius plot for large birds, 100-m (328-ft) radius plot for small birds.

[b] Please note surveys of small birds used smaller viewsheds and shorter survey periods than that used for large birds; direct comparison between large and small bird use is not possible.

Table 2b. Summary of index to species richness and sample size by season and overall during the fixed-point bird use surveys at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska, from April 25, 2020 to May 26, 2021 (Year 2).

Index to Species Richness (species/plot[a]/60-minute survey)				
Season	**# Visits**	**# Surveys Conducted**	**Species Richness**	**Large Birds**
Spring	5	61	14	0.88
Summer	3	57	11	1.05
Fall	3	57	12	0.58
Winter	3	57	5	0.23
Overall	**14**	**232**	**21**	**0.69**
Index to Species Richness (species/plot[a]/10-minute survey)				
Season	**# Visits**	**# Surveys Conducted**	**Species Richness**	**Small Birds[b]**
Spring	5	61	17	2.43
Summer	3	57	15	2.25
Fall	3	57	9	1.60
Winter	3	57	4	0.93
Overall	**14**	**232**	**25**	**1.80**

Species Richness: The total number of unique species observed within viewshed during avian use surveys.

Index to Species Richness: Average number of species observed within the observer viewshed/plot/visit within seasons.

[a] 800-meter (m; 2,625-foot [ft]) radius plot for large birds, 100-m (328-ft) radius plot for small birds.

[b] Please note surveys of small birds used smaller viewsheds and shorter survey periods than that used for large birds; direct comparison between large and small bird use is not possible.

Special Status Species

Eagles

Mean use

During Year 1, bald eagle mean use was 0.03 observations/800-m radius plot/60-min survey during fall with no other bald eagle observations within 800 m recorded in other seasons (there was one bald eagle observation recorded in the spring but, not within 800 m; Appendix B1). Golden eagle mean use ranged from 0.01 observations/800-m radius plot/60-min survey during summer, fall, and winter to 0.07 in spring (Appendix B). Overall, eagle (both bald and golden) mean use was 0.03 observations/800-m radius plot/60-min survey.

There were no bald eagle observations during the Year 2 surveys. Golden eagles were only observed during the fall season and mean use was 0.04 observations/800-m radius plot/60-min survey (Appendix B).

Activity minutes

During Year 1, eleven bald eagle risk minutes from two bald eagle observations were recorded compared to 16 total bald eagle minutes from three bald eagle observations during 300 total survey hours (Table 3a). Bald eagle risk minutes per survey ranged from 0.17-0.75 risk min/800-m plot/60-min survey (Figure 4a).

Table 3a. The bald eagle minutes and observations recorded during avian use surveys at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska, from April 1, 2019 to March 11, 2020 (Year 1).

	Eagle Minutes		Eagle Observations			
Season	**Within[a] Risk Cylinder**	**Total[b]**	**Within[a] Risk Cylinder**	**Total[b]**	**Survey Hours**	**Eagle Risk Minutes/Survey Hour**
Spring	0	3	0	1	75	0
Summer	0	0	0	0	75	0
Fall	11	13	2	2	75	0.15
Winter	0	0	0	0	75	0
Total	**11**	**16**	**2**	**3**	**300**	**0.04**

[a] In = minutes or observations inside the risk cylinder; minutes inside risk cylinder = eagle exposure minutes.

[b] Total = minutes or observations inside and outside the risk cylinder.

During Year 1, thirty-three golden eagle risk minutes from five golden eagle observations were recorded compared to 95 total golden eagle minutes from 12 golden eagle observations during 300 total survey hours (Table 3b). Golden eagle risk minutes ranged from 0.08 to 1.08 risk min/800-m plot/60-min survey across five different survey plots (Figure 4b). The five survey plots with golden eagle risk minutes are spread throughout the Project area (Figure 4b).

Table 3b. The golden eagle minutes and observations recorded during avian use surveys in the Pronghorn Flats Wind Energy Project in Banner County, Nebraska, from April 1, 2019 to March 11, 2020 (Year 1).

	Eagle Minutes		Eagle Observations			
Season	**Within[a] Risk Cylinder**	**Total[b]**	**Within[a] Risk Cylinder**	**Total[b]**	**Survey Hours**	**Eagle Risk Minutes/Survey Hour**
Spring	10	49	2	7	75	0.13
Summer	9	27	1	3	75	0.12
Fall	13	18	1	1	75	0.17
Winter	1	1	1	1	75	0.01
Total	**33**	**95**	**5**	**12**	**300**	**0.11**

[a] In = minutes or observations inside the risk cylinder; minutes inside risk cylinder = eagle exposure minutes.

[b] Total = minutes or observations inside and outside the risk cylinder.

During Year 2, five golden eagle risk minutes from one golden eagle observation were recorded compared to nine total golden eagle minutes from two golden eagle observations during 232 total survey hours (Table 3c). Golden eagles were observed at survey Point 24 and Point 27. While, no risk minutes were associated with the observation at survey Point 24, there were 0.42 risk minutes per survey hour at survey Point 27 (Figure 4c). Survey Point 27 is located in the eastern part of the Year 2 MCP (Figure 4c).

Table 3c. The golden eagle minutes and observations recorded during avian use surveys in the Pronghorn Flats Wind Energy Project in Banner County, Nebraska, from April 25, 2020 to May 26, 2021 (Year 2).

	Eagle Minutes		Eagle Observations			
Season	**Within[a] Risk Cylinder**	**Total[b]**	**Within[a] Risk Cylinder**	**Total[b]**	**Survey Hours**	**Eagle Risk Minutes/Survey Hour**
Spring	0	0	0	0	61	0.00
Summer	0	0	0	0	57	0.00
Fall	5	9	1	2	57	0.09
Winter	0	0	0	0	57	0.00
Total	**5**	**9**	**1**	**2**	**232**	**0.02**

[a] In = minutes or observations inside the risk cylinder; minutes inside risk cylinder = eagle exposure minutes.

[b] Total = minutes or observations inside and outside the risk cylinder.

Additionally, two unidentified eagles were observed during the Year 1 surveys, but both were observed outside the 800-m viewshed, with the closest being approximately 1,500 m (4,900 ft) away. No unidentified eagles were observed in Year 2.

Spatial Variation

Mean Use by Point

During Year 1, eagle observations were recorded at six of the survey plots, with mean use ranging from zero to 0.25 eagles/800-m plot/60-min survey among plots (Figures 4a and 4b, Appendix C1). Bald eagles and golden eagles were both recorded at Points 18 and 20.

During Year 2, golden eagle observations were recorded at two of the survey plots (Points 24 and 27), with mean use estimated to 0.08 eagles/800-m plot/60-min survey, for both locations (Figures 4c and 4d, Appendix C). No bald eagles were observed during the Year 2 surveys.

Flight Paths

During Year 1, bald and golden eagle flight paths were recorded in the study area, though there doesn't appear to be a discernable pattern (Figures 5a and 5b). Also, the study area does not appear to contain topographic features that would be thought to concentrate eagles.

During Year 2, golden eagle flight paths were recorded within the study area. A single flight path was recorded at Point 24 and Point 27. There doesn't appear to be a discernable pattern to the flight paths that were recorded (Figures 5a and 5b).

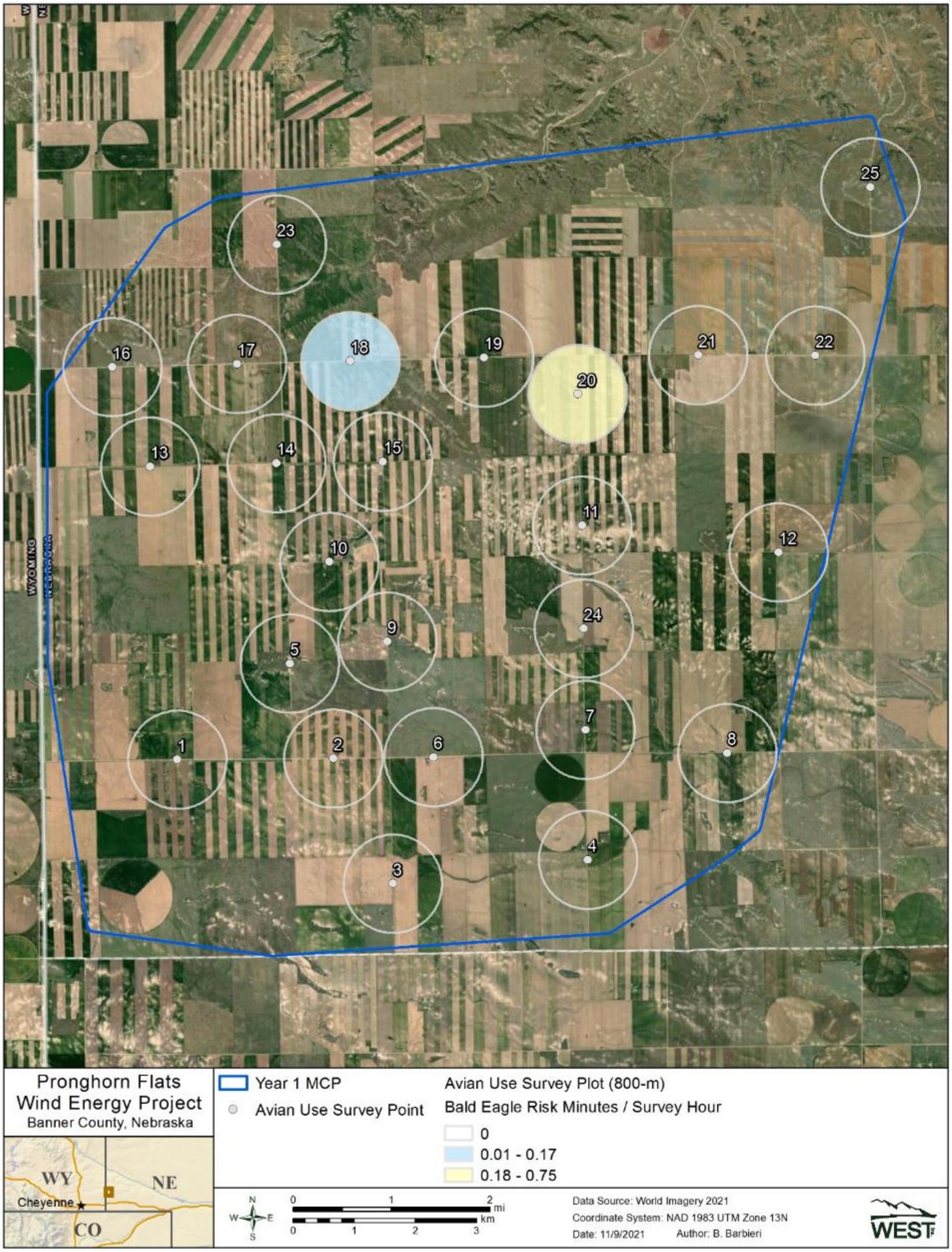

Figure 4a. Estimated bald eagle risk (flying within 800 meters and below 200 meters) minutes per survey hour at the Pronghorn Flats Wind Energy Project in Banner County, Nebraska, from April 1, 2019 to March 11, 2020.

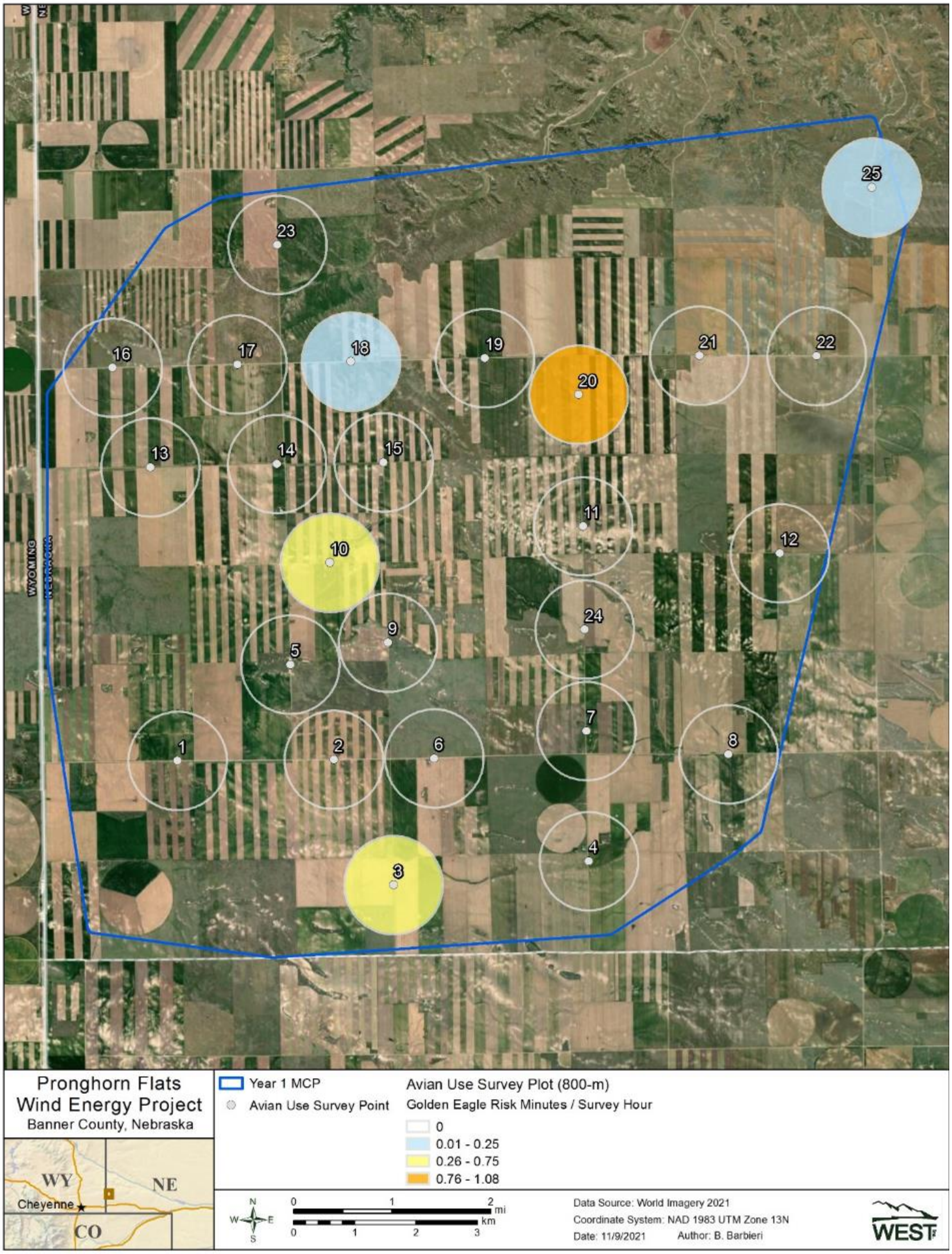

Figure 4b. Estimated golden eagle risk (flying within 800 meters and below 200 meters) minutes per survey hour at the Pronghorn Flats Wind Energy Project in Banner County, Nebraska, from April 1, 2019 to March 11, 2020.

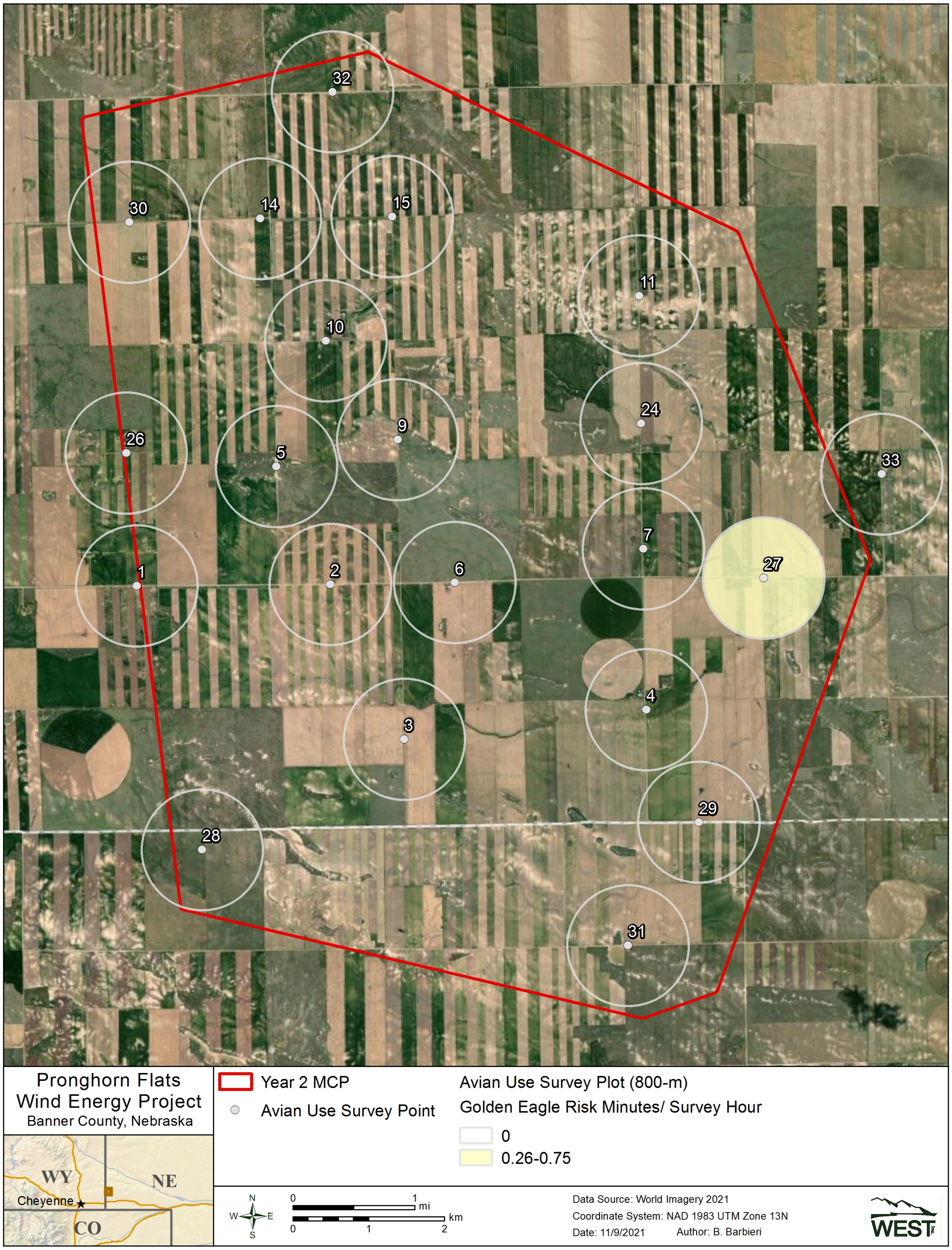

Figure 4c. Estimated golden eagle risk (flying within 800 meters and below 200 meters) minutes per survey hour at the Pronghorn Flats Wind Energy Project in Banner County, Nebraska, from April 25, 2020 to May 26, 2021.

Figure 5a. Mapped bald eagle flight paths at the Pronghorn Flat Wind Energy Project, Banner County, Nebraska, from April 1, 2019 to March 11, 2020.

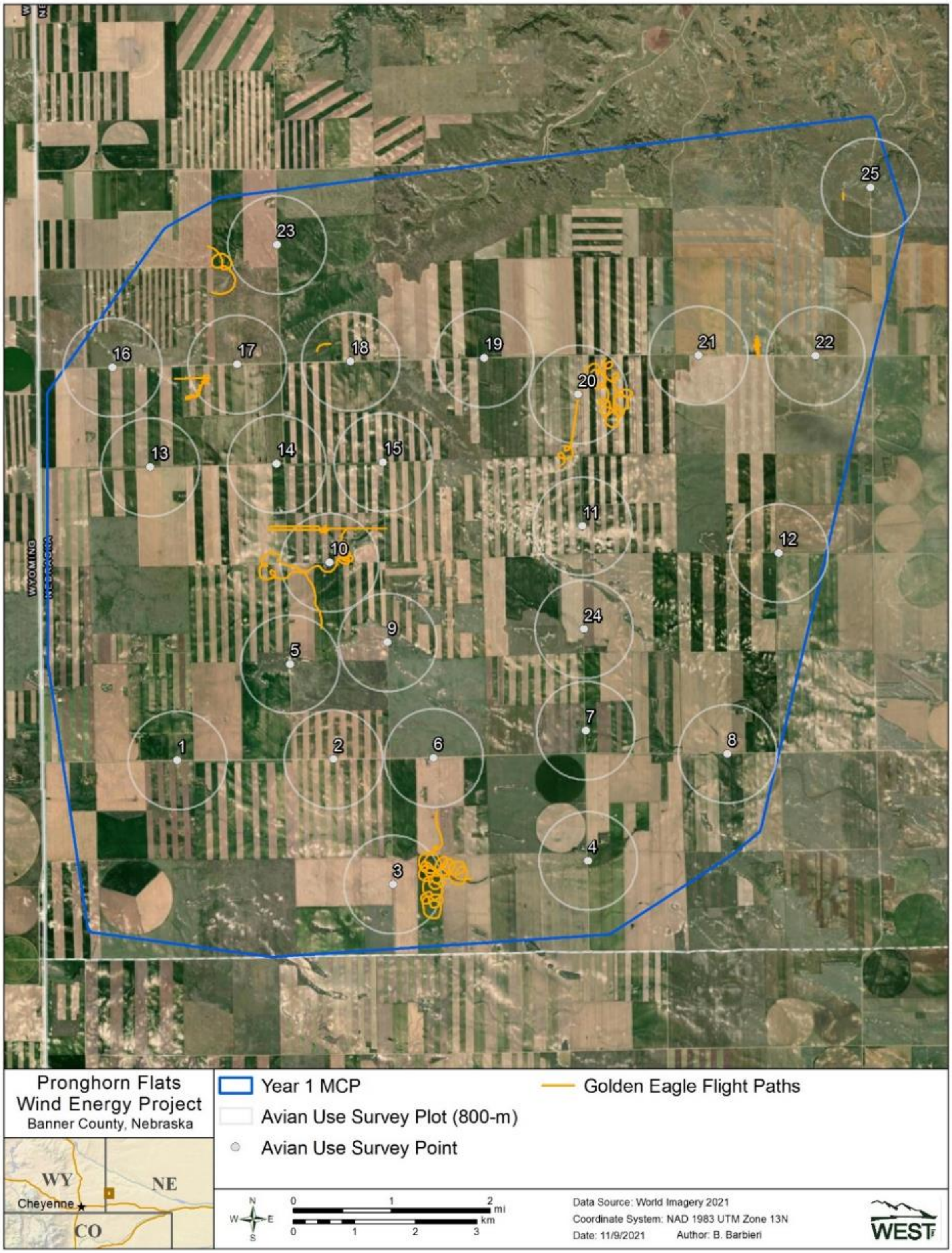

Figure 5b. Mapped golden eagle flight paths at the Pronghorn Flat Wind Energy Project, Banner County, Nebraska, from April 1, 2019 to March 11, 2020.

Figure 5c. Mapped golden eagle flight paths at the Pronghorn Flat Wind Energy Project, Banner County, Nebraska, from April 25, 2020 to May 26, 2021.

Federal- and State-protected Species

Other than bald and golden eagles, no other federal-protected species were observed within the Project (Tables 4a and 4b). Thick-billed longspur (*Rhynchophanes mccownii*), a state-listed threatened species, was observed during the Year 2 surveys (Tables 4a and 4b).

Table 4a. Special status species of concern by number (#) of groups (grps) and individual observations (obs) observed at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska during the fixed-point bird use surveys and as incidental wildlife observations from April 1, 2019 to March 11, 2020.

			Surveys		Incidental		Total	
Species	**Scientific Name**	**Status**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
golden eagle	*Aquila chrysaetos*	BGEPA	12	12	1	2	13	14
bald eagle	*Haliaeetus leucocephalus*	BGEPA	3	3	1	1	4	4
unidentified eagle		BGEPA	2	2	0	0	2	2
Total	**2 species**		**17**	**17**	**2**	**3**	**19**	**20**

BGEPA = Bald and Golden Eagle Protection Act of 1940.

Table 4b. Species of concern by number (#) of groups (grps) and individual observations (obs) observed at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska during the fixed-point bird use surveys and as incidental wildlife observations from April 25, 2020 to May 26, 2021.

			Surveys		Incidental		Total	
Species	**Scientific Name**	**Status**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
golden eagle	*Aquila chrysaetos*	BGEPA	2	2	1	1	3	3
Thick-billed longspur	*Rhynchophanes mccownii*	ST	2	4	0	0	2	4
Total	**2 species**		**4**	**6**	**1**	**1**	**5**	**7**

BGEPA = Bald and Golden Eagle Protection Act of 1940.

ST – state-listed threatened (Nebraska Game and Parks Commission 2021)

Large Birds

Mean Use, Percent of Use, and Frequency of Occurrence

During Year 1, mean use, percent of use, and frequency of occurrence were calculated by season for large bird types (Figures 6a, 6b, 6c) and species (Appendix B1). Large bird mean use ranged from 1.16 observations/800-m radius plot/60-min survey to 11.83 among seasons and was highest during spring (11.83), followed by fall (6.47), summer (5.37), and winter (1.16; Figure 6a). Waterfowl had the highest use during spring (10.07), fall (2.76), and winter (0.51), while doves/pigeons had the highest use during summer (3.64; Figure 6a). Based on large bird types, waterfowl also composed the majority of large bird use during spring (85.1%), winter (43.7%), and fall (42.7%), while doves/pigeons composed the majority of large bird use during summer (67.7%; Figure 6b). Large bird frequency of occurrence varied among seasons, with diurnal raptors most frequently observed during spring (58.7%), fall (61.3%) and winter (24.0%) and doves/pigeons during summer (86.7%; Figure 6c, Appendix B1).

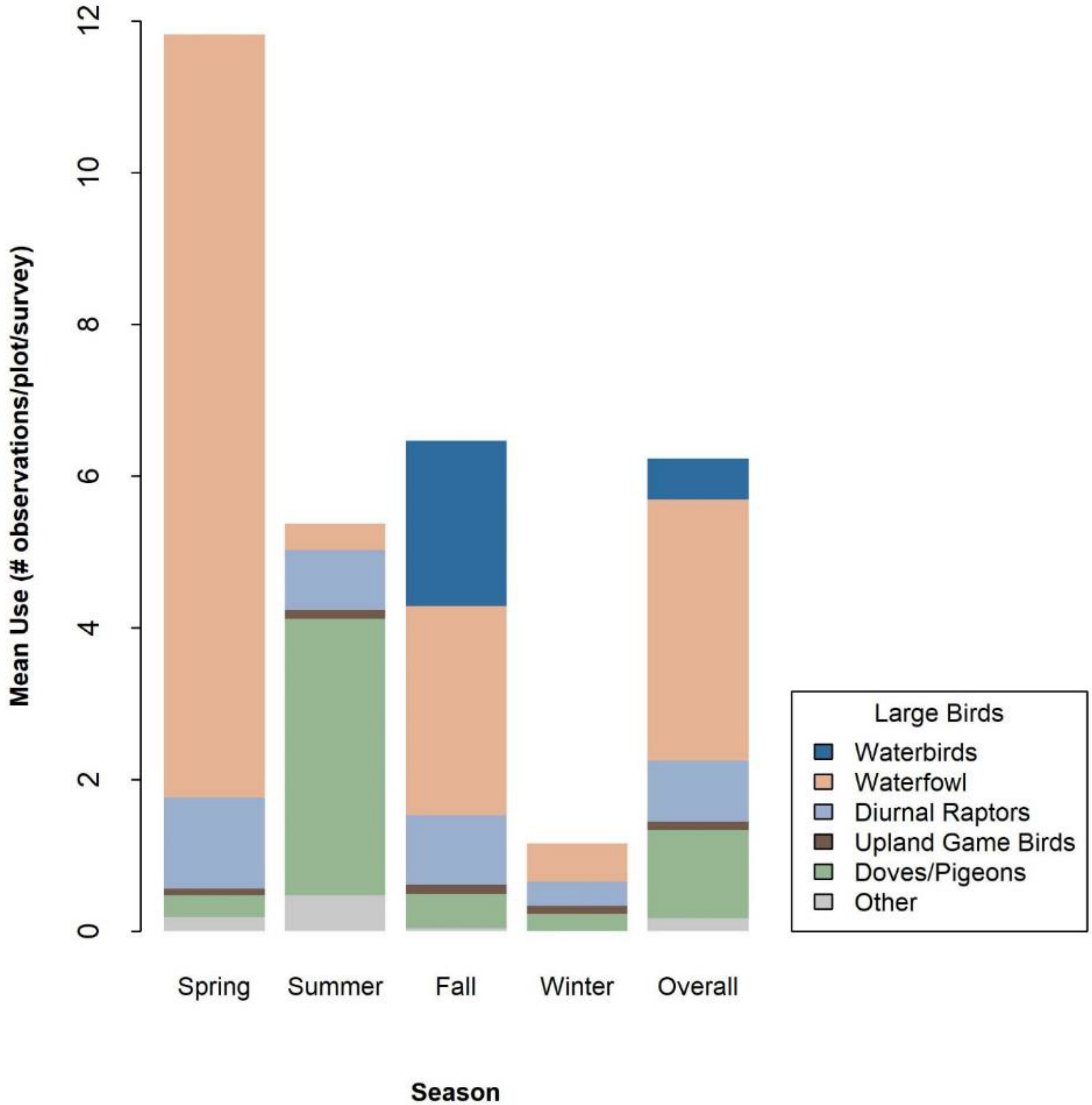

Figure 6a. Large bird mean use (observations/plot/60 minute survey) by season and bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 1, 2019 to March 11, 2020.

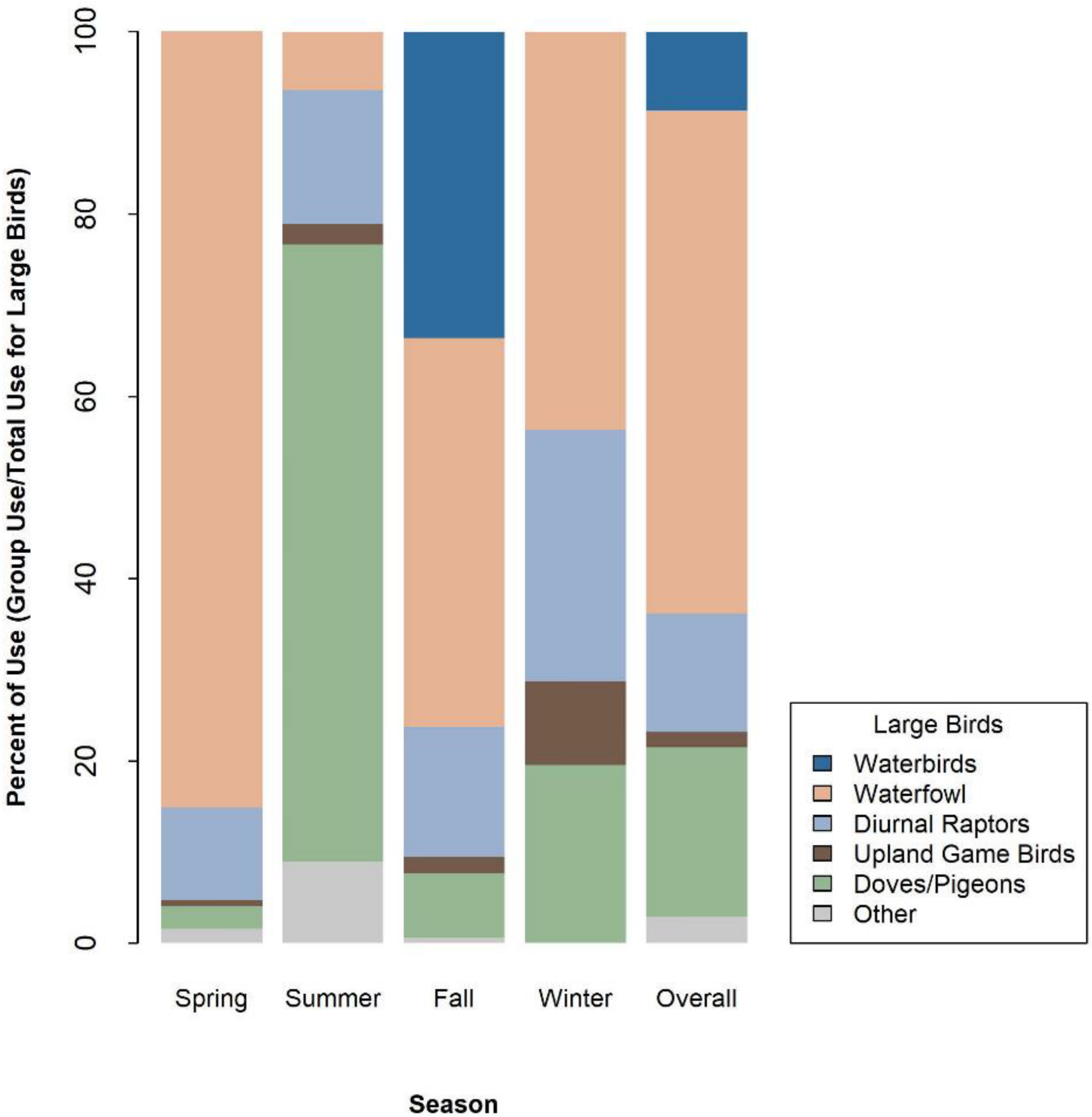

Figure 6b. Large bird percent of use by season and bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 1, 2019 to March 11, 2020.

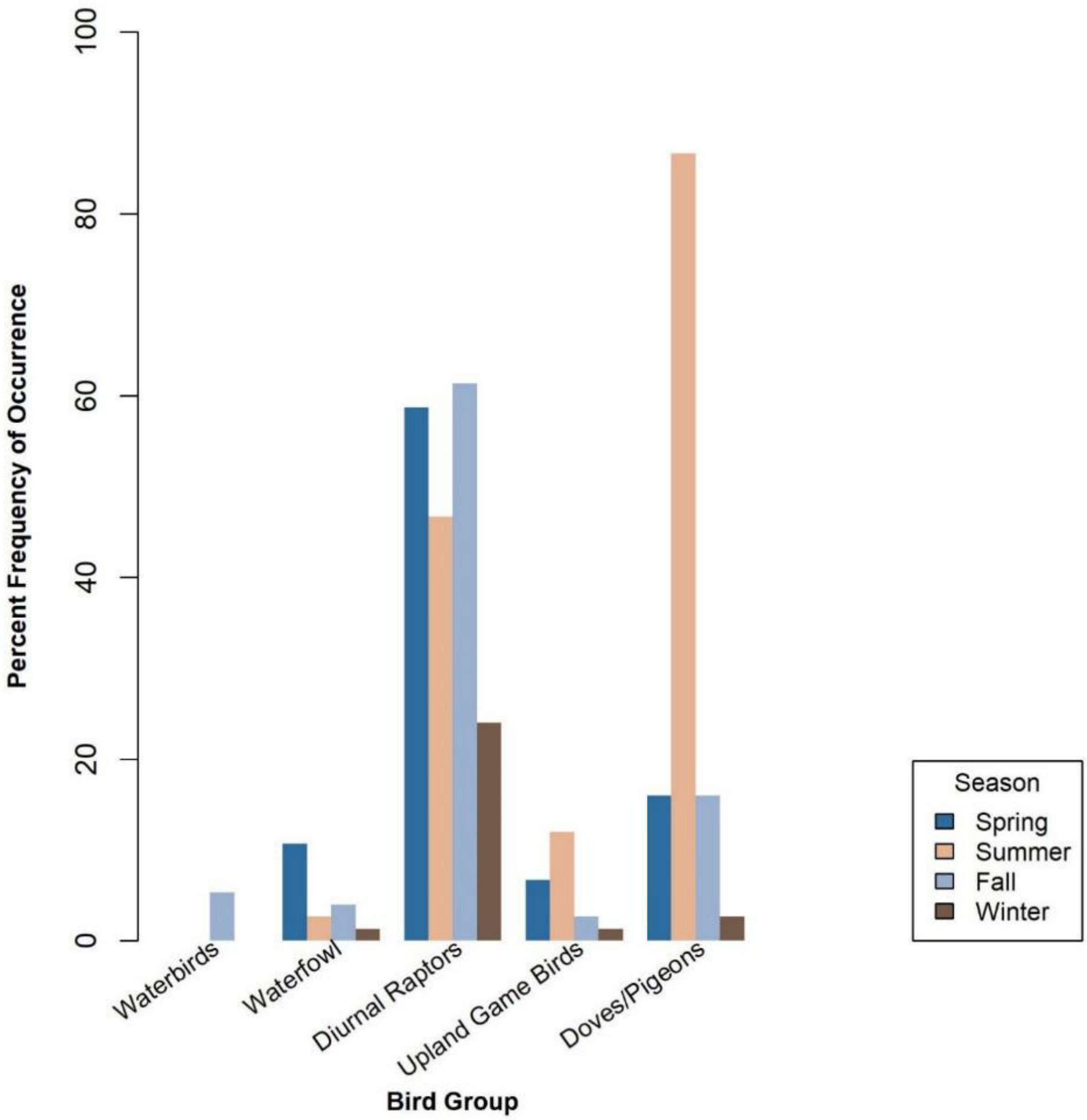

Figure 6c. Large bird frequency of occurrence by season and bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 1, 2019 to March 11, 2020.

During Year 2, mean use, percent of use, and frequency of occurrence were calculated by season for large bird types (Figures 6d, 6e, 6f) and species (Appendix B). Large bird mean use ranged from 0.23 observations/800-m radius plot/60-min survey to 3.30 among seasons and was highest during fall (3.30), followed by summer (3.04), spring (1.89), and winter (0.23; Figure 6d). Doves/pigeons had the highest use during summer (2.25), and spring (0.67), while waterbirds had the highest use during fall (2.53). Diurnal raptors were the only bird type recorded in winter with a use value of 0.23. (Figure 6d). Based on large bird types, doves/pigeons composed the majority of use during summer (74.0%) and spring (35.4%), waterbirds composed the majority of use during fall (76.6%), and diurnal raptor during winter (100%, Figure 6e). Large bird frequency of occurrence varied among seasons, with diurnal raptors most frequently observed during spring (42.0%), fall (35.1%) and winter (21.1%) and doves/pigeons during summer (50.9%; Figure 6f, Appendix B).

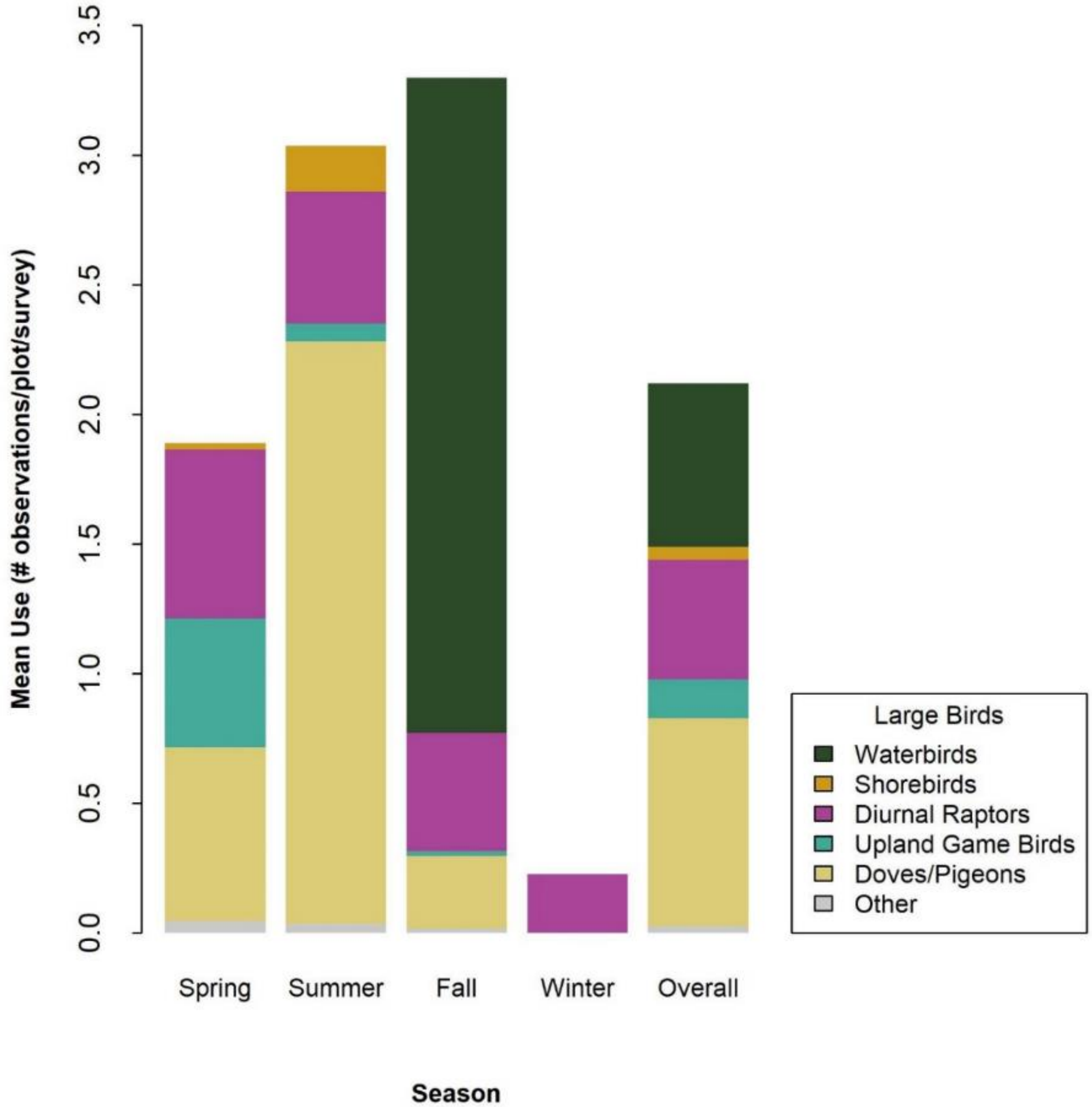

Figure 6d. Large bird mean use (observations/plot/60 minute survey) by season and bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 25, 2020 to May 26, 2021.

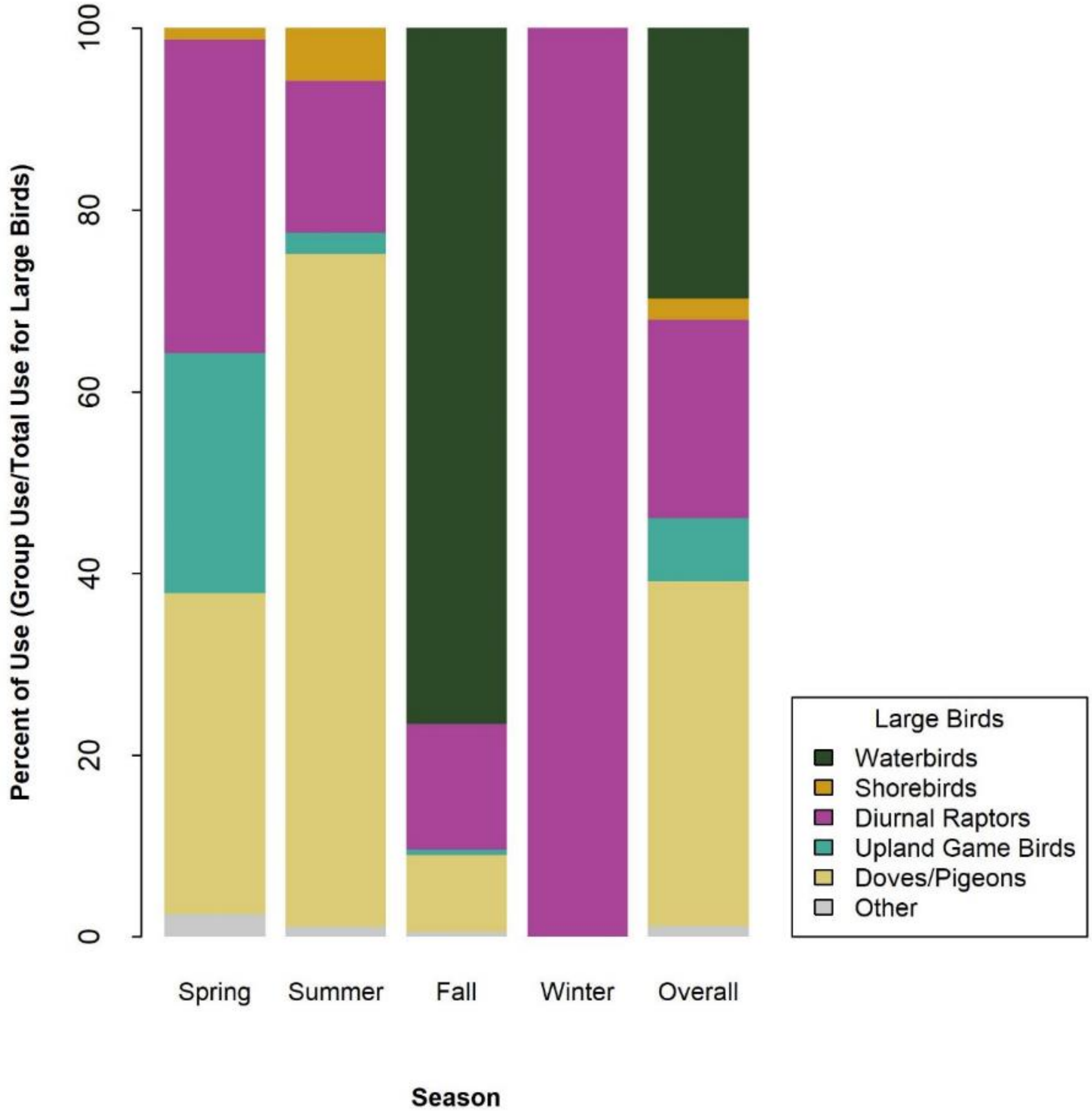

Figure 6e. Large bird percent of use by season and bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 25, 2020 to May 26, 2021.

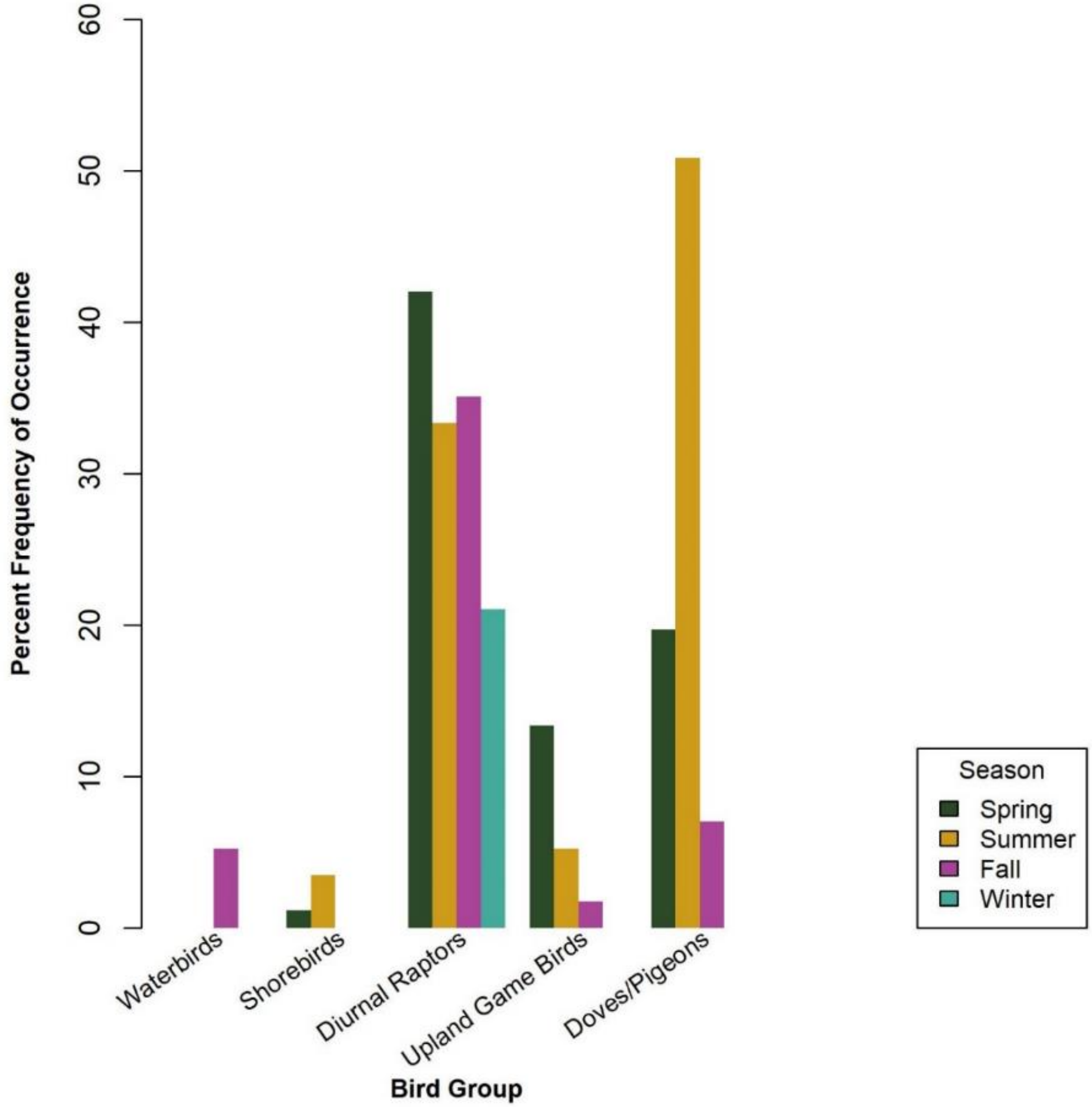

Figure 6f. Large bird frequency of occurrence by season and bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 25, 2020 to May 26, 2021.

Large Bird Mean Flight Height

During Year 1, based on initial observations, mean large bird flight heights ranged from 2.0 m (6.6 ft) for upland game birds to 118.8 m (389.60 ft) for waterbirds. Waterbirds (100%), waterfowl (92.2%) and large corvids (85.7%) were initially recorded most frequently within the RSH range (Table 5a). Diurnal raptors were initially recorded flying within the estimated RSH 27.6% of the time. Amongst, diurnal raptor subtypes buteos (n = 86) and eagles (n = 10) were initially observed flying within the estimated RSH 43.0% and 40.0% of the time, respectively (Table 5a).

Table 5a. Group and individual observation flight height characteristics by large bird type[a] and raptor subtype during fixed-point bird use surveys at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 1, 2019 to March 11, 2020.

Bird Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight height Categories <25 m	25−150 m[b]	> 150 m
Waterbirds	**4**	**161**	**118.8**	**98.8**	**0**	**100**	**0**
Waterfowl	**18**	**1,012**	**113.3**	**98.6**	**3.3**	**92.2**	**4.5**
Shorebirds	**6**	**11**	**5.5**	**57.9**	**100**	**0**	**0**
Diurnal Raptors	**204**	**225**	**28.2**	**93.0**	**68.0**	**27.6**	**4.4**
Accipiters	*1*	*1*	*12.0*	*100*	*100*	*0*	*0*
Buteos	*73*	*86*	*33.5*	*90.5*	*54.7*	*43.0*	*2.3*
Northern Harrier	*91*	*98*	*17.4*	*99.0*	*80.6*	*15.3*	*4.1*
Eagles	*10*	*10*	*95.9*	*100*	*30.0*	*40.0*	*30.0*
Falcons	*24*	*25*	*18.2*	*89.3*	*80.0*	*20.0*	*0*
Other Raptors	*5*	*5*	*61.4*	*55.6*	*60.0*	*20.0*	*20.0*
Vultures	**16**	**23**	**21.0**	**92.0**	**91.3**	**8.7**	**0**
Upland Game Birds	**4**	**11**	**2.0**	**34.4**	**100**	**0**	**0**
Doves/Pigeons	**133**	**220**	**4.5**	**63.6**	**100**	**0**	**0**
Large Corvids	**3**	**7**	**21.7**	**87.5**	**14.3**	**85.7**	**0**
Goatsuckers	**1**	**1**	**15.0**	**100**	**100**	**0**	**0**
Large Birds Overall	**389**	**1,671**	**23.9**	**89.7**	**27.0**	**69.7**	**3.4**

[a] 800-meter (m; 2,625-foot [ft]) radius plot for large birds.

[b] the assumed rotor-swept height for potential collision with a turbine blade, 25 to 150 m (82 to 492 ft) above ground level.

Zeroes and NA values indicate the species was observed, but was not flying.

Obs = observations.

All metrics are developed based on First Activity and First Flight Height.

During Year 2, initial mean large bird flight heights ranged from 3.0 m (9.8 ft) for owls to 333.0 m (1,092.5 ft) for waterbirds. Vultures (75%), diurnal raptors (38.4%) and shorebirds (33.3%) were initially recorded most frequently within the RSH range (Table 5b). Amongst, diurnal raptor subtypes buteos (n = 34) and falcons (n = 25) were initially observed flying within the estimated RSH 70.6% and 32.0% of the time, respectively (Table 5b).

Table 5b. Group and individual observation flight height characteristics by large bird type[a] and raptor subtype during fixed-point bird use surveys at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 25, 2020 to May 26, 2021.

Bird Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight height Categories <25 m	25−150 m[b]	> 150 m
Waterbirds	**3**	**144**	**333.0**	**100**	**0**	**0**	**100**
Shorebirds	**3**	**3**	**12.0**	**25.0**	**66.7**	**33.3**	**0**
Diurnal Raptors	**79**	**86**	**33.0**	**87.8**	**59.3**	**38.4**	**2.3**
Accipiters	*0*	*0*	*NA*	*0*	*NA*	*NA*	*NA*
Buteos	*32*	*34*	*44.0*	*81.0*	*29.4*	*70.6*	*0*
Northern Harrier	*23*	*25*	*6.0*	*96.2*	*96.0*	*4.0*	*0*
Eagles	*2*	*2*	*250.0*	*100*	*0*	*0*	*100*
Falcons	*22*	*25*	*26.0*	*92.6*	*68.0*	*32.0*	*0*
Owls	**1**	**1**	**3.0**	**50.0**	**100**	**0**	**0**
Vultures	**4**	**4**	**68.0**	**100**	**25.0**	**75.0**	**0**
Upland Game Birds	**5**	**17**	**4.0**	**77.3**	**100**	**0**	**0**
Doves/Pigeons	**54**	**125**	**13.0**	**75.8**	**86.4**	**13.6**	**0**
Large Birds Overall	**149**	**380**	**31.0**	**84.8**	**47.4**	**14.2**	**38.4**

[a] 800-meter (m; 2,625-foot [ft]) radius plot for large birds.

[b] the assumed rotor-swept height for potential collision with a turbine blade, 25 to 150 m (82 to 492 ft) above ground level.

Zeroes and NA values indicate the species was observed, but was not flying.

Obs = observations.

All metrics are developed based on First Activity and First Flight Height.

Spatial Variation

Mean Use by Point

During Year 1, large birds were observed at all 25 survey plots, with highest use observed at Point 8 with 41.25 birds/800-m plot/60 min survey, followed by Point 17 (18.92), Point 14 (11.58), and Point 11 (10.92; Figure 7a, Appendix C). Use at these four plots was due primarily to use by waterfowl.

During Year 2, large birds were observed at all 21 survey plots, with highest use observed at Point 32 with 9.17 birds/800-m plot/60 min survey, followed by Point 11 (3.58), Point 30 (3.00), and Point 15 (2.67; Figure 7b, Appendix C). Use at Points 32 and 11 was due primarily to use by waterbirds, while use at Points 15 and 30 was due primarily to use by doves/pigeons.

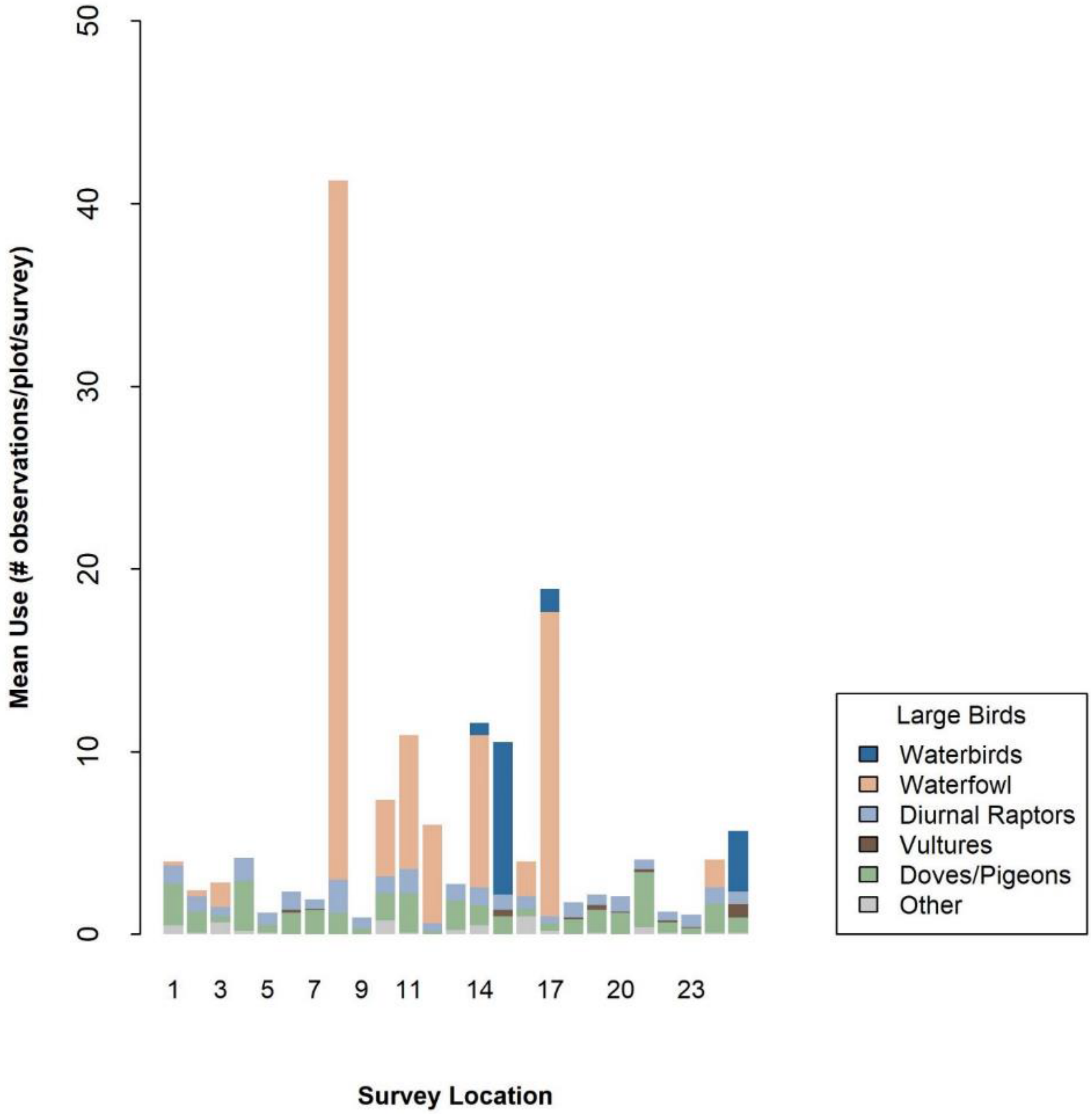

Figure 7a. Large bird mean use (# observations/plot/60 minute survey) by point by bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 1, 2019 to March 11, 2020.

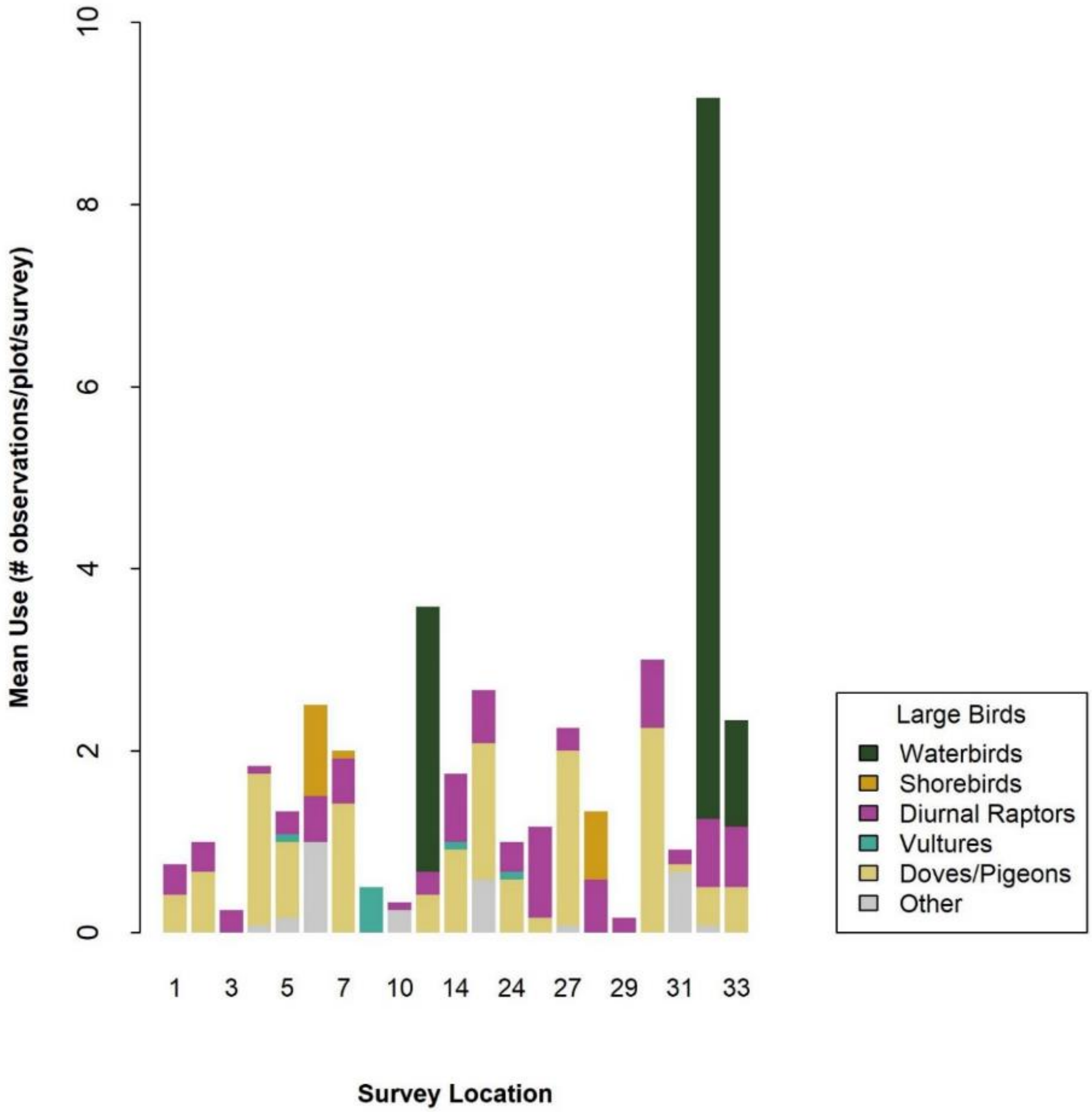

Figure 7b. Large bird mean use (# observations/plot/60 minute survey) by point by bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 25, 2020 to May 26, 2021.

Small Birds

Mean Use, Percent of Use, and Frequency of Occurrence

During Year 1, mean use, percent of use, and frequency of occurrence were calculated by season for small bird types (Figures 8a, 8b, 8c) and species (Appendix B2). Small bird mean use ranged from 2.92 observations/100-m radius plot/10-min survey to 28.81 among seasons and was highest during winter (28.81), followed by summer (7.09), spring (6.79), and fall (2.92; Figure 8a). Small bird frequency of occurrence varied among seasons with passerines most frequently observed during spring (94.7%), summer (84.0%), winter (61.3%) and fall (53.3%; Figure 8c, Appendix B2).

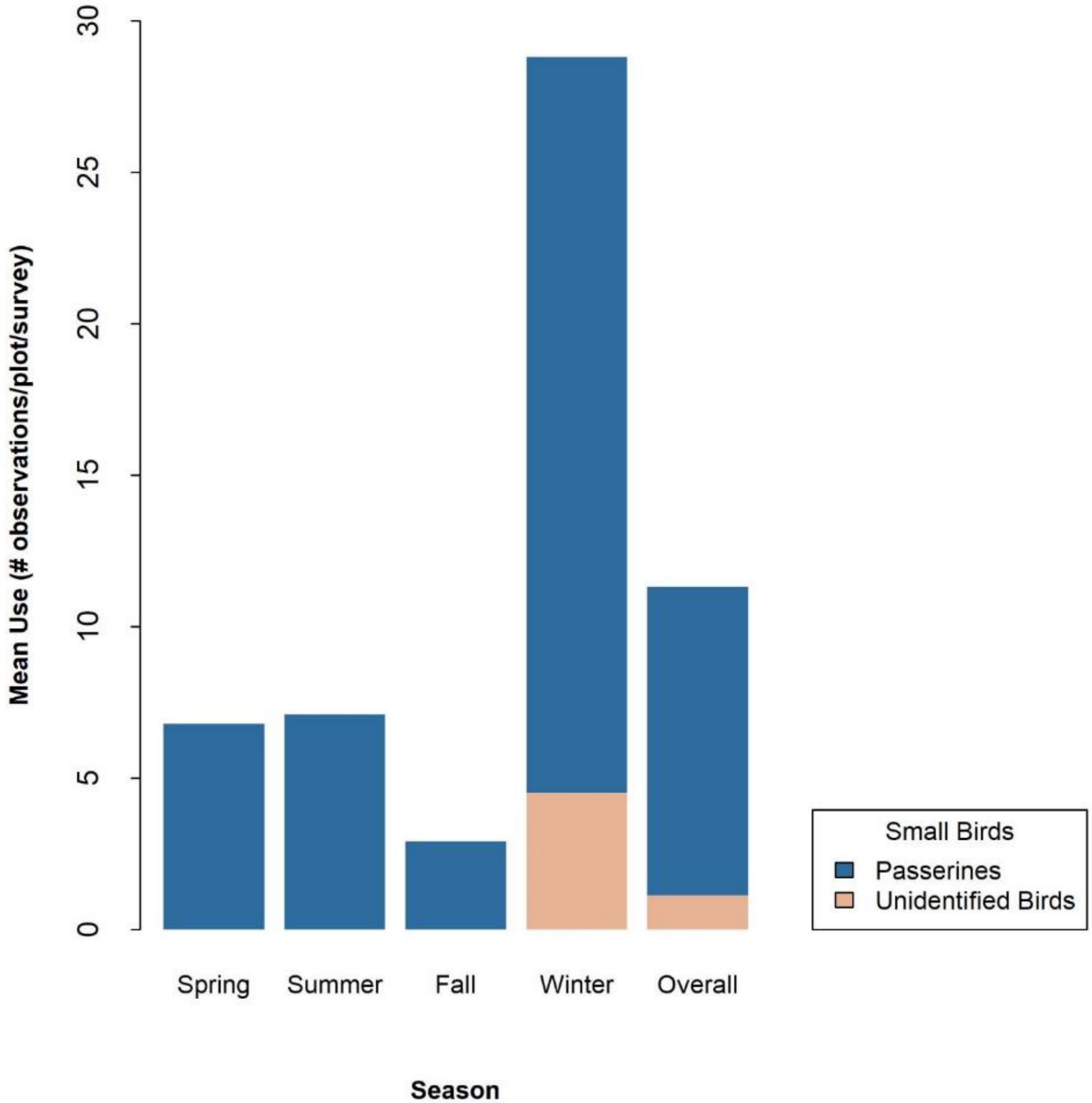

Figure 8a. Small bird mean use (observations/100-meter plot/10 minute survey) by season and bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 1, 2019 to March 11, 2020.

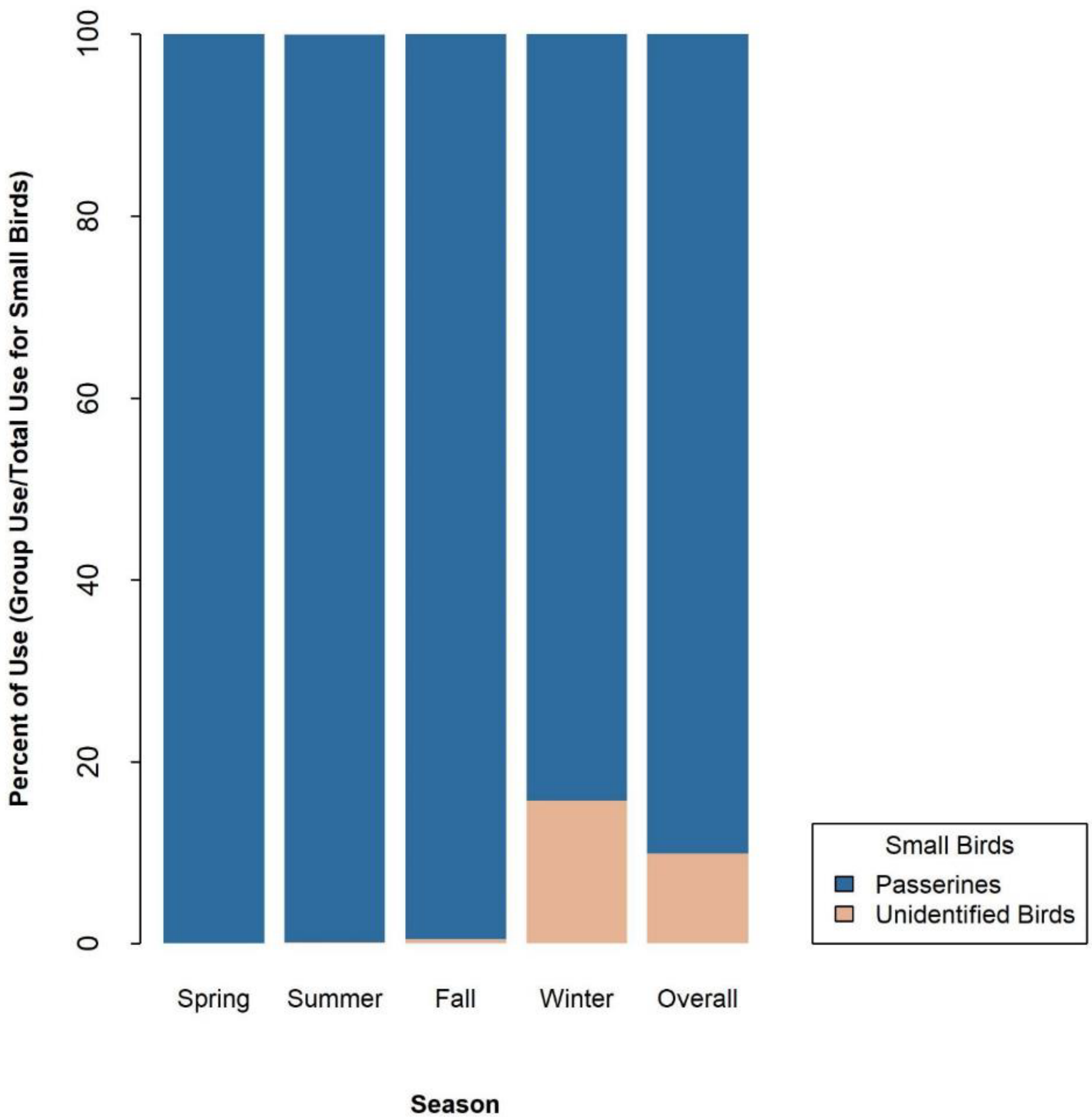

Figure 8b. Small bird percent of use by season and bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska, from April 1, 2019 to March 11, 2020.

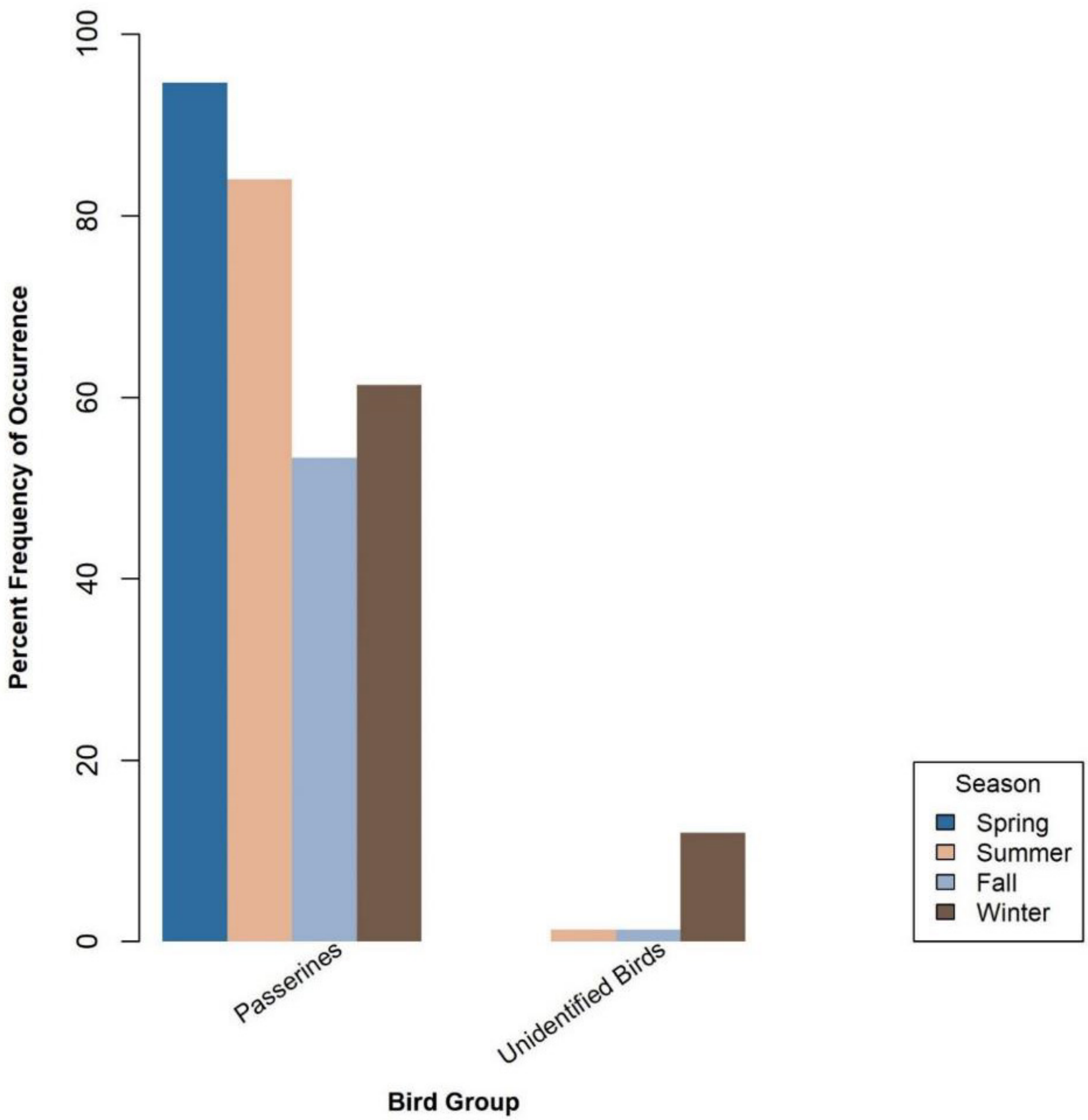

Figure 8c. Small bird frequency of occurrence by season and bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 1, 2019 to March 11, 2020.

During Year 2, mean use, percent of use, and frequency of occurrence were calculated by season for small bird types and species (Figures 8d, 8e, 8f; Appendix B). Small bird mean use ranged from 10.09 observations/100-m radius plot/10-min survey to 25.49 among seasons and was highest during fall (25.49), followed by winter (20.51), spring (17.92), and summer (10.09; Figure 8c). Small bird frequency of occurrence varied among seasons and ranged from 80.7% in the winter to 92.6% in the spring, while unidentified small bird frequency of occurrence ranged from 8.8% in spring to 19.3% in fall (Figure 8f, Appendix B). Woodpeckers were only observed during the fall and occurred during 3.5% of surveys (Figure 8f, Appendix B).

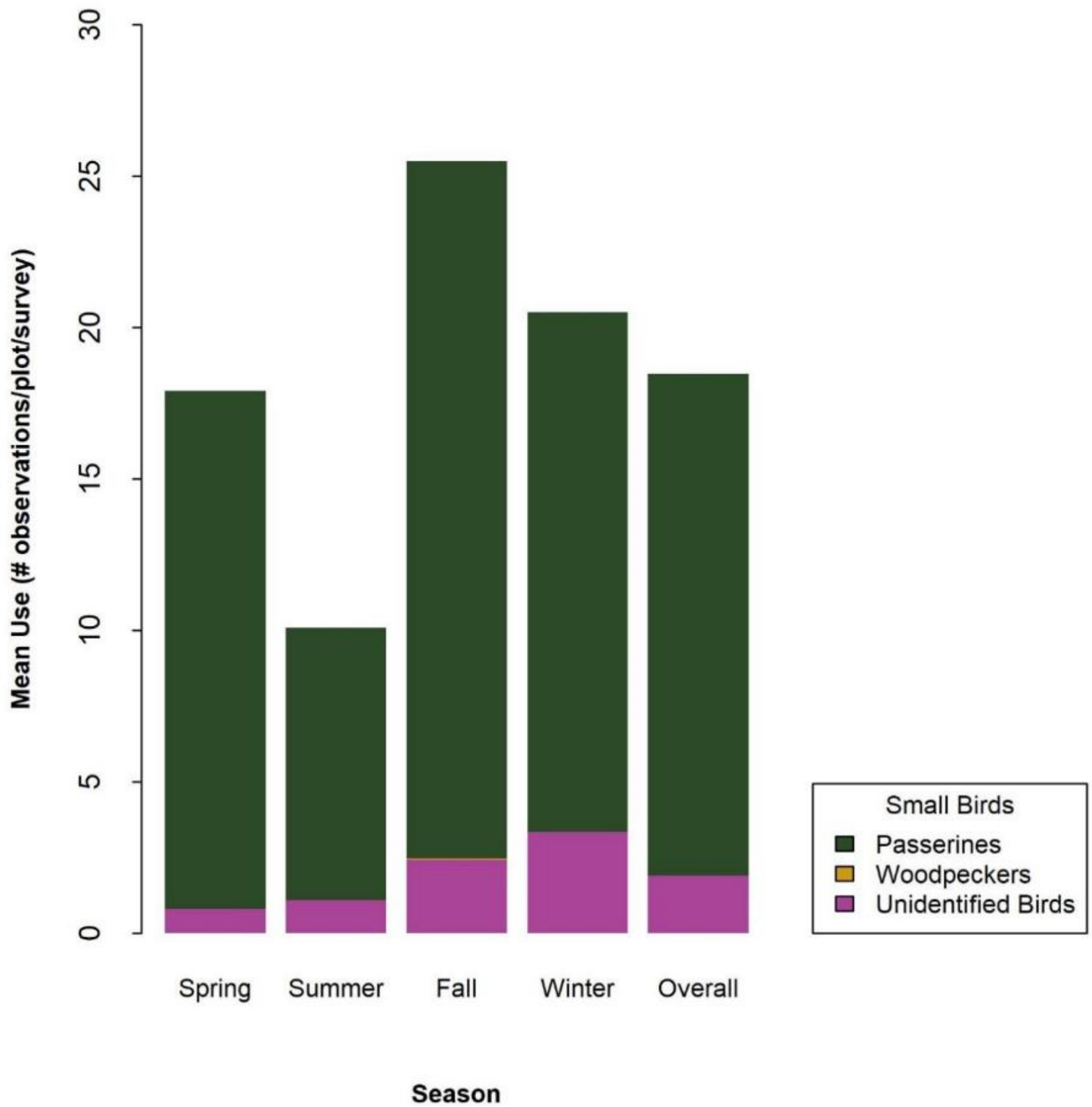

Figure 8d. Small bird mean use (observations/100-meter plot/10 minute survey) by season and bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 25, 2020 to May 26, 2021.

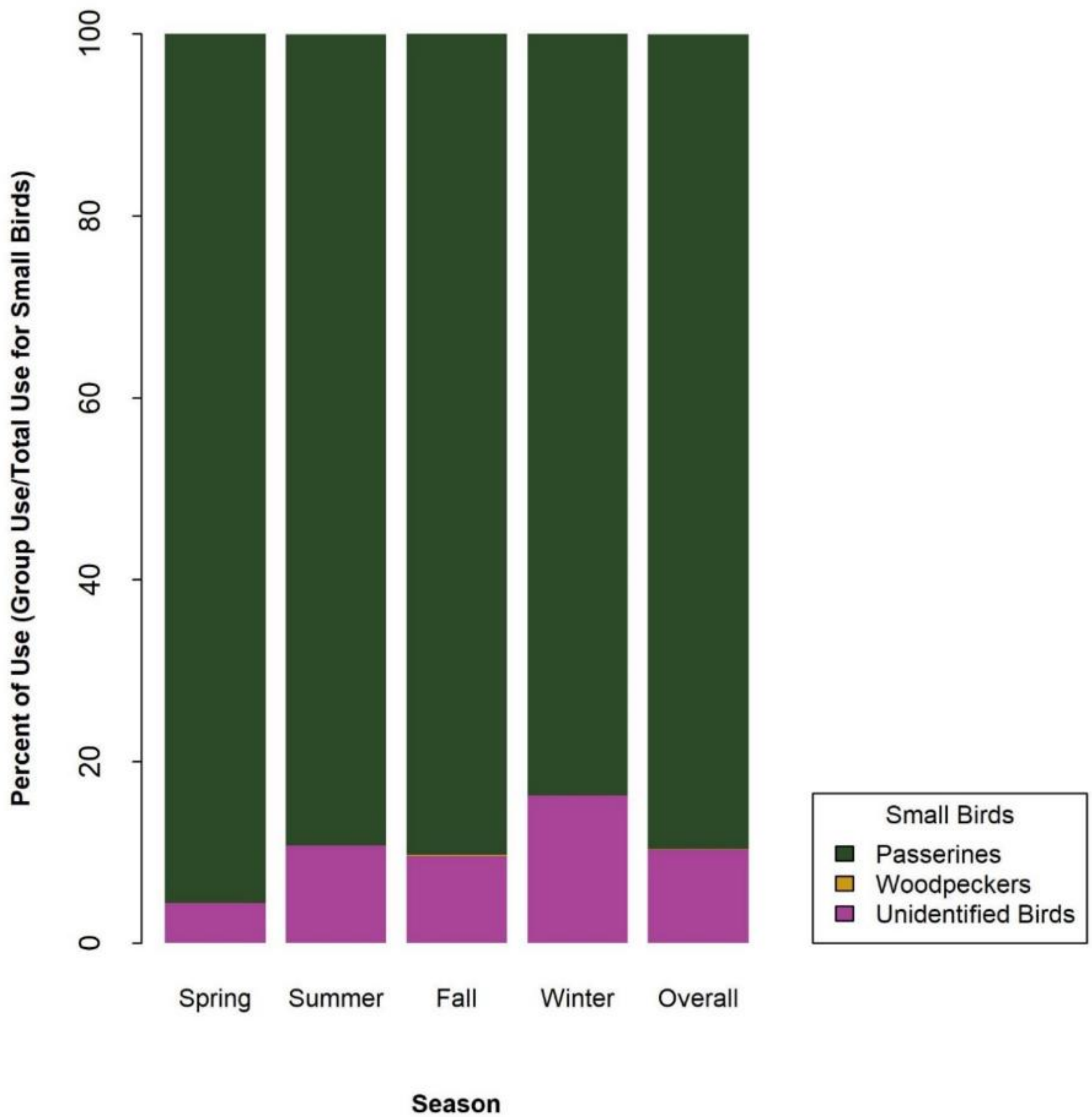

Figure 8e. Small bird percent of use by season and bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska, from April 25, 2020 to May 26, 2021.

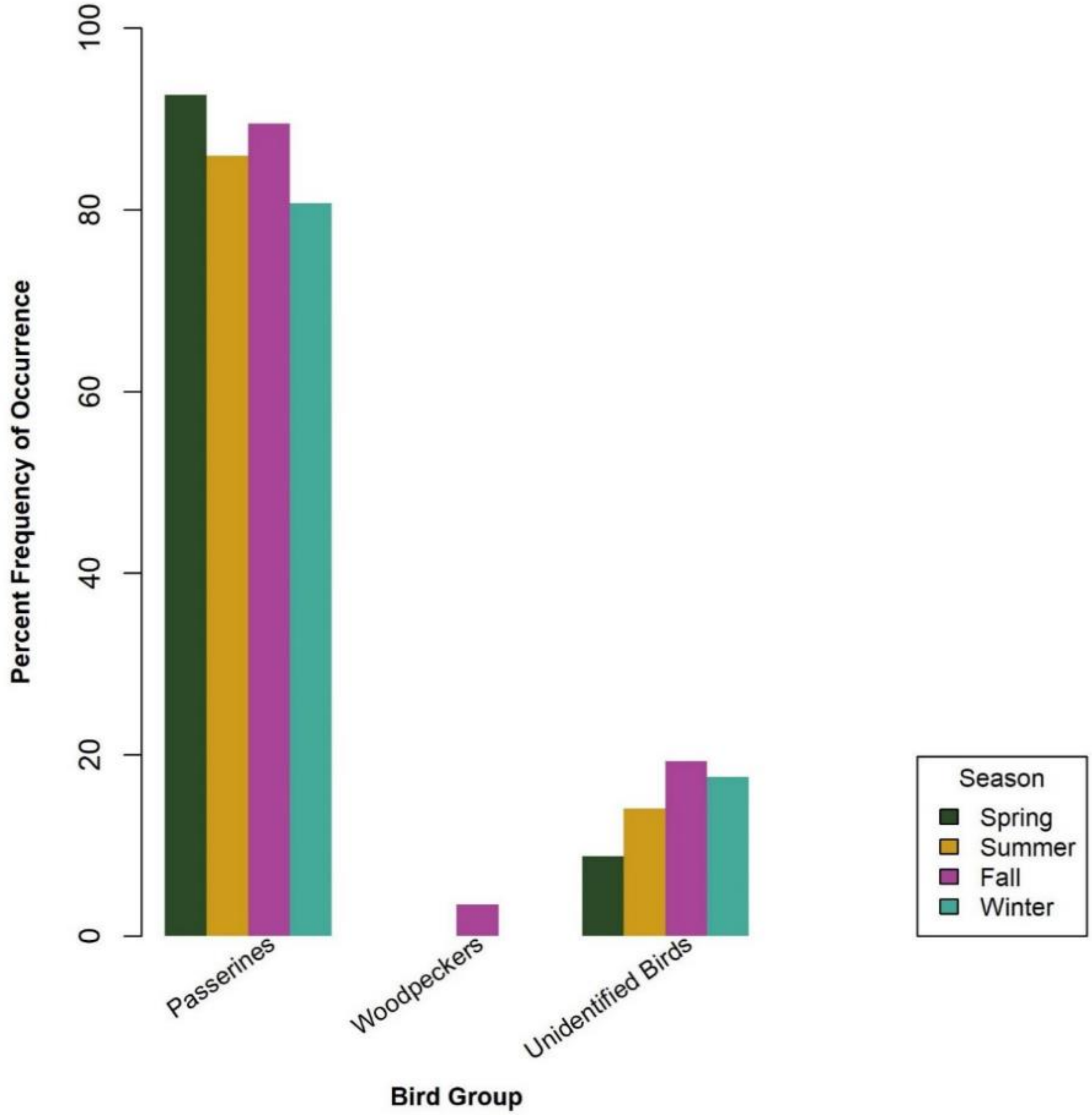

Figure 8f. Small bird frequency of occurrence by season and bird type at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 25, 2020 to May 26, 2021.

Small Bird Mean Flight Height

During Year 1, initial mean small bird flight heights ranged from 5.79 m (19.00 ft) for passerines to 11.00 m (36.09 ft) for unidentified small birds (Table 6a). Grassland/Sparrows were the most common subtype initially observed in flight (Table 6a). The vast majority (98.9%) of small birds were initially observed below the RSH (Table 6a).

Table 6a. Group and individual observation flight height characteristics by bird type[a] and passerine subtype during fixed-point bird use surveys at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 1, 2019 to March 11, 2020.

Bird Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight height Categories		
					<25 m	25−150 m[b]	> 150 m
Passerines	**322**	**2,343**	**5.79**	**76.1**	**98.8**	**1.2**	**0**
Blackbirds/Orioles	*41*	*59*	*3.95*	*21.9*	*100*	*0*	*0*
Flycatchers	*4*	*4*	*5.00*	*57.1*	*100*	*0*	*0*
Grassland/Sparrows	*261*	*2,234*	*6.25*	*81.1*	*98.7*	*1.3*	*0*
Swallows	*15*	*45*	*3.20*	*100*	*100*	*0*	*0*
Thrushes	*1*	*1*	*3.00*	*33.3*	*100*	*0*	*0*
Unidentified Birds	**13**	**339**	**11.00**	**99.1**	**100**	**0**	**0**
Small Birds Overall	**335**	**2,682**	**5.99**	**78.4**	**98.9**	**1.1**	**0**

[a] 100-meter (m; 328-foot [ft]) radius plot for small birds.

[b] The assumed rotor-swept height for potential collision with a turbine blade, or 25 to 150 m (82 to 492 ft) above ground level.

Zeroes and NA values indicate the species was observed, but was not flying.

Obs = observations.

All metrics are developed based on First Activity and First Flight Height.

During Year 2, initial mean small bird flight heights ranged from eight m (26 ft) for passerines to 20 m (66 ft) for woodpeckers (Table 6b). Thrushes (33.3%) were the most common subtype initially observed in flight (Table 6b). The vast majority (95.2%) of small birds were initially observed below the RSH (Table 6b).

Table 6b. Group and individual observation flight height characteristics by bird type[a] and passerine subtype during fixed-point bird use surveys at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 25, 2020 to May 26, 2021.

Bird Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight height Categories		
					<25 m	25−150 m[b]	> 150 m
Passerines	**643**	**3,461**	**8.00**	**88.6**	**98.2**	**1.8**	**0**
Blackbirds/Orioles	*94*	*217*	*9.00*	*58.0*	*95.4*	*4.6*	*0*
Flycatchers	*6*	*10*	*7.00*	*55.6*	*100*	*0*	*0*
Grassland/Sparrows	*519*	*3,184*	*8.00*	*92.0*	*98.6*	*1.4*	*0*
Swallows	*16*	*40*	*16.00*	*100*	*77.5*	*22.5*	*0*
Shrikes	*2*	*2*	*13.00*	*66.7*	*100*	*0*	*0*
Thrushes	*3*	*3*	*13.00*	*37.5*	*66.7*	*33.3*	*0*
Warblers	*1*	*1*	*20.00*	*100*	*100*	*0*	*0*

Table 6b. Group and individual observation flight height characteristics by bird type[a] and passerine subtype during fixed-point bird use surveys at the Pronghorn Flats Wind Energy Project, Banner County, Nebraska from April 25, 2020 to May 26, 2021.

Bird Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight height Categories		
					<25 m	25−150 m[b]	> 150 m
Woodpeckers	**1**	**1**	**20.00**	**50.0**	**100**	**0**	**0**
Unidentified Birds	**38**	**462**	**14.00**	**99.1**	**73.2**	**26.8**	**0**
Small Birds Overall	**682**	**3,924**	**8.00**	**89.7**	**95.2**	**4.8**	**0**

[a] 100-meter (m; 328-foot [ft]) radius plot for small birds.

[b] The assumed rotor-swept height for potential collision with a turbine blade, or 25 to 150 m (82 to 492 ft) above ground level.

Zeroes and NA values indicate the species was observed, but was not flying.

Obs = observations.

All metrics are developed based on First Activity and First Flight Height.

Spatial Variation

Mean Use by Point

During Year 1, small bird use ranged from 3.50 observations/100-m radius plot/10-minute survey to 104.00 across plots and was relatively uniform throughout the Project area except for Point 16, which is on the far western portion of the study area, and Point 8, which is located in the southeastern portion of the Project area (Figure 9a).

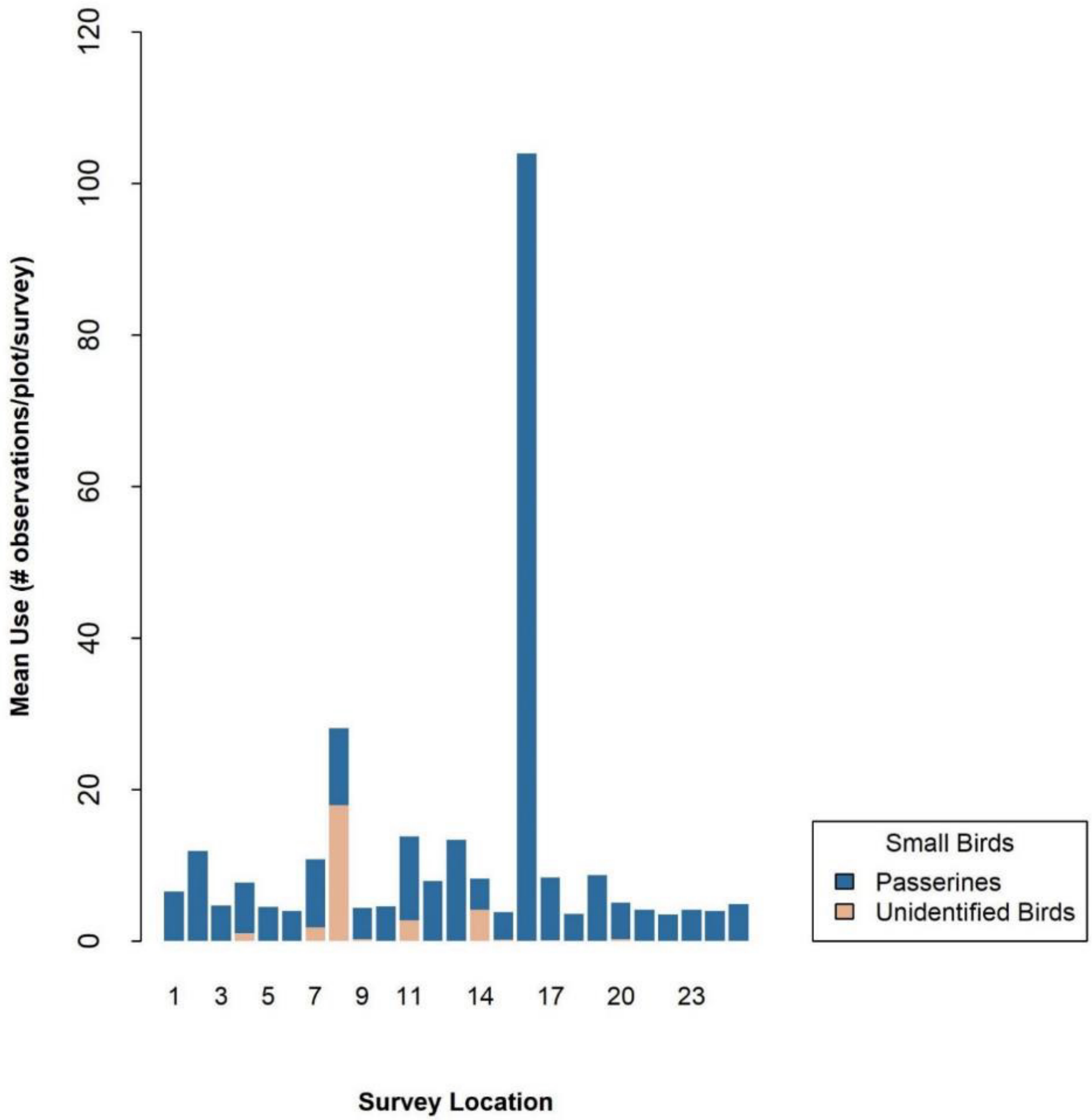

Figure 9a. Small bird mean use (observations/plot/10 minute survey) by survey point at the Pronghorn Flats Wind Energy Project area in Banner County, Nebraska from April 1, 2019 to March 11, 2020.

During Year 2, small bird use ranged from 4.00 observations/100-m radius plot/10-minute survey to 41.75 across points (Figure 9b). The highest use values were from passerines at Points 29 (41.75) and 33 (36.08), followed by Point 3 (27.08, Appendix C).

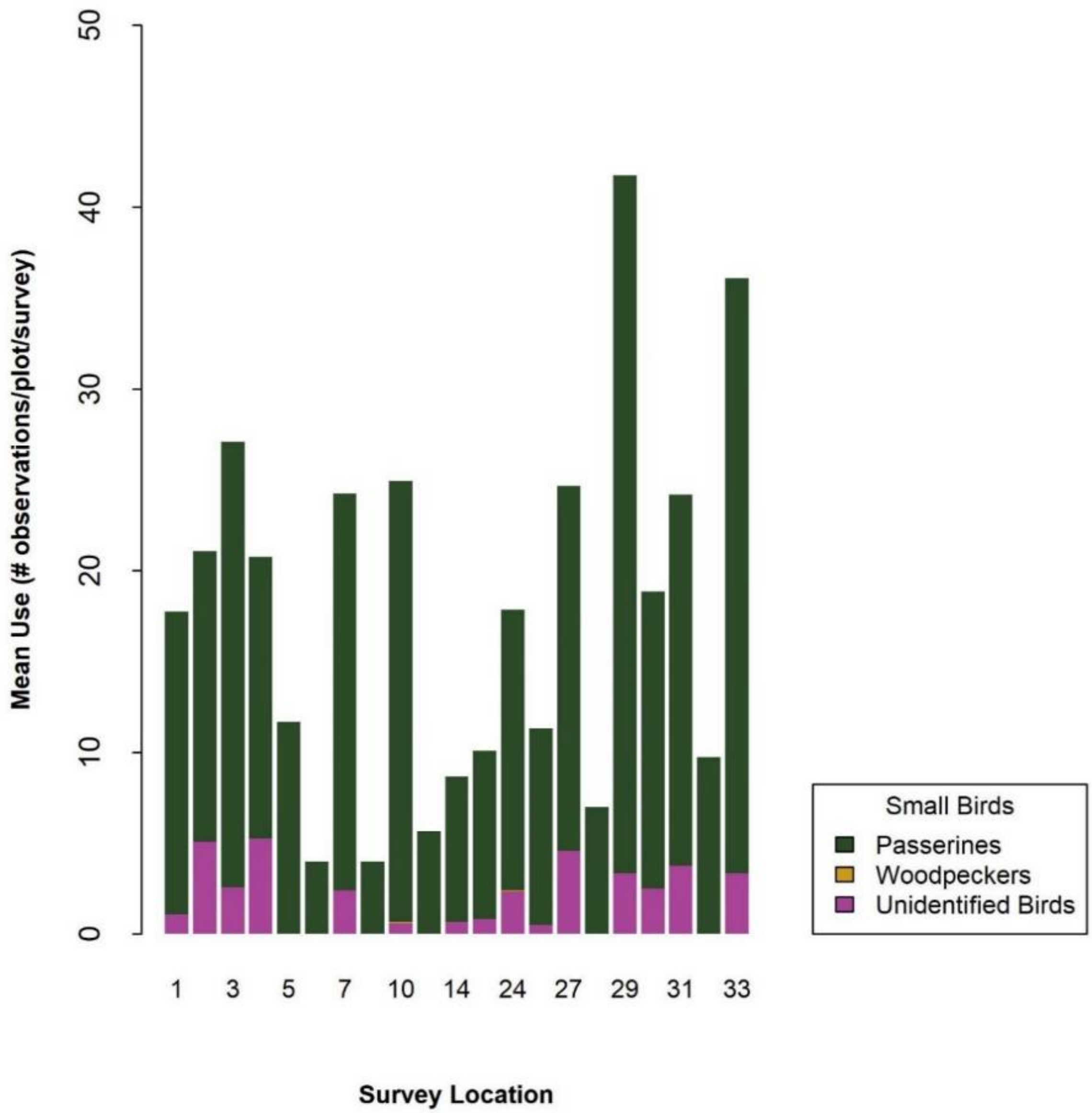

Figure 9b. Small bird mean use (observations/plot/10 minute survey) by survey point at the Pronghorn Flats Wind Energy Project area in Banner County, Nebraska from April 25, 2020 to May 26, 2021.

Incidental Observations

Over the course of two years of surveys, two special status avian species were observed incidentally and include bald eagle (one group, one individual) and golden eagle (two groups, three individuals).

SUMMARY

Special Status Species

No federally listed threatened or endangered species were recorded at the Project during surveys or incidentally during either year of surveys. One state listed species was observed during the course of more than two years of surveys: the thick-billed longspur, a state-listed threatened species, which was observed during the spring and summer of the Year 2 surveys. Both bald and golden eagles were observed during Year 1 surveys; bald eagles were observed only during the fall and spring, and golden eagles were observed during all seasons. No bald eagles were observed during the Year 2 surveys and golden eagles were observed only during the fall season.

Overall, the species composition, seasonal abundance, and spatial use patterns documented during surveys are considered typical for birds in this region. The majority of species observed are common and abundant within the region.

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Appendix A. All Bird Types and Species Observed at the Pronghorn Flats Wind Energy Project during Avian Use Surveys, April 1, 2019 to March 11, 2020 and April 25, 2020 to May 26, 2021.

Appendix A1. Summary of all groups and individual observations, regardless of distance from observer, by large bird type and species for fixed-point surveys at the Pronghorn Flats Wind Energy Project from April 1, 2019 to March 11, 2020.

		Spring		Summer		Fall		Winter		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterbirds		**0**	**0**	**0**	**0**	**5**	**163**	**0**	**0**	**5**	**163**
sandhill crane	*Antigone canadensis*	0	0	0	0	5	163	0	0	5	163
Waterfowl		**16**	**755**	**2**	**26**	**3**	**207**	**1**	**38**	**22**	**1,026**
green-winged teal	*Anas crecca*	1	2	0	0	0	0	0	0	1	2
Mallard	*Anas platyrhynchos*	3	14	0	0	0	0	0	0	3	14
Canada goose	*Branta canadensis*	11	693	1	23	1	200	1	38	14	954
cackling goose	*Branta hutchinsii*	1	46	0	0	2	7	0	0	3	53
unidentified duck		0	0	1	3	0	0	0	0	1	3
Shorebirds		**2**	**3**	**9**	**14**	**2**	**2**	**0**	**0**	**13**	**19**
Killdeer	*Charadrius vociferus*	2	3	9	14	2	2	0	0	13	19
Diurnal Raptors		**85**	**93**	**56**	**63**	**62**	**69**	**24**	**24**	**227**	**249**
Accipiters		*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*1*
Cooper's hawk	*Accipiter cooperii*	1	1	0	0	0	0	0	0	1	1
Buteos		*16*	*17*	*36*	*42*	*24*	*31*	*5*	*5*	*81*	*95*
red-tailed hawk	*Buteo jamaicensis*	4	4	4	4	7	7	0	0	15	15
rough-legged hawk	*Buteo lagopus*	0	0	0	0	2	2	5	5	7	7
unidentified buteo		2	2	3	4	4	4	0	0	9	10
Swainson's hawk	*Buteo swainsoni*	10	11	29	34	11	18	0	0	50	63
Northern Harrier		*48*	*55*	*10*	*10*	*22*	*22*	*12*	*12*	*92*	*99*
northern harrier	*Circus hudsonius*	48	55	10	10	22	22	12	12	92	99
Eagles		*8*	*8*	*5*	*5*	*3*	*3*	*1*	*1*	*17*	*17*
golden eagle	*Aquila chrysaetos*	7	7	3	3	1	1	1	1	12	12
bald eagle	*Haliaeetus leucocephalus*	1	1	0	0	2	2	0	0	3	3
unidentified eagle		0	0	2	2	0	0	0	0	2	2
Falcons		*9*	*9*	*2*	*3*	*10*	*10*	*6*	*6*	*27*	*28*
Merlin	*Falco columbarius*	0	0	0	0	4	4	4	4	8	8
American kestrel	*Falco sparverius*	7	7	2	3	6	6	1	1	16	17
unidentified falcon		2	2	0	0	0	0	1	1	3	3
Other Raptors		*3*	*3*	*3*	*3*	*3*	*3*	*0*	*0*	*9*	*9*
unidentified raptor		3	3	3	3	3	3	0	0	9	9
Vultures		**1**	**2**	**16**	**22**	**1**	**1**	**0**	**0**	**18**	**25**
turkey vulture	*Cathartes aura*	1	2	16	22	1	1	0	0	18	25
Upland Game Birds		**5**	**6**	**9**	**9**	**3**	**9**	**1**	**8**	**18**	**32**
ring-necked pheasant	*Phasianus colchicus*	3	3	8	8	3	9	0	0	14	20
sharp-tailed grouse	*Tympanuchus phasianellus*	2	3	1	1	0	0	1	8	4	12

Appendix A1. Summary of all groups and individual observations, regardless of distance from observer, by large bird type and species for fixed-point surveys at the Pronghorn Flats Wind Energy Project from April 1, 2019 to March 11, 2020.

		Spring		Summer		Fall		Winter		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Doves/Pigeons		**17**	**22**	**173**	**273**	**18**	**34**	**4**	**17**	**212**	**346**
rock pigeon	*Columba livia*	0	0	0	0	0	0	4	17	4	17
Eurasian collared-dove	*Streptopelia decaocto*	1	1	8	10	12	27	0	0	21	38
mourning dove	*Zenaida macroura*	16	21	165	263	6	7	0	0	187	291
Large Corvids		**4**	**8**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**8**
American crow	*Corvus brachyrhynchos*	3	7	0	0	0	0	0	0	3	7
common raven	*Corvus corax*	1	1	0	0	0	0	0	0	1	1
Goatsuckers		**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**
common nighthawk	*Chordeiles minor*	1	1	0	0	0	0	0	0	1	1
Overall		**131**	**890**	**265**	**407**	**94**	**485**	**30**	**87**	**520**	**1,869**

[a] grps = groups; obs = observations.

Appendix A2. Summary of all groups and individual observations, regardless of distance from observer, by small bird type and species for fixed-point surveys at the Pronghorn Flats Wind Energy Project from April 1, 2019 to March 11, 2020.

		Spring		Summer		Fall		Winter		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Passerines		**288**	**509**	**312**	**531**	**76**	**218**	**106**	**1,821**	**782**	**3,079**
Blackbirds/Orioles		*108*	*169*	*70*	*89*	*11*	*12*	*0*	*0*	*189*	*270*
red-winged blackbird	*Agelaius phoeniceus*	15	48	27	38	0	0	0	0	42	86
Brewer's blackbird	*Euphagus cyanocephalus*	2	2	1	1	0	0	0	0	3	3
common grackle	*Quiscalus quiscula*	2	4	0	0	0	0	0	0	2	4
western meadowlark	*Sturnella neglecta*	88	113	41	46	11	12	0	0	140	171
European starling	*Sturnus vulgaris*	0	0	1	4	0	0	0	0	1	4
unidentified blackbird		1	2	0	0	0	0	0	0	1	2
Flycatchers		*5*	*5*	*2*	*2*	*0*	*0*	*0*	*0*	*7*	*7*
Say's phoebe	*Sayornis saya*	1	1	0	0	0	0	0	0	1	1
western kingbird	*Tyrannus verticalis*	2	2	0	0	0	0	0	0	2	2
Cassin's kingbird	*Tyrannus vociferans*	2	2	2	2	0	0	0	0	4	4
Grassland/Sparrows		*172*	*332*	*226*	*396*	*64*	*205*	*106*	*1,821*	*568*	*2,754*
grasshopper sparrow	*Ammodramus savannarum*	0	0	19	19	0	0	0	0	19	19
lark bunting	*Calamospiza melanocorys*	9	29	97	172	3	5	0	0	109	206
Lapland longspur	*Calcarius lapponicus*	0	0	0	0	0	0	9	895	9	895
lark sparrow	*Chondestes grammacus*	1	1	0	0	0	0	0	0	1	1
horned lark	*Eremophila alpestris*	158	290	106	200	57	193	97	926	418	1,609
dark-eyed junco	*Junco hyemalis*	1	9	0	0	0	0	0	0	1	9
vesper sparrow	*Pooecetes gramineus*	1	1	0	0	2	4	0	0	3	5
chipping sparrow	*Spizella passerina*	1	1	0	0	0	0	0	0	1	1
white-crowned sparrow	*Zonotrichia leucophrys*	0	0	0	0	1	2	0	0	1	2
unidentified sparrow		1	1	4	5	1	1	0	0	6	7
Swallows		*1*	*1*	*13*	*43*	*1*	*1*	*0*	*0*	*15*	*45*
barn swallow	*Hirundo rustica*	1	1	6	7	1	1	0	0	8	9
cliff swallow	*Petrochelidon pyrrhonota*	0	0	6	33	0	0	0	0	6	33
tree swallow	*Tachycineta bicolor*	0	0	1	3	0	0	0	0	1	3
Thrushes		*2*	*2*	*1*	*1*	*0*	*0*	*0*	*0*	*3*	*3*
American robin	*Turdus migratorius*	2	2	1	1	0	0	0	0	3	3
Unidentified Birds		**0**	**0**	**1**	**1**	**1**	**1**	**14**	**340**	**16**	**342**
unidentified small bird		0	0	1	1	1	1	14	340	16	342
Overall		**288**	**509**	**313**	**532**	**77**	**219**	**120**	**2,161**	**798**	**3,421**

grps = groups; obs = observations.

Appendix A3. Summary of all groups and individual observations, regardless of distance from observer, by large bird type and species during avian bird surveys at the Pronghorn Flats Wind Energy Project from April 25, 2020 to May 26, 2021.

Type/Species	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
Waterbirds		**0**	**0**	**0**	**0**	**3**	**144**	**0**	**0**	**3**	**144**
sandhill crane	*Antigone canadensis*	0	0	0	0	3	144	0	0	3	144
Shorebirds		**2**	**2**	**2**	**10**	**0**	**0**	**0**	**0**	**4**	**12**
upland sandpiper	*Bartramia longicauda*	0	0	1	1	0	0	0	0	1	1
killdeer	*Charadrius vociferus*	2	2	0	0	0	0	0	0	2	2
long-billed curlew	*Numenius americanus*	0	0	1	9	0	0	0	0	1	9
Diurnal Raptors		**28**	**30**	**24**	**29**	**24**	**26**	**13**	**13**	**89**	**98**
Accipiters		*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*1*
sharp-shinned hawk	*Accipiter striatus*	1	1	0	0	0	0	0	0	1	1
Buteos		*11*	*12*	*14*	*17*	*9*	*9*	*4*	*4*	*38*	*42*
red-tailed hawk	*Buteo jamaicensis*	2	2	2	2	5	5	2	2	11	11
rough-legged hawk	*Buteo lagopus*	1	1	0	0	0	0	2	2	3	3
ferruginous hawk	*Buteo regalis*	0	0	0	0	2	2	0	0	2	2
unidentified buteo		1	1	0	0	0	0	0	0	1	1
Swainson’s hawk	*Buteo swainsoni*	7	8	12	15	2	2	0	0	21	25
Northern Harrier		*11*	*12*	*3*	*3*	*5*	*6*	*5*	*5*	*24*	*26*
northern harrier	*Circus hudsonius*	11	12	3	3	5	6	5	5	24	26
Eagles		*0*	*0*	*0*	*0*	*2*	*2*	*0*	*0*	*2*	*2*
golden eagle	*Aquila chrysaetos*	0	0	0	0	2	2	0	0	2	2
Falcons		*5*	*5*	*7*	*9*	*8*	*9*	*4*	*4*	*24*	*27*
merlin	*Falco columbarius*	0	0	0	0	1	1	0	0	1	1
prairie falcon	*Falco mexicanus*	1	1	1	1	3	4	3	3	8	9
American kestrel	*Falco sparverius*	4	4	6	8	4	4	1	1	15	17
Owls		**1**	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**2**	**2**
burrowing owl	*Athene cunicularia*	1	1	0	0	1	1	0	0	2	2
Vultures		**2**	**2**	**2**	**2**	**0**	**0**	**0**	**0**	**4**	**4**
turkey vulture	*Cathartes aura*	2	2	2	2	0	0	0	0	4	4
Upland Game Birds		**5**	**17**	**3**	**4**	**1**	**1**	**0**	**0**	**9**	**22**
ring-necked pheasant	*Phasianus colchicus*	1	1	0	0	1	1	0	0	2	2
sharp-tailed grouse	*Tympanuchus phasianellus*	4	16	3	4	0	0	0	0	7	20
Doves/Pigeons		**10**	**21**	**57**	**128**	**6**	**16**	**0**	**0**	**73**	**165**
Eurasian collared-dove	*Streptopelia decaocto*	0	0	1	1	0	0	0	0	1	1
mourning dove	*Zenaida macroura*	10	21	56	127	6	16	0	0	72	164

Appendix A3. Summary of all groups and individual observations, regardless of distance from observer, by large bird type and species during avian bird surveys at the Pronghorn Flats Wind Energy Project from April 25, 2020 to May 26, 2021.

		Spring		Summer		Fall		Winter		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Large Corvids		**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**
American crow	*Corvus brachyrhynchos*	1	1	0	0	0	0	0	0	1	1
Overall		**49**	**74**	**88**	**173**	**35**	**188**	**13**	**13**	**185**	**448**

[a] grps = groups; obs = observations.

Appendix A4. Summary of all groups and individual observations, regardless of distance from observer, by small bird type and species during avian bird surveys at the Pronghorn Flats Wind Energy Project from April 25, 2020 to May 26, 2021.

		Spring		Summer		Fall		Winter		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Passerines		**326**	**1,105**	**212**	**513**	**238**	**1,312**	**139**	**979**	**915**	**3,909**
Passerines(Subtype)		*0*	*0*	*2*	*4*	*0*	*0*	*0*	*0*	*2*	*4*
unidentified passerine		0	0	2	4	0	0	0	0	2	4
Blackbirds/Orioles		*85*	*140*	*78*	*109*	*42*	*119*	*6*	*6*	*211*	*374*
red-winged blackbird	*Agelaius phoeniceus*	9	20	12	16	0	0	0	0	21	36
Brewer's blackbird	*Euphagus cyanocephalus*	0	0	1	1	1	50	0	0	2	51
common grackle	*Quiscalus quiscula*	3	8	0	0	0	0	0	0	3	8
western meadowlark	*Sturnella neglecta*	71	110	65	92	41	69	6	6	183	277
European starling	*Sturnus vulgaris*	1	1	0	0	0	0	0	0	1	1
unidentified blackbird		1	1	0	0	0	0	0	0	1	1
Flycatchers		*2*	*3*	*8*	*15*	*0*	*0*	*0*	*0*	*10*	*18*
Say's phoebe	*Sayornis saya*	1	1	0	0	0	0	0	0	1	1
western kingbird	*Tyrannus verticalis*	1	2	7	14	0	0	0	0	8	16
Cassin's kingbird	*Tyrannus vociferans*	0	0	1	1	0	0	0	0	1	1
Grassland/Sparrows		*230*	*941*	*108*	*354*	*195*	*1,192*	*133*	*973*	*666*	*3,460*
grasshopper sparrow	*Ammodramus savannarum*	1	1	0	0	0	0	0	0	1	1
lark bunting	*Calamospiza melanocorys*	27	47	33	155	0	0	0	0	60	202
Lapland longspur	*Calcarius lapponicus*	23	177	0	0	8	58	0	0	31	235
chestnut-collared longspur	*Calcarius ornatus*	1	6	1	2	0	0	0	0	2	8
lark sparrow	*Chondestes grammacus*	1	1	3	4	0	0	0	0	4	5
horned lark	*Eremophila alpestris*	165	692	63	174	174	1,103	130	967	532	2,936
vesper sparrow	*Pooecetes gramineus*	7	8	4	7	7	16	0	0	18	31
thick-billed longspur	*Rhynchophanes mccownii*	1	1	1	3	0	0	0	0	2	4
clay-colored sparrow	*Spizella pallida*	0	0	1	6	2	5	0	0	3	11
chipping sparrow	*Spizella passerina*	0	0	0	0	0	0	1	1	1	1
American tree sparrow	*Spizelloides arborea*	4	8	0	0	0	0	0	0	4	8
white-crowned sparrow	*Zonotrichia leucophrys*	0	0	0	0	2	7	1	3	3	10
unidentified sparrow		0	0	2	3	2	3	1	2	5	8
Swallows		*6*	*15*	*11*	*26*	*0*	*0*	*0*	*0*	*17*	*41*
barn swallow	*Hirundo rustica*	6	15	11	26	0	0	0	0	17	41
Shrikes		*0*	*0*	*3*	*3*	*0*	*0*	*0*	*0*	*3*	*3*
loggerhead shrike	*Lanius ludovicianus*	0	0	3	3	0	0	0	0	3	3
Thrushes		*3*	*6*	*2*	*2*	*0*	*0*	*0*	*0*	*5*	*8*
American robin	*Turdus migratorius*	3	6	2	2	0	0	0	0	5	8
Warblers		*0*	*0*	*0*	*0*	*1*	*1*	*0*	*0*	*1*	*1*
Wilson's warbler	*Cardellina pusilla*	0	0	0	0	1	1	0	0	1	1

Appendix A4. Summary of all groups and individual observations, regardless of distance from observer, by small bird type and species during avian bird surveys at the Pronghorn Flats Wind Energy Project from April 25, 2020 to May 26, 2021.

		Spring		Summer		Fall		Winter		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Woodpeckers		**0**	**0**	**0**	**0**	**2**	**2**	**0**	**0**	**2**	**2**
northern flicker	*Colaptes auratus*	0	0	0	0	2	2	0	0	2	2
Unidentified Birds		**8**	**75**	**10**	**62**	**12**	**139**	**11**	**190**	**41**	**466**
unidentified small bird		8	75	10	62	12	139	11	190	41	466
Overall		**334**	**1,180**	**222**	**575**	**252**	**1,453**	**150**	**1,169**	**958**	**4,377**

[a] grps = groups; obs = observations.

Appendix B. Bird Use, Percent of Use, and Frequency of Occurrence for Large Birds and Small Birds Observed during Avian Use Surveys at the Pronghorn Flats Wind Energy Project from April 1, 2019 to March 11, 2020 and April 25, 2020 to May 26, 2021.

Appendix B1. Mean large birds use (number of large birds/plot[a]/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species by season during the fixed-point bird use surveys at the Pronghorn Flats Wind Energy Project from April 1, 2019 to March 11, 2020.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Waterbirds	**0**	**0**	**2.17**	**0**	**0**	**0**	**33.6**	**0**	**0**	**0**	**5.3**	**0**
sandhill crane	0	0	2.17	0	0	0	33.6	0	0	0	5.3	0
Waterfowl	**10.07**	**0.35**	**2.76**	**0.51**	**85.1**	**6.5**	**42.7**	**43.7**	**10.7**	**2.7**	**4.0**	**1.3**
green-winged teal	0.03	0	0	0	0.2	0	0	0	1.3	0	0	0
mallard	0.19	0	0	0	1.6	0	0	0	2.7	0	0	0
Canada goose	9.24	0.31	2.67	0.51	78.1	5.7	41.2	43.7	8.0	1.3	1.3	1.3
cackling goose	0.61	0	0.09	0	5.2	0	1.4	0	1.3	0	2.7	0
unidentified duck	0	0.04	0	0	0	0.7	0	0	0	1.3	0	0
Shorebirds	**0.04**	**0.19**	**0.03**	**0**	**0.3**	**3.5**	**0.4**	**0**	**1.3**	**8.0**	**2.7**	**0**
killdeer	0.04	0.19	0.03	0	0.3	3.5	0.4	0	1.3	8.0	2.7	0
Diurnal Raptors	**1.20**	**0.79**	**0.92**	**0.32**	**10.1**	**14.6**	**14.2**	**27.6**	**58.7**	**46.7**	**61.3**	**24.0**
Accipiters	*0.01*	*0*	*0*	*0*	*0.1*	*0*	*0*	*0*	*1.3*	*0*	*0*	*0*
Cooper's hawk	0.01	0	0	0	0.1	0	0	0	1.3	0	0	0
Buteos	*0.23*	*0.56*	*0.41*	*0.07*	*1.9*	*10.4*	*6.4*	*5.7*	*14.7*	*38.7*	*25.3*	*6.7*
red-tailed hawk	0.05	0.05	0.09	0	0.5	1.0	1.4	0	5.3	5.3	9.3	0
rough-legged hawk	0	0	0.03	0.07	0	0	0.4	5.7	0	0	2.7	6.7
unidentified buteo	0.03	0.05	0.05	0	0.2	1.0	0.8	0	2.7	2.7	5.3	0
Swainson's hawk	0.15	0.45	0.24	0	1.2	8.4	3.7	0	9.3	32.0	12.0	0
Northern Harrier	*0.73*	*0.13*	*0.29*	*0.16*	*6.2*	*2.5*	*4.5*	*13.8*	*41.3*	*10.7*	*29.3*	*13.3*
northern harrier	0.73	0.13	0.29	0.16	6.2	2.5	4.5	13.8	41.3	10.7	29.3	13.3
Eagles	*0.07*	*0.01*	*0.04*	*0.01*	*0.6*	*0.2*	*0.6*	*1.1*	*5.3*	*1.3*	*4.0*	*1.3*
golden eagle	0.07	0.01	0.01	0.01	0.6	0.2	0.2	1.1	5.3	1.3	1.3	1.3
bald eagle	0	0	0.03	0	0	0	0.4	0	0	0	2.7	0
Falcons	*0.12*	*0.04*	*0.13*	*0.08*	*1.0*	*0.7*	*2.1*	*6.9*	*12.0*	*2.7*	*13.3*	*8.0*
merlin	0	0	0.05	0.05	0	0	0.8	4.6	0	0	5.3	5.3
American kestrel	0.09	0.04	0.08	0.01	0.8	0.7	1.2	1.1	9.3	2.7	8.0	1.3
unidentified falcon	0.03	0	0	0.01	0.2	0	0	1.1	2.7	0	0	1.3
Other Raptors	*0.04*	*0.04*	*0.04*	*0*	*0.3*	*0.7*	*0.6*	*0*	*4.0*	*2.7*	*4.0*	*0*
unidentified raptor	0.04	0.04	0.04	0	0.3	0.7	0.6	0	4.0	2.7	4.0	0
Vultures	**0.03**	**0.29**	**0.01**	**0**	**0.2**	**5.5**	**0.2**	**0**	**1.3**	**12.0**	**1.3**	**0**
turkey vulture	0.03	0.29	0.01	0	0.2	5.5	0.2	0	1.3	12.0	1.3	0
Upland Game Birds	**0.08**	**0.12**	**0.12**	**0.11**	**0.7**	**2.2**	**1.9**	**9.2**	**6.7**	**12.0**	**2.7**	**1.3**
ring-necked pheasant	0.04	0.11	0.12	0	0.3	2.0	1.9	0	4.0	10.7	2.7	0
sharp-tailed grouse	0.04	0.01	0	0.11	0.3	0.2	0	9.2	2.7	1.3	0	1.3

Appendix B1. Mean large birds use (number of large birds/plot[a]/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species by season during the fixed-point bird use surveys at the Pronghorn Flats Wind Energy Project from April 1, 2019 to March 11, 2020.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Doves/Pigeons	**0.29**	**3.64**	**0.45**	**0.23**	**2.5**	**67.7**	**7.0**	**19.5**	**16.0**	**86.7**	**16.0**	**2.7**
rock pigeon	0	0	0	0.23	0	0	0	19.5	0	0	0	2.7
Eurasian collared-dove	0.01	0.13	0.36	0	0.1	2.5	5.6	0	1.3	9.3	12.0	0
mourning dove	0.28	3.51	0.09	0	2.4	65.3	1.4	0	14.7	82.7	8.0	0
Large Corvids	**0.11**	**0**	**0**	**0**	**0.9**	**0**	**0**	**0**	**5.3**	**0**	**0**	**0**
American crow	0.09	0	0	0	0.8	0	0	0	4.0	0	0	0
common raven	0.01	0	0	0	0.1	0	0	0	1.3	0	0	0
Goatsuckers	**0.01**	**0**	**0**	**0**	**0.1**	**0**	**0**	**0**	**1.3**	**0**	**0**	**0**
common nighthawk	0.01	0	0	0	0.1	0	0	0	1.3	0	0	0
Overall	**11.83**	**5.37**	**6.47**	**1.16**	**100**	**100**	**100**	**100**				

[a] 800-meter (2,625 foot) radius plot for large birds

Sums of values may not equal totals shown due to rounding.

Appendix B2. Mean small birds use (number of small birds/plot[a]/10-minute survey), percent of total use (%), and frequency of occurrence (%) for each small bird type and species by season during the fixed-point bird use surveys at the Pronghorn Flats Wind Energy Project from April 1, 2019 to March 11, 2020.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Passerines	**6.79**	**7.08**	**2.91**	**24.28**	**100**	**99.8**	**99.5**	**84.3**	**94.7**	**84.0**	**53.3**	**61.3**
Blackbirds/Orioles	*2.25*	*1.19*	*0.16*	*0*	*33.2*	*16.7*	*5.5*	*0*	*66.7*	*50.7*	*9.3*	*0*
red-winged blackbird	0.64	0.51	0	0	9.4	7.1	0	0	17.3	20.0	0	0
Brewer's blackbird	0.03	0.01	0	0	0.4	0.2	0	0	2.7	1.3	0	0
common grackle	0.05	0	0	0	0.8	0	0	0	2.7	0	0	0
western meadowlark	1.51	0.61	0.16	0	22.2	8.6	5.5	0	61.3	40.0	9.3	0
European starling	0	0.05	0	0	0	0.8	0	0	0	1.3	0	0
unidentified blackbird	0.03	0	0	0	0.4	0	0	0	1.3	0	0	0
Flycatchers	*0.07*	*0.03*	*0*	*0*	*1.0*	*0.4*	*0*	*0*	*5.3*	*1.3*	*0*	*0*
Say's phoebe	0.01	0	0	0	0.2	0	0	0	1.3	0	0	0
western kingbird	0.03	0	0	0	0.4	0	0	0	2.7	0	0	0
Cassin's kingbird	0.03	0.03	0	0	0.4	0.4	0	0	1.3	1.3	0	0
Grassland/Sparrows	*4.43*	*5.28*	*2.73*	*24.28*	*65.2*	*74.4*	*93.6*	*84.3*	*90.7*	*82.7*	*48.0*	*61.3*
grasshopper sparrow	0	0.25	0	0	0	3.6	0	0	0	17.3	0	0
lark bunting	0.39	2.29	0.07	0	5.7	32.3	2.3	0	8.0	53.3	4.0	0
Lapland longspur	0	0	0	11.93	0	0	0	41.4	0	0	0	9.3
lark sparrow	0.01	0	0	0	0.2	0	0	0	1.3	0	0	0
horned lark	3.87	2.67	2.57	12.35	57.0	37.6	88.1	42.9	88.0	65.3	44.0	61.3
dark-eyed junco	0.12	0	0	0	1.8	0	0	0	1.3	0	0	0
vesper sparrow	0.01	0	0.05	0	0.2	0	1.8	0	1.3	0	2.7	0
chipping sparrow	0.01	0	0	0	0.2	0	0	0	1.3	0	0	0
white-crowned sparrow	0	0	0.03	0	0	0	0.9	0	0	0	1.3	0
unidentified sparrow	0.01	0.07	0.01	0	0.2	0.9	0.5	0	1.3	5.3	1.3	0
Swallows	*0.01*	*0.57*	*0.01*	*0*	*0.2*	*8.1*	*0.5*	*0*	*1.3*	*9.3*	*1.3*	*0*
barn swallow	0.01	0.09	0.01	0	0.2	1.3	0.5	0	1.3	5.3	1.3	0
cliff swallow	0	0.44	0	0	0	6.2	0	0	0	5.3	0	0
tree swallow	0	0.04	0	0	0	0.6	0	0	0	1.3	0	0
Thrushes	*0.03*	*0.01*	*0*	*0*	*0.4*	*0.2*	*0*	*0*	*2.7*	*1.3*	*0*	*0*
American robin	0.03	0.01	0	0	0.4	0.2	0	0	2.7	1.3	0	0
Unidentified Birds	**0**	**0.01**	**0.01**	**4.53**	**0**	**0.2**	**0.5**	**15.7**	**0**	**1.3**	**1.3**	**12.0**
unidentified small bird	0	0.01	0.01	4.53	0	0.2	0.5	15.7	0	1.3	1.3	12.0
Overall	**6.79**	**7.09**	**2.92**	**28.81**	**100**	**100**	**100**	**100**				

[a] 100-meter (328 foot) radius plot for small birds. Sums of values may not equal totals shown due to rounding.

Appendix B3. Mean large birds use (number of large birds/plot[a]/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species by season during avian bird use surveys at the Pronghorn Flats Wind Energy Project from April 25, 2020 to May 26, 2021.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Waterbirds	**0**	**0**	**2.53**	**0**	**0**	**0**	**76.6**	**0**	**0**	**0**	**5.3**	**0**
sandhill crane	0	0	2.53	0	0	0	76.6	0	0	0	5.3	0
Shorebirds	**0.02**	**0.18**	**0**	**0**	**1.2**	**5.8**	**0**	**0**	**1.2**	**3.5**	**0**	**0**
upland sandpiper	0	0.02	0	0	0	0.6	0	0	0	1.8	0	0
killdeer	0.02	0	0	0	1.2	0	0	0	1.2	0	0	0
long-billed curlew	0	0.16	0	0	0	5.2	0	0	0	1.8	0	0
Diurnal Raptors	**0.65**	**0.51**	**0.46**	**0.23**	**34.5**	**16.8**	**13.8**	**100**	**42.0**	**33.3**	**35.1**	**21.1**
Accipiters	*0.01*	*0*	*0*	*0*	*0.6*	*0*	*0*	*0*	*1.2*	*0*	*0*	*0*
sharp-shinned hawk	0.01	0	0	0	0.6	0	0	0	1.2	0	0	0
Buteos	*0.33*	*0.30*	*0.16*	*0.07*	*17.5*	*9.8*	*4.8*	*30.8*	*21.8*	*21.1*	*14.0*	*7.0*
red-tailed hawk	0.02	0.04	0.09	0.04	1.2	1.2	2.7	15.4	1.2	3.5	8.8	3.5
rough-legged hawk	0.01	0	0	0.04	0.6	0	0	15.4	1.1	0	0	3.5
ferruginous hawk	0	0	0.04	0	0	0	1.1	0	0	0	3.5	0
unidentified buteo	0.01	0	0	0	0.6	0	0	0	1.1	0	0	0
Swainson's hawk	0.29	0.26	0.04	0	15.1	8.7	1.1	0	18.5	19.3	3.5	0
Northern Harrier	*0.14*	*0.05*	*0.11*	*0.09*	*7.3*	*1.7*	*3.2*	*38.5*	*9.2*	*5.3*	*8.8*	*8.8*
northern harrier	0.14	0.05	0.11	0.09	7.3	1.7	3.2	38.5	9.2	5.3	8.8	8.8
Eagles	*0*	*0*	*0.04*	*0*	*0*	*0*	*1.1*	*0*	*0*	*0*	*3.5*	*0*
golden eagle	0	0	0.04	0	0	0	1.1	0	0	0	3.5	0
Falcons	*0.17*	*0.16*	*0.16*	*0.07*	*9.1*	*5.2*	*4.8*	*30.8*	*17.1*	*12.3*	*14.0*	*7.0*
merlin	0	0	0.02	0	0	0	0.5	0	0	0	1.8	0
prairie falcon	0.01	0.02	0.07	0.05	0.6	0.6	2.1	23.1	1.1	1.8	5.3	5.3
American kestrel	0.16	0.14	0.07	0.02	8.5	4.6	2.1	7.7	16.1	10.5	7.0	1.8
Owls	**0.01**	**0**	**0.02**	**0**	**0.6**	**0**	**0.5**	**0**	**1.2**	**0**	**1.8**	**0**
burrowing owl	0.01	0	0.02	0	0.6	0	0.5	0	1.2	0	1.8	0
Vultures	**0.02**	**0.04**	**0**	**0**	**1.2**	**1.2**	**0**	**0**	**2.4**	**3.5**	**0**	**0**
turkey vulture	0.02	0.04	0	0	1.2	1.2	0	0	2.4	3.5	0	0
Upland Game Birds	**0.50**	**0.07**	**0.02**	**0**	**26.4**	**2.3**	**0.5**	**0**	**13.4**	**5.3**	**1.8**	**0**
ring-necked pheasant	0.01	0	0.02	0	0.6	0	0.5	0	1.2	0	1.8	0
sharp-tailed grouse	0.49	0.07	0	0	25.8	2.3	0	0	12.2	5.3	0	0
Doves/Pigeons	**0.67**	**2.25**	**0.28**	**0**	**35.4**	**74.0**	**8.5**	**0**	**19.7**	**50.9**	**7.0**	**0**
Eurasian collared-dove	0	0.02	0	0	0	0.6	0	0	0	1.8	0	0
mourning dove	0.67	2.23	0.28	0	35.4	73.4	8.5	0	19.7	50.9	7.0	0

Appendix B3. Mean large birds use (number of large birds/plot[a]/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species by season during avian bird use surveys at the Pronghorn Flats Wind Energy Project from April 25, 2020 to May 26, 2021.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Large Corvids	**0.01**	**0**	**0**	**0**	**0.6**	**0**	**0**	**0**	**1.2**	**0**	**0**	**0**
American crow	0.01	0	0	0	0.6	0	0	0	1.2	0	0	0
Overall	**1.89**	**3.04**	**3.30**	**0.23**	**100**	**100**	**100**	**100**	**NA**	**NA**	**NA**	**NA**

[a] 800-meter (2,625 foot) radius plot for large birds.

Sums of values may not equal totals shown due to rounding.

Appendix B4. Mean small birds use (number of small birds/plot[a]/10-minute survey), percent of total use (%), and frequency of occurrence (%) for each small bird type and species by season during avian bird use surveys at the Pronghorn Flats Wind Energy Project from April 25, 2020 to May 26, 2021.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Passerines	**17.13**	**9.00**	**23.02**	**17.18**	**95.6**	**89.2**	**90.3**	**83.7**	**92.6**	**86.0**	**89.5**	**80.7**
Passerines(Subtype)	*0*	*0.07*	*0*	*0*	*0*	*0.7*	*0*	*0*	*0*	*3.5*	*0*	*0*
unidentified passerine	0	0.07	0	0	0	0.7	0	0	0	3.5	0	0
Blackbirds/Orioles	*2.67*	*1.91*	*2.09*	*0.11*	*14.9*	*19.0*	*8.2*	*0.5*	*67.4*	*59.6*	*40.4*	*8.8*
red-winged blackbird	0.46	0.28	0	0	2.6	2.8	0	0	10.9	14.0	0	0
Brewer's blackbird	0	0.02	0.88	0	0	0.2	3.4	0	0	1.8	1.8	0
common grackle	0.25	0	0	0	1.4	0	0	0	7.4	0	0	0
western meadowlark	1.94	1.61	1.21	0.11	10.8	16.0	4.7	0.5	67.4	57.9	40.4	8.8
European starling	0.01	0	0	0	0.1	0	0	0	1.2	0	0	0
unidentified blackbird	0.01	0	0	0	0.1	0	0	0	1.2	0	0	0
Flycatchers	*0.15*	*0.26*	*0*	*0*	*0.8*	*2.6*	*0*	*0*	*10.0*	*10.5*	*0*	*0*
Say's phoebe	0.05	0	0	0	0.3	0	0	0	5.0	0	0	0
western kingbird	0.10	0.25	0	0	0.6	2.4	0	0	5.0	10.5	0	0
Cassin's kingbird	0	0.02	0	0	0	0.2	0	0	0	1.8	0	0
Grassland/Sparrows	*14.07*	*6.21*	*20.91*	*17.07*	*78.5*	*61.6*	*82.0*	*83.2*	*86.8*	*70.2*	*86.0*	*80.7*
grasshopper sparrow	0.01	0	0	0	0.1	0	0	0	1.2	0	0	0
lark bunting	0.55	2.72	0	0	3.1	27.0	0	0	17.6	38.6	0	0
Lapland longspur	1.86	0	1.02	0	10.4	0	4.0	0	8.4	0	8.8	0
chestnut-collared longspur	0.30	0.04	0	0	1.7	0.3	0	0	5.0	1.8	0	0
lark sparrow	0.01	0.07	0	0	0.1	0.7	0	0	1.2	5.3	0	0
horned lark	10.91	3.05	19.35	16.96	60.9	30.3	75.9	82.7	78.5	57.9	86.0	78.9
vesper sparrow	0.32	0.12	0.28	0	1.8	1.2	1.1	0	22.4	7.0	8.8	0
thick-billed longspur	0.01	0.05	0	0	0.1	0.5	0	0	1.2	1.8	0	0
clay-colored sparrow	0	0.11	0.09	0	0	1.0	0.3	0	0	1.8	3.5	0
chipping sparrow	0	0	0	0.02	0	0	0	0.1	0	0	0	1.8
American tree sparrow	0.08	0	0	0	0.5	0	0	0	2.1	0	0	0
white-crowned sparrow	0	0	0.12	0.05	0	0	0.5	0.3	0	0	3.5	1.8
unidentified sparrow	0	0.05	0.05	0.04	0	0.5	0.2	0.2	0	3.5	3.5	1.8
Swallows	*0.16*	*0.46*	*0*	*0*	*0.9*	*4.5*	*0*	*0*	*4.7*	*14.0*	*0*	*0*
barn swallow	0.16	0.46	0	0	0.9	4.5	0	0	4.7	14.0	0	0
Shrikes	*0*	*0.05*	*0*	*0*	*0*	*0.5*	*0*	*0*	*0*	*5.3*	*0*	*0*
loggerhead shrike	0	0.05	0	0	0	0.5	0	0	0	5.3	0	0
Thrushes	*0.07*	*0.04*	*0*	*0*	*0.4*	*0.3*	*0*	*0*	*3.4*	*3.5*	*0*	*0*
American robin	0.07	0.04	0	0	0.4	0.3	0	0	3.4	3.5	0	0

Appendix B4. Mean small birds use (number of small birds/plot[a]/10-minute survey), percent of total use (%), and frequency of occurrence (%) for each small bird type and species by season during avian bird use surveys at the Pronghorn Flats Wind Energy Project from April 25, 2020 to May 26, 2021.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Warblers	*0*	*0*	*0.02*	*0*	*0*	*0*	*0.1*	*0*	*0*	*0*	*1.8*	*0*
Wilson's warbler	0	0	0.02	0	0	0	0.1	0	0	0	1.8	0
Woodpeckers	**0**	**0**	**0.04**	**0**	**0**	**0**	**0.1**	**0**	**0**	**0**	**3.5**	**0**
northern flicker	0	0	0.04	0	0	0	0.1	0	0	0	3.5	0
Unidentified Birds	**0.80**	**1.09**	**2.44**	**3.33**	**4.4**	**10.8**	**9.6**	**16.3**	**8.8**	**14.0**	**19.3**	**17.5**
unidentified small bird	0.80	1.09	2.44	3.33	4.4	10.8	9.6	16.3	8.8	14.0	19.3	17.5
Overall	**17.92**	**10.09**	**25.49**	**20.51**	**100**	**100**	**100**	**100**	**NA**	**NA**	**NA**	**NA**

[a] 100-meter (328 foot) radius plot for small birds

Sums of values may not equal totals shown due to rounding.

Appendix C. Mean Use by Point for All Birds, Bird Types, and Diurnal Raptor Subtypes during Avian Use Surveys at the Pronghorn Flats Wind Energy Project from April 1, 2019 to March 11, 2020 and April 25, 2020 to May 26, 2021.

Appendix C1. Mean use (number of birds/60-minute survey) by point for large birds[a], major bird types, and diurnal raptor subtypes observed at the Pronghorn Flats Wind Energy Project during fixed-point bird use surveys from April 1, 2019 to March 11, 2020.

	Survey Point												
Bird Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Waterbirds	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Waterfowl	**0.25**	**0.33**	**1.33**	**0**	**0**	**0**	**0**	**38.25**	**0**	**4.17**	**7.33**	**5.42**	**0**
Shorebirds	**0.17**	**0**	**0**	**0.17**	**0**	**0**	**0**	**0**	**0**	**0.67**	**0**	**0**	**0**
Diurnal Raptors	**1.00**	**0.83**	**0.50**	**1.25**	**0.67**	**1.00**	**0.50**	**1.83**	**0.58**	**0.92**	**1.33**	**0.42**	**0.92**
Accipiters	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0.08*	*0*	*0*
Buteos	*0.17*	*0.42*	*0.25*	*0.58*	*0.58*	*0.33*	*0.42*	*0.75*	*0.17*	*0.08*	*0.75*	*0.08*	*0.08*
Northern Harrier	*0.58*	*0.25*	*0.17*	*0.58*	*0.08*	*0.50*	*0.08*	*0.67*	*0.33*	*0.50*	*0.42*	*0.33*	*0.50*
Eagles	*0*	*0*	*0.08*	*0*	*0*	*0*	*0*	*0*	*0*	*0.25*	*0*	*0*	*0*
Falcons	*0.17*	*0.08*	*0*	*0.08*	*0*	*0.17*	*0*	*0.25*	*0.08*	*0*	*0*	*0*	*0.33*
Other Raptors	*0.08*	*0.08*	*0*	*0*	*0*	*0*	*0*	*0.17*	*0*	*0.08*	*0.08*	*0*	*0*
Vultures	**0**	**0**	**0**	**0**	**0**	**0.17**	**0.08**	**0**	**0**	**0**	**0**	**0**	**0**
Upland Game Birds	**0.25**	**0.08**	**0.67**	**0**	**0.08**	**0**	**0**	**0**	**0**	**0.08**	**0.08**	**0**	**0.17**
Doves/Pigeons	**2.25**	**1.17**	**0.33**	**2.75**	**0.42**	**1.17**	**1.33**	**1.17**	**0.33**	**1.50**	**2.17**	**0.17**	**1.58**
Large Corvids	**0.08**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.08**
Goatsuckers	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
All Large Birds	**4.00**	**2.42**	**2.83**	**4.17**	**1.17**	**2.33**	**1.92**	**41.25**	**0.92**	**7.33**	**10.92**	**6.00**	**2.75**

[a] 800-meter (2,625 foot) radius plot for large birds

Sums of values may not equal totals shown due to rounding.

Appendix C1 (*continued*). Mean use (number of birds/60-minute survey) by point for large birds[a], major bird types, and diurnal raptor subtypes observed at the Pronghorn Flats Wind Energy Project during fixed-point bird use surveys from April 1, 2019 to March 11, 2020.

	Survey Point											
Bird Type	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Waterbirds	**0.67**	**8.33**	**0**	**1.25**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3.33**
Waterfowl	**8.33**	**0**	**1.92**	**16.67**	**0**	**0**	**0**	**0**	**0**	**0**	**1.50**	**0**
Shorebirds	**0.08**	**0**	**0.08**	**0**	**0**	**0**	**0**	**0.25**	**0.08**	**0**	**0.08**	**0**
Diurnal Raptors	**1.00**	**0.83**	**0.67**	**0.42**	**0.83**	**0.58**	**0.83**	**0.50**	**0.50**	**0.67**	**0.92**	**0.67**
Accipiters	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Buteos	*0.42*	*0.42*	*0*	*0*	*0.17*	*0.17*	*0.42*	*0.33*	*0.25*	*0.25*	*0.58*	*0.25*
Northern Harrier	*0.42*	*0.17*	*0.58*	*0.33*	*0.33*	*0.33*	*0.17*	*0.08*	*0*	*0.42*	*0.33*	*0.08*
Eagles	*0*	*0*	*0*	*0.08*	*0.17*	*0*	*0.17*	*0*	*0*	*0*	*0*	*0.08*
Falcons	*0.17*	*0.25*	*0*	*0*	*0*	*0.08*	*0.08*	*0.08*	*0.25*	*0*	*0*	*0.25*
Other Raptors	*0*	*0*	*0.08*	*0*	*0.17*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Vultures	**0**	**0.33**	**0**	**0**	**0.08**	**0.25**	**0.08**	**0.17**	**0.08**	**0.08**	**0**	**0.75**
Upland Game Birds	**0**	**0**	**0.92**	**0.17**	**0**	**0**	**0**	**0.17**	**0**	**0**	**0**	**0**
Doves/Pigeons	**1.08**	**1.00**	**0.42**	**0.42**	**0.83**	**1.25**	**1.17**	**3.00**	**0.58**	**0.33**	**1.58**	**0.83**
Large Corvids	**0.42**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.08**
Goatsuckers	**0**	**0**	**0**	**0**	**0**	**0.08**	**0**	**0**	**0**	**0**	**0**	**0**
All Large Birds	**11.58**	**10.50**	**4.00**	**18.92**	**1.75**	**2.17**	**2.08**	**4.08**	**1.25**	**1.08**	**4.08**	**5.67**

[a] 800-meter (2,625 foot) radius plot for large birds

Sums of values may not equal totals shown due to rounding.

Appendix C2. Mean use (number of birds/10-minute survey) by point for small birds[a] and major bird types observed at the Pronghorn Flats Wind Energy Project during fixed-point bird use surveys from April 1, 2019 to March 11, 2020.

	Survey Point												
Bird Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Passerines	**6.58**	**11.92**	**4.67**	**6.67**	**4.50**	**4.00**	**9.00**	**10.17**	**4.17**	**4.58**	**11.08**	**7.92**	**13.33**
Unidentified Birds	**0**	**0**	**0**	**1.08**	**0**	**0**	**1.83**	**17.92**	**0.25**	**0**	**2.75**	**0**	**0**
All Small Birds	**6.58**	**11.92**	**4.67**	**7.75**	**4.50**	**4.00**	**10.83**	**28.08**	**4.42**	**4.58**	**13.83**	**7.92**	**13.33**

[a] 100-meter (328 foot) radius plot for small birds

Sums of values may not equal totals shown due to rounding.

Appendix C2 (*continued*). Mean use (number of birds/10-minute survey) by point for small birds[a] and major bird types observed at the Pronghorn Flats Wind Energy Project during fixed-point bird use surveys from April 1, 2019 to March 11, 2020.

	Survey Point											
Bird Type	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Passerines	**4.08**	**3.67**	**104.00**	**8.33**	**3.58**	**8.75**	**4.83**	**4.17**	**3.50**	**4.17**	**4.00**	**4.92**
Unidentified Birds	**4.17**	**0.17**	**0**	**0.08**	**0**	**0**	**0.25**	**0**	**0**	**0**	**0**	**0**
All Small Birds	**8.25**	**3.83**	**104.00**	**8.42**	**3.58**	**8.75**	**5.08**	**4.17**	**3.50**	**4.17**	**4.00**	**4.92**

[a] 100-meter (328 foot) radius plot for small birds

Sums of values may not equal totals shown due to rounding.

Appendix C3. Mean use (number of birds/60-minute survey) by point for large birds[a] and bird types observed during avian bird use surveys at the Pronghorn Flats Wind Energy Project from April 25, 2020 to May 26, 2021.

	Survey Point										
Bird Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**9**	**10**	**11**	**14**
Waterbirds	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2.92**	**0**
Shorebirds	**0**	**0**	**0**	**0**	**0**	**1.00**	**0.08**	**0**	**0**	**0**	**0**
Diurnal Raptors	**0.33**	**0.33**	**0.25**	**0.08**	**0.25**	**0.50**	**0.50**	**0**	**0.08**	**0.25**	**0.75**
Accipiters	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Buteos	*0.17*	*0.25*	*0.08*	*0*	*0.17*	*0*	*0.17*	*0*	*0*	*0.08*	*0.42*
Northern Harrier	*0.08*	*0*	*0.08*	*0.08*	*0*	*0.50*	*0.25*	*0*	*0.08*	*0.17*	*0.25*
Eagles	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Falcons	*0.08*	*0.08*	*0.08*	*0*	*0.08*	*0*	*0.08*	*0*	*0*	*0*	*0.08*
Owls	**0**	**0**	**0**	**0**	**0.08**	**0**	**0**	**0**	**0.08**	**0**	**0**
Vultures	**0**	**0**	**0**	**0**	**0.08**	**0**	**0**	**0.50**	**0**	**0**	**0.08**
Upland Game Birds	**0**	**0**	**0**	**0**	**0.08**	**1.00**	**0**	**0**	**0.17**	**0**	**0**
Doves/Pigeons	**0.42**	**0.67**	**0**	**1.67**	**0.83**	**0**	**1.42**	**0**	**0**	**0.42**	**0.92**
Large Corvids	**0**	**0**	**0**	**0.08**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
All Large Birds	**0.75**	**1.00**	**0.25**	**1.83**	**1.33**	**2.50**	**2.00**	**0.50**	**0.33**	**3.58**	**1.75**

[a] 800-meter (2,625 foot) radius plot for large birds

Sums of values may not equal totals shown due to rounding.

Appendix C3 *(continued)*. Mean use (number of birds/60-minute survey) by point for large birds[a] and bird types observed during avian bird use surveys at the Pronghorn Flats Wind Energy Project from April 25, 2020 to May 26, 2021.

	Survey Point									
Bird Type	**15**	**24**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
Waterbirds	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**7.92**	**1.17**
Shorebirds	**0**	**0**	**0**	**0**	**0.75**	**0**	**0**	**0**	**0**	**0**
Diurnal Raptors	**0.58**	**0.33**	**1.00**	**0.25**	**0.58**	**0.17**	**0.75**	**0.17**	**0.75**	**0.67**
Accipiters	*0*	*0.08*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Buteos	*0*	*0*	*0.50*	*0*	*0.42*	*0*	*0.25*	*0.08*	*0.50*	*0.42*
Northern Harrier	*0.42*	*0.08*	*0.17*	*0.08*	*0.08*	*0.08*	*0.08*	*0*	*0.08*	*0*
Eagles	*0*	*0.08*	*0*	*0.08*	*0*	*0*	*0*	*0*	*0*	*0*
Falcons	*0.17*	*0.08*	*0.33*	*0.08*	*0.08*	*0.08*	*0.42*	*0.08*	*0.17*	*0.25*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Vultures	**0**	**0.08**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Upland Game Birds	**0.58**	**0**	**0**	**0.08**	**0**	**0**	**0**	**0.67**	**0.08**	**0**
Doves/Pigeons	**1.50**	**0.58**	**0.17**	**1.92**	**0**	**0**	**2.25**	**0.08**	**0.42**	**0.50**
Large Corvids	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
All Large Birds	**2.67**	**1.00**	**1.17**	**2.25**	**1.33**	**0.17**	**3.00**	**0.92**	**9.17**	**2.33**

[a] 800-meter (2,625 foot) radius plot for large birds

Sums of values may not equal totals shown due to rounding.

Appendix C4. Mean use (number of birds/10-minute survey) by point for small birds[a] and bird types observed during avian bird use surveys at the Pronghorn Flats Wind Energy Project from April 25, 2020 to May 26, 2021.

	Survey Point										
Bird Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**9**	**10**	**11**	**14**
Passerines	**16.67**	**16.00**	**24.50**	**15.50**	**11.67**	**4.00**	**21.83**	**4.00**	**24.25**	**5.67**	**8.00**
Woodpeckers	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.08**	**0**	**0**
Unidentified Birds	**1.08**	**5.08**	**2.58**	**5.25**	**0**	**0**	**2.42**	**0**	**0.58**	**0**	**0.67**
All Small Birds	**17.75**	**21.08**	**27.08**	**20.75**	**11.67**	**4.00**	**24.25**	**4.00**	**24.92**	**5.67**	**8.67**

[a] 100-meter (328 foot) radius plot for small birds

Sums of values may not equal totals shown due to rounding.

Appendix C4 *(continued)*. Mean use (number of birds/10-minute survey) by point for small birds[a] and bird types observed during avian bird use surveys at the Pronghorn Flats Wind Energy Project from April 25, 2020 to May 26, 2021.

	Survey Point									
Bird Type	**15**	**24**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
Passerines	**9.25**	**15.42**	**10.83**	**20.08**	**7.00**	**38.42**	**16.33**	**20.42**	**9.75**	**32.75**
Woodpeckers	**0**	**0.08**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Unidentified Birds	**0.83**	**2.33**	**0.50**	**4.58**	**0**	**3.33**	**2.50**	**3.75**	**0**	**3.33**
All Small Birds	**10.08**	**17.83**	**11.33**	**24.67**	**7.00**	**41.75**	**18.83**	**24.17**	**9.75**	**36.08**

[a] 100-meter (328 foot) radius plot for small birds

Sums of values may not equal totals shown due to rounding.

Appendix D. U.S. Fish and Wildlife Service Wyoming and Nebraska Ecological Services Field Office Information for Planning and Consultation Report for the Pronghorn Flats 115-kilovolt Wind Project

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Nebraska Ecological Services Field Office
9325 B South Alda Rd., Ste B
Wood River, NE 68883-9565
Phone: (308) 382-6468 Fax: (308) 384-8835
http://www.fws.gov//nebraskaes

In Reply Refer To: February 15, 2022
Project Code: 2022-0008081
Project Name: Pronghorn Flats

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Note: IPaC has provided all available attachments because this project is in multiple field office jurisdictions.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Nebraska Ecological Services Field Office
9325 B South Alda Rd., Ste B
Wood River, NE 68883-9565
(308) 382-6468

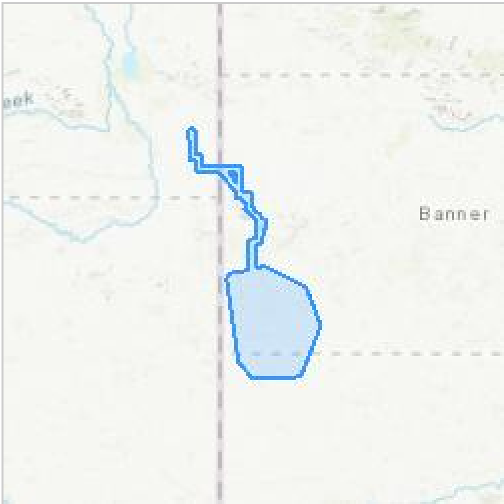
This project's location is within the jurisdiction of multiple offices. However, only one species list document will be provided for all offices. The species and critical habitats in this document reflect the aggregation of those that fall in each of the affiliated office's jurisdiction. Other offices affiliated with the project:

Wyoming Ecological Services Field Office
334 Parsley Boulevard
Cheyenne, WY 82007-4178
(307) 772-2374

Project Summary

Project Code: 2022-0008081
Event Code: None
Project Name: Pronghorn Flats
Project Type: Power Gen - Wind
Project Description: ..proposed wind energy development
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@41.50659995,-104.00549746743698,14z



Counties: Nebraska and Wyoming

Endangered Species Act Species

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Whooping Crane *Grus americana* Population: Wherever found, except where listed as an experimental population There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/758	Endangered

Fishes

NAME	STATUS
Pallid Sturgeon *Scaphirhynchus albus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7162	Endangered

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Western Prairie Fringed Orchid *Platanthera praeclara* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1669	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

THERE ARE NO FWS MIGRATORY BIRDS OF CONCERN WITHIN THE VICINITY OF YOUR PROJECT AREA.

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical

Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER POND

- PUSCh
- PUBFx
- PABFh
- PUBFh

RIVERINE

- R4SBC
- R5UBH

FRESHWATER EMERGENT WETLAND

- PEM1A
- PEM1C
- PEM1Ah

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Appendix E. Pronghorn Flats 115-kilovolt Wind Project Shadow Flicker Final Report

Pronghorn Flats Wind Farm
Shadow Flicker Analysis
Banner and Kimball Counties, NE

June 10,

2020

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Report Update

EAPC bears no responsibility to update this report for any changes occurring subsequent to the final issuance of this report.

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Executive Summary

EAPC was hired by Orion Wind Resources, LLC (OWR) to provide a shadow flicker analysis on dwellings in the vicinity of the proposed Pronghorn Flats Wind Farm (PFWF) near Scottsbluff in Banner and Kimball Counties, NE. The planned wind farm consists of up to 43 wind turbines. Coordinates of the locations of these wind turbines as well as 30 dwellings within 2,000 meters (1.25 miles) of a wind turbine were provided by PFWF. A windPRO model was built combining digital elevation data with the project turbine layout and dwelling locations supplied by PFWF to generate shadow flicker models for the site. The resulting models were then used to perform shadow flicker calculations for the area.

The wind turbine model evaluated for this report was the General Electric (GE) 3.03-140-98, which is a 3.03 megawatt (MW) capacity generator with a rotor diameter of 140 meters and a hub height of 98 meters above ground level (AGL).

The model is based on other conservative assumptions as well. No credit was taken for the blocking effects of trees or buildings. The receptors were omni-directional rather than modeling specific facades of buildings, and the study assumes 100% turbine availability.

While there are no rules in Nebraska that limit the number of shadow flicker hours allowed, it is generally accepted practice to limit the number of hours to less than 30 hours per year at any dwelling.

The results of this study indicate that of the 30 dwellings modeled, the highest amount of shadow flicker per year on any dwelling within 2,000 meters (1.25 miles) of a wind turbine is 28 hours and 15 minutes for the GE 3.03-140-98 m hub height layout modelled. All dwellings located within the project area would experience less than 30 total hours of shadow flicker in any given year.

1. windPRO is the world's leading software tool for designing and analyzing wind farms, including noise and shadow flicker.

Background

Shadow flicker from wind turbines occurs when rotating wind turbine blades move between the sun and the observer. Shadow flicker is generally experienced in areas near wind turbines where the distance between the observer and wind turbine blade is short enough that sunlight has not been significantly diffused by the atmosphere. When the blades rotate, this shadow creates a pulsating effect, known as shadow flicker. If the blade's shadow passes over the window of a building, it will have the effect of increasing and decreasing the light intensity in the room at a low frequency hence the term "flicker." In this case, with a maximum rotational speed of 15.7 rpm for the GE 3.03-140-98, the frequency would be 0.78 Hz. This flickering effect can also be experienced outdoors, but the effect is typically less intense, and becomes less intense when farther from the wind turbine causing the flicker.

This flickering effect is most noticeable within approximately 1,000 meters of the turbine and becomes more and more diffused as the distance increases. Based on the width of the blades for the GE 3.03-140-98 turbine, beyond 1,600 meters (5,250 ft) the shadow flicker effects become indistinguishable. There are no uniform standards defining what distance from the turbine is regarded as an acceptable limit beyond which the shadow flicker is considered to be insignificant. The same applies to the number of hours of flickering that is deemed to be acceptable.

Shadow flicker is typically greatest in the winter months when the angle of the sun is lower and casts longer shadows. The effect is also more pronounced around sunrise and sunset when the sun is near the horizon and the shadows are longer. A number of factors influence the amount of shadow flicker on the shadow receptors.

One consideration is the environment around the shadow receptor. Obstacles such as terrain, trees or buildings between the wind turbine and the receptor can significantly reduce or eliminate shadow flicker effects. Deciduous trees may block the shadow flickering effect to some degree, depending on the tree density, species present and time of year. Deciduous trees can lead to a reduction of shadow flicker during the summer when the trees are bearing leaves. However, during the winter months, these trees are without their leaves and their impact on shadow flicker is not as significant. Coniferous trees tend to provide mitigation from shadow flicker year-round. For this study, no credit was taken for any potential shading effects from any type of trees or other obstacles that would reduce the number of shadow flickering hours at the structures which will make the shadow flicker prediction more conservative (higher than in reality).

Another consideration is the time of day when shadow flicker occurs. For example, it may be more acceptable for private homes to experience the shadow flickering during daytime hours when family members may be at work or school. Likewise, a commercial property would not be significantly affected if all the shadow flicker impact occurred before or after business hours.

The climate also needs be considered when assessing shadow flicker. In areas with a significant amount of overcast weather, there would be less shadow flicker, as there are no shadows if the sun is blocked by clouds. Also, if the wind is not blowing, the turbines would not be operational and therefore not creating shadow flickering.

Methodology

This shadow flicker analysis was performed utilizing windPRO, which has the ability to calculate detailed shadow flicker maps across an entire area of interest or at site-specific locations using shadow receptors.

Shadow maps which indicate where the shadows will be cast and for how long, are generated using windPRO, calculating the shadow flicker in varying user-defined resolutions. Standard resolution was used for this study and represents shadow flicker being calculated every three minutes of every day over the period of an entire year over a grid with a 20 m x 20 m resolution.

In addition to generating a shadow flicker map, the amount of shadow flicker that may occur at a specific point can be calculated more precisely by placing a shadow receptor at the location of interest and essentially “recording” the shadow flicker that occurs as the relative sunrise to sunset motion of the sun is simulated throughout an entire year.

The point-specific shadow flicker calculation is run at a higher resolution as compared to the shadow flicker map calculation to utilize the highest precision available within windPRO. Shadow flicker at each shadow receptor location is calculated every minute of every day for an entire year. Shadow receptors can be configured to represent an omni-directional window of a specific size at a specific point (greenhouse mode) or a window facing a single direction of a specific size at a specific point (single direction mode). The shadow receptors used in this analysis were configured as greenhouse-mode receptors representing a 1 m x 1 m window located 1 m above ground level. This represents more of a “worst-case” scenario and thus will produce more conservative results since it assumes that all windows are always in direct line of sight with the turbines and the sun.

As a part of the calculation method, windPRO must determine whether or not a turbine will be visible at the receptor locations and not blocked by local topography or obstacles. It does this by performing a preliminary Zones of Visual Influence (ZVI) calculation, utilizing 10 m grid spacing. If a particular turbine is not visible within the 10 m x 10 m area that the shadow receptor is contained within, then that turbine is not included in the shadow flicker calculation for that receptor.

The actual calculation of potential shadow flicker at a given shadow receptor is carried out by simulating the environment near the wind turbines and the shadow receptors. The position of the sun relative to the turbine rotor disk and the resulting shadow is calculated in time steps of one minute throughout an entire year. If the shadow of the rotor disk (which in the calculation is assumed solid) at any time casts a shadow on a receptor window, then this step will be registered as one minute of shadow flicker. The calculation also requires that the sun must be at least 3.0° above the horizon in order to register shadow flicker. When the sun angle is less than 3.0°, the shadow quickly becomes too diffuse to be distinguishable since the amount of atmosphere that the light must pass through is 15 times greater than when the sun is directly overhead.

The inputs for the windPRO shadow flicker calculation include the following:

- Turbine Coordinates
- Turbine Specifications
- Shadow Receptor Coordinates
- Monthly Sunshine Probabilities
- Joint Wind Speed and Direction Frequency Distribution
- USGS Digital Elevation Model (DEM) (height contour data)

A description of each input variable and how they affect the shadow flicker calculation are included below.

Turbine Coordinates: The location of a wind turbine in relation to a shadow receptor is one of the most important factors in determining shadow flicker impacts. A line-of-site is required for shadow flicker to occur. The intensity of the shadow flicker is dependent upon the distance from the wind turbine and weather conditions. The table of wind turbine coordinates can be found in Appendix A.

Turbine Specifications: A wind turbine's total height and rotor diameter and blade width are included in the windPRO shadow flicker model. The taller the wind turbine, the more likely shadow flicker could have an impact on local shadow receptors as the ability to clear obstacles (such as hills or trees) is greater, although in this analysis, no credit is taken for any such blockage from trees. The larger the rotor diameter is, the wider the area where shadows will be cast. The wider the blade is, the farther the shadow will persist. Also included with the turbine specifications are the cut-in and cut-out wind speeds within which the wind turbine is operational. If the wind speed is below the cut-in threshold or above the cut-out threshold, the turbine rotor will not be spinning and thus shadow flicker will not occur.

Shadow Receptor Coordinates: As with the wind turbine coordinates, the elevation, distance and orientation of a shadow receptor in relation to the wind turbines and the sun are the main factors in determining the impact of shadow flicker. EAPC was provided with coordinates for all participating and non-participating occupied structures found to be located in the vicinity of the wind farm.

Monthly Sunshine Probabilities: windPRO calculates sunrise and sunset times to determine the total annual hours of daylight for the modeled area. To further refine the shadow flicker calculations, the monthly probability of sunshine is included to account for cloud cover. The greater the probability of cloud cover, the less of an impact from shadow flicker. The monthly sunshine probabilities for many of the larger cities across the United States are available from the National Climatic Data Center (NCDC). For this study, 44 years' worth of monthly sunshine probability data were retrieved for North Platte, NE, which was the closest, most representative station, to create the long-term representative monthly sunshine probabilities. The long-term representative monthly average sunshine probabilities are presented below in Table 1.

Table 1: North Platte, NE monthly sunshine probabilities

North Platte, NE Monthly Sunshine Probabilities (1965-2009)												
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sunshine %	60	62	65	66	68	72	76	75	73	70	60	67
retrieved from: http:// http://www1.ncdc.noaa.gov/pub/data/ccd-data/pctpos15.dat												

Joint Wind Speed and Direction Frequency Distribution: A set of long-term corrected wind distributions was provided by PFWF to represent the annual wind speed and direction distribution for the project site. This data was used to estimate the probable number of operational hours for the wind turbines from each of the 12 wind direction sectors. During operation, the wind turbine rotors will always be assumed to face into the wind and automatically orient themselves as the wind direction changes. Shadow flicker can only occur when the blades are turning and the wind turbine rotor is between the sun and the receptor. Shadow flicker is most significant when the rotor is facing the sun.

USGS Digital Elevation Model (DEM) (height contour data): For this study, 3-meter resolution USGS National Elevation Database (NED) DEM's were used to construct 10-foot interval height contour lines for the windPRO shadow flicker model. The height contour information is important to the shadow flicker calculation since it allows the model to place the wind turbines and the shadow receptors at the correct elevations. The height contour lines also allow the model to include the topography of the site when calculating the zones of visual influence surrounding the wind turbine and shadow receptor locations.

Wind Turbines from Adjacent Projects: OWR is not aware of any other operating energy conversion facilities, existing or under construction, within or adjacent to the proposed project area.

The sun's path with respect to each wind turbine location is calculated by the software to determine the paths of cast shadows for every minute of every day over a full year. The turbine runtime and direction are calculated from the site's long-term wind speed and direction distribution. Finally, the effects of cloud cover are calculated using long-term reference data (monthly sunshine probability) to arrive at the projected annual flicker time at each receptor.

Results

The results of this study indicate that for the 30 dwellings modeled, the highest non-participating dwelling would experience 28 hours and 15 minutes of shadow flicker per year and the highest participating dwelling would experience 25 hours and 43 minutes of shadow flicker per year for the GE 3.03-140-98 m hub height layout modelled. The distribution of shadow flicker impacts is shown below in Table 2. The full tables of results can be found in Appendix B.

Table 2: Pronghorn Flats dwellings cumulative realistic shadow flicker distribution.

Realistic Shadow Flicker (hrs/year)	Number of Non-Participating Dwellings	Number of Participating Dwellings
0	11	2
0 to 5	2	0
5 to 10	4	1
10 to 15	1	0
15 to 20	0	3
20 to 25	2	2
25 to 30	1	1
30+	0	0

It is important to note that no credit was taken for any potential shading effects from any type of trees, shrubs or other obstacles that would reduce the number of shadow flickering hours at the structures, and the receptors are modeled as "greenhouses".

The realistic shadow flicker results are shown in Appendix B. The map for the realistic flicker can be found in Appendix C.

Conclusions

The term “realistic“ as used in this report means that turbine operational hours and direction as well as local sunshine probabilities have been factored in, but no blocking or shading effects due to trees or structures have been accounted for. This means that the realistic estimates are still inherently conservative values. Also, the realistic shadow flicker hours predicted by windPRO assume an availability factor of 100% which is very unlikely to be the case. Actual availability factors will likely be in the range of 95-98%, however, with a conservative approach to estimating shadow flicker totals, the realistic estimates are not discounted accordingly.

The shadow flicker impact on dwellings within 2,000 meters (1.25 miles) of a wind turbine was calculated by taking into account turbine operational time, turbine operational direction and sunshine probabilities. This shadow flicker analysis is based on a number of conservative assumptions including:

- The turbines are operating at 100% availability.
- No credit was taken for the blocking effects of trees, shrubs, window coverings or other structures.
- The receptors were omni-directional rather than modeling specific facades of houses.

The results of this study indicate that for the 30 dwellings modeled, the highest amount of shadow flicker per year on any dwelling within 2,000 meters (1.25 miles) of a wind turbine is 28 hours and 15 minutes for the GE 3.03-140-98 m hub height layout modelled.

The overall effect of these conservative assumptions is that the number of hours of shadow flicker that would be observed should be less than those predicted by this study.

APPENDIX A – Table of Wind Turbine Coordinates

Table A-1: Pronghorn Flats Wind Farm
43 GE 3.03-140-98m HH WTG's UTM
NAD83 Zone 13

WTG	Turbine Type	Easting (m)	Northing (m)	Base Elev. AMSL (m)
1	GE 3.04-140-98	584,353	4,593,073	1,611
2	GE 3.04-140-98	584,060	4,592,357	1,599
3	GE 3.04-140-98	581,945	4,592,354	1,614
4	GE 3.04-140-98	581,185	4,592,008	1,617
5	GE 3.04-140-98	580,639	4,591,557	1,614
6	GE 3.04-140-98	589,829	4,590,897	1,572
7	GE 3.04-140-98	585,782	4,590,801	1,598
8	GE 3.04-140-98	582,240	4,590,725	1,599
9	GE 3.04-140-98	589,212	4,590,689	1,575
10	GE 3.04-140-98	583,820	4,590,676	1,592
11	GE 3.04-140-98	580,400	4,590,520	1,609
12	GE 3.04-140-98	588,603	4,590,473	1,575
13	GE 3.04-140-98	583,675	4,590,025	1,594
14	GE 3.04-140-98	588,311	4,589,994	1,581
15	GE 3.04-140-98	586,205	4,589,712	1,599
16	GE 3.04-140-98	582,026	4,589,469	1,598
17	GE 3.04-140-98	588,219	4,589,136	1,596
18	GE 3.04-140-98	589,355	4,588,063	1,586
19	GE 3.04-140-98	589,091	4,587,642	1,570
20	GE 3.04-140-98	590,892	4,587,562	1,581
21	GE 3.04-140-98	580,433	4,587,531	1,614
22	GE 3.04-140-98	581,970	4,587,504	1,604
23	GE 3.04-140-98	582,091	4,586,408	1,605
24	GE 3.04-140-98	590,476	4,586,398	1,564
25	GE 3.04-140-98	580,104	4,586,388	1,614
26	GE 3.04-140-98	582,495	4,585,270	1,599
27	GE 3.04-140-98	580,637	4,584,913	1,611
28	GE 3.04-140-98	581,457	4,584,856	1,603
29	GE 3.04-140-98	579,995	4,584,828	1,613
30	GE 3.04-140-98	588,894	4,584,354	1,571
31	GE 3.04-140-98	583,813	4,584,321	1,598
32	GE 3.04-140-98	581,549	4,583,761	1,612
33	GE 3.04-140-98	581,143	4,583,285	1,606
34	GE 3.04-140-98	588,328	4,583,260	1,574
35	GE 3.04-140-98	583,474	4,582,687	1,612
36	GE 3.04-140-98	582,750	4,582,562	1,597
37	GE 3.04-140-98	585,133	4,581,926	1,591
38	GE 3.04-140-98	581,694	4,581,844	1,598
39	GE 3.04-140-98	583,966	4,581,564	1,596
40	GE 3.04-140-98	584,718	4,581,506	1,593

Table A-1: Pronghorn Flats Wind Farm
43 GE 3.03-140-98m HH WTG's UTM
NAD83 Zone 13

continued

WTG	Turbine Type	Easting (m)	Northing (m)	Base Elev. AMSL (m)
41	GE 3.04-140-98	588,013	4,581,065	1,587
42	GE 3.04-140-98	583,297	4,581,056	1,589
43	GE 3.04-140-98	588,971	4,580,778	1,581

APPENDIX B – Tables of Shadow Flicker Results

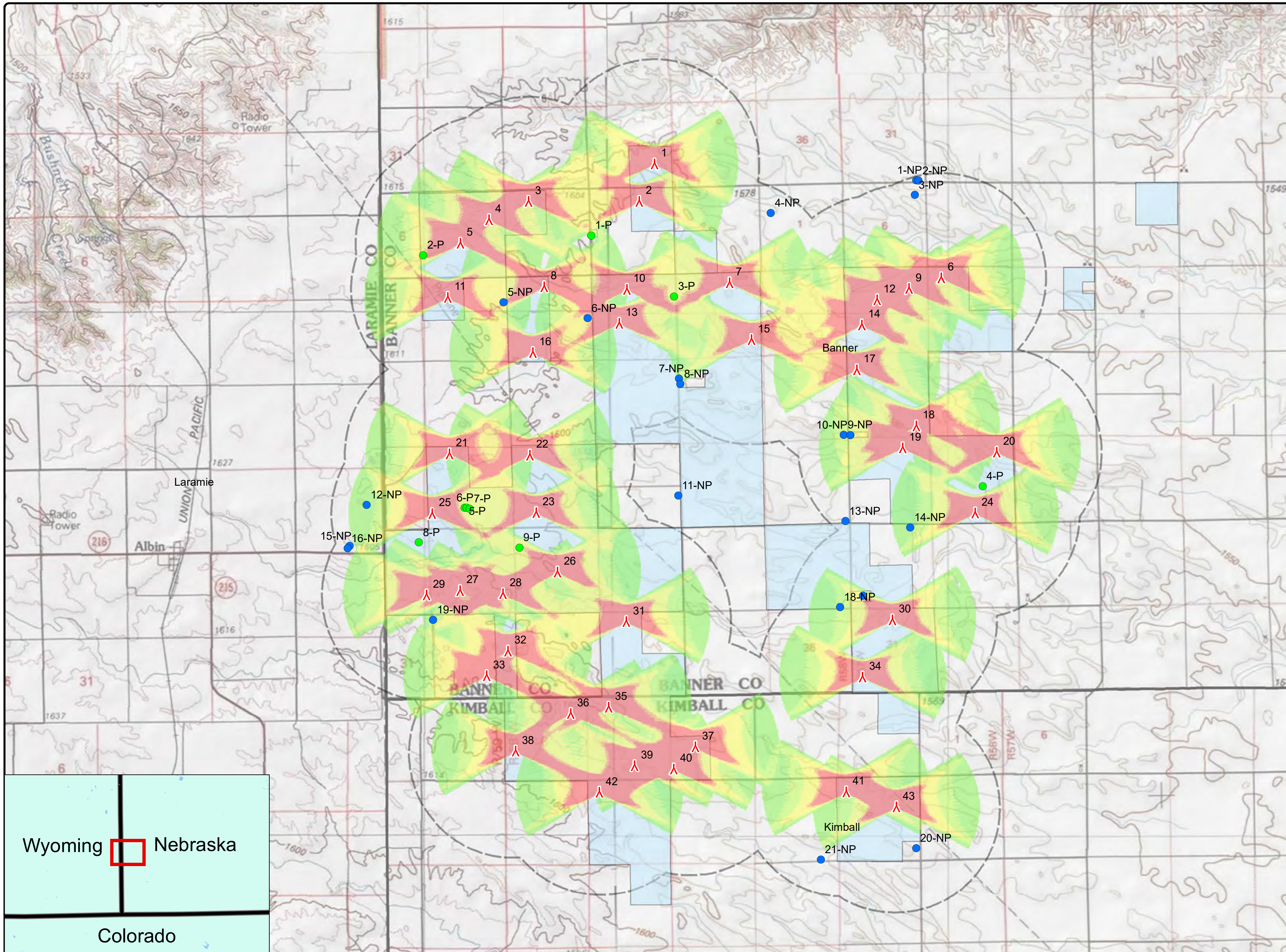
Table B-1: Pronghorn Flats Wind Farm Shadow Flicker Tabular Results Sorted by Receptor ID
Realistic case shadow results at occupied structures
Results using 43 GE 3.03-140-98m HH WTG's
UTM NAD83 Zone 13

Receptor ID	Participation Status	Easting (m)	Northing (m)	Elevation AMSL (m)	Shadow Flicker (hrs/year)
1-NP	NP	589357	4592764	1,568.6	0:00
2-NP	NP	589396	4592754	1,568.2	0:00
3-NP	NP	589326	4592481	1,570.7	0:00
4-NP	NP	586575	4592140	1,579.0	0:00
5-NP	NP	581470	4590430	1,605.0	28:15
6-NP	NP	583071	4590125	1,597.6	24:19
7-NP	NP	584822	4588968	1,595.2	5:10
8-NP	NP	584844	4588871	1,596.0	0:00
9-NP	NP	587967	4587899	1,570.0	7:51
10-NP	NP	588099	4587891	1,569.0	10:34
11-NP	NP	584805	4586738	1,584.0	0:00
12-NP	NP	578853	4586557	1,617.2	3:23
13-NP	NP	587999	4586245	1,569.0	0:00
14-NP	NP	589242	4586129	1,564.4	4:01
15-NP	NP	578528	4585772	1,611.0	0:00
16-NP	NP	578486	4585724	1,611.0	0:00
17-NP	NP	588339	4584816	1,571.6	21:35
18-NP	NP	587902	4584603	1,572.3	6:03
19-NP	NP	580120	4584359	1,611.1	5:57
20-NP	NP	589353	4579990	1,579.2	0:00
21-NP	NP	587533	4579776	1,567.3	0:00
1-P	P	583141	4591710	1,599.9	4:36
2-P	P	579933	4591328	1,622.4	25:43
3-P	P	584726	4590540	1,590.0	21:12
4-P	P	590621	4586911	1,572.0	0:00
5-P	P	580727	4586498	1,608.0	19:48
6-P	P	580760	4586498	1,608.0	18:21
7-P	P	580820	4586479	1,608.0	16:31
8-P	P	579851	4585838	1,612.6	0:00
9-P	P	581771	4585740	1,605.0	23:45

Table B-2: Pronghorn Flats Wind Farm Shadow Flicker Tabular Results Sorted by hr/yr
Realistic case shadow results at occupied structures
Results using 43 GE 3.03-140-98m HH WTG's
UTM NAD83 Zone 13

Receptor ID	Participation Status	Easting (m)	Northing (m)	Elevation AMSL (m)	Shadow Flicker (hrs/year)
5-NP	NP	581470	4590430	1,605.0	28:15
6-NP	NP	583071	4590125	1,597.6	24:19
17-NP	NP	588339	4584816	1,571.6	21:35
10-NP	NP	588099	4587891	1,569.0	10:34
9-NP	NP	587967	4587899	1,570.0	7:51
18-NP	NP	587902	4584603	1,572.3	6:03
19-NP	NP	580120	4584359	1,611.1	5:57
7-NP	NP	584822	4588968	1,595.2	5:10
14-NP	NP	589242	4586129	1,564.4	4:01
12-NP	NP	578853	4586557	1,617.2	3:23
1-NP	NP	589357	4592764	1,568.6	0:00
2-NP	NP	589396	4592754	1,568.2	0:00
3-NP	NP	589326	4592481	1,570.7	0:00
4-NP	NP	586575	4592140	1,579.0	0:00
8-NP	NP	584844	4588871	1,596.0	0:00
11-NP	NP	584805	4586738	1,584.0	0:00
13-NP	NP	587999	4586245	1,569.0	0:00
15-NP	NP	578528	4585772	1,611.0	0:00
16-NP	NP	578486	4585724	1,611.0	0:00
20-NP	NP	589353	4579990	1,579.2	0:00
21-NP	NP	587533	4579776	1,567.3	0:00
2-P	P	579933	4591328	1,622.4	25:43
9-P	P	581771	4585740	1,605.0	23:45
3-P	P	584726	4590540	1,590.0	21:12
5-P	P	580727	4586498	1,608.0	19:48
6-P	P	580760	4586498	1,608.0	18:21
7-P	P	580820	4586479	1,608.0	16:31
1-P	P	583141	4591710	1,599.9	4:36
4-P	P	590621	4586911	1,572.0	0:00
8-P	P	579851	4585838	1,612.6	0:00

APPENDIX C – Shadow Flicker Map



0 0.5 1 2 Mile

EAPC WIND ENERGY

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Pronghorn Flats Wind Farm Shadow Flicker Iso-Lines

Client

Orion Renewable Energy

Project Description

43 GE 3.03-140-98 m HH WTGs.
Realistic shadow flicker map.

Assumes statistical reduction due to sunshine probability, turbine orientation and operation probability. Sensors in "greenhouse" mode. No obstacles assumed.

Location: Banner County, NE
Project #: 20202880

Issue Dates

#	Description	Date
1	Original	2020.05.22

Drawn By: AS *Checked By:* JH

Legend

- Banner County Turbine Array
- Participants
- Non Participants

Shadow Flicker

Hours per year

- 0-5
- 5-10
- 10-15
- 15-20
- 20-25
- 25-30
- >30
- Participating Land Parcels
- 2 km Turbine Buffer
- County Lines

Appendix F. Pronghorn Flats 115-kilovolt Wind Project Public Scoping Comments

Pronghorn Flats 115-kilovolt Project
Project Scoping Comment Summary

1. Adjacent landowner concerned about effects to people and requests analysis of what sound, vibration, blinking lights and strobe effect may have on a person with multiple sclerosis. Expressed concerns about impacts to birds and other wildlife.

2. Expressed support for proposed project

3. Requested coordination with and contacted Orion regarding powerline routing.

4. Expressed support of and a request for locating pole structures on private property.

5. Requested review of potential impacts to jurisdictional dams, floodplain management, registered groundwater wells, stream gages, and surface water rights.

6. Expressed concern with proposed turbine proximity to missile silos and requested appropriate shapefiles for review.

7. Presented questions regarding visual, eminent domain, fencing, land use, noise, light,decommissioning, and proximity to missile silos.

8. Expressed concern with switchyard and project design. Expressed opposition based on a personal opinion that the project is of no public good.

9. Two separate requests were made for coordinatin and communication with the project developer, topics were not expressed.

10. Expressed concerns and questions regarding ownership and operation of the project because of experiencing prior issues with WAPA and associated land use.

11. No identified issues at this time. Waiting for the EA.

12. Expressed concern regarding: No Easement granted yet (as of 6/26/20 in letter), impact on the character of the land, concerned project planning is centered around wildlife impacts instead of human habitat impacts, loss of unestimated damage on the historic viewshed, socioeconomic value of the ranch, noise pollution to the quiet surroundings from human/electronic events, and industrialization to unoccupied spaces.
EA should address the human element and loss of enjoyment of life. Impacts to the human/wildlife relationship. Power line persons and lack of proper maintenance and respect to private lands.   WAPA issues. Harder (less efficient) to farm land around transmission lines above ground appurtenances.

13. Requested consideration of alternate route for transmission line to reduce wildlife conflicts. Species of greatest conservation need identified in the provided comments and recommended conducting specified surveys, and requested consideration of seasonal work schedules to minimize widlife impacts.