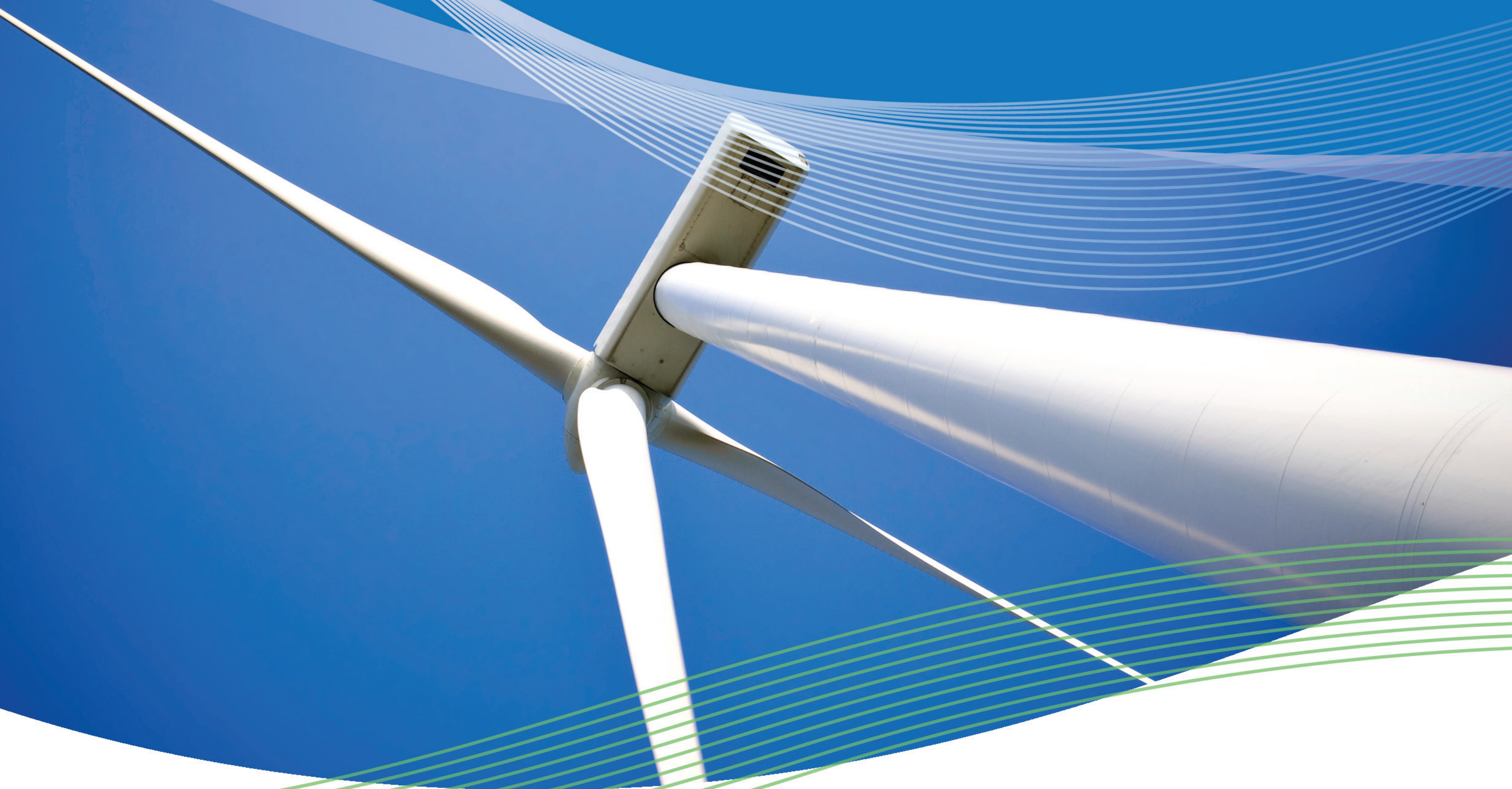
July 2017

South Dakota Public Utilities Commission

Facility Permit Application

Crocker Wind Farm

Clark County, South Dakota



GERONIMO ENERGY

CROCKER WIND FARM

Clark County, SD

Application to the South Dakota Public Utilities Commission for a Facility Permit

Crocker Wind Farm

Clark County, South Dakota

July 25, 2017

CROCKER WIND FARM, LLC

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ACRONYMS

Acronym	**Definition**
ACRS	Aluminum Conductor Steel Reinforced
APLIC	Avian Power Line Interaction Committee
Applicant	Crocker Wind Farm, LLC
ARSD	Administrative Rules of South Dakota
ASOS	Automated Surface Observing Systems
BBCS	Bird and Bat Conservation Strategy
BCC	Birds of Conservation Concern
BMP	Best Management Practice
Commission	South Dakota Public Utilities Commission
Crocker	Crocker Wind Farm, LLC
CUP	Conditional Use Permit
CWA	Clean Water Act
DOA	Department of Agriculture
DOC	Department of Commerce
DOE	Department of Energy
DOJ	Department of Justice
EA	Environmental Assessment
ECPG	Eagle Conservation Plan Guidance, Module 1 – Land-based Wind Energy, Version 2
ELF	Extremely Low Frequency
EMF	Electromagnetic Field
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
Geronimo	Geronimo Energy, LLC
GPA	Game Production Area
IRP	Integrated Resources Plan
ITC	Interstate Telecommunications Cooperative, Inc.
JEDI	Jobs and Economic Development Impact
kV	Kilovolt
kV/m	Kilovolt per meter
LiDAR	Light Range Detection and Ranging

Acronym	Definition
LNBL	Lawrence Berkeley National Laboratory
MBTA	Migratory Bird Treaty Act
mG	milligauss
MISO	Midcontinent Independent System Operator
m/s	Meters per second
MS4s	Municipal Separate Storm Sewer Systems
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHD	Natural Heritage Database
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NRI	National Rivers Inventory
NTIA	National Telecommunications and Information Administration
NWR	National Wildlife Refuge
NWI	National Wetlands Inventory
O&M	Operations and Maintenance
PEIS	Upper Great Plains Wind Energy Programmatic Environmental Impact Statement
POI	Point-of-Interconnect
RD	Rotor Diameter
RES	Renewable Energy Standard
SCADA	Supervisory Control and Data Acquisition
SCS	Site Characterization Study
SDCL	South Dakota Codified Law
SDDENR	South Dakota Department of Environment and Natural Resources
SDDLR	South Dakota Department of Labor and Regulation
SDDOA	South Dakota Department of Agriculture
SDGFP	South Dakota Game, Fish, and Parks
SDGS	South Dakota Geologic Survey
SDPUC	South Dakota Public Utilities Commission
SHPO	State Historic Preservation Office
SoDAR	Sonic Detection and Ranging
SPP	Southwest Power Pool, Inc.

Acronym	Definition
SWPPP	Storm Water Pollution Prevention Plan
TMDL	Total Maximum Daily Load
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
WAPA	Western Area Power Administration
WEG	Wind Energy Guidelines
WES	Wind Energy System
WEST	Western Ecosystems Technology, Inc.
WIA	Hunter Walk In Area
WHO	World Health Organization
WNS	White Nose Syndrome
WPA	Waterfowl Production Area
v/m	Volts per meter

1.0 INTRODUCTION

Crocker Wind Farm, LLC ("Crocker" or "Applicant"), a wholly-owned subsidiary of Geronimo Energy, LLC ("Geronimo"), respectfully submits this application (the "Application") to the South Dakota Public Utilities Commission ("Commission") for a Facility Permit to construct and operate the Crocker Wind Farm (the "Project"). Crocker is proposing to construct a wind energy facility located on approximately 29,331 acres of privately owned land in Clark County, South Dakota ("Project Area"), approximately 8 miles north of Clark, South Dakota (Figure 1). The proposed Project includes up to 200 wind turbines, associated access roads, a new collector substation, an operations and maintenance ("O&M") facility ("Wind Farm"), and associated 345 kilovolt ("kV") transmission in Clark County, South Dakota ("Transmission Line Route"). The Project will result in the installation of approximately 6.5 miles of overhead transmission that will be wholly located within the Wind Farm's boundary. The Transmission Line Route will run from a substation in Section 30 of Township 119N, Range 58W to the Point-of-Interconnect ("POI"), which is located approximately 2 miles north of the town of Crocker in Section 9 of Township 119N, Range 58W Two routing options from the substation in Section 30 are under consideration (Refer to Figures 2a-2d). At the POI, the power will transfer to the Basin Electric Groton-to-Watertown 345 kV transmission line, part of the Southwest Power Pool, Inc. ("SPP")/Western Area Power Administration ("WAPA") Transmission line portfolio in Clark County, South Dakota. The Project would generate utility scale electric power for residential, commercial, and industrial consumers. Power from the Project would help meet the growing generation needs of the region for several decades and provide a significant economic benefit to the local community and government.

The proposed Project includes the following components:

- Up to 200 three-bladed, horizontal-axis wind turbines;
- Access roads and improvements to existing roads;
- Underground and/or aboveground electrical collection and communication lines;
- Operations and maintenance facility;
- Project substation facility and interconnection facilities;
- Up to four permanent meteorological towers (height dependent on the final turbine hub height);
- Sonic Detection and Ranging ("SoDAR") or Light Range Detection and Ranging ("LiDAR") unit;
- Underground and/or aboveground electrical feeder line;
- A temporary batch plant and staging/layout area for construction of the Project; and
- Approximately 6.5 miles of 345 kV transmission line.

2.0 FACILITY PERMIT APPLICATION

This Application provides information on the anticipated environmental and other impacts by the Project on the following resources:

- Physical (geology, economic deposits, soils)
- Hydrology (water)
- Terrestrial ecosystems (vegetation, wetlands, wildlife, threatened and endangered species)
- Aquatic ecosystems
- Land use (agriculture, residential, displacement, noise, aesthetics, electromagnetic interference, safety and health)
- Water quality
- Air quality
- Communities (socioeconomics, cultural resources)

Crocker proposes to construct and operate some of the facilities on U.S. Fish and Wildlife Service ("USFWS") grassland easement land. Therefore, in addition to this Application, the USFWS is preparing an Environmental Assessment ("EA") for the Project in accordance with the applicable requirements and standards of the National Environmental Policy Act ("NEPA"). The EA will tier off of the analysis conducted in the *Upper Great Plains Wind Energy Programmatic Environmental Impact Statement* ("PEIS"), prepared jointly by WAPA and the USFWS (Western and USFWS, 2015). The PEIS assesses environmental impacts associated with wind energy development and identifies management practices to address impacts. The EA for the Project will focus on site-specific issues that are not already addressed in sufficient detail in the PEIS. The Project is not expected to have significant impacts on the environment.

In this Application, the Applicant has addressed each matter set forth in South Dakota Codified Laws ("SDCL") Chapter 49-41B and in Administrative Rules of South Dakota ("ARSD") Chapter 20:10:22 (Energy Facility Siting Rules) related to wind energy facilities. Included with this Application is a Completeness Checklist (Table 3-1) that sets forth where in the application each rule requirement is addressed.

Pursuant to SDCL 49-41B-22, the information presented here establishes that:

- The proposed wind energy facility complies with applicable laws and rules;
- The facility will not pose a threat of serious injury to the environment or to the social and economic condition of inhabitants in, or near, the Project Area;
- The facility will not substantially impair the health, safety, or welfare of the inhabitants; and

- The facility will not unduly interfere with the orderly development of the region, having given consideration to the views of the governing bodies of the local affected units of government.

3.0 COMPLETENESS CHECK

The contents required for an application with the South Dakota Public Utilities Commission ("SDPUC") are described in SDCL 49-41B and further clarified in ARSD 20:10:22:01(1) et seq. The SDPUC submittal requirements are listed in Table 3-1 with cross-references indicating where the information can be found in this Application.

Table 3-1: Completeness Checklist

SDCL	ARSD	Required Information	Location
49-41B-11(1)	20:10:22:06	**Names of participants required.** The application shall contain the name, address, and telephone number of all persons participating in the proposed facility at the time of filing, as well as the names of any individuals authorized to receive communications relating to the application on behalf of those persons.	Chapter 4.0
49-41B-11(7)	20:10:22:07	**Name of owner and manager.** The application shall contain a complete description of the current and proposed rights of ownership of the proposed facility. It shall also contain the name of the project manager of the proposed facility.	Chapter 5.0
49-41B-11(8)	20:10:22:08	**Purpose of facility.** The applicant shall describe the purpose of the proposed facility.	Chapter 6.0
49-41B-11(12)	20:10:22:09	**Estimated cost of facility.** The applicant shall describe the estimated construction cost of the proposed facility	Chapter 7.0
49-41B-11(9)	20:10:22:10	**Demand for facility.** The applicant shall provide a description of present and estimated consumer demand and estimated future energy needs of those customers to be directly served by the proposed facility. The applicant shall also provide data, data sources, assumptions, forecast methods or models, or other reasoning upon which the description is based. This statement shall also include information on the relative contribution to any power or energy distribution network or pool that the proposed facility is projected to supply and a statement on the consequences of delay or termination of the construction of the facility.	Chapter 6.0
49-41B-11(2)	20:10:22:11	**General site description.** The application shall contain a general site description of the proposed facility including a description of the specific site and its location with respect to state, county, and other political subdivisions; a map showing prominent features such as cities, lakes and rivers; and maps showing cemeteries, places of historical significance, transportation facilities, or other public facilities adjacent to or abutting the plant or transmission site.	Chapter 8.0 Figures 1, 2a-d, 7a-d, and 10a-d

SDCL	ARSD	Required Information	Location
49-41B-11(6); 49-41B-21; 34A-9-7(4)	20:10:22:12	**Alternative sites.** The applicant shall present information related to its selection of the proposed site for the facility, including the following: (1) The general criteria used to select alternative sites, how these criteria were measured and weighed, and reasons for selecting these criteria; (2) An evaluation of alternative sites considered by the applicant for the facility; (3) An evaluation of the proposed plant, wind energy, or transmission site and its advantages over the other alternative sites considered by the applicant, including a discussion of the extent to which reliance upon eminent domain powers could be reduced by use of an alternative site, alternative generation method, or alternative waste handling method.	Chapter 9.0
49-41B-11(2,11); 49-41B-21; 49-41B-22	20:10:22:13	**Environmental information.** The applicant shall provide a description of the existing environment at the time of the submission of the application, estimates of changes in the existing environment which are anticipated to result from construction and operation of the proposed facility, and identification of irreversible changes which are anticipated to remain beyond the operating lifetime of the facility. The environmental effects shall be calculated to reveal and assess demonstrated or suspected hazards to the health and welfare of human, plant and animal communities which may be cumulative or synergistic consequences of siting the proposed facility in combination with any operating energy conversion facilities, existing or under construction. The applicant shall provide a list of other major industrial facilities under regulation which may have an adverse effect on the environment as a result of their construction or operation in the transmission site, wind energy site, or siting area.	Chapters 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 17.0, 18.0, 20.0

SDCL	ARSD	Required Information	Location
49-41B-11(2,11); 49-41B-21; 49-41B-22	20:10:22:14	**Effect on physical environment.** The applicant shall provide information describing the effect of the proposed facility on the physical environment. The information shall include: (1) A written description of the regional land forms surrounding the proposed plant or wind energy site or through which the transmission facility will pass; (2) A topographic map of the plant, wind energy, or transmission site; (3) A written summary of the geological features of the plant, wind energy, or transmission site using the topographic map as a base showing the bedrock geology and surficial geology with sufficient cross-sections to depict the major subsurface variations in the siting area; (4) A description and location of economic deposits such as lignite, sand and gravel, scoria, and industrial and ceramic quality clay existent within the plant, wind energy, or transmission site; (5) A description of the soil type at the plant, wind energy, or transmission site; (6) An analysis of potential erosion or sedimentation which may result from site clearing, construction, or operating activities and measures which will be taken for their control; (7) Information on areas of seismic risks, subsidence potential and slope instability for the plant, wind energy, or transmission site; and (8) An analysis of any constraints that may be imposed by geological characteristics on the design, construction, or operation of the proposed facility and a description of plans to offset such constraints.	Chapter 11.0 Figures 1, 3a-d, 4a-d

SDCL	ARSD	Required Information	Location
49-41B-11(2,11); 49-41B-21; 49-41B-22	20:10:22:15	**Hydrology.** The applicant shall provide information concerning the hydrology in the area of the proposed plant, wind energy, or transmission site and the effect of the proposed site on surface and groundwater. The information shall include: (1) A map drawn to scale of the plant, wind energy, or transmission site showing surface water drainage patterns before and anticipated patterns after construction of the facility; (2) Using plans filed with any local, state, or federal agencies, indication on a map drawn to scale of the current planned water uses by communities, agriculture, recreation, fish, and wildlife which may be affected by the location of the proposed facility and a summary of those effects; (3) A map drawn to scale locating any known surface or groundwater supplies within the siting area to be used as a water source or a direct water discharge site for the proposed facility and all offsite pipelines or channels required for water transmission; (4) If aquifers are to be used as a source of potable water supply or process water, specifications of the aquifers to be used and definition of their characteristics, including the capacity of the aquifer to yield water, the estimated recharge rate, and the quality of ground water; (5) A description of designs for storage, reprocessing, and cooling prior to discharge of heated water entering natural drainage systems; and (6) If deep well injection is to be used for effluent disposal, a description of the reservoir storage capacity, rate of injection, and confinement characteristics and potential negative effects on any aquifers and groundwater users which may be affected.	Chapter 12.0 and Figures 5a-d
49-41B-11(2,11); 49-41B-21; 49-41B-22	20:10:22:16	**Effect on terrestrial ecosystems.** The applicant shall provide information on the effect of the proposed facility on the terrestrial ecosystems, including existing information resulting from biological surveys conducted to identify and quantify the terrestrial fauna and flora potentially affected within the transmission site, wind energy site, or siting area; an analysis of the impact of construction and operation of the proposed facility on the terrestrial biotic environment, including breeding times and places and pathways of migration; important species; and planned measures to ameliorate negative biological impacts as a result of construction and operation of the proposed facility.	Chapter 13.0

SDCL	ARSD	Required Information	Location
49-41B-11(2,11); 49-41B-21; 49-41B-22	20:10:22:17	**Effect on aquatic ecosystems.** The applicant shall provide information of the effect of the proposed facility on aquatic ecosystems, and including existing information resulting from biological surveys conducted to identify and quantify the aquatic fauna and flora, potentially affected within the transmission site, wind energy site, or siting area, an analysis of the impact of the construction and operation of the proposed facility on the total aquatic biotic environment and planned measures to ameliorate negative biological impacts as a result of construction and operation of the proposed facility.	Chapter 14.0
49-41B-11(2,11); 49-41B-22	20:10:22:18	**Land use.** The applicant shall provide the following information concerning present and anticipated use or condition of the land: (1) A map or maps drawn to scale of the plant, wind energy, or transmission site identifying existing land use according to the following classification system: (a) Land used primarily for row and nonrow crops in rotation; (b) Irrigated lands; (c) Pasturelands and rangelands; (d) Haylands; (e) Undisturbed native grasslands; (f) Existing and potential extractive nonrenewable resources; (g) Other major industries; (h) Rural residences and farmsteads, family farms, and ranches; (i) Residential; (j) Public, commercial, and institutional use; (k) Municipal water supply and water sources for organized rural water systems; and (l) Noise sensitive land uses; (2) Identification of the number of persons and homes which will be displaced by the location of the proposed facility; (3) An analysis of the compatibility of the proposed facility with present land use of the surrounding area, with special attention paid to the effects on rural life and the business of farming; and (4) A general analysis of the effects of the proposed facility and associated facilities on land uses and the planned measures to ameliorate adverse impacts.	Chapters 15.0, 20.0 Figures 3a-d, 6a-d, and 7a-d

SDCL	ARSD	Required Information	Location
49-41B-11(2,11); 49-41B-28	20:10:22:19	**Local land use controls.** The applicant shall provide a general description of local land use controls and the manner in which the proposed facility will comply with the local land use zoning or building rules, regulations or ordinances. If the proposed facility violates local land use controls, the applicant shall provide the commission with a detailed explanation of the reasons why the proposed facility should preempt the local controls. The explanation shall include a detailed description of the restrictiveness of the local controls in view of existing technology, factors of cost, economics, needs of parties, or any additional information to aid the commission in determining whether a permit may supersede or preempt a local control pursuant to SDCL 49-41B-28.	Chapter 16.0
49-41B-11(2,11); 49-41B-21; 49-41B-22	20:10:22:20	**Water quality.** The applicant shall provide evidence that the proposed facility will comply with all water quality standards and regulations of any federal or state agency having jurisdiction and any variances permitted.	Chapter 17.0
49-41B-11(2,11); 49-41B-21; 49-41B-22	20:10:22:21	**Air quality.** The applicant shall provide evidence that the proposed facility will comply with all air quality standards and regulations of any federal or state agency having jurisdiction and any variances permitted.	Chapter 18.0
49-41B-11(3)	20:10:22:22	**Time schedule.** The applicant shall provide estimated time schedules for accomplishment of major events in the commencement and duration of construction of the proposed facility.	Chapter 19.0

SDCL	ARSD	Required Information	Location
49-41B-11(11); 49-41B-22	20:10:22:23	**Community impact.** The applicant shall include an identification and analysis of the effects the construction, operation, and maintenance of the proposed facility will have on the anticipated affected area including the following: (1) A forecast of the impact on commercial and industrial sectors, housing, land values, labor market, health facilities, energy, sewage and water, solid waste management facilities, fire protection, law enforcement, recreational facilities, schools, transportation facilities, and other community and government facilities or services; (2) A forecast of the immediate and long-range impact of property and other taxes of the affected taxing jurisdictions; (3) A forecast of the impact on agricultural production and uses; (4) A forecast of the impact on population, income, occupational distribution, and integration and cohesion of communities; (5) A forecast of the impact on transportation facilities; (6) A forecast of the impact on landmarks and cultural resources of historic, religious, archaeological, scenic, natural, or other cultural significance. The information shall include the applicant's plans to coordinate with the local and state office of disaster services in the event of accidental release of contaminants from the proposed facility; and (7) An indication of means of ameliorating negative social impact of the facility development.	Chapter 20.0
49-41B-11(4)	20:10:22:24	**Employment estimates.** The application shall contain the estimated number of jobs and a description of job classifications, together with the estimated annual employment expenditures of the applicants, the contractors, and the subcontractors during the construction phase of the proposed facility. In a separate tabulation, the application shall contain the same data with respect to the operating life of the proposed facility, to be made for the first ten years of commercial operation in one-year intervals. The application shall include plans of the applicant for utilization and training of the available labor force in South Dakota by categories of special skills required. There shall also be an assessment of the adequacy of local manpower to meet temporary and permanent labor requirements during construction and operation of the proposed facility and the estimated percentage that will remain within the county and the township in which the facility is located after construction is completed.	Chapters 20.0 and 21.0

SDCL	ARSD	Required Information	Location
49-41B-11(5)	20:10:22:25	**Future additions and modifications.** The applicant shall describe any plans for future modification or expansion of the proposed facility or construction of additional facilities which the applicant may wish to be approved in the permit.	Chapter 22.0
49-41B-35(3)	20:10:22:33.01	**Decommissioning of wind energy facilities.** Funding for removal of facilities. The applicant shall provide a plan regarding the action to be taken upon the decommissioning and removal of the wind energy facilities. Estimates of monetary costs and the site condition after decommissioning shall be included in the plan. The commission may require a bond, guarantee, insurance, or other requirement to provide funding for the decommissioning and removal of a wind energy facility. The commission shall consider the size of the facility, the location of the facility, and the financial condition of the applicant when determining whether to require some type of funding. The same criteria shall be used to determine the amount of any required funding.	Chapter 23.0
49-41B 11(2,11)	20:10:22:33.02	**Information concerning wind energy facilities.** If a wind energy facility is proposed, the applicant shall provide the following information: (1) Configuration of the wind turbines, including the distance measured from ground level to the blade extended at its highest point, distance between the wind turbines, type of material, and color; (2) The number of wind turbines, including the number of anticipated additions of wind turbines in each of the next five years; (3) Any warning lighting requirements for the wind turbines; (4) Setback distances from off-site buildings, right-of-ways of public roads, and property lines; (5) Anticipated noise levels during construction and operation; (6) Anticipated electromagnetic interference during operation of the facilities; (7) The proposed wind energy site and major alternatives as depicted on overhead photographs and land use culture maps; (8) Reliability and safety; (9) Right-of-way or condemnation requirements; (10) Necessary clearing activities; (11) Configuration of towers and poles for any electric interconnection facilities, including material, overall height, and width; (12) Conductor configuration and size, length of span between structures, and number of circuits per pole or tower for any electric interconnection facilities; and (13) If any electric interconnection facilities are placed underground, the depth of burial, distance between access points, conductor configuration and size, and number of	Chapter 25.0

SDCL	ARSD	Required Information	Location
49-41B-11(2,11)	20:10:22:34	**Transmission facility layout and construction.** If a transmission facility is proposed, the applicant shall submit a policy statement concerning the route clearing, construction and landscaping operations, and a description of plans for continued right-of-way maintenance, including stabilization and weed control.	Chapter 26
49-41B-11(2,11)	20:10:22:35	**Information concerning transmission facilities.** If a transmission facility is proposed, the applicant shall provide the following information: (1) Configuration of the towers and poles, including material, overall height, and width; (2) Conductor configuration and size, length of span between structures, and number of circuits per pole or tower; (3) The proposed transmission site and major alternatives as depicted on overhead photographs and land use culture maps; (4) Reliability and safety; (5) Right-of-way or condemnation requirements; (6) Necessary clearing activities; and (7) If the transmission facility is placed underground, the depth of burial, distance between access points, conductor configuration and size, and number of circuits.	Chapter 27
49-41B-7; 49-41B-22	20:10:22:36	**Additional information in application.** The applicant shall also submit as part of the application any additional information necessary for the local review committees to assess the effects of the proposed facility pursuant to SDCL 49-41B-7. The applicant shall also submit as part of its application any additional information necessary to meet the burden of proof specified in SDCL 49-41B-22.	Section 28.0
49-41B-22	N/A	**Applicant's burden of proof.** The applicant has the burden of proof to establish that: (1) The proposed facility will comply with all applicable laws and rules; (2) The facility will not pose a threat of serious injury to the environment nor to the social and economic condition of inhabitants or expected inhabitants in the siting area; (3) The facility will not substantially impair the health, safety or welfare of the inhabitants; and (4) The facility will not unduly interfere with the orderly development of the region with due consideration having been given the views of governing bodies of affected local units of government	Chapter 1.0 and Section 28.4

SDCL	ARSD	Required Information	Location
49-41B-11	20:10:22:39	**Testimony and exhibits.** Upon the filing of an application pursuant to SDCL 49-41B-11, an applicant shall also file all data, exhibits, and related testimony which the applicant intends to submit in support of its application. The application shall specifically show the witnesses supporting the information contained in the application.	Chapter 29.0

4.0 NAMES OF PARTICIPANTS (ARSD 20:10:22:06)

The Applicant, a South Dakota limited liability company, is a wholly owned subsidiary of Geronimo Energy, LLC. Geronimo Energy, LLC is a privately held Delaware limited liability company headquartered in Edina, Minnesota. Individuals who are authorized to receive communications relating to the application on behalf of the Applicant include:

- Brett Koenecke and Kara Semmler
  May, Adam, Gerdes and Thompson, LLP
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  605-224-8803
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- Patrick Smith and Melissa Schmit
  Geronimo Energy, LLC
  7650 Edinborough Way Suite 725, Edina, MN 55435
  952-988-9000
  patrick@geronimoenergy.com, melissa@geronimoenergy.com

5.0 NAME OF OWNER AND MANAGER (ARSD 20:10:22:07)

The Applicant will be the sole owner of the proposed Project. Patrick Smith and Melissa Schmit are the primary contacts.

6.0 PURPOSE OF, AND DEMAND FOR, THE WIND ENERGY FACILITY (ARSD 20:10:22:08, 20:10:22:10)

6.1 Wind Resources Areas

The Department of Energy's National Renewable Energy Lab ranks South Dakota as having the ninth highest wind development potential in the United States; however only 977 megawatts ("MW") of wind energy generation has actually been installed as of the third quarter of 2016. In 2015, more than 20 percent of South Dakota's electricity generation was sourced from wind power (AWEA, 2016).

The Project is being proposed in order to meet the growing demand for energy production from clean, environmentally-friendly, renewable sources. The specific Project location was selected after a series of wind resource, transmission, and environmental fatal flaw analyses indicated that the Project Area could support a wind farm with up to 200 turbines. Continuous study of the wind resource since 2010 has proven this Project Area to be one of South Dakota's premier wind development sites thereby allowing the proposed Project to compete with projects in other states.

Overall, the Project is consistent with South Dakota's commitment to growing the renewable energy portfolio of both the state and country, and will help to meet the significant regional need for renewable energy. Crocker may help meet South Dakota's renewable and recycled energy objective, or renewable energy standards in another state, by adding hundreds of MW of renewable electricity generating capacity. However, the need for the Project and Crocker's ability to complete the Project is ultimately determined by the market's demand for long-term energy contracts. Utilities seeking to diversify and build their energy generation portfolios are attracted to wind energy projects because of long-term competitive pricing, environmental benefits, and existing and potential (state and federal) renewable energy policies.

6.2 Renewable Power Demand

Wind energy provides the most cost effective energy source for customers, making it desirable to utilities. New wind energy facilities are less expensive to construct than new conventional energy sources, even without government subsidies. Table 6-1 provides a comparison of the unsubsidized levelized cost of energy for both alternative and conventional energy sources. In general, alternative energy sources provide lower costs per MW-hour than conventional sources. Additionally, the unsubsidized levelized cost of wind energy is the lowest of all alternative energy.

Table 6-1: Unsubsidized Levelized Cost of Energy

	Energy Source	Levelized Cost ($/MW hour)
Alternative Energy	Fuel Cell	$106-167
	Geothermal	$79-117
	Solar PV – Crystalline Utility Scale	$49-61
	Solar PV – Thin Film Utility Scale	$46-56
	Biomass Direct	$77-110
	Wind	$32-62

Table 6-1: Unsubsidized Levelized Cost of Energy

	Energy Source	Levelized Cost ($/MW hour)
Conventional Energy	Diesel Reciprocating Engine	$212-281
	Natural Gas Reciprocating Engine	$68-101
	Gas Peaking	$165-217
	Nuclear	$97-136
	Coal	$60-143

Source: Lazard's Levelized Cost of Energy Analysis – Version 10.0, 2016

Competitive wind energy pricing coupled with utilities' desire produces clean energy that can replace the decline in older conventional energy facilities. Wind energy provides a solution to fill the production void in the Midwest with competitively priced power.

In addition to the demand based on cost, the Project is needed to meet the growing demand for additional renewable resources intended to meet the Renewable Energy Standard ("RES") and other clean energy requirements in South Dakota and neighboring states. Additionally, well established commercial customers are interested in contracting with wind projects to capitalize on the competitive energy price and environmental benefits.

A review of utilities' integrated resource plans ("IRPs"), requests for proposals, and similar documents confirms that utilities are seeking additional renewable generation resources in the next several years (Xcel Energy, 2014; Minnesota Power, 2015; Otter Tail Power Company, 2016). For example, in the Midcontinent Independent System Operator ("MISO") region, utilities have expressed a need for thousands of megawatts of renewable energy (including wind) before 2020 (MISO, 2016). The SPP region is also seeing demand for renewable energy (including wind) confirmed with requests for proposals and other market indicators. Utilities will continue to require additional renewable energy generation between 2020 and 2030. Given this demand for renewable energy, a market exists for independently produced electricity generated from wind and other renewables, including the energy to be generated by the Project.

6.3 Additional Considerations

6.3.1 Socially Beneficial Uses of Energy Output

Energy produced by the Project will provide significant, numerous, and varied societal benefits. First, the Project will provide a large amount of renewable energy with minimal environmental impact. Further, regional and national security and energy reliability can be enhanced through the development of diversified generation resources such as wind.

The Project will also provide a supplementary source of income for the rural landowners and farmers on whose land the Project will be sited. The landowners in the Project footprint who host turbines will receive annual lease payments for each turbine sited on their property plus payments based on acres in the activated Project Area. Because only a small portion of the land will be used for the Project, farming operations can continue largely undisturbed. Less than one percent of the acres within the Project boundary will be removed from agricultural use over the life of the Project.

6.3.2 Effects of Facility in Inducing Future Development

The Project is not expected to directly affect other possible developments in Clark County. However, additional wind energy infrastructure in the Project Area may provide significant benefits to the local economy and local landowners. At 400 MW's, the Project would benefit landowners in the Project Area with average annual lease payments of over $2 million over the first 20 years. Additional wind energy infrastructure will also provide an additional source of revenue in to the state, school districts, county and townships in which the Project is sited. This same size project is estimated to pay approximately $1.8 million per year in wind farm capacity and production taxes.

Crocker has announced and is committed to creating an independently run community fund and providing that fund with $200 per MW per year for 20 years (400 MW Project would generate $80,000/yr). Refer to Section 9.1 for additional information on the fund. The Project will also provide significant income opportunities for local residents not affiliated with Project ownership. Construction of the Wind Farm is anticipated to generate approximately 140 construction jobs and 10-20 permanent operations and maintenance positions. Approximately 60 workers will be required for transmission line construction. It is not expected that additional permanent jobs will be created from the transmission line; however, construction of the line would enable hundreds of MW's of wind energy conversion systems to be installed for the Crocker Wind Farm which will have a significant economic impact. The Project has already created consulting, management, and environmental work.

At the same time, the Project is providing income to local residents, it will also help contribute to making the energy those residents rely upon less susceptible to volatility (U.S. Department of Energy, 2014 and 2015). The development of wind energy technology now makes wind power price competitive with new natural gas and coal generation (U.S. Energy Information Administration, 2015). The development of wind energy in South Dakota reduces dependence on turbulent fossil fuel markets and helps keep energy dollars in South Dakota (U.S. Department of Energy, 2015).

7.0 ESTIMATED COST OF THE WIND ENERGY FACILITY (ARSD 20:10:22:09)

7.1 Capital and Operational Costs

The total installed capital costs for the Wind Farm are estimated to be approximately $ 1.5 million per MW with project cost depending on project size and other variables including wind turbines, associated electrical and communication systems, and access roads. Ongoing operations and maintenance costs and administrative costs are estimated to be approximately $6.5-7.5 million per year, including payments to landowners for wind lease and easement rights.

The total installed capital costs for the Transmission Line are estimated to be approximately $6 million. Ongoing operations and maintenance costs and administrative costs are estimated to be approximately $100,000 per year, including payments to landowners for easement rights.

7.2 Site and Design Dependent Costs

The overall cost of developing the Project will depend primarily on site selection and construction timing. Site-dependent costs will include: the relative ease of access to the individual wind turbine locations, site-specific subsurface conditions that determine foundation design, access road design and layout, ease of underground work, and the layout of the turbine arrays which affects road and electrical cable cost. Both underground and aboveground cable may be employed to connect turbines, transformers, and the interconnect point. The underground placement of cables is preferred.

8.0 GENERAL SITE AND PROJECT COMPONENT DESCRIPTION (ARSD 20:10:22:11, 20:10:22:33:02)

8.1 Wind Farm Facility

Geronimo was introduced to the proposed Crocker Wind Farm by a group of landowners interested in developing a wind farm on their land. After analyzing a broader area for wind resource, geographic characteristics, easement availability, additional landowner interest, environmental resources, transmission availability and economic potential, Crocker selected the area within the Project boundary identified in Figure 1 of this Application as the Project Area. The Project Area was selected based on its excellent wind resources, its close proximity to existing transmission infrastructure and substations, the landowner's interest in participating in the Project and the low environmental impacts resulting from siting the Project in the Project Area compared with other potentially developable projects in the region. Crocker also conducted due diligence on environmental factors, which indicated no environmental fatal flaws were present.

According to the National Renewable Energy Laboratory's ("NREL") "Wind Powering America," wind resources within the Project's region range from 8.5 to 8.7 meters per second ("m/s") at Crocker's proposed turbine hub heights (U.S. Department of Energy, Energy Efficiency and Renewable Energy 2012). Crocker initiated its internal wind resource and energy assessment using data collected by meteorological towers installed in and around the Project Area in 2010. Long-term data was available from the National Weather Service Automated Surface Observing Systems ("ASOS") network Redwood Falls (Minnesota), and Sioux Falls, Sisseton and Watertown (South Dakota) stations. This site-specific wind analysis indicates the Project Area has a highly-suitable wind resource for economical, sustainable, and reliable production of power. Crocker also proposes to install up to four (4) permanent meteorological towers to monitor the performance of the Project, conform to grid integration requirements, and validate wind turbine power curves.

Crocker has modified the footprint of the Project over time to create the most efficient and effective wind energy project possible while minimizing environmental impacts. The Project will have up to 200 turbines and Crocker continues to assess its turbine options. For the purposes of this application Crocker has provided an evaluation of turbines that are typical of the environmental impacts that may be associated with turbines in this nameplate range. The Project's aboveground facilities will occupy less than one percent of the Project Area.

The Project's facilities will include:

- Wind turbines and related equipment;
- New gravel access roads and improvements to existing roads;
- Underground and/or aboveground electrical collection and communication lines;
- Operations and maintenance facility;
- Project substation facility and interconnection facilities;
- Up to 4 permanent meteorological towers (height dependent on the final turbine hub height);

- Sonic Detection and Ranging ("SoDAR") or Light Range Detection and Ranging ("LiDAR") units;
- Aboveground electrical feeder line;
- A temporary batch plant and staging/laydown area for construction of the Project; and
- Approximately 6.5 miles of 345 kV transmission.

Table 8-1 lists the counties, townships, sections, and ranges that are included in the Project Area. Figure 1 shows the Project's location.

Table 8-1: Project Location

County Name	Township Name	Township	Range	Sections
Wind Farm				
Clark	Spring Valley	119N	58W	3-10, 15-19, 25-26,30-31, 33-36
Clark	Warren	119N	59W	23-27, 34-36
Clark	Ash	118N	59W	1-3, 10-15
Clark	Woodland	118N	58W	1-12, 14-16, 21-23, 26, 34
Clark	Cottonwood	119N	57W	29-32
Transmission Line				
Clark	Spring Valley	119N	58W	9-10, 15-19, 30

8.2 Wind Turbine Generators

The proposed Project would consist of up to 200 three-bladed, horizontal-axis wind turbines (Figures 2a-d and associate map series). Note that turbine numbering is not sequential; refer to Table 8-2 for the number of turbines in each layout. Crocker has not yet finalized the specific turbine choice for the Project. The decision will be finalized prior to construction in order to create the most viable, cost-effective and optimal design for the Project given the known conditions of the Project Area and the turbines that are commercially available when the Project is constructed. The turbines Crocker is considering for the Project span the energy production range of 2.0 MW to 4.0 MW. Turbine heights would range from 80 to 110 meters (262 to 360 feet) and the rotor diameter ("RD") would range from 110 to 136 meters (361 to 446 feet). Table 8-2 shows the range of characteristics for the four representative turbines.

Table 8-2: Wind Turbine Characteristics

Characteristic	Turbine			
	Gamesa G126	Vestas V136-3.45	GE 2.5-116	Vestas V110
Nameplate capacity (kW)	2625	3450	2500	2000
Hub height (m)[1]	84	82	90	80/95
Rotor Diameter (m)	126	136	116	110
Total height (m)[2]	147	150	148	135/150
Cut-in wind speed (m/s)[3]	3	3	3	3
Rated capacity wind speed (m/s)[4]	10	10	11	11
Cut-out wind speed (m/s)[5]	25	21	25	20
Maximum sustained wind speed (m/s)[6]	52.5	52.5	52.5	52.5
Wind Swept Area (m^2)	12,469	14,526	10,568	9,503
Rotor speed (rpm)	6.0-11.6	6.6-12.5	8.0-15.7	6-17.0
Proposed Turbines in layout	152	116	160	200

***1** Hub height = the turbine height from the ground to the top of the nacelle. Tower heights may range from 80 to 95 m.*
***2.** Total height = the total turbine height from the ground to the tip of the blade in an upright position.*
***3** Cut-in wind speed = wind speed at which turbine begins operation*
***4** Rated capacity wind speed = wind speed at which turbine reaches its rated capacity*
***5** Cut-out wind speed = wind speed above which turbine shuts down operation*
***6** Maximum sustained wind speed = wind speed up to which turbine is designed to withstand*

Turbine

Table 8-2 provides details on the hub height, RD, and wind speed operation parameters for the Gamesa G126-2.625 MW wind turbine, the Vestas V136-3.45 wind turbine, the GE 2.5-116 wind turbine, and the Vestas V110-2.0 MW wind turbine. All four models have active yaw and pitch regulation and asynchronous generators. The turbines use a bedplate drive-train design where all nacelle components are joined on common structures to improve durability. All four turbine models are capable of operating with adjusted cut-in speeds and full blade feathering.

All proposed turbine models have Supervisory Control and Data Acquisition ("SCADA") communication technology to control and monitor the Project. The SCADA communications system permits automatic, independent operation and remote supervision, allowing the simultaneous control of the wind turbines.

Operations, maintenance, and service arrangements between the turbine manufacturer and the Applicant will be structured to provide timely and efficient operations and maintenance. The computerized data network will provide detailed operating and performance information for each wind turbine. The Applicant will maintain a computer program and database for tracking each wind turbine's operational history.

Other turbine specifications include:

- Rotor blade pitch regulation
- Gearbox with three-step planetary spur gear system
- Double fed three-phase asynchronous generator
- A braking system for each blade and a hydraulic parking brake (disc brake)
- Yaw systems that are electromechanically driven

Some of the turbines being considered also incorporate new technology compared to turbines currently in the landscape, including:

- Force-flow bedplates (nacelle components joined on a common structure to improve durability)
- New gearbox bearing designs (improving reliability by reducing bending and thrust)
- Low noise trailing edges
- SCADA Controlled Generation Modulation

8.3 Wind Turbine Towers

The towers are conical tubular in shape with a hub height of 82 to 95 meters (269 to 312 ft). The towers are painted a non-glare white, off-white or gray. The turbine tower, where the nacelle is mounted, consists of three to four sections manufactured from certified steel plates. Welds are made with automatically controlled power welding machines and are ultrasonically inspected during manufacturing per American National Standards Institute specifications. All surfaces are sandblasted and multi-layer coated for protection against corrosion. Access to the turbine is through a lockable steel door at the base of the tower. Within the tower, access to the nacelle is provided by a ladder connecting four platforms and equipped with a fall arresting safety system.

8.4 Wind Turbine Foundations

The wind turbines' freestanding tubular towers will be connected by anchor bolts to a concrete foundation. Turbine foundations will use a pad-and-pier tower mounting system consisting of top and bottom templates. These templates consist of anchor bolts and reinforcing steel bar (rebar); they are placed within the excavated portion of the turbine footing and filled with concrete. The anchor bolts protrude from the concrete pad surface and the turbine base is fastened to these bolts. The excavated portion of the concrete turbine pad ranges from approximately 291 to 737 cubic yards depending on soil requirements and turbine size. The turbine pad dimensions are approximately 20 feet in above-ground diameter and typically range in depth from four to six feet. An approximate height of two to three feet of the turbine pad remains above grade. Geotechnical surveys, turbine tower load specifications, and cost considerations will dictate final design parameters of the foundations.

In addition, turbine assembly will require a 40 by 120 foot gravel crane pad extending from the access road to the turbine foundation, which will be graded to a maximum of one percent, and an approximate 260 by 260 feet to 335 by 335 feet area for component laydown and rotor assembly centered close to the turbine foundation, which will be graded to a maximum of five percent.

8.5 Generator Step-up Transformers

At the base, or within the tower section of each turbine, a step-up transformer will be installed to raise the voltage of the electricity generated by the turbine to the power collection line voltage of 34.5 kV. In some turbine models (e.g. Gamesa G126, Vestas V110, and Vestas V136-3.45), the step-up transformer is located within the nacelle. If external transformers are used (e.g., for the GE 2.5-116), then small, concrete slab foundations will be constructed, to support the transformers, within the gravel area at the turbine base. The transformer is a rectangular steel box measuring approximately 2.3 by 2.6 m (7.5 by 8.5 ft). Support for the transformer is provided by a concrete pad or foundation approximately 8.0 in thick, which is placed over 0.6 m (2 ft) of concrete fill. The concrete fill will measure 2.3 by 4.1 m (7.5 by 13.5 ft) and will be placed under the transformer pad and between the transformer and the tower pedestal. The exact dimensions of the transformers, concrete pad and concrete fill will be dependent upon transformer manufacturer specifications and site-specific engineering requirements.

8.6 Access Roads

The Project will include permanent all-weather gravel roads that provide access to the wind turbines. The primary function of the access roads is to provide accessibility to the turbines for turbine maintenance crews. The access roads will be low-profile to allow farm equipment to cross. Roads will initially be approximately 34 feet wide to accommodate transportation of heavy construction equipment. Once Crocker completes construction of the turbines, the access roads will be reduced to their permanent width of 16 – 18 feet. Total access road length will be approximately 61 miles with final lengths determined by the civil engineering and final turbine layout.

Crocker designed the access road network to serve the Project most efficiently while taking landowner input and other factors on road locations into consideration.

8.7 O&M Facility

An O&M building will be constructed in or near the Project Area and will provide access and storage for Project maintenance and operations. The O&M facility may be co-located with the Project substation, however the location has not been finalized. Construction of the O&M facility will require a building permit from the applicable county and/or township in which the O&M facility will be located. The buildings typically used for this purpose are approximately 3,000 to 5,000 square ft and house the equipment to operate and maintain the Project. The parking lot adjacent to the building is typically approximately 3,000 square feet.

8.8 Meteorological Towers and Sodar Units

Crocker proposes to construct up to four permanent meteorological towers with the potential for a SODAR and/or a LiDAR unit(s). Met towers may be used for monitoring wildlife activity as well as meteorological data. The expected locations of the four permanent meteorological towers or SODAR/LiDAR units are not yet known as they will be dependent on the turbine chosen and final layout. The permanent met towers will be equal to the turbine hub height and will be located around the perimeter of the Project. The location of the preliminary meteorological towers is shown on Figures 2a-d.

8.9 Temporary Laydown/Stockpile Areas/Batch Plant/Crane Walks

Crocker will also grade a temporary laydown area of approximately ten acres, centrally-located within the Project Area, to serve both as a parking area for construction personnel and staging area for turbine components during construction. A separate staging area of approximately ten acres will serve as a parking and unloading area for large equipment deliveries.

8.10 Transmission Interconnection Facilities

8.10.1 Collector Lines and Feeder Lines

From the step-up transformers, power will run through an underground and/or aboveground collection system to the Project substation, which will raise the voltage to 345 kV. It is likely that the Project will utilize underground collection lines. The electrical collection system will consist of a network of underground electrical cabling operating at 34.5 kV. Up to 156 miles of underground lines will be installed by trenching, plowing, or, where needed, directionally boring the cables underground. Generally, the electrical collection lines will be buried in trenches. Additionally, collector system cabling may go aboveground when conflicts with existing underground utilities, other infrastructure, or sensitive environmental conditions such as native prairie remnants cannot be resolved and aboveground cabling will resolve the conflict. Where electrical collectors meet public road right-of-way, the power collection lines will either rise to become aboveground lines (if requested by the road authority or if shallow bedrock, sensitive environmental conditions, or conflicts with underground utility or other infrastructure are encountered) or will continue as underground lines. The collection lines will occasionally require an aboveground junction box when the lines from separate spools need to be spliced together.

Conceptual electrical layouts based on the proposed turbine layouts are shown on Figures 2a-d.

8.10.2 Collector System and Fiber Optic Communication System

Construction of the Project will include up to 200 wind turbines, each potentially with a pad-mounted transformer at its base and with underground and/or aboveground electrical collection and fiber optic communication systems. These wires will connect the Project's wind turbines to the substation and provide communications between the wind turbines, substation, O&M facility and electrical grid. If underground, the wires will be placed in the same trench wherever possible and will include a marking system and occasional aboveground junction boxes. All of the collection circuits will connect to Crocker's substation which will have a fiber optic connection to the O&M building and a communication system to the grid operator. The power delivered to the substation will be converted to 345 kV. After the interconnection substation, the electricity from the Project will enter the grid via a 345 kV transmission line connecting the Project substation to a switch yard built by the interconnecting utility. All grid to Project communications will be specified by the interconnecting utility(ies) under a Generator Interconnection Agreement.

8.10.3 Substation

The Project substation will be designed according to good utility practices, Southern Power Pool Standards, and the Avian Powerline Interaction Working Group Guidelines. The substation will include a control house, power transformers, switches, metering and other equipment needed for safe electrical operations of the wind farm and interconnection to the electrical grid. The area around the substation will be graveled and fenced. The substation's area will be approximately 500 feet by 500 feet once construction is complete.

9.0 ALTERNATE SITES AND SITING CRITERIA (ARSD 20:10:22:12)

9.1 General Project Location Selection

Crocker entered into lease agreements with a central group of interested and motivated landowners in 2010. At that time, Crocker also began collecting wind data. In 2014, the initial landowner agreements were renewed and the Project footprint was expanded to accommodate surrounding interested landowners. Crocker expanded the footprint for the Project after completing a thorough analysis of the Project's economic, technical, and environmental characteristics. Before finalizing the selection of the site, Crocker reviewed various regional site options and specific site layouts. The final Crocker site selection process considered the following criteria:

- **Wind Resource Quality:** Wind resource at the Project is significantly better than an average site in the upper Great Plains, making the Project very competitive on a regional basis.
- **Landowner and Community Interest:** Geronimo prides itself on developing wind farms that are farmer-friendly, community driven and beneficial for rural communities. Crocker is an example of this approach. Crocker started when a group of local landowners identified wind energy as the best method for maximizing and diversifying their land assets. Geronimo will also launch the Crocker Community Fund upon the Project's commercial operation with an initial commitment of 20 years at $200 per MW per year (400 MW Project is $80,000 per year). The Crocker Community Fund, a 501(c)(3) organization, is advised by a local board nominated by landowners. Its purpose is engaging in, assisting with, and contributing money to exclusively charitable activities and opportunities within the communities of South Dakota connected to the Project.
- **Transmission Suitability:** The Project's interconnection feasibility and transmission suitability initially drew Crocker to the Project Area. The Project is situated to allow the economical delivery of power to the electrical transmission system.
- **Environmental Considerations:** Before selecting the Project Area Crocker assessed multiple sites in the region from environmental and cultural perspectives. Crocker selected the Project Area in part because it offered relatively low environmental impacts (see Appendix A for the Site Characterization Study).
- **Economics of the Project:** The high quality wind resource previously discussed directly affects the economics of the Project. The Project is a competitive, cost-effective energy project.

Once the site was selected and secured, Crocker identified preliminary turbine locations based on wind resource analysis, efficient design, initial site inspection, topography, known environmentally-sensitive areas, and communications with local, state and federal agencies. Crocker has reviewed the preliminary turbine location with participating landowners in siting workshops. Comments and suggestions made by participating landowners will be incorporated into the final layout to the extent practicable.

9.2 Site Configuration and Alternative Sites Considered

Crocker initially chose the location for the Project in 2010 based on coordination with an interested landowner group, minimal environmental concerns and a viable interconnection resource. The project boundary was modified over time based on landowner interest, and to avoid environmental concerns like Mallard Slough and other large waterbodies to the east of the Project that provide habitat to waterfowl in the area. In October 2016, the Project was expanded to the Clark & Day County line to accommodate additional landowner interest in an area with strong wind resource and minimal environmental concerns.

The current layout of up to 200 turbines reflects the optimal configuration to best capture wind energy while meeting required setbacks from residences and other local features, avoiding cultural resources and wildlife habitat. The layout will be further refined for the purpose of eliminating and/or minimizing impacts to the environmentally sensitive areas based on ongoing ecological studies and coordination with landowners.

9.3 Lack of Reliance on Eminent Domain Powers

Because Crocker Wind Farm, LLC is not a public utility, it does not possess and thus did not rely on eminent domain powers to acquire easements for the Project. All Project facilities for the wind energy facility and associated transmission line will be located on properties that have been obtained through voluntary agreements with landowners or within the public right of way. Crocker will also coordinate with federal, state, and local agencies to obtain appropriate permits, as necessary.

10.0 ENVIRONMENTAL INFORMATION (ARSD 20:10:22:13)

Sections 11.0 through 14.0 and Sections 17.0, 18.0, and 20.0 provide a description of the existing environment at the time of the Application submittal, potential changes to the existing environment that are anticipated as a result of Project construction and operation, and irreversible changes that are anticipated to remain beyond the operational lifetime of the facility.

11.0 EFFECT ON PHYSICAL ENVIRONMENT (ARSD 20:10:22:14)

The following sections describe the existing physical environment within the Wind Farm Project Area and the Transmission Line Route and the potential effects of the proposed Project on the physical environment.

11.1 Existing Physical Environment

The following sections describe the existing geology, soil types, and seismic risks within the Wind Farm Project Area and Transmission Line Route.

11.1.1 Geology – Wind Farm Project Area and Transmission Line Route

11.1.1.1 Regional Landforms/Surficial Geology

Surficial geology of the Wind Farm Project Area and Transmission Line Route consists of glacial deposits associated with the Wisconsin glacial age. The Project is situated along the western margins of the Coteau des Prairies, a broad, flat-iron shaped glacial derived highland exhibiting a gently rolling to undulating surface. The Coteau des Prairies is an approximately 400-foot-thick mantle of till deposited as lateral and terminal glacial moraine. The elevation in the Project vicinity is caused by thick deposits of Wisconsin age glacial till (up to 400 feet thick) which consists of loamy, silty sediment (Krueger, 1999).

11.1.1.2 Bedrock Geology

The bedrock underlying the Coteau des Prairies in the Project vicinity consists of the Pierre Shale. This Cretaceous age deposit consists of light-gray to black shale which may contain iron or manganese concretions, marl, and bentonite (Schultz and Jarret, 2009).

11.1.1.3 Economic Deposits

Commercial mineral deposits within the Wind Farm Project Area and Transmission Line Route are limited to sand, gravel and construction aggregate enterprises. Information from the South Dakota Department of Environment and Natural Resources ("SDDENR") Minerals and Mining Program and a review of United States Geological Survey ("USGS") 7.5-minute quadrangle mapping indicates that two sand and gravel operations are located within the Wind Farm Project Area. Both of the identified active sand and gravel deposits are located in the northern half of Section 10 in Woodland Township (Township 118 North, Range 58 West) in the east-central portion of the Wind Farm Project Area (SDDENR, 2016b) (Figures 3a-d). There are no economic deposits along the Transmission Line Route.

A review of the online information from the SDDENR Oil and Gas Initiative Program GIS Website reveals that the Crocker Wind Farm Project Area and Transmission Line Route do not lie within an oil and gas field. The nearest identified oil and gas field is the Lantry field, which is located approximately 170 miles directly west of the Project vicinity (SDDENR, 2016c). No other active or historic economic mineral deposits exist within the vicinity of the Project.

11.1.2 Soil Types – Wind Farm

The soils within the Wind Farm Project Area are predominantly level to steep loamy and silty soils derived from till and morraine deposits. These soils are suitable for both crop production and grassland vegetation for livestock grazing (NRCS, 2015).

The soils within the Wind Farm Project Area have a low potential for corrosive impacts to buried steel and concrete. The majority (76%) of soils in the Wind Farm Project Area are well drained, and only approximately 1 percent of the soils have a hydric component. Approximately 15 percent of the soils are considered to have a high potential for frost action (NRCS, 2015). Table 11-1 lists the soil types located within the Wind Farm Project Area, which are also displayed on Figures 4a-d.

Table 11-1: Soil Map Units within the Wind Farm Project Area

Map Unit Symbol	Map Unit Name	Acres in Wind Farm	Percent of Wind Farm	Prime Farmland Classification
BcB	Barnes-Buse-Svea loams, 1 to 6 percent slopes	4,727.11	15.43%	All areas are prime farmland
BrD	Buse-Barnes loams, 9 to 20 percent slopes	4,368.14	14.89%	Not prime farmland
BcC	Barnes-Buse-Svea loams, 2 to 9 percent slopes	4,306.00	14.68%	Farmland of statewide importance
FnB	Forman-Buse-Aastad loams, 1 to 6 percent slopes	2,596.42	8.85%	All areas are prime farmland
FnC	Forman-Buse-Aastad loams, 2 to 9 percent slopes	1,670.86	5.70%	Farmland of statewide importance
Ss	Southam silty clay loam, 0 to 1 percent slopes	1,266.68	4.32%	Not prime farmland
Pa	Parnell silty clay loam	934.23	3.19%	Not prime farmland
RsC	Renshaw-Sioux complex, 6 to 9 percent slopes	904.08	3.08%	Not prime farmland
RsB	Renshaw-Sioux complex, 2 to 6 percent slopes	607.68	2.07%	Not prime farmland
RfB	Renshaw-Fordville loams, 2 to 6 percent slopes	523.84	1.79%	Prime farmland if irrigated
BuE	Buse-La Prairie, channeled-Barnes loams, 0 to 40 percent slopes	515.07	1.76%	Not prime farmland
BzE	Buse-Sioux complex, 9 to 40 percent slopes	511.03	1.74%	Not prime farmland
G171B	Barnes-Buse-Svea loams, 0 to 6 percent slopes	482.58	1.65%	All areas are prime farmland
At	Aastad-Tonka complex	453.34	1.55%	Prime farmland if drained
SrD	Sioux-Renshaw complex, 9 to 15 percent slopes	423.91	1.45%	Not prime farmland
BdB	Barnes-Svea loams, 1 to 6 percent slopes	419.72	1.43%	All areas are prime farmland
ByE	Buse-Langhei complex, 15 to 40 percent slopes	299.26	1.02%	Not prime farmland
Od	Oldham silty clay loam	289.69	0.99%	Not prime farmland

Table 11-1: Soil Map Units within the Wind Farm Project Area

Map Unit Symbol	Map Unit Name	Acres in Wind Farm	Percent of Wind Farm	Prime Farmland Classification
FmB	Forman-Aastad loams, 1 to 6 percent slopes	278.15	0.95%	All areas are prime farmland
RfA	Renshaw-Fordville loams, 0 to 2 percent slopes	275.93	0.94%	Prime farmland if irrigated
BdA	Barnes-Svea loams, 0 to 2 percent slopes	235.80	0.80%	All areas are prime farmland
La	La Prairie loam	234.72	0.80%	All areas are prime farmland
PrB	Poinsett-Rusklyn-Waubay silty clay loams, 1 to 6 percent slopes	230.01	0.78%	All areas are prime farmland
KrB	Kranzburg-Buse-Waubay complex, 1 to 6 percent slopes	217.46	0.74%	All areas are prime farmland
Aa	Aastad loam	210.66	0.72%	All areas are prime farmland
BbB	Barnes-Buse loams, 2 to 6 percent slopes	183.50	0.63%	All areas are prime farmland
EgB	Egeland-Embden complex, 2 to 6 percent slopes	171.24	0.58%	All areas are prime farmland
BbC	Barnes-Buse loams, 6 to 9 percent slopes	141.36	0.48%	Farmland of statewide importance
G171C	Barnes-Buse-Svea loams, 1 to 9 percent slopes	139.73	0.48%	Farmland of statewide importance
PoC	Poinsett-Rusklyn silty clay loams, 6 to 9 percent slopes	136.99	0.47%	Farmland of statewide importance
Hb	Hamerly-Tonka complex	126.14	0.43%	Prime farmland if drained
HaA	Hamerly loam, 0 to 2 percent slopes	117.76	0.40%	All areas are prime farmland
G143A	Barnes-Svea loams, 0 to 3 percent slopes	113.15	0.39%	All areas are prime farmland
G559A	La Prairie-Fairdale loams, channeled, 0 to 2 percent slopes, frequently flooded	106.02	0.36%	Not prime farmland
W	Water	105.52	0.36%	Not prime farmland
Va	Vallers-Hamerly loams	89.67	0.31%	Prime farmland if drained
FdA	Fordville loam, 0 to 2 percent slopes	89.20	0.30%	All areas are prime farmland
Lo	Lowe loam	84.84	0.29%	Prime farmland if drained
BsE	Buse-Barnes loams, 9 to 40 percent slopes, very stony	83.22	0.28%	Not prime farmland
FmA	Forman-Aastad loams, 0 to 3 percent slopes	80.66	0.28%	All areas are prime farmland
G155B	Barnes-Svea loams, 0 to 6 percent slopes	68.18	0.23%	All areas are prime farmland
MaC	Maddock-Egeland sandy loams, 6 to 9 percent slopes	56.40	0.19%	Not prime farmland
Lf	La Prairie-Fairdale loams, channeled	50.72	0.17%	Not prime farmland

Table 11-1: Soil Map Units within the Wind Farm Project Area

Map Unit Symbol	Map Unit Name	Acres in Wind Farm	Percent of Wind Farm	Prime Farmland Classification
To	Tonka silty clay loam, 0 to 1 percent slopes	45.52	0.16%	Prime farmland if drained
G143F	Buse-Barnes loams, 15 to 35 percent slopes	41.69	0.14%	Not prime farmland
Mw	Minnewaukan loamy sand	40.83	0.14%	Not prime farmland
EgA	Egeland-Embden complex, 0 to 2 percent slopes	40.62	0.14%	All areas are prime farmland
G189A	Aastad loam, 0 to 3 percent slopes, drainageway	35.54	0.12%	All areas are prime farmland
Og	Orthents, gravelly	33.31	0.11%	Not prime farmland
G274A	Renshaw-Fordville loams, 0 to 2 percent slopes	32.18	0.11%	Prime farmland if irrigated
Cw	Cubden-Tonka silty clay loams, coteau, 0 to 2 percent slopes	31.83	0.11%	Prime farmland if drained
G374A	Egeland-Embden complex, 0 to 2 percent slopes	29.48	0.10%	All areas are prime farmland
Re	Rauville silty clay loam	29.16	0.10%	Not prime farmland
G561A	La Prairie loam, 0 to 2 percent slopes, occasionally flooded	25.72	0.09%	All areas are prime farmland
G143D	Barnes-Buse-Langhei loams, 9 to 15 percent slopes	23.77	0.08%	Not prime farmland
Pm	Playmoor silty clay loam	21.31	0.07%	Not prime farmland
Ba	Badger-Tonka silty clay loams	20.91	0.07%	Prime farmland if drained
MtB	Minnewasta sandy loam, 2 to 6 percent slopes	18.81	0.06%	Not prime farmland
PwB	Poinsett-Waubay silty clay loams, 1 to 6 percent slopes	17.04	0.06%	All areas are prime farmland
PwA	Poinsett-Waubay silty clay loams, 0 to 2 percent slopes	15.49	0.05%	All areas are prime farmland
G276A	Renshaw-Sioux complex, 0 to 2 percent slopes	15.18	0.05%	Not prime farmland
G521A	Lowe loam, 0 to 1 percent slopes, occasionally flooded	14.84	0.05%	Not prime farmland
G274B	Renshaw-Fordville loams, 2 to 6 percent slopes	14.17	0.05%	Prime farmland if irrigated
G100A	Hamerly-Tonka complex, 0 to 3 percent slopes	8.87	0.03%	Prime farmland if drained
G276C	Renshaw-Sioux complex, 6 to 9 percent slopes	7.54	0.03%	Not prime farmland
Wa	Waubay silty clay loam, 0 to 2 percent slopes	6.75	0.02%	All areas are prime farmland
G997	Water, intermittent	4.72	0.02%	Not prime farmland
FoC	Forman-Buse-Aastad loams, 2 to 9 percent slopes	4.71	0.02%	Farmland of statewide importance
G003A	Parnell silty clay loam, 0 to 1 percent slopes	4.54	0.02%	Not prime farmland

Table 11-1: Soil Map Units within the Wind Farm Project Area

Map Unit Symbol	Map Unit Name	Acres in Wind Farm	Percent of Wind Farm	Prime Farmland Classification
G004A	Southam silty clay loam, 0 to 1 percent slopes	3.70	0.01%	Not prime farmland
G996	Water	3.36	0.01%	Not prime farmland
Sw	Southam silty clay loam, 0 to 1 percent slopes	2.42	0.01%	Not prime farmland
Cv	Cubden-Badger silty clay loams	1.93	0.01%	Prime farmland if drained
FoB	Forman-Buse-Aastad loams, 1 to 6 percent slopes	1.84	0.01%	All areas are prime farmland
G144B	Barnes-Buse loams, 3 to 6 percent slopes	1.71	0.01%	All areas are prime farmland
BnD	Buse-Barnes loams, 9 to 20 percent slopes	1.12	<0.01%	Not prime farmland
Oh	Oldham silty clay loam	0.94	<0.01%	Not prime farmland
G380C	Maddock-Egeland sandy loams, 6 to 9 percent slopes	0.62	<0.01%	Not prime farmland
HmA	Hetland silty clay loam, 0 to 2 percent slopes	0.40	<0.01%	All areas are prime farmland
G651E	Udarents loamy, abandoned gravel pits, 0 to 25 percent slopes	0.31	<0.01%	Not prime farmland
G276B	Renshaw-Sioux complex, 2 to 6 percent slopes	0.28	<0.01%	Not prime farmland
MnA	Minnewasta sandy loam, 0 to 2 percent slopes	0.06	<0.01%	Not prime farmland
Totals		**29,331**	**100 %**	

11.1.3 Soil Types – Transmission Line Route

The soils specific to the Transmission Line Route are predominantly level to steep loamy and silty soils derived from till and moraine deposits. These soils are suitable for both crop production and grassland vegetation for livestock grazing (NRCS, 2015).

The soils within the Transmission Line Route have a low potential for corrosive impacts to buried steel and concrete. The majority (76%) of soils in the Transmission Line Route are well drained. Approximately 5 percent of the soils are considered to have a high potential for frost action (NRCS, 2015). Table 11-2 lists the soil types located within the Transmission Line Route.

Table 11-2: Soil Map Units within the Transmission Line Route

Map Unit Symbol	Map Unit Name	Acres in T-Line Route	Percent of T-Line Route	Prime Farmland Classification
BrD	Buse-Barnes loams, 9 to 20 percent slopes	20.87	26.23%	Not prime farmland
FnB	Forman-Buse-Aastad loams, 1 to 6 percent slopes	11.99	15.08%	All areas are prime farmland

Table 11-2: Soil Map Units within the Transmission Line Route

Map Unit Symbol	Map Unit Name	Acres in T-Line Route	Percent of T-Line Route	Prime Farmland Classification
FnC	Forman-Buse-Aastad loams, 2 to 9 percent slopes	8.74	10.99%	Farmland of statewide importance
BcB	Barnes-Buse-Svea loams, 1 to 6 percent slopes	6.98	8.77%	All areas prime farmland
RfB	Renshaw-Fordville loams, 2 to 6 percent slopes	6.27	7.88%	Prime farmland if irrigated
RsC	Renshaw-Sioux complex, 6 to 9 percent slopes	5.55	6.98%	Not prime farmland
BcC	Barnes-Buse-Svea loams, 2 to 9 percent slopes	4.53	5.69%	Farmland of statewide importance
SrD	Sioux-Renshaw complex, 9 to 15 percent slopes	2.52	3.17%	Not prime farmland
Aa	Aastad loam	2.13	2.67%	All areas prime farmland
RsB	Renshaw-Sioux complex, 2 to 6 percent slopes	2.06	2.59%	Not prime farmland
Lo	Lowe loam	1.78	2.24%	Prime farmland if drained
FmA	Forman-Aastad loams, 0 to 3 percent slopes	1.56	1.96%	All areas prime farmland
ByE	Buse-Langhei complex, 15 to 40 percent slopes	1.52	1.91%	Not prime farmland
BzE	Buse-Sioux complex, 9 to 40 percent slopes	1.27	1.59%	Not prime farmland
Pa	Parnell silty clay loam	0.50	0.63%	Not prime farmland
Va	Vallers-Hamerly loams	0.38	0.48%	Prime farmland if drained
La	La Prairie loam	0.34	0.42%	All areas prime farmland
BbB	Barnes-Buse loams, 2 to 6 percent slopes	0.28	0.35%	All areas prime farmland
FmB	Forman-Aastad loams, 1 to 6 percent slopes	0.18	0.22%	All areas prime farmland
At	Aastad-Tonka complex	0.10	0.13%	Prime farmland if drained
Totals		**79.54**	**100.0%**	

11.1.4 Seismic Risks – Wind Farm Project Area and Transmission Line Route

The risk of seismic activity in the vicinity of the Wind Farm Project Area and Transmission Line Route is extremely low to negligible. The USGS Earthquake Hazards Program estimates a less than 1.0 percent probability that a Magnitude 5 or greater earthquake event will occur within 50 kilometers of the Project within the next 20 years. According to the USGS 2014 Seismic Hazard

Map for South Dakota, the Peak Ground Acceleration with a 2 percent chance of exceedance in 50 years is 0.02 g to 0.04 g ("g" are units of acceleration due to gravity) (USGS, 2014).

According to the South Dakota Geologic Survey, no earthquakes have been recorded in Clark County, South Dakota from 1872 to 2013 (SDGS, 2013). A review of the geologic mapping and information provided by the USGS Earthquake Hazards Program indicate that there are no active or inactive faults in the vicinity of the Project (USGS, 2016).

11.1.5 Subsidence Potential – Wind Farm Project Area and Transmission Line Route

The potential for subsidence within the Wind Farm Project Area and Transmission Line Route is negligible. The Pierre Shale bedrock is buried beneath an approximately 400-foot-thick layer of till across the entire Project vicinity. Additionally, the bedrock does not exhibit karst topography or contain subsurface geologic layers or members that are identified as susceptible to dissolution by water. There are no documented historic underground mining operations within the Project vicinity, which could indicate a potential subsidence risk.

11.2 Facility Impacts

11.2.1 Potential for Impacts to Geologic and Soil Resources – Wind Farm

The limited number of developed or potential economic mineral resources within the Wind Farm Project Area indicates that the development and construction of the proposed wind generation facility will have no impact to economic mineral resources. The closest sand and gravel operation is located approximately 1,076 feet from proposed turbines (Figures 3a-d).

Staging and construction activities associated with wind turbine foundations, access roads, collector lines, substation, O&M facilities, and interconnection transmission line would result in approximately 996 acres of temporary disturbance and up to approximately 243 acres of permanent impacts to soils within the Wind Farm Project Area. During construction it is anticipated that existing ground cover vegetation would be removed in construction work areas. This could potentially increase erosion potential, which is discussed in more detail below. Project related impacts to agricultural soils are discussed in Sections 13.2 and 20.2.3.

11.2.2 Potential for Impacts to Geologic and Soil Resources – Transmission Line Route

Construction and operation of the transmission line will not impact economic mineral resources.

Temporary impacts associated with construction of the transmission line will be associated with accessing the transmission structure locations along the right-of way. Permanent impacts will be limited to the transmission structure foundations, which generally range from 6 to 11 feet in diameter. During construction it is anticipated that existing ground cover vegetation may be removed in construction work areas. This could potentially increase erosion potential, which is discussed in more detail below. Project related impacts to agricultural soils are discussed in Sections 13.2 and 20.2.3.

11.2.2.1 Erosion, Slope Stability, and Sedimentation – Wind Farm

Wind facilities are predominantly designed with turbines situated at higher elevations to minimize obstructions to wind. The Applicant has designed the Project to minimize construction episodes of cut and fill work and avoid construction in steep slope areas while maintaining optimal turbine locations. The current layout sites access roads away from steep slopes to the degree possible. Comparable efforts have been taken in the design of the underground collector lines to avoid crossing steep ravines when possible.

Project construction will require a SDDENR General Permit for Storm Water Discharges Associated with Construction Activities. In compliance with the provisions of this General Permit, Crocker will develop a Storm Water Pollution Prevention Plan ("SWPPP") to identify potential sources of stormwater pollution from the project site and specify structural and non-structural Best Management Practices ("BMPs") which will be implemented to minimize negative impacts caused by storm water discharges from the Project. The SWPPP will be implemented from the start of construction through restoration. During operation of the facility, erosion and sediment impacts to surface water and ground water resources are not anticipated to change from pre-construction conditions.

11.2.2.2 Erosion, Slope, Stability, and Sedimentation – Transmission Line Route

The Applicant has routed the transmission line to minimize construction episodes of cut and fill work and avoid construction in steep slope areas. The current layout sites transmission facilities away from steep slopes to the degree possible.

Because construction of the wind farm will occur simultaneously with the transmission line, the Project will utilize one SWPPP. See Section 11.2.2.1 for more information.

11.2.3 Geological Constraints on Design, Construction, and Operation – Wind Farm Project Area and Transmission Line Route

The geologic conditions within the Wind Farm Project Area are well-suited for the construction of the proposed wind facility and associated transmission line. Excavation, bearing, and groundwater conditions associated with the underlying Pierre Shale bedrock within the Wind Farm Project Area and Transmission Line Route are not anticipated to affect construction or operation of the Project facilities.

Geotechnical soil borings will be conducted at wind turbine foundation and transmission line structure locations prior to construction to determine the soil suitability to support turbine foundations and transmission line structures. This information will help dictate final design parameters of the turbine and structure foundations. Modifications to the Project design would be suggested if unfavorable soil conditions are encountered.

12.0 EFFECT ON HYDROLOGY (ARSD 20:10:22:14, 20:10:22:15)

The following sections describe the exiting hydrology within the Wind Farm Project Area and Transmission Line Route and the potential effects of the proposed Project on hydrology.

12.1 Existing Hydrology

This section describes the hydrogeology, surface water resources, floodplains, National Park Service ("NPS") Nationwide Rivers Inventory ("NRI") resources, and impaired waters within the Project vicinity.

12.1.1 Hydrogeology – Wind Farm and Transmission Line Route

The Wind Farm Project Area and Transmission Line Route are located within the Northern Great Plains aquifer system. The aquifer system extends more than 300,000 square miles, underlying most of North Dakota and South Dakota, and parts of Montana and Wyoming. Five major aquifers comprise the permeable rocks of the aquifer system, including: lower Tertiary, upper Cretaceous, lower Cretaceous, upper Paleozoic, and lower Paleozoic (USGS, 1996).

According to Hamilton (1986), the principal aquifers within the Wind Farm Project Area and Transmission Line Route are the Prairie Coteau 1 and Altamont Aquifer 2. The Prairie Coteau 1 aquifer is the shallowest of the three aquifers on the Coteau des Prairies, has a range in depth of 0-40 feet, an aerial extent of 80 square miles, and a storage of 200,000 acre-feet of water. The Altamont Aquifer 2 is located at a lower altitude, is the medium-depth aquifer of the three Altamont aquifers, and has a range in depth of 10-480 feet, aerial extent of 630 square miles, and a storage of 3,230,000 acre-feet of water. Recharge of both aquifers is from infiltration of precipitation as well as from lateral inflow. Groundwater in both aquifers generally contains more than 1,000 milligrams per liter of dissolved solids, such as calcium, magnesium, sodium, bicarbonate, and sulfate, with the Altamont Aquifer showing higher readings.

12.1.2 Surface Water Resources – Wind Farm and Transmission Line Route

The Wind Farm Project Area and Transmission Line Route are located within the Missouri River Basin. The Missouri River Basin consists of sub-region, basin, and sub-basin drainages. The Wind Farm Project Area and Transmission Line Route are within the James and Missouri-Big Sioux Sub-Regions, James and Big Sioux Basins, and the Middle James, Upper Big Sioux, and Mud Sub-Basins (USGS, 2013). The region is well endowed with water resources, and according to the National Wetlands Inventory ("NWI"), contains nearly 1,400 wetlands and waterbodies in both the Wind Farm Project Area and Transmission Line Route (Figures 5a-d). NWI indicates the water resources within the overall Project Area include lakes, freshwater ponds, riverine systems, freshwater emergent wetlands, freshwater scrub-shrub, and freshwater forested wetlands. Based on the number of wetlands in the Project vicinity, this Region of South Dakota extending north into North Dakota is called the "Prairie Pothole Region."

12.1.2.1 Middle James Sub-Basin

The majority of the Wind Farm Project Area and Transmission Line Route are located within the Middle James Sub-Basin (Figures 5a-d). Topography within the Sub-Basin indicates that drainage generally flows in a gradual manner from the northeast to the southwest with a series of small lake basins and prairie pothole wetlands. In the southwestern portion of the Wind Farm Project Area, topography increases to reduce the number of wetlands, and a variety of springs and unnamed waterbodies drain off the Prairie Coteau and join to form Fountain Creek, a tributary to Timber Creek and then the James River.

12.1.2.2 Upper Big Sioux Sub-Basin

The eastern-most portion of the Wind Farm Project Area is located within the Upper Big Sioux Sub-Basin (Figures 5a-d). The Transmission Line Route is not within this Sub-Basin. Topography of the Wind Farm Project Area within this Sub-Basin is fairly gentle throughout, and indicates a slight west to east direction of drainage, with a more southwest to northeast drainage in the southeastern-most portion of the Wind Farm Project Area. Small lake basins and prairie pothole wetlands are present throughout.

12.1.2.3 Mud Sub-Basin

The northern-most portion of both the Wind Farm Project Area and Transmission Line Route are located within the Mud Sub-Basin (Figures 5a-d). Topography is undulating within this Sub-Basin, with small lake basins and prairie pothole wetlands, along with an overall northeasterly drainage.

12.1.3 Floodplains – Wind Farm and Transmission Line Route

Floodplains are hydrologically important areas that perform many natural functions. The storage of excess water and reduction of flow velocity during times of flood, groundwater recharge, provision of habitat, and removal of excess sediment, nutrients, and other pollutants are only some of the functions. The placement of fill into floodplains reduces the effectiveness of these functions.

A search for floodplains as designated by the Federal Emergency Management Agency ("FEMA") indicates that FEMA has not completed a study to determine flood hazards in Clark County (FEMA, 2016).

12.1.4 National Park Service Nationwide Rivers Inventory (NRI) – Wind Farm and Transmission Line Route

The NRI is a listing of "more than 3,400 free-flowing river segments in the United States that are believed to possess one or more "outstandingly remarkable' natural or cultural values judged to be of more than local or regional significance." Under the NRI, all federal agencies must seek to avoid or mitigate actions that would adversely affect one or more NRI segments (NPS, 2011). There are no NRI-listed rivers within the Wind Farm Project Area or Transmission Line Route; the closest NRI segment listed is the James River in Spink County, approximately 23 miles southwest of the Wind Farm Project Area.

12.1.5 Impaired Waters – Wind Farm and Transmission Line Route

The Clean Water Act ("CWA") is the cornerstone of surface water quality protection in the United States. The CWA requires that states assess all waters of the state to determine if they meet water quality standards, publish biannually a list of impaired waters that do not meet water quality standards commensurate with the assigned beneficial use of the water, and develop total maximum daily load ("TMDL") studies or pollutant-reduction goals needed to restore impaired waters. The list of impaired waters is known as the 303(d) list.

There are no 303(d)-listed waterbodies within the Wind Farm Project Area or Transmission Line Route in Clark County. However, there are three lakes located within Clark County that are impaired for mercury in fish tissue (SDDENR, 2016d). Reid Lake is 0.45 mile southeast of the Project boundary, while Swan Lake is approximately 6.7 miles northeast, and Antelope Lake is approximately 10.0 miles southeast. The South Dakota Mercury Total Maximum Daily Load lists point sources of water pollution into mining, non-storm water National Pollutant Discharge Elimination System permitted facilities, and Municipal Separate Storm Sewer Systems ("MS4s") (SDDENR, 2015). The same study attributes nonpoint sources of mercury pollution to wet and dry atmospheric deposition throughout the world. Because the proposed Project does not fit into or impact any of the above listed mercury sources, the Project will not be restricted by the wasteload allocation or load allocation established in the TMDL.

12.2 Facility Impacts – Wind Farm and Transmission Line Route

This section describes the potential effects of the Project on current or planned water uses and surface or groundwater resources.

12.2.1 Effect on Current or Planned Water Use

The Project will not require surface water appropriation, permanent dewatering, or deep well injection, and water storage, reprocessing, or cooling will not be required for either construction or operation of the facilities. The facilities will not impact either municipal or private water uses in the Project vicinity.

Due to the lack of a rural water supply for the O&M facility, a water supply well will be required. Water usage at the O&M facility will be similar to a household volume, or approximately 400 gallons per day (USEPA, 2016). In compliance with the Clark County Zoning Ordinance, a private wastewater treatment system that meets the requirements of the SDDENR would be installed for the O&M facility (Clark County, 2014). However, use of water for operations will be negligible and will not create undue burden so no mitigation is proposed. The batch plant operator will obtain the relevant permits and access to water supply and will address supply and drawdown in those permits.

Residential domestic wells will not be impacted by construction dewatering due to a minimum setback of 2,000 feet from non-participating residences and 1,000 feet from participating residences. In the case that other potential water supply wells are located near potential construction dewatering locations, provisions would be made to ensure that an adequate supply of water is provided until construction dewatering activities have ceased. These impacts are expected to be minor and temporary. Construction dewatering will be conducted in compliance with South Dakota law. Surface water availability for communities, schools, agriculture, recreation, fish, or wildlife will not be impacted.

12.2.2 Potential for Surface and Groundwater Impacts

As described in Section 12.2.1, impacts to groundwater as a result of the Project will be minor and temporary. Potential impacts to surface waters include the delivery of sediment into waters during Project construction due to excavation and the exposure of soils. Additionally, increased stormwater runoff due to an increase in impervious surfaces could result in increased sedimentation, a reduction of available flood storage, and impacts to drainage patterns.

The use of BMPs will minimize the delivery of sediment due to erosional processes. Further discussion of BMPs is in Section 12.2.2.2. Up to approximately 243 acres will be considered impervious surfaces (turbine foundations, access roads, project substation, interconnection substation, O&M facility). Impervious surfaces will represent less than one percent of the Project Area. With a percentage of total area impact that low, the Project is not expected to cause significant changes to existing hydrology or stormwater runoff. The use of BMPs during construction will control erosion and minimize sedimentation during precipitation events.

12.2.2.1 Groundwater Dewatering

As discussed in Section 12.2.1, excavation necessary for the construction of wind turbine foundations, collector line trenches, and transmission structures, dewatering may be required to create the conditions necessary for crew safety and Project success. Construction dewatering may temporarily lower water tables in the immediate area of dewatering activities, and depending on the extent of dewatering, may temporarily lower nearby surface water elevations as dictated by the proximity of the surface water and its connectivity to groundwater.

Because wind turbines and transmission line structures are typically located at higher elevations where water tables tend to be deeper, groundwater dewatering will be minimized to the greatest extent practicable, and where conducted, impacts will be temporary, and BMPs will be implemented. Authorization to Discharge under the Surface Water Discharge System (Permit No.: SDG0700000) will be obtained from the SDDENR prior to commencing construction, and the terms will be adhered to.

12.2.2.2 Deterioration of Water Quality

Excavation and exposure of soils during the construction of wind turbines, access roads, O&M facility, underground collector lines, substation, and transmission line structures holds the potential to cause sediment runoff and sedimentation in receiving waters during storm events.

Project construction will require coverage under the General Permit for Storm Water Discharges Associated with Construction Activities, administered by the SDDENR. One condition of the permit is the development and implementation of SWPPP that identifies potential sources of stormwater pollution at the construction site and specifies the structural and non-structural controls that shall be in place to minimize the negative impacts to receiving waters caused by stormwater discharges associated with the construction activities. The controls, or BMPs, may include silt fence, straw wattles, erosion control blankets, project staging, and other methods to control erosion and sedimentation. Due to the erosion and sediment controls that will be implemented during Project construction, negative impacts to water quality are not anticipated.

12.2.2.3 Impacts to Drainage Patterns

The dispersed nature of the wind farm facility and transmission line structures would not provide enough of a concentration of increased impervious surfaces to change drainage patterns. With wind turbines and transmission line structures generally being located at higher elevations, impacts to streams and drainage ways are not anticipated. The transmission line will be designed to span larger wetlands or other water features where practicable.

The construction of the underground collection system may impact drainageways, but these impacts would be temporary in nature, with existing contours and drainage patterns restored as soon as practicable after trenching, typically within 24 hours of trenching. Where crossings of streams and drainageways cannot be avoided by access roads, appropriately designed crossings (i.e. culverts, low water crossings) would be constructed to maintain existing drainage.

12.2.2.4 Impacts to Flood Storage Areas

As discussed in Section 12.1.3, floodplains have not been mapped by FEMA in Clark County. Although the federal government has not officially mapped floodplains in the County, it is unlikely the Project would impact floodplains. Wind turbines, transmission line structures, access roads, the O&M facility, and the Project substation will be located at higher elevations. Any potential impacts to floodplains would be temporary in nature, and existing contours and elevations would be restored upon project completion.

12.2.2.5 Increased Runoff

The creation of impervious surfaces reduces the ability of soils to infiltrate precipitation to groundwater, potentially increasing the volume and rates of stormwater runoff. The wind turbine and transmission pole foundations, access roads, O&M facility, and substation will create up to 243 acres of impervious surfaces. Infiltration will be inhibited within the newly created impervious surfaces, and incremental increases in stormwater runoff may be exhibited immediately adjacent to these surfaces. However, as discussed in Section 12.2.2, the increase in impervious surfaces represents less than one percent of the Project Area, and the implementation of stormwater BMPs is anticipated to adequately mitigate any increases in runoff as a result of construction. As such, the Project is not anticipated to cause significant changes in runoff patterns or volume.

13.0 EFFECT ON TERRESTRIAL ECOSYSTEMS (ARSD 20:10:22:16)

The following sections describe the existing terrestrial ecosystem within the Wind Farm Project Area and Transmission Line Route and the potential effects of the proposed Project on these terrestrial systems.

13.1 Existing Terrestrial Ecosystem

Terrestrial ecosystem data were collected from literature searches, federal and state agency reports, and natural resource databases. Biologists from Western Ecosystems Technology, Inc ("WEST") provided regional and site-specific information for terrestrial resources.

13.1.1 Vegetation – Wind Farm

The Wind Farm Project Area is located within the Prairie Coteau Level IV Ecoregion of South Dakota (USEPA, 1996). Vegetation communities in this ecoregion are comprised of dry-hill prairie and northern mesic tallgrass prairie, characterized by grass species such as big and little bluestem, Indiangrass, porcupine grass, prairie June grass, and sideoats grama. The Coteau receives sufficient precipitation to support plains American basswood and bur oak forests along the margins of wetlands (Bryce, et al., 1998).

Cultivation occurs in the flatter outwash plains and on gentler slopes void of rocks. Wheat, corn, soybeans, oats, barley, and alfalfa are the main crops grown in Clark County. Pasture land supports cattle and other livestock operations.

Land cover types within the Wind Farm Project Area are summarized in Table 13-1 and displayed on Figures 6a-d.

Table 13-1: Summary of Land Cover in the Wind Farm Project Area

Land Cover Type	Acres in Wind Farm	Percent of Wind Farm
Hay/Pasture	10,888	37.1%
Grassland/Herbaceous	9,860	33.6%
Cultivated Crops	4,634	15.8%
Open Water	2,957	10.1%
Developed, Open Space	670	2.3%
Deciduous Forest	123	0.4%
Emergent Herbaceous Wetlands	92	0.3%
Shrub/Scrub	84	0.3%
Developed, Low Intensity	17	0.1%
Developed, Medium Intensity	4	<0.1%
Woody Wetlands	2	<0.1%
Developed, High Intensity	1	<0.1%
Total	**29,331**	**100.0%**

Hay/pasture lands represent the majority of land cover type (37.1%) in the Wind Farm Project Area. Hay/pasture areas include areas in which naturally occurring or planted grasses, legumes, or grass-legume mixtures used for livestock grazing or the production of seed or hay crops (USGS NLCD, 2011). Grassland/herbaceous areas are second most abundant (33.6%). Site visits and grassland-specific studies indicate that much of the mapped grassland is actively grazed pasture. Hay/pasture, grassland/herbaceous, and cultivated crop land cover types are evenly distributed throughout and represent a combined 86 percent of the Wind Farm Project Area. The cultivated crops include lands being actively tilled, particularly cultivated areas producing annual crops such as corn or soybeans (USGS NLCD, 2011).

The open water land cover type consists of surface water, generally with less than 25 percent cover of vegetation or soil (USGS NLCD, 2011). Most of the open water lakes are located in the northern and western portions of the Wind Farm Project Area. Developed land cover types, which generally correspond with State Highway 20 in the Wind Farm Project Area, consist of areas with a mixture of constructed materials (impervious surfaces) and vegetation.

13.1.2 Vegetation – Transmission Line

The Transmission Line Route is also located within the Prairie Coteau Level IV Ecoregion of South Dakota (USEPA, 1996). The vegetation communities described above also apply to the Transmission Line Route.

Land cover types specific to the Transmission Line Route are summarized in Table 13-2 and displayed on Figures 6a-d. The majority of the Transmission Line Route (74.6%) is mapped as grassland/herbaceous and hay/pasture. Developed, open space is also an abundant land cover type, due to the fact the Transmission Line Route parallels existing roads for most of the route. The Transmission Line Route also passes through cultivated crops and open water land cover types.

Table 13-2: Summary of Land Cover in the Transmission Line Route

Land Cover Type	Acres in Transmission Line Route	Percent of Transmission Line Route
Grassland/Herbaceous	37.51	47.16
Hay/Pasture	21.84	27.45
Developed, Open Space	11.79	14.83
Cultivated Crops	6.75	8.49
Open Water	1.64	2.07
Total	**79.54**	**100%**

Note: The following land cover types are not present within the Transmission Line Route: deciduous forest, developed – high intensity, developed – medium intensity, developed – low intensity, shrub/scrub, emergent herbaceous wetlands, and woody wetlands.

13.1.3 Cropland and Pastureland – Wind Farm

Approximately 16 percent of the Wind Farm Project Area is cultivated cropland (row crop or cover crop) and 70 percent is grassland and pastureland. Site visits confirm that a significant portion of the mapped grassland/herbaceous is actually grazed pasture. In Clark County in 2012 (the latest available year for the U.S. Department of Agriculture ["USDA"] Census of Agriculture), approximately 66 percent of the land area was cropland, corn and soybeans being the most common crops. Other common cultivated crops included forage-land (used for ally hay and haylage, grass silage, and greenchop), wheat, and spring wheat (USDA, 2012). Specific acreages of different crops within the Wind Farm Project Area, which change from year to year, are not available. In Clark County in 2012, approximately 26 percent of the land area was pastureland (USDA, 2012).

Natural Resources Conservation Service ("NRCS") farmland classifications include "prime farmland" (land, which has the best combination of physical and chemical characteristics for the production of crops), "farmland of statewide importance" (land other than prime farmland, which has a good combination of physical and chemical characteristics for the production of crops), and "not prime farmland" (land that does not meet qualifications for prime farmland), amongst other classifications. Approximately 37 percent of the Wind Farm Project Area is classified as "not prime farmland." Approximately 22 percent of the Wind Farm Project Area is classified as "farmland of statewide importance," and approximately 35 percent of the Wind Farm Project Area is classified as "prime farmland." The remaining 6 percent of the Wind Farm Project Area is considered "prime farmland if either drained" (2.9 percent) or irrigated (2.9 percent).

13.1.4 Cropland and Pastureland – Transmission Line Route

Approximately 12 percent of the Transmission Line Route is cultivated cropland (row crop or cover crop) and 72 percent is grassland and pastureland. Similar to the Wind Farm Project Area, site visits confirm that much of the mapped grassland/herbaceous land cover in the Transmission Line Route is grazed pasture.

Approximately 43 percent of the Transmission Line Route is classified as "not prime farmland." Approximately 17 percent of the Project Area is classified as "farmland of statewide importance," and approximately 29 percent of the Project Area is classified as "prime farmland." The remaining approximately 11 percent of the Project Area is considered "prime farmland if drained" or "prime farmland if irrigated."

13.1.5 Conservation Easements – Wind Farm

The USFWS holds some easements on private lands that have wetlands and/or grassland habitat. Land covered by a USFWS grassland easement may not be cultivated and mowing, haying, and grass seed harvesting must be delayed until after July 15 each year. This restriction is to help grassland nesting species, such as ducks and pheasants, complete their nesting before the grass is disturbed. Wetlands covered by a wetland easement cannot be drained, filled, leveled, or burned. A USFWS wetland easement protects the wetland area of a parcel; the upland area outside the wetland is not covered by the easement. The wetland easements help provide crucial habitat for many types of wildlife including ducks, pheasants, and deer. Crocker is coordinating with the USFWS to construct and operate Project facilities on wetland and grassland easements (Figures 7a-d).

Crocker is also conducting a title search to identify any additional conservation easements on any properties within the Wind Farm Project Area.

13.1.6 Conservation Easements – Transmission Line Route

The Transmission Line Route crosses USFWS wetland and grassland easements (Figures 7a-d). Crocker will work with the USFWS to minimize impacts to easement land and will avoid placing transmission structures within wetlands on USFWS wetland easements.

13.1.7 Noxious Weeds – Wind Farm and Transmission Line Route

Noxious weeds are regulated by State (SDCL 38-22) and Federal (US CFR 2006) rules and regulations designed to stop the spread of plants that are detrimental to the environment, crops, livestock, and/or public health. According to the South Dakota Department of Agriculture (SDDOA), 7 listed species of noxious weeds have the potential to occur and are regulated within Clark County (SDDOA, 2015a and 2015b). Three of these species are listed statewide, and the remaining four species are locally listed for Clark County (Table 13-3).

Table 13-3: State and Local Noxious Weeds of South Dakota

Common Name	Scientific Name	State Weed Status
Leafy spurge	*Euphorbia esula*	State noxious weed
Canada thistle	*Cirsium arvense*	State noxious weed
Perennial sow thistle	*Sonchus arvensis*	State noxious weed
Absinth wormwood	*Artemisia absinthium*	Local noxious weed
Field bindweed	*Convolvulus arvensis*	Local noxious weed
Musk thistle	*Carduus nutans*	Local noxious weed
Plumeless thistle	*Carduus acnthoides*	Local noxious weed

13.1.8 Wetlands – Wind Farm

Wetlands perform several important functions within a landscape, including flood attenuation, groundwater recharge, water quality protection, and wildlife habitat. Wetlands are defined in the Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987), as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands have the following general diagnostic characteristics: hydrophytic vegetation, hydric soil, and wetland hydrology.

Wetlands and other waters of the U.S. within the Project Area were identified by reviewing digital NWI data. NWI data are produced by the USFWS and provide reconnaissance level information including location, type, and size of these resources. NWI maps are produced by review of high altitude imagery, and interpretation is variable based on quality of aerial photographs, experience of the interpreter, and whether ground-truthing was conducted.

According to the NWI, approximately 8 percent of the Wind Farm Project Area is mapped as wetlands or ponds (Figures 5a-d). Descriptions of the mapped wetlands and ponds are shown on Table 13-4.

Table 13-4: NWI Mapped Wetlands in the Wind Farm Project Area

Wetland Type		Area (acres)
Palustrine Emergent Wetland (PEM)	PEM1A	169.57
	PEM1Ad	18.76
	PEM1Ax	0.10
	PEM1C	844.49
	PEM1Cd	57.82
	PEM1Cx	4.17
	PEM1F	42.12
	PEM1/ABF	1,055.24
	PEM1/ABFh	0.75
	PEM1/FOA	0.14
	PEM1/FOC	11.88
	PEM1/SSA	0.51
	Sub Total	**2,205.54**
Palustrine Forested Wetland (PFO)	PFOA	13.90
	PFOAh	1.30
	PFO/EM1A	0.32
	PFO/SSC	0.35
	Sub Total	**15.87**
Palustrine Shrub-scrub Wetland (PSS)	PSSA	3.47
	PSSAd	0.72
	PSSC	2.54
	PSS/FOA	4.09
	PSS/FOC	2.06
	Sub Total	**12.88**
Freshwater Pond/Lake/Riverine	PAB/EM1F	49.13
	PABFh	39.37
	PABFx	35.56
	L2ABG	47.80
	R4SBC	24.31
	R5UBH	2.71
	Sub Total	**198.88**
Wetland Total		**2,433.15**

Wetlands are defined by the U.S. Army Corps of Engineers ("USACE") as a subset of waters of the U.S. Other waters of the U.S. include unvegetated waterways and other water bodies with a defined bed and bank, such as tide channels, drainages, ponds, creeks, rivers, and lakes. The USACE has the authority to regulate the discharge of dredged and fill material into jurisdictional waters of the U.S. Impacts to waters of the U.S. are reviewed, permitted, and mitigated through the CWA Section 404 permitting process.

13.1.9 Wetlands – Transmission Line Route

According to the NWI, less than 0.5 acres out of the 80-acre Transmission Line Route is comprised of freshwater emergent wetlands and freshwater pond (Figures 5a-d). Descriptions of the mapped wetlands and ponds are shown on Table 13-5.

Table 13-5: NWI Mapped Wetlands in the Transmission Line Route

Wetland Type		Area (acres)
Palustrine Emergent Wetland (PEM)	PEM1A	0.06
	PEM1C	0.36
	Sub Total	**0.42**
Freshwater Pond	PABFx	0.05
	Sub Total	**0.05**
Wetland Total		**0.47**

13.1.10 Wildlife – Wind Farm and Transmission Line Route

<u>Regulatory Environment</u>

Migratory Bird Treaty Act

The Migratory Bird Treaty Act ("MBTA") is the cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide for international protection of migratory birds. It is a strict liability statute, meaning that proof of intent, knowledge, or negligence is not an element of an MBTA violation. The statute's language is clear that actions resulting in a "taking" or possession (permanent or temporary) of a protected species, in the absence of a USFWS permit or regulatory authorization, are a violation. The MBTA states, "Unless and except as permitted by regulations … it shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import …transport or cause to be transported… any migratory bird, any part, nest, or eggs of any such bird …" 16 U.S.C. 703. The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" 50 CFR 10.12. The USFWS maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines (USFWS, 2015).

USFWS Land-Based Wind Energy Guidelines

On March 23, 2012, the USFWS issued the Land-Based Wind Energy Guidelines ("WEG"; USFWS, 2012). These voluntary guidelines provide a structured, scientific process for addressing wildlife conservation concerns at all stages of land-based wind energy development. They also promote effective communication among wind energy developers and federal, state, and local conservation agencies and tribes. The WEG's are founded upon a tiered approach for assessing potential impacts to wildlife and their habitats. The tiered approach is an iterative decision-making process for collecting information in increasing detail, quantifying the possible risks of proposed wind energy projects to wildlife and habitats, and evaluating those risks to make siting, construction, and operation decisions. Subsequent tiers refine and build upon issues raised and efforts undertaken in previous tiers. At each tier, a set of questions is provided to help the developer identify potential problems associated with each phase of a project, and to guide the decision process. The tiered approach is designed to assess the risks of project development by formulating questions that relate to site-specific conditions regarding potential species and habitat impacts. The tiers are outlined briefly as:

- Tier I: Preliminary evaluation or screening of sites (landscape-level screening of possible project sites; generally based on readily available public information)
- Tier II: Site characterization (comprehensive characterization of one or more potential project sites; generally based on consulting with the appropriate agencies/authorities and one or more reconnaissance level site visits by a wildlife biologist)
- Tier III: Field studies to document site wildlife conditions and predict project impacts (site-specific assessments at the proposed project site; quantitative and scientifically rigorous studies; e.g., acoustical monitoring, point count avian surveys, raptor nest surveys, lek surveys, etc.)
- Tier IV: Post-construction mortality studies (to evaluate direct fatality impacts)
- Tier V: Other post-construction studies (to evaluate direct and indirect effects of adverse habitat impacts, and assess how they may be addressed; not done for most projects; e.g., post-construction displacement and/or use studies, curtailment effectiveness studies, etc.)

This tiered approach allows developers to determine whether they have sufficient information, whether and/or how to proceed with development of a project, or whether additional information gathered at a subsequent tier is necessary to make those decisions. The WEGs indicate that wind energy developers who voluntarily adhere to these guidelines will be undertaking a robust level of wildlife impact analysis, and have a shared responsibility with the USFWS to ensure that the scientific standards of the guidelines are upheld and used to make wise development decisions.

It is important to note that not all of the five tiers are recommended or necessary for all projects.

At each tier, potential issues associated with developing or operating a project are identified and questions formulated to guide the decision process. The guidelines outline the questions to be posed at each tier, and recommend methods and metrics for gathering the data needed to answer those questions. If sufficient data are available at a particular tier, the following outcomes are possible based on analysis of the information gathered:

- The project is abandoned because the risk is considered unacceptable,
- The project proceeds in the development process without additional data collection,
- An action, or combination of actions, such as project modification, mitigation, or specific post-construction monitoring, is indicated.

If data are deemed insufficient at a tier, more intensive study is conducted in the subsequent tier until sufficient data are available to make a decision to abandon the project, modify the project, or proceed with and expand the project (USFWS, 2012).

Results of Tier I and II Process

A Tier I and II Site Characterization Study ("SCS") was completed for the proposed Project in October 2016 (Appendix A). The study was based on off-site resources, a site visit by a qualified biologist on April 17, 2016, and solicitation of written comments from South Dakota Game, Fish and Parks ("SDGFP") and the USFWS in April and October of 2016. Based on the results of the SCS, Tier III studies are in progress for the Project. This decision was reached by answering the following questions from the USFWS guidelines:

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

Correspondence with SDGFP did not identify any known records of federally- or state-listed species within the Wind Farm Project Area and Transmission Line Route. Additionally, designated critical habitat is not present within the Wind Farm Project Area and Transmission Line Route. Several records of non-listed species of concern were documented within two miles of the Wind Farm Project Area (colonial waterbirds, including great egret, snowy egret, great blue heron and black-crowned heron).

Significant grassland land cover is present within the Wind Farm Project Area and Transmission Line Route which may provide suitable habitat for two federally-listed butterfly species: the Dakota skipper and Poweshiek skipperling. Many of these parcels have been heavily grazed, degrading potentially suitable habitat. Suitable forested habitat for summer foraging and roosting for the northern long-eared bat is limited in the Wind Farm Project Area and Transmission Line Route. Bald eagles may be present in the Wind Farm Project Area and Transmission Line Route, however nesting and perching habitat opportunities are also limited due to lack of large trees and tall structures for nesting.

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

Federally-owned parcels are not present in the Wind Farm Project Area or the Transmission Line Route; several USFWS-managed easements on private land occur within the Wind Farm Project Area and along the Transmission Line Route. Crocker is coordinating with USFWS on wind farm development on some of these easements.

Designated critical habitat for federally-listed species is not present within the Wind Farm Project Area or Transmission Line Route. Two state-managed Game Production Areas fall within the

Wind Farm Project Area; other state-owned and managed lands are also present adjacent to the Wind Farm Project Area. A private land with public hunting Walk in Area ("WIA") is designated within the Wind Farm Project Area and is adjacent to one of the Game Production Areas. The Transmission Line Route is adjacent to this WIA.

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

Land cover in the Wind Farm Project Area and Transmission Line Route is primarily cultivated cropland, grazed pasture and open water. As such, suitable habitat for rare plant species is limited. While a large portion of the Wind Farm Project Area is believed to be unbroken sod, many of these parcels are currently in use as pasture and therefore, degraded. There may be scattered parcels that have remained ungrazed; these may support some species of rare plants associated with untilled prairies.

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

Crocker found that there are no Natural Heritage Database ("NHD") records of bat maternity roosts or hibernacula or other animal congregation areas within the Wind Farm Project Area or Transmission Line Route. The NHD identified a colonial waterbird nesting site within two miles of the Wind Farm Project Area. Wildlife may congregate in habitat offered by the lakes and wetlands that are found within the Wind Farm Project Area, particularly during avian migration. However, suitable habitat is not found in higher densities within the Wind Farm Project Area and Transmission Line Route than in areas adjacent to or surrounding the Project. Crocker conducted aerial lek surveys in 2016 and 2017 and did not identify any leks in the Wind Farm Project Area. Similarly, based on eagle nest surveys, there are no eagle nests within 5 miles of the Project.

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

Much of the Wind Farm Project Area and Transmission Line Route have been previously highly fragmented; land cover within the Wind Farm Project Area and Transmission Line Route Project Area is primarily pasture, cultivated cropland, and developed land. However, intact grasslands and pasture/hay parcels can be found in relatively large, contiguous complexes, particularly in the western half of the Wind Farm Project Area. These areas may provide suitable habitat for species such as the upland sandpiper, marbled godwit, sedge wren, grasshopper sparrow, and the northern harrier, which are all identified by the USFWS as species of habitat fragmentation concern (USFWS, 2013b).

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

The Wind Farm Project Area and Transmission Line Route occur within the range of the northern long-eared bat, and the species may be found foraging and roosting in summer within the limited forested areas within the Project boundary. The species may also be found more generally throughout the Wind Farm Project Area and Transmission Line Route during early fall migration. A Northern long-eared bat desktop habitat assessment was completed as well as acoustic surveys.

Northern long-eared bat habitat is limited in the Wind Farm Project Area and northern long-eared bat was not qualitatively verified at any of the four acoustic stations (Appendix B).

Grassland and prairie species may find suitable breeding, nesting, and foraging habitat within the areas providing this cover type within the Wind Farm Project Area and Transmission Line Route. A prairie grouse survey did not identify any leks in the Project vicinity (Appendix B). Bald eagles may be present year-round in the Wind Farm Project Area and Transmission Line Route, although suitable nesting and winter roosting habitats are limited. Golden eagles are less common in this area and may rarely be found during migration. The area is likely to be used by relatively high numbers of waterfowl, although risk to this avian group from wind projects appears to be relatively low. Additional field studies for breeding birds and federally listed butterflies will be conducted during 2017. A list of species observed during the first year of avian surveys (April 2016 – March 2017) can be found in Appendix B.

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

The potential for adverse impacts to species of concern is low, based on available information. Habitat features within the Wind Farm Project Area and Transmission Line Route are not found in higher densities than in the surrounding landscape, and designated critical habitat is not present in the Wind Farm Project Area and Transmission Line Route.

Summary of Tier I and Tier II Process

Crocker initiated Tier III studies in April 2016 to provide baseline avian and bat use data (Appendix B). The Tier I and II questions identified quality habitats in native prairie, Game Production Areas, and conservation easements within the Wind Farm Project Area and Transmission Line Route, as well as Game Production Areas found adjacent. Habitat assessment work has informed the turbine siting process to minimize impacts to quality habitats. Turbines will not be sited in the Game Production Areas or WPAs. One turbine and associated infrastructure is sited in the privately owned WIA. Modification of this WIA may be required on a temporary basis for the safety of the construction and operation staff.

Baseline avian and bat data have been incorporated into the Bird and Bat Conservation Strategy (“BBCS”; Appendix C). Crocker will continue to coordinate with USFWS and SDGFP on Tier III data and the BBCS.

Bald and Golden Eagle Protection Act

Under authority of the Bald and Golden Eagle Protection Act (“Eagle Act”), 16 U.S.C. 668–668d, bald eagles and golden eagles are afforded additional legal protection. The Eagle Act prohibits the take, sale, purchase, barter, offer of sale, purchase, or barter, transport, export or import, at any time or in any manner of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof, 16 U.S.C. 668. The Eagle Act also defines take to include “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb,” 16 U.S.C. 668c, and includes criminal and civil penalties for violating the statute. See 16 U.S.C. 668. The term “disturb” is defined as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury to an eagle, or either a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior, 50 CFR 22.3.

Eagle Conservation Plan Guidelines

Wind energy developers and wildlife agencies have recognized a need for specific guidance to help make wind energy facilities compatible with eagle conservation and the laws and regulations that protect eagles. The USFWS has developed the Eagle Conservation Plan Guidance, Module 1 – Land-based Wind Energy, Version 2 (“ECPG”) (USFWS, 2013a). The ECPG suggest specific questions that should be considered to help place a prospective project site into an appropriate risk category. Crocker has considered these questions and provided responses below.

Does existing or historical information indicate that eagles or eagle habitat may be present within the geographic region under development consideration?

Suitable nesting and foraging habitat is limited within the Wind Farm Project Area and Transmission Line Route. The Prairie Coteau landscape does not support the large trees eagles require to build nests. There is the potential for eagles to forage in the large lakes near or within the Wind Farm Project Area and Transmission Line Route; however, they are more likely to occur along the Big Sioux and James Rivers in winter due to ice cover on the lakes. Throughout the year, areas along these larger rivers appear to be used by eagles more than the lakes on the Prairie Coteau.

Within a prospective project site, are there areas of habitat known to be or potentially valuable to eagles that would be destroyed or degraded due to the project?

At the time of application Crocker has not identified any areas of habitat uniquely valuable to eagles and Crocker’s plans do not include activities that would destroy or degrade areas of unique habitat value.

Are there important eagle use areas or migration concentration sites documented or thought to occur in the project area?

There are no important eagle use areas or migration concentration sites found in the Wind Farm Project Area and Transmission Line Route.

Does existing or historical information indicate that habitat supporting abundant prey for eagles may be present within the geographic region under development consideration?

It does not appear that the lakes near or within the Wind Farm Project Area and Transmission Line Route support abundant prey. The Big Sioux and James Rivers to the east and west of the Wind Farm Project Area and Transmission Line Route, respectively, are more likely to support prey throughout the year.

For a given prospective site, is there potential for significant adverse impacts to eagles based on answers to above questions and considering the design of the proposed project?

Raptor nest surveys in April of 2016 and 2017 did not identify any eagle nests within the Wind Farm Project Area or Transmission Line Route. As of June 30, 2017, only eight bald eagle observations totaling 12 eagle minutes have been observed over the course of 410 hours of eagle use surveys (April 2016 – June 2017). Currently Bald Eagles are being observed at a rate of .06% of the survey time and golden eagles are being observed 0% of the survey time indicating low eagle usage of the site. Two of these observations were in late fall 2016, five in March 2017, and one in May 2017. One observation was a perched eagle; the rest were eagles traveling through the Wind Farm Project Area. Suitable nesting and foraging habitat is limited within the Wind Farm Project Area and Transmission Line Route. For these reasons, the potential for significant adverse impacts to eagles at Crocker is low.

Summary of Eagle Conservation Plan Guidance and 2016 Raptor Nest Surveys

Crocker conducted a raptor nest survey in early April 2016, in accordance with guidelines provided in the ECPG. Bald eagle nest surveys focused on locating eyries (large, stick nest structures) in suitable eagle nesting substrate (trees, transmission lines, cliff faces, etc.) within and around the proposed Wind Farm Project Area and Transmission Line Route and a 1-mile and 10-mile buffer areas. No occupied or potential bald eagle nests were located within the Wind Farm Project Area and Transmission Line Route. A total of two occupied active bald eagle nests were observed within the 10-mile buffer area. The distance to the Wind Farm Project Area and Transmission Line Route from the nests ranged from 3.3 to 5.1 miles. The 2016 raptor nest survey report is included in Appendix B.

The inter-nest distance of the two bald eagle nests observed is 8.4 miles. The ECPG states that eagle pairs at nests within one-half the mean inter-nest distance, in this case 4.2 miles, are susceptible to disturbance take and blade strike mortality. However, it is anticipated that most flight corridors used by nesting bald eagles are located closer than 4.2 miles from the nest. Additionally, the Draft Midwest Wind Energy Multi-Species Habitat Conservation Plan (USFWS, 2016a) lists 1.6 miles as a maximum area for turbine setbacks from bald eagle nests, with potential for turbines to be sited closer if evidence shows they are not located within higher use travel corridors. Crocker will continue to monitor eagle use within the Wind Farm Project Area through April 2018 and reevaluate the risk to eagles at that time.

<u>Wildlife</u>

Information on the existing wildlife in the Wind Farm Project Area and Transmission Line Route was obtained from a variety of sources including SDGFP, USFWS, and avian and bat preconstruction surveys conducted by Crocker (initiated in April 2016). The following sections include a discussion of general wildlife that occurs in the Wind Farm Project Area and Transmission Line Route.

Wildlife in the Wind Farm Project Area and Transmission Line Route consists of birds, mammals, fish, reptiles, amphibians, and insects, both resident and migratory, which use habitat found in the Wind Farm Project Area and Transmission Line Route for foraging, breeding, and/or sheltering.

The resident species are representative of South Dakota game and non-game fauna that are associated with upland grasslands, farmlands, and wetland and forested areas. The majority of the migratory wildlife species are birds, including waterfowl, raptors, and songbirds.

Included below is a discussion of migratory and resident birds, mammals, reptiles and amphibians that are expected to exist in the Wind Farm Project Area and Transmission Line Route.

Birds

Various migratory and resident bird species use the Wind Farm Project Area and Transmission Line Route as a part of their life cycle. Migratory bird species may use the Wind Farm Project Area and Transmission Line Route for resting, foraging, or breeding activities for only a portion of the year. Resident bird species occupy the Wind Farm Project Area and Transmission Line Route throughout the year. A list of migratory and resident bird species documented by WEST during April 2016 – March 2017 avian surveys at the Wind Farm Project Area is presented in Appendix B. It is anticipated that the species listed from current surveys will be representative of bird use in the Project vicinity and adequately predict and document the bird presence and use of the Wind Farm Project Area. Nonetheless, Crocker will continue to conduct studies during the state facility permit process and will provide the results of those studies to SDGFP and the Commission.

The Prairie Pothole Region provides habitat for potentially high concentrations of both waterfowl and grassland birds. Birds observed during April 2016 – March 2017 include upland game birds (ring-necked pheasant, mourning dove, wild turkey), ducks and geese (Canada goose, mallard, canvasback, redhead), raptors (northern harrier, red-tailed hawk, American kestrel), shorebirds (killdeer, lesser yellowlegs, upland sandpiper), woodpeckers (red-headed woodpecker, hairy woodpecker, northern flicker), and songbirds (wrens, sparrows, blackbirds, swallows). None of the observed birds are federally or state protected species. Several are Birds of Conservation Concern ("BCC") species as identified by USFWS (see Appendix B).

Mammals

Mammals that may occur in the Wind Farm Project Area and Transmission Line Route use the food and cover available from agricultural fields, grasslands, farm woodlots, wetland areas, and wooded ravines. Grassland areas and woody vegetation are also habitat for a variety of small mammals. White-tailed deer (*Odocoileus virginianus*), an economically important species, have a strong affinity for agricultural crops and use farm woodlots, wooded ravines, and intermittent stream bottoms for shelter.

Bat species present in South Dakota include the hoary bat (*Lasiurus cinereus*), eastern red bat (*Lasiurus borealis*), big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), northern long-eared bat (*Myotis septentrionalis*), and little brown bat (*Myotis lucifiugus*). These bat species are known to occur throughout South Dakota and the Midwest, and therefore, it is anticipated that a similar combination of bat species will be found in the vicinity of the Project Area. Crocker has conducted pre-construction bat acoustic surveys; the results of these surveys are discussed in Section 13.1.2.1.

Reptiles and Amphibians

Reptile and amphibian species that may be present in the Wind Farm Project Area and Transmission Line Route include many snakes, frogs, and turtles. These species may utilize grasslands, wetlands, and pasture areas.

13.1.11 Sensitive Terrestrial Species – Wind Farm and Transmission Line Route

13.1.11.1 Federally-listed Species

The Endangered Species Act ("ESA") directs the USFWS to identify and protect endangered and threatened species and their critical habitat, and to provide a means to conserve their ecosystems. Among its other provisions, the ESA requires the USFWS to assess civil and criminal penalties for violations of the Act or its regulations. Section 9 of the ESA prohibits take of federally-listed species. Take is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct" 16 U.S.C. 1532. The term "harm" includes significant habitat alteration which kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering, 50 CFR 17.3. Projects involving federal lands, funding or authorizations will require consultation between the federal agency and the USFWS, pursuant to section 7 of the ESA. Because some of the Project facilities are proposed to be built on USFWS easements, a federal nexus will occur in connection with the associated right-of-way review process.

Federally-listed species that may be present in Clark County, South Dakota are found in Table 13-6.

Table 13-6: Federally Listed Species Known to Occur in Clark County

Scientific Name	Common Name	ESA Status
Myotis septentrionalis	Northern long-eared bat	Threatened
Hesperia dacotae	Dakota skipper	Threatened
Oarisma poweshiek	Poweshiek skipperling	Endangered
Notropis topeka	Topeka shiner	Endangered
Calidris canutus rufa	Rufa red knot	Threatened
Grus americana	Whooping crane	Endangered

A review of the state NHD did not identify any records for federally-listed species within in the Wind Farm Project Area and Transmission Line Route. Federally listed species known to occur in Clark County are discussed in detail, below.

Northern long-eared bat

The range of the northern long-eared bat ("NLEB") stretches across much of the eastern and Midwestern United States. During summer, northern long-eared bats roost singly or in colonies under bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females may also roost in cooler places such as caves and mines. This species is thought to be opportunistic in selecting roosts, utilizing tree species based on the tree's ability to retain bark or provide cavities or crevices. It has also been found, rarely, roosting in structures such as barns and sheds. In winter, northern long-eared bats utilize caves and mines as hibernacula (USFWS, 2016b).

On April 1, 2015, the USFWS listed the NLEB as threatened under the Endangered Species Act (ESA) and simultaneously published an interim 4(d) rule; the final listing and interim 4(d) rule took effect as of May 4, 2015. On January 14, 2016 the USFWS published the final 4(d) rule identifying prohibitions that focus on protecting the bat's sensitive life stages in areas affected by White Nose Syndrome ("WNS"). (USFWS, 2016c). The 4(d) rule allows incidental take of the species resulting from otherwise lawful activities, including wind farm construction and operation. The 4(d) rule and the associated Biological Opinion is intended for use by agencies to streamline consultation for northern long-eared bats. Under the provisions of the 4(d) rule, incidental take is not prohibited for wind farm construction and operation more than 0.25 mile from known hibernacula and more than 150 feet from known roost trees within areas of the country affected by white nose syndrome. With the discovery of a WNS infected hibernacula in Becker County, Minnesota in the winter of 2016/2017, the USFWS WNS buffer zone was expanded to include portions of eastern South Dakota; Clark County falls within the WNS zone.

This species is associated with mature, interior forest habitats (Center for Biological Diversity, 2016). South Dakota forms the western edge of northern long-eared bat range. In addition, roosting and foraging habitats are limited in the Wind Farm Project Area and Transmission Line Route.

Acoustic surveys were conducted for northern long-eared bats within the Wind Farm Project Area from July 22-27, 2016 (Appendix B). Surveys were completed at two sites in suitable northern long-eared bat habitat. Qualitative analysis of the acoustic data did not identify the presence of northern long-eared bats at either site. No further surveys are required; this species is likely absent from the Wind Farm Project Area.

Dakota skipper and Poweshiek skipperling

The Poweshiek skipperling is a small butterfly with a wing-span of approximately 1 inch. Coloration is dark brown above with some light orange along the wing margins and a lighter orange head. The underside of the wings, which can be seen when at rest, are dark to light brown with very prominent white veins that may make the wing look striped. The Poweshiek skipperling is found untilled prairie fens, grassy lake and stream margins, moist meadows, and wet-mesic to dry tallgrass prairies. Skipperling larvae hibernate over winter on the ground; they emerge in spring and early summer to continue developing until they pupate and emerge as adult butterflies. Adults have a short lifespan of only one to two weeks and can be seen between mid-June and mid-July, during which they breed and lay eggs. Larvae hatch during late summer; they feed and develop through early fall and then overwinter to continue development the following spring (USFWS, 2014a).

The Dakota skipper is a small-to-medium sized butterfly characterized by a short, sturdy body and a quick, skipping flight. Adult males are tawny-orange to brown on dorsal surfaces with lighter, dusty yellow-orange ventral surfaces; forewings display conspicuous dark markings (Royer and Marrone, 1992). The species is an obligate of untilled, high-quality native prairie containing a variety of wildflowers and grasses (McCabe 1981, Royer and Marrone, 1992). Like the Poweshiek skipperling, this species can be found in both wetlands and uplands. Dakota skippers do not thrive in heavily grazed or cultivated areas. The preferred wetland habitat is associated with plant species consisting of bluestem grasses, wood lily, and harebell. The preferred upland habitat contains bluestem grasses, needlegrass, purple coneflower, and blanketflower. Like the Poweshiek skipperling, Dakota skipper adults have a lifespan of only one to two weeks and can also be seen during the breeding and egg-laying season between mid-June and mid-July (USFWS, 2014a).

Ground-based field assessments were conducted on September 21-22 and 26-28, 2016 to determine the presence of suitable habitat for federally-listed butterfly species within grassland parcels within the Wind Farm Project Area (Appendix B). The majority of the grassland habitats within the Wind Farm Project Area are not suitable for the Poweshiek skipperling or Dakota skipper; these areas are heavily grazed, soils are compacted, and are generally dominated by smooth brome and Kentucky bluegrass. Suitable habitat is present elsewhere in the Wind Farm Project Area; approximately 162.5 acres of grassland habitat may be suitable for federally-listed butterfly species. Not all grassland parcels were surveyed due to access restrictions and additional assessments occurred in June of 2017 on grassland parcels. Individual butterfly surveys occurred during the June/July flight period. No Dakota skipper or Poweshiek skipperling were documented during these surveys.

Topeka shiner

The Topeka shiner is a small minnow, typically less than three inches in length. Coloring is silver with a dark lateral stripe. The species primarily occurs in small to mid-size prairie streams in the central United States where it is usually found in pool and run areas containing clear, clean water in South Dakota, Minnesota, Kansas, Iowa, Missouri and Nebraska. Typical Topeka shiner streams are perennial, but the species may be found in those which lose flow seasonally. Suitable streams tend to have good water quality and cool to moderate temperatures (USFWS, 2010; 2016d).

Critical habitat has been designated for the Topeka shiner, but is not present in the Wind Farm Project Area and Transmission Line Route. Field surveys were not conducted for this species; a review of the NHD did not identify any records of Topeka Shiner in the Wind Farm Project Area and Transmission Line Route.

Rufa red knot

The red knot is a large sandpiper known for its long-distance migration between breeding grounds in the Arctic and wintering areas in high latitudes of the Southern Hemisphere. Although large numbers of rufa red knots migrate along the Atlantic coast of North America and winter on the coasts of South America, there are also rufa red knots that winter in the southeastern U.S., including Florida, South Carolina, Georgia, and Texas; some individuals wintering in the northwestern Gulf of Mexico migrate through the interior of North America in spring and fall and use stopover sites in the Northern Great Plains.

The occurrence of rufa red knots in South Dakota is unpredictable, and the number of migrating shorebirds documented in the interior can vary dramatically due to high inter-annual availability in water levels and habitat quality at mid-continental wetlands. Suitable stopover habitat is present in the Wind Farm Project Area and Transmission Line Route (USFWS, 2014b).

Field surveys were not conducted for this species due to the unpredictable presence of individuals in the Wind Farm Project Area and Transmission Line Route.

Whooping crane

The whooping crane is characterized by its large size; it is the tallest bird in North America, and adults stand nearly 5 feet tall with a wing span that averages 7.5 feet. Adult plumage is primarily white with black primary feathers on the wings, with a red crown and red facial skin often apparent. Juvenile plumage is brown or cinnamon throughout with short facial feathers. (CWS and USFWS 2007).

Whooping cranes embark on a bi-annual migration from summer nesting and breeding grounds in Wood Buffalo National Park in northern Alberta to the barrier islands and coastal marshes of the Aransas National Wildlife Refuge on the Gulf Coast of Texas. The migratory corridor is approximately 2,400 miles in length, 220 miles wide, and includes eastern Montana and portions of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma and eastern Texas (USFWS 2014c). The birds arrive in Texas in the weeks between late October and mid-November and remain in the wintering grounds until late March. Spring migration begins between March 25 and April 15, with the last birds leaving the Texas coast by May 1 and arriving in the Wood Buffalo nesting grounds a few weeks later (CWS and USFWS 2007).

During migration, birds stop to feed daily and primarily forage for waste grains in agricultural fields (Johns et al. 1997) but will also eat frogs, fish, crayfish, insects, and plant tubers (CWS and USFWS 2007). They also utilize upland freshwater sites and forage for acorns, crayfish, insects, and snails (Chavez-Ramirez et al. 1996). Migrating cranes also use riverine habitats and more open roosting sites in wetlands, sandbars and shallow river channels (CWS and USFWS 2007).

13.1.11.2 State-listed Species

South Dakota’s endangered species law (SD Statute 34A-08) regulates the taking, importation, transportation, and sale of state endangered or threatened species. SDGFP administers the state list of rare, threatened, and endangered species. There is one state-listed species that may be present in Clark County, South Dakota – the northern river otter, which is listed as threatened.

Element Occurrence Records provided by the Wildlife Diversity Program, SDGFP on March 14, 2016, indicate no occurrences of state sensitive or tracked invertebrate and/or vertebrate species within the Wind Farm Project Area and Transmission Line Route. State species of concern were documented within two miles of the Wind Farm Project boundary; these species are not afforded protections under the state endangered species law statute. The record included a colonial waterbird nesting colony for snowy egret, great egret, great blue heron, and black-crowned night heron.

13.2 Impacts to Terrestrial Systems

13.2.1 Vegetation – Wind Farm

Vegetation will be removed for the installation of turbine pads, access roads, substations and O&M facilities. It is expected that the majority of the turbines will be sited in plowed crop fields that are typically planted in row crops. Access roads in the agricultural landscape are expected to impact crop fields, and potentially grassed areas of ditches and roadsides, or small wooded areas. Crocker's final design will determine the final disturbance acreage. Less than one percent of the Wind Farm Project Area will be permanently converted to sites for wind turbines, access roads, and facilities. Currently Crocker's upper estimate of permanent disturbance is 243 acres of land converted to wind project facilities. The areas surrounding each turbine will still be able to be farmed, grazed, or otherwise managed as it was prior to installation of the wind farm.

Temporary vegetation impacts will be associated with crane walkways, the installation of underground collection lines, and contractor staging and lay down areas. With ground disturbance and equipment deliveries from different geographic regions, Crocker will work together with all Project construction parties entering the Project Area to control and prevent the introduction of invasive species. To the extent practicable, direct permanent and temporary impacts to natural areas, including wetlands and native prairies, will be avoided and minimized.

A summary of permanent impacts is provided in Table 13-7. The amount of vegetation that will be removed as a result of the Project will be determined once a site layout is finalized, but the vast majority is anticipated to be hay/pasture, grassland/herbaceous, and cultivated crops. Vegetation will be permanently removed and replaced by wind turbines, access roads, and substation components. Additional areas may also be temporarily disturbed for the installation of underground power lines during construction. Approximately 10 acres of land will be temporarily impacted for contractor staging, concrete batch plant, if utilized, and laydown areas. Temporarily disturbed areas will be reseeded to blend with existing vegetation. The turbines will avoid forests and groves to maximize turbine output and reduce tree removal. Avoidance and minimization of impacts to native prairies and wetlands will reduce impacts to those vegetated areas.

Table 13-7: Summary of Estimated Permanent Impacts to Vegetation (Acres)

	Cultivated Crops	Grassland/ Herbaceous	Hay/ Pasture	Developed, Open Space and Low Intensity	Shrub/ Scrub Wetland	Total
Gamesa G126 Turbines	7.32	17.94	36.40	-	-	**61.66**
Gamesa G126 Access Roads	10.41	32.00	51.73	4.15	-	**98.29**
Vestas V136 Turbines	4.86	12.44	29.75	-	-	**47.06**
Vestas V136 Access Roads	6.76	25.47	43.07	3.14	-	**78.45**
GE 2.5-116 Turbines	8.04	18.92	37.81	0.14	-	**64.91**

Table 13-7: Summary of Estimated Permanent Impacts to Vegetation (Acres)

	Cultivated Crops	Grassland/ Herbaceous	Hay/ Pasture	Developed, Open Space and Low Intensity	Shrub/ Scrub Wetland	Total
GE 2.5-116 Access Roads	10.19	33.54	52.45	4.24	-	**100.43**
Vestas V110 Turbines	14.46	21.52	44.99	0.14	0.03	**81.13**
Vestas V110 Access Roads	18.52	39.47	64.78	4.68	0.37	**127.82**
O&M Facility	4.55	-	0.94	-	-	**5.50**
Project Substation	6.98	2.15	0.29	-	-	**9.42**
Interconnection Substation	-	14.30	4.19	-	-	**18.49**
MAX. EST. TOTAL[1]	**44.52**	**77.44**	**115.20**	**4.8**	**0.41**	**242.37**

[1]Totals here include permanent impacts for the O&M facility, project substation, interconnection substation, and Vestas V110 turbines and access roads because that layout has the most infrastructure (200 turbines and associated facilities). Permanent impacts will be less if a different turbine model is used.

The following measures will be used to avoid and minimize potential impacts to land of the Project area during siting, construction, and operation to the extent practicable:

- Conduct a preconstruction inventory of the Project Area for existing WPAs, GPAs, recreation areas, wetlands, native prairie, and forests. The pre-construction inventories will have varying levels of detail with the most specific detail in the vicinity of construction;
- Exclude established WPAs, GPAs, and recreation areas from consideration for Project facilities;
- Avoid disturbance of wetlands during construction and operation of the Project. If jurisdictional wetland impacts are proposed, then the Applicant will obtain applicable wetland permits;
- Design Project to minimize the need to clear existing trees and shrubs;
- Prepare a construction SWPPP and secure a NPDES Permit; and
- Use BMPs during construction and operation of the Project to protect topsoil and adjacent resources and to minimize soil erosion. Practices may include containing excavated material, protecting exposed soil and stabilizing restored material, revegetating non-cropland and range areas with wildlife conservation species and, wherever feasible, planting native tall grass prairie species in cooperation with landowners.

13.2.2 Vegetation – Transmission Line

Permanent impacts from the transmission line will be limited to structure foundations, which will range from 6 feet to 11 feet. There will be temporary impacts associated with accessing the structure foundations. Similar to the wind farm, temporarily disturbed areas impacts will be reseeded to blend in with the surrounding vegetation. See above for mitigiatve measures for vegetation impacts along the Transmission Line Route.

13.2.3 Wetlands – Wind Farm

Turbines, step-up transformers, and meteorological towers will be constructed on higher elevation portions of the Wind Farm Project Area to maximize the wind resource, and as such are likely to avoid direct impacts to wetlands, which tend to be in lower topographic positions. Permanent impacts to wetlands will be less than one acre, depending on the final layout (Table 13-8). Note that wetland delineation data was used for the majority of this analysis; however, there have been layout changes since the field data was collected. NWI data are used to supplement the survey data in some locations. All mapped water features will be field verified and final impact calculations will vary based on delineated wetlands (USACE, 1987). Additionally, after field verification of wetlands, Project facilities may undergo minor shifts so as to avoid wetland features to the extent practicable. Access roads, operations facility and substations will be designed to avoid impacts to wetlands whenever feasible. Temporary impacts associated with crane walkways will also be minimized. Installation of underground utilities is expected to avoid impacts by boring under water features as necessary and will minimize impacts to wetlands or where possible make them coincident with other impacts (e.g., crane walks).

Table 13-8: Summary of Wetland Impacts[1]

	Delineated Wetlands (acres)		NWI Wetlands (acres)	Total Impacts (acres)
	PEM	L2AB	PEM	
Gamesa G126 Turbines	-	0.06	-	**0.06**
Gamesa G126 Access Roads	0.42	-	0.03	**0.45**
Vestas V136 Turbines	-	0.06	-	**0.06**
Vestas V136 Access Roads	0.29	-	0.02	**0.31**
GE 2.5-116 Turbines	-	0.06	-	**0.06**
GE 2.5-116 Access Roads	0.42	-	0.03	**0.45**
Vestas V110 Turbines	0.07	0.06	-	**0.13**

Table 13-8: Summary of Wetland Impacts[1]

	Delineated Wetlands (acres)		NWI Wetlands (acres)	Total Impacts (acres)
	PEM	L2AB	PEM	
Vestas V110 Access Roads	0.44	-	0.04	**0.44**
Interconnection Substation	0.37	-	-	**0.37**
MAX. EST. TOTAL[2]	**0.88**	**0.06**	**0.04**	**0.98**

[1]This summary provides impacts within the survey corridor. In some instances, the layout design has changed to areas outside that survey corridor and therefore, are supplemented with NWI mapped wetlands. No wetland impacts are anticipated at the O&M facility or the project substation.
[2]Totals here include wetland impacts for the interconnection substation and the Vestas V110 turbines and access roads because that layout has the most infrastructure (200 turbines and associated facilities). Wetland impacts will be less if a different turbine model is used.

Formal wetland delineations of the Project Area will be completed prior to construction, and the layout will be designed to avoid and minimize wetland impacts. Wetlands will be avoided to the extent possible during the construction phase of the Project. If wetland impacts cannot be avoided, the Applicant will submit a permit application to the USACE for dredge and fill within waters of the U.S. under Section 404 of the CWA.

Crocker will mitigate direct or indirect impacts to wetlands during construction and operation by protecting topsoil, minimizing soil erosion and protecting adjacent wetland resources. Practices may include containing excavated material, use of silt fences, protecting exposed soil, stabilizing restored material, and re-vegetating disturbed areas with non-invasive species.

13.2.4 Wetlands – Transmission Line

Impacts to wetlands from the transmission line are expected to be minimal and temporary in nature. Because transmission structure spans will range from 400 feet to 1,000 feet, Crocker anticipates siting structures in upland areas only, spanning any wetlands along the Transmission Line Route. Temporary impacts may result from construction matting to access structure locations. Crocker will obtain any required permits prior to wetland impacts.

13.2.5 Wildlife – Wind Farm

Development of the Project, including the construction and operation, is expected to produce a minimal impact to wildlife. Based on studies of existing wind power projects in the United States and Europe, the impact to wildlife would primarily occur to avian and bat populations. While Crocker preconstruction surveys are ongoing, it can be expected that, similar to other wind developments, there is a high likelihood that individual bird and bat fatalities will occur at the Project, but that it is unlikely to affect populations of most species, especially at a regional scale.

Few recent studies are available in comparable landscapes that provide both pre- and post-construction data from which to draw correlative inferences about potential impacts. However, studies conducted at other wind facilities in the Midwest can be instructive and provide useful comparisons. The purpose of these post-construction studies was to estimate the avian and bat fatality rates and identify any patterns related to habitat or conservation lands.

13.2.5.1 Bird Fatality

The studies described below focus on post-construction fatality patterns observed for waterfowl and grassland birds, the two guilds of birds that are most prevalent in the Project vicinity and in the same geographic region.

- Post-construction mortality monitoring at PrairieWinds ND1 near Minot, North Dakota in 2010 and 2011 found waterfowl mortality per MW to be 0.38 and 0.44, respectively (Derby et al. 2011a, 2012a). The Project is located in a dense complex of prairie pothole wetlands.

- PrairieWinds SD1 near Crow Lake, South Dakota is also located in prairie pothole wetland habitat similar to PrairieWinds 1. Post-construction mortality surveys conducted in 2011-2012, 2012-2013, and 2013-2014 found bird mortality to be 0.45, 0.78, and 0.45 large/birds/MW/year, respectively (Derby et al. 2012b, 2013, 2014). Estimates for waterfowl fatalities were not calculated; however, fewer waterfowl/waterbirds were documented during scheduled searches, and as such, waterfowl mortality rates are believed to be lower than the totals reported for each year.

- Surveys of spring mortality conducted in 2013 and 2014 at Tatanka wind farm in North and South Dakota found waterfowl mortality to be 0.79 birds/MW (Graff-Brianna, 2015). These studies were conducted in spring only; mortality over the course of a year may be higher.

- Results of post-construction mortality monitoring at Top of Iowa WRA indicated low impacts to waterfowl species. The Top of Iowa wind development is located in an agricultural area with several WMAs interspersed within and adjacent to the Top of Iowa WRA, providing wetland, grassland, and woodland habitat. During pre-construction surveys, the Top of Iowa WRA had high shorebird, passerine, and migrant and resident waterfowl utilization. However, no waterfowl fatalities were found during extensive post-construction searches, although geese and other waterfowl had been documented flying in and around the turbines (Jain, 2005). Overall avian fatalities were found to be 0.38 birds/turbine/year in 2003, and 0.76 birds/turbine/year in 2004.

- The Prairie Rose post-construction study in Rock County, Minnesota (Chodachek et. al, 2015) identified the following impacts:

    - Post-construction fatality monitoring was conducted during spring (April 15 to June 15) and fall (August 15 to October 31) in 2014. Additionally, there was an operational shut-down during part of the fall monitoring period (August 18 – August 28, 2014), a time when bat fatalities have been shown to be associated with fall migration. Post-construction fatality estimates provided for Prairie Rose are defined per study period (i.e., 8 weeks during spring migration and 10 weeks during fall migration) and not extrapolated to per year that many other studies report.

  - Post-construction fatality monitoring in 2014 estimated 0.44 bird fatality per MW per study period. The estimated bird fatality rate of 0.44 bird fatality per MW per study period at Prairie Rose is low compared to 33 other wind projects in the Midwest. Although, most of these studies typically included at least 3 seasons or an all year survey, it is unlikely that the bird fatality rate would change much with a summer survey as songbirds are the most common fatality reported at wind energy facilities, particularly during spring and fall migration.

- Studies at the Big Blue, Grand Meadow, and Oak Glen Wind Farms in Minnesota in 2013 (Chodachek et al., 2013) focused on bat fatality, observing impacts to birds:
  - Post-construction fatality monitoring in 2013 estimated a range of adjusted range of bat fatalities between 3.1 to 6.3 bat fatalities per MW per year for the three wind farms studied. Bat fatalities tended to peak twice; once in late July/early August and again in late August/early September. Fatalities were primarily composed of migratory tree-roosting bats, including the eastern red bat and the hoary bat.
  - Post-construction fatality monitoring in 2013 estimate less than one bird fatality per MW per study period for the three wind farms included in the study. The overall fatality rate was 0.3 to 0.5 bird fatality per MW per study period. No large bird fatalities or threatened/endangered species fatalities were observed.

- Studies at Buffalo Ridge Wind Resource Area in Minnesota in 2001 and 2002 (Johnson et al., 2002; Johnson et al., 2003) estimated avian and bat fatality, while also assessing impacts to grassland breeding birds:
  - Following construction of the wind turbines there was a reduction in use of the area within 100 meters of the turbines by about 32 percent of species of grassland breeding birds. It was hypothesized that lower avian use may be associated with avoidance of turbine noise, maintenance activities, and less available habitat. The researchers stated that "on a large scale basis, reduced use by birds associated with wind power development appears to be relatively minor and would not likely have any population consequences on a regional level" (Johnson et al., 2002).
  - Avian mortality appeared to be low in the vicinity of the project area at nearby Buffalo Ridge WRA compared to other wind facilities in the United States. They found an overall avian mortality of 0.98 birds per turbine per year. Avian mortality is primarily related to nocturnal migrants. Resident bird mortality was very low and involved common species. The researchers stated that "based on the estimated number of birds that migrate through Buffalo Ridge each year, the number of wind plant related avian fatalities

at Buffalo Ridge is likely inconsequential from a population standpoint" (Johnson et al., 2002).

- WEST studied bat mortality at the Buffalo Ridge WRA in 2001 and 2002 and found an overall mortality average of 2.16 bats/turbine/year. Approximately 82 percent of the bat mortality occurred from mid-July to the end of August. WEST found that "both the bat detector and mist net data indicate there are relatively large breeding populations of bats in close proximity to the wind plant that experienced little to no wind plant related collision mortality" (Johnson et al., 2003). It appeared that most bat mortality at Buffalo Ridge involved migrating bats. Researchers highlighted that bat mortality increased with reduced distance between turbines and wetlands or woodlands. Turbines in this study were 750 KW turbines with a 50 meter tower and RD of 46 or 48 meters, depending on blade length. Turbines will be larger at the Crocker Wind Farm.

Ranges of estimated avian mortality (resident and migratory) observed for a sample of wind-energy projects in the U.S. (National Research Council, 2007) are from 1 to 12 birds per MW per year. However, many of these estimates are based on older generation wind energy facilities which typically have higher MW/year fatality rates compared to newer generation turbines, which, while taller and having more wind-swept area, also have rotor-blades that move slower, are easier to see, and have other features that apparently reduce avian mortality (Erickson et al., 2002, Smallwood and Karas, 2009). Post-construction mortality studies at other sites, as discussed above, indicate that collision events will likely be much lower than national averages.

The results of the studies discussed above indicate that while wind projects located in proximity to waterfowl/waterbird migration stopover and breeding habitat do result in some mortality, the rates do not appear to approach levels that would affect populations on a population level. The USFWS 2016 Waterfowl Population Status Report estimates a total duck population of 48.8 million birds across the entire survey area (USFWS, 2016e).

13.2.5.2 Bat Fatality

Bat activity was monitored at two sampling locations between April 14 and October 27, 2016 to estimate levels of bat activity in the Wind Farm Project Area during the species' active season (Appendix B). Bat activity in the Wind Farm Project Area was highest during the fall migration period. Bat activity measured during pre-construction surveys is expected to be positively correlated to post-construction fatalities; however, few studies documenting pre-construction activity and documenting post-construction mortality are available for comparison. The studies discussed below have both pre- and post-construction data, and are located in the same geographical region as Crocker.

- The Buffalo Ridge II Wind Facility in Brookings County, South Dakota is located approximately 60 miles from the Wind Farm Project Area. Pre-construction studies estimated bat activity at 1.75 bats/detector-night (2008). Fatality estimates based on post-construction monitoring were 2.81 bats/MW/study period (in this case, 1 year; 2012).

- The Buffalo Ridge Phase II Facility located in Lincoln County, Minnesota estimated pre-construction bat activity at 1.9 bats/detector-night (1998-1999). Fatality estimates based on post-construction monitoring efforts conducted bi-monthly in the summer and fall were 1.64 bats/MW/study period (2000).
- Post-construction fatality monitoring in 2014 estimate 0.41 bat fatality per MW per study period at the Prairie Rose Wind Farm (Chodachek et. al, 2015).

Based on the above data, the land cover types within the Wind Farm Project Area, and the similarity of species composition between the Prairie Winds and Buffalo Ridge developments and the Wind Farm Project Area, the impact of the proposed Project on wildlife is expected to be minimal. There is potential for avian and bat collisions with Project turbines or meteorological towers, but those impacts are likely to be consistent with impacts found at the Prairie Winds and Buffalo Ridge developments. Additional impacts may include a small reduction in the available habitat that some wildlife uses for forage or cover; however, operation of the Project will not significantly change the existing land use.

The Applicant will implement the following measures to the extent practicable to help avoid potential impacts to wildlife in the Project Area during selection of the turbine locations and subsequent Project development and operation:

- Avoid and minimize siting turbines in native prairie and native plant communities.
- Maintain, at a minimum, the 500-foot setback or property line setback (if greater depending on the turbine model selected) from GPAs and WPAs (non-participating parcels) to reduce risk to waterfowl/waterbirds and grassland-associated birds when siting turbines in the Project Area. The closest distance of a turbine to a WPA or GPA is 551 feet.
- Avoid or minimize disturbance of individual wetlands or drainage systems during Project construction. Wetland delineations will be conducted prior to construction to identify the limits of wetland boundaries in the vicinity of Project activities.
- Protect existing trees and shrubs by avoiding tree removal for turbines, access roads, and underground collector lines. These will be identified based on aerial photos and during field surveys.
- Avoid construction activities within deer-wintering yards during winter.
- Maintain sound water and soil conservation practices during construction and operation of the Project to protect topsoil and adjacent resources and to minimize soil erosion. To minimize erosion during and after construction, BMPs for erosion and sediment control will be used. These practices include silt fencing, temporary seeding, permanent seeding, mulching, filter strips, erosion blankets, grassed waterways, and sod stabilization.
- Construct wind turbines using tubular monopole towers.
- Light turbines according to FAA requirements.
- Revegetate non-cropland and pasture areas disturbed during construction or operation with an appropriate native seeding mix.

- Inspect and control noxious weeds in areas disturbed by the construction and operation of the Project.
- Prepare and implement a BBCS during construction and operation of the Project. A draft BBCS is attached to this Application as Appendix C. This BBCS consists of Geronimo's corporate standards for minimizing impacts to avian and bat species during construction and operation of wind energy projects. The BBCS has been developed in a manner that is consistent with the WEGs (USFWS, 2012). It includes Crocker's commitments to wind farm siting and transmission route suitability assessments, construction practices and design standards, operational practices, permit compliance, and construction and operation worker training.

The Applicant is committed to minimizing wildlife impacts within the Project Area. Crocker will design their facility to minimize avian impacts by avoiding high use wildlife habitat (woodlands adjacent to farmsteads and GPAs/WPAs), using tubular towers to minimize perching, placing electrical collection lines underground as practicable, and minimizing infrastructure. Crocker continues to consult with the wildlife agencies regarding appropriate mitigation measures for wildlife impacts.

13.2.6 Wildlife – Transmission Line

The design of the transmission facilities will be based on the Avian Power Line Interaction Committee's ("APLIC") suggested measures designed to minimize the risk of electrocution of birds by power lines (APLIC, 2012). Adequate spacing of the line diminishes the risk of electrocution. To the extent practicable, the collector system will be placed underground, eliminating the risk of electrocution. In areas with overhead lines, flight diverters and other devices may be employed provided they are effective at reducing collisions and electrocutions.

13.2.7 Sensitive Terrestrial Species

13.2.7.1 Federally-listed Species – Wind Farm

Northern long-eared bat

Suitable habitat for the northern long-eared bat is limited in the Wind Farm Project Area. The species is forest-dependent and requires forested areas for roosting and foraging in summer. Winter impacts are not expected as the species is not present on the landscape in winter; desktop analysis did not identify features (i.e., caves or mines) that would provide suitable hibernacula habitat within the Wind Farm Project Area.

Acoustic surveys did not identify the presence of the species within the Wind Farm Project Area, and the species is considered absent from the Wind Farm Project Area during summer. As such, impacts to the species during migration and summer roosting and foraging are not expected.

Minor tree removal may be required for some Project facilities, namely access roads. Per USFWS guidance, it is preferable to complete these activities in the winter months when northern long-eared bats are inactive and not present on the landscape. If tree clearing cannot be completed between November 1 and March 31, Crocker will request coverage under the Programmatic Biological Opinion for this species using the streamlined consultation process.

Dakota skipper and Poweshiek skipperling

Crocker is working to site Project facilities in cropland and actively grazed pasture to avoid prairie remnant habitat that may be suitable to Dakota skipper and Poweshiek skipperling. Prairie remnant areas proposed for Project facilities have been evaluated for these butterfly species. Species-specific surveys for individuals have been conducted in areas of suitable habitat that will be impacted to determine presence/absence; these surveys took place during the species' flight period in late June/early July 2017. No Dakota skipper or Poweshiek skipperling were documented during these surveys.

Topeka shiner

Small streams present in the western portion of the Wind Farm Project drain into the James River may offer suitable habitat and are of potential concern. However, Wind Farm Project operations are not likely to have direct impacts to Topeka shiner or their habitat. Attention to siting of turbines and access roads will minimize impacts to the species and their habitat. Implementation of erosion and sediment control BMPs during construction will be critical to reduce degradation of water quality downstream of the Project. With these measures, impacts to the Topeka shiner are not anticipated.

Rufa red knot

During migration, the red knot may stop opportunistically to forage and roost; however, their occurrence is not predictable. If the species was to occur in the Wind Farm Project Area, it would likely be a few individuals migrants stopping at ponds or wetlands to forage and roost. The Project is unlikely to impact the species at a population level due to the location and the small number of migrants utilizing this migration corridor. No rufa red knots have been observed during avian surveys.

Whooping crane

The Wind Farm Project Area does not fall within the 95% migration corridor (i.e., the 220-mile band where 95% of all whooping crane sightings have occurred). Preferred stopover habitat includes shallow, wide riverine areas, such as the James and Missouri River valleys. It is unlikely that whooping cranes will utilize the Wind Farm Project Area as stopover habitat; as such, impacts to the species are not anticipated. Additionally, no whooping cranes have been observed during avian surveys. Crocker is consulting with the USFWS on this species.

13.2.7.2 Federally-listed Species – Transmission Line

Northern long-eared bat

The transmission line will be installed along an existing right-of-way, and minimal tree clearing will necessary for construction of the line. Impacts from construction or operation of the transmission line on the northern long-eared bat are not anticipated.

Dakota skipper and Poweshiek skipperling

The transmission line is primarily sited along an existing right-of-way. Approximately 74 acres of the Transmission Line Route consist of grassland/herbaceous and hay/pasture land cover types. These areas may contain suitable habitat for the Dakota skipper and Poweshiek skipperling. Crocker will confirm transmission line structures will not be placed within suitable Dakota skipper and Poweshiek skipperling habitat. If suitable habitat is present and will be impacted by the placement of transmission line structures, species-specific surveys for individuals have been conducted in these areas during the species' flight period in late June/early July, 2017. No Dakota skipper or Poweshiek skipperling were documented during these surveys.

Topeka shiner

Construction and operation of the transmission line will not directly impact individual Topeka shiners or their habitat. The implementation of erosion and sedimentation control BMPs would reduce water quality degradation along and downstream of the Transmission Line Route.

Rufa red knot

The occurrence of rufa red knots in South Dakota is unpredictable; if the species were to occur along the Transmission Line Route, it would likely be a few isolated individuals stopping over during spring or fall migration. There are no NHD records for the species in the vicinity of the Transmission Line Route, and no red knots have been identified to date during avian observation studies. As such, impacts to the species are not anticipated.

Whooping crane

Collisions with power lines is a major cause of migrating whooping crane mortality. However, the Project is outside of the 220-mile wide 95% migration corridor, no whooping cranes have been documented in Clark County, and there are no NHD records in the vicinity of the Transmission Line Route.

The Applicant will implement the following measures to avoid potential impacts to federal and state-listed species and rare or sensitive habitat in the area during site selection for the wind turbines and access roads and the subsequent Project development and operation:

- Conduct pre-construction surveys for high quality habitat suitable to listed butterfly species (Dakota skipper and Poweshiek skipperling).
- Avoid or minimize disturbance of individual wetlands or drainage systems during Project construction.
- Avoid or minimize placement of turbines in high quality native prairie.
- Continue to coordinate with the USFWS and SDGFP as the Project layout is developed.

13.2.7.3 State-listed Species – Wind Farm and Transmission Line

The northern river otter is the only state listed species that may occur in Clark County. The species was formerly found in riparian areas throughout South Dakota. This mammal was likely extirpated from the state as a result of habitat loss and trapping. The species prefers large rivers with permanent flow and a low gradient (Kiesow and Dieter, 2005). Suitable habitat is not present in the Wind Farm Project Area and Transmission Line Route; as such, impacts on the northern river otter are not anticipated.

14.0 EFFECT ON AQUATIC ECOSYSTEMS (ARSD 20:10:22:17)

The following sections describe the existing aquatic ecosystems within the Wind Farm Project Area and Transmission Line Route and the potential impacts to aquatic ecosystems as a result of the Project.

14.1 Existing Aquatic Ecosystem – Wind Farm and Transmission Line Route

Surface waters are described in Section 12.1 and are depicted on Figured 5a-d. According to NWI data, lakes, freshwater ponds, riverine systems, freshwater emergent wetlands, freshwater scrub-shrub, and freshwater forested wetlands account for approximately 8 percent of the Wind Farm Project Area, and less than 0.5 acres specifically within the Transmission Line Route.

The USFWS lists one aquatic species with potential to occur in Clark County – the Topeka shiner (USFWS, 2016a). The Topeka shiner, a fish found in small to mid-sized prairie streams of the central prairie regions of the country with relatively high water quality and cool to moderate temperatures. The Topeka shiner is discussed in greater detail in Section 13.1.2.1.

14.2 Impacts to Aquatic Ecosystems and Mitigation – Wind Farm and Transmission Line Route

As discussed in Section 12.2, the primary potential for the Project to impact aquatic ecosystems would be due to increased sedimentation caused by erosion during construction, and from changes in runoff patterns and water volumes due to increased impervious surfaces. Section 12.2 addresses the BMPs that would be used to minimize impacts to aquatic ecosystems as a result of erosion and increases in impervious surfaces.

Construction in areas with steep slopes will be minimized, and will typically not include the construction of wind turbines or transmission structures, but where alternatives do not exist with respect to siting, will be restricted to access roads and underground collector lines. As discussed in Section 12.2, Project construction will require coverage under the General Permit for Storm Water Discharges Associated with Construction Activities, which requires the development and implementation of a SWPPP that will prescribe BMPs that shall be in place to control erosion and sedimentation. The BMPs may include silt fence, straw wattles, erosion control blankets, project staging, and other methods. The erosion and sediment controls that will be implemented during construction and for Project operation will help ensure that water resources are not impacted by sediment runoff from exposed soils during precipitation and wind events.

According to the Federal Register (USFWS, 2004), one of the primary constituent elements of critical habitat for the Topeka shiner is sand, gravel, cobble, and silt substrates with amounts of fine sediment and substrate embeddedness that allow for nest building and maintenance of nests and eggs. Excessive sedimentation and water runoff that could increase the velocity of waterbodies in excess of 0.5 meters/second could prove detrimental to the Topeka Shiner. As presented in Section 12.2 and in the previous paragraph, excessive sedimentation is not anticipated as a result of the Project, and significant changes to runoff patters as a result of the Project are not anticipated.

15.0 LAND USE (ARSD 20:10:22:18)

15.1 Existing Land Use – Wind Farm and Transmission Line Route

Cropland, pastureland, and grasslands dominate the Wind Farm Project Area and Transmission Line Route. Vegetation in the Project vicinity is predominantly grasslands and pasture, interspersed with cultivated parcels and open water. There are 35 residences within the Wind Farm Project Area. The closest residence to the Transmission Line Route is nearly 2,180 feet or 0.4 miles. The Transmission Line Route is generally co-located with existing county roadways or along existing property lines.

15.2 Existing Recreation – Wind Farm and Transmission Line Route

Recreational opportunities in Clark County include hunting, biking, hiking, boating, fishing, camping, swimming, horseback riding, cross country skiing, snowmobiling, and nature viewing. Figures 7a-d show the locations of Waterfowl Production Areas ("WPAs"), Game Production Areas ("GPAs"), WIA hunting areas, and School and Public Lands in the Project vicinity.

USFWS WPAs are managed to protect breeding, forage, shelter, and migratory habitat for waterfowl or wading birds, such as ducks, geese, herons, and egrets. WPAs provide opportunities for viewing wildlife and intact ecosystems and also provide hunting opportunities. WPAs located in the Project vicinity are listed in Table 15-1 and displayed on Figures 7a-d.

Table 15-1: Waterfowl Production Areas in the Project Vicinity

WPA Name	General Location[1]	WPA Area (Acres)
Schmit WPA	Northeast	63.65
Thompson WPA	North	78.81
Graves WPA	Southeast	147.51
Bristol Grazing Association WPA	North	44.00

[1] Location from the Wind Farm Project Area

South Dakota GPAs are managed to provide wildlife habitat, improve wildlife production, and provide public hunting and trapping opportunities. There are two GPAs within the Wind Farm Project Area and none along the Transmission Line Route. GPAs in the Project vicinity are included in Table 15-2.

Table 15-2: Game Production Areas in the Project Vicinity

GPA Name	General Location	WMA Area(acres)
Wagner GPA, Clark County	Within	80.0
Spring Valley GPA, Clark County	Within	80.0
Sherwood GPA/WA, Clark County	Adjacent, East	400.0
Bailey Lake GPA/WA, Clark County	Adjacent, Southeast	32.0
Crocker GPA, Clark County	Adjacent	80.0
Lily GPA, Day County	Northeast	480.0
Cottonwood Lake GPA, Clark County	East	484.0

The SDGFP offers a Walk-In Access WIA Program for public hunting on private land. There is one WIA parcel within the Wind Farm Project Area covering 81.17 acres. The Transmission Line Route is also adjacent to this parcel (Figures 7a-d). The WIA Program includes walk-in agreements with the landowner that typically last one to three years.

The SD Office of School and Public Lands manages over 750,000 acres of land in the state. These lands are available to the public for hunting and fishing. There is one 80-acre School and Public Lands parcel in the eastern portion of the Wind Farm Project Area.

15.3 Existing Noise – Wind Farm

The term ambient acoustic environment refers to the all-encompassing sound in a given environment or community. The outdoor ambient acoustic environment is a composite of sound from varying sources, distances, and directions. The Applicant has conducted background sound level monitoring throughout the Wind Farm Project Area to quantify the existing sound levels and to identify existing sources of sound. Monitoring was conducted at three locations distributed throughout the Wind Farm Project Area (Appendix D). Daytime sound levels throughout the Wind Farm Project Area generally ranged between 41 and 50 dBA, while nighttime sound levels were generally between 36 and 52 dBA. The range of daytime L_{EQ} across the project area was 41 to 50 dBA, and the range of nighttime L_{EQ} across the project area was 36 to 51 dBA. Common sources of sound included wind rustling through vegetation, roadway traffic, aircraft overflights, occasional farming operations, and biogenic sources such as birds and insects.

Higher sound levels typically exist near roadways and near areas that experience greater human activities such as farming. Agricultural/rural areas with higher wind resources generally experience higher sound levels compared to agricultural/rural areas with lower wind resources. Different communities can experience a wide variety of sound levels within their given ambient acoustic environments, and the variability of sound sources creates their respective spectral content. A comparison of typical noise generators is outlined below in Table 15-3.

Table 15-3: Decibel Levels of Common Noise Sources

Sound Pressure Level (dBA)	Noise Source
140	Jet Engine (at 25 meters)
130	Jet Aircraft (at 100 meters)
120	Rock and Roll Concert
130	Jet Plane Taking Off (at 200 ft)
120	Operating Heavy Equipment
110	Night Club
100	Construction Site
90	Boiler Room
80	Freight Train (at 100 ft)
70	Classroom
60	Conversational Speech
50	Urban Residence
40	Soft Whisper
30	North Rim of the Grand Canyon
20	Silent Study Room

Source: OSHA 2016.

A variety of construction related equipment will be used at differing times and for various lengths of time. A majority of these activities would not occur at the same time. The Applicant expects a maximum sound level during construction to range between 85 and 95 dBA at 50 feet for a short duration. Sound levels are expected to be quieter for areas where activities are occurring at distances greater than 50 feet from the facility.

Clark County has defined noise standards for the operation of Wind Energy Systems ("WES"). The adopted standards are set forth in the Zoning Ordinance for Clark County and specifies the allowable noise levels may not be exceeded 50 dBA, average A-weighted sound pressure.

15.4 Existing Visual resources – Wind Farm and Transmission Line Route

Visual impacts from the Project would depend on the extent to which the existing landscape is already altered from its natural condition and the degree to which state agencies address landscape quality. There are 35 occupied residences within the Wind Farm Project Area and other scattered rural residences adjacent to, but external to the Wind Farm Project Area. Travelers through the Project vicinity include local or regional traffic along State Highway 20 or other local roads. Recreational users in the Project vicinity may include hunters accessing WPAs, GPAs, or WIAs.

15.4.1 Shadow Flicker – Wind Farm

Shadow flicker caused by wind turbines is defined as alternating changes in light intensity at a given stationary location, or receptor, such as the window of a home. In order for shadow flicker to occur, three conditions must be met: (1) the sun must be shining with no clouds to obscure it; (2) the rotor blades must be spinning and must be located between the receptor and the sun; and

(3) the receptor must be sufficiently close to the turbine to be able to distinguish a shadow created by it. Shadow flicker intensity and frequency at a given receptor are determined by a number of interacting factors:

- Sun angle and sun path – As the sun moves across the sky on a given day, shadows are longest during periods nearest sunrise and sunset, and shortest near midday. They are longer in winter than in summer. On the longest day of the year (the summer solstice), the sun's path tracks much farther to the north and much higher in the sky than on the shortest day of the day (the winter solstice). As a result, the duration of shadow flicker at a given receptor will change significantly from one season to the next.
- Turbine and receptor locations – The frequency of shadow flicker at a given receptor tends to decrease with greater distance between the turbine and receptor. The frequency of occurrence is also affected by the sightline direction between turbine and receptor. A turbine placed due east of a given receptor will cause shadow flicker at the receptor at some point during the year, while a turbine placed due north of the same receptor at the same distance will not, due to the path of the sun.
- Cloud cover and degree of visibility – As noted above, shadow flicker will not occur when the sun is obscured by clouds. A clear day has more opportunity for shadow flicker than a cloudy day. Likewise, smoke, fog, haze, or other phenomena limiting visibility would reduce the intensity of the shadow flicker.
- Wind direction – The size of the area affected by shadow flicker caused by a single wind turbine is based on the direction that the turbine is facing in relation to the sun and location of the receptor. The turbine is designed to rotate to face into the wind, and as a result, turbine direction is determined by wind direction. Shadow flicker will affect a larger area if the wind is blowing from a direction such that the turbine rotor is near perpendicular to the sun-receptor view line. Similarly, shadow flicker will affect a smaller area if the wind is blowing from a direction such that the turbine rotor is near parallel to the sun-receptor view line.
- Wind speed – Shadow flicker can only occur if the turbine is in operation. Turbines are designed to operate within a specific range of wind speeds. If the wind speed is too low or too high, the turbine will not operate, eliminating shadow flicker.
- Obstacles – Obstacles, such as trees or buildings, which lie between the wind turbine and the receptor have a screening effect and can reduce or eliminate the occurrence of shadow flicker.
- Contrast – Because shadow flicker is defined as a change in light intensity, the effects of shadow flicker can be reduced by increasing the amount of light within a home or room experiencing shadowing flicker.
- Local topography – Changes in elevation between the turbine location and the receptor can either reduce or increase frequency of occurrence of shadow flicker, compared to flat terrain.

A typical shadow flicker distribution map is included on Figures 9a-d. The shadow flicker frequency in the figure was created using the WindPro Modeling program (Version 2.9.285) using the typical assumptions for distribution of wind direction and sunshine probability (Tables 15-4 and 15-5). The assumptions are specific to the Project Area.

Table 15-4: Wind Direction Distribution Assumptions for Shadow Flicker Model

Direction	N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW
Percent Blowing in Direction	8.9	6.1	5.3	6.6	8.2	10.7	15.2	8.1	5.1	5.8	9.1	11.0

Table 15-5: Probability of Sunshine Assumptions for Shadow Flicker Model

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sunshine Probability	52%	54%	58%	63%	65%	66%	74%	78%	68%	59%	51%	51%

Data gathered from National Climatic Data Center for Huron, SD, the closest, most representative station (1956-1983)

15.5 Land Use Impacts Analysis

The following sections describe the potential Project land use impacts, including displacement, recreational impacts, noise, aesthetics, and electromagnetic interference. Section 20.2.3 discusses impacts to the agricultural land uses within the Wind Farm Project Area and Transmission Line Route.

15.5.1 Displacement – Wind Farm and Transmission Line Route

There are 35 occupied residences within the Wind Farm Project Area and Transmission Line Route. As designed, the proposed Project layout of turbines, access roads, collector lines, and associated facilities will not cause displacement of residences or businesses due to construction of the Project. The minimum distance between an occupied residence and a proposed turbine location is approximately 1,045 feet. This distance represents the Vestas V110 layout. The minimum distance will be greater if a different layout is constructed. The minimum distance between the Transmission Line Route and a residence is 2,180 feet.

15.5.2 Recreational Impacts – Wind Farm and Transmission Line Route

The wind farm and transmission line will avoid all WPAs and GPAs. There is one turbine and associated access road and collection line proposed on a WIA parcel. Crocker will work with the landowner of the WIA and SDGFP to address safety issues associated with the WIA. The landowner will need to consent to impacts that may affect their land interests. No impacts to use are expected. In general, recreational impacts will be visual in nature affecting individuals using public land in the Project vicinity for recreation. See Section 15.5.4 for additional discussion of visual impacts and proposed mitigative measures.

15.5.3 Noise Analysis – Wind Farm

15.5.3.1 Construction and Decommission

Potential noise associated with construction and decommissioning of the wind project would include site preparation, foundation excavation, concrete work, and affiliated construction activities. Impacts from construction related noise would be minimized by scheduling the heavy construction work during daylight hours. It is anticipated that some construction operations may be conducted outside of normal working hours. In these cases, the necessary construction efforts generally require activities that must be completed, in their entirety, once initiated (i.e. pouring concrete). All construction and decommissioning related noise producing activities would be undertaken as to comply with applicable county and State regulatory obligations and ordinances.

15.5.3.2 Operation

When in motion, the wind turbines emit audible sound. The level of this sound varies with the speed of the turbine and the distance of the listener from the turbine. Sound is generated primarily from aerodynamic flow around the blades and secondarily from the mechanical and electrical equipment in the nacelle. The most stringent noise restriction, as defined in the Clark County Zoning Ordinance (Section 4.21 Wind Energy System Requirements) is a 50 dBA, A-weighted sound pressure limit (Clark County, 2014).

The Applicant has conducted a preliminary noise assessment of the wind project in accordance with ISO 9613-2, the international standard for modeling outdoor sound attenuation. The model was developed using a software program called Cadna-A to determine the sound levels at receptors within the Wind Farm Project Area. The monitoring methodologies and results are detailed in Appendix D. The Cadna-A acoustical analysis software is designed for evaluating environmental noise from stationary and mobile sources and was used to calculate the L_{EQ} for all four turbine models for each conceptual layout. Assuming that wind speeds are at the maximum sound power level wind speed for each turbine model and are constant for an entire one-hour period, the L_{EQ} calculated by Cadna-A was compared to the County and State standards.

The analysis accounted for all noise generating elements associated with the various proposed wind turbine types and conceptual layouts for the Project. It also accounts for uncertainty both from the turbine manufacturer and internal model error making for an overall conservative noise level estimate for the Project. All proposed wind turbines (noise sources) were modeled in Cadna-A and Project-related noise levels were calculated at 70 noise-sensitive receptors within the Project Area (Appendix D). Table 15-6 presents analysis results. The baseline noise isopleths (a line or curve of equal values) are depicted on Figures 8a-d.

Table 15-6: Summary of Noise Assessment

Turbine Model		Residence Classification		
		dB(A) Levels at All Residences	dB(A) Levels at Participating	dB(A) Levels at Non-Participating
Vestas V110	Avg L_{EQ} Modeled	43	46	40
	Max L_{EQ} Modeled	50	50	47
	Min L_{EQ} Modeled	32	35	32

Table 15-6: Summary of Noise Assessment

Turbine Model		Residence Classification		
		dB(A) Levels at All Residences	dB(A) Levels at Participating	dB(A) Levels at Non-Participating
GE 2.5-116	Avg L_{EQ} Modeled	41	44	38
	Max L_{EQ} Modeled	50	50	45
	Min L_{EQ} Modeled	28	29	28
Gamesa 126	Avg L_{EQ} Modeled	41	44	38
	Max L_{EQ} Modeled	50	50	45
	Min L_{EQ} Modeled	27	28	27
Vestas 136-3.45	Avg L_{EQ} Modeled	38	41	36
	Max L_{EQ} Modeled	50	50	44
	Min L_{EQ} Modeled	26	27	26

The maximum calculated noise level, based on assumptions incorporated into the Cadna-A model and the most current turbine layout, results in a 50 dBA L_{EQ} at the nearest noise-sensitive receptor (maximum Project related L_{EQ} range from 44 to 50 dBA). Average Project-related sound pressure levels at residences for all turbine models range from 38 to 43 dBA, on an hourly L_{EQ} basis. As depicted in the multi-turbine constraint maps, all proposed conceptual turbine layouts comply with Clark County noise guidelines at residential receptors. Maximum calculated noise levels at all non-participating residential receptors for all turbine models are below the noise limit of 50 dBA.

Impacts to nearby residents and other potentially affected parties in terms of noise will be taken into consideration as part of the turbine siting. The Applicant proposes siting turbines the minimum 2,000 ft from non-participating residences and 1,000 ft from participating residences to comply with the Clark County Ordinance of 50 dBA noise level (Clark County, 2014). To the extent that the sound characteristics of the selected turbine vary, the Applicant will ensure compliance with County noise standards. The preliminary layout has been modeled to help ensure cumulative impacts from all wind turbines, and maximum calculated noise levels for all turbine models, are below the Clark County noise limit of 50 dBA at residential receptors.

15.5.4 Visual Impacts – Wind Farm and Transmission Line Route

Visual impacts are defined as the human response to visual contrasts resulting from introduction of elements into a viewshed. Contrasts interact with viewer perceptions of the landscape and may cause either a negative or positive response to the changes in the viewed landscape.

The construction and operation of the proposed Project will not introduce new visual components into the Project vicinity. The Day County Wind Energy Center is located within a mile of northwest corner of the Wind Farm Project Area (Figure 1). This NextEra Energy Resources wind farm consists of 66 1.5 MW turbines and became operational in 2010. Additionally, the 19.5 MW Oak Tree Wind Farm, consisting of eleven 1.85 MW turbines, is located approximately 1.5 miles southeast of the Wind Farm Project Area (Figure 1). This project became operational in December 2014.

Sensitive viewsheds are generally associated with scenic resources and can include state or national parks, monuments, and recreation areas or historic sites and landmarks. The nearest scenic resource is the Waubay National Wildlife Refuge ("NWR"). The Wind Farm Project Area is located over 20 miles to the south and west of this NWR.

Adverse visual impacts are not anticipated. Depending on topography and atmospheric conditions, the Project turbines and transmission line structures may be visible. However, the Project would not cause large visual contrasts in the landscape at this distance and would not be noticeably visible, if visible at all.

15.5.5 Shadow Flicker Impacts – Wind Farm

Shadow flicker frequency calculations for the Project were modeled by 70 residences (receptors) with WindPRO 2.9.285. The maximum predicted shadow flicker impacts that occurred at a residence for each turbine layout are show in Tables 15-7 and 15-8. Appendix E shows results of the shadow flicker assessment at Crocker Wind Farm.

Table 15-7: Maximum Predicted Shadow Flicker Impacts Participating Residences (hours/year)

Participating Residences				
Statistic	Turbine Model			
	Vestas V110	GE 2.5-116	Gamesa G126	Vestas V136-3.45
Max - Worst Case	255.0	223.1	267.2	252.9
Avg - Worst Case	65.9	55.9	53.4	43.5
Max - Real Case	101.0	90.6	110.0	104.1
Avg - Real Case	18.9	15.8	13.7	10.7

Table 15-8: Maximum Predicted Shadow Flicker Impacts Non-Participating Residences (hours/year)

Non-Participating Residences				
Statistic	Turbine Model			
	Vestas V110	GE 2.5-116	Gamesa G126	Vestas V136-3.45
Max - Worst Case	57.6	56.2	40.2	43.6
Avg - Worst Case	10.3	8.6	8.2	6.7
Max - Real Case	21.9	19.0	14.1	13.1
Avg - Real Case	9.8	9.2	9.9	8.5

WindPRO 2.9.285 calculates the number of hours per year as well as the maximum minutes per day during which a given receptor could realistically expect to be exposed to shadow flicker from nearby wind turbines. Simulated conditions for the worst case scenario were:

- There is always sunshine.
- The turbines are always in operation.
- The wind direction always orients the rotors perpendicular to the sun-receptor sightline.
- There are no local obstacles blocking potential shadows, such as buildings or vegetation.
- Specific window configurations on houses are not considered.
- Receptors are assumed to be exposed to the sky in all directions, and the shielding influence of terrain is not considered ("greenhouse receptors").

The worst case scenario model was refined to represent a less conservative expected scenario by incorporating the following more realistic features in the expected case scenario model:

- Wind direction – Turbine rotors do not orient themselves to the sun all day, every day, as modeled in the worst case scenario. To adjust for actual rotor direction, wind data is entered into the model. For the analysis included in this application, wind data was taken from the temporary meteorological tower located within the Project area.
- Turbine operating hours – The turbine will not be operational all of the time due to local winds being outside of turbine operation specifications. Project-specific wind data again was incorporated to reflect the frequency of sufficient wind speed to activate the turbine. The expected percentage of time the turbine is activated is multiplied by the number of minutes of shadow flicker.
- Consideration of maintenance and other downtime – Turbines, project facilities, and even the transmission grid may be unavailable due to routine maintenance activities or emergency situations. Industry best estimates are turbine availability of 97%, balance-of-plant availability of 99%, and grid availability of 99.8%. A 4.2% reduction in the annual operating hours was included to account for these factors.
- Actual sunshine hours – Sunshine hours are affected by cloud cover, fog or haze, time of day, and time of year. Monthly average sunshine probabilities are taken from the National Climatic Data Center Comparative Climatic Data. For the shadow flicker analysis, the Huron, SD, station was chosen because it is the closest station in the database.

Combining these three mitigating factors creates a less conservative scenario which aims to produce a scenario closest to the actual expected results. These "expected" results represent a significant reduction in shadow flicker hours per day or per year in contrast to a worst case scenario. However, by including the above factors into the model, it is possible – although not likely – to have lower modeled results compared to actual results in the field. This is due to the fact that true meteorological factors like wind direction or sunshine hours could be different from the averages used in a way that is worse for shadow flicker.

There are no non-participating residences which the model calculates will receive more than 30 hours of shadow flicker per year in the real case (Appendix E). The model does suggest several participants will receive more than 30 hours per year of shadow flicker, but the impacts are primarily due to turbines located on their land and these landowners are less likely to perceive this as an annoyance.

At a distance of 2,000 feet or greater for non-participants and 1,000 feet or greater for participants (the Project minimum setback for residences), receptors will typically experience shadow flicker only when the sun is low in the sky, and only when the factors described above are present. If a receptor does experience shadow flicker, it most likely will be only during a few days per year from a given turbine, and for a total of only a fraction (typically less than 1 percent) of annual daylight hours.

Shadow flicker from the proposed turbines is not harmful to the health of photosensitive individuals, including those with epilepsy. The frequency of shadow flicker due to wind turbines is a function of the rotor speed and number of blades, and it is generally no greater than approximately 1.5 hertz (i.e., 1.5 flashes per second). The Epilepsy Foundation has determined that generally, the frequency of flashing lights most likely to trigger seizures is between 5 and 30 flashes per second (Epilepsy Foundation, 2006).

Crocker will consider shadow flicker when siting wind turbines to minimize impacts to area residents. Flicker mitigation will be addressed as situations arrive wherein a residence is experiencing inordinately more flicker than anticipated in the modeling, although it is highly unlikely more flicker than modeled will occur. In order to assess site-specific mitigation measures, flicker occurrences should be documented daily for several consecutive months including time of location, day and duration. Mitigation measures will be considered and implemented based on individual circumstances of residences experiencing shadow flicker, and as a reasonable function of the amount of flicker experienced. If shadow flicker concerns are reported to Crocker, project representatives will implement the following procedure:

- Log the contact in Crocker’s complaint database to track resolution efforts;
- Prepare site-specific assessment of shadow flicker impacts, noting the time of day, season, and expected duration of future flicker impacts;
- Meet with the landowner to discuss site-specific assessment, educate landowners on landowner driven mitigation strategies (e.g. modification of interior lighting) and discuss concerns;
- Assess the residence to determine if on-sit mitigation measures, including but not limited to, installation of exterior or interior screening, are appropriate for the level of impact and effectively address the concern;
- Work with the landowner to develop a mitigation plan; and
- Implement the mitigation plan.

15.5.6 Electromagnetic Interference – Wind Farm

The Applicant has conducted a microwave beam path analysis, which identified seven paths intersecting the Wind Farm Project Area (Appendix F and Figures 10a-d). Other communication signals licensed by the Federal Communications Commission ("FCC") in and in the vicinity of the Project are listed in Table 15-9.

Table 15-9: FCC Licensed Signals in the Project Vicinity

Communication System Type	Number of Signals
ASR (Antenna Registration System)	3
FM (FM Radio Signals)	0
Microwave (Radio wave Transmission)	2
Cellular	0
LM broadcast (Land mobile broadcast tower)	4

Source: Comsearch

Because of their height, modern wind turbines have the potential to interfere with existing communications systems licensed to operate in the United States. Comsearch conducted a Licensed Microwave Study for the Crocker Wind Farm. Turbines have been sited in a manner that avoids all identified microwave beam paths and communication systems. The construction and operation of the Project will not result in interference to microwave, radio, or navigation signals.

Crocker Wind received a response letter from the United States Department of Commerce National Telecommunications and Information Administration ("NTIA") on May 13, 2016 (Appendix G). The agency indicated that after a 45+ day period of review, no federal agencies identified any concerns regarding blockage of their radio frequency transmissions. The Department of Agriculture ("DOA") and Department of Justice ("DOJ") provided responses to NTIA stating No Harmful Interference Anticipated. The Department of Commerce ("DOC") and the Department of Energy ("DOE") expressed concerns the Wind Farm Project may obstruct radio frequency transmissions or weather radar. Crocker is coordinating with both agencies to assess potential impacts and will continue to do so as the Project layout is finalized.

If interference to a residence's or business's television service is reported to Crocker, Crocker will work with affected parties to determine the cause of interference and, when necessary, reestablish television reception and service.

Crocker plans to address any post-construction television interference concerns on a case-by-case basis. If television interference is reported to Crocker project representatives will:

- Log the contact in Crocker's complaint database to track resolution efforts.
- Review results of the report to assess whether impacts are likely Project related.
- Meet with landowner and local communication technician to determine the current status of their television reception infrastructure.
- Discuss with the landowner the option of (1) installing a combination of high gain antenna and/or a low noise amplifier or (2) entering into an agreement to provide a

monetary contribution (equal to the cost of installing the recommended equipment) toward comparable satellite television services at the residence.

- At the landowner's election, Crocker will either install the necessary equipment or enter into an agreement to reimburse the landowner for the cost of comparable satellite television services.
- If the landowner chooses satellite service, Crocker will consider the matter closed upon installation of the satellite dish.
- If the landowner chooses to have the antenna and/or amplifier installed and later complains of continued interference issues, Crocker will send a technician to the site to assess whether the equipment is working properly and fix the equipment as needed and evaluate the reported interference issues.
- If Project related interference remains an issue, Crocker will propose an agreement that reimburses the landowner for the costs of comparable satellite television services and will remove the antenna and amplifier equipment, unless it was initially installed to serve multiple households.

If Crocker and the landowner are unable to reach an agreement to resolve interference-related issues, Crocker will report the concern as an unresolved complaint and defer to the Commission's dispute resolution process to resolve the matter.

In the event the wind farm or its operation causes interference to other communication systems, the Applicant will take the steps necessary to correct the problem. If interference is identified during or after construction of the Project, Crocker will address the interference on a case-by-case basis.

Crocker initiated coordination with the Interstate Telecommunications Cooperative., Inc. ("ITC") on April 18, 2016 (Appendix G). Coordination is on-going to determine the potential for inductive interference to their copper lines within the Project Area. Crocker will enter into an agreement with the ITC to ensure any interference will be mitigated prior to construction. Crocker does not propose mitigative measures for other communication systems at this time.

16.0 LOCAL LAND USE CONTROLS (ARSD 20:10:22:19)

Zoning ordinances and comprehensive plans are land use and community planning tools used to guide the direction and intent of growth for a county or municipality. Generally, these ordinances and comprehensive plans include elements on existing and future land use, population and housing trends, economic development, and environmental characteristics. In preparing this Application, the Applicant has reviewed and analyzed the land use and other applicable elements of the most recently adopted ordinances and plans of the counties and municipalities within and adjacent to the proposed Wind Farm Project Area. Crocker submitted an application for a Conditional Use Permit ("CUP") to Clark County for the wind farm and transmission line in February of 2017. Crocker obtained a CUP in April of 2017 containing nine conditions, including a ¾ mile setback from non-participating residences. Crocker has sought relief in Circuit Court regarding the permit conditions and seeks a reduced setback in addition to amending conditions that require clarification of terms to accurately represent the intent of Clark County. The Clark County Zoning Ordinance requires a 1,000 ft setback from non-participating residences and the layout presented in this Application depicts a 2,000 ft setback. This Application places the minimum distance between a non-participating residence and a proposed turbine location at approximately 2,167 feet. This distance represents the Vestas V110 or GE116 layout. The minimum distance will be greater if a different layout is constructed. Crocker will keep the Commission informed on a resolution with Clark County and will amend this Application as necessary.

Chapter 4.21 of the Clark County Zoning Ordinance, the WES Requirements, outlines a number of general provisions including but not limited to: mitigation measures, setbacks, electromagnetic interference, lighting, turbine spacing, footprint minimization, collector lines, towers, noise, etc. Crocker will comply with all provisions and setback requirements. Table 16-1 outlines the Clark County setbacks. In addition to the county imposed setbacks, the final layout will avoid biological and cultural resources identified during field investigations as recommended by federal and state agencies.

Table 16-1: Wind Turbine Setback Requirements for the Project

Turbine Setback Requirement	County Requirements	Proposed Setbacks
4.21.03 (2)(a) Off-site residences, businesses, churches, and buildings owned and/or maintained by governmental entity	1,000 feet	2,000 feet plus any distance needed to minimize noise and shadow flicker
4.21.03 (2)(a) Buildings on-site or lessor's residences	500 feet	1,000 feet plus any distance needed to minimize noise and shadow flicker
4.21.03 (2)(b) Centerline of public roads	500 feet or 110% the height of the wind turbine	550 feet minimum and 110% of turbine height should the turbine be taller

Table 16-1: Wind Turbine Setback Requirements for the Project

Turbine Setback Requirement	County Requirements	Proposed Setbacks
4.21.03 (2)(c) Any property line	500 feet or 110% the height of the wind turbine, whichever is greater	2x rotor diameter for non-participants, setback has been waived for participants
Condition of Conditional Use Permit	1-mile from cemeteries	1 mile
Noise requirement	Distance from receptors must meet the noise standard of 50 dB(A)	Crocker will site turbines at the distance required to meet the 50 dB(A) standard

17.0 WATER QUALITY (ARSD 20:10:22:20)

Potential impacts to water quality are addressed in Section 12.0 and again in Section 14.0. The delivery of sediment into receiving waters during Project construction due to the excavation and exposure of soils, as well as potential increases of stormwater runoff due to impervious surfaces are the principle potential impacts to water quality. Sediment and erosion control BMPs would prevent water quality issues that might otherwise cause issues in receiving waters.

The implementation of the SWPPP as required under the General Permit for Storm Water Discharges Associated with Construction Activities that will be issued by the SDDENR will ensure the minimization of impacts to water quality. The BMPs that will be outlined in the SWPPP will be in place to control erosion and sedimentation. The erosion and sediment controls that will be implemented during construction and for Project operation will help ensure that water quality is not impacted by construction and operation of the Project.

18.0 AIR QUALITY (ARSD 20:10:22:21)

18.1 Existing Air Quality – Wind Farm and Transmission Line Route

In accordance with Environmental Protection Agency ("EPA") requirements, the SDDENR operates an ambient air monitoring network of samplers. The nearest monitoring location to the Project is located in Watertown, Codington County, approximately 35 miles southeast (SDDENR, 2016a). The primary emission sources that exist within the Wind Farm Project Area and Transmission Line Route include agriculture equipment, and vehicle use along State Highway 20.

18.2 Air Quality Impacts – Wind Farm and Transmission Line Route

While Project construction is underway, fugitive dust emission may occur due to vehicular traffic in the Project area. Due to vehicular and equipment operation, there may also be short-term emissions from diesel fuel equipment during construction. Any air quality effects resulting from construction would be short term, and limited to the time of construction activities and would not result in National Ambient Air Quality Standard ("NAAQS") exceedances for particulate matter. Construction and operation of the Project would not result in a violation to Federal, State, or local air quality standards. Operation of the project would not produce air emissions which would impact the Project area's ambient air quality. The Project will obtain a general air quality permit for construction through the SDDENR. Additionally, best management practices will be implemented during construction to suppress fugitive dust emissions to the extent practicable.

19.0 TIME SCHEDULE (ARSD 20:10:22:22)

19.1 Land Acquisition

The Applicant will be responsible for all land acquisition and will obtain the necessary easements, leases or purchase agreements from landowners. Crocker may either lease, secure easements or purchase the necessary parcels for the substation, O&M facilities, and temporary laydown and staging areas. Land acquisition for the Project is complete.

19.2 Sale of Power

Crocker is actively marketing the sale of the electricity to third parties, both utilities and large power consumers/marketers. The sale of the electricity may take the form of a power purchase agreement or a sale of the Project to a utility. Crocker's target completion for the initial phases of this sale are in the second half of 2017. This sale will drive the timelines for many of the major financial commitments such as equipment procurement and construction contracting.

19.3 Equipment Procurement, Manufacture and Delivery

Crocker previously began procurement of project specific equipment and is in the process of procuring turbines for the Project. Turbines will be allocated to the Project after meteorological and economic studies are completed to achieve the best match of turbines for the Project. Equipment could start arriving on site as early as third quarter 2018.

19.4 Construction

Crocker personnel will oversee the primary contractors performing onsite Project construction, including, but not limited to, roads, wind turbine assembly, electrical, and communications work. The construction will take approximately twelve months to complete; however, depending upon seasonal or weather-related constraints (i.e., minimal work would occur during winter months) it may take more or less time. Construction could commence on site as early as third quarter 2018.

19.5 Construction Financing

The Applicant will be responsible for financing all predevelopment, development, and construction activities. The Applicant anticipates financing the cost of all predevelopment activities through internal funds. Construction will be financed with internal funds or a combination of internal funds and third-party sources of debt and equity capital.

19.6 Permanent Financing

Permanent financing will be provided with the Applicant's internal funds or a combination of internal funds and third-party sources of debt and equity capital.

19.7 Expected Commercial Operation Date

The Applicant anticipates that the Project would begin commercial operation by fourth quarter 2019. The commercial operation date is dependent on the completion of the interconnection process, permitting and other development activities.

20.0 COMMUNITY IMPACT (ARSD (20:10:22:23)

20.1 Existing Socioeconomic and Community Resources – Wind Farm and Transmission Line Route

20.1.1 Communities

The Wind Farm Project Area and Transmission Line Route are located in northeastern South Dakota in Clark County. Clark County had an estimated population of 3,659 in 2015 (U.S. Census Bureau, 2016). The largest city in Clark County, South Dakota is the Clark which, in 2010, had an estimated population of 1,139 (31% of Clark County). Clark is located approximately 7 miles southeast of the Wind Farm Project Area. Crocker, a town of 19 people in 2010 is located adjacent to the Wind Farm Project Area. An additional seven municipalities are located within 10 miles of the Project Area. The populations of communities in the Project vicinity are listed in Table 20-1 and shown on Figure 1.

Table 20-1: Populations of Communities in the Project Vicinity

Community, County	2010 Population	Distance and Direction from Wind Farm Project Area
Crocker, Clark County	19	Adjacent
Clark, Clark County	1,139	7 miles southeast
Bradley, Clark County	72	3.5 miles east
Raymond, Clark County	50	8.0 miles southwest
Garden City, Clark County	53	9.5 miles southeast
Lily, Day County	21	5.5 miles northeast
Butler, Day County	17	8.5 miles northeast
Turton, Spink County	61	8.0 miles west
Conde, Spink County	187	9.5 miles northwest

Source: U.S. Census Bureau, 2016

The median household income in Clark County reported in the 2010 census data was $30,208. Within the county 10.9% of the people are reported living at or below the poverty level. In comparison to the state as a whole, the median household income for the State was slightly higher ($35,282) while the state poverty rate was slightly lower (9.3%)(U.S. Census Bureau, 2016).

In Clark County, the largest employers in 2016 were: (1) manufacturing (comprising 11.3 percent of employment); (2) retail trade (11.0 percent); and (3) health care and social assistance (9.8 percent). The unemployment rate in Clark County in September 2016 was 2.7 percent. Unemployment rates for Clark County was slightly higher than the unemployment rate in South Dakota for the same month (2.4 percent) (SDDLR, 2016).

20.1.2 Commercial, Industrial, and Agricultural Sectors

The Wind Farm Project Area and Transmission Line Route are agricultural (predominantly pasture/hay and cultivated crops). No commercial, industrial, mining, or institutional land uses are located within the Wind Farm Project Area or Transmission Line Route. In 2012, Clark County's 597 farms encompassed a total of 608,805 acres (average farm size of 1,020 acres) and produced $249.4 million in agricultural products (USDA, 2012). Sixty-four percent of sales were from crop sales, and 36 percent was livestock sales. The majority of crop acreage was soybean and corn. Cattle and calves was the largest livestock component in the county. Clark county ranked 11th of the 66 South Dakota counties in total value of agricultural products sold.

20.1.3 Transportation

20.1.3.1 Surface Transportation

In general, the existing roadway infrastructure in and around the Wind Farm Project Area and Transmission Line Route is characterized by state, county, and township roads that generally follow section lines. Various county and township roads provide access to the Project and include both two-lane and gravel roads. In the agricultural areas, many landowners use private, single-lane farm roads and driveways on their property. Roads within the Wind Farm Project Area are summarized in Table 20-2. The Transmission Line Route parallels 419th Avenue, State Highway 20, a two-track, and property lines for most of the route.

Table 20-2: Summary of Roadways within the Wind Farm Project Boundary

Road Type	Miles within Project Boundary
Federal Highways	0
State Highways	1.0
County Highways/Roads	11.9
Township Roads	21.5

20.1.3.2 Aviation

There is one airport in the Project vicinity. The Clark County airport is located approximately 7 miles southeast of the Wind Farm Project Area. This airport hosts an asphalt runway at an elevation of 1793'. There are no other public airports in proximity to the Wind Farm Project Area or Transmission Line Route (SDDOT, 2015). Crocker has not identified any private airstrips in the Wind Farm Project Area; however, there is one private airstrip within one mile of the Project boundary.

Air traffic may be present near the Project Area for crop dusting of agricultural fields. Crop dusting is typically carried out during the day by highly maneuverable airplanes or helicopters. The installation of wind turbine towers in active croplands and installation of aboveground collection lines, if needed, will create a potential for collisions with crop-dusting aircraft. However, aboveground collection lines are expected to be similar to existing distribution lines (located along the edges of fields and roadways) and the turbines themselves would be visible from a distance and lighted according to FAA guidelines. Crocker has received Determinations of No Hazard for turbine positions from the FAA.

20.1.4 Cultural Resources – Wind Farm and Transmission Line Route

The South Dakota State Historical Society Archaeological Research Center was contacted in June 2016 to initiate project coordination. Tetra Tech conducted a Level I Record Search and collected data from the Archaeological Research Center in Rapid City, South Dakota, of known cultural resources information derived from previous professional cultural resources surveys and reported archaeological sites and architecture inventory resources. Data collection included gathering records of sites within the Wind Farm Project Area and a 1-mile buffer. The standard 1-mile study area is used to gather valuable information regarding the location of previously identified cultural resources and cultural resources surveys. This information is then used to identify site types that may be encountered and landforms or areas that have a higher potential for containing significant cultural resources. Collected data includes archaeological site files, architecture inventory files, and previous cultural resources studies and reports. Due to the sensitive nature of this data, it is not included on Figures.

Archeological Sites

The Level I Record Search revealed that nine previously documented archaeological sites are located within the Wind Farm Project Area and four within the surrounding 1-mile buffer (Table 20-3).

Table 20-3: Previously Reported Archaeological Sites within the 1-Mile Study Area

County	State Site Number	Site Name	Site Type	Cultural Affiliation	NRHP Eligibility Recommendation	Project Area/Buffer
Clark	39CK0003	NA	Stone Circle, Cairn, Unknown Burial	Pre-Contact	Unevaluated	Project Area
Clark	39CK0008	NA	Artifact Scatter	Pre-Contact	Unevaluated	Project Area
Clark	39CK0010	NA	Artifact Scatter/Stone Circle	Pre-Contact	Unevaluated	Buffer
Clark	39CK0013	NA	Surface Feature	Pre-Contact	Unevaluated	Project Area
Clark	39CK0014	NA	Stone Circle	Pre-Contact	Unevaluated	Buffer
Clark	39CK0019	NA	Artifact Scatter	Pre-Contact	Unevaluated	Project Area
Clark	39CK0020	NA	Isolated Find	Historic	Unevaluated	Project Area
Clark	39CK0023	NA	Artifact Scatter	Pre-contact	Unevaluated	Buffer
Clark	39CK0024	NA	Artifact Scatter/Stone Circle	Pre-Contact	Unevaluated	Project Area
Clark	39CK0030	NA	Stone Circle	Unknown	Unevaluated	Project Area
Clark	39CK0033	NA	Foundation	Historic	Unevaluated	Project Area
Clark	39CK0048	NA	Farmstead/Dump	Historic	Unevaluated	Project Area
Clark	39CK2003	NA	Railroad Grade	Historic	Unevaluated	Buffer

Site 39CK0003 – this site is a Pre-Contact site comprised of a stone circle, a stone cairn, and an unidentified burial. The site is located within the Wind Farm Project Area but will be avoided during Project construction.

Site 39CK0008 – this site is a Pre-Contact site comprised of an artifact scatter. The site is located within the Wind Farm Project Area but will be avoided during Project construction.

Site 39CK0010 – this site is a Pre-Contact site comprised of a stone circle and artifact scatter. The site is located within the 1-mile buffer and will not be impacted by the Project.

Site 39CK0013 – this site is a Pre-Contact site comprised of a surface depression. The site is located within the Wind Farm Project Area but will be avoided during Project construction.

Site 39CK0014 – this site is a Pre-Contact site comprised of a stone circle. The site is located within the 1-mile buffer and will not be impacted by the Project.

Site 39CK0019 – this site is a Pre-Contact site comprised of an artifact scatter. The site is located within the Wind Farm Project Area but will be avoided during Project construction.

Site 39CK0020 – this site is a Pre-Contact site comprised of a single artifact find spot. The site is located within the Wind Farm Project Area but will be avoided during Project construction.

Site 39CK0023 – this site is a Pre-Contact site comprised of an artifact scatter. The site is located within the 1-mile buffer and will not be impacted by the Project.

Site 39CK0024 – this site is a Pre-Contact site comprised of a stone circle and artifact scatter. The site is located within the Wind Farm Project Area but will be avoided during Project construction.

Site 39CK0030 – this site is a Pre-Contact site comprised of a stone circle. The site is located within the Wind Farm Project Area but will be avoided during Project construction.

Site 39CK0030 – this site is a Historic site comprised of a structural foundation. The site is located within the Wind Farm Project Area but will be avoided during Project construction.

Site 39CK0048 – this site is a Historic site comprised of a farmstead and dump. The site is located within the Wind Farm Project Area but will be avoided during Project construction.

Site 39CK2009 – this site is a Historic site comprised of a railroad grade remnant. The site is located within the 1-mile buffer and will not be impacted by the Project.

Historic Structures

The Level I Record Search revealed that four previously documented historic structures were identified, all of which are located within the 1-mile buffer (Table 20-4).

Table 20-4: Previously Reported Architecture Resources within the 1-Mile Study Area

County	Inventory Number/ID	Property Name	Property Category	NRHP Eligibility Recommendation	Project Area/Buffer
Clark	25768/ CK00000035	Gary Hagstrom Barn	Agriculture/ Subsistance	Unevaluated	Buffer
Clark	261/ CK00000007	Bradley First Lutheran Church	Religion	National Register Listed	Buffer
Clark	56944/ CK00000087	Crocker Grain Elevator	Agriculture/ Subsistance	National Register Eligible	Buffer
Day	42448/ DA00000150	Vacant House	Domestic	Not Eligible for National Register	Buffer

Structure 25768/CK00000035 - this site is the Gary Hagstrom Barn. The structure is a wood frame building on a concrete foundation in fair condition. The site is located within the 1-mile buffer and will not be impacted by the Project.

Structure 261/CK00000007 - this site is the Bradley First Lutheran Church. The structure was constructed in ca. 1914 and is a wood frame Gothic Revival building constructed on a stone foundation. The structure was nominated for the National Register of Historic Places and listed in 2000. The site is located within the 1-mile buffer and will not be impacted by the Project.

Structure 56944/CK00000087 - this site is the Crocker Grain Elevator. The structure was constructed in ca. 1910 and is constructed of concrete. The structure is considered eligible for listing on the National Register of Historic Places. The site is located within the 1-mile buffer and will not be impacted by the Project.

Structure 42448/DA00000150 - this site is an uninhabited residence. The structure was constructed in ca. 1900. The structure is considered ineligible for listing on the National Register of Historic Places. The site is located within the 1-mile buffer and will not be impacted by the Project.

20.2 Socioeconomic and Community Impacts – Wind Farm and Transmission Line Route

20.2.1 Community Impacts

The Project is anticipated to provide positive short-term and long-term impacts to the local economy. Construction activities for the Project would be limited to short-term effects. Increased patronage of local commercial businesses, such as restaurants, grocery stores, hotels, and gas stations, will result in increased business from construction related workers. Local contractors and suppliers will be used for portions of the construction. Total wages and salaries paid to contractors and workers in Clark County will contribute to the total personal income of the region. Additional personal income will be generated for residents in the county and state by circulation and recirculation of dollars paid out by the Applicant for business expenditures and for state and local taxes. Expenditures made for equipment, fuel, operating supplies, and other products and services benefit businesses in the county and the state.

Construction crews hired would include a variety of skilled and unskilled laborers. This diverse workforce would include foremen, carpenters, iron workers, electricians, millwrights, and heavy equipment operators. The increased labor force would be necessary for the installation of the various Project components, including wind turbines, access roads, underground collector system, O&M buildings, and transmission line structures. The number of construction jobs expected to be created during the peak of construction is approximately 140. The Applicant anticipates that a majority of the short-term construction positions would be filled by a labor force from outside the local community as there would not be sufficient trained local labor to fill the number of jobs available. A significant portion of the non-local construction workforce would likely originate from within 55 miles of the Project. It is anticipated that many of the short-term construction laborers would commute to the Project Area and limit the need for additional temporary or permanent housing at the Project Area. NREL's Wind Energy Jobs and Economic Development Impact (JEDI) model calculates the construction phase local economic benefit to be millions of dollars.

As the Project is located in a predominantly rural setting construction and operation of the Project will have minimal impacts on social services for the local populace. The construction phase of the Project is expected to be relatively short term lasting approximately 12-18 months. Crocker and its construction team will coordinate with first responders, including but not limited to air ambulance, local sheriff's office(s) and local fire services, to develop a safety plan during construction and operations of the Project. Crocker will also be in contact with local first responders to offer information about the Project and to answer any questions response teams may have regarding Project plans and details.

Long-term beneficial impacts to the county's tax base as a result of the construction and operation of the Project will contribute to improving the local economy in this area of South Dakota. In addition to the creation of jobs and personal income, the Project will pay approximately $1.8 million per year in taxes which will benefit the State of South Dakota, School Districts, Clark County, and the townships in the Project Area. As mentioned above, increased spending during the construction and operations periods would result in additional personal income for local residents, as well as increased State and local tax revenues. Participating landowners would receive direct economic benefit from lease payments for wind turbines, transmission structures, and other Project infrastructure located on their property. These payments would serve as a reliable, supplementary source of income.

Post-construction operations of the Project would generate 10-20 full-time jobs, which would have a positive effect on local income levels. These long-term employee positions include an O&M supervisor, a lead wind technician, and wind technicians.

No negative long-term impacts to the socioeconomic status of the Project Area are anticipated. The short-term construction force will have a minimal to negligible effect on industry, housing, local labor market, regional health facilities, public infrastructure (water and sewer systems), solid waste facilities, schools, fire protection, law enforcement, or other community, government, or recreational facilities.

20.2.2 Property Value Impacts

A review of academic literature pertaining to wind project development and its impact on property values was completed for the Project by Mark A. Thayer of San Diego State University (Thayer, 2017; Appendix H). The report summarized the results of two Hedonic Price Model studies (Hoen, et.al. 2009; Hoen, et.al. 2013) conducted by the Environmental Energy Technologies Division of the Lawrence Berkeley National Laboratory ("LBNL") and included a review of additional studies providing supportive and critical views. The 2009 LBNL study determined that there was no significant impact to sale values of properties over time due to proximity of wind-energy project development. The 2013 follow-up study examined changes in property values of 51,276 home sales from 27 counties in nine states within 10 miles of 67 individual wind energy projects. This study found no statistical evidence for differences in home values from pre- to post-construction. The summary report is provided in Appendix H.

Similarly, the impact of transmission lines on property values was reviewed. Jackson and Pitts (2010) conducted a literature review highlighting several studies. Studies reviewed were empirical studies between 1964 and 2009. Based on the studies reviewed, while having some inconsistencies in their detailed results, generally pointed to small or no effects on sales price due to the presence of electric transmission lines. Some studies found an effect but this effect generally dissipated with time and distance. The effects that were found ranged from approximately 2% to 9% (Jackson and Pitts, 2010).

20.2.3 Agricultural Impacts

Minimal existing agricultural land would be taken out of crop and forage production by the proposed Project, primarily the area around wind turbine foundations, access roads, interconnection facilities, and transmission structures. Landowners would be compensated by the Applicant for losses to crop production during construction. Agricultural activities can occur up to the edge of access roads and turbine pads. The buried underground collection system would not alter agricultural activities.

Approximately 978 acres of agricultural land (including cultivated crops, hay/pasture, and grassland/herbaceous) would be temporarily impacted by Project construction for collection lines and workspace around each turbine foundation. It is estimated that approximately 237 acres of agricultural land would be permanently impacted, which constitutes less than 1 percent of the total land within the Project Area. Approximately 128 acres of prime farmland would be permanently impacted, which constitutes less than 1 percent of the total land within the Wind Farm Project Area. Agricultural land and prime farmland impacts displayed here represent the Vestas V110 layout, which has the most turbines and associated access roads. Impacts to these resources will be less if a different layout is constructed. Areas disturbed due to construction that will not host permanent Project facilities would be re-vegetated with vegetation types matching the surrounding agricultural landscape.

20.2.4 Transportation Impacts

20.2.4.1 Ground Transportation

During the construction phase, temporary impacts are anticipated on some public roads within the Wind Farm Project Area and Transmission Line Route. Roads will be affected by the transportation of equipment to and from the Project. Construction traffic will use the existing county and state roadway system to access the Project and deliver construction materials and personnel. Some roads may also be temporarily expanded along specific routes as necessary to facilitate the movement of equipment. Crocker expects to enter into road use agreements with the county and townships, and to have a bond set by the Commission in accord with state law. Construction activities will increase the amount of traffic using local roadways, but such use is not anticipated to result in adverse traffic impacts. Operation and maintenance activities will not noticeably increase traffic in the Project vicinity.

The Project may also temporarily affect traffic numbers in the area due to construction traffic. During the construction phase, several types of light, medium, and heavy-duty construction vehicles will travel to and from the Project Area, as well as private vehicles used by construction personnel. The Applicant estimates that there will be 375 large truck trips per day and up to 875 small-vehicle (pickups and automobiles) trips per day in the area during peak construction periods.

After construction is complete, traffic impacts during the operations phase of the Project will be minimal. A small maintenance crew driving through the area in pickup trucks on a regular basis will monitor and maintain the wind turbines and transmission lines, as needed. There would be a slight increase in traffic for occasional turbine, substation repair, and transmission line repair, but traffic function will not be impacted as a result.

20.2.4.2 Air Traffic

The closest airport to the Project is the Clark County airport, located approximately 7 miles southeast. Crocker will coordinate with the Clark County airport, the FAA, and SDDOT prior to construction to understand potential impacts.

The Project has received "Determination of No Hazard" responses from the FAA for the proposed turbine locations up to 499 feet. If taller turbines are used or if the project layout changes from what had been provided to the FAA, the Project will re-file with the FAA for the changes.

The installation of wind turbine towers in active croplands and installation of aboveground collection lines, if needed, will create a potential collision risk with crop-dusting aircraft. However, aboveground collection lines are expected to be similar to existing distribution lines (located along the edges of fields and roadways). The Applicant will notify local airports about the Project including locations of new towers in the area to minimize impacts and reduce potential risks to crop dusters.

One private airstrip is located outside of the Project boundary in Township 118N, Range 58W, Section 18. Following coordination with the landowner and Clark County, Crocker eliminated a turbine location in the southeast quarter of Township 118N, Range 59W, Section 13 and shifted another turbine in the southwest quarter of the same section, placing it approximately 1.5 miles from the end of the private airstrip.

The Applicant will mark and light the turbines to comply with FAA requirements. The Applicant will paint meteorological towers red at the top to improve visibility and will notify local airports about the Project and new towers in the area to reduce the risk to crop dusters. Crocker will work with landowners on coordinating crop dusting activities. Permanent meteorological towers will be freestanding with no guy wires. Temporary meteorological towers will have supporting guy wires which will be marked with safety shields (colored balls) for increased visibility.

20.3 Cultural Resource Impacts – Wind Farm and Transmission Line Route

Archaeological resources could be impacted directly during the construction of a wind energy facility and associated transmission line. Construction within the turbine footprint, cable trenching, access roads, and transmission structures could impact previously unidentified archaeological resources. In addition, construction of turbines or transmission structures may impact viewshed integrity from existing architecture inventory resources.

Project notification comment request letters were sent to the South Dakota State Historical Society on April 18, and October 25, 2016. The Applicant received a response from SHPO dated

November 7, 2016 that recommended a record search be obtained from the Archaeological Research Center and that a Level III Intensive (cultural resources) survey be completed prior to Project construction. The Applicant conducted the literature search (see Section 20.1.4) and Level III Intensive survey during Fall 2016.

The Level III Intensive Survey was conducted in areas that could have been potentially impacted by the Project. The surveyed areas included the proposed footprint of the turbines, substation, temporary work areas, staging areas, and access roads and cable routes. Archaeological field investigations were conducted in accordance with the South Dakota Guidelines for Cultural Resource Surveys and Survey Reports (State Historical Preservation Center, 2005) and the South Dakota Historic Resource Survey Manual (Vogt, 2006).

The Level III Intensive survey resulted in the documentation of ten additional archaeological resources located within the Project area. Table 20-5 provides a summary of the newly documented resources.

Table 20-5: Newly Documented Archaeological Resources within the Project Area

Field Survey Identification Number	Resource Type	Temporal/Cultural Affiliation
CK001	Abandoned Farmstead	Historic Euro-American
CK004	Cairn	Prehistoric Native American
CK005	Dump	Historic Euro-American
CK007	Abandoned Farmstead	Historic Euro-American
CK008	Abandoned Farmstead	Historic Euro-American
CK011	Abandoned Farmstead	Historic Euro-American
CK012	Lithic Scatter	Prehistoric Native American
CK014	Lithic Scatter	Prehistoric Native American
CK015	Abandoned Farmstead	Historic Euro-American
MD_01	Modern Dump	Historic Euro-American

Seven of the field identified archaeological resources date to the historic period and were comprised of materials and/or features relating to Euro-American occupations. Five of the historic sites are abandoned historic farmsteads and two are historic dumps. Three of the field identified archaeological resources date to the prehistoric period and were comprised of materials and/or features relating to Native-American occupations. Two of the prehistoric sites are lithic scatters and one is a stone cairn. None of the sites have been formally evaluated for eligibility for listing in the National Register of Historic Places. However, all of the sites identified during the Level III Intensive Survey were delineated to establish external site boundaries and Project infrastructure was altered to ensure that all newly documented sites would be avoided.

21.0 EMPLOYMENT ESTIMATES (ARSD 20:10:22:24)

See Section 20.2.1.

22.0 FUTURE ADDITIONS AND MODIFICATIONS (ARSD 20:10:22:25)

Figures 2a-d associated map series (Figures 2a.1-2a.4 – 2d.1-2d.4) depict the preliminary project layouts. The Applicant requests that the SDPUC approve the Project for up to 400 MW and 200 turbine locations as shown on the preliminary Vestas V110 layouts in this Application, with the understanding that a different turbine model may be used, some of the turbine locations shown may ultimately be relocated or not be constructed as part of the Project or, alternately, that additional turbine locations may be required.

23.0 DECOMMISSIONING OF WIND ENERGY FACILITIES (ARSD 20:10:22:33.01)

At the end of commercial operation, Crocker or the Project owners will be responsible for removing wind facilities, and removing the turbine foundations to a depth of four feet below grade. In this case, a decision may be made on whether to continue operation with existing equipment or to retrofit the turbines and power system with upgrades based on newer technologies.

23.1 Anticipated Life of the Project

The anticipated Project life is approximately thirty (30) years beyond the date of first commercial operation.

23.2 Cost to Decommission

The estimated decommissioning cost in current dollars is expected to be between $100,000 - $150,000 per turbine after salvage value, including associated facilities. Crocker will be responsible for all costs to decommission the Project and associated facilities. The cost to decommission will depend upon the prevailing rates for salvage value of the equipment and labor costs.

Because of the uncertainties surrounding future decommissioning costs and salvage values, Crocker will review and update the cost estimate of decommissioning and restoration for the Project every five years after Project commissioning.

23.3 List of Decommissioning and Restoration Activities

Consistent with the terms of the wind lease and easement agreements with individual landowners, Crocker will complete the following list of decommissioning and restoration activities:

Turbine removal - Access roads to turbines will be widened to a sufficient width to accommodate movement of appropriately-sized cranes, trucks and other machinery required for the disassembly and removal of the turbines. Control cabinets, electronic components, and internal cables will be removed. The rotor, nacelle and tower sections will be lowered to the ground where they may be transported whole for reconditioning and reuse, or disassembled/cut into more easily transportable sections for salvageable, recyclable, or disposable components.

Turbine and substation foundation removal - Topsoil will be removed from an area surrounding the foundation and stored for later replacement, as applicable. Turbine foundations will be excavated to a depth sufficient to remove all anchor bolts, rebar, conduits, cable, and concrete to a depth of 48 inches below grade. The remaining excavation will be filled with clean subgrade material of quality comparable to the immediate surrounding area. The sub-grade material will be compacted to a density similar to surrounding sub-grade material. All unexcavated areas compacted by equipment used in decommissioning shall be de-compacted in a manner to adequately restore the topsoil and sub-grade material to the proper density consistent and compatible with the surrounding area.

Underground collection cables - The cables and conduits contain no materials known to be harmful to the environment. As part of the decommissioning, these items will be removed to a depth of at least 48 inches. All cable and conduit buried greater than 48 inches will be left in place and abandoned.

Substation and interconnection facilities - Disassembly of the substation and interconnection facilities will include only the areas owned by Crocker. Components (including steel, conductors, switches, transformers, fencing, control houses, etc.) will be removed from the Project Area and reconditioned and reused, sold as scrap, recycled, or disposed of appropriately, at Crocker's sole discretion. To remove foundations and underground components without damaging or impacting adjacent facilities to the extent possible, such foundations and underground components will be removed to a depth of 48 inches and the excavation area filled, contoured and re-seeded, if necessary (e.g., the area will not be subject to row crop agriculture after restoration).

Access roads - Unless otherwise requested by the landowner, permanent access roads constructed to accommodate the Project will be removed. Ditch crossings connecting access roads to public roads will be removed unless the landowner requests they remain in place. Improvements to township and county roads that were not removed after construction will remain in place.

Crocker will restore and reclaim the site to its pre-Project topography and topsoil quality using BMPs consistent with those outlined by *2012 USFWS Land-Based Wind Energy Guidelines*. The goal of decommissioning will be to restore natural hydrology and plant communities to the greatest extent practical while minimizing new disturbance and removal of native vegetation. The decommissioning BMPs that will be employed on the Project to the extent practicable with the intent of meeting this goal include:

1. Minimize new disturbance and removal of native vegetation to the greatest extent practicable.

2. Remove foundations to four feet below surrounding grade, and cover with soil to allow adequate root penetration for native plants, and so that subsurface structures do not substantially disrupt ground water movements.

3. Reuse topsoil that is removed during construction and use as topsoil when restoring plant communities. Once decommissioning activity is complete, restore topsoils to assist in establishing and maintaining pre-construction native plant communities to the extent possible, consistent with landowner objectives.

4. Stabilize soil and re-vegetate with native plants appropriate for the soil conditions and adjacent habitat, and use local seed sources where feasible, consistent with landowner objectives.

5. Restore surface water flows to pre-disturbance conditions, including removal of stream crossings, roads, and pads, consistent with storm water management objectives and requirements.

6. Conduct survey, using qualified experts, to detect populations of invasive species, and implement and maintain comprehensive approaches to preventing and controlling invasive species as necessary.

7. Remove any unnecessary overhead electrical lines and associated poles.

8. After decommissioning, install erosion control measures in all disturbance areas where potential for erosion exists, consistent with storm water management objectives and requirements.

9. Remove fencing unless the landowner requests it stay.

10. Remediate any petroleum product leaks and chemical releases prior to completion of decommissioning. Decommissioning and restoration activities will be completed within 12 months after the date the Project ceases to operate.

24.0 RELIABILITY AND SAFETY (ARSD 20:10:22:33.02)

24.1 Reliability

The Project will be available at least 97 percent of the time, consistent with other utility-scale wind projects.

24.2 Safety

The Project is located in a rural setting. Construction and operation of the Project will have minimal impacts on the security and safety of the local populace. Crocker and its construction team will coordinate with first responders, including but not limited to air ambulance, local sheriff's office(s) and local fire services to develop a safety plan during construction and operation of the Project. Crocker will also be in contact with local first responders to offer information about the Project and to answer any questions response teams may have regarding Project plans and details. The following security measures will be taken to reduce the chance of physical and property damage, as well as personal injury, at the site:

- The towers will be setback from occupied homesteads as described in this Application and the applicable regulations identified herein. These distances are considered to be safe based on developer experience, and are consistent with prior Facility Permits.
- Security measures will be taken during the construction and operation of the Project including temporary (safety) and permanent fencing, warning signs, and locks of equipment and wind power facilities.
- Regular maintenance and inspections will address potential blade failures, minimizing the potential for blade throw.
- Turbines will sit on steel enclosed tubular towers within which all electrical equipment will be located, except for the pad-mounted transformer where applicable.
- Access to the interior of the tower is only though a solid steel door that will be locked when not in use.
- Permanent meteorological towers will be free-standing. The guy wires on temporary meteorological towers will have color sleeves at ground level to increase visibility.
- Where necessary or requested by landowners, the Applicant will construct gates or fences.
- Safety training and standardized practices will be conducted for construction crews and on-site personnel.

24.2.1 Electromagnetic Fields and Stray Voltage

The term electromagnetic field ("EMF") refers to electric and magnetic fields that are present around any electrical device. Electric fields arise from the voltage or electrical charges and magnetic fields arise from the flow of electricity or current that travels along transmission lines, power collection (feeder) lines, substation transformers, house wiring, and electrical appliances. The intensity of the electric field is related to the voltage of the line and the intensity of the magnetic field is related to the current flow through the conductors (wire). EMF can occur indoors and outdoors. However, there are no discernible health impacts from power lines (NIEH, 1999). The proposed interconnection transmission line will be located adjacent to the O&M facility. Wind turbine generators and associated interconnection cables will be setback from residences in excess of state standards, where EMF will be at background levels.

In those instances where distribution lines have been shown to contribute to stray voltage, the electric distribution system directly serving the farm or the wiring on a farm was directly serving the farm or the wiring on a farm was directly under and parallel to the transmission line. These circumstances are considered in installing transmission lines and can be readily mitigated. Problems related to distribution lines are also readily managed by correctly connecting and grounding electrical equipment.

While the general consensus is that electric fields pose no risk to humans, the question of whether or not exposure to magnetic fields potentially causes biological responses or even health effects continues to be the subject of research and debate. EMF from underground electrical collection lines dissipates very close to the lines because they are installed below ground within insulated shielding. The electrical fields are negligible, and there is a small magnetic field directly above the lines that, based on engineering analysis, dissipates within 20 feet on either side of the installed cable. EMF associated with the transformers at the base of each turbine completely dissipates within 500 ft, so the 2,000 ft minimum turbine setback from non-participating residences and 1,000 ft setback from participating residences will be adequate to avoid any EMF exposure to homes.

Stray voltage is a natural phenomenon that is the result of low levels of electrical current flowing between two points that are not directly connected. Electrical systems, including farm systems and utility distribution systems, must be adequately grounded to the earth to ensure continuous safety and reliability, and to minimize this current flow. Potential effects from stray voltage can result from a person or animal coming in contact with neutral-to-earth voltage. Stray voltage does not cause electrocution and is not related to ground current, EMF, or earth currents. Stray voltage is a particular concern for dairy farms because it can impact operations and milk production. Problems are usually related to the distribution and service lines directly serving the farm or the wiring on a farm affecting confined farm animals. No impacts due to electromagnetic fields or stray voltage are anticipated and no mitigation is proposed.

25.0 INFORMATION CONCERNING WIND ENERGY FACILITIES (ARSD 20:10:22:33.02)

The following information requirements concerning wind energy facilities have been discussed in previous sections of this application, as indicated below.

- Configuration of wind turbines – Sections 8.1, 8.2, 8.3, 8.4 and Figures 2a-d
- Number of wind turbines – Section 8.1 and Figures 2a-d
- Warning lighting requirements for wind turbines – Section 20.2.4.2
- Setback distances – Section 9.4 and 16.0
- Noise levels during construction and operation – Section 15.4.3
- Electromagnetic interference – Section 15.4.5
- Site and major alternatives – Section 9.0
- Reliability and safety – Section 24.0
- Right-of-way or condemnation requirements – Section 8.0
- Clearing activities – Sections 8.10 and 13.2
- Configuration of towers and poles – Section 8.10
- Conductor and structure configurations – Section 8.10
- Underground electric interconnection facilities – Section 8.10

Refer to Section 3.0 Completeness Checklist (ARSD 20:10:22:33.02, Information concerning wind energy facilities) for additional requirement details.

26.0 TRANSMISSION FACILITY LAYOUT AND CONSTRUCTION (ARSD 20:10:22:34)

26.1 Route Clearing

The Transmission Line Route will be designed to meet or surpass applicable electrical codes, and comply with good utility practices. Surveyors will stake the construction corridor within the approved right-of-way and the pole locations of the approved alignment in preparation for the construction crew arriving on site. Once the construction crew arrives; they will begin by clearing and grubbing out the right-of-way to ensure that vegetation meets the standards and that the construction crew will have easy access to the construction site. Crocker will coordinate with landowners on clearing and grubbing to ensure minimal impact to wind breaks, landscaping, and other vegetative buffers. The crew will use chain saws, lifts, tractors and bulldozers only where needed to clear vegetation. The crew will install temporary culverts and field approaches where needed to access the route and to maintain adequate access and drainage throughout construction.

26.2 Transmission Construction Procedures

Construction will begin after applicable federal, state, and local approvals have been obtained, property and right-of-way are acquired, soil conditions are established and final design is completed. The precise timing of construction will take into account various requirements that may be in place due to permit conditions, system loading issues, weather and available workforce and materials.

The Applicant will work with an experienced contractor to construct and maintain the transmission line in conjunction with the construction and operation of the Crocker Wind Farm. Construction will follow industry best practices. These best practices address transmission specifics such as right-of-way clearing, staging, and erecting transmission line structures and stringing transmission lines. They also address general construction best practices including but not limited to safety and storm water pollution prevention planning. Crocker will be considering the proposed schedule for activities, permit requirements, safety measures, prohibitions, maintenance guidelines, inspection procedures, and terrain characteristics throughout the Project’s development, construction, and operations. In some cases these activities, such as schedules, are modified to minimize impacts to sensitive animals or environments or to enhance safety.

Transmission line structures are generally designed for installation at existing grades. Typically, structure sites with ten percent or less slope will not be graded or leveled. Sites with more than ten percent slope will have working areas graded level or fill brought in for working pads. Crocker anticipates that only minimal grading will be needed because the route has very little elevation change. If the landowner permits, it is preferred to leave the leveled areas and working pads in place for use in future maintenance activities. If permission is not obtained, the site will be graded back to as close to its original condition as possible, and all imported fill, including temporary culverts and road approaches, will be removed from the site and disturbed areas will be returned to pre-disturbance conditions.

Typical construction equipment used on a project consists of tree removal equipment, mowers, cranes, backhoes, digger-derrick line trucks, track-mounted drill rigs, dump trucks, front end loaders, bucket trucks, bulldozers, flatbed tractor-trailers, flatbed trucks, pickup trucks, concrete trucks and various trailers. Many types of excavation equipment are set on wheel or track-driven vehicles. Poles are transported on tractor-trailers.

Staging areas are generally established when constructing a transmission project. In the case of the Project, the staging area will likely be partially shared with the associated Crocker Wind Farm. Staging involves delivering the equipment and materials to construct the new transmission line facilities. Structures are delivered to staging areas, sorted and loaded onto structure trailers for delivery to the staked location. The materials are stored until they are needed for the Project. In some cases, additional space (temporary laydown areas) may be required. These areas will be selected for their location, access, security, and ability to efficiently and safely warehouse supplies. The areas are chosen to minimize excavation and grading. Sufficient rights to use the temporary laydown areas outside of the transmission line right-of-way will be obtained from affected landowners through rental agreements. Insulators and other hardware are attached to the structure while it is on the ground in the laydown area.

When it is time to install the poles, structures are moved from the staging areas, delivered to the staked location and placed within the right-of-way until the structure is set. Typically, access to the transmission line right-of-way corridor is made directly from existing roads or trails that run parallel or perpendicular to the transmission line right-of-way. In all cases where construction traffic and activities are within close proximity to local, county or state roadways, the contractor will coordinate with the governing body on traffic control and safety measures. In some situations, private field roads or trails are used. Permission from the property owner is obtained prior to accessing the transmission line corridor outside of public rights-of-way. Where necessary to accommodate the heavy equipment used in construction (including cranes, concrete cement trucks, and hole-drilling equipment), existing access roads may be upgraded or new roads may be constructed. Once construction is complete the temporary field approaches and access roads installed for the Transmission Line Route will be removed and revegetated. Previously removed woody vegetation will be allowed to regrow so long as it does not encroach on NESC prescribed clearances.

At this time, the Applicant anticipates the predominant method for securing the poles for the Project to be concrete foundations. Monopole structures are generally placed on foundations measuring between 6 to 11 feet in diameter and will typically be between 100 and 120 feet tall. Spacing intervals will be between 400 and 1,000 feet. The spoils will be removed from site unless other arrangements are made with the landowner. Crocker will not dispose of spoil materials within remnant prairie lands, areas restored to native plant communities, wetlands, protected water bodies, protected watercourses, or in a manner that could impact these areas through erosion or transport of the spoil materials. Concrete foundations will be used when warranted by site specific design criteria or circumstances. For concrete foundations, the excavation process will utilize temporary steel casing and rebar, concrete and anchor bolts will be placed in the hole. The standard projection of a concrete foundation is one foot above grade.

26.3 Restoration Procedures

The ground will be disturbed during the normal course of work (as is typical of most construction projects), which can take several weeks in any one location. The Applicant will take the steps necessary to lessen the impact of the Transmission Line Route on the surrounding environment by restoring areas disturbed by construction in accordance with BMPs and the Project's permit conditions. This will begin with a pre-construction survey that will identify areas requiring special restoration procedures. During construction, crews will also attempt to limit ground disturbance wherever possible. As construction on each parcel of land is completed, disturbed areas will be restored to its original condition to the maximum extent practicable. In addition, a management plan will be developed to prevent the spread of noxious and invasive weeds during construction and ongoing operations.

The Applicant or their contractor will contact each property owner after construction is completed to identify and address any damage that may have occurred as a result of the construction of the Project. If damage has occurred to crops, fences or the property, the Applicant will fairly compensate the landowner for the damages sustained in accordance with the terms and conditions agreed upon in the Transmission Easement Agreement entered into by Crocker and the landowner.

In some cases, the Applicant may engage an outside contractor to restore the damaged property to its original condition to the extent practicable. Portions of permanent vegetation that are disturbed or removed during construction of transmission lines will be reestablished to pre-disturbance conditions. Resilient species of common grasses and shrubs typically reestablish naturally with few problems after disturbance. Areas with significant soil compaction and disturbance from construction activities along the route will require assistance in reestablishing the vegetation stratum and controlling soil erosion. Commonly used BMPs to control soil erosion and assist in reestablishing vegetation that may be used on the Transmission Line Route include, but are not limited to:

- Erosion control blankets with embedded seeds
- Silt fences
- Hay bales
- Hydro seeding
- Planting individual seeds or seedlings of non-invasive native species

26.4 Maintenance Procedures

Transmission lines are designed to operate for decades. Typically, they require only moderate maintenance, particularly in the first few years of operation. The estimated service life of the proposed Transmission Line is approximately forty years. However, high-voltage transmission lines are seldom completely retired. The Applicant anticipates that the line could potentially, and would likely be broadly integrated into the transmission system over time, ultimately providing wider utility than just interconnecting the Crocker Wind Farm into the electrical grid.

The principal operating and maintenance cost for transmission facilities is the cost of inspections, which will be performed monthly by either truck or by air. Inspections will be conducted to ensure that the transmission line is fully functional and that no vegetation has encroached so as to violate required clearances. Annual operating and maintenance costs for 345 kV transmission lines in South Dakota and the surrounding states are expected to be approximately $300 to $600 per mile. Actual line-specific maintenance costs depend on the setting, the amount of vegetation management necessary, storm damage occurrences, structure types, materials used, and the age of the line.

27.0 INFORMATION CONCERNING TRANSMISSION FACILITIES (ARSD 20:10:22:35)

27.1 Configuration of Towers and Conductor Information

Crocker will design the structures to best blend with the broader visual environment. Typical structures for the Transmission Line Route will be primarily self-supporting galvanized or weathering steel, wood, or concrete. Monopole structures will be used unless conditions require the use of a more custom structure like an H-frame. Additionally, some guying may be required and will be determined once geotechnical investigations and structural design is completed. Crocker anticipates using Type 2-bundle 954 aluminum conductor steel reinforced ("ACRS") conductors or conductors of comparable capacity. Monopole structures are generally placed on concrete foundations measuring between 6 to 11 feet in diameter and will typically be between 100 and 120 feet tall. Spacing intervals will be between 400 and 1,000 feet.

27.2 Reliability and Safety

27.2.1 Transmission Line Reliability

As previously mentioned, transmission lines are designed to operate for decades. Typically, they require only moderate maintenance, particularly in the first few years of operation. The estimated service life of the proposed Transmission Line is approximately forty years. Transmission infrastructure includes very few mechanical elements, which results in reliability. It is built to withstand weather extremes, with the exception of severe weather such as tornadoes and heavy ice storms. Transmission lines are automatically taken out of service by the operation of protective relaying equipment when a fault is sensed on the system. Such interruptions are usually momentary. Scheduled maintenance outages are also infrequent. As a result, the average annual availability of transmission infrastructure is very high, in excess of 99 percent.

27.2.2 Transmission Line Safety

The Transmission Line Route will be designed in compliance with local, State, and good utility standards regarding clearance to ground, clearance to utilities, clearance to buildings, strength of materials, and right-of-way widths. The Applicant's contracted crews will comply with local, state, and good utility standards regarding installation of facilities and standard construction practices. Crocker will use proper signage and guard structures when stringing wire across roads and railroads. Installation of the guard structures and signage will be coordinated with the owner of the transportation corridor being protected. Guard structures can be temporary wood poles with a cross arm or line trucks with their booms used to hold the wire and protect the lanes of traffic.

The proposed transmission line will be equipped with protective devices, such as breakers and relays, to safeguard the public from the transmission line if a transmission line or pole falls or other accident occurs. Breakers and relays are located where the line connects to the substation, and will de-energize the line in the event of an emergency. In addition to protective devices, proper signage will be posted warning the public of the safety risks associated with the energized equipment.

27.2.2.1 Electromagnetic Fields and Stray Voltage

The frequency of transmission line EMF in the United States is 60 hertz and falls in the extremely low frequency ("ELF") range of the electromagnetic spectrum (any frequency below 300 hertz). For the lower frequencies associated with power lines, the electric and magnetic fields are typically evaluated separately. The intensity of the electric field is related to the voltage of the line, while the intensity of the magnetic field is related to the current flow along the conductors.

Concerns about health effects of EMF from power lines were first raised in the late 1970s. Since then, considerable research has been conducted to determine if exposure to magnetic fields, such as those from high-voltage power lines, causes biological responses and health effects. Initial epidemiological studies completed in the late 1970s showed a weak correlation between surrogate indicators of magnetic field exposure (such as wiring codes or distance from roads) and increased rates of childhood leukemia (Wertheimer et. al, 1979). Toxicological and laboratory studies have not shown a biological mechanism between EMF and cancer or other adverse health effects. In 2007, the World Health Organization ("WHO") concluded a review of health implications from magnetic fields and concluded, "…virtually all of the laboratory evidence and the mechanistic evidence fail to support a relationship between low-level ELF magnetic fields and changes in biological function or disease status" (WHO, 2007).

Natural and human-made electromagnetic fields are present everywhere in our environment. Natural electric fields in the atmosphere range from background static levels of 10 to 120 volts per meter ("V/m") to well over several kilovolts per meter ("kV/m") produced by the build-up of electric charges in thunderstorms. The Earth itself has a magnetic field that ranges from approximately 300 to 700 milligauss ("mG"). In addition to the presence of the earth's steady state electric field, an average home experiences additional magnetic fields of 0.5 mG to 4 mG which arise from the general wiring and appliances located in a typical home.

Crocker conducted an EMF study for the transmission line and estimated the maximum magnetic field at 62.98 mG, which occurs at approximately 10 feet from the proposed transmission line centerline. The maximum electric field for the Crocker transmission line is calculated to be 6.73 kV/m at 15 feet from the proposed transmission line centerline. At 75 feet from the proposed transmission line centerline (the edge of the proposed right-of-way), the calculated electric field is 1.11 kV/m. The results of this study are presented in Appendix I.

Impacts from stray voltage are typically related to improper grounding of electrical service to the farm (distribution lines) or on-farm electrical wiring. Transmission lines do not, by themselves, create stray voltage because they do not connect to businesses or residences and they are typically grounded properly. However, transmission lines can induce stray voltage on a distribution circuit that is parallel to and immediately under the transmission line. Appropriate measures, such as proper grounding, will be taken to prevent stray voltage problems.

27.3 Right-of-way or Condemnation Requirements

Crocker must acquire easement rights to route facilities across private property. During the route development process, the Applicant reached out to landowners to obtain feedback on proposed routes and to negotiate land rights. The Transmission Line Route covers approximately 102 acres, all of which are privately owned parcels subject to easement agreements between Crocker and Clark County landowners. Crocker will also coordinate with the appropriate agencies where the Transmission Line Route shares right-of-way with other public utilities or public roads. This coordination is anticipated to be complete by the first quarter of 2018.

The Transmission Line will be built primarily with monopole structures, which typically require a 150 foot right-of-way for the length of the route. Diagrams of typical structures to be used on this Project are shown in Appendix J.

27.4 Necessary Clearing Activities

The Transmission Line has been routed to minimize tree clearing to the extent feasible. Isolated trees may need to cleared to allow safe operation of the Transmission Line. Refer to Section 26.1 for information on route clearing.

27.5 Underground Transmission

No portion of the Transmission Line will require underground transmission.

28.0 ADDITIONAL INFORMATION IN APPLICATION (ARSD 10:22:36)

28.1 Permits and Approvals

The Applicant will be responsible for undertaking all required environmental review and will obtain all permits and licenses that are required following issuance of the Facility Permit. The potential permits or approvals that have been identified as being required for the construction and operation of the Project are shown in Table 28-1.

Table 28-1: Permits and Approvals

Regulatory Authority	Permit/Approval
Federal Approvals	
U.S. Army Corps of Engineers	Wetland Delineation Approvals
	Jurisdictional Determination
	Federal Clean Water Act Section 404 and Section 10 Permit(s)
Lead Federal Agency - U.S. Fish and Wildlife Service	NEPA Review (Section 7 Consultation), Review for Threatened and Endangered Species
Environmental Protection Agency (Region 8) (EPA) in coordination with the South Dakota Department of Health	Spill Prevention Control and Countermeasure (SPCC) Plan
National Historic Preservation Act	Federal Section 106 Review (Class I Literature Review / Class III Cultural Field Study)
Federal Aviation Administration	Form 7460-1 Notice of Proposed Construction or Alteration (Determination of No Hazard)
	Notice of Actual Construction or Alteration (Form 7460-2)
Federal Communications Commission	Non-Federally Licensed Microwave Study
	NTIA Communication Study
Federal Energy Regulatory Commission	Exempt Wholesale Generator Self Cert. (EWG)
	Market-Based Rate Authorization
Federal Emergency Management Agency	Floodplain Designation
State of South Dakota Approvals	
South Dakota Aeronautics Commission	Aeronautical Hazard Permit

Table 28-1: Permits and Approvals

Regulatory Authority	Permit/Approval
South Dakota Public Utilities Commission	Application for Facility Permit
South Dakota State Historic Preservation Office (SHPO)	Cultural and Historic Resources Review and Review of State and National Register of Historic Sites and Archeological Survey
South Dakota Department of Environment and Natural Resources	Section 401 Water Quality Certification
	National Pollutant Discharge Elimination System Permit (NPDES) – MPCA General Stormwater Permit for Construction Activity
	Temporary Water Use Permit for Construction Activities
	Water Rights Permit for Nonirrigation Use
	Temporary Discharge Permit
	Air Quality Permit
South Dakota Department of Transportation	Utility Permits on Trunk Highway Right-of-way
	Oversize/Overweight Permit for State Highways
	Tall Structure Permit
Local Approvals	
Clark County	Right-of-way permits, crossing permits, driveway permits for access roads, building permit for O&M building, oversize/overweight permits for County Roads, conditional use permit and building permit for WES and transmission line
Townships	Right-of-way permits, crossing permits, driveway permits for access roads, building permit for O&M building, oversize/overweight permits for township roads
MISO	Turbine Change Study
	Generator Interconnection Agreement

28.2 Agency Coordination

The Applicant has coordinated with various federal, state, and local agencies to identify agency concerns regarding the proposed Project in various manners of communication. The Applicant has consulted with the following agencies regarding the proposed Project:

- South Dakota Department of Environment and Natural Resources
- South Dakota Department of Transportation
- SDGFP
- SHPO
- USFWS
- USACE
- ITC
- South Dakota Aeronautics Commission
- USDA – NRCS
- Clark County
- Ash Township
- Cottonwood Township
- Spring Valley Township
- Warren Township
- Woodland Township

Additional agency and public coordination will be conducted in conjunction with the scoping process required for the EA. The USFWS will be the lead Federal agency for the EA. The Applicant will continue working with the public and interested federal, state, and local agencies to address any comments they have regarding the Project. Additional opportunities for public and agency comments will be held as part of the review process for this Application.

28.3 Applicant's Burden of Proof (49-41B-22)

As described in Section 2.0 and 3.0, the Applicant has addressed the matters set forth in SDCL Chapter 49-41B and in ARSD Chapter 20:10:22 (Energy Facility Siting Rules), related to wind energy facilities.

Pursuant to SDCL 49-41B-22, the information presented in this Application establishes that:

- The proposed wind energy and transmission facilities comply with applicable laws and rules.
- The facilities would not pose a threat of serious injury to the environment or to the social and economic condition of inhabitants in or near the Project Area.
- The facilities would not substantially impair the health, safety, or welfare of the inhabitants.
- The facilities would not unduly interfere with the orderly development of the region, having given consideration to the views of the governing bodies of the local affected units of government.

29.0 TESTIMONY AND EXHIBITS (ARSD 20:10:22:39)

The Applicant has filed a motion to waive the requirement to file testimony at the time of filing and has asked the Commission to order pre-filed testimony two weeks after the initial public meeting.

30.0 REFERENCES

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