Contents

Index of Figures

Index of Tables

Index of Diagrams

Maps

Appendices

1 Introduction

This environmental assessment (EA) has been prepared for the Big Bend Wind Project (Wind Project or wind portion) and Big Bend Wind High Voltage Transmission Line (HVTL) Project (Big Bend HVTL Project or HVTL Project) proposed by Big Bend Wind Farm, LLC (Big Bend or Wind Applicant), and the Red Rock Solar Project (Solar Project or solar portion) proposed by Red Rock Solar, LLC (Red Rock or Solar Applicant). The Big Bend Wind Project and Red Rock Solar Project were identified as a hybrid project within their applications. In some instances when both Big Bend and Red Rock are being referred to the term Applicants will be used, and when referring to both the Wind Project and Solar Project the term Hybrid Projects will be used. When the term Projects is used within this document, it is referring to all three components, the Wind Project, Solar Project, and HVTL Project collectively.

This EA evaluates the potential human and environmental impacts of the proposed Projects, and possible mitigation measures including an alternate route, alternate route segments, alternate Points of Interconnection (POIs) to the grid, and Best Management Practices (BMPs). Additionally, it evaluates system alternatives and alternatives to the Projects. This EA is not a decision-making document, but rather serves as a guide for decision makers.

The EA is intended to facilitate informed decisions by the Public Utilities Commission (Commission), particularly with respect to the goals of the:

- Minnesota Power Plant Siting Act (MN Statute Chapter 216E) to "minimize adverse human and environmental impacts while insuring continuing electric power system reliability and integrity and insuring that electric energy needs are met and fulfilled in an orderly and timely fashion",
- siting of wind energy conversion systems (MN Statute Chapter 216F) to "site large wind energy conversion systems (LWECS) in an orderly manner compatible with environmental preservation, sustainable development, and the efficient use of resources", and
- Certificate of Need; Power Plant or Line (MN Rules Chapter 7849) to complete the "assessment of need for large electric generating facilities and large high voltage transmission lines"

1.1 What is the state of Minnesota's role?

The applicants need five approvals from the Public Utilities Commission. Commerce prepared this EA. An administrative law judge will oversee a public hearing.

In order to build the Big Bend Wind Project, the Big Bend Wind HVTL, and the Red Rock Solar Facility, Big Bend and Red Rock must obtain five approvals from the Public Utilities Commission

(Commission)—a certificate of need (CN) for the LWECS and HVTL, a site permit for the Wind Project, a route permit for the HVTL, a CN for the solar facility, and a site permit for the solar facility. In addition to these approvals from the Commission, the Project also requires approvals (e.g., permits, licenses) from other state agencies and federal agencies with permitting authority for specific resources (e.g., the waters of Minnesota). Commission site and route permits supersede and preempt all zoning, building, and land-use regulations promulgated by local units of government.[1]

Big Bend applied to the Commission for a CN, an LWECS site permit, and a route permit for the Big Bend Wind Project and Big Bend Wind HVTL in November 2020, and Red Rock applied to the Commission for a CN and site permit for the Red Rock Solar Project in November 2020. Big Bend Wind, LLC filed an Amended site permit application (Amended Wind SPA) in September 2021, which replaces the initially filed LWECS site permit for the Big Bend Wind Project.

With these applications, the Commission has before it three distinct considerations:

- Whether the proposed Projects are needed, or whether some other project would be more appropriate for the state of Minnesota, for example, a project of a different type or size, or a project that is not needed until further into the future?
- If the proposed Big Bend Wind Project, Big Bend Wind HVTL Project, and Red Rock Solar Project are needed, are the Projects, as proposed, compatible with environmental preservation, sustainable development, and the efficient use of resources?
- If the proposed Big Bend Wind Project is needed, where is it best located and what conditions should be placed on the site permit?
- If the proposed Big Bend Wind HVTL Project is needed, where is the transmission line best located and what conditions should be placed on the route permit?
- If the proposed Red Rock Solar Project is needed, where is it best located and what conditions should be placed on the site permit?

To help the Commission with its decision-making and to ensure a fair and robust airing of the issues, the state of Minnesota has set out a process for the Commission to follow in making its decisions on Certificates of Need, Site Permits, and Route Permit.[2] In this instance, this EA was prepared, and a public hearing will be held. The goal of the EA is to describe potential human and environmental impacts of the project (*the facts*), whereas the intent of the public hearing is to allow interested persons the opportunity to advocate, question, and debate what the Commission should decide about the Projects (*what the facts mean*). The record developed during this process – including all public

[1] Minnesota Statutes 216E.10

[2] Minnesota Statutes 216B and 216E

input – will be considered by the Commission when it makes its decisions on the Applicant's Certificate of Need, Amended Wind Site Permit, Solar Site Permit, and Route Permit Applications.

1.2 How is this document organized?

The EA addresses the matters identified in the revised scoping decision.

This EA is based on Big Bend's CN, amended wind site permit, and route permit applications, Red Rock's certificate of need and site permit applications, public comments received during the scoping comment periods for this EA, and input from the Commission. This EA addresses the matters identified in the scoping decision and the revised scoping decision for this project (Appendix A) and is organized as follows:

Chapter 1	Introduction	Provides an overview of the Project, the state of Minnesota's role, and the organization of the document.
Chapter 2	Regulatory Framework	Describes the regulatory framework associated with the project, including the state of Minnesota's CN and site and route permitting processes, the environmental review process, and the permits and approvals that would be required for the project.
Chapter 3	Proposed Hybrid Big Bend Wind and Red Rock Solar Project and System Alternatives	Describes the engineering, design, and construction of the proposed wind project and solar project. Chapter 3 also discusses the system alternatives being evaluated.
Chapter 4	Big Bend Wind Project and Red Rock Solar Project and System Alternatives – Human and Environmental Impacts	Describes the potential impacts and mitigative measures for the Big Bend Wind Project and the Red Rock Solar Project. Chapter 4 also discusses the feasibility, availability, and potential impacts of the proposed up to 335 MW hybrid wind and solar project, and system alternatives, including a 335 MW solar facility (no wind energy component), a 335 MW hybrid wind and solar project located elsewhere in the State of Minnesota, and a 335 MW solar facility with battery storage located elsewhere in the State of Minnesota.

Chapter 5	Proposed Transmission Project, Alternate Routes, Alternate Route Segments	Describes the engineering, design, and construction of the proposed transmission project. Chapter 5 also discusses possible points of interconnection, routes and route segments.
Chapter 6	HVTL Potential Impacts and Mitigation	Describes the potential impacts and mitigative measures for the Big Bend Wind HVTL Project. Chapter 6 also discusses the environmental setting, topics dismissed from detailed analysis, and the details potential human and environmental impacts.
Chapter 7	Unavoidable, Irreversible, and Cumulative Impacts	Describes unavoidable impacts and irreversible and irretrievable commitments of resources. Chapter 7 also summarizes potential cumulative effects of the HVTL Project and other projects in the area.
Chapter 8	Application of Routing Factors	Describes information and data about the Big Bend HVTL Project to assist the Commission in making a route permit decision.

1.3 What do the applicants propose to construct?

An up to 300 MW wind energy and up to 60 MW solar energy generating facility, which will be a hybrid energy project ultimately having a total nameplate capacity of 335 MW. The wind and solar facilities will deliver the energy they generate to the grid via an 18 mile long 161 kV high voltage transmission line.

The Project consists of three major components, a wind project of up to 300 MW, an up to 60 MW solar generation facility and the 161 kV HVTL of approximately 18 miles, refer to **Figure 1-1**. The Big Bend Wind Project and Red Rock Solar Project have been proposed as a hybrid generation facility that would generate a total of 335 MW of energy. Red Rock has indicated that due to the cost of transmission to reach grid interconnection, the solar project would not be constructed and operated without the construction and operation of the wind project. Big Bend Wind Project could be constructed and operated without the solar project.

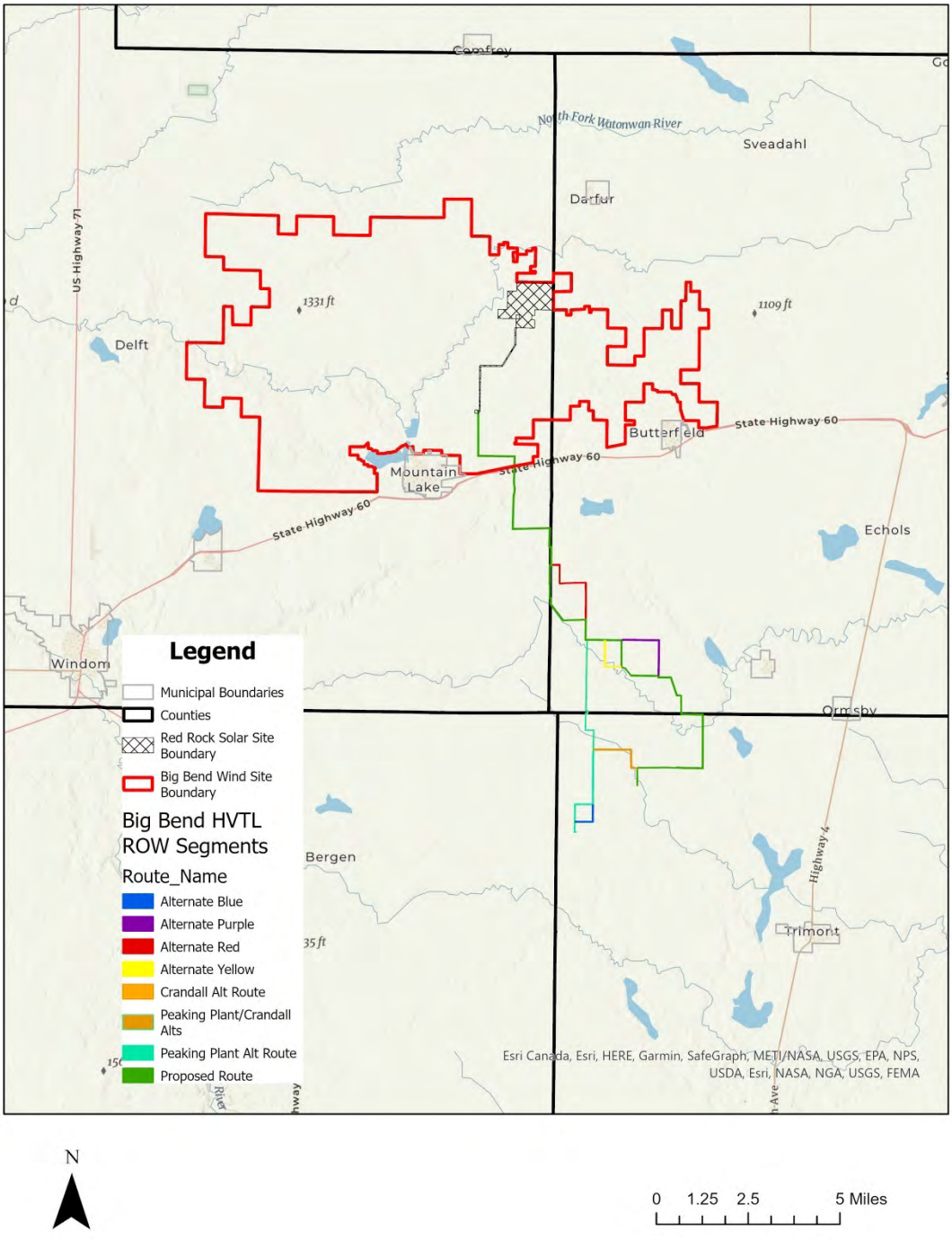
1.3.1 300 MW Big Bend Wind Project

The Wind Project will be located in Cottonwood and Watonwan counties, Minnesota. The Project will have up to 300 MW of nameplate wind energy capacity. Big Bend has continued to assess its turbine

options throughout the SPA review process and has selected wind turbines with rated nameplate power outputs of 5.8 MW (GE-158), 6.0 MW (Vestas V162) to 5.94 MW (Nordex N-163), which would result in the construction and operation of 45 to 47 turbines, refer to **Figure 1-2**.[3]

[3] Amended Wind SPA – Table 5.2-1

Figure 1-1. Projects Overview

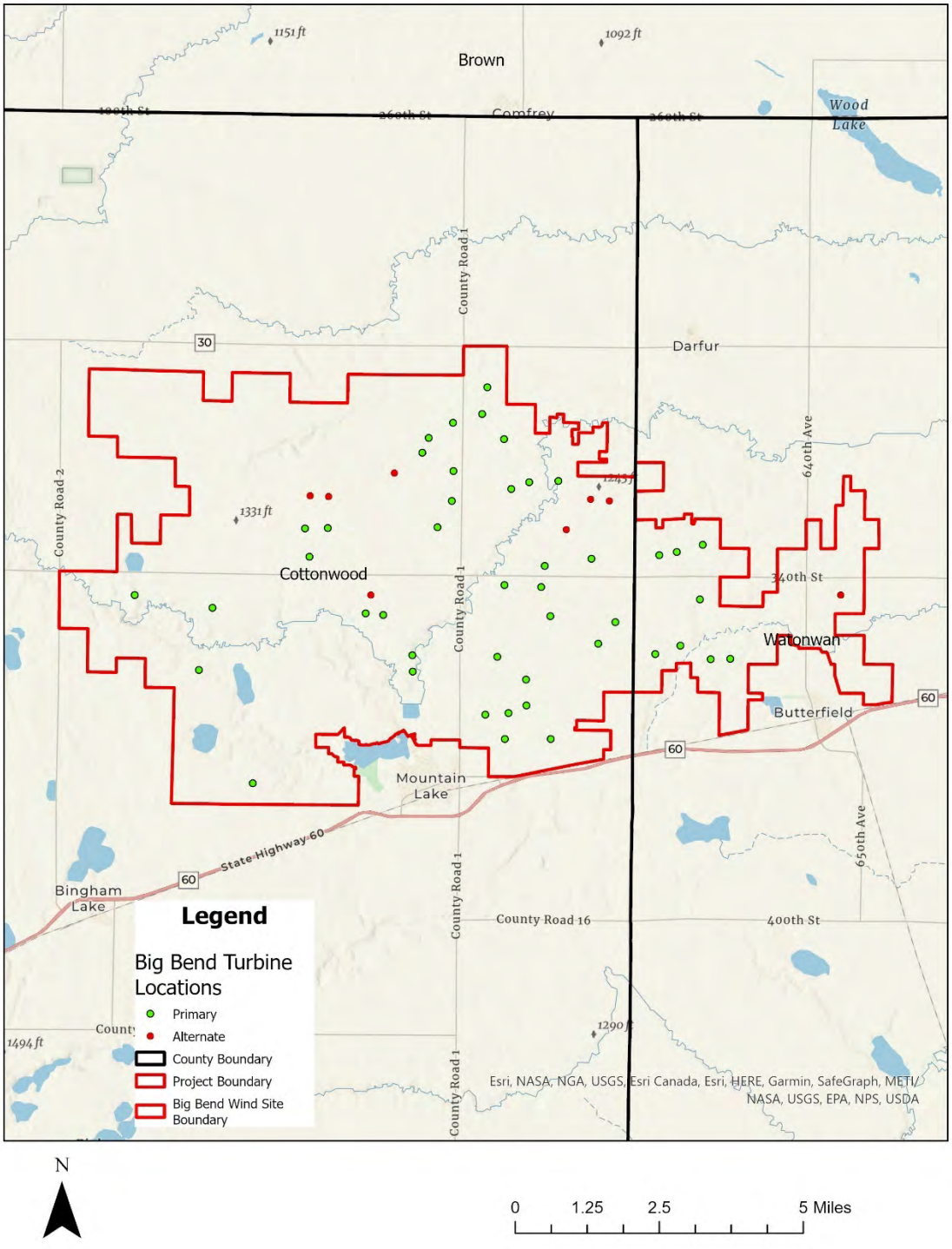


A number of facilities will be constructed to support the operation of the wind turbines and facilitate the delivery of the electricity to consumers. Big Bend is seeking approval from the Commission through the LWECS site permit for the following associated infrastructure: up to one permanent meteorological tower and other weather data collection systems, up to four ADLS radars, an electrical collection and communications system, new gravel access roads, improvements to existing roads, temporary laydown and staging areas, one temporary concrete batch plant if needed during construction, one wind project substation, one Sonic Detection and Ranging (SoDAR) or one Light Detection and Ranging (LiDAR) unit and an Operations and Maintenance O&M facility.[4]

At the time of the Amended Wind SPA filing, Big Bend stated it has leased, or has pending leases acquired on 79 percent of the land required for successful construction and operation of the Project site.[5] Three turbine locations A01, A02, and A03 are proposed to be sited in locations that would not meet the Wind Access Buffer Setback requirements from non-participating landowner property boundaries. Easement negotiations are ongoing, but if agreements cannot be reached with non-participating landowners near turbine locations A01, A02, and A03, Big Bend has indicated that they will be requesting Wind Access Buffer Setback waivers from the Commission to allow for the construction and operation of these turbines.[6]

[4] Amended Wind SPA – Sections 5.3 and 6.0
[5] Amended Wind SPA – Section 7.0
[6] Amended Wind SPA – Section 7.0

Figure 1-2. Big Bend Wind Project



Big Bend anticipates turbine delivery to the project site as early as the third quarter of 2022, so construction is anticipated to begin mid to late 2022 and take approximately eight months. Big Bend anticipates a commercial operation date (COD) in the fourth quarter of 2022.[7]

The Applicant states that Wind Project is needed to meet the growing demand for additional renewable resources required to meet energy sector needs, consumer demand, and renewable and other clean energy requirements in Minnesota and neighboring states.[8] The Applicant continues that given the demand for renewable energy, a market exists for independently produced electricity generated from wind and other renewables, including the up to 300 MW to be generated by the Project.[9]

The wind project substation will connect to the Blue Lake-Wilmarth-Interstate Interconnection 345 kilovolt (kV) transmission line through the Xcel Energy Crandall Switching Station (Crandall), or at Great River Energy (GRE) Lakefield Junction Peaking Plant through the Lakefield Junction Station (Lakefield Junction) via the proposed, approximately 18 mile long 161 kV Big Bend HVTL.

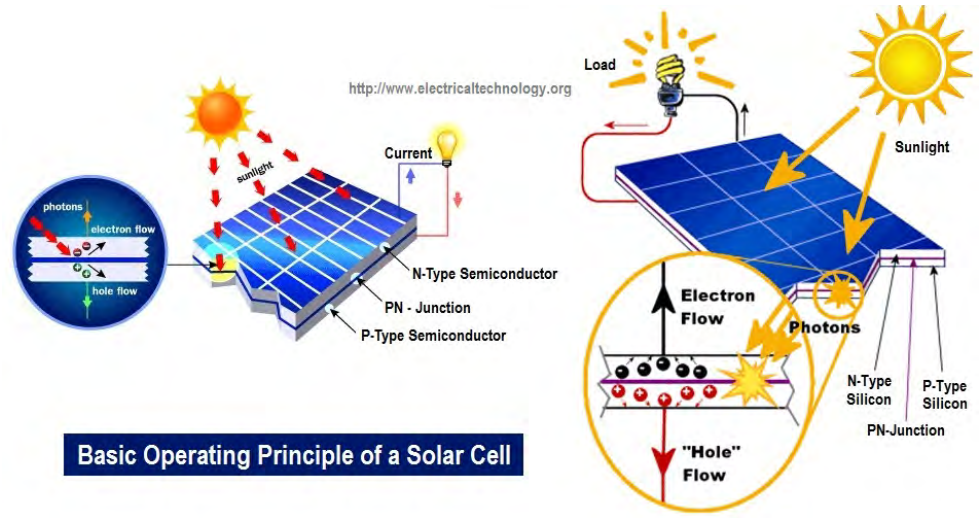
1.3.2 60 MW Red Rock Solar Facility

The Red Rock Solar Project will be located in Cottonwood County, Minnesota, (see **Figure 1-3**) and generate up to 60 MW of electric energy. The Solar Project's primary components include photovoltaic (PV) panels affixed to linear ground-mounted single-axis tracking systems, inverters and transformers housed in electrical cabinets, electrical collection system, a solar project substation, and supervisory control and data acquisition ("SCADA") systems and metering equipment.[10]

PV systems convert both direct and indirect solar energy (direct and scattered sunlight) to electrical energy by capitalizing on nature's inherent desire to keep electrical charges in balance, see **Diagram 1-1**. At the most basic level, electrical current is the flow of electrons through a conductor. When solar radiation strikes a PV cell some of it is absorbed, exciting electrons within the cell. Some of these electrons move freely between layers from negative to positive. In the process, electrons from the positive layer are disrupted and "flow" back to the negative layer through the external load creating a continuous flow of electrons, or, a continuous flow of electric current.

[7] Amended Wind SPA – Section 10.8
[8] Big Bend Wind CNA – Section 3.1
[9] Big Bend Wind CNA – Section 3.1
[10] Solar SPA – Section 3.0

Diagram 1-1. Solar Cell [11]



The Solar Project also requires fencing, access roads, laydown areas, a solar project substation, collection lines between the arrays within the fenced facility, and collection line outside the fenced facility to the solar project substation.[12] The solar array will connect to the project substation through a below ground AC 34.5 kV collection line.[13]

At the time of the filing, Red Rock holds leases on 846.2 acres of privately owned lands and has a purchase option available for the five acres of land planned for the solar substation. The proposed solar project facilities are anticipated to cover approximately 483 acres of the land (under 11 seperate landowners) currently under easement. The remaining approximately 363.8 acres of land under lease is not anticipated to be occupied by solar facility equipment and infrastructure, and the landowners will be allowed to continue regular farming activities in this area throughout the life of the solar project.[14]

Red Rock anticipated construction of the Solar Project to begin mid-2022 and last for approximately seven months. Commercial operation (COD) is anticipated to begin in the fourth quarter of 2022.

[11] Source: https://www.electricaltechnology.org/2015/06/how-to-make-a-solar-cell-photovoltaic-cell.html.
[12] Solar SPA – Section 2.0
[13] Solar SPA – Section 3.0
[14] Solar SPA – Section 2.2

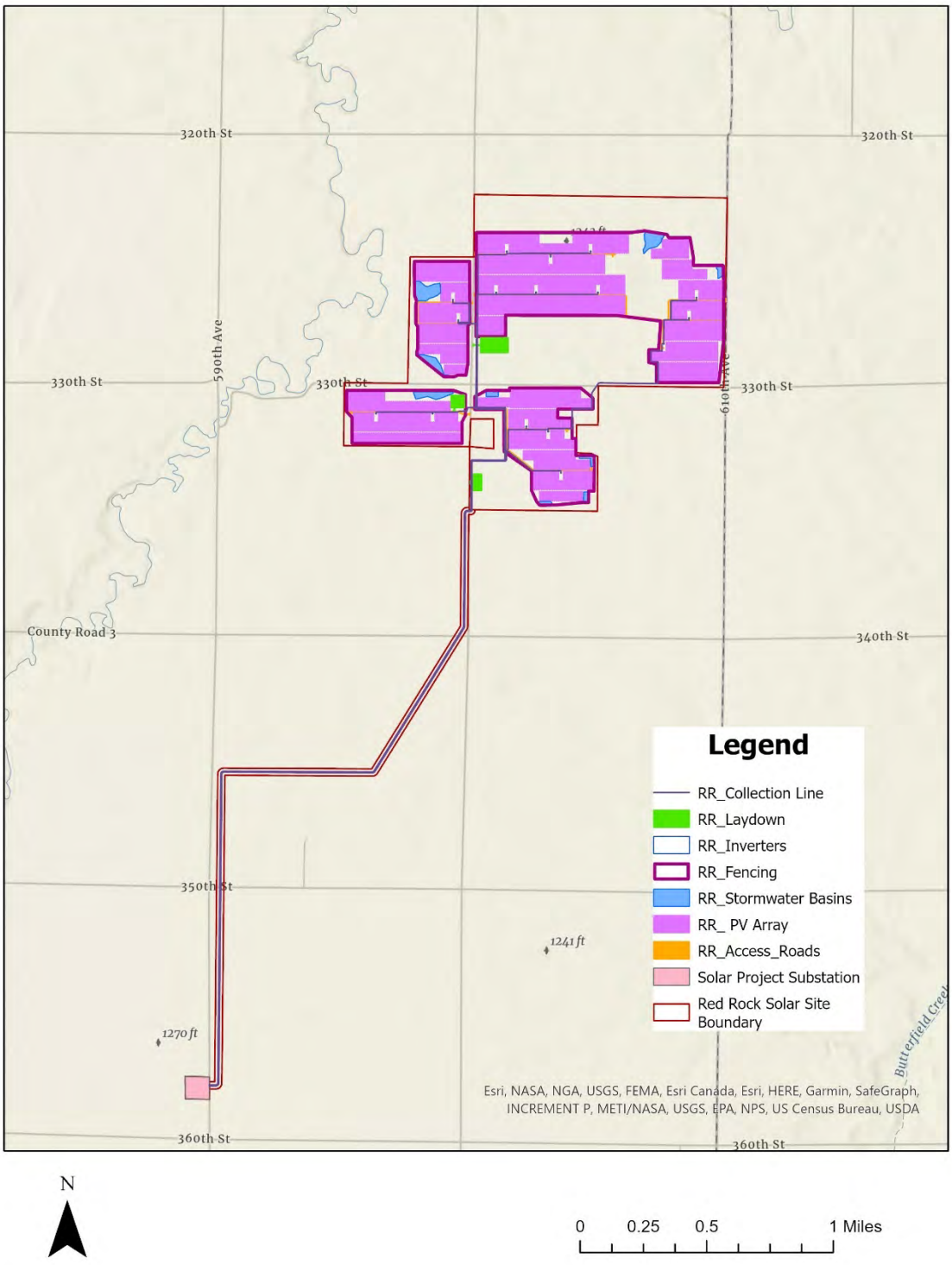
The Solar Applicant states that Solar Project will help meet the renewable energy needs and goals of a utility, or commercial or industrial purchaser. The Applicant continues that the Red Rock Solar Project will be constructed and operated as part of the first hybrid renewable project in Minnesota with the Big Bend Wind Project. Solar and wind energy facilities complement each other, as solar facilities provide a good capacity resource and wind facilities provide a good energy resource.[15]

The solar project substation will connect to the Blue Lake-Wilmarth-Interstate Interconnection 345 kilovolt (kV) transmission line through the Xcel Energy Crandall Switching Station (Crandall), or at Great River Energy (GRE) Lakefield Junction Peaking Plant through the Lakefield Junction Station (Lakefield Junction) via the proposed, approximately 18 mile long 161 kV Big Bend HVTL.[16]

[15] Red Rock Solar CNA – Section 3.1

[16] Solar SPA – Section 2.1

Figure 1-3. Red Rock Solar Project



1.3.3 Big Bend Wind 161 kV HVTL

Big Bend Wind proposes to construct and operate 18 miles of new 161 kV HVTL. If the proposed projects are approved the wind project and solar project substations would be connected into the proposed Big Bend HVTL.

The HVTL Applicant's Proposed Route for the Big Bend HVTL Project would begin at the proposed wind project and the solar project substations near the intersection of 366th Street and 590th Avenue in Midway Township of southeastern Cottonwood County and would extend generally to the southeast through Midway and Mountain Lake Townships in Cottonwood County, Odin Township in Watonwan County, and Cedar Township in Martin County. The Applicant's proposed route would terminate at a proposed Step-up Substation to be constructed near the intersection of 230th Street and 30th Avenue, across the road (230th Street) from the existing Crandall Switching Station in Cedar Township in northwestern Martin County. The proposed Step-up Substation will be connected to the existing Crandall Switching Station via a less-than 1,500 foot long 345 kV connector line, which is where the proposed Big Bend HVTL will interconnect to the larger transmission grid system, see Figure 1-4.

In addition to their proposed route, the HVTL Applicant identified an alternate route to get to the Crandall Switching Station (Crandall Alternate Route), an alternate route with a different POI at the GRE Lakefield Junction Peaking Plant (Peaking Plant Alternate Route), and three alternate route segments (Red, Yellow, and Purple) along the Proposed Route are under consideration.

The Crandall Alternate Route takes a more direct straight line route to the south and turning to the southeast when compared to the Applicant's Proposed Route, and both of these routes terminate at the Crandall Substation POI. Big Bend identified three potential alternate route segments, Alternate Red, Alternate Yellow, and Alternate Purple. All three of the proposed alternate route segments are located between the proposed wind project substation and the Crandall Switching Station POI, and are considered alternatives to segments of the Applicant's Proposed Route.[17]

The Peaking Plant Alternate Route takes a direct route south to the GRE Lakefield Junction Peaking Plant POI. A member of the public provided an alternate route segment, referred to as the Peaking

[17] Big Bend HVTL RPA – Section 3.0

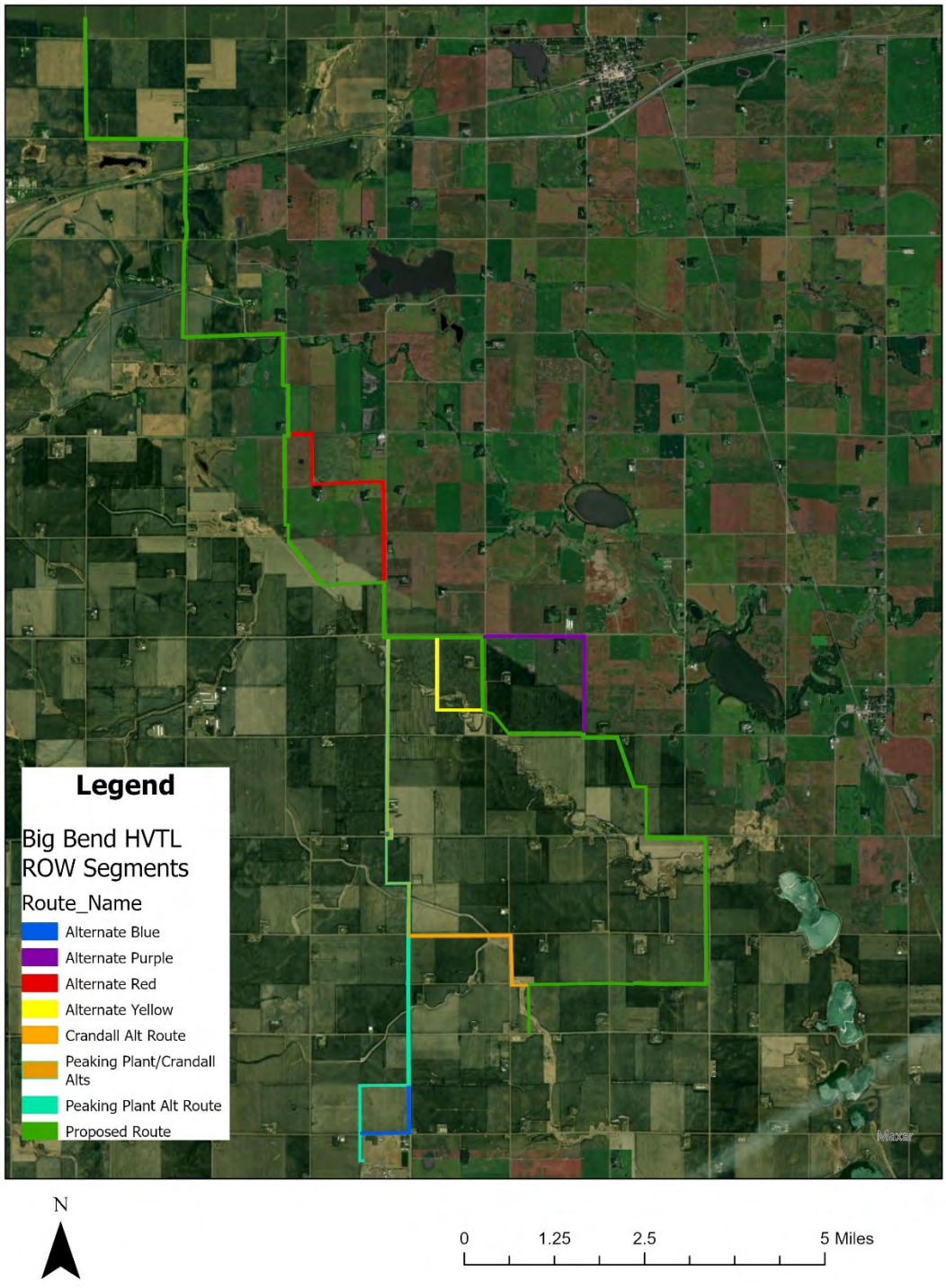
Plant Alternate Route – Alternate Route Segment, during the EA scoping process, and this alternate route segment has been carried forward and is analyzed in this EA.

Both POIs, Crandall and Lakefield Junction will require a step-up substation and a segment of less than 1,500 feet of 345 KV transmission line that will connect to the Blue Lake-Wilmarth-Interstate 345 kV transmission line.[18]

The Applicant's Proposed Route, Crandall Switching Station, Lakefield Junction Peaking Plant, the alternate routes, and alternate route segments are illustrated in **Figure 1-4**.

[18] Solar SPA – Section 2.1

Figure 1-4. Big Bend HVTL Project



At the time of filing, Big Bend had secured 100 percent of the total necessary private easements on the Proposed Route and continues to work on acquiring land rights that are necessary for the alternate segments.[19] Big Bend did not address the topic of exercising eminent domain in their application documents. EERA identified the potential issues associated with the Applicant avoiding the potential use of eminent domain to establish the HVTL route, and instead obtaining voluntary easements for the HVTL route.[20] The Applicant's Reply Comments on Application Completeness, filed on December 23, 2020, did not address the eminent domain issue identified in EERA's Comments on Application Completeness.

Big Bend anticipates that project construction will begin in the second quarter 2022, and construction will take approximately 7 to 9 months. The new Big Bend HVTL is anticipated to be in service by the fourth quarter of 2022.[21]

1.4 Sources of Information

The primary sources of information for this EA are the applications for the CNs, amended wind site permit, solar site permit, and route permit submitted by Big Bend and Red Rock. Additional sources of information are identified in the footnotes throughout the document. New and additional data has been included from the applicant and from state agencies. Information was also gathered by visits to the project area.

A number of spatial data sources, which describe the resources in the Project Area, were used in preparing this EA. Spatial data from these sources can be imported into geographic information system (GIS) software, where the data can be analyzed and potential impacts of the project quantified, e.g., acres of wetland within the anticipated right-of-way.

[19] Big Bend HVTL RPA – Section 3.0
[20] DOC-EERA. Comments – and Recommendations. December 14, 2020. eDocket ID# 202012-169066-02
[21] Big Bend HVTL RPA – Table 2.6-1

2 Regulatory Framework

This chapter discusses the five approvals required from the commission for the construction and operation of the Big Bend Wind Project, Big Bend 161 kV HVTL Project, and Red Rock Solar Project. It describes the environmental review process and lists the factors the commission must consider when making decisions. This chapter also discusses required approvals from federal and state agencies and local units of government with permitting authority for actions related to the project. Lastly, it lists topics outside the scope of the EA.

2.1 What commission approvals are required?

The projects will require two certificates of need, a site permit for the wind project, a site permit for the solar project, and a route permit for the transmission project.

Big Bend filed three separate applications in support of its proposed up to 300-megawatt (MW) large wind energy conversion system (LWECS) to be located in Cottonwood and Watonwan Counties, and a 18-mile 161 kilovolt (kV) transmission line to be located in Cottonwood, Martin, and Watonwan counties (collectively, the Big Bend Project). Red Rock filed two separate applications in support of its proposed up to 60 MW solar energy generation facility to be located in Cottonwood County:

- a certificate of need application for the wind project and the associated 161 kV transmission line,[i]
- a large wind energy conversion system (LWECS) site permit application,[ii]
- an amended LWECS site permit application,[iii]
- a high-voltage transmission line (HVTL) route permit application for the proposed 161 kV transmission line,[iv]
- a certificate of need application for the solar facility [v]
- a site permit application for the solar facility[vi]

2.1.1 Certificate of Need

Construction of a large energy facility in Minnesota requires a CN from the commission.[22] The up to 300 MW Big Bend Wind Project, the Big Bend 161 kV transmission line project, and the up to 60 MW Red Rock solar project all meet the definition of a large energy facility and require two CNs, one CN for the wind project and transmission line project and a separate CN for the solar project. Big Bend submitted a CN application for the Big Bend Wind Project and the Big Bend HVTL Project to the commission on November 9, 2020, and Red Rock submitted a CN application for the Red Rock Solar Project to the commission on November 9, 2020. The commission accepted the applications as complete and referred it to the Office of Administrative Hearings (OAH) for contested and public hearings, to be conducted jointly with the hearings for the two site and route permit applications and

[22] Minnesota Statutes 216B.243.

authorized the Department of Commerce (Department) to conduct environmental review jointly with the site and route permit applications[23].

The commission must determine whether the proposed projects are needed or if another project would be more appropriate for the state of Minnesota. Minnesota Rules, part 7849.0120 provides the criteria that the Commission must use in determining whether to grant a CN:

- The probable result of denial would be an adverse effect on the future adequacy, reliability, or efficiency of energy supply to the applicant, to the applicant's customers, or to the people of Minnesota and neighboring states.
- A more reasonable and prudent alternative to the proposed facility has not been demonstrated by a preponderance of the evidence on the record.
- The proposed facility, or a suitable modification of the facility, will provide benefits to society in a manner compatible with protecting the natural and socioeconomic environments, including human health.
- The record does not demonstrate that the design, construction, or operation of the proposed facility, or a suitable modification of the facility, will fail to comply with relevant policies, rules, and regulations of other state and federal agencies and local governments.

If the commission determines that the applicant has met these criteria, a CN is granted. The commission's CN decision determines the type of project, the size of the project, and the project's termini, or its start and end points. The Commission could place conditions on the granting of a CN. The CN decision does not determine the locations of wind turbines, solar panels, or the route for transmission line; these determinations are made in the site and route permits for the Project.

2.1.2 LWECS Site Permit

A site permit from the commission is required to construct a large wind energy conversion system (LWECS), which is any combination of wind turbines and associated facilities with the capacity to generate five MW or more of electricity. This requirement became law in 1995. The Minnesota Wind Siting Act is found at Minnesota Statutes Chapter 216F. The rules to implement the permitting requirements are in Minnesota Rule 7854.

The Big Bend Wind Project will generate up to 300 MW; thus, it requires a site permit. Big Bend submitted the original site permit application to the commission on November 9, 2020; updated and revised site permit application appendices were filed on September 20, 2021. The commission issued

[23] Commission. Order – Order Acceptiing Applications as Complete. March 11, 2021. eDocket ID# 20213-171785-05

a Draft Site Permit on July 22, 2021[24] (**Appendix B**). Big Bend Wind, LLC filed an Amended Wind Site Permit Application on September 20, 2021.[25]

Only information provided in the Amended Wind Site Permit Application, not the Initial Wind Site Permit Application, has been used and referenced in the preparation of this EA.

In making a siting decision for the wind farm, the Commission considers factors prescribed in statute and rule. Minnesota Statutes, section 216E.03, identifies considerations that the Commission must take into account when siting wind farms, including potential impacts on human and natural resources. The commission also must determine that a project is compatible with environmental preservation, sustainable development, and the efficient use of resources as indicated in Minnesota Statute 216F.03.

2.1.3 Solar Facility Site Permit

MN Statute Chapter 216E states that a site permit from the commission is required to construct a large electric power generating plant of 50 MW or greater in size, which would include solar generation facilities. The rules to implement the permitting and meeting the environmental review requirements are in Minnesota Rule 7850.

The Red Rock Solar Project will generate up to 60 MW; thus, it requires a site permit. Red Rock submitted the initial site permit application to the commission on November 9, 2020; updated and revised Site Permit Application appendices were filed on January 14, 2021.

If the commission determines the project is needed, it must determine where it will be located. Minnesota Statutes 216E.03 lists considerations that guide the study, evaluation, and designation of site permits. Minnesota Rule 7850.4100 lists the factors the commission must consider when making a site permit decision.

A. Effects on human settlement, including, but not limited to, displacement, noise, aesthetics, cultural values, recreation, and public services.
B. Effects on public health and safety.
C. Effects on land-based economies, including, but not limited to, agriculture, forestry, tourism, and mining.
D. Effects on archaeological and historic resources.
E. Effects on the natural environment, including effects on air and water quality resources and flora and fauna.
F. Effects on rare and unique natural resources.

[24] Commission. Order – Identifying Additional Route Segment and Issuing Draft Site Permit. July 22, 2021. eDocket ID # 20217-176400-03

[25] Amended Wind SPA

G. Application of design options that maximize energy efficiencies, mitigate adverse environmental effects, and could accommodate expansion of transmission or generating capacity.
H. Use or paralleling of existing rights-of-way, survey lines, natural division lines, and agricultural field boundaries.
I. Use of existing large electric power generating plant sites.
J. Use of existing transportation, pipeline, and electrical transmission systems or rights-of-way.
K. Electrical system reliability.
L. Costs of constructing, operating, and maintaining the facility which are dependent on design and route.
M. Adverse human and natural environmental effects which cannot be avoided.
N. Irreversible and irretrievable commitments of resources.

The commission is also guided by the "state's goals to conserve resources, minimize environmental impacts, minimize human settlement and other land use conflicts, and ensure the state's electric energy security through efficient, cost-effective power supply and electric transmission infrastructure".[vii]

The commission may not issue a site permit for a project that requires a CN, until a CN has been approved by the commission, though these approvals may occur consecutively at the same commission meeting.

2.1.4 Route Permit

Minnesota Statute 216E.03 requires a route permit from the Commission for the construction of a high-voltage transmission line in Minnesota. The 161 kV transmission line proposed by Big Bend Wind, meets the definition of a high-voltage transmission line and requires a route permit from the commission. Big Bend submitted a route permit application to the commission on November 9, 2020. After accepting the application as complete,[26] the Commission referred it to the Office of Administrative Hearings (OAH) a public hearing, to be conducted jointly with the hearings for the CNs and site permit applications for the Big Bend Wind Project and the Red Rock Solar Project and authorized the Department to conduct environmental review jointly with the CN application.

The proposed Big Bend HVTL is being reviewed under the Alternative Permitting Process as authorized under Minnesota Statute 216E.04 and Minnesota Rule 7850.2800, Subpart 1, Item C. Per Minnesota Statute 216E.01 Subdivision 4(3) the Applicant has identified the proposed route, rejected routes and route segments considered, an alternate point of interconnection (end point) under consideration.

The commission is charged with selecting transmission line routes that minimize adverse human and environmental impacts while ensuring electric power system reliability and integrity. Route permits

[26] Commission. Order – Order Accepting Applications as Complete. March 11, 2021. eDocket ID # 20213-171785-02

issued by the Commission include a permitted route and anticipated alignment, as well as conditions specifying construction and operation standards. A sample route permit is included in Appendix D.

Minnesota Statutes, section 216E.03, identifies considerations that the commission must take into account when designating transmission lines routes. Minnesota Rules, part 7850.4100 lists 14 factors for the commission to consider when making a decision on a route permit:

- Effects on human settlement, including, but not limited to, displacement, noise, aesthetics, cultural values, recreation, and public services.
- Effects on public health and safety.
- Effects on land-based economies, including, but not limited to, agriculture, forestry, tourism, and mining.
- Effects on archaeological and historic resources.
- Effects on the natural environment, including effects on air and water quality resources and flora and fauna.
- Effects on rare and unique natural resources.
- Application of design options that maximize energy efficiencies, mitigate adverse environmental effects, and could accommodate expansion of transmission or generating capacity.
- Use or paralleling of existing right-of-way (ROW), survey lines, natural division lines, and agricultural field boundaries.
- Use of existing large electric power-generating plant sites.
- Use of existing transportation, pipeline, and electrical transmission systems or rights-of-way.
- Electrical systems reliability.
- Costs of constructing, operating, and maintaining the facility which are dependent on design and route.
- Adverse human and natural environmental effects which cannot be avoided.
- Irreversible and irretrievable commitments of resources.

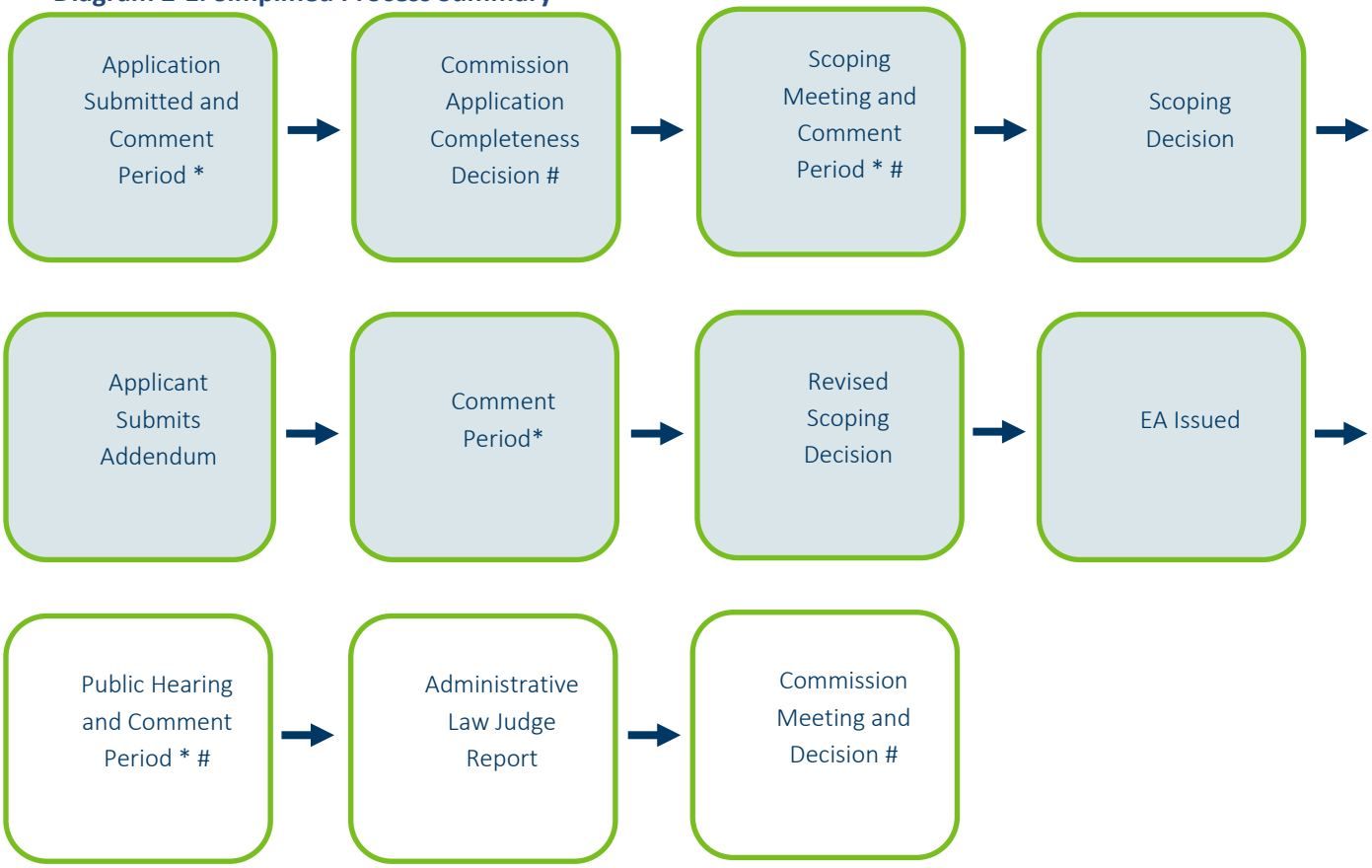
Minnesota Statute 216E.03 states that the Commission must make specific findings that it has considered locating a route for a new transmission line along an existing transmission line ROW or parallel to existing highway ROW and, to the extent these are not used for the route, the Commission must state the reasons why. The Commission may not issue a route permit for a project that requires a CN until a CN has been approved by the Commission, though these approvals may occur consecutively at the same Commission meeting.

The Commission is charged with making a final decision on a route permit within 1 year after finding the route permit application complete. The Commission may extend this time limit for up to 3 months for just cause or upon agreement of the applicant.

2.2 What is environmental review?

Minnesota law requires that potential human and environmental impacts be analyzed before the Commission decides whether to grant any of the necessary certificates of need, site permits, or the route permit for the Proposed Projects. This analysis is called environmental review. **Diagram 2-1** outlines the permitting process as it has unfolded for this project. (Read from left to right; shaded steps are complete; "*" means public comment opportunity and "#" means public meeting opportunity.)

Diagram 2-1. Simplified Process Summary



Certificate of Need

Applications for a certificate of need require preparation of an environmental report (ER).[viii] An ER contains "information on the human and environmental impacts of the [project] associated with the size, type, and timing of the project, system configurations, and voltage".[ix] It also contains information on system alternatives to the project, as well as mitigation measures.

Route Permit

Minnesota law provides the Commission with two processes to review HVTL route permit applications. These are the full permitting process[x] and the alternative permitting process.[xi] The full process includes preparing an environmental impact statement and holding a contested-case hearing. The

alternative process, which applies to HVTL of between 100 and 200 kV,[xii] requires an EA instead of the more detailed environmental impact statement and a public hearing instead of the more formal contested-case hearing.[xiii,xiv]

An EA contains an overview of the resources affected by the project and discusses potential human and environmental impacts and mitigation measures.[xv] It also contains information on alternative sites should alternative sites be studied in the EA.

Solar Project Site Permit

Minnesota law provides the commission with two processes to review site permit applications. These are the full permitting process[xvi] and the alternative permitting process.[xvii] The full process includes preparing an environmental impact statement and holding a contested-case hearing. The alternative process, which applies to solar projects,[xviii] requires an EA instead of the more detailed environmental impact statement and a public hearing instead of the more formal contested-case hearing.[xix,xx]

An EA contains an overview of the resources affected by the project and discusses potential human and environmental impacts and mitigation measures.[xxi] It also contains information on alternative sites should alternative sites be studied in the EA.

LWECS Site Permit

Minnesota Statute 216F.05 provides the commission with authority to establish an application process, including environmental review requirements, to obtain a site permit for LWECS. Minnesota Rule 7854.0500, Subpart 7, establishes the necessary environmental information to be provided in the LWECS site permit application, the analysis of potential impacts of the proposed project, proposed mitigative measures, and any adverse environmental effects that can't be avoided. The environmental review and impact analysis included in the LWECS site permit application, per Minnesota Rule 7854.0500, Subpart 7, satisfies all environmental review requirements of Chapter 4410, parts 7849.1000 to 7849.2100, and Minnesota Statutes, chapter 116D for proposed LWECS projects.

Joint Proceeding

When there are multiple applications before the Commission for various components of a project or proposed projects that are related, the environmental reviews required for each application may be combined. For Big Wind Project, Big Bend HVTL, and the Red Rock Solar Project, the commission has authorized the Department to combine the environmental reviews required for the CNs, site permits, and route permit. This EA addresses the CN applications, site permit applications and route permit application, and this EA satisfies the environmental review requirements of completing an ER for the submitted CN applications. The use of the terms environmental review and EA throughout this document also refers to and includes the ER, unless noted otherwise.

2.2.1 What are the steps in developing an Environmental Assessment?

Scoping Process

Scoping is the first step in the development of the environmental assessment for the projects. The scoping process has two primary purposes:

- gather public input as to the impacts, mitigation measures, system alternatives to the proposed project, solar site alternatives, HVTL route alternatives to study in the EA.
- focus the EA on those impacts, mitigation measures, and alternatives that will aid in the commission's decisions on the certificates of need, solar site permit, and the route permit.

Department staff gathered input on the scope of the EA through a public meeting and an associated comment period. commission and EERA staff held a joint public information and EA scoping meeting on April 1, 2021.

Due to the current COVID-19 pandemic, a remote-access meeting replaced the standard in-person meeting, as directed by the Governor's Executive Order 20-78.[27] Similar to an in-person meeting, the remote-access meeting provided interested persons the opportunity to: (1) learn about the state permitting process and the proposed project; and (2) ask questions and provide comments on potential issues and alternatives to be considered for analysis in the EA or included as a condition in a draft LWECS site permit.

Total attendance, including staff, at this meeting was approximately 50 persons. Some individuals attended through both the Webex visual portal and call-in phone conferencing and others attended only by call-in phone conferencing. Several verbal questions and comments were provided during the Public Information and Environmental Assessment Scoping Meeting.[28] No detailed system alternatives were provided during the meeting. Attendees suggested ideas such as developing only solar energy generation for the project and reducing the number of proposed turbines to be constructed and operated.

A 44 - day comment period, closing on April 30, 2021, provided the public an opportunity to submit written comments to EERA staff on identified issues, potential impacts, mitigation measures, and site, route, or system alternatives for consideration in the scope of the EA.

Staff received a variety of comments about the proposed projects from State agencies, intervening parties, local County Commissioners, and members of the public. The Minnesota Department of Natural Resources (MN DNR)[29] and Minnesota Department of Transportation (MnDOT) – Office of

[27] https://www.leg.state.mn.us/archive/execorders/20-78.pdf.

[28] DOC-EERA. Minutes - Public Information and Scoping Meeting Minutes – April 1, 2021. April 30, 2021. eDocket ID # 20214-173685-04

[29] Minnesota Department of Natural Resources (MN DNR). Comments. April 29, 2021. eDocket ID # 20214-173605-01

Land Management[30] provided agency comments in writing during the comment period. The MnDOT – Aviation and Aeronautics Unit[31] contacted EERA staff with a concern from a member of the public about the Big Bend Wind Farm, via email at the end of the Application Completeness Comment Period. EERA thought it was appropriate to include the comments from MnDOT – Aviation and Aeronautics into the PDSP and EA Scoping comments. The Minnesota Historical Society (MNHS)[32], the Upper Sioux Community[33], and the Lower Sioux Indian Community[34], three of the intervening parties in the Contested Case Proceedings for the proposed Big Bend Wind Farm, provided written comments during the comment period. Some of the Commissioners on the Cottonwood County Board provided comments during the Public Information and Scoping Meeting and can be seen in the Public Information and Scoping Meeting Minutes[35].

DOC-EERA received a number of comments from the members of the public[36], and commission staff also received a comment from a member of the public[37] during the comment period. All comments received during the PDSP and EA Scoping comment period and during the Public Information and Scoping Meeting are available to view or download on eDockets or the EERA webpage.

Agency Comments

The MN DNR provided comments with respect to all aspects of the proposed Projects, the Big Bend Wind Farm, Big Bend Wind HVTL, and the Red Rock Solar facility.[38] They indicate there are known calcareous fens located within five miles of the Project Area, and the Project applicant will need to complete the necessary field review of all wetlands within 500 feet of construction activities to determine if any of the wetlands are calcareous fens. If any calcareous fens are identified within 500 feet of any proposed construction activities a Calcareous Fen Management Plan will need to be developed in consultation with the MN DNR.

Two Henslow's sparrows were identified in the Project Area during pre-construction avian surveys. The Henslow's sparrow is a State endangered species, and MN DNR has indicated that possible

[30] MNDOT. Comments. April 30, 2021. eDocket ID # **20214-173649-01**
[31] MNDOT Aeronautics and DOC-EERA. Comments – MNDOT Aeronautics Comments and email to DOC-EERA. May 24, 2021. eDocket # **20215-174410-01**
[32] Minnesota Historical Society. Comments – Comments on the Scope of the Environmental Assessment for the Big Bend Wind Project. April 29, 2021. eDocket ID # 20214-173618-02
[33] Upper Sioux Community Tribal Historic Preservation Office. Letter. April 1, 2021. eDocket ID # 20214-172506-03
[34] Lower Sioux Indian Community. Comments. April 30, 2021. eDocket ID # 20214-173724-01
[35] DOC-EERA. Public Information and Scoping Meeting Minutes. April 30, 2021. eDockets ID # 20214-173685-03.
[36] DOC-EERA. Public Comment – Public Comments received by EERA on PDSP and EA Scoping. May 3, 2021. eDocket ID # 20215-173780-03
[37] PUC. Public Comment – B Hutchinson. May 4, 2021. eDocket ID # 20215-173848-01
[38] Minnesota Department of Natural Resources. Comments. April 29, 2021. eDocket ID # 20214-173605-01

construction restrictions may be necessary between May 15 and July 15. Adjustments of construction timing, and the location of construction activities in proximity to potential Henslow's sparrow nesting habitat will be evaluated as possible mitigation measures within the EA.

MN DNR's comments recommend a minimum of two years of post-construction fatality monitoring for the Project, which is consistent with the most recently approved LWECS Site Permits issued by the Commission. EERA recommends a minimum of two years of post-construction fatality monitoring be completed at the proposed project, and this language has been revised in the Preliminary Draft Site Permit (PDSP).

MN DNR's comment letter states that the proposed location of Turbine 43 is within a mapped National Wetland Inventory (NWI) wetland basin. The NWI is a useful tool for wetland delineators to assess large project areas for potential wetland areas to investigate further. However, it is important to remember that upon further field investigation some wetland basins on the NWI may be determined to not be wetlands, and not all wetland basins are identified on the NWI. The Project Applicant will conduct a detailed wetland investigation, both desktop and field based, to identify and delineate all wetlands that could potentially be impacted by the proposed projects. All wetland impacts related to the proposed projects will be mitigated for as required by the State of Minnesota Wetland Conservation Act (WCA) and the United States Army Corps of Engineers (USACOE) 404 Wetland Permit program.

The proposed Big Bend HVTL route crossed multiple wetland basins identified on the NWI, the South Fork of the Watonwan River, Cedar Creek, and other water bodies. MN DNR has requested that the Applicant coordinate with their agency on the placement of avian flight diverters on the proposed HVTL at water body crossings to help reduce the potential for avian and HVTL collisions. EERA considered this to be a reasonable mitigation measure, it was carried forward in the EA Scope, and additional details on this mitigation measure will are addressed in this document.

MN DNR provided comments specific to the Red Rock Solar Vegetation Management Plan (VMP) and requested the EA to consider and evaluate the use of diverse native prairie species seed mixes within the solar facility and the importance of establishing pollinator habitat within the project area. The MN DNR recommends Red Rock Solar, LLC use a diverse native prairie species seed mix as indicated in MN Statute 2020, Section 216B.1642, Subdivision 1. MN DNR also recommends the VMP be updated to include additional maps of the NE, NW, SE, and SW units, similar to those provided in the Agricultural Impact Mitigation Plan (AIMP) for the proposed project. EERA considered these recommendations to be reasonable, they were carried forward in the EA Scope, and additional details on the VMP and AIMP are included in this document.

MnDOT – Office of Land Management acknowledges that TH 60 AND TH 30 will likely provide general transportation access to the projects.[39] However, MnDOT does not anticipate any temporary access roads for project construction or continued use during the life of the projects to be built along TH 60 or TH 30. MnDOT strongly supports the proposed turbine locations utilizing the 1.1 times total turbine heigh setback from public roads trails. MnDOT – Office of Land Management staff does identify potential concerns with the Turbine T-55 shadow flicker that could extend onto a segment of TH 60 that has been the site of numerous crashes. Currently, no collection line locations pose immediate concerns to MnDOT – Office of Land Management staff.

MnDOT – Office of Land Management's comments identified concerns with the proposed Big Bend HVTL route's single perpendicular crossing of TH 60, at the TH 60 and County State Aid Highway 8 (CSAH 8) intersection. At the TH 60 and CSAH 8 intersection, TH 60 expands to a width of 615 feet, so HVTL routing and proper pole placement will need to evaluate and planned appropriately to ensure TH 60 can be spanned safely. MnDOT – Office of Land Management comments indicated that no poles placement will be allowed within site corners or within the median at the intersection of TH 60 and CSAH 8, and there are some possible drainage concerns in the area as well. The Applicant will need to work with MnDOT – Office of Lane Management staff to make sure that safe and permittable pole placement can be planned out.

MnDOT – Office of Land Management did not have any comments or concerns specific to the proposed Red Rock Solar Project at the time of scoping.

All proposed projects may need to acquire MnDOT permits; utility accommodation on trunk highway right of way, oversize/overweight hauling, and other highway access permitting. MnDOT permit reviews can result in additional construction criteria and/or the requests to move portions of the proposed project structures out of given areas of concern. Permit applications submitted to MnDOT – Office of Land Management, as part of the proposed projects, will not be issued until the Commission has issued approved permits for, and authorized construction of, these projects.

The Applicant will need to coordinate with MnDOT on plans to haul oversize loads to the project area to take into account future MnDOT highway construction activities planned for the 2022 construction season:

- Two to four lane expansion of US Highway 14 between Nicollet and New Ulm
- Construction of an RCUT on US Highway 14 in Eagle Lake between CSAH 86 and CSAH 17
- Resurfacing of I-90 eastbound lanes from TH 4 near Sherburn and TH 15 near Fairmont
- Pavement replacement and bridge rehabilitations on eastbound and westbound lanes of TH 60/TH 15 between Madelia and south junction of TH 60

[39] MnDOT. Comments. April 30, 2021. eDocket ID # 20214-173649-01.

- Resurfacing of US Highway 169 between Winnebago and Vernon Center and between Elmore and Blue Earth
- Bridge replacements on US Highway 169 near St. Peter
- A concrete overlay on both east and west bound I-90 between the South Dakota/Minnesota state line and Beaver Creek

MnDOT's planned construction projects can experience schedule changes, and the Applicant should check on project status on a regular basis.

EERA will remain in contact with MnDOT – Office of Land Management, and we will include our evaluation of proposed pole placement, the proposed route, and the proposed route segments as they could impact transportation safety within this in document. The EA will also further evaluate the shadow flicker concerns specific to the location of turbine T-55.

EERA's Preliminary Draft Site Permit (PDSP) includes conditions specific to project related road use, additional permits needed, and turbine setback distances from public roads and trails.

Comments were also provided by the MnDOT Aviation and Aeronautics unit. The MnDOT, Aviation and Aeronautics Unit were contacted by Mr. Elvin Theissen, who owns land adjacent to the Big Bend Wind project area and currently has an active private airplane runway present on his land.[40] Mr. Theissen indicated to MnDOT Aviation staff that the construction of Turbine T47 in its proposed location would make his private runway unusable.

MnDOT Aviation staff also informed EERA that because the total proposed turbine height is over 500 feet, the turbines are considered obstructions to the safety of flight, and an additional permit issued by MnDOT must be acquired by the project proponent under MN Statute 360.83.

It is EERA's understanding that the Applicant is currently working with Mr. Theissen to identify a method to allow construction and operation of the proposed Turbine T47, while still allowing safe operation of Mr. Theisen's private runway. Additional details on this situation will be included, and this issue will be evaluated in this document. The additional MnDOT Aviation permit is covered under the typical LWECS Site Permit condition 5.6.2 Other Permits and Regulations language, which will be maintained in the submitted PDSP. Issuance of any MnDOT Aviation Permits necessary to construct and operate the proposed Big Bend Wind Farm will need to be filed in eDockets, as a pre-construction compliance filing, 14 days prior to the pre-construction meeting.

[40] MnDOT Aeronautics and DOC-EERA. Comments – MnDOT Aeronautics Comments and Email to DOC-EERA. May 24, 2021. eDocket ID # 20215-174410-01

Local County Board Comments[41]

Two Cottonwood County Commissioners voiced their support for the proposed projects during the Public Information and Scoping Meeting. They stated that the County has received positive feedback on the proposed projects, and they have basically not heard any negative feedback at this time. The Commissioners stated that all County Board votes have been unanimously in support of both the wind facility and the solar facility.

Intervening Party Comments

Minnesota Historical Society (MNHS) provided comments identifying the potential impacts of the initially proposed Big Bend Wind Farm on the users of the Jeffers Petroglyphs site located to the northwest of the proposed project.[42] MNHS stated that the preservation and protection of the Jeffers Petroglyphs site is necessary because of the site's historical importance and also to protect the current spiritual use and ceremonial importance of the site to Native American Tribes. MNHS points to the Minnesota Historic Sites Act and Statutory Obligations, MN Statute 138, in particular 138.40 and 138.665, and the responsibility of State departments and agencies to "protect the physical features and historic character" of the designated historic properties in the State. To meet these statute obligations MNHS has recommended that a full independent visual impact analysis (VIA), including standards-based evaluation, and full tribal consultation be completed by EERA.

MNHS has requested that their staff, Tribal community representatives, the Red Rock Ridge Research Group, the State Archaeologist, and the State Historic Preservation Office (SHPO) be involved with the VIA process, Key Observation Point (KOP) selection, and VIA analysis. MNHS has recommended the VIA methodology and the analysis and identification of any potential adverse effects of the proposed project on the Jeffers Petroglyphs site be completed in accordance with the methodology in the National Park Service's *Guide to Evaluating Visual Impact Assessments for Renewable Energy Projects.*[43] MNHS further recommended the VIA evaluate the proposed turbine locations for Big Bend Wind, along with a turbine layout eliminating all proposed turbines within eight miles of the Jeffers Petroglyphs site property boundary, and a turbine layout eliminating all proposed turbines within 10 miles of the Jeffers Petroglyphs site property boundary. In addition to the eight mile and 10 mile "no turbine" buffers, MNHS has recommended that the proposed turbines that remain outside of these buffer zones should be no taller than a total turbine height (ground to tallest blade tip height position) 570 feet and 656 feet, respectively.

---

[41] DOC-EERA. Minutes – Public Information and Scoping Meeting Minutes – April 1, 2021. April 30, 2021. eDocket ID # 20214-173685-03

[42] Minnesota Historical Society. Comments on the Scope of the Environmental Assessment for the Big Bend Wind Project. April 29, 2021. eDocket ID # 20214-173618-02.

[43] National Park Service. Guide to Evaluating Visual Impact Assessments for Renewable Energy Projects. Natural Resource Report NPS/ARD/NRR. August 2014. https://irma.nps.gov/DataStore/DownloadFile/498939

MNHS has also indicated they want their staff involved in selecting the KOPS, lighting quality, and the range of views for photos to be used in the photographic simulations. The MNHS wanted the VIA to reflect the expected landscape and proposed project as closely as possible, and the KOPs should reflect the range of views and viewing conditions that users at the Jeffers Petroglyphs will experience with the proposed project.

MNHS recommended three KOP locations to be utilized in the VIA:

- The highest elevation location on the Jeffers Petroglyphs site
    - This location provides a 360 degree view for the user
    - The most common location where tribal ceremonies are conducted
    - All visitors are able to access this location regularly during evening tours
    - Should include a "worst case" scenario and capture a panoramic angle from the east, south, and west
- The first boardwalk located approximately 430 yards east of the Jeffers Petroglyphs visitor center
    - This is the first stop for visitors on tours of the Jeffers Petroglyphs site, and users are asked to look around and reimagine the landscape as it would have looked in the past
    - Large industrial scale turbines would affect a user's ability to reimagine
- The Jeffers Petroglyphs Astronomical Education Facility
    - Used for astronomical activities
    - Turbines could interfere with the locating of celestial bodies and the events conducted at this facility
    - Should depict viewpoints with an angle to the east, south, and west

MNHS comments also directed EERA to conduct full consultation with the 11 federally recognized tribal nations in Minnesota, and the seven federally recognized tribal nations that have been exiled from Minnesota.

Tribal Nations in Minnesota

- Lower Sioux Indian Community
- Upper Sioux Community
- Shakopee Mdewakanton Sioux Community
- Prairie Island Indian Community
- Bois Forte Band of Chippewa
- The Fond du Lac Band of Lake Superior Chippewa
- Grand Portage Band of Chippewa Indians
- Leech Lake Band of Ojibwe
- Mille Lacs Band of Ojibwe
- White Earth Reservation
- Red Lake Band of Chippewa Indians

Tribal Nations Exiled from Minnesota

- Flandreau Santee Sioux Tribe
- Crow Creek Sioux Tribe
- Sisseton-Wahpeton Oyate of the Lake Traverse Reservation
- Yankton Sioux Tribe
- Standing Rock Sioux Tribe
- Spirit Lake Tribe
- Santee Sioux Tribe

MNHS recommends that EERA's tribal consultation should include engaging tribal representatives on VIA methods, KOP selection, identifying potential adverse effects of the proposed project on users of the Jeffers Petroglyph sites, and potential recommended mitigation strategies. The MNHS comments also state that EERA should document all consultation with the SHPO and the Minnesota State Archaeologist regarding actions or mitigation measures that are agreed upon to avoid and mitigate any adverse effects of the proposed project on users of the Jeffers Petroglyphs site.

MNHS has identified the following alternatives to be included in the EA;

- Different turbine locations
- Different turbine heights
- Reduction in the number and density of turbines
- Removal of all wind turbines within 8 miles of the Jeffers Petroglyphs site property boundary, and the remaining turbines be reduced in height to no more than 570 feet (ground to blade tip), as shown in the July 2019 VIA completed by Apex
    - Any energy output lost should be shifted to an increase in solar facility size
- Removal of all wind turbines within 10 miles if the Jeffers Petroglyphs site property boundary, and the remaining turbines be reduced in height to no more than 656 (ground to blade tip)
    - Any energy output lost should be shifted to an increase in solar facility size and output

The Upper Sioux Community indicated that the turbine locations for the proposed Big Bend Wind Project will have a clear negative impact on the viewshed of the Jeffers Petroglyphs State Historic Site and other associated sacred sites located on the Red Rock Ridge.[44] The Upper Sioux Community and its members identify the Jeffers Petroglyphs Site and the Red Rock Ridge as culturally and spiritually significant areas.[45]

[44] Upper Sioux Community Tribal Historic Preservation Office. Letter. April 1, 2021. eDocket ID # 20214-172506-03

[45] Upper Sioux Community Tribal Historic Preservation Office. Letter. April 1, 2021. eDocket ID # 20214-172506-03

The Lower Sioux Indian Community filed comments sharing their significant concern with the proposed projects and their potential impacts to the Jeffers Petroglyphs and the Red Rock Ridge.[46] The Jeffers Petroglyphs and the Red Rock Ridge are considered sacred historic landmarks and sacred active locations used for ceremonies and spiritual engagement of the Lower Sioux Indian Community and numerous other Indian Tribes. Jeffers Petroglyphs site and the Red Rock Ridge are a pivotal component of this State's, and the continent's, history. Individuals of numerous federally recognized Indian tribes travel to the Jeffers Petroglyphs and the Red Rock Ridge to take part in ceremonies, prayer, connecting with their ancestors, and other spiritual activities.

An essential component of the Jeffers Petroglyphs site and the Red Rock Ridge is the solitude provided to those that use the sites and participate in ceremonies at the sites. The Lower Sioux Indian Community has concerns that proposed projects will impact the solitude an individual can experience at the Jeffers Petroglyphs site and the Red Rock Ridge, which will substantially jeopardize their ability to practice the ceremonies of their culture. Lower Sioux Indian Community agrees with the MNHS recommendations for a detailed VIA of the proposed Big Bend Wind Farm's potential impacts to the viewshed from the Jeffers Petroglyphs and the Red Rock Ridge. The Lower Sioux Indian Community indicated their desire to be consulted in further assessments of potential viewshed impacts.

The Lower Sioux Indian Community has additional concerns about the potential impact of turbine generated noise on the spiritual experience of the users of the Jeffers Petroglyphs. The Lower Sioux Indian Community is also concerned about the potential impacts of vibrations on the formations and carvings within the Jeffers Petroglyphs site and the Red Rock Ridge. The Lower Sioux Indian Community stated concerns that the public and private funding for management of the Jeffers Petroglyphs and the Red Rock Ridge may be impacted by the construction and operation of the proposed projects.

The Lower Sioux Indian Community stated that the Jeffers Petroglyphs site and the Red Rock Ridge are part of a larger network of sacred sites extending westward into Montana. This larger network of sacred sites is known of and actively used by multiple Indigenous groups throughout the Midwest. The larger network of sacred sites is representative of the Dakota concept of Kopemni, and any impacts to the Jeffers Petroglyphs or the Red Rock Ridge would be considered an impact to the larger network of sacred sites extending to the west. The Lower Sioux Indian Community stated that the proposed projects have the distinct potential of contributing to the larger national theme of cultural genocide (intentionally or not), by imposing on and impacting the ability of Indian Tribal members' abilities to engage in the ceremonies and spiritual activities essential to their distinct cultural existence.

The Lower Sioux Indian Community stated concerns regarding other potential impacts of the proposed projects that should be evaluated in the EA, including the disturbance of native prairie lands and the

[46] Lower Sioux Indian Community. Comments. April 30, 2021. eDocket ID # 20214-173724-01.

impairment of soils, releasing carbon and reduction to the surrounding carbon sink, and the disturbance to other natural habitats and ecosystems - of particular concern are local wetlands. The Lower Sioux Indian Community has concerns that the proposed projects could also interfere with local efforts to rehabilitate and restore the natural environment and habitats within and near the project area. The Lower Sioux Indian Community has particular concerns that the Big Bend Wind Farm will impact resident and migratory wildlife, including inadvertent destruction of birds, bats, and the local eagle population and potential impacts to migratory routes.

The Lower Sioux Indian Community identified potential human impacts of the proposed projects to be evaluated in the EA. Potential impacts specific to the Big Bend Wind Farm include sleeplessness, headaches, stress, hearing problems, heart palpitations, anxiety, depression, and potential socioeconomic impacts. Potential impacts specific to the Red Rock Solar Project include improper disposal of solar panels and potential human health impacts, and the potential human health impacts from the toxic chemicals used to clean the solar panels. The Lower Sioux Indian Community also expressed concerns about the proposed projects as a whole including: long term exposure to electromagnetic fields in and surrounding the project site, property values, impacts to local utilities and infrastructure due to ground disturbance, increased heavy machinery, increased construction traffic, and road closures, and adjustments and maintenance of other utilities, gas, phone, water, and sewer.

The Lower Sioux Indian Community stated they would like all phases of the wind facility and solar facility process considered in the EA;

- Sourcing and transporting raw materials
- Manufacturing and transporting component parts
- Construction and related activities
- Operation, maintenance, recycling, and waste
- Decommissioning and dismantling

In determining the need for the proposed projects the Lower Sioux Indian Community has identified three items to consider in the EA; regional energy needs, statewide and metro-specific energy needs, and the propriety of the high voltage transmission line. The regional energy needs should take into account the numerous local and distant energy sources, including the significant number of existing and soon- to-exist renewable energy sources. Statewide and metro-specific energy needs should look at existing sources of energy, and also projected energy sources approved or likely to be approved by the Commission in the near future. Additionally, trends in small-scale and residential energy production should also be taken into consideration.

The Lower Sioux Indian Community comments stressed the importance for EERA to adhere to Executive Order 19-24 (E.O. 19-24). All interested Indian tribes in Minnesota and other federally recognized tribes with historical or spiritual connections to the Jeffers Petroglyphs and the Red Rock Ridge should be engaged in the EA development process, identifying potential impacts of the

proposed projects, mitigation strategies, and alternatives. The Lower Sioux Indian Community recommended that EERA and the Commission follow the United States Environmental Protection Agency's Policy on Environmental Justice for Working with Federally Recognized Tribes and Indigenous Peoples, to enhance tribal consultation.

The Lower Sioux Indian Community requested that the EA consider if the proposed projects meet the letter and spirit of the following State and Federal environmental, religious preservation, and equal protection laws:

- Minnesota Environmental Rights Act – Minn Stat. Ch. 116B
- Minnesota Environmental Policy Act – Minn Stat. Ch. 116D
- National Historic Preservation Act - 16 U.S.C. 470 et al
- American Indian Religious Freedom Act of 1978 – 42 U.S.C. 1996
- First and Fourteenth Amendments of the United States Constitution
- Article I of the Minnesota Constitution

The Lower Sioux Indian Community has identified the following alternatives to be considered in the EA;

- No build
- Solar Only Project
    - Including additional solar panels and modifications to the high voltage transmission line
- Wind and Solar
    - 8-mile buffer between Jeffers Petroglyphs and Red Rock Ridge and the wind project, and no turbines taller than 570 feet (ground to blade tip)
- Wind and Solar
    - 10-mile buffer between Jeffers Petroglyphs and Red Rock Ridge and the wind project, and no turbines taller than 660 feet (ground to blade tip)
- Wind and Solar
    - 11-mile buffer between Jeffers Petroglyphs and Red Rock Ridge and the wind project, and no turbines taller than 660 feet (ground to blade tip)

EERA acknowledges the comments from MNHS and Lower Sioux Indian Community with regard to the importance of incorporating and completing consultation with the numerous Tribal Communities that use the Jeffers Petroglyphs and the Red Rock Ridge because of their cultural significance. The Department has been coordinating and communicating with Minnesota Tribal Communities regarding the Big Bend Wind Farm since late 2019, prior to the Initial Site Permit Application. The Department has had numerous meetings engaging Minnesota Tribal Community representatives to provide details on the proposed Big Bend Wind Farm, how to navigate the permitting process, submitting comments, how to intervene as a party in the permitting process, detailed discussions regarding the Jeffers Petroglyphs, and a site visit at the Jeffers Petroglyphs.

It is important to note that Minnesota Historic Sites Act and Statutory Obligations, MN Statute 138, in particular 138.40 and 138.665 is directed specifically at State agencies that are funding or licensing undertakings that will affect designated or listed properties. The Department does not provide funding or license undertakings with respect to the proposed projects, and the Commission will need to specifically address items under MN Statute 138 as the permitting processes proceed. E.O. 19-24 applies to both the Department and the Commission, and as indicated above, the Department has been coordinating and communicating regularly with Tribal Communities when appropriate. The Commission has also communicated with numerous Tribal Communities by sending out notice of comment period on the PDSP and EA scoping. Commission staff and the Commissioners are slightly more restricted on coordinating and communicating directly with Tribal representatives due to ex parte communication issues.

EERA contracted with an independent consultant to conduct visualization renderings of what the Big Bend Wind Farm site layouts proposed in the initial Wind SPA would look like to users of the Jeffers Petroglyphs site. EERA and our consultant conducted a field visit to the Jeffers Petroglyphs with MNHS staff and representatives of the Upper Sioux Community on April 28, 2021. A representative of the Lower Sioux Indian Community was present virtually for a portion of the April 28, 2021 meeting as well. The field visit produced a number of potential Key Observation Points (KOPs) to utilize in the visualization renderings. Additionally, EERA coordinated with the Red Rock Ridge Research Group and received input on the KOPs within the Jeffers Petroglyphs site and a few locations outside of the Jeffers Petroglyphs property boundaries but on the Red Rock Ridge.

The intent of the visualization renderings was to assess the potential visual impacts of the initial Wind SPA site layouts of Big Bend Wind Project on users of the Jeffers Petroglyphs site, and the visualization renderings were intended to look at how the visual impacts would change by looking at various turbine setbacks in the initial Wind SPA from the Jeffers Petroglyphs site. Once the Settlement Agreement was reached by Big Bend Wind, LLC, Red Rock Solar, LLC, Apex Clean Energy Holdings, LLC, MNHS, Lower Sioux Indian Community in the State of Minnesota, and the Upper Sioux Community on September 13, 2021, and the nearest turbines to the Jeffers Petroglyphs site were setback 6.5 miles the visualization renderings were no longer a necessary assessment to evaluate Big Bend Wind's potential visual impacts to a user at the Jeffers Petroglyphs site. Big Bend has completed a Visual Impact Assessment as part of their Amended Site Permit Application for the wind portion of the hybrid project, and potential viewshed impacts of the proposed projects are discussed in Section 4.3.1.1 Aesthetics of this EA.

The Laborers' International Union of North America (LIUNA) submitted a Petition for Intervention in the contested case for the proposed Projects on July 30, 2021.[47, 48] The Office of Administrative Hearings (OAH) issued an order recognizing LIUNA as an intervening party in the contested case proceedings for the proposed Projects on August 17, 2021.[49] LIUNA submitted comments on the proposed Project during the EA Scoping public comment period, prior to being an intervening party, and those comments have been included in the following section, *Public Comments – Comment Period and Public Meeting*.

Public Comments – Comment Period and Public Meeting[50,51]

The public comments received during the comment period ranged from general support for both wind and solar projects including the proposed projects, to support for the MNHS proposed eight-mile buffer and turbine setback from the Jeffers Petroglyphs. Public commentors identified concerns that the proposed Big Bend Wind Farm could potentially impact existing wildlife habitat, disturbance of large tracks of native prairie habitat, increase the spread of invasive species, impact the viewshed of the Jeffers Petroglyphs, impact the viewshed from the native prairie habitat on the Red Rock Ridge, result in wildlife endangerment through turbine strike, and concerns regarding the potential impacts of noise and shadow flicker on homes, businesses, houses of worship, and parks within and adjacent to the project area.

One public commentor identified potential species-specific impact concerns that could be associated with the proposed Big Bend Wind Farm: the long-legged upland sandpiper, Dakota skipper, Henslow's sparrow, burrowing owl, loggerhead shrike, king rail, Poweshiek skipperling, Wilson's phalarope, trumpeter swan, common gallinule, marbled godwit, Bell's vireo, Forster's tern, purple martin, and bald eagles.

One commentor identified the potential concern that the proposed solar panels would introduce additional impervious surface into the Watonwan River Watershed.

One public commentor indicated that the proposed projects should support the restoration and health of the Watonwan River and the work done by Watonwan River One Water One Plan. The

[47] LIUNA Minnesota and North Dakota. Intervention – Petition for Intervention Cover Letter. July 30, 2021. eDocket ID # 20217-176628-04

[48] LIUNA Minnesota and North Dakota. Intervention – Petition for Intervention. July 30, 2021. eDocket ID # 20217-176628-09

[49] OAH. Order – Order on Petition to Intervene by the Laborers District Council of Minnesota and North Dakota. August 17, 2021. eDocket ID # 20218-177217-05

[50] DOC-EERA. Public Information and Scoping Meeting Minutes. April 30, 2021. eDockets ID # 20214-173685-03.

[51] DOC-EERA. Public Comments Received by EERA on PDSP and EA Scoping. May 3, 2021. eDocket ID # 20215-173780-03.

commentator recommended the project proponent implement the mitigation measure of wetland basin restoration to create habitat and benefit the Watonwan River. The commentor also identified potential impacts to river health that are included in the watershed management plan; land use change that results in the loss of vegetation cover, lack of recreational access and connectivity, and terrestrial invasive species. The commentor indicated that the Applications don't mention how the project proponent will avoid spreading invasive species during construction, and only mentions management after the fact. The development of the proposed projects will create land easement conflicts, and negatively impact long-term conservation efforts along the Watonwan River, which will ultimately impact the Minnesota and Mississippi Rivers. Specifically, the proposed projects will likely limit any future conservation efforts to restore the large shallow Mountain Lake area. The commentator further stated that industrialization of lands also restricts access and connection to the land and community opportunities for exercise, bird watch, and to botanize.

Some commentors identified concerns with specific turbine locations in the proposed Big Bend Wind Farm. Turbines T43 and T44, as proposed, are within the flight pattern of a State licensed airstrip in Section 19 of Butterfield Township in Cottonwood County. The commentor indicated Turbine T43 is proposed on Joel Penner's Property, and the turbine location could be shifted north, remain on Mr. Penner's Property, and be outside the licensed airstrip's flight pattern. The proposed Turbine T44 location is on Duwayn Falk's Property, and the commentor indicated Turbine T44 can be shifted to another section to the northwest and still be on Mr. Falk's Property. Commentators stated that wildlife species that utilize the Watonwan River; ducks, herons, bald eagles, osprey, turkeys, and other raptors and birds will possibly be impacted significantly by Turbines T49 and T16.

One public commentor identified an alternative to the proposed projects, which would be to make the entire project a solar facility with no wind facility. The commentor also cited the reduction in the demand for corn and ethanol, because of less dependence on fossil fuels, as additional supporting evidence that the loss of prime farmland would not be a significant impact if a larger solar facility was constructed. The commentor indicated that the all-solar facility alternative would avoid or minimize the following impacts associated with the wind facility: viewshed impacts (distance of one mile or less), less impacts on neighbors, visitors, and non-participants, and wildlife risks. The commentor indicated increasing the solar facility could include more landowners, not limit the size of the project in anyway, could produce more energy, and more landowners have expressed interest in solar.

One public commentor stated that for the proposed Big Bend Wind HVTL the proposed Alternate Peaking Plant Route – Lakefield Junction POI should not be included in the EA. The commentor's reasons for removal of this alternate POI include the following: it is purely speculative, is not reliable for energy delivery, it is unclear if the alternate POI has been discussed with Great River Energy (GRE) the plant owner, the routes require agreements to cross Odell Wind Farm and Trimont Wind Farm easements, there has been a lack of negotiations with private landowners along the proposed alternate route, and the net zero interconnection is a surplus interconnection service.

One commentor at the Public Information and Scoping Meeting indicated concern about the proposed project's potential impact on local economic development. The commentator stated they have heard from a lot of her neighbors and other families that they will be leaving the area if the proposed projects are constructed, and this will result in local businesses closing and local schools also being negatively impacted. The commentator suggested a study to ask everyone in the project area what they think of the project. The commentor identified the following specific concerns: the need for additional bald eagle nest surveys, potential impacts to livestock (cattle and horses), the large size of the proposed wind turbines, increase in assessed property value and taxes, decreasing property values, and that the generated energy does not remain local.

Another public commentor wanted some clarification on the potential that the project proponent would need to use eminent domain for the proposed Big Bend Wind HVTL. There was additional discussion on this item with the project proponent's legal counsel during the Public Information and Scoping Meeting, and those discussion details are in the Meeting Minutes. The issue of eminent domain is primarily a legal topic, and will be briefly discussed in this document, but the depth of coverage will be minimal as it is not a factor to evaluate and consider for potential environmental impacts. The commentor also asked for clarification on the solar facility collection line, and if the collection line would be above or below ground as proposed. The commentor raised concerns about the interconnection differences between the proposed Crandell Substation and the Lakefield Junction Station, the project proponent possibly holding site control on 50 acres of land adjacent to the Lakefield Junction Station and expressed that the alternate route to the Lakefield Junction Station should follow available roadways and avoid cutting through the middle of sections that are entirely agricultural lands. The commentor also asked for clarification on the proposed project's long-term power purchase agreement, which the project proponent specified that the proposed project currently does not have a power purchase agreement and they are considering all options, including the possibility of moving forward as a merchant operator.

Kevin Pranis, representative for Laborers' International Union of North America (LIUNA), suggested two items to be considered for inclusion in the EA Scope – First, looking at the overall economic impacts of the proposed projects, which is not only jobs but also the possible new career opportunities through the registered apprenticeship programs. Mr. Pranis indicated there is information available in the commission's utility economic recovery docket that may be helpful for use in completing this evaluation in the EA. The second item Mr. Pranis recommended to include in the EA is to look at the potential impacts of the proposed projects through the lens of understanding that the need and push toward increasing the availability of renewable energy development is the direction the country as a whole is going. He acknowledged there are real impacts of renewable energy, but we are going to need to learn to accept those impacts and try to maximize the potential benefits of renewable energy projects as much as we possibly can.

A couple of public commentors identified concerns with the proposed Big Bend Wind HVTL running through an old lake bottom along 600th Avenue, noting there are local conservation efforts that are

trying to restore a large wetland area. Another commentor, the owner of the old lakebed, provided additional context to the potential to restore the old lakebed to wetland habitat. The owner indicated that previous surveys determined that restoration of the old lakebed would possibly lead to the back-up of the City of Mountain Lake's drainage resulting in the need for the installation and operation of a lift station for the City of Mountain Lake. The property owner also stated that the old lakebed area is highly productive for agriculture, even with the occasional flooding issues.[52]

Another public commentor wanted to know if their electricity bills would decrease once the proposed projects are constructed and operational, and he also wanted to know how much money the landowners receive when they host a wind turbine on their property. One public commentor indicated there is an island within the old lake bottom, which is where the Island County Park is located and is home to the Mountain Lake National Registered Historic Space, an over 100 BC Native American village. The commentor also indicated that the lake bottom is a culturally significant area to local youth.

EERA is considering the solar facility collection line extending to the project substation to be an underground line and will be reviewed and evaluated that way in this document. EERA indicated to the public commentor at the Public Information and Scoping Meeting that additional information about the old lake bottom wetland restoration project would be needed to address this adequately in the EA. As of the date of filing the EA Scoping Decision, EERA had not been provided any additional information or data on the old lake bottom wetland restoration project. With the current landowner indicating he has no intentions to proceed with the old lake bottom restoration project, and with no identified restoration plan, EERA cannot include an evaluation of the old lake bottom restoration project in the EA.

Late Filed Public Comment[53]

On June 11, 2021, Kent Scholl sent late filed comments to EERA and Commission staff via email, including a proposed alternative transmission line route alignment to be considered in the EA. Mr. Scholl's proposed alternative route alignment is specific to the Applicant's Peaking Plant Alternate Route with potential interconnection to the Lakefield Junction Station. Mr. Scholl's proposed alternative route segment would keep the proposed transmission line alignment along the east side of Section 18, T110N, R33W, which is adjacent to 20th Avenue, the alignment would travel south to 220th Street, and then go west adjacent to 220th Street to the proposed step-up substation. **Figure 5** shows the alternative route segment proposed by Mr. Scholl, which is referred to as the Peaking Plant Alternative – Alternate Route Segment.

[52] DOC-EERA. Minutes - Public Information and Scoping Meeting Minutes – April 1, 2021. pg. 64, lines 18-25 and pg. 65, lines 1-25. April 30, 2021. eDocket ID # 20214-173685-04

[53] Commission (On behalf of Ken Scholl). Public Comment – Received Outside Comment Period – K Scholl. June 15, 2021. eDocket ID # 20216-175099-01

Additional Procedural Steps

EERA utilized various comments from parties, State agencies, and members of the public to develop a Preliminary Draft Site Permit[54] for the Big Bend Wind Project and developed an EA Scoping Decision[55] that was signed and issued by the Commissioner of the Department of Commerce (the Department).

On September 14, 2021, Big Bend Wind, LLC filed a fully executed Settlement Agreement, see Appendix E,[56] that was mutually agreed upon by Big Bend Wind, LLC, Red Rock Solar, LLC, Apex Clean Energy Holdings, LLC, Minnesota Historical Society, Lower Sioux Indian Community in the State of Minnesota, and the Upper Sioux Community. As a result of the Settlement Agreement, Big Bend Wind, LLC filed an Amended SPA[57] for the Big Bend Wind Project on September 20, 2021.

The Big Bend Wind Project, as amended, reflected a substantial change when compared with the originally proposed project. The Department determined that the scope of the EA needed for the Project must be re-opened for re-evaluation pursuant to MN Rule 7850.3700, Subp.3. No amendments were made to the Big Bend Wind CN application, the Big Bend HVTL route permit application, the Red Rock Solar CN application, or the Red Rock Solar SPA as a result of the Settlement Agreement.

The Department issued a Notice of Substantial Changes and New Information and Comment Period of the Environmental Assessment Scope on October 15, 2021[58], and the comment period ended on November 1, 2021.

The notice requested comment on the following questions:

- What additional potential human and environmental impacts of the proposed project should be considered in the scope of the Environmental Assessment (EA), and/or the draft site permit?

---

[54] DOC-EERA. Comments – Comments, Recommendations, and Preliminary Draft Site Permit. June 3, 2021. eDocket ID # 20216-174802-01

[55] DOC-EERA. Other – Environmental Assessment Scoping Decision. August 24, 2021. eDocket ID # 20218-177409-04

[56] Big Bend Wind, LLC. Big Bend Settlement Agreement. September 14, 2021. eDocket ID# 20219-177943-02, 20219-177943-05, 20219-177943-08, 20219-177943-11, 20219-177943-14, 20219-177943-17, 20219-177943-20, 20219-177943-23 (hereinafter referred to as the Settlement Agreement)

[57] Big Bend Wind, LLC. Amended Site Permit Application and Appendices. September 20, 2021. eDocket ID# 20219-178365-02, 20219-178112-03, 20219-178112-04, 20219-178112-05, 20219-178112-06, 20219-178115-01, 20219-178115-02, 20219-178115-03, 20219-178115-04, 20219-178115-05, 20219-178115-06, 20219-178115-07, 20219-178117-01, 20219-178117-02, 20219-178117-03, 20219-178117-04, 20219-178117-05, 20219-178117-06, 20219-178117-07, 20219-178117-08, 20219-178117-09, 20219-178120-01, 20219-178120-02, 20219-178120-03, 20219-178120-04, 20219-178120-05, 20219-178120-06, 20219-178120-07, 20219-178125-07, 20219-178125-08, 20219-178125-09, 20219-178125-10, 20219-178127-01, 20219-178127-02 (hereinafter referred to as the Amended Wind SPA)

[58] DOC-EERA. Notice of Substantial Changes and New Information and Comment Period of the Environmental Assessment Scope. October 15, 2021. eDocket ID# 202110-178883-05

- What are possible methods to minimize, mitigate, or avoid the potential impacts?
- Are there other ways to meet the stated need for the amended project, for example, a different size project or a different type of facility? If so, what system alternatives to the amended project should be studied in the EA?
- Should the Department maintain the system alternatives including turbine exclusion areas from the originally proposed layout of eight (8), ten (10), and eleven (11) miles from the Jeffers Petroglyphs site, as identified in the Department's EA Scoping Decision issued on August 24, 2021?

During the second comment period one comment letter was received by Brad Hutchinson[59], a member of the public, and a comment letter was submitted by the Applicant[60].

Mr. Hutchinson's comments identified concerns with respect to wind turbine impacts on birds and bats that utilize the project area, both through direct strike fatalities, and also the loss of and encroachment of development on wildlife habitat in the area. Mr. Hutchinson did indicate that the seven-mile turbine setback from Jeffers Petroglyphs was a positive change to the project, but shifting the turbines from that portion of the project area into the remainder of the project area would increase the turbine density throughout the remainder of the project area and result in an increase in potential impacts of shadow flicker and noise on the local residents. Mr. Hutchinson requested that a system alternative of only constructing and operating a solar energy generation facility be evaluated to meet the energy need.

The Applicant indicated they believe the human and environmental impacts identified in the previously issued EA Scoping Decision and Draft Site Permit are appropriate to be carried forward for this EA Scoping Decision. Methods for avoiding, minimizing and mitigating potential impacts of the proposed project identified in the previous EA Scoping Decision were also recommended to be carried forward by the Applicant. The Applicant's comments state that the system alternatives including hybrid wind and solar facilities, with wind turbine setbacks from Jeffers Petroglyphs of eight (8), ten (10), and eleven (11) miles, should not be carried forward in the EA scope, because the Settlement Agreement has been reached to address this issue.

DOC-EERA has taken comments from both EA Scoping comment periods into consideration in developing the EA Scoping Decision, and in completing this EA. The Big Bend Wind Project, as amended, in the Amended Wind SPA, and information provided in the Amended Wind SPA were considered to be the proposed wind project as we completed this EA. System Alternatives proposed during the first EA Scoping comment period and included in the first EA Scoping, which requested the use of various turbine setbacks from the Jeffers Petroglyphs, were removed from the second EA

[59] DOC-EERA. Comments – Public Comments Received from Brad Hutchinson. November 3, 2021. eDockets ID# 202111-179472-02

[60] Big Bend Wind, LLC and Red Rock Solar, LLC. Comments – BBRR Scoping Comments. November 1, 2021. eDockets ID# 202111-179402-04

Scoping Decision. The issue of turbine setbacks from the Jeffers Petroglyphs has been addressed in the executed Settlement Agreement, and the EA will not evaluate turbine exclusion areas other than the seven (7) mile turbine setback identified in the Settlement Agreement.

Alternatives

The following section specifically addresses system alternatives, route and route segment alternatives, and solar site alternatives that were identified by agencies, intervening parties, and public commentors. If an alternative is identified as not appropriate for inclusion in the EA scope, EERA has provided the reasons for not including the specific alternative and a recommendation as to how, if possible, the issues raised in relation to the proposed alternative can be addressed.

System Alternatives Suggested by Intervening Parties

MNHS and the Lower Sioux Community both suggested system alternatives be considered that would exclude wind turbine construction and operation within eight (8) and ten (10) miles of the Jeffers Petroglyphs. Additionally, the Lower Sioux Community suggested three other system alternatives to be considered in the EA, No Build, Solar Only Project, and wind/solar hybrid with no wind turbines constructed and operated within 11 miles of the Jeffers Petroglyphs. More specifics on the MNHS and the Lower Sioux Community suggested system alternatives are detailed below.

MNHS has identified the following alternatives to be included in the EA;

- Removal of all wind turbines within 8 miles of the Jeffers Petroglyphs site property boundary, and the remaining turbines be reduced in height to no more than 570 feet (ground to blade tip),
    - Any energy output lost from turbine removal should be shifted to the solar facility, and additional solar panels should be constructed
- Removal of all wind turbines within 10 miles of the Jeffers Petroglyphs site property boundary, and the remaining turbines be reduced in height to no more than 656 (ground to blade tip)
    - Any energy output lost from turbine removal should be shifted to the solar facility, and additional solar panels should be constructed

The Lower Sioux Community has identified the following alternatives to be considered in the EA;

- No build
- Solar Only Project
    - Including additional solar panels and modifications to the high voltage transmission line
- Wind and Solar
    - 8 mile buffer between Jeffers Petroglyphs and Red Rock Ridge and the wind project, and no turbines taller than 570 feet (ground to blade tip)
    - Any energy output lost from turbine removal should be shifted to the solar facility, and additional solar panels should be constructed
- Wind and Solar
    - 10 mile buffer between Jeffers Petroglyphs and Red Rock Ridge and the wind project, and no turbines taller than 660 feet (ground to blade tip)

  - Any energy output lost from turbine removal should be shifted to the solar facility, and additional solar panels should be constructed
- Wind and Solar
  - 11 mile buffer between Jeffers Petroglyphs and Red Rock Ridge and the wind project, and no turbines taller than 660 feet (ground to blade tip)
  - Any energy output lost from turbine removal should be shifted to the solar facility, and additional solar panels should be constructed

During the second comment period on the EA scope neither MNHS nor the Lower Sioux Community provided comments requesting that there suggested system alternatives provided in the first comment period be carried forward in the Revised EA Scoping Decision. EERA has evaluated the No Build and Solar Only system alternatives in this EA, but system alternatives using hybrid wind/solar projects with turbine setback distances from the Jeffers Petroglyphs, different than the proposed project have not been evaluated in this EA.

Route Alternatives and Route Segment Alternatives Suggested

Mr. Scholl recommended a route segment alternative to be considered and evaluated in the EA. The Scholl route segment alternative is specific to a portion of the Applicant's proposed Peaking Plant Alternative Route that extends to the Lakefield Junction Station. Mr. Scholl's proposed alternative route segment would maintain the transmission line going south adjacent to 20th Avenue along the east side of Section 18, T104N, R33W, at 220th Street the alternative route segment would turn west an travel adjacent to 220th Street to the proposed step up substation. Mr. Scholl's proposed alternative route segment is referred to as the Peaking Plant Alternative – Alternate Route Segment .

The Applicant's proposed route and route segment are shown on Figure 1-4.

The Commission discussed the Applicant's proposed route, proposed route segments, and the route segment proposed by Mr. Scholl during their regular agenda meeting on Thursday, June 17th. The Commissioners requested that EERA include Mr. Scholl's proposed route segment alternative in the EA being developed for the proposed Projects.

Solar Project - Site Alternatives Suggested

No specific solar site alternatives were recommended during the Public Information and EA Scoping Meeting or during the associated comment period.

Some recommendations were made to increase the size of the Red Rock Solar Project to offset the need for all of the proposed Big Bend Wind Farm. EERA has evaluated this as a system alternative, as the general location of the proposed projects will still remain similar to what has been proposed.

EERA Staff Alternatives Analysis

The scoping process assists staff to identify "only those potentially significant issues relevant to the project" and alternatives to the project. Staff has completed abbreviated analysis in the EA for certain

resource topics that are commonly considered in environmental review, but are determined immaterial to the Commission's decision in these dockets. Abbreviated analysis means that the resource topic will not be discussed in as much detail as the standard analysis.

Abbreviating analysis for certain resource topics will provide for a shorter document that is more relevant and useable. This approach is consistent with Minnesota Statute and Rule, which state the purpose of scoping, in part, is to reduce the scope and bulk of environmental review documents. The decision whether to abbreviate analysis for certain resource topics will be made by EERA staff, and will be based on information from the CN applications, site permit applications, route permit application, field visits, scoping comments received, preliminary environmental analysis, and staff experience with similar projects.

The portion of the EA evaluation related to LWECS need is limited to analyzing and assessing the potential impacts of proposed projects compared broadly to system alternatives. As such, EERA believes that the proposed system alternatives, listed below, are appropriate for inclusion in this EA and were evaluated to inform the CN decision:

- a hypothetical 335 MW solar facility (with no wind component),
- 335 MW Wind and Solar Hybrid Project sited elsewhere in the State
- 335 MW solar facility with battery storage, located elsewhere in the State
- No-build Alternative

The Department issued a scoping decision for the EA on August 24, 2021, and a revised EA Scoping Decision was issued on November 5, 2021 (Appendix A). The scoping decisions identify the system alternatives, route alternatives, route segment alternatives, and alignment alternatives evaluated in this EA and those alternatives that were not carried forward for evaluation. Department staff provided notice of the scoping decisions to those persons on the project mailing list, and the scoping decision was filed to eDockets and noticed in the Environmental Quality Board (EQB) Monitor. Based on the scoping decision, Department staff has prepared this EA.

Public Hearing

A public hearing will be held in the project area; you can provide comments at the hearing.

Minnesota Rule 7850.3800, subpart 1, requires the commission hold a public hearing and open a public comment period once the EA is complete and available. The hearing will be presided over by an ALJ. You will have the opportunity to speak at the hearing, ask questions, and submit comments. Commerce staff will respond to your questions and comments about the EA at the public hearing, but staff is not required to revise or supplement the document.[xxii]

Comments received during the hearing and the associated public comment period become part of the project record. The ALJ will provide a written report to the Commission summarizing the public hearing

and comment period, and any spoken or written comments received. The ALJ will also provide the Commission with proposed findings and a recommendation whether to issue the certificates of need, wind site permit, route permit, and the solar site permit that have been applied for the proposed project.

2.3 Are other permits or approvals required?

Yes, other permits and approvals might be required for the projects.

A CN and site permits for the wind project and solar project from the commission is the only state approvals required for the siting of the LWECS and the solar generation facility. Likewise, a CN and route permit from the commission are the only state approvals required for the routing of the transmission project (i.e., the commission's route permit determines where the line will be located). commission-issued site and route permits supersede local planning and zoning and bind state agencies;[61] thus, state agencies are required to participate in the commission's permitting process to aid the Commission's decision-making and to indicate sites and routes that are not permittable.

However, various federal, tribal, state, and local approvals may be required for activities related to the construction and operation of the project. All permits subsequent to the commission's issuance of a site permit or route permit, and necessary for the project (commonly referred to as "downstream permits"), must be obtained by a permittee. The information in this EA may be used by downstream permitting agencies in their evaluation of impacts to resources. Table 2-1 lists permits and approvals that could be required for the project, depending on the final design.

Federal Approvals

The United States Army Corps of Engineers (USACE) regulates potential impacts to waters of the United States. Dredged or fill material, including material that moves from construction sites into these waters, could impact the quality of the waters. The USACE requires permits for projects that may cause such impacts. The USACE is also charged with coordinating with Native American tribes regarding potential impacts to traditional cultural properties.

The U.S. Fish and Wildlife Service (USFWS) requires permits for the taking of threatened or endangered species. The USFWS encourages consultation with project proposers to ascertain a project's potential to impact these species and to identify general mitigation measures for the project. USFWS also administers the process and issuance of Bald Eagle Non-intentional Take Permits, should the project proponent choose to pursue a permit.

The Federal Aviation Administration (FAA) regulates civil aviation, including the airspace used for aviation. The FAA requires permits for tall structures, such as wind turbines and transmission

[61] Minnesota Statutes, sections 216F.07 and 216E.10.

structures, which could adversely impact aviation. Additionally, FAA is also responsible for issuing final approval for the proposed wind project to utilize an automated detection lighting system (ADLS), which is currently proposed to reduce the nighttime turbine lightening impacts on those that live in the project area and on individuals that may be using the Jeffers Petroglyphs Site for nighttime ceremonies.

State of Minnesota Approvals

The MNDNR regulates potential impacts to Minnesota's public lands and waters. The MNDNR requires a license to cross public lands and waters; licenses may require mitigation measures. Similar to the USFWS, the DNR encourages consultation with project proposers to ascertain a project's potential to impact state-listed threatened and endangered species and possible mitigation measures.

A general national pollutant discharge elimination system/sanitary disposal system (NPDES/ SDS) construction stormwater permit from the Minnesota Pollution Control Agency (MPCA) is required for stormwater discharges from construction sites. A permit is required if a project disturbs 1 acre or more of land. To ensure that state water quality standards are not compromised, the general NPDES/SDS permit requires:

- use of best management practices,
- a stormwater pollution prevention plan, and
- adequate stormwater treatment capacity once the project is constructed.

The Minnesota State Historic Preservation Office (SHPO) is charged with preserving and protecting the state's historic resources. SHPO consults with project proposers and state agencies to identify historic resources (e.g., through surveys) and to avoid and minimize impacts to these resources.

The Minnesota Department of Agriculture (MDA) ensures the integrity of Minnesota's food supply while protecting the health of its environment and the resources required for food production. MDA assists in the development of agricultural impact mitigation plans (AIMP) to avoid and mitigate impacts to agricultural lands.

A permit from the Minnesota Department of Transportation (MnDOT) is required for transmission lines that are adjacent to or cross over Minnesota trunk highway rights-of-way (ROWs). MnDOT's utility accommodation policy generally allows utilities to occupy portions of highway rights-of-way where such occupation does not put the safety of the traveling public or highway workers at risk or unduly impair the public's investment in the transportation system.

MnDOT permits and approvals necessary for the wind project are anticipated to include utility permits, oversize/overweight permits, tall tower permits, and airspace obstruction notifications. Utility permits will be necessary to allow for any Big Bend Wind Project associated utility line placement within ROWs managed by MnDOT, and oversize/overweight permits will be necessary to transport a

number of Project related equipment components into the Project Area via MnDOT managed and regulated State trunk highways. MnDOT's Tall Tower Permit is required for wind turbines that will exceed a height of 500 feet AGL that are located outside the zoned territory of public use airport with airport zoning currently in place, which is anticipated to apply to all proposed primary and alternate turbines for the Big Bend Wind Project. Any Project related meteorological towers between 50 to 200 feet AGL will require the project proponent to provide a Airspace Obstruction Notification form to MnDOT Aeronautics, which will provide tower location information and identify how the towers will be marked and lighted.

The Minnesota Board of Water and Soil Resources (BWSR) oversees implementation of Minnesota's Wetland Conservation Act (WCA). The WCA is implemented by local units of government (LGUs). For linear projects that cross multiple LGUs, BWSR typically coordinates the review of potential wetland impacts among the affected LGUs. The WCA requires anyone proposing to impact a wetland to:

- try to avoid the impact,
- try to minimize any unavoidable impacts, and
- replace any lost wetland functions.

Local Approvals

The commission's site and route permits supersede local planning and zoning regulations and ordinances. However, permittees must obtain all local approvals necessary for the project that are not preempted by the Commission's site or route permits such as approvals for the safe use of local roads. If the Commission issues a Wind Site Permit the development and local approval of a Road Use Agreement between the Applicant and local road authorities will be required prior to beginning project construction.

Table 2-1. Potential Permits and Approvals Required for the Big Bend and Red Rock Projects

Unit of Government	Type of Application	Purpose
U.S. Army Corps of Engineers – St. Paul District (USACE)	Section 404 Clean Water Act – Dredge and Fill	Protects water quality through authorized discharges of dredged and fill material into waters of the United States.
	Section 10 – Rivers and Harbor Act	Protects water quality through authorized crossings of navigable waters.
U.S. Fish and Wildlife Service (USFWS)	Section 7 Endangered Species Act Consultation	Establishes conservation measures for endangered species.
	Special Use Permit	Authorization to cross USFWS-owned land or easements.
Federal Aviation Administration (FAA)	Part 7460 Review	Review to prevent airspace hazards due to structures taller than 200 feet.
Native American Tribes	National Historic Preservation Act (NHPA), coordination in support of USACE Section 106 to determine impacts on traditional cultural properties	Coordination to prevent impacts to traditional cultural properties.
Minnesota Department of Natural Resources (DNR)	License to Cross Public Waters	License to prevent impacts associated with crossing public waters.
	License to Cross Public Lands	License to prevent impacts associated with crossing public lands.
	State Threatened and Endangered Species Consultation	Consultation to avoid, minimize, and mitigate impacts to state-listed species.
Minnesota Pollution Control Agency (MPCA)	National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Permit	Minimizes impacts to waters due to construction of the project.
	Section 401 Clean Water Act – Water Quality Certification	Ensures project will comply with state water quality standards.
Minnesota State Historic Preservation Office (SHPO)	National Historic Preservation Act Section 106 Consultation	Ensures adequate consideration of impacts on significant cultural resources.
Minnesota Department of Agriculture (MDA)	Agriculture Impact Mitigation Plan (AIMP)	Establishes measures for protection of agricultural resources.
Minnesota Department of Transportation (DOT)	Utility Permit	Authorizes accommodation of utilities along highway rights-of-way
	Driveway Access	Authorizes access to driveways along highways.
	Oversize/Overweight Permit	Authorizes the use of roads for oversize or overweight vehicles.
	Tall Towers Permit	Wind turbines more than 500 feet above ground level (AGL) outside the zoned territory of a public use airport with airport zoning in place.
	Airspace Obstruction Notification	Notification of meteorological tower placement and plans to mark and light them.
Minnesota Board of Water and Soil Resources (BWSR)	Wetland Conservation Act	Coordination with BWSR and local governments to ensure conservation of wetlands.
Cottonwood County	Floodplain Development Permit	Required in areas mapped as floodplain by FEMA.
	County Entrance Permit	Required for access from county roads
	Utility Permit	Required to place utilities in a public road ROW
	WCA LGU	Required if there are wetland impacts

Do electrical codes apply?

Yes, if constructed the project must meet electrical safety code requirements.

The proposed projects, the wind project, the solar project, and the transmission project, must meet the requirements of the National Electrical Safety Code (NESC). Permittees must comply with the most recent edition of the NESC, as published by the Institute of Electrical and Electronics Engineers, Inc., and approved by the American National Standards Institute, when constructing new facilities or upgrading existing facilities.[62]

The NESC is designed to protect human health and the environment. It also ensures that the collection system, the transmission lines and all associated structures are built from high-quality materials that will withstand the operational stresses placed upon them over the expected lifespan of the equipment, provided that routine maintenance is performed.

Permittees must also comply with North American Electric Reliability Corporation (NERC) standards. NERC standards define the reliability requirements for planning and operating the electrical transmission grid in North America.

2.4 Are any issues outside the scope of this EA?

Yes, the scoping decision identified several issues that will not be studied.

This EA does not address the following:

- Any site alternative other than the site proposed by the applicant.
- Any system alternative not specifically identified in the scoping decision.
- The way landowners are compensated for use or sale of their land.

[62] Minnesota Statute 326B.35.

3 Proposed Hybrid Big Bend Wind and Red Rock Solar Project and System Alternatives

Red Rock Solar, LLC has indicated that the Big Bend Wind Project and Red Rock Solar Project are proposed as a hybrid wind energy and solar energy facility that could generate up to 335 MW of energy.[63] Big Bend Wind Project could be constructed and operated on its own, but the Red Rock Solar Project will not move forward on its own, should the Big Bend Wind Project not be approved.[64] To help inform the commission's evaluation of size, type, and timing in their decision on the CN, the proposed hybrid wind energy and solar energy facility of up to 335 MW are evaluated relative to potential system alternatives.

The system alternatives evaluated in this EA include:

- a generic 335 MW solar facility (with no wind component) sited elsewhere in the State,
- a generic 335 MW hybrid wind energy and solar energy facility, located elsewhere in the State,
- a generic 335 MW solar facility with battery storage, located elsewhere in the State,
- a "no-build" alternative is included in the analysis as a consequence of Minn. Rule 7849.0340, the No-facility Alternative requirement.

3.1 Big Bend Wind Project Description

All primary (45) and alternate (7) turbine locations under consideration are the same for the Nordex N-163 and the Vestas V162 turbine models. The primary (47) and alternate (5) under consideration for the GE-158 turbine model are the same locations being used for the Nordex N-163 and the Vestas V162, see Figure 3-1. Due to a smaller name plate capacity the GE-158 turbine layout will need two additional primary turbines to meet the energy generation needs of the proposed project, the two additional primary turbine locations under this layout are in the same locations as alternate turbines under the Nordex N-163 and Vestas V162 layouts. All 52 turbine locations, whether primary or alternate, and regardless of turbine model type, were proposed to be located in the same locations.

[63] Solar CNA – Section 2.1

[64] Solar CNA – Section 2.1

Turbine hub heights are 118 meters (388 feet) for the Nordex N-163, 119 meters (391 feet) for the Vestas V162, and 117 meters (384 feet) for the GE-158 turbines. The rotor diameters are 163 meters (535 feet) for the Nordex N-163, 162 meters (532 feet) for the V162 turbines, and 158 meters (519 feet) for the GE-158.[65]

Turbine specifications are provided in Table 3-1.

Table 3-1. Wind Turbine Specifications[66]

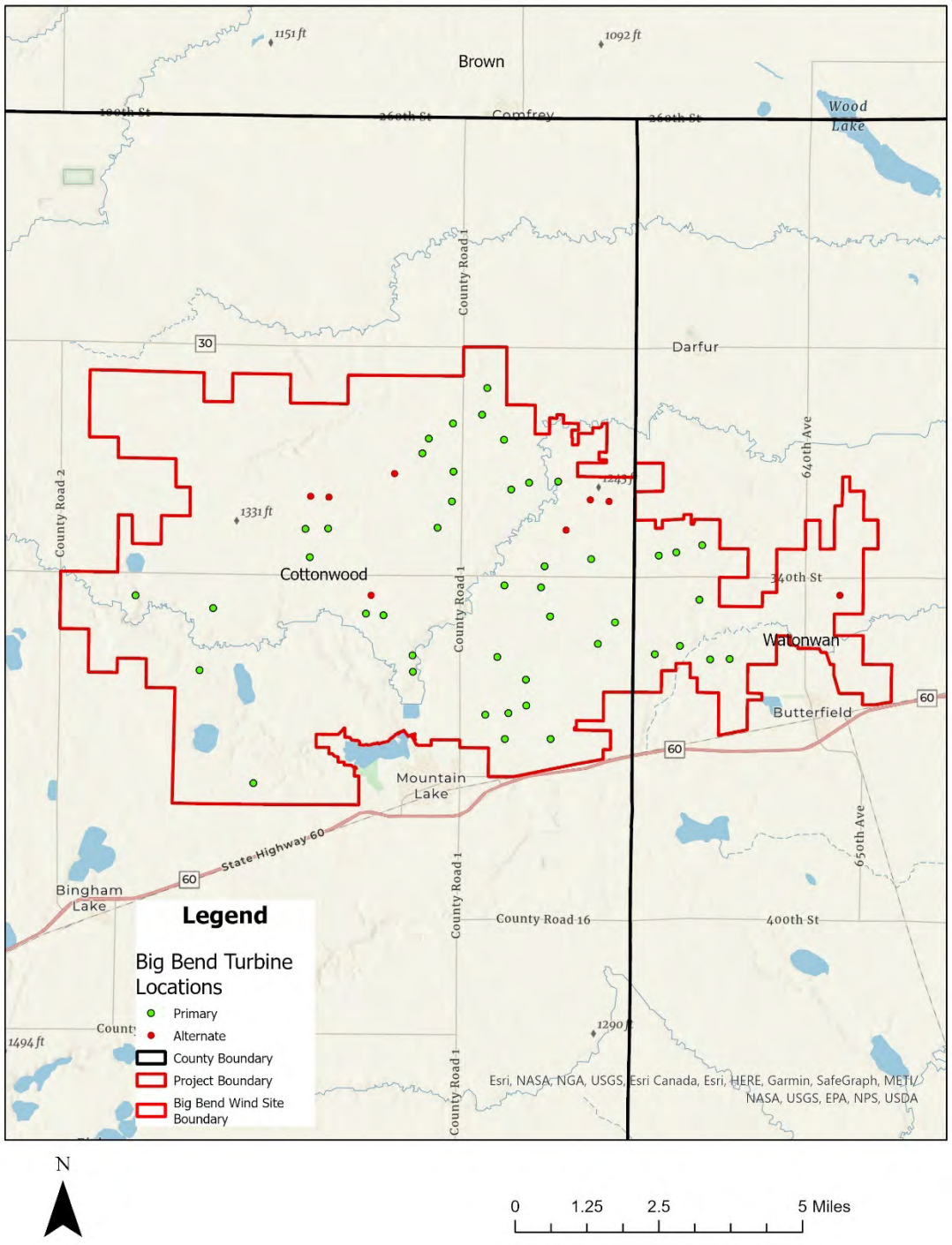
Characteristic	Turbine Model		
	Nordex N-163	**Vestas V162**	**GE-158**
Nameplate capacity (kilowatts)	5,940	6,000	5,800
Hub height in meters (m)[1]	118	119	117
Rotor Diameter (m)	163	162	158
Total height[2] (m)	199.5	200	196
Cut-in wind speed[3] meters per second (m/s)	3	3	3
Rated capacity wind speed[4] (m/s)	12.5	12.0	13.0
Cut-out wind speed[5] (m/s)	26	24	25
Wind Swept Area (m^2)	20,867	20,611	19,607
Rotor speed (rpm)	6-11.8	4.3-12.1	x-10.1
Primary Turbine Positions	45	45	47
Alternate Turbine Positions	7	7	6
Pitch Regulation	Electric Motors	Hydraulic Control	Electric
Gearbox	Multi-stage planetary gear + spur gear stage	2-stage planetary	Multi-stage planetary/helical
Yaw Control	Four state planetary gear	Multiple stages planetary gear	Multiple stages planetary gear
Braking System	Main aerodynamic brake (individual blade), mechanical brake on high-speed shaft	Main aerodynamic brake (individual blade), mechanical brake on medium-speed shaft	Main aerodynamic brake (individual blade), mechanical brake
Main Bearing	Spherical roller bearing	Rolling Bearings	Rolling Bearings

[65] Amended Wind SPA – Section 5.2.2

[66] Amended Wind SPA – Section 5.2.2, Table 5.2-2

[1]	Hub height = the turbine height from the ground to the top of the nacelle.	
[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	

Figure 3-1. Big Bend Wind – Purposed Turbine Layout



3.1.1 Wind Project Location

The Project is in eastern Cottonwood and western Watonwan counties in southern Minnesota, north of Mountain Lake, Minnesota. The site is within Delton, Selma, Carson, and Midway townships in Cottonwood County, and Butterfield township in Watonwan County.
Table 3-2 lists the Township, Range, and Sections in which the project is located.

Table 2-2. Big Bend Wind Project Location[67]

County Name	Township Name	Township	Range	Sections
Cottonwood	Delton	107N	35W	25-28, 33-36
	Selma	107N	34W	27-29, 31-36
	Carson	106N	34W	1, 2, 10-16, 21-26, 35, and 36
	Midway	106N	33W	1-32, 34-26
Watonwan	Butterfield	106N	33W	3, 6-11, 15-23, 26, 28, and 29

Within the approximately 43,523 acres Wind Project Area, and at the time of filing the Amended Wind SPA Big Bend has secured wind rights for approximately 34,025 acres of private land and has an additional 160 acres of pending participation lands, which is approximately 79 percent of the land within the proposed Wind Project Area.[68]

3.1.2 Wind Project Design and Layout

The preliminary site layouts for the three turbine options are shown on Figures 3-1 and 3-2; the wind project design/layout is meant to optimize the wind resource and avoids and/or minimizes potential human and environmental impacts. The proposed turbine locations incorporate the wind energy conversion facility siting criteria outlined in the Commission's Order Establishing General Wind Permit Standards (Docket No. E, G999/M-07-1102, January 11, 2008 - Commission General Permit Standards), applicable local government ordinances,[69] and the Settlement Agreement specific to the Jeffers Petroglyphs.[70] Table 3-3 incorporates avoidance and setback requirements used by Big Bend.[71]

[67] Amended Wind SPA – Section 4.0, Table 4.0-1
[68] Amended Wind SPA – Section 4.0
[69] Amended Wind SPA – Section 5.1
[70] Amended Wind SPA – Section 5.1
[71] Amended Wind SPA – Section 5.1 and Table 5.1-1

Table 3-3. Wind Project Setback Comparison

Turbine Setback Requirement	Distance for Setback	Authority	Setback applied to Big Bend Wind Project
Wind Access Buffer – Prevailing Wind Directions	5 x rotor diameter (RD)	Commission's General Permit Standards	5 x RD
Wind Access Buffer – Non-Prevailing Wind Directions	3 x RD	Commission's General Permit Standards	3 x RD
Residences	500 feet, or the minimum distance required to meet the state noise standard of 50 decibels (dB) using the A-weighted scale (dB(A)), whichever is greater	Commission's General Permit Standards	1,200 feet from residences
Noise Requirements	Distance must meet the state noise standard of 50 dB(A)[2]	Minnesota Pollution Control Agency (MPCA)	Turbines are sited for turbine-only noise to be < 45 dB(A) at non-participating residences and < 47 dB(A) at participating residences
Public Roads and Trails	Minimum 250 feet	Commission's General Permit Standards	1.1 x total turbine height

[1] Commission's General Permit Standards identify the minimum setback from residences as 500 feet, or the minimum distance required to meet the state noise standard of 50 decibels dB(A), whichever is greater. Big Bend will be following Apex's best practice of siting turbines at least 1,200 feet from residences or the minimum distance required to meet the state noise standard of 50 decibels dB(A), whichever is greater.

[2] Noise standards are regulated by the MPCA under Minn. R. Ch. 7030. These rules establish the maximum night and daytime noise levels that effectively limit wind turbine noise to 50 dB(A). The MPCA standards require A-weighting measurements of noise; background noise must be at least 10 dB lower than the noise source being measured. Additionally, based on the 2019 LWECS Application Guidance, DOC-EERA staff recommend turbine-only noise to be < 45 dB(A) at non-participating residences and < 47 dB(A) at participating residences. The layouts included in this Application meet this recommendation.

Table 3-4. Minimum Property Boundary Setback Distances by Turbine Model

Turbine Model	5 RD[1]	3 RD[1] (m)	1.1x Total Height (including blades)
Nordex N-163	815 m (2,674 ft)	489 m (1,605 ft)	220 m (722 ft)
Vestas V162	810 m (2,658 ft)	486 m (1,595 ft)	220 m (722 ft)
GE-158	790 m (2,592 ft)	459 m (1,506 ft)	216 m (708 ft)

[1]The listed RDs provide the range of rotor sizes; depending on the final turbine selection, the RD may vary from the listed values.

3.1.3 Wind Project Construction

Turbine pad dimensions will range from approximately 291 to 737 cubic yards depending on soil requirements and turbine size at each turbine location. The portion of the foundation that is above ground is roughly 20 feet wide at the base of the tower and typically range in depth from four to six feet.[72] Geotechnical surveys, turbine tower load specifications, and cost considerations will dictate final design parameters of the foundations. Each turbine tower will be secure and connected by anchor bolts to a concrete foundation using a pad-and-pier tower mounting system.

The turbine towers, on which the nacelle, hub, and blades is mounted, consist of three or four sections made of certified steel plates. Tower sections are welded together using automatically controlled power welding machines. Welds are and ultrasonically inspected during manufacturing per American National Standards Institute (ANSI) specifications.[73] All surfaces are coated for protection against corrosion in a non-glare white, off-white, or light gray color. The turbine towers also house all electrical, control, and communication cables. At the base of each tower is the necessary electrical equipment to condition the generated electricity to match the requirements of the electric grid, known as the pad-mount transformer, and transmit the electricity to the Wind Project Substation.[74] Access to the turbine is through a lockable steel door at the base of the tower, and a system of ladders and platforms provides access vertically, through the tower, to the nacelle and hub.

The nacelle is located directly on top of the turbine tower and houses the generator, generator cabling and cooling equipment, gear boxes, upper turbine controls, hoist, and various other equipment. The hub extends from the nacelle and provides support and a point of connection for the turbine rotor and blades. The hub also provides support for yaw motors, the mechanical braking system, and an emergency power source to allow the mechanical brakes to function, even if a the power connection to the grid is lost.[75] All turbines will be equipped with three blades mounted to the rotor. The blades are made of carbon fibers and fiberglass, with internal structures to provide support.[76] Each turbine will be grounded and shielded to protect against lightning. The grounding system installed during foundation work will be designed for local soil conditions and in accordance with local utility or code requirements. Lightning receptors are placed in each rotor blade and in the turbine tower. The electrical components are also protected.[77]

[72] Amended Wind SPA – Section 10.4.1
[73] Amended Wind SPA – Section 5.2.2
[74] Amended Wind SPA – Section 5.2
[75] Amended Wind SPA – Section 5.2
[76] Amended Wind SPA – Section 5.2
[77] Amended Wind SPA – Section 4.0

Wind turbines capture the linear energy of the wind, and convert it into rotational energy, as the wind drives the blades and rotor the mechanical force is transferred from the hub to a gear box in the nacelle via a shaft. The gear box adjusts the shaft rotating speed to match the generator speed required to optimally produce energy. The electricity produced by the generator is then transferred through insulated cables down through the turbine tower to the transformer located at the base of each tower. Each turbine is equipped with an anemometer and weathervane on the nacelle, which allows for continuous wind speed and wind direction monitoring. As wind speed and direction change the turbine nacelle and hub are being rotated to match, and the blade angles are rotated by the yaw monitors to adjust for optimization based on wind speed and direction.[78] All turbines will use low noise trailing edge blade to reduce operating noise.[79] All turbines are equipped with mechanical braking systems, located within the hub, which can lock the blade rotor and prevent spinning to all for maintenance work to be completed safely.[80] All three turbine models being considered are able to operate at variable (adjusted) cut-in speeds and with full blade feathering. A Supervisory Control and Data Acquisition (SCADA) will be used to communicate, control, and monitor the project as a whole and for each individual turbine.[81]

A number of facilities would be constructed to support the operation of the wind turbines and facilitate the delivery of the electricity to consumers. Big Bend is seeking approval from the Commission through the LWECS site permit for the following associated facilities: one permanent meteorological tower and other weather data collection systems (SoDAR and/or LiDAR units), up to two temporary met towers, up to four ADLS radars, an electrical collection and communications system, access roads, temporary laydown and staging areas, a collector substation and associated equipment, and an O&M facility. The Project may require the construction and operation of a temporary concrete batch plant, and if necessary, the plant location will be determined and permitted locally by the construction contractor.[82]

3.1.4 Wind Project Cost and Schedule

The installed capital costs for the proposed wind project are estimated to be approximately $383 million, including development, design and construction of the facilities. Ongoing operations and maintenance costs are estimated to be approximately $12.2 – 16.2 million per year one, including payments to landowners for wind lease and easement rights.[83]

[78] Amended Wind SPA – Section 5.2.1
[79] Amended Wind SPA – Section 5.2.2
[80] Amended Wind SPA – Section 5.2.1
[81] Amended Wind SPA – Section 5.2.2
[82] Amended Wind SPA – Section 6.2
[83] Amended Wind SPA – Section 10.7

Depending on interconnection process completion, permitting, and other development activities the Project is expected to achieve commercial operation by the fourth quarter 2022.[84]

3.1.5 Wind Project Decommissioning

Information in this section is adapted from the Decommissioning Plan prepared by Big Bend and submitted with the LWECS site permit application. The anticipated lifespan of the wind farm is 30 years.[85]

Big Bend or the Project owners will be responsible for removing wind facilities and removing the turbine foundations to a depth of four feet below grade. The overhead electrical lines associated with the Project connecting the Wind Project Substation to the voltage step-up substation, located at the point of interconnection south of the Project. All poles, conductors, switches, and lines associated with this interconnection link will be removed and hauled off-site to a recycling facility or disposal site. Underground infrastructure such as pole foundations will be removed down to four feet below grade. Pole foundation holes will be filled with a suitable clean compactable material. Topsoil will be applied and the areas and re-vegetated to pre-construction conditions. The interconnection substation will continue to be owned by the transmission line owner.[86]

The decommissioning of the Wind Project will begin with the preparation of crane paths and crane pads for the movement and setup of large industrial cranes. A crane will be used to remove hub and blades from the nacelle and placed on the ground. Once on the ground, a crew and small crane will remove the blades from the hub. Disassembled, blades will be placed into a carrying frame and loaded onto a truck for removal from the site. The hub will also be loaded onto a truck for removal. After removal of the rotor, the crane will remove the nacelle and then take down the tower section by section. Turbine foundations will be removed to a depth of four feet and removed from the site and recycled or disposed of at a commercial landfill.

Pad mounted transformers will be disconnected and removed from the site. The concrete pads will be crushed and hauled offsite. A crane will be used to dismantle MET towers from the top down and will be loaded onto trucks to be removed from the site. Unless a landowner informs Big Bend otherwise, access road, will be removed and the land will be restored.

[84] Amended Wind SPA – Section 10.8.6
[85] Amended Wind SPA – Section 11.0 and Appendix M
[86] Amended Wind SPA – Section 11.0 and Appendix M

Underground collection lines are planned to be installed at a depth of at least 48 inches, and the electrical cables and fiber optic conduits planned to be utilized are not known to contain any materials known to be harmful to the environment. Underground collection lines will be abandoned in place and be non-functional. If the cables are to be removed, a backhoe or specialized trenching equipment will be necessary for removal.[87]

Materials from the Wind Project Substation will be disassembled and recycled, including steel framing, conductors, switchgear, transformers, security fencing, and components of the step-up the facility. Bulldozers, wheeled loaders, and/or backhoes will be used to remove and haul off the rock base material, which will be recycled or disposed of at a landfill. Soils will be decompacted and restored to the pre-construction tillable condition.[88]

All unsalvageable materials will be disposed of at authorized sites in accordance with applicable regulations.[89]

After dismantling the Project, Big Bend (or the Project owners), or its contractor, would remove components having salvage value. Generally, turbines, transformers, electrical components, towers, and transmission poles are refurbished and resold or are recycled for scrap. Decommissioning of the existing turbines will include removal and transport of generators and towers offsite to disposal facilities and/or sale of towers and generators. Unless expressly requested by the landowner, non-salvageable material will be broken down for transport, removed from the site, and disposed at an authorized site in accordance with applicable regulations. About 85 percent of turbine component materials—such as steel, copper wire, electronics, and gearing—can be recycled or reused. But the blades are different as they are made up of fiberglass (a composite material) to be lightweight for efficiency yet still durable enough to withstand storms.[90] The fiberglass blades pose the greatest challenge to end-of-use considerations; while it is possible to cut the blades into pieces onsite during a decommissioning or repowering process, the pieces are still difficult and costly to transport for recycling or disposal. Additionally, the process of cutting the extremely strong blades requires enormous equipment such as vehicle mounted wire saws or diamond-wire saws. Because there are so few options for recycling the blades currently, the vast majority of those that reach end-of-use are either being stored in various places or taken to landfills.[91]

[87] Amended Wind SPA – Appendix M
[88] Amended Wind SPA – Appendix M
[89] Amended Wind SPA – Appendix M
[90] Wind Turbine Blades Don't Have to End Up In Landfills - Union of Concerned Scientists (ucsusa.org).
[91] Wind Turbine Blades Don't Have to End Up In Landfills - Union of Concerned Scientists (ucsusa.org).

The estimated decommissioning costs is approximately $5,538,506 ($106,317 per turbine after salvage value). The cost to decommission will depend upon the prevailing rates for salvage value of the equipment and labor costs.[92]

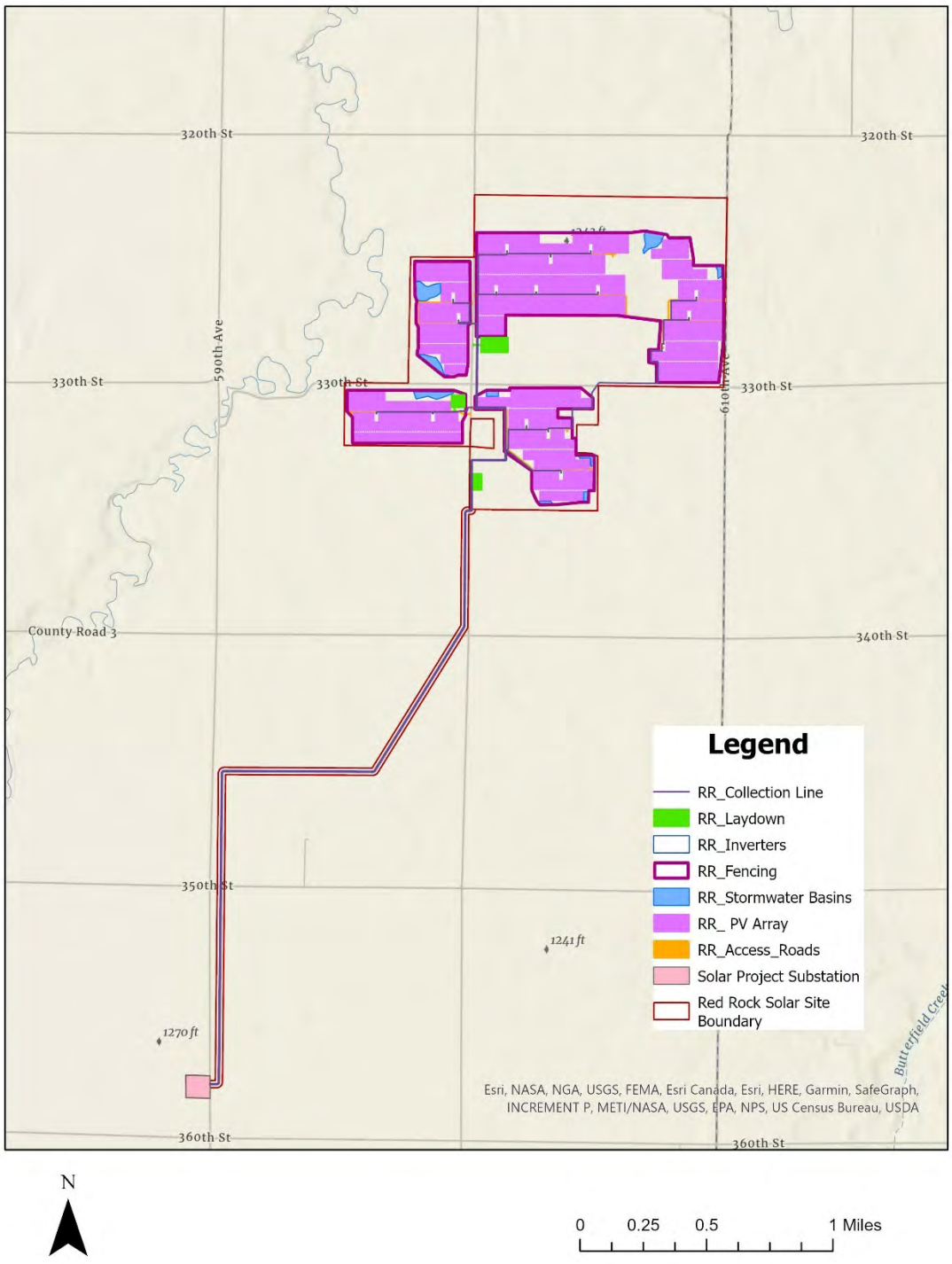
3.2 Red Rock Solar Project

3.2.1 Solar Project Location

The Red Rock Solar Project is proposed to be constructed and operated in Sections 1, 2, 11, 12, 14, 22, and 23, Township 106 North, Range 34 West, Cottonwood County, Minnesota. The Solar Project is located approximately four miles north of the City of Mountain Lake. The project area was selected based on landowner interest, optimal solar resources, and minimal impacts on environmental resources.

[92] Amended Wind SPA – Appendix M

Figure 3-2. Red Rock Solar Project Location and Layout



3.2.2 Solar Project Design and Components

The project consists of photovoltaic (PV) solar panels mounted on a linear axis tracking system, an electrical collection system, a project substation, a switchyard and short transmission line to connect the project to the electrical grid, fencing, access roads, and stormwater ponds. Red Rock will utilize the Big Bend Wind O&M building.

Solar panels are made up of PV cells that generate direct current (DC) electricity. The PV panels to be used for the Red Rock Solar Project will be tempered glass, approximately three feet long and seven feet wide, and one to two inches thick. PV panels construction consists of an aluminum frame (side-mount or under-mount), silicon, weatherized plastic backing, heat strengthen front glass, and laminate material encapsulation for weather protection.

The panel surfaces are constructed of a dark, light absorbing material, and uses an anti-reflective coating, so only approximately two percent of the incoming sunlight is reflected by the panels. The applicant proposes to place solar panels on a tracking system, generally running north and south, which will allow the panels to track the sun from east to west each day. The solar panels will face east in the morning, will be parallel to the ground mid-day, and will face west in the afternoon. This tracking of the sun maximizes the project's electrical production.

When tilted to their highest position (early and late in the day), with an angle of 45 degrees, the top edge of the solar panels will be, at most, 20 feet above the ground.

The tracking rack system constructed of galvanized steel and aluminum, and are mounted on steel piers typically driven into the ground. Red Rock does not anticipate the mounting piers to require excavation or concrete foundation installation. The tracking rack system is rotated by small motors under the PV panels.

Red Rock will use a SCADA system to allow for remote control and monitoring of the solar project electrical and mechanical status. Red Rock will be able to monitor operational status and fault status of the solar project, as well as viewing meteorological data and grid station data.

Electrical Collection System

The DC electrical energy generated by the solar panels will travel through electrical wiring to power inverters located throughout the solar project area. DC wiring systems will be run through a hanging harness system mounted below PV panels, which will reduce soil disturbance. The DC electrical energy from the solar panels (about 1,500 volts DC) is changed to alternating current (AC) energy by the inverters (about 600 to 900 volts AC). The AC energy is transformed to 34.5 kilovolts (kV) by the step-up transformer.

Project inverters and transformers will be housed together on what is referred to as a "skid", which are placed on concrete slab or pier foundations. Skid foundations will be approximately 15 feet by 20 feet, and the total height of the skid structures will be approximately 12 feet above the ground surface. Red Rock plans to utilize 16 centrally located inverter skids (one inverter per every three to four MW of capacity is required), the final number of inverters will ultimately depend on which

panels and inverters are available and selected at the time of construction. Inverters will be located along access roads.

The AC energy is then run from the step-up transformers, through an AC collection system to the Red Rock Solar Substation. The AC collection system will be trenched into place, below ground, at a depth of approximately four feet. The AC collection line will be approximately 3.1 miles long, between the fenced solar arrays and the Red Rock Solar Substation. The AC collection line is collocated with underground collection lines for the Big Bend Wind Project.

Solar Project Substation

The solar project substation will be a 34.5/161 kv step-ip substation with metering and switching equipment. The area within the substation will be graveled to minimize risk of fire and will be fenced with six-foot-high chain link, topped with one foot of barbed wire. The solar project substation's area will be approximately 300 feet by 200 feet once construction is complete. Final dimensions will depend on equipment selection, engineering, and design specifications.

The solar project substation will be designed and constructed according to regional utility practices, Midcontinent Independent Transmission System Operator Standards, Midwest Reliability Organization Standards, National Electric Safety Code, and the Rural Utility Service Code.

Fencing

All solar arrays will be fenced for security. Fencing will be secured to posts that will be directly embedded in the soil or set in concrete foundations as required for structural integrity. Fencing around solar arrays will consist of 7-foot-high agricultural woven wire fence with a one-foot top of 3-4 strands of smooth wire (no barbs). Fencing around the solar project substation will consist of 6-foot-high chain link, with a one foot top of barbed wire to comply with National Electric Code.

Access Roads

The solar project will include approximately 4.1 miles of internal graveled access roads. These roads will be used for operations and maintenance activities. Roads will be up to 20 feet in width, with some wider sections at curves and intersections, approximately 30-foot radius. There are seven access points from county roads into the solar project, all proposed entrances will have locked gates.

Red Rock has committed to working with Cottonwood County to facilitate and pay for required public road upgrades to meet required standards. These upgrades may include, but are not limited to road improvements, additional aggregate, and driveway changes. Red Rock will enter into a road use and repair agreement with Cottonwood County and/or Midway Township. Driveway changes and additions will require Red Rock to obtain county entrance permits from Cottonwood County prior to beginning construction.

Stormwater Drainage Basins

The solar project has currently been designed with 10 drainage basins located throughout the solar project area in existing low areas. The 10 drainage basin range in size from 0.4 to 10.1 acres. The drainage basins will be vegetated with a wet seed mix to help stabilize soils after rain events.

Weather Stations

Up to three weather stations will be located within the solar project area. Each station would be up to 10 feet in height.

Temporary Facilities

Three temporary laydown areas will be used during construction of the solar project, these areas will be used for parking areas and staging areas for solar project components. One of the laydown areas will be within the fenced portion of the solar project, and the other two will be located outside of the fenced project area. Total area of all three laydown areas will be 7.6 acres. The laydown area inside the fenced areas will be stored and seeded with the appropriate grass seed mixture. The two

laydown areas outside the fenced area will be restored to pre-construction conditions and suitable for agricultural use.

Table 3-5. Estimate Solar Project Component Temporary and Permanent Impact Acreages within the Project Footprint

Project Facilities	Temporary Facility Impacts (acres)	Permanent Facility Impacts (acres)
Access Road	--	10.1
Inverter Skids	--	0.1
Solar Project Substation	4.0	1.4
Solar Panels (coverage area)	--	412.3
Temporary Laydown Areas	5.8	1.8
Collection Lines between Solar Arrays	--	24.1
Collection Line from fence to Solar Project Substation	55.1	--
Stormwater Basins	--	23.7
Project Totals	**64.9**	**473.5**

3.2.3 Solar Project Construction

Project construction will begin only after all necessary permits and approvals have been received. Construction begins with initial site preparation including grading, improving access, and preparing staging/laydown areas. Grading of the solar project area will be focused on areas requiring leveling to allow for better workspaces, and in areas with greater than five percent slope to maintain soil stability. Soils from graded areas will be separated into topsoil/organic matter and subsoil. Temporary and permanent erosion control and soil stabilization measures established in accordance with the solar project's SWPPP will be used to minimize topsoil erosion. Typical construction equipment will be used for the project – scrapers, bulldozers, dump trucks, and backhoes. Additional specialty equipment could include a pile driver, crane, forklift, and drill rig.

After initial site preparation, associated access roads would be constructed. Topsoil will be stripped from areas planned for access road and turnout construction. Compaction of the subgrade material will occur in an area 32 feet wide for the access roads and turnouts. Access road construction may or

may not use geo-fabric on the compacted surface, this determination will be made according to soils present. Access roads will be built up with four to 12 inches of gravel, being placed level with existing grade to maintain drainage and minimize ponding. Grading will be completed across the entire solar project area to ensure appropriate drainage will be maintained across the site. Previously stripped topsoil will be respread across the solar project area or possibly stored close to where it was removed. Topsoil storage locations will be record with GPS to facilitate final reclamation after solar project decommissioning.

Solar arrays will be constructed in blocks, and multiple blocks will be constructed simultaneously. The tracking system and solar panels will be mounted on steel posts driven into the ground. Pier depth will depend on final geotechnical analysis and design. Concrete foundations may be required in some areas. The tracking system and supports for the solar panels (racking) will be bolted to the posts. Solar panels, including electrical connections, grounding, and cable management systems, will be installed by crews using hand tools.

The DC electrical wiring connecting the PV panels to inverters will installed in hanging harnesses underneath of the PV panels, avoiding additional ground disturbance through trenching. The AC electrical wiring will be installed below-ground with trenching or plowing to a depth of four feet. During trenching and plowing activities the topsoil and subsoil materials will be separated. Once the AC cable is placed in the trench, backfilling will occur with the subsoil material followed by the top soil. Inverter skids will be installed on concrete or pier foundations. Concrete foundations may be poured on-site or pre-cast and then assembled.

The solar project substation construction will include site preparation (including grading) and the installation of substructures and electrical equipment. Trenching machines, concrete trucks and pumpers, vibrators, forklifts, boom trucks, and large cranes will be required for concrete foundation and embedments installation. Above ground and below ground conduits for this equipment will run to a control enclosure with protection, control, and automation relay panels. The enclosure will include batteries and battery charges for auxiliary power to the switchyards control system. A station service transformer will also be necessary to meet primary AC power requirements. The foundation and grounding grid for the substation will be installed. Substation equipment will be delivered and stored on the foundation.

The solar project substation site will be covered with crushed rock. Installation of major concrete substation foundations will be completed by digging out the area with a small rubber tire backhoe and pouring the concrete slab. Minor foundations will be installed with an auger/drill type machine. All equipment working on the solar project substation will be within the footprint of the substation. Topsoil removed from the substation site will be stored at a pre-established location for storage, and those areas will be located with GPS and graded for revegetation. If subsoil is removed a pre-established location will be identified for storage, and locations will be identified with GPS. After decommissioning the stored subsoil and topsoil would be replaced to where it was removed to re-establish the site.

The applicant estimates that for several weeks – during delivery of the trackers and solar panels – there will be between 10 and 20 semi-truck deliveries daily. Traffic will decrease once these components are delivered. Workers at the site will use light duty trucks and cars for transportation. The applicant estimates that the project will create approximately 200 temporary construction jobs and one full-time operational job. The applicant indicates that it will prioritize the use of local, union construction craft employees to the greatest extent feasible consistent with other project constraints.

3.2.4 Solar Project Restoration

Once solar project construction is complete, areas without permanent above ground facilities will be stabilized with sediment and erosion control measures, such as silt fencing, biologs, and re-vegetated according to the Vegetation Management Plan (VMP). The solar project area will be seeded with one of three seed mixes; a native low growing mix, a grazing mix, or a wet seed mix. A cover crop will be seeded with the native seed mixes to help provide temporary soil stability and prevent erosion as the native seed mixes establish.

The VMP details the two vegetation management strategies to be utilized at the solar project moving forward. If the native seed mixture is used throughout the solar project area, mowing once per year in the fall will be utilized to establish the native plant community. If Red Rock decides to graze the solar project area with sheep the grazing seed mix will be seeded across the site. Regardless of the seed mix and vegetation management selected, the wet seed mix will be used for the stormwater drainage basins. The VMP provides details on site preparation, installation of seed mixes, management of invasive species and noxious weeds, and the control of erosion and sedimentation. Restoration management will occur for three years with established vegetation community targets. The VMP also identifies long-term maintenance activities; monitoring for and treating invasive species, mowing, and re-seeding.

3.2.5 Solar Project Operation and Maintenance

Once construction is complete it is anticipated that there will be one to two truck on site daily, and there will be one full time staff necessary to maintain and operate the facility. The Red Rock Solar Project will be maintained and operated by Red Rock, an affiliate, or a contractor. Primary tasks include scheduled monthly, quarterly, and yearly inspections of electrical equipment, vegetation management (mechanically or with grazers), as well as snow removal on access roads.

Derating/degradation of project components occurs over time, and with this process comes loses in efficiency. Certain amounts of this derating and degradation is unavoidable, so Red Rock will implement a predictive maintenance schedule to help avoid component failures and losses of efficiency.

The electrical performance of the project will be monitored in real-time by a supervisory control and data acquisition (SCADA) system. The SCADA system allows for early notification of abnormal operations, which facilitates prompt maintenance and repair

The estimated service life of the project is at least 30 years.

3.2.6 Solar Project Cost

The Red Rock Solar project will have an installed total capital cost is estimated to be $86,159,274, with the following breakdown:

- Engineering, Procurement, Construction Contractor – approximately $81,054,689
- Development Expense – approximately $1,145,511
- Financing – approximately $3,959,074
- Interconnection – Red Rock will utilize the Big Bend HVTL and interconnection.

3.2.7 Solar Project Schedule

EERA anticipates the CN and site permit for the Red Rock Solar Project will come before the commission for a final decision in the second quarter of 2022. Red Rock anticipates project construction will take approximately seven months.

3.2.8 Solar Project Decommissioning

As the project progresses through its service life, the applicant indicates that it may seek to repower the project through re-permitting and retrofitting. This decision will be based on available newer technologies for upgrades, and if Red Rock decides to extend operations, they will pursue re-permitting.

If the project is not repowered, Red Rock will decommission the project and remove the project facilities. Decommissioning would include removal of the solar arrays (panels, racking, and steel posts), inverters, fencing, access roads, lighting, and the project substation. Above-ground electrical cabling would be removed; below-ground cabling would be removed to a depth of four feet or in accordance with lease terms for individual landowners.

During decommissioning Red Rock would keep grading activities to a minimum and would limit it to re-spreading topsoil that had been removed during project construction. Standard practice would be utilized with respect to project components, dismantling and repurposing, salvaging/recycling, or disposing of the solar energy improvements, and restoration.

If the project is decommissioned, it is assumed the site will return to agricultural use. Red Rock will restore the site to pre-construction conditions to facilitate this use. To this end, best management practices will be used during decommissioning to minimize soil erosion and maintain natural hydrology. Areas of compacted soils will be de-compacted to support agricultural use.

Decommissioning and site restoration is estimated to take five to nine months.

The applicant will be responsible for all costs associated with decommissioning the project. Red Rock has committed to providing financial security to Cottonwood County on the 10th year of the project's operation. Financial security will come in the form of, or a combination of, performance bonds, surety bonds, letter of credit, corporate guarantee, or another form that is satisfactory to the county. The financial security will be accessible to the county or landowner. The Net Removal Cost is currently estimated at $16,983 per MW. Beginning on the 5th year of operation, and every five years after, Red Rock will have a third-party engineer re-evaluate the Net Removal Cost.

3.3 System Alternatives

The Commission must consider system alternatives to the proposed Project.[93] In addition to evaluating alternatives and their impacts, a no build option must also be evaluated. This section provides a discussion of alternate power sources to the Big Bend Wind and Red Rock Solar Facilities.

The system alternatives considered would generate energy equivalent to that of the proposed wind project and solar project and provide renewable, low, or zero carbon emission energy. Typically, alternatives to the project would include generation facilities of all types, including plants that use coal, natural gas, fuel oil, or similar non-renewable fuels, as well as transmission facilities (to import energy) in lieu of generation. However, because the proposed wind project and solar project would be producing renewable energy for use in Minnesota and the surrounding area, alternatives considered here were selected as they are technologies eligible to be counted toward renewable energy objectives.[94] Alternatives to the transmission project associated with the wind project are discussed in Chapter 5.

The analysis in this EA will describe differences in the impacts associated with the proposed hybrid Big Bend Wind and Red Rock Solar Project and three hypothetical System Alternatives.

System Alternatives to the hybrid Big Bend Wind Project and Red Rock Solar Project evaluated include:

- a hypothetical 335 MW solar facility (with no wind component),
- a hypothetical 335 MW wind energy and solar facility hybrid, located elsewhere in the State,
- a hypothetical 335 MW solar facility with battery storage, located elsewhere in the State
- No Build Alternative

[93] Minnesota Rule 7849.1200.

[94] Minn. Statute 216B.1691, Subdivision. 1.

3.3.1 335 MW Solar Facility (with no wind component)

One alternative renewable energy source to the hybrid Big Bend Wind and Red Rock Solar Project is a solar energy facility of similar electrical capacity as the proposed hybrid project.

The analysis for this alternative relies on data from other utility scale solar projects reviewed by the Commission,[95] as well as literary searches. While the capacity of other projects reviewed by the commission are less than 335 MW, many of the impacts associated with utility scale solar projects are similar regardless of capacity.

3.3.2 335 MW Wind Energy and Solar Facility Hybrid (Located elsewhere in the State)

Another alternative to the proposed hybrid Big Bend Wind and Red Rock Solar Project that would utilize a renewable energy resource is a generic hybrid wind energy and solar energy facility, sited elsewhere in Minnesota. Such a project could be a single approximately 335 MW Project or a combination of smaller dispersed projects. While possible to site a wind project elsewhere in Minnesota, potential alternative locations are limited to areas in the state with adequate wind resources as shown in **Figure 3-3.** Solar project locations within the state are also limited by the availability of adequate solar resources, see **Figure 3-4.**

[95] Elk Creek Solar Project (eDocket No. IP7009/GS-19-495), North Star Solar Project (IP6943/GS-15-33), Marshall Solar Project, (IP6941/GS-14-1052), Aurora Distributed Solar Project (E6928/GS-14-515), and Regal Solar Project (IP7003/GS-19-395).

Figure 3-3. Minnesota Wind Resource Map[96]

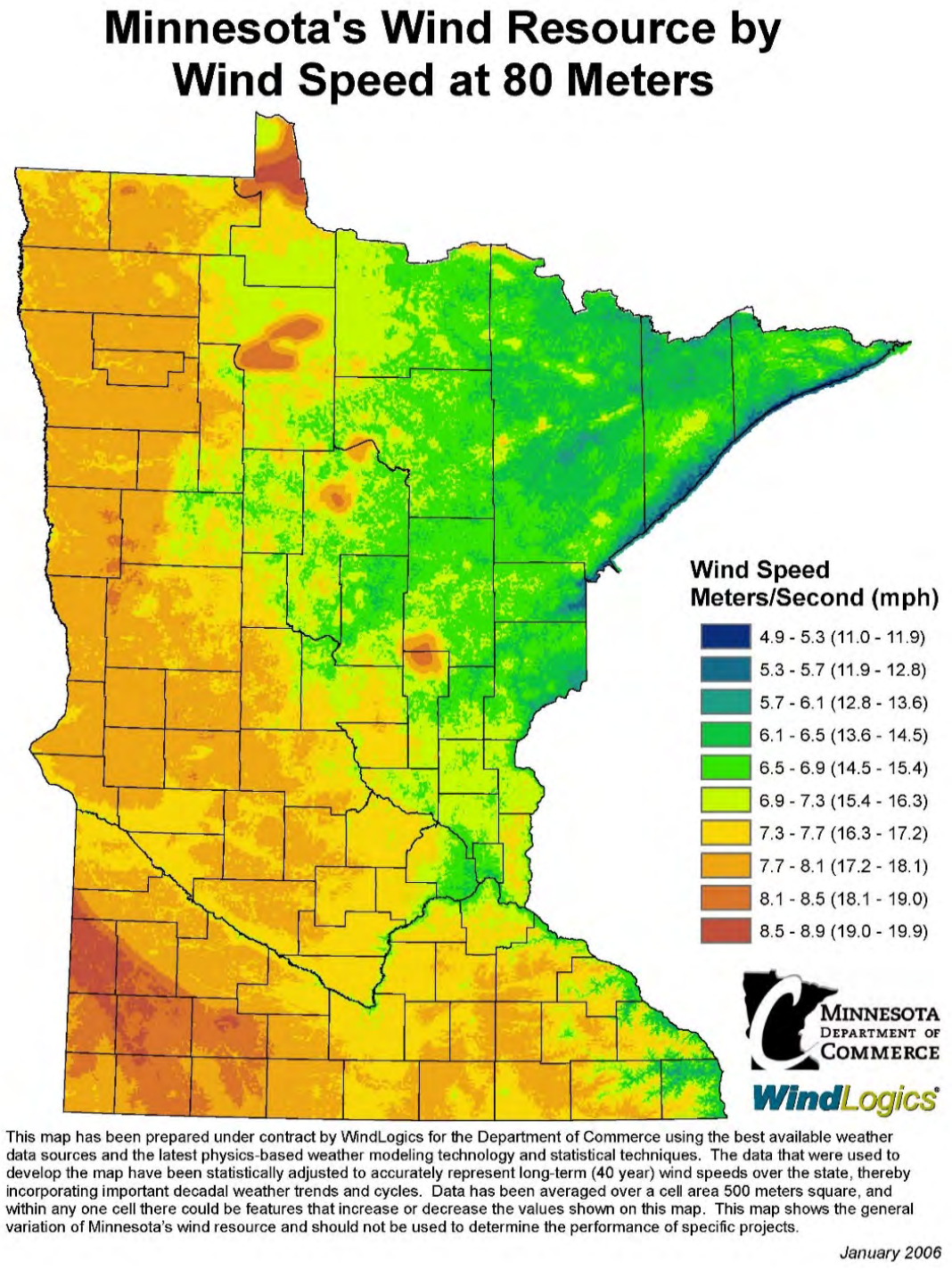
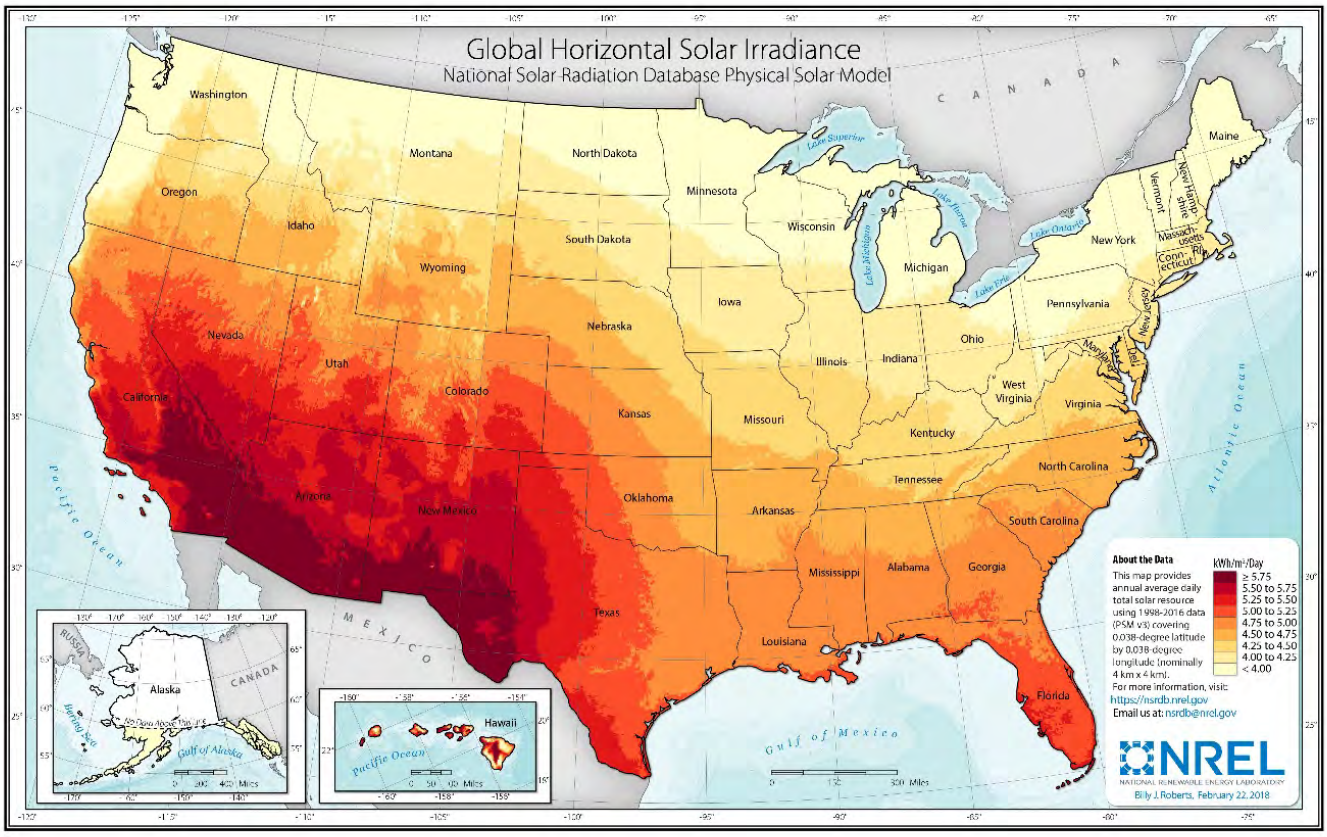


Figure 3-4. Global Horizontal Solar Irradiance: United States



3.3.3 335 MW Solar Facility with Battery Storage (Located elsewhere in the State)

Another system alternative to the hybrid Big Bend Wind and Red Rock Solar Project is a solar energy facility of similar electrical capacity as the proposed hybrid project with the addition of a battery storage component to a solar facility as outlined in the 335 MW Solar Facility Alternative. The solar facility with battery storage alternative could be at a single site or could be several smaller utility-scale sites. The battery energy storage system (BESS) to be used for analysis purposes, will have a lithium-ion chemistry, and will be located near the solar generation site, also referred to as being co-located with the generator. Lithium-ion battery systems such as this utilize semitrailers to house the BESS.

[96] Minnesota Department of Commerce, Map Resources
https://stage.wcm.mnit.mn.gov/commerce/industries/energy/technical-assistance/maps.jsp

3.3.4 No Build Alternative

The no build alternative assumes no hybrid wind energy and solar energy project is constructed. The analysis for this alternative considers the potential benefits and drawbacks of not constructing the proposed Big Bend Wind Project and Red Rock Solar Project.

The no build alternative analyzes the impacts of the status quo. For example, with a proposed roadway project, the no build alternative assesses the impacts associated with not improving the roadway. This includes potential traffic increases on nearby roads and highways, increased maintenance costs, and longer travel times.

For the proposed hybrid wind energy and solar energy project, the primary impacts of the no build alternative are: (1) reducing the state's ability to meet its renewable energy objectives, (2) the loss of economic benefits in the project area, and (3) the possible negative impact of providing replacement electricity from a non-renewable energy source.

The potential impacts of the no build alternative are discussed below.

Drawbacks of the No Build Alternative

Failure to Further Renewable Energy Objectives

Minnesota has committed to a renewable energy objective of generating 25 percent of its electricity from eligible renewable sources by the year 2025.[97] Minnesota utilities forecast the need for 5,841 MW of renewable generation by the year 2025 to meet this objective.[98] If the hybrid Big Bend Wind and Red Rock Solar Project is not built, it could reduce the state's ability to meet renewable energy objectives.

Loss of Economic Benefits

If the proposed hybrid wind energy and solar energy project is not built, there would be a loss of economic benefits in the project area. Landowners would lose lease payments over the operational life of the project. Local governments would lose wind energy production tax revenues. The wind project will pay a Wind Energy Production Tax to the local units of government of $0.0012 per kilowatt-hour (kWh) of electricity produced. This would result in an estimated total Wind Energy

[97] Minn. Statute 216B.1691.
[98] Minn. Statutes 216C.05.

Production Tax revenues of $38,900,000, over the projected 30 year operational life of the proposed wind facility.[99]

The solar project will pay approximately $208,000 annually in production tax payments to Cottonwood County, which will total approximately $6,200,000 over the 30 year solar project life. Additionally, the solar project will pay approximately $52,000 annually to Midway Township, and which will total approximately $1,600,000 over the life of the project.[100]

Big Bend has stated that it will form the "Big Bend Community Fund," a 501(c)(3) organization for the purpose of engaging in and contributing money to the support of charitable activities within the communities near the Project. Assuming the Wind Project is constructed at 300 MW, the Project will contribute $60,000 annually to the Big Bend Community Fund to support charitable activities within the neighboring communities.

If the hybrid Big Bend Wind and Red Rock Solar Project is not constructed, there would be a loss of revenue to local businesses. The proposed wind project is expected to generate approximately 316 jobs during project construction, and 14 permanent operation and maintenance jobs.[101] The solar project is expected to generate up to 200 temporary construction jobs and one permanent operation and maintenance job.[102]

These employment opportunities and associated income would be lost if the project is not built. If the hybrid Big Bend Wind and Red Rock Project is not constructed, local labor would not be employed in the construction or operation of the project, although to some degree this loss would be offset by other employment opportunities. The location of these opportunities is unknown.

Replacement with Non-Renewable Resources

Impacts of non-renewable energy sources vary. However, it is possible that if the hybrid Big Bend Wind and Red Rock Solar Project is not built, the electrical power it would have produced may be replaced with a non-renewable energy resource. The projected average annual output from the Big Bend Wind Project is between approximately 1129 and 1225 gigawatt-hours. [103]

[99] Amended Wind SPA – Section 8.13.3
[100] Solar CAN – Section 4.3.1
[101] Amended Wind SPA – Section 8.13.3
[102] Solar SPA – Section 3.5
[103] Amended Wind SPA – Section 10.9.2

The projected average annual output from the Red Rock Solar Project is anticipated to be between 115,632 and 135,034 megawatt-hours.[104] Though the impacts associated with non- renewable sources vary, it is possible to estimate, as an example, the impact of replacing the hybrid Big Bend Wind and Red Rock Solar Project MWh/year output with natural gas or, less likely, coal energy. However, since no non-renewable proposals are being considered in this case, that comparative analysis is not pursued in this review.

Benefits of the No Build Alternative

Benefits of not building the project include avoidance of potential human and environmental impacts associated with the proposed hybrid wind and solar project. These potential impacts are discussed further in Chapter 4 for the hybrid wind and solar project and in Chapter 7 of this EA for the associated transmission project.

[104] Solar CNA – Section 5.1.2

4 Big Bend Wind Project and Red Rock Solar Project and System Alternatives - Human and Environmental Impacts

Chapter 4 defines human and environmental impacts and mitigative measures that are anticipated to occur specifically for the Red Rock Solar Project site. It also discusses the environmental setting, the potential human and environmental impacts of the proposed hybrid Big Bend Wind and Red Rock Solar project and the identified system alternatives, along with possible mitigation strategies.

This chapter is intended to satisfy environmental report requirements for the CNs for the projects, Minnesota Rules 7849.1500, as well as the environmental assessment requirements specific to the Red Rock Solar Project site permit application and process, Minnesota Rule 7850.3700. As such, the discussion of potential human and environmental impacts and mitigation measures for the Red Rock Project will be specifically identified, but it will likely be included with relevant discussion of the hybrid wind and solar project, as a whole.

4.1 Describing Potential Impacts

Potential impacts are measured on a qualitative scale based on an expected impact intensity level; the impact intensity level takes mitigation into account.

A potential impact is the anticipated change to an existing condition caused either directly or indirectly by the construction and operation of a proposed project. Potential impacts can be positive or negative and short- or long-term. Impacts vary in duration and size, by resource, and across locations. In certain circumstances, potential impacts can accumulate incrementally meaning that impacts from the project would be in addition to on-the-ground impacts already occurring.

Direct impacts are caused by the proposed action and occur at the same time and place. An indirect impact is caused by the proposed action but is further removed in distance or occurs later in time. This EA considers direct and indirect impacts that are reasonably foreseeable, which means a reasonable person would anticipate or predict the impact. Cumulative potential effects are the result of the incremental impacts of the proposed action in addition to other projects in the environmentally relevant area.

4.1.1 Potential Impacts and Mitigation

To provide appropriate context, the following terms and concepts are used to describe and analyze potential impacts:

Duration Impacts vary in length. Short-term impacts are generally associated with construction. Long-term impacts are associated with the operation of the project. Permanent impacts extend beyond project decommissioning and reclamation.

Size Impacts vary in size. To the extent possible, potential impacts are described quantitatively, for example, the number of impacted acres or the percentage of affected individuals in a population.

Uniqueness Resources are different. Common resources occur frequently, while uncommon resources are not ordinarily encountered.

Location Impacts are location dependent. For example, common resources in one location might be uncommon in another.

The context of an impact—in combination with its anticipated on-the-ground effect—is used to determine an impact intensity level, which can range from highly beneficial to highly harmful. Impact intensity levels are described using a qualitative scale, which is explained below. These terms are not intended as value judgments, but rather a means to ensure common understanding among readers and to compare potential impacts between alternatives.

Negligible impacts do not alter an existing resource condition or function and are generally not noticeable to an average observer. These short-term impacts affect common resources.

Minimal impacts do not considerably alter an existing resource condition or function. Minimal impacts might, for some resources and at some locations, be noticeable to an average observer. These impacts generally affect common resources over the short- or long-term.

Moderate impacts alter an existing resource condition or function and are generally noticeable to the average observer. Impacts might be spread out over a large area making them difficult to observe but can be estimated by modeling. Moderate impacts might be long-term or permanent to common resources, but generally short- to long-term to uncommon resources.

Significant impacts alter an existing resource condition or function to the extent that the resource is impaired or cannot function. Significant impacts are likely noticeable or predictable to the average observer. Impacts might be spread out over a large area making them difficult to observe but can be estimated by modeling. Significant impacts can be of any duration and affect common or uncommon resources.

Also discussed are opportunities to mitigate potential impacts by avoiding, minimizing, or correcting the on-the-ground effect. Collectively, these actions are referred to as mitigation.

To avoid an impact means to eliminate it altogether, for example, by not undertaking part or all the project, or relocating the project.

To minimize an impact means to limit its intensity, for example, by reducing project size or moving a portion of the project.

To correct an impact means fixing it by repairing, rehabilitating, or restoring the affected resource, or compensating for it by replacing it or providing a substitute resource elsewhere. Correcting an impact can be used when an impact cannot be avoided or further minimized.

Some impacts can be avoided or minimized; some might be unavoidable but can be minimized; others might be unavoidable and unable to be minimized but can be corrected. The level at which an impact can be mitigated might change the impact intensity level.

Regions of Influence

Potential impacts to human and environmental resources are analyzed within specific geographic areas called regions of influence (ROI). The ROI is the geographic area where the project might exert some influence and is used as the basis for assessing potential impacts. ROIs vary by resource. As necessary, the EA discusses potential impacts and mitigation measures beyond the identified ROI to provide appropriate context. Also, direct impacts within the ROI might cause indirect impacts outside the ROI.

This EA uses the following ROIs for the analysis of human and environmental impacts associated with the Red Rock Solar Project: anticipated **project boundary** (areas of involved in project construction, areas within the fenced in facilities, i.e. solar array, substation, and the collection line corridor); **Local Vicinity** (1,000 feet from the project boundary); **project area** (one mile from the project boundary); and **Cottonwood County**. The ROIs are based on a distance from an anticipated alignment developed by the applicant and extend on both sides of the centerline. **Table 4-1** summarizes the ROIs used in this EA by resource element.

Table 4-1. Regions of Influence for the Red Rock Solar Project

Resource Type	Resource Element	Region of Influence
Human Settlement	Displacement, Electrical Interference, Land Use and Zoning	Project Boundary
	Aesthetics, Noise, Property Values, Recreation	Local Vicinity
	Cultural Values, Environmental Justice	Project Area
	Socioeconomics	Cottonwood County
Public Services	Airports, Roads, Emergency Services, Public Utilities	Project Area
Public Health and Safety	Electric and Magnetic Fields, Implantable Medical Devices, Stray Voltage, Worker and Public Safety	Project Boundary

Land-based Economies	Agriculture, Forestry, Mining	Project Boundary
	Tourism	Project Area
Archaeological and Historic Resources		Project Area
Natural Environment	Geology, Topography, Soils, Vegetation	Project Boundary
	Water Resources, Wetlands, Wildlife (except birds), Wildlife Habitat	Project Boundary
	Wildlife (birds)	Local Vicinity
	Air Quality, Climate Change	Project Area
	Rare and Unique Resources	Project Area

4.1.2 Environmental Setting

The project area is rural open space. Agriculture, both cultivated croplands and livestock are present throughout the project area, as are homesteads.

Prior to colonization, Dakota and Ojibwe peoples occupied lands in the future state of Minnesota. "Dakota and Ojibwe cultures arise from an intimate knowledge of place, from personal, local connections among people and the rest of the natural world. Ojibwe and Dakota languages, family and political structures, traditional economies, and spirituality arose from and were shaped by the landscape through which people walk."[xxiii]

The project area is located in the Minnesota River Prairie subsection, and was likely dominated by tallgrass prairie with islands of wet prairie and wetlands. Floodplain forests dominated by silver maple, elm, cottonwood, and willows grew along the rivers and streams. The soils throughout the area have been highly influenced by recent glaciation and is well to moderately well-drained loamy soils.

4.2 Potential Impacts to Human and Environmental Resources

4.2.1 Potential Impacts to Human Settlement

4.2.1.1 *Aesthetics*

Large energy projects can pose an impact aesthetically or on visual resources. This EA examines potential aesthetic impacts; additionally, impairment of visibility

Aesthetic, or visual resources, are generally defined as the natural and built features of a landscape that may be viewed by the public and contribute to the visual quality and character of an area. Aesthetic resources form the overall impression that an observer has of an area or its landscape character. Distinctive landforms, water bodies, vegetation, and human-made features that contribute to an area's aesthetic qualities are elements that contribute to an area's visual character. Visual quality is generally defined as the visual significance or appeal of a landscape based on cultural values and the landscape's intrinsic physical elements.

Viewer sensitivity is an individual's interest or concern for the quality of a viewshed and varies depending upon the activity viewers are engaged in, their values and expectations related to the viewshed, and their level of concern for potential changes to the viewshed. Individuals using protected, natural, cultural, or historic areas will likely have high viewer sensitivity to changes within the viewshed of the area they are visiting and using. High viewer sensitivity is generally associated with individuals engaged in recreational activities, traveling to scenic sites for pleasure and to or from recreational areas, experiencing viewsheds from resorts, or road-side pull-outs. Residents may have a high sensitivity to potential aesthetic impacts. Low viewer sensitivity is generally associated with individuals commuting, working, or passing through an area.

Viewer exposure varies for any particular view location or travel route depending on the number of viewers and the frequency and duration of their views. Viewer exposure would typically be highest for views experienced by high numbers of people, frequently, and for long periods. Other factors, such as viewing angle and viewer position relative to a feature or area, can also be contributing factors to viewer exposure.

Viewshed Impacts

The proposed Big Bend Wind Project will place additional turbines on the landscape that currently are not present. These turbines will have unavoidable impacts on the residences in the project area, and visitors to the area. The Jeffers Petroglyphs site is located approximately 2.7 miles north of the Big Bend Wind project area. The Jeffers Petroglyphs site is of great significance to Native American Tribes in Minnesota, as well as Tribes outside of Minnesota. Native American Tribes utilize the Jeffers Petroglyphs for various ceremonial purposes, and the connection between the rock carvings, the horizon, and constellations are very significant. Additional discussion regarding cultural values of the Jeffers Petroglyphs is in Section 4.2.1.2.

Because they are generally large facilities (footprint) with numerous highly geometric and sometimes highly reflective surfaces, solar energy facilities may create visual impacts; however, being visible is not necessarily the same as being intrusive. Due to their relatively low profile, PV solar facilities will not be visible from great distance; the viewshed and aesthetic impacts will be experienced primarily by nearby residents and people using the roads adjacent to the facilities.

Typically, when the PV panels are at a zero-degree angle (sun is directly overhead) panels will be approximately four to six feet off of the ground. When panels are at their maximum tilt of 45 degrees (tilted east in the morning and west in the afternoon as the panels follow the sun) the tops of the panels may be approximately 20 feet off the ground. Unlike concentrating solar, which uses mirrors to concentrate the solar energy to create heat energy used to create electricity, modern PV panels are constructed of dark, light-absorbing material and covered with an anti-reflective coating in order to limit reflection. Because of the materials used, glare and reflection should be minimal; today's panels reflect as little as two percent of the incoming sunlight depending on the angle of the sun and assuming use of anti-reflective coatings.

Perimeter fencing for solar farms in Minnesota are typically eight-foot wood pole and woven wire fence (i.e. deer fence or an agricultural fence) that shield or minimize the visual impacts.

Shadow Flicker

Shadow flicker (Diagram 4-1) is a phenomenon associated with wind facilities; the effect of the sun (low on the horizon) shining through the rotating blades of a wind turbine, casting a moving shadow. It is perceived as a "flicker" due to the rotating blades repeatedly casting the shadow. Although in many cases shadow flicker occurs only a few hours in a year, it can potentially create a nuisance for homeowners in close proximity to turbines.

Shadow flicker caused by wind turbines is defined as alternating changes in light intensity at a given stationary location (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 close enough to the turbine to be able to distinguish a shadow.

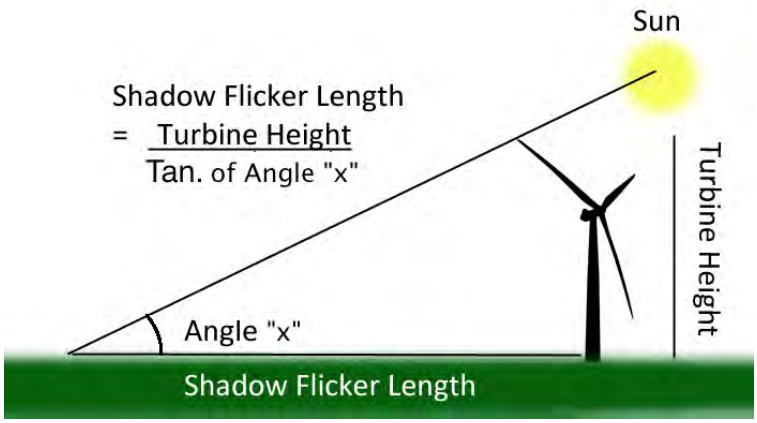
Shadow intensity, or how "light" or "dark" a shadow appears at a specific receptor, will vary with distance from the turbine. The closer a receptor is to a turbine, the more turbine blades block out the sun's rays, and shadows will be wider and darker. Receptors located farther away from a turbine experience thinner and less distinct shadows since the blades block out less sunlight. Shadow flicker is reduced or eliminated when buildings, trees, blinds, or curtains are located between the turbine and receptor.

While there are no rules for a Minnesota "light standard" defining the amount of shadow flicker that is acceptable for a commercial wind project, the default industry standard is for no occupied residence to receive more than 30 hours per year of shadow flicker (in Minnesota, this is generally applied to non-participating landowners). No other states have adopted a standard for shadow flicker; however, other

countries have examined the issue and have adopted standards. Standards depend on assumptions about how flicker impacts are to be calculated:[105]

- Germany has established a "norm" for shadow flicker that does not exceed 30 hours/yr. or 30 minutes/day at a receptor. It is unclear whether this is a worst-case scenario (e.g., clear skies every day) or a real-case scenario (e.g., weather representative of the Project area).
- Belgium has adopted the German norm, adding a requirement for modeling in an EIA.
- Denmark recommends a maximum of 10 hours/yr. assuming average cloud cover in the Project area.
- France has adopted no standard but requires shadow flicker modeling.
- The Netherlands have adopted a yearly maximum of 5 hours and 40 minutes assuming clear skies.
- The State of Victoria, Australia, has adopted a shadow flicker standard of 30 hours/yr.

Diagram 4-1. Shadow Flicker[106]



[105] Haugen, Katherine M.B. 2011. *International Review of Policies and Recommendations for Wind Turbine Setbacks from Residences: Setbacks, Noise, Shadow Flicker, and Other Concerns*. Minnesota Department of Commerce. https://mn.gov/eera/web/project-file?legacyPath=/opt/documents/International_Review_of_Wind_Policies_and_Recommendations.pdf.

[106] Environmental issues and impacts for wind power, John Twidell. *EU/Thailand Seminar, Bangkok; Oct 4 & 5 2012.*

Facility and Structure Lighting

Temporary lighting can be necessary for worker and public safety during the construction phase energy projects. Permanent lighting is generally necessary for ongoing operations and maintenance of large energy projects, and is installed near O&M areas, security gates and in perimeter areas.

Large electric generating facilities would generally have some type of lighting at the facility to ensure safe operation of the facility. The Federal Aviation Administration (FAA) requires that all structures more than 200 feet above the ground have proper lighting or marking to allow for safe air navigation.[107] To meet this requirement wind turbines are typically lighted with red flashing lights, which can create an undesirable nighttime view in a rural setting for some individuals.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

The Big Bend Wind portion of the hybrid project would alter the current landscape through the introduction of large wind turbines. Many factors influence how a wind energy facility is perceived. Factors may include levels of visual sensitivity of individuals, viewing conditions, visual settings, and individual ideas and experiences. Distance from a turbine(s) and activities within and near the project area, landscape features such as hills and tree cover, as well an individual's personal feelings about wind energy technology can all contribute to how a wind energy facility is perceived. The wind portion of the hybrid project would be located in a predominantly rural, agricultural area characterized by flat to gently undulating topography.

The topography of the Project Area is glaciated, gently rolling plains with elevations ranging from 1,109 to 1,421 feet above sea level. Elevations decrease in a southwest to northeast direction; the highest elevations are in the west/southwest corner of the wind portion of the Project Area. Agricultural fields, farmsteads, and gently rolling topography visually dominate the Project Area. The landscape can be classified as rural open space.[108]

Viewsheds in this area are generally broad and uninterrupted, with only small scattered areas where they are defined by trees or topography. The settlements in the vicinity are residences and farm buildings scattered along rural county roads. The area is also shaped by a built environment.

---

[107] Federal Aviation Administration. 2000. *Proposed construction or alteration of objects that may affect the navigable airspace. FAA Advisory Circular AC 70/7460-2K*, http://rgl.faa.gov/REGULATORY_AND_GUIDANCE_LIBRARY/RGADVISORYCIRCULAR.NSF/0/22990146db0931f186256c2a00721867/$FILE/ac70-7460-2K.pdf

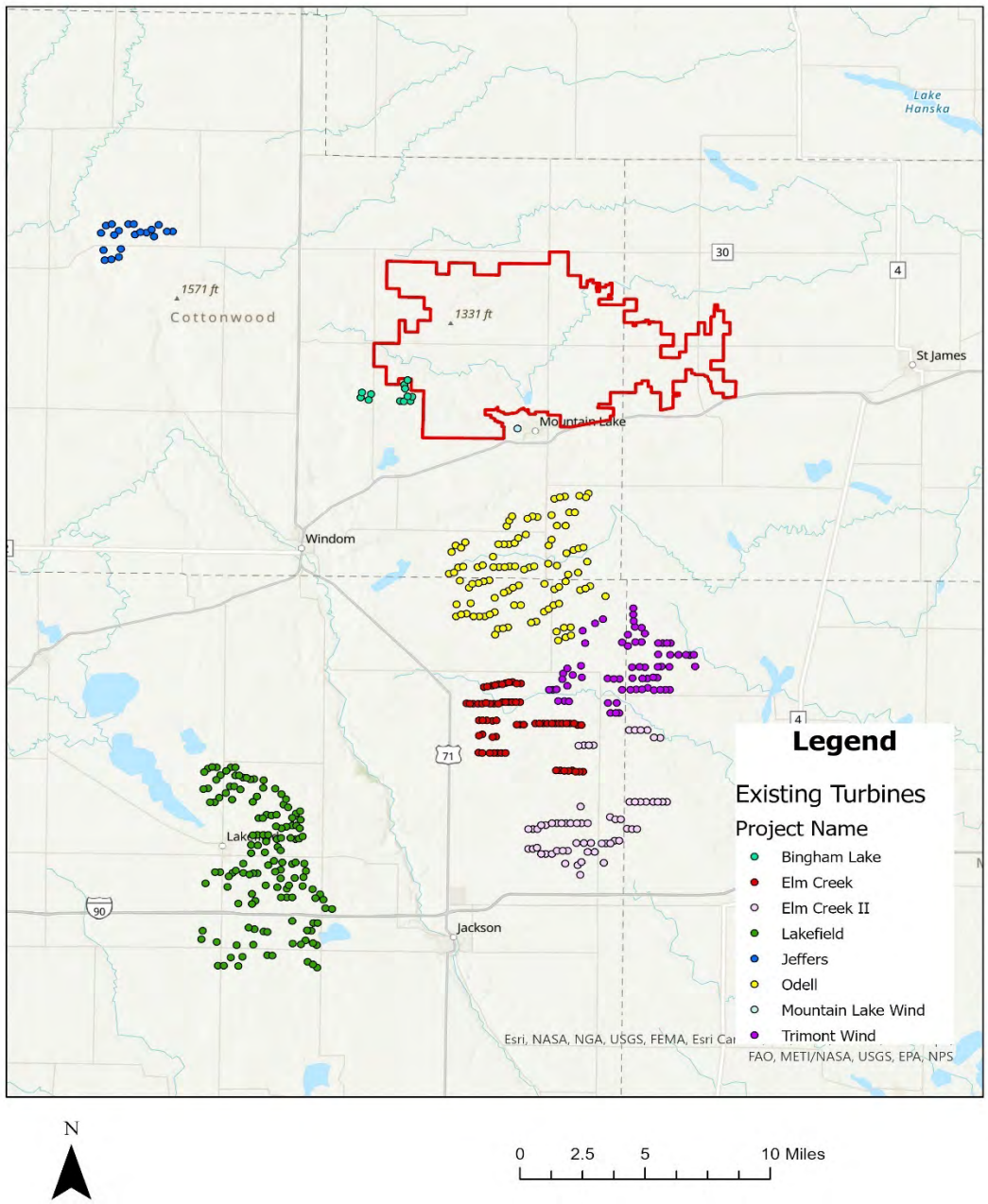
[108] Amended Wind SPA – Section 8.5.1.1

Horizontal elements, such as highways and county roads, are consistent with the long and open viewsheds in the area. Vertical elements such as transmission lines and wind turbines are visible from considerable distances and are the tallest and often the most dominant visual feature on the landscape.

There are several wind facilities located south and west, within 10 miles, of the Big Bend Wind portion of the hybrid project, and turbines at these facilities are currently visible to residents within the Big Bend Wind portion of the Project Area (**Figure 4-1**). Mountain Lake Wind (one turbine), Bingham Lake Wind (eight turbines), Farmers' Ridge/Westridge Wind (four turbines), Odell Wind Farm (100 turbines), Odin Wind Farm (10 turbines), Trimont Area Wind Farm (67 turbines), and Jeffers Wind Energy Center (20 turbines).[109]

[109] Amended Wind SPA – Section 8.5.1.1

Figure 4-1. Nearby Operating Wind Facilities



Residences with turbines and associated infrastructure closest to their homes are those that are participating in the Project by signing easements. The closest turbine to a participating residence is

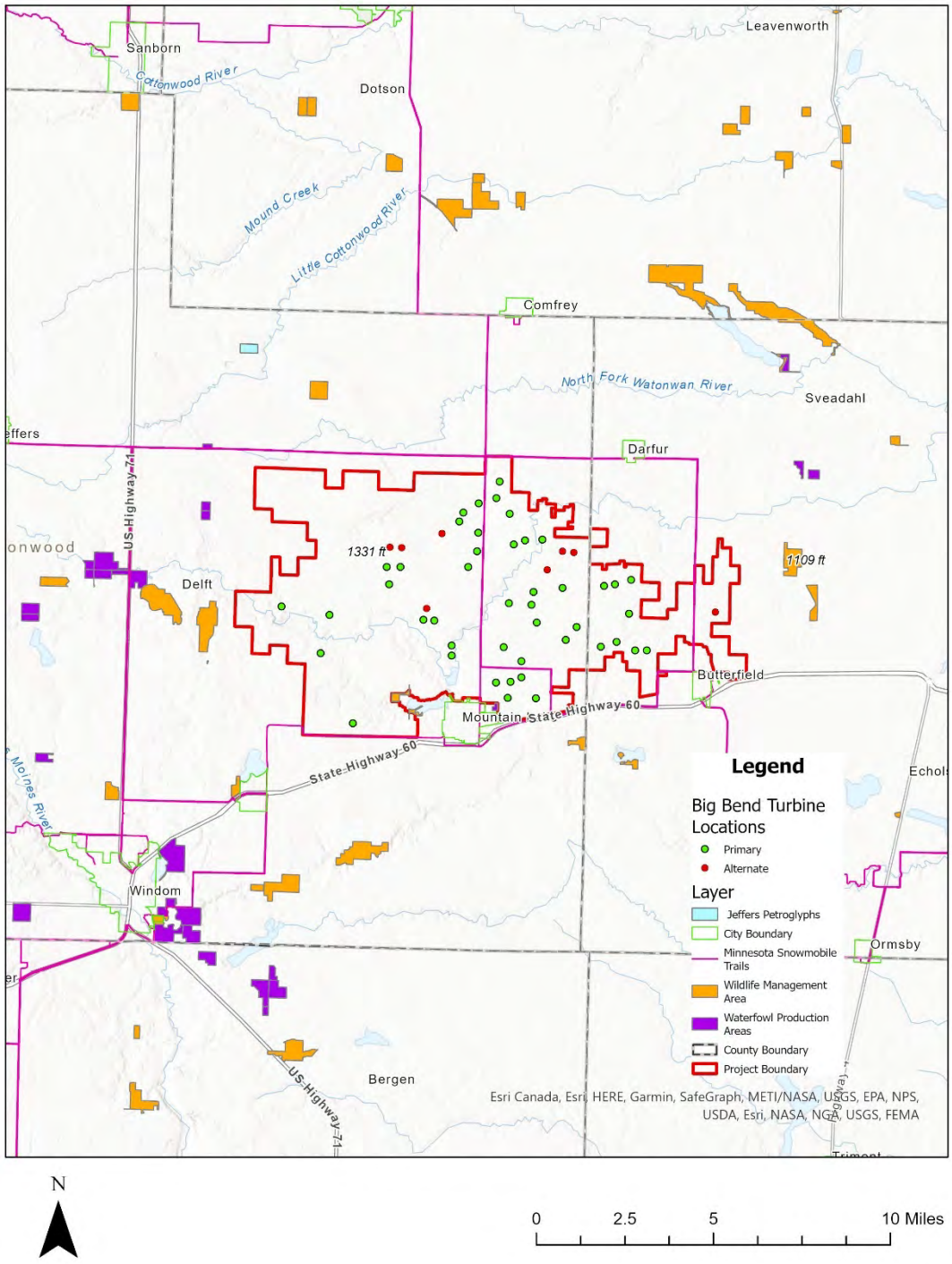
1,367 feet, and the closest turbine to a non-participating residence is 2,380 feet.[110] While people living in or traveling through the area are accustomed to viewing wind turbines, the Project will add to the cumulative visual impacts by adding up to 52 new turbines in the area.

The wind project will be located within the viewshed of MNDNR-managed Wildlife Management Areas (WMAs), USFWS Waterfowl Production Areas (WPAs), lands owned by The Nature Conservancy, Jeffers Petroglyphs Site, and other natural areas may be visible by people using those areas, see **Figure 4-2**. The degree of the visual and unavoidable impact on public resources will vary based upon the distance from the Project, obstructions such as trees between the public resource and Project, a viewer's orientation to the Project (i.e., facing towards or away), and the viewer's personal preferences.[111]

[110] Amended Wind SPA – Section 8.5.2.2

[111] Amended Wind SPA – Section 8.5.2.1

Figure 4-2. Public Areas with Potential Visual Impacts from the Wind Project



All turbines will be set back from public lands based on a minimum of the 3 RD by 5 RD setbacks from all non-leased properties per the Commission siting guidelines. To the extent public resources are utilized at night, turbine lighting may be visible.

The facilities within the Red Rock Solar portion of the hybrid project will be visible from adjacent roads and parcels. The facilities are relatively low profile and won't be visible from long distances. The closest residence to the solar portion of the hybrid project is 364 feet to the north. The Solar Project Substation will have a vertical profile of between 80 to 120 feet above the ground.

Big Bend conducted a shadow flicker assessment on the proposed site layouts to determine impacts. The Shadow Flicker Report provides details regarding the methodology (WindPRO modeling) and results of the assessment.[112]

Shadow flicker frequency calculations for the Project were modeled for 970 residences (receptors) for all turbines in each layout; all non-participating residences are expected to experience below 30 hours per year of shadow flicker for all turbine models and layouts evaluated (Table 4-2).[113]

Shadow flicker from wind turbines has raised concerns to the health of photosensitive individuals (including those with epilepsy); the Epilepsy Foundation has determined that generally, the frequency of flashing lights most likely to trigger seizures is between five and 30 flashes per second.[114] 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 Hz (i.e., 1.5 flashes per second), which is below the frequency range that is thought to trigger seizures.

Table 4-2: Maximum Shadow Flicker (hours/year)[115]

Turbine Model	Maximum Shadow Flicker (hours/year)	
	Participating	Non-Participating
Nordex N-163	59 hours : 36 minutes	25 hours : 50 minutes
Vestas V162	59 hours : 10 minutes	25 hours : 28 minutes
GE-158	57 hours : 10 minutes	23 hours : 56 minutes

[112] Amended Wind SPA – Appendix F
[113] Amended Wind SPA – Section 8.5.4.2
[114] https://www.epilepsysociety.org.uk/wind-turbines-and-photosensitive-epilepsy#.XjmIb2dYbcs.
[115] Amended Wind SPA – Section 8.5.4.2 and Table 8.5-4

The wind project will have some non-turbine facilities (e.g. O&M facility and Collector Substation) which must be lit at times to allow for worker safety.

Because of the relatively low profile of PV solar farms FAA lighting requirements are not applicable to Red Rock Solar. Temporary lighting would be expected during the construction phase of the solar portion of the hybrid project. After construction, any temporary service poles/lights would be removed. Permanent motion-activated lighting is anticipated to be installed near O&M areas, security gates and in perimeter areas.

335 MW Solar Facility (No wind component)

The facilities within the 335 mw solar facility system alternative will be visible from adjacent roads and parcels. The facilities would relatively low profile and won't be visible from long distances. The potential impacts to viewshed for this system alternative would be similar to those of the solar portion of the proposed hybrid project, but larger in scale due to using more land to meet the needed 335 MW capacity with all solar generation.

No shadow flicker impacts will occur with this system alternative.

Because of the relatively low profile of PV solar farms FAA lighting requirements are not applicable to solar farms.

Temporary lighting would be expected during the construction phase of any solar farm project. After construction, any temporary service poles/lights would be removed. Permanent motion-activated lighting is anticipated to be installed near O&M areas, security gates and in perimeter areas. Standard downward lighting should be utilized to minimize impacts to adjacent land uses.

Potential impacts on aesthetics of this system alternative are anticipated to be similar to those of the proposed Red Rock Solar portion of the hybrid project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

A 335 MW hybrid wind and solar facility alternative, located elsewhere in Minnesota, the wind portion of the alternative will generate visual impacts on the landscape and shadow flicker noticeable to residents within the project area. The impacts of the wind portion of the 335 MW hybrid wind and solar facility alternative would be similar to those of Big Bend Wind, if the alternative was sited in a similar agricultural setting. The impacts could vary in other settings or be perceived as more impactful, such as in a more populated area.

A 335 MW hybrid wind solar facility alternative, located elsewhere in Minnesota, would have lighting impacts similar to the the proposed hybrid wind and solar project.

Temporary lighting would be expected during the construction phase of any solar farm project. After construction, any temporary service poles/lights would be removed. Permanent motion-activated lighting is anticipated to be installed near O&M areas, security gates and in perimeter areas. Standard downward lighting should be utilized to minimize impacts to adjacent land uses.

Potential impacts of this system alternative are anticipated to be similar to those of the proposed projects.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

Because of the relatively low profile of PV solar farms FAA lighting requirements are not applicable to solar facilities.

No shadow flicker impacts will occur with this system alternative.

Temporary lighting would be expected during the construction phase of any solar facility and battery storage project. After construction, any temporary service poles/lights would be removed. Permanent motion-activated lighting is anticipated to be installed near O&M areas, security gates and in perimeter areas. Standard downward lighting should be utilized to minimize impacts to adjacent land uses.

The 335 MW solar facility with battery storage alternative will have similar visual impacts as the 335 MW solar facility alternative, with additional visual impacts to nearby residents and users of local roads the respect to the battery storage portion of the facility. These additional lights would have negligible impacts on an individual outside of the facility.

Potential impacts on aesthetics of this system alternative are anticipated to be similar to those of the proposed Red Rock Solar portion of the hybrid project.

Mitigation

Mitigation of impacts to aesthetic and visual resources is best accomplished through micro-siting of wind turbines and maintaining designated setbacks from participating and non-participating landowners. In general, siting wind projects in rural areas minimizes human impacts. Aesthetic impacts to public lands can be mitigated by siting wind projects outside of these areas and utilizing natural features such as topography and vegetation to reduce visual intrusions.

Setbacks for individual turbines assist in mitigating visibility impacts. Wind turbines must be set back from non-participating property lines a minimum distance of 5 rotor diameters (RD) on the prevailing wind direction and 3 RD on the non-prevailing wind direction. Turbines are designed to be a uniform off-white color to blend in with the horizon and reduce visibility impacts.

Specific to the Big Bend portion of the hybrid project concerning means to minimize potential aesthetic impacts, the Applicant has stated that it will implement the following measures:[116]

- Wind turbines will exhibit visual uniformity in the shape, color, and size of rotor blades, nacelles, and towers.
- Collection cables or lines on the site will be buried in a manner that minimizes additional surface disturbance (e.g., collocating them with access roads, where feasible).
- For ancillary buildings and other structures, low-profile structures will be chosen whenever possible to reduce their visibility.
- Turbine foundations and roads have been designed to minimize and balance cuts and fills.
- Facilities, structures, and roads will be located in stable fertile soils to reduce visual contrasts from erosion and to better support rapid and complete regrowth of vegetation
- Lighting for facilities will not exceed the minimum required for safety and security, and full-cutoff designs that minimize upward light pollution will be selected.
- Big Bend has stated that it will install aircraft detection lighting system (ADLS) that are off until aircraft approach.
- Commercial messages and symbols on wind turbines will be avoided.
- Wind turbines will be sited consistent with the Settlement Agreement among Big Bend and Intervenors.[117]

Specific to the Jeffers Petroglyphs site there was a Settlement Agreement[118] that was mutually agreed upon by Big Bend Wind, LLC, Red Rock Solar, LLC, Apex Clean Energy Holdings, LLC, Minnesota Historical Society, Lower Sioux Indian Community in the State of Minnesota, and the Upper Sioux Community would establish a turbine setback distance of at least 6.5 miles from the Jeffers Petroglyph site. In reviewing the Visual Impact Assessment Report for the Big Bend Wind Project, it is evident that

[116] Amended Wind SPA – Section 8.5.3

[117] Amended Wind SPA – Appendix B

[118] Big Bend Wind, LLC. Big Bend Settlement Agreement. September 14, 2021. eDocket ID# 20219-177943-02, 20219-177943-05, 20219-177943-08, 20219-177943-11, 20219-177943-14, 20219-177943-17, 20219-177943-20, 20219-177943-23 (hereinafter referred to as the Settlement Agreement)

individual users of the Jeffers Petroglyphs site will be able to see the turbines at the Big Bend Wind Project. Those user impacts will vary depending on the viewer's intended use of the Jeffers Petroglyphs site and the weather conditions and visibility at the time of use.

Mitigating the visual or aesthetic impacts from the Red Rock Solar Project may involve screening the site with a combination of perimeter fencing, vegetation, and berms depending on the setting.

The most practical solutions to shadow flicker issues include:

- Providing education to landowners about how to minimize the effect of shadow flicker.
- Provide screening (blackout curtains, vegetation planting, awnings) to limit the view of the offending turbine(s).
- Implement Turbine Control Software programmed to temporarily shut down the offending turbine(s) during the periods where shadow flicker effects can occur.[119]

Shadow flicker is not produced by solar panels, so no mitigation is proposed for the solar project.

Lighting of the wind turbines will be consistent with FAA guidelines and is similar to that for other tall structures in rural areas, such as communication towers. Big Bend has stated that it will coordinate with the FAA on potential implementation of an Aircraft Detection Lighting System (ADLS) for the Project.[120] If approved by the FAA, during operation ADLS will detect approaching aircraft and the synchronized flashing red lights on each of the turbines will turn on until the aircraft has moved beyond the project. The red lights on the turbines will be turned off when no aircraft are near the turbines.[121]

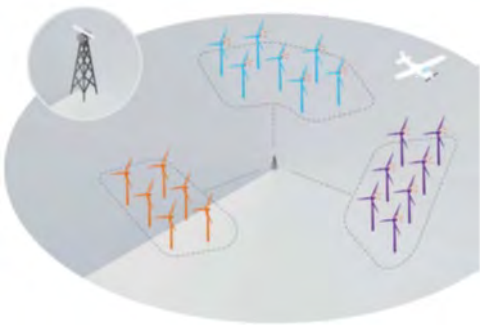
Big Bend must submit and receive FAA approval of lighting plan. A lighting plan will be provided prior to construction.

The FAA-has approved commercial operation of ADLS for use at other operating wind facilities. The ADLS is designed to mitigate the impact of nighttime lights by deploying a radar-based system around a wind farm, turning lights on only when low-flying aircraft are detected nearby.[122] The ADLS can be designed for a single wind facility, or to serve multiple wind farms (Diagram 4).

[119] Amended Wind SPA – Section 8.5.4.3
[120] Amended Wind SPA – Section 8.5.3
[121] Amended Wind SPA – Section 8.5.3
[122] Patterson, James. *Performance Assessment of the Laufer Wind Aircraft Detection System as an Aircraft Detection Lighting System*. FAA. 2018.

Approval was received from the Federal Communications Commission (FCC) and FAA Spectrum Office for the Vestas Intelilight system on January 11, 2017. The Vestas InteliLight system was installed at a wind park near Hancock, Maine in October 2017.[123]

Diagram 4-2. Aircraft Detection Lighting System[124]



All non-turbine facilities at the wind project will only be lit when workers are present, or at other times when lighting is absolutely necessary. Additionally, downward facing lights will be used at non-turbine facilities.

Red Rock Solar will use down lit security lighting at the Project entrance, and down lit, switch controlled, lights at each inverter to facilitate maintenance activities.[125] With mitigation measures, impacts to light sensitive land uses and the aesthetics of the area will be negligible.

4.2.1.2 Cultural Values

A hybrid wind and solar energy project is going to have the potential for effects, real or perceived, on a local area, including impacts to human, community and social environments. The human setting into which the proposed hybrid Big Bend and Red Rock Solar Project is being proposed to be set is rural and predominately agricultural. From a larger landscape perspective there are already a number of

---

http://www.airporttech.tc.faa.gov/DesktopModules/EasyDNNNews/DocumentDownload.ashx?portalid=0&moduleid=3682&articleid=26&documentid=1203.

[123] Patterson, James; Canter, Garrison. *Performance Assessment of the Vestas InteliLight X-Band System as an Aircraft Detection Lighting System (ADLS)*. FAA. 2018. https://www.airporttech.tc.faa.gov/Products/Airport-Safety-Papers-Publications/Airport-Safety-Detail/ArtMID/3682/ArticleID/165/Performance-Assessment-of-the-Vestas-InteliLight%E2%84%A2-X-Band-System-as-an-Aircraft-Detection-Lighting-System-ADLS.

[124] Electronics 360. *Video: Lighting Up Wind Turbine Airspace.* https://electronics360.globalspec.com/article/8760/video-lighting-up-wind-turbine-airspace

[125] Solar SPA – Section 4.2.4.1

commercial wind turbines operating to the west and the south of the proposed project, see Figure 4-1.

Cultural values are informed, in part, by history, heritage, work, recreational pursuits of residents, and geographical features. Cultural values in the hybrid project area are primarily tied to agricultural production, light industry, and recreational activities such as hunting and fishing.

Additionally, the Jeffers Petroglyphs site is located approximately 2.7 miles north of the Big Bend Wind Project boundary and approximately nine miles northwest of the Red Rock Solar Project boundary. The Jeffers Petroglyphs is a sacred and culturally significant site for several Native American Tribes throughout the United States, including Tribes in Minnesota. The rock carvings found at the Jeffers Petroglyphs site provide direct documentation of Native American presence in the area over the past several thousand years. The rock carvings also document significant Tribal historic events and spiritual beliefs tied to the sacred landscape. The Jeffers Petroglyphs site is still utilized by Native Americans for ceremonial and worship purposes, exchanging and learning Tribal oral histories, and providing a sense of place allowing Native Americans to connect with their ancestors.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

The value residents put on the character of the landscape within which they live is subjective, meaning its relative value depends upon the perception and philosophical or psychological responses unique to individuals. Because of this, construction of the project might—for some residents—change their perception of the area's character thus potentially eroding their sense of place. This tension between infrastructure projects and rural character creates real tradeoffs.

While negative impacts will occur to specific resource elements, for example, aesthetics, the construction and operation of the project is not anticipated to impact or alter the work and leisure pursuits of residents in the Big Bend Wind or Red Rock Solar Project Areas, or land use in such a way as to impact the underlying culture of the area. There is currently a significant presence of existing transmission lines and operating wind projects in all three counties, so the current aesthetics of the Project Area has structures that will be similar to those constructed for the Big Bend Wind and Red Rock Solar portions of the hybrid project.

The ROI for cultural values is the project area. The project contributes to the growth of renewable energy and is likely to strengthen and reinforce this value, especially in an area that already has wind farms. Development of the project will change the character of the area potentially changing residents' sense of place. There are tradeoffs for rural communities between renewable energy projects and retaining the rural character of an area. Construction and operation of the project is not anticipated to impact or alter the work and leisure pursuits of residents in the project area or land use in such a way as to impact the underlying culture of the area.

335 MW Solar Facility (No wind component)

As with a hybrid wind and solar facility impacts to cultural values from a 335 MW solar facility system alternative depends upon site-specific characteristics; it is difficult to assess the degree individual residents and users for a solar facility without knowledge of the land cover types, topography, and general environmental setting of a hypothetical project site.

Potential impacts of this system alternative are anticipated to be similar to those of the Red Rock Solar portion of the proposed hybrid project, only large in size due to a larger project area.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

As with a hybrid wind and solar facility impacts to cultural values from a 335 MW hybrid wind and solar facility system alternative depends upon site-specific characteristics; it is difficult to assess the degree individual residents and users for a hybrid facility without knowledge of the land cover types, topography, and general environmental setting of a hypothetical project site.

Potential impacts of this system alternative are anticipated to be similar to those of the proposed hybrid project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

As with a hybrid wind and solar facility impacts to cultural values from a 335 MW solar facility with battery storage system alternative depends upon site-specific characteristics; it is difficult to assess the degree individual residents and users users for a solar facility without knowledge of the land cover types, topography, and general environmental setting of a hypothetical project site.

Potential impacts of this system alternative are anticipated to be similar to those of the Red Rock Solar portion of the proposed hybrid project.

Mitigation

There are no conditions included in the Draft Site Permit or sample permit that directly mitigate impacts to cultural values, sense of place, or community unity.

Big Bend Wind, LLC, Red Rock Solar, LLC, Apex Clean Energy Holdings, LLC, Minnesota Historical Society, Lower Sioux Indian Community in the State of Minnesota, and the Upper Sioux Community developed a Settlement Agreement to establish setback distances for wind turbine locations within the Big Bend Wind Project to minimize visual impacts to individuals using the Jeffers Petroglyphs Site.

4.2.1.3 Displacement

In the context of this section of the EA, displacement means removing a residence or building to facilitate the safe construction and operation of the proposed wind energy facility or the construction and operation of the proposed solar generation facility.[xxiv] Wind turbine placement must meet several constraints and setbacks. Siting of the solar facility also must meet multiple setbacks to avoid impacts to various resources. Displacements are very rare in the context of wind and solar facilities.

Noise generated by the wind turbines and the solar array inverters create some of the greatest constraints with respect to siting project component and residences. Noise modeling was completed by Big Bend Wind, and all residences within the Big Bend Wind Project Area are not expected to experience noise levels that will exceed the Minnesota Noise Standards during operation of the proposed wind project. The nearest residence to a proposed wind turbine location is 1,367 feet. The Red Rock Solar portion of the hybrid project has been designed so the inverters will be located 1,122 feet from the nearest residence. Noise from the Red Rock Solar portion of the hybrid project's electric collection system would not be expected to be perceptible.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

No displacements are expected to occur due to the construction and operation of the Big Bend Wind Project or the Red Rock Solar Project.

335 MW Solar Facility (No wind component)

As with a hybrid wind and solar facility impacts, displacement caused by a 335 MW solar facility system alternative would be highly unlikely to occur.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

As with a hybrid wind and solar facility impacts, displacement caused by a 335 MW hybrid wind and solar facility system alternative would be highly unlikely to occur.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

As with a hybrid wind and solar facility impacts, displacement caused by a 335 MW solar facility with battery storage system alternative would be highly unlikely to occur.

Mitigation

No displacements are expected to occur due to the construction and operation of the Big Bend Wind Project or the Red Rock Solar Project, so no mitigation is proposed at this time.

4.2.1.4 *Electrical Interference*

The Big Bend Wind Project may cause short-term, isolated, and minimal impacts to local over the air television transmission. These impacts can be further minimized through mitigation, and Big Bend Wind has committed to working with local residents as issues arise.

The Red Rock Solar Project is not anticipated to cause any electrical interference impacts, and no additional mitigation is necessary.

For a more detailed discussion on this topic refer to Section 4.3.2.8 Existing Infrastructure.

The wind DSP includes conditions specific to these issues.

4.2.1.5 *Environmental Justice*

The EPA defines Environmental justice as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income in the development, implementation, and enforcement of environmental laws, regulations, and policies," and is intended to ensure that all people benefit from equal levels of environmental protection and have the same opportunities to participate in decisions that might affect their environment or health.[xxv]

An important second step in an environmental justice assessment is identifying whether an environmental justice area of concern is present within the project's region of influence. This is a critical component of the assessment because if there is not an area of concern in the region impacted by the project, there is no possibility of disproportionate impacts to an environmental justice area of concern and the environmental justice analysis stops there.

EJSCREEN, an interactive screening and mapping tool developed by the U.S. Environmental Protection Agency, provides a nationally consistent dataset and approach for combining EJ environmental and demographic indicators.[xxvi] An assessment of existing conditions provides an important baseline to assess susceptibility and the possibility that the project impacts may be exacerbated by existing conditions or existing disproportionate impacts.[xxvii]

EERA utilized data from EJSCREEN at various scales and extents to analyze the Big Bend Wind and Red Rock Solar Project potential to disproportionately impact individuals below the poverty level and persons of color. EJSCREEN reports were generated for the county level, and also at the more refined census tract level, the full EJSCREEN Reports are available in Appendix F.

EJSCREEN data at the census tract level, shows that all negative environmental indicators are below the state average except for the ozone (ppb), lead paint indicator (percentage of pre-1960s housing), Risk Management Plan (RMP) Proximity (facility count/kilometer distance), and wastewater discharge indicator (toxicity-weighted concentration/meter distance). Additionally, there are no Superfund Sites

at the county or census tract level. Analysis at the county level and census tract level indicates no Hazardous Waste Treatment, Storage, and Disposal Facilities.

For the purposes of this impact evaluation, two census tracts are considered to be areas of concern for environmental justice due to poverty levels if at least 40 percent of the people within a tract report incomes less than the 185 percent of the federal poverty level. MnRiskS identifies the census tract #2701 as an area of concern for environmental justice due to poverty issues.

Potential Impacts

The ROI for this analysis is the Big Bend Wind and Red Rock Solar project areas, which intersects three census tracts, #2701, #9503, #9501. These census tracts are the best approximation of the geographic area within which potential disproportionate adverse impacts from the project could occur. Cottonwood and Watonwan counties, which contain these census tracts, are considered representative of the general population in the project area against which census tract poverty and demographic data can be compared. These counties serve as the region of comparison (ROC) for this assessment.

Staff conducted a demographic assessment of the affected community to identify low-income and people of color populations that might be present. U.S. Census data was used to identify low-income and people of color populations. Low-income and people of color populations are determined to be present in an area when the low-income percentage or people of color group percentage exceeds 50 percent or is “meaningfully greater” than in the general population of the larger ROC. In this analysis, a difference of 10 percentage points or more was used as the threshold to distinguish whether a “meaningfully greater” low-income or minority population resides in the ROI.

Table 4-2-5 lists the percentage of individuals living below the poverty level, population size, and the percentage of those persons who did not self-identify as white alone. Information about Minnesota and Cottonwood, Watonwan, and Martin counties is provided for context.

The low-income and persons of color populations in the census tracts, represented by the percentage living in poverty and those not self-identifying as white alone, were compared with the ROC to determine if any were greater than 50 percent or 10 percentage points or more than the ROC. None of the census tracts exceeded 50 percent, and none of the census tracts exceeded the ROC percentage by 10 percentage points or more, which is the defined threshold of significance for potential environmental justice impacts from the project.

Table 4-2-5. Low-Income and Persons of Color Population Characteristics

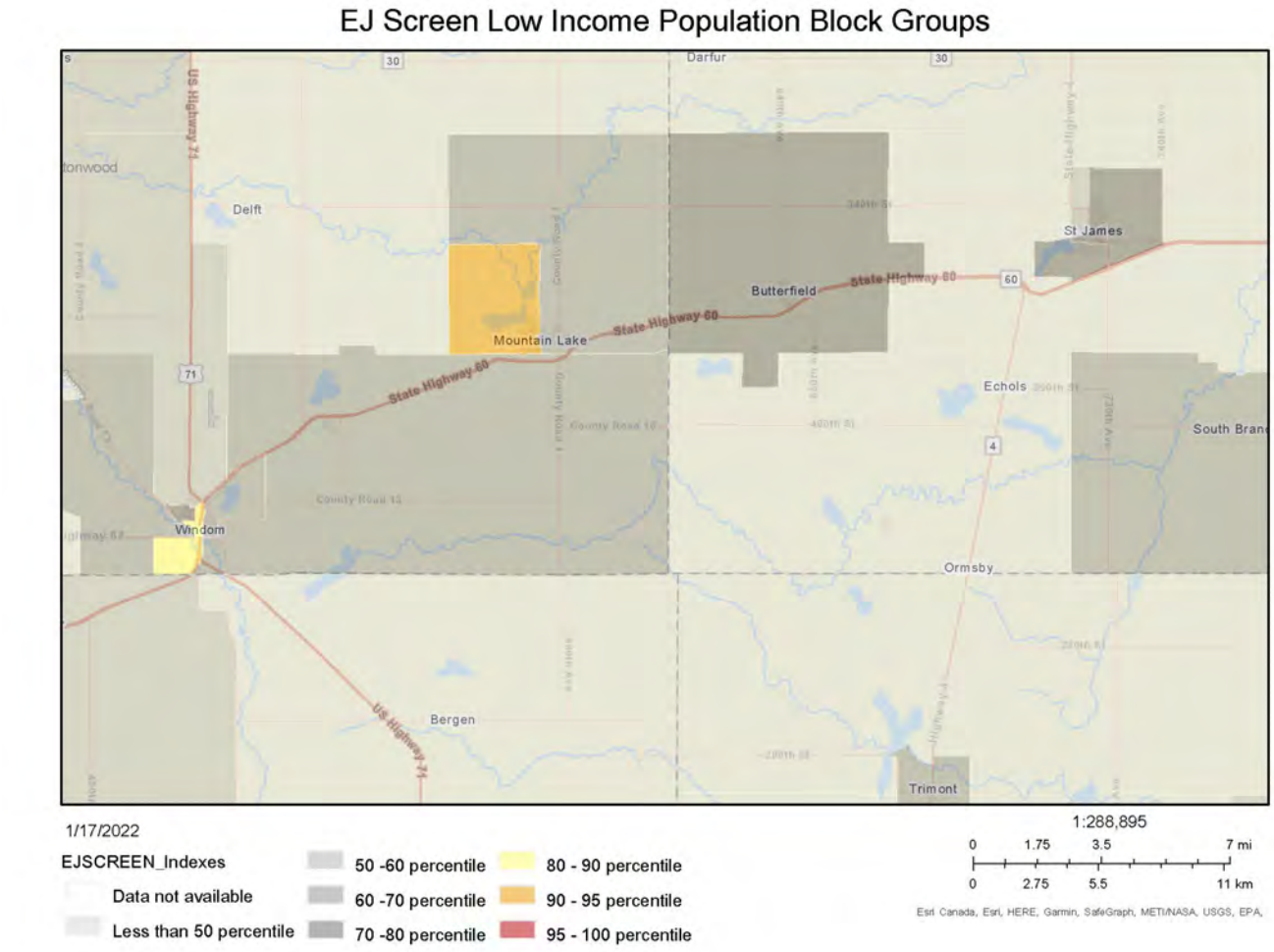
Area	Census Tract	% Low Income	Population Size	% Persons of Color**
Minnesota	—	10.13	5,636,632	20.9
Cottonwood County	—	32	11,372	13
Watonwan County		33	10,973	27
ROC*	—	33	22,345	20
Watonwan County	9503	27	2,797	15
	9501	35	2,925	25
Cottonwood County	2701	37	2,709	23

Source: EPA EJScreen, 2014-2018 American Community Survey

* The ROC is calculated by dividing the total low income and persons of color population in the ROC by the total population of the ROC.

** Persons of color population includes all persons excluding those who self-identified as non-Hispanic white alone.

Figure 4-2-5 EJ Screen Low Income Population Block Groups



The Big Bend Wind Project and Red Rock Solar Project intersect census tracts identified by MnRiskS, #2701, as an area of concern for poverty issues. As shown in Table 4-2-5 the census tracts are not significantly different than the large county populations. Additionally, when looking at census tract #2701 in greater detail, at the census block group level, see Figure 4-2-5 the census tracts data for low income populations appears to be significantly impacted by the larger population center of the City of Mountain Lake. The Big Bend Wind Project and Red Rock Solar projects are located outside of the City of Mountain Lake, which is the primary population center in the area.

Based on EERA's analysis and evaluation of current low income and persons of color populations within Cottonwood and Watonwan counties and local communities, no impacts to these populations are not anticipated to occur as a result of the construction and operation of the Big Bend Wind Project and/or the Red Rock Solar Project.

Mitigation

The Big Bend Wind Project and Red Rock Solar Project are not anticipated to have any environmental justice impacts, and no mitigation is proposed at this time.

4.2.1.6 Local Zoning and Ordinances

Land use is the characterization of land based on what can be built on it and how the land is used. Zoning is a regulatory tool used by local governments (cities, counties, and some townships) to guide specific land uses within specific geographic areas. Although the State of Minnesota Site Permits for the Big Bend Wind Project and the Red Rock Solar Project supersede the counties' ordinances, the commission does take siting standards established by the local counties into consideration when issuing a site permit.

Local Ordinances

Cottonwood County

The siting of wind turbines and large solar energy systems are both conditionally permitted within the Agricultural District of Cottonwood County. The Cottonwood County Renewable Energy Ordinance addresses the placement of wind turbines and solar energy facilities within the Agricultural District.

Wind turbine siting is not permitted in the Floodplain District and Shoreland District zones in Cottonwood County.

Within the Big Bend Wind portion of the hybrid project area there are small areas zoned as 2A Farm Entity 1st Tier, Municipality Property All Other, Rural Vacant Land, and Rural Vacant Non-contiguous. This zoning categories are not further described within the Cottonwood County Zoning Ordinance.

Watonwan County

Watonwan County's Zoning Ordinance addresses the siting of LWECS within the various zoning districts. Siting of LWECS within the Agricultural District is a conditionally permitted use. Wind turbine siting is not a listed permitted use or conditional use in the Floodplain Overlay District or the Shoreland Overlay District in Watonwan County.

City of Mountain Lake

Zoning regulations within the City of Mountain Lake allow for wind energy development in the commercial and industrial zones, but wind energy development is not permitted within the residential zones of the City.

Comprehensive Planning and Project Compatibility

A comprehensive plan is an official public document that translates community input and ideas into policies or actions and is approved by a decision-making body, such as a board or commission. Comprehensive plans can affect budgets, direct zoning, lead to the development of ordinances, and is a primary tool for directing future growth and development in an area (e.g. county, municipality, or city). Comprehensive plans are based on detailed analyses of economic, social, demographic, and land and natural resources present in the community. Comprehensive plans provide a "road map" not only for growth and development but for decision makers; land developers; existing and prospective residents; employees; and business operators.

The Cottonwood County Comprehensive Land Use Plan (2005) states that, similar to other counties in southwestern Minnesota, agricultural production will continue to be the predominant industry in the county. However, the plan lists a number of opportunities for industry diversification that would contribute to future economic growth, including renewable energy development. Specifically, the plan discusses opportunities related to wind power and ethanol and bio-diesel production.

Watonwan County does not have a comprehensive plan.

The City of Mountain Lake's Comprehensive Plan identifies economic development and land use expansion goals within the City, but the primary focus of economic development is the downtown Commercial District (C-1).

Table 4-3. Zoning Ordinances and Comprehensive Plans for Local Governments[126]

Governing Body[1]	Name of Plan	Year Adopted	Development Plan
Cottonwood County	Cottonwood County Zoning Ordinance	2016	Comprehensive Land Use Plan (2005)
Watonwan County	Watonwan County Zoning Ordinance	2014	Not Available[2]

[126] Amended Wind SPA – Section 8.2.1 and Solar SPA – Section 4.2.8.2

City of Mountain Lake	City of Mountain Lake Code of Ordinances, Chapter 9 Land Use Regulation (Zoning)	Undated	Comprehensive Plan (2006)

1 Townships in the Project Area are included in the comprehensive plans for their respective counties.

2 Watonwan County Planning and Zoning Department indicated to Big Bend there is no comprehensive plan developed for the county.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

The proposed hybrid wind and solar project is consistent and compatible with Cottonwood and Watonwan counties' zoning ordinances, and the respective comprehensive plan goals in the Cottonwood County comprehensive plan, see Table 4-3. The proposed hybrid wind and solar project will be compatible with the rural and agricultural character of the counties and will allow agricultural activities to continue throughout nearly the entire wind portion of the hybrid project area once the wind facility is constructed.

The majority of the Big Bend Wind portion of the hybrid project area, within Cottonwood County, is located in the Agricultural District. Small areas of the wind portion of the hybrid project area is located in the Floodplain District and Shoreland District zoned by Cottonwood County. The majority of the Big Bend wind portion of the hybrid project area, within Watonwan County is located within the Agricultural District, which allows for LWECS as a conditionally permitted use. Smaller areas of the wind portion of the Project Area is located within in the Flood Plain Overlay District and the Shoreland Overlay District.

Big Bend's current turbine layout does not propose to site any turbines within the Floodplain District, or the Shoreland District in Cottonwood County. Big Bend's current turbine layout avoids placing any wind turbines within the portions of the Project Area in the Flood Plain Overly District or the Shoreland Overly District in Watonwan County.

All of the Red Rock Solar Project Area is located within Cottonwood County's Agricultural District, and solar energy development is a conditionally permitted use in the Agricultural District. The Red Rock Solar Project will not conflict with local zoning ordinances.

The southern boundary of the Big Bend Wind portion of the proposed hybrid project is located directly adjacent to the municipal boundary of the City of Mountain Lake. The areas adjacent to the Big Bend

boundary within City limits are zoned as residential, commercial, or industrial. The wind portion of the hybrid project area does not cross the City of Mountain Lake's municipal boundary and the closest proposed wind turbine location is approximate 2,700 feet from the edge of city limits, so no conflicts with the City's zoning regulations are anticipated.

There are no anticipated impacts to, or conflicts with, local zoning ordinances or comprehensive plants for the hybrid Big Bend Wind and Red Rock Solar Project. The wind facility and solar facility are compatible with existing land use and zoning.

335 MW Solar Facility (No wind component)

A 335 MW solar facility would require a site permit from the Commission. Although the Commission permit supersedes local zoning, solar farms would be reviewed for compatibility with local land uses.

Potential impacts of this system alternative are anticipated to be similar to those of the proposed projects.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

Unless a county has assumed permitting authority (delegation) for wind facilities, a permit from the Commission supersedes county zoning. A well planned and sited wind facility should account for local land use and planning during the design phase and include known setback requirements in the project layout. The solar portion of a hybrid facility would require a site permit from the Commission. Although the Commission permit supersedes local zoning, solar farms would be reviewed for compatibility with local land uses.

Potential impacts of this system alternative are anticipated to be similar to those of the proposed projects.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

A 335 MW solar facility with battery storage would require a site permit from the Commission. Although the Commission permit supersedes local zoning, solar farms with a battery storage component would be reviewed for compatibility with local land uses.

Potential impacts of this system alternative are anticipated to be similar to those of the proposed projects.

Mitigation

The Big Bend Wind Project and Red Rock Solar Project have mitigated potential impacts and conflicts to local zoning ordinances and comprehensive plans by properly siting the facilities. Alternate turbine locations provide some flexibility in micro-siting and if necessary, and can be used to mitigate setback requirements.

No additional mitigation is proposed for the Big Bend Wind Project or the Red Rock Solar Project.

4.2.1.7 Noise

Large electric generation facilities produce noise during the construction and operational phases. Potential human impacts due to noise include hearing loss, stress, annoyance, and sleep disturbance.

Noise can be defined as unwanted or inappropriate sound. Sound has multiple characteristics which determine whether a sound is too loud or otherwise inappropriate. Sound travels in a wave motion and produces a sound pressure level. This sound pressure level is commonly measured in decibels (dB). Sounds also consists of frequencies as in the high frequency (or pitch) of a whistle. Most sounds are not a single frequency but a mixture of frequencies, and sounds can be constant or intermittent. The perceived loudness of a sound depends on all of these characteristics. Noise levels depend on the distance from the noise source and the attenuation of the surrounding environment. Table 4-4 below provides an estimate of decibel levels of common noise sources.

The State of Minnesota has promulgated noise standards designed to ensure public health and minimize citizen exposure to inappropriate sounds. The rules for permissible noise vary according to land use, i.e., according to their noise area classification (NAC).

In a residential setting, for example, noise restrictions are more stringent than in an industrial setting. Rural residential homes are considered NAC 1 (residential), while agricultural land and agricultural activities are classified as NAC 3 (industrial). The rules also distinguish between nighttime and daytime noise; less noise is permitted at night. Sound levels are not to be exceeded for 10 percent and 50 percent of the time in a one-hour survey (L_{10} and L_{50}) for each noise area classification. Table 4-5 lists Minnesota's noise standards by area classification.

The A-weighted decibel scale (dBA) is commonly used to measure the selective sensitivity of human hearing. This scales the physical sound levels that are measured as a pressure wave to match an equivalent "loudness" level across the audible spectrum that more closely resembles what a human ear would perceive. The A-weighted scale effectively puts more relative weight on the range of frequencies

that the average human ear perceives clearly (e.g., mid-level frequencies) and less weight on those that humans do not perceive as well (e.g., very high and lower frequencies).

The C-weighted scale (dBC) is used to measure human sensitivity at louder levels. C-weighted decibels are often used as a proxy to estimate the impact of low frequency noise. This scale puts more weight on the lower frequencies than the A-weighted scale.[127] The G-Weighted scale (dBG) is designed for sound or noise whose spectrum lies partly or wholly within the frequency band of 1 Hz to 20 Hz.[128]

The numerical value of the results will, in general, differ between the A-weightings, C-weightings and G-weightings. Numerical values across weightings should be compared with caution, since the respective results relate to different frequencies of the noise spectrum. Measurement programs for wind turbine noise have documented a significant correlation between dBA and dBC levels. Additionally, measurements comparing A-weighted noise levels and G-weighted noise levels show a significant correlation between the dBA and dBG as well.[129]

Low frequency noise is considered audible but only at high amplitudes. Low frequency noise is commonly considered to be in the range of 20-200 Hz. Infrasound occurs in even lower frequency ranges (less than 20 Hz) and is generally inaudible to the human ear. However, it may still interact with the body and may be felt as vibrations. Studies have shown that pain from infrasound can result when sound levels are 165 dB or above at 2 Hz and 145 dB or above at 20 Hz. (Massachusetts Department of Public Health 2012). The magnitude of existing background low frequency noise/infrasound levels vary but can be of sufficient strength to mask the low frequency noise and infrasound contributions from wind turbines. Common background sound sources of low frequency noise and infrasound include wind interacting with vegetation, agricultural machinery and roadway noise.[130]

Wind energy facilities produce noise during the construction phase, as a result of heavy equipment operation and increased vehicle traffic associated with the transport of construction materials and

[127] Minnesota Pollution Control Agency (MPCA). 2015. *A Guide to Noise Control in Minnesota: Acoustical Properties, Measurement, Analysis and Regulation*. pca.mn.us.

[128] State Government of Victoria Department of Health. 2013. *Wind Farms, Sound, and Health: Technical Information.* https://www2.health.vic.gov.au/public-health/environmental-health/environmental-health-in-the-community/wind-farms-sound-and-health.

[129] State Government of Victoria Department of Health. 2013. *Wind Farms, Sound, and Health: Technical Information.* https://www2.health.vic.gov.au/public-health/environmental-health/environmental-health-in-the-community/wind-farms-sound-and-health.

[130] State Government of Victoria Department of Health. 2013. *Wind Farms, Sound, and Health: Technical Information.* https://www2.health.vic.gov.au/public-health/environmental-health/environmental-health-in-the-community/wind-farms-sound-and-health.

personnel to and from the work areas. During the operational phase of a wind project turbines produce mechanical noise (noise due to the gearbox and generator in the nacelle) and aerodynamic noise (noise due to wind passing over the turbine blades).[131] Perceived sound characteristics would depend on the type/size of turbine, the speed of the turbine (if turning), and the distance of the listener from the turbine.

Wind turbines produce audible, low frequency sound and sub-audible sound (infrasound). These sounds can have a rhythmic modulation due to the spinning of the turbine blades. Impacts due to these sound characteristics are subjective (i.e., human sensitivity, especially to low frequency sound, is variable). However, low frequency sounds may cause annoyance and sleep disturbance for more sensitive individuals.

Construction of solar facility is anticipated to generate noise with the heavy equipment and increased vehicle traffic associated with the transport of construction materials and personnel to and from the work areas. During operation of a solar facility the primary source of noise will be from the inverters, and to a lesser extent from the transformers and rotation of tracking systems, located at each facility.

The proposed hybrid project is located in a predominately rural agricultural landscape. The ground cover is primarily farmland and open fields, with residential dwellings interspersed throughout the area. Typical agricultural noise sources include farm machinery, agricultural vehicle operations, recreational activities, (such as hunting and all-terrain vehicles), motor vehicle traffic, and road construction activities.

[131] Minnesota Department of Health, *Public Health Impacts of Wind Turbines*. 2009, http://www.health.state.mn.us/divs/eh/hazardous/topics/windturbines.pdf.

Table 4-4. Common Noise Sources and Levels (A-weighted Decibels)[132]

Sound Pressure Level (dBA)	Common Indoor and Outdoor Noise Sources
100-110	Rock band (at 16.4 ft [5 m]) Jet flyover (at 984.3 ft [300 m])
90-100	Gas lawnmower (at 3.28 ft [1 m])
80-90	Food blender (at 3.28 ft [1 m])
70-80	Shouting (at 3.28 ft [1 m]) Vacuum cleaner (at 9.84 ft [3 m])
60-70	Normal speech (at 3.28 ft [1 m])
50-60	Large business office Dishwasher next room, quiet urban daytime
40-50	Library, quiet urban nighttime
30-40	Quiet suburban nighttime
20-30	Bedroom at night
10-20	Quiet rural nighttime Broadcast recording studio
0	Threshold of hearing

[132] Minnesota Pollution Control Agency (MPCA). 2015. *A Guide to Noise Control in Minnesota: Acoustical Properties, Measurement, Analysis and Regulation*. pca.mn.us.

Table 4-5. MPCA Noise Standards - Hourly A-Weighted Decibels

Noise Area Classification	Daytime		Nighttime	
	L50	L10	L50	L10
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

The Big Bend Wind Project will produce noise during the construction phase, as a result of heavy equipment operation and increased vehicle traffic associated with the transport of construction materials and personnel to and from the work areas. Noise impacts during the construction phase of Big Bend Wind are anticipated to be short-term, isolated, and minimal, and with minimization efforts likely to be negligible.

The operation of the Big Bend wind portion of the hybrid project will produce noise. Turbines produce mechanical noise (noise due to the gearbox and generator in the nacelle) and aerodynamic noise (noise due to wind passing over the turbine blades).[133] Perceived sound characteristics would depend on the type/size of turbine, the speed of the turbine (if turning), and the distance of the listener from the turbine.

Wind turbines produce audible, low frequency sound and sub-audible sound (infrasound). These sounds can have a rhythmic modulation due to the spinning of the turbine blades. Impacts due to these sound characteristics are subjective (i.e., human sensitivity, especially to low frequency sound, is variable). However, low frequency sounds may cause annoyance and sleep disturbance for more sensitive individuals.

Big Bend conducted a preliminary noise assessment of the proposed project, which models (Cadna/A sound level calculation software) the anticipated sound levels that will be experienced at noise-sensitive receptors throughout the project area.[134]

[133] Minnesota Department of Health, *Public Health Impacts of Wind Turbines*. 2009, http://www.health.state.mn.us/divs/eh/hazardous/topics/windturbines.pdf.

[134] Amended Wind SPA – Section 8.4.2

The layouts have been modeled to help ensure cumulative impacts from all wind turbines, and maximum calculated noise levels for all turbine models are below the MPCA's nighttime L50 noise limit of 50 dB(A) at residential receptors (Table 4-6).

Maximum calculated total sound levels at all residential receptors for all turbine models are below the nighttime L50 noise limit of 50 dB(A). The maximum calculated sound level, based on assumptions incorporated into the Cadna-A model and the turbine layouts results in a maximum of 45 dB(A) L50 at the nearest noise-sensitive receptor (turbine only and total sound for the Nordex N-163), a maximum of 47 dB(A) L50 at the nearest noise-sensitive receptor (turbine only and total sound for the Vestas V162), and a maximum of 47 dB(A) L50 at the nearest noise-sensitive receptor (turbine only and total sound for the GE-158). Average Project-related sound levels at residences for all turbine models range from 31 to 36 dB(A), on an hourly L50 basis. Modeling for all turbine models indicates that participating residences (closest 1,367 feet) will be exposed to higher turbine only and total sound levels, when compared to non-participating residences (closest 2,380 feet).[135]

Table 4-6. Summary of Noise Assessment[136]

Turbine Model	Noise Source	Statistic	Residence Classification		
			dB(A) Levels at All Residences	dB(A) Levels at Participating	dB(A) Levels at Non-Participating
Nordex N-163	Turbine-Only Noise	Avg L50 Modeled	31	36	30
		Max L50 Modeled	45	45	42
		Min L50 Modeled	16	19	16
	Total Sound (Background + Turbine)1	Avg L50 Modeled	35	38	35
		Max L50 Modeled	45	45	42
		Min L50 Modeled	33	33	33
Vestas V162	Turbine-Only Noise	Avg L50 Modeled	33	38	32
		Max L50 Modeled	47	47	44
		Min L50 Modeled	16	20	16
	Total Sound (Background + Turbine)1	Avg L50 Modeled	36	39	36
		Max L50 Modeled	47	47	44
		Min L50 Modeled	33	33	33
		Avg L50 Modeled	33	38	32

[135] Amended Wind SPA – Section 8.4.2

[136] Amended Wind SPA – Section 8.4.2 and Table 8.4-3

GE-158	Turbine-Only Noise	Max L50 Modeled	47	47	44
		Min L50 Modeled	18	21	18
	Total Sound (Background + Turbine)1	Avg L50 Modeled	36	39	36
		Max L50 Modeled	47	47	44
		Min L50 Modeled	33	33	33
1 The average Project nighttime sound was monitored at 33 dB(A) (L50)					

During construction of the Red Rock Project noise will be generated by heavy equipment operation and increased vehicle traffic associated with the transport of construction materials and personnel to and from the work areas. Noise impacts during the construction phase of Red Rock Solar are anticipated to be short-term, isolated, and minimal, and with minimization efforts likely to be negligible.

During operation of the Red Rock Solar portion of the hybrid project, the primary source of noise will be from the inverters, and to a lesser extent from the transformers and rotation of tracking systems, located at each facility. The anticipated inverter noise is predicted to be 63.3 dBA at 50 feet from the source and is modelled to dissipate to 50 Dba within 233 feet from the inverter, and the tracking equipment is predicted to be 64.3 dba at 50 feet and noise dissipation to 50 dba is anticipated to occur within 130 feet of the trackers. The proposed solar portion of the hybrid project has been designed so the inverters will be located 1,122 feet from the nearest residence.[137] Noise from the Red Rock Solar portion of the hybrid project's electric collection system would not be expected to be perceptible. During operations noise impacts for the Red Rock Solar Project are anticipated to be negligible.

335 MW Solar Facility (No wind component)

Noise concerns for a generic 335 MW PV solar farm will be related primarily to the construction phase as the result of heavy equipment operation and increased vehicle traffic associated with the transport of construction materials and personnel to and from the work area. As in other solar projects before the Commission, it is anticipated that construction activities will only occur during daylight hours.

During operation of the PV solar farm, the primary source of noise will be from the inverters, and to a lesser extent from the transformers and rotation of tracking systems, located at each facility. All electrical equipment would be designed to National Electrical Manufacturer Association standards. Operational noise impacts from this system alternative would be dependent on the location of project

[137] Solar SPA – Section 4.2.3.1

inverters with respect to the closest residence or another features sensitive to noise impacts (i.e. church, school).

Noise from the PV solar farm's electric collection system would not be expected to be perceptible. Because the solar facilities do not generate electricity at night, the tracking systems would not be rotating and noise from inverters would be at less than peak levels.

Potential impacts of this system alternative are anticipated to be similar to those of the Red Rock Solar portion of the hybrid project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

The wind portion of the 335 MW hybrid wind and solar facility alternative would have noise impacts and mitigation similar to the Big Bend Wind portion of the proposed hybrid project. The solar portion of the 335 MW hybrid wind and solar facility alternative would have noise impacts and mitigation similar to the Red Rock Solar portion of the proposed hybrid project. Depending on location relative to receptors, surrounding vegetation, topography, and turbine selection, impacts from noise could be more or less than those expected of the proposed Hybrid Project.

Potential impacts of this system alternative area anticipated to be similar to those of the proposed hybrid project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

The 335 MW solar facility with battery storage alternative will have noise impacts similar to 335 MW solar only system alternative. The battery storage portion of this facility is not anticipated to produce any perceivable noise levels that will contribute to the energy generation portion of the facility.

Potential impacts of this system alternative are anticipated to be similar to those of the Red Rock Solar portion of the hybrid project.

Mitigation

Mitigation for noise impacts associated with construction of Big Bend Wind and Red Rock Solar, beyond BMPs (limit idling of equipment, limit construction to day light hours) is not anticipated to be warranted. As in other energy facilities before the Commission, it is anticipated that construction activities will only occur during daylight hours. Some level of noise impacts during the construction phase of Big Bend Wind and Red Rock Solar is going to be unavoidable.

The primary means of mitigating sound (noise) produced by wind turbines is siting. Turbines must be sited to comply with noise standards in Minnesota Rule 7030.[138] For rural residential of the area, this means sound levels must meet an L50 standard of 50 dBA.

Big Bend has incorporated into the project design a minimum 1,200 feet from residences plus the distance required to comply with the MPCA limit of a 50 dB(A) nighttime L50 noise level. Setback requirements are enforced by the Site Permit issued by the Commission. The Commission continuously reviews public health setbacks related to wind farms to determine if they remain appropriate and reasonable.[139] If Big Bend Wind is issued a site permit, they will be required to conduct post-construction noise monitoring to confirm pre-construction noise modelling is validated, and to show compliance with Minnesota noise standards.

No mitigation measures are planned for the operational phase of the Red Rock Solar Project as the solar facility equipment has been setback a significant distance from the nearest residence, and the facility will not generate significant noise during nighttime hours.

All electrical equipment would be designed to National Electrical Manufacturer Association standards.

4.2.1.8 Property Values

Large electric generation facilities have the potential to impact property values. Often, negative effects from these facilities are the result of impacts that extend beyond the immediate footprint. Examples include noise, emissions and visual impacts. Because property values are influenced by a complex interaction between factors specific to each individual piece of real estate as well as local and national market conditions, the effect of one particular project on the value of one particular property is difficult to determine.

The placement of infrastructure near human settlements has the potential to impact property values. The impacts can be positive and negative. The type and extent of impacts depends on the relative location of the infrastructure and existing land uses in the project area. For example, a new highway may increase the value of properties anticipated to be used for commercial purposes but decrease the value of nearby residential properties.

---

[138] Minn. Rules 7030.0040, Noise Standards, https://www.revisor.leg.state.mn.us/rules/?id=7030.0040.

[139] Commission *Investigation into Large Wind Energy Conversion Systems Permit Conditions on Setbacks and the Minnesota Department of Health Environmental Health Division's White Paper on Public Health Impacts of Wind Turbines*, CI-09-845, found on eDocket, https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showeDocketsSearch&showEdocket=true&userType=public, enter "09" for year and "845" for number

Potential impacts to property values due to large energy facilities are related to three main concerns:

- potential aesthetic impacts of the facility,
- concern over potential health effects from emissions (air emissions, wastewater discharges, electric and magnetic fields, etc.), and
- potential interference with agriculture or other land uses.

In December 2009, the United States Department of Energy Lawrence Berkeley National Laboratory released a technical analysis of wind energy facilities' impacts on the property values of nearby residences. Using a variety of different analytic approaches, the report found no evidence that sales price of homes surrounding wind facilities were measurably affected by either the view of wind facilities or the distance of the home to those facilities. Though the analysis acknowledged the possibility that individual homes or small numbers of homes may be negatively impacted, it concluded that if these impacts do exist, their frequency is too small to result in any widespread, statistically observable impact.[140]

Six counties in southern Minnesota (Dodge, Jackson, Lincoln, Martin, Mower and Murray counties) with large wind energy conversion systems responded to a Stearns County survey asking about impacts on property values as a result of wind farms. That survey showed that neither properties hosting turbines nor those adjacent to those properties in the counties listed, have been negatively impacted by the presence of wind farms. [141]

A review of the literature found no research specifically aimed at quantifying impacts to property values based solely on proximity to utility-scale PV facilities. As the recently permitted Aurora Distributed Solar and North Star Projects involve the first utility-scale PV facilities across Minnesota, comparable sales data are just becoming available. Very initial results from Chisago County (North Star) show no impact. As the industry continues to develop comparable data should become available.

[140] Hoen et al. 2009. *The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis*. https://emp.lbl.gov/publications/impact-wind-power-projects.

[141] Stearns County Board of Commissioners. 2010.*Stearns County Resolution No. 10-46: Resolution Adopting Findings of Fact for the Proposed Stearns County Interim Ordinance No. 444 Imposing a Moratorium on Large Wind Energy Conversion Systems (LWECS) for Projects 5 MW or Greater.* https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7B84D17419-28C1-4D3F-AAE0-5D4DE117F9E4%7D&documentTitle=20106-52067-01.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

The impacts on property values due to the development of the hybrid Big Bend Wind and Red Rock Solar Project are difficult to quantify. Numerous factors influence a property's market value, including acreage, schools, parks, neighborhood characteristics and improvements. The overall status of the housing/land market at the time of sale is an important factor on the value of a property.

Southern and southwestern Minnesota have experienced the greatest development of wind energy facilities in the state and several wind energy facilities exist in the region. There are several wind facilities located south and west, within 10 miles, of the Big Bend Wind portion of the hybrid project, and turbines at these facilities are currently visible to residents within the Big Bend Wind portion of the Project Area (**Figure 14**). Mountain Lake Wind (one turbine), Bingham Lake Wind (eight turbines), Farmers' Ridge/Westridge Wind (four turbines), Odell Wind Farm (100 turbines), Odin Wind Farm (10 turbines), Trimont Area Wind Farm (67 turbines), and Jeffers Wind Energy Center (20 turbines).[142]

Visual impacts from the wind portion of the hybrid project alternative may be more pronounced if the site was located in a part of the State with fewer wind turbines present on the landscape but based on the current research there are no scientific findings that suggest property values are reduced by the presence of a visible wind turbine located in close proximity to a property.

The Red Rock Solar Project will essentially have no long-term emissions or noise impacts to adjacent land uses during operation of the facility. The installation of PV panels will create a visual impact, but lacking the height of smokestacks or wind turbines, the visual impact at ground level, or within a neighboring building, would be minimal. The property where the Red Rock Solar Project is located could see a potential change in value depending on changes in agricultural commodity values and thus the value of lands used for agricultural production. This change in property value would only be realized if the property was sold, and would depend on the existing market at that time.

Impacts to property values of the Red Rock Solar Project are anticipated to be negligible.

335 MW Solar Facility (No wind component)

As with the solar portion of the proposed hybrid project the negative effects from a solar facility would essentially have no emissions and no noise impacts to adjacent land uses during operation of the facility. The installation of PV facilities would create a visual impact, but lacking the height of

[142] Amended Wind SPA – Section 8.5.1.1

smokestacks or wind turbines, the visual impact at ground level, or within a neighboring building, would be minimal.

Potential impacts of this system alternative are anticipated to be similar to those of the Red Rock Solar portion of the proposed hybrid project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

The 335 MW hybrid wind and solar facility alternative, located elsewhere in the State, would essentially have the same potential for impacts on property values as has been identified for the proposed Big Bend Wind and Red Rock Solar hybrid project. Visual impacts from the wind portion of the hybrid project alternative may be more pronounced if the site was located in a part of the State with fewer wind turbines present on the landscape but based on the current research there are no scientific findings that suggest property values are reduced by the presence of a visible wind turbine located in close proximity to a property.

The solar portion of the hybrid project alternative, located elsewhere in the State, will have the same anticipated impacts of the Red Rock solar portion of the proposed hybrid project.

Potential impacts of this system alternative are anticipated to be similar to those of the proposed projects.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

As with the 335 MW solar facility alternative the negative effects from a solar facility with battery storage would essentially have no emissions and no noise impacts to adjacent land uses during operation of the facility. The installation of PV facilities and industrial battery banks would create a visual impact, but lacking the height of smokestacks or wind turbines, the visual impact at ground level, or within a neighboring building, would be minimal.

Potential impacts of this system alternative are anticipated to be similar to those of the Red Rock Solar portion of the proposed hybrid project.

Mitigation

Negative impacts to property value due to the development of the Big Bend Wind and Red Rock Solar hybrid project are anticipated to be isolated and minimal. In unique situations it is possible that specific, individual property values may be negatively impacted.

Big Bend has sited turbines further from individual non-participant residences, which will mitigate property values to some extent.

Red Rock Solar may have unavoidable, minimal impacts on property values, but the project has been designed and sited in manner that will minimize impacts to the greatest extent practicable.

4.2.1.9 Recreation

Both construction and operation of wind energy facilities and solar energy facilities can impacts to local recreational lands and the users of those lands.

Snowmobile trails exist within the Big Bend Wind project area. Various recreational opportunities exist on private lands within and public lands outside of the Big Bend Wind and Red Rock Solar project areas; including bird watching, fishing, hunting, canoeing/kayaking, and hiking. Activities in the project area are associated with watercourses, WMAs, snowmobile trails, and county and city parks. **Figure 4-3** shows recreational opportunities in and around the hybrid project area.

Several wind energy facilities exist in the region, so there are currently wind turbines visible on the landscape around the proposed wind project area.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

The impacts of the Red Rock Solar Project on recreation is anticipated to be minimal, and with mitigation the impacts will be short-term and negligible. There are no public recreational lands within the local vicinity. Depending on the timing of construction of the solar project there could be some additional truck traffic on local roads that may be noticeable to user of the snowmobile trails close to the solar project area, but general trail and road use regulations should minimize those interactions. Truck traffic during construction could result in indirect impacts to recreationalist on private lands near the solar project area. Operation of the Red Rock Solar Project will have no long-term impacts to recreational activities.

There are no public recreational lands within the Big Bend Wind Project, but there are some public recreational lands adjacent to the wind portion of the hybrid project area. Visual impacts to users of recreational lands adjacent to the Big Bend Wind project area is possible, and the impact will vary depending on the individual user and likely how close the recreational land is to wind turbine location. Local snowmobile trails do cross the Big Bend Wind project area, but with the current proposed turbine layouts being considered the closest turbine to a trail is over 750 feet away.

Fugitive dust associated with construction of the Big Bend Wind Project might indirectly impact recreationalists. New built features will be introduced to the landscape, and construction equipment and vehicle traffic will affect aesthetics. Some recreational users may notice the visual impact of additional turbines on the landscape, but that will depend on the individual user. Moderate impacts associated with construction of the wind project are anticipated to be short-term and isolated.

Operational impacts of the wind project, such as changes to the viewshed and noise, will be long-term and subjective to the individual.

Impacts can be minimized or avoided.

335 MW Solar Facility (No wind component)

As with a hybrid wind and solar facility impacts to recreation from a 335 MW solar facility system alternative depends upon site-specific characteristics; it is difficult to assess the degree and ecological significance of impacts to recreational lands and users for a solar facility without knowledge of the land cover types, topography, and general environmental setting of a hypothetical project site.

Potential impacts of this system alternative are anticipated to be similar to those of the Red Rock Solar portion of the proposed hybrid project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

As with a hybrid wind and solar facility impacts to recreation from a 335 MW hybrid wind and solar facility system alternative depends upon site-specific characteristics; it is difficult to assess the degree and ecological significance of impacts to recreational lands and users for a solar facility without knowledge of the land cover types, topography, and general environmental setting of a hypothetical project site.

Potential impacts of this system alternative are anticipated to be similar to those of the proposed hybrid project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

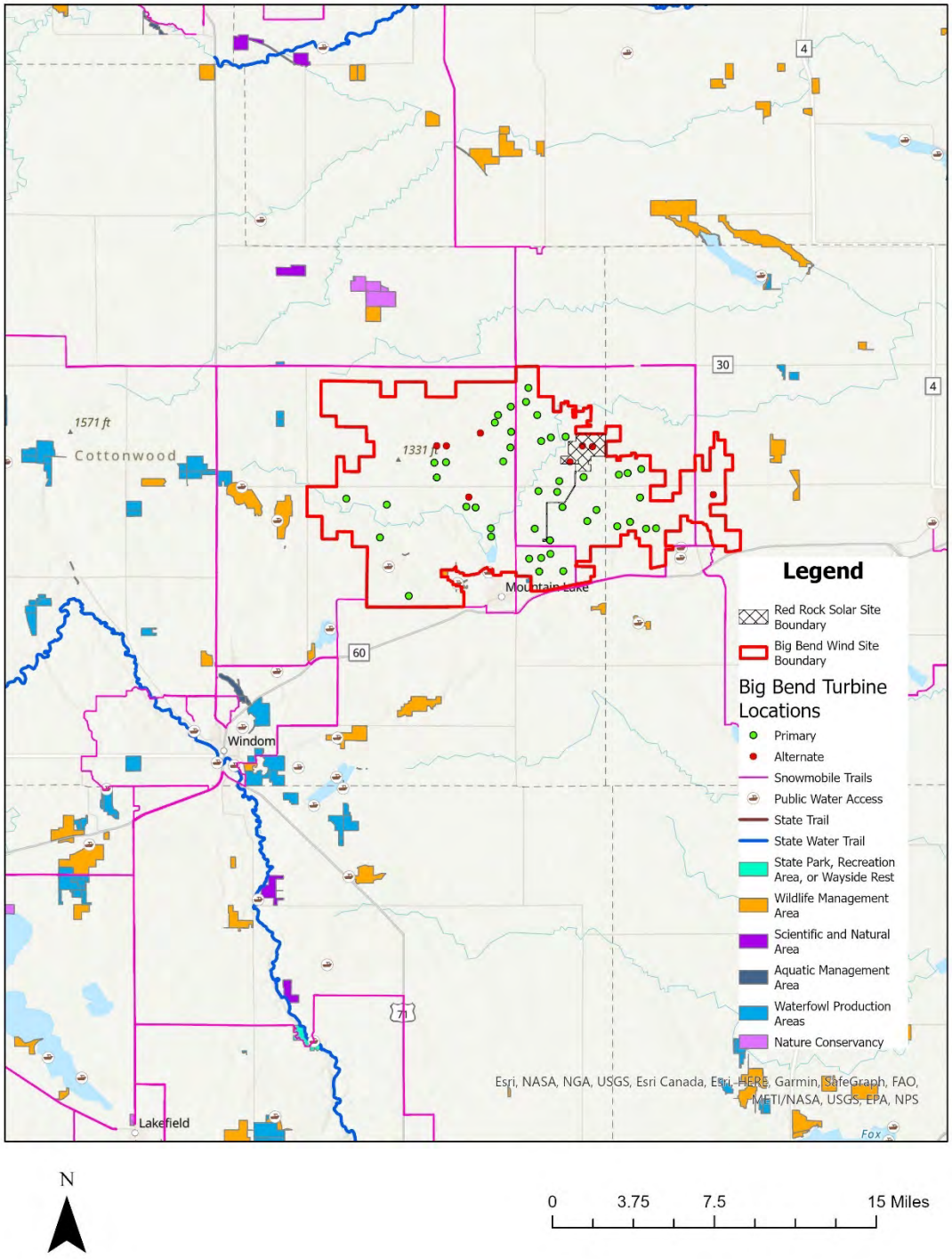
As with a hybrid wind and solar facility impacts to recreation from a 335 MW solar facility with battery storage system alternative depends upon site-specific characteristics; it is difficult to assess the degree and ecological significance of impacts to recreational lands and users for a solar facility without knowledge of the land cover types, topography, and general environmental setting of a hypothetical project site.

Potential impacts of this system alternative are anticipated to be similar to those of the Red Rock Solar portion of the proposed hybrid project.

Mitigation

The contractor will implement a dust control and mitigation plan during construction. Other anticipated impacts of the proposed Big Bend Wind Project and the Red Rock Solar Project are anticipated to be unavoidable.

Figure 4-3. Recreational Lands within the Hybrid Project Area



4.2.1.10 Socioeconomics

This section provides an overview of the regional economy based on available data, including the impact of the local and non-local labor, and a discussion of the potential short-term and long-term economic impacts of the hybrid Big Bend Wind and Red Rock Solar Project.

Demographics

Broadly defined, demography is the study of the characteristics of populations through statistical data. It provides a description of a population and how those characteristics change over time. Where there are foreseeable impacts, the incorporation of demographic data into environmental review may be useful in the evaluation of these potential impacts to the host community. These impacts may be beneficial or adverse.

The hybrid Big Bend Wind and Red Rock Solar Project is proposed to be located in southwestern Minnesota in a rural agricultural region in Cottonwood and Watonwan Counties. The 2010 census population for Cottonwood was 11,687, while the U.S. Census 2019 American Community Survey (ACS) population estimate for Cottonwood County was 11,196, representing a decrease of approximately 4.2 percent.[143] The 2010 census population for Watonwan County was 11,211, while the U.S. Census 2019 ACS population estimate for Watonwan County was 10,897, representing a decrease of approximately 2.8 percent.[144] The 2010 census population for Minnesota was 5,303,925, while the U.S. Census 2019 population estimate for Minnesota was 5,639,632, which is an increase of approximately 6.3 percent.[145]

84.7 percent of the population in Cottonwood County and 70.4 percent of the population of Watonwan County identify as white only, not Hispanic or Latino, while at the state level 79.1 percent of the population identifies as white only, not Hispanic or Latino. The percentage of total minority residents in Cottonwood County is 15.3 percent and Watonwan County is 29.6 percent, compared to 20.9 percent minority at the state level.[146]

The total number of housing units in the counties in the Project Area is 5,435 in Cottonwood County, and 5,042 in Watonwan County (U.S. Census Bureau 2018 data).

[143] Amended Wind SPA – Section 8.1.1
[144] Amended Wind SPA – Section 8.1.1
[145] Amended Wind SPA – Section 8.1.1
[146] Amended Wind SPA – Section 8.1.1

Local and Regional Economies

Utility scale wind and solar development provide economic benefits across all phases of development and across industries, such as manufacturing; construction, operation and maintenance. Minnesota ranks seventh in the country for installed wind capacity (3,845 MW), with a total capital investment of $7.4 billion.[147] Minnesota is also home to wind–related manufacturing facilities that supply turbine components and other parts to the industry supply chain and that contribute to the state's economy.

Because utility scale wind and solar developments are usually located in rural areas, they can provide noticeable economic impacts on the smaller, rural communities that host them. At the local level, wind energy and solar energy projects provide short-term construction wages to workers and increased spending in the local economy for food, lodging, fuel, and incidental expenditures. Over the long-term, while a wind project is operating, the project owner pays production tax revenues to local government; and lease payments to landowners. The project also provides long-term jobs for a small number of permanent operation and maintenance workers. While a solar project is operating, the project owner pays production tax revenue to local governments.

The local economic benefit of construction-period wages is difficult to quantify, and the conclusions drawn can vary depending on the assumptions made to conduct the economic model. Site-specific variables are also relevant, including the availability of local labor and the extent to which the construction contractor recruits and hires the local labor that is available.

Household incomes were significantly lower in Region 8 than the rest of the state. The median household income in Region 8 was $56,514 in 2019, compared to a $71,306 median throughout the State of Minnesota. Almost half (44.6 percent) of the households in the region had incomes below $50,000 in 2019, compared to just 34.8 percent statewide. Another 34.4 percent of households earned between $50,000 and $100,000 in the region. In contrast, only 21.1 percent of households in Region 8 earned over $100,000 per year, compared to 33.4 percent of households statewide.[148]

Household incomes were significantly lower in Region 9 than the rest of the state. The median household income in Region 9 was $58,487 in 2019, compared to a $71,306 median throughout the State of Minnesota. Almost half (41.4 percent) of the households in the region had incomes below $50,000 in 2019, compared to just 34.8 percent statewide. Another 34.2 percent of households

[147] American Wind Energy Association, *Factsheet: Wind Energy in Minnesota* (https://www.awea.org/Awea/media/Resources/StateFactSheets/Minnesota.pdf).
[148] MN Employment and Economic Development. Regional Profile – Region 8. November 15, 2021. https://mn.gov/deed/assets/111521_region8_tcm1045-133260.pdf.

earned between $50,000 and $100,000 in the region. In contrast, only 24.4 percent of households in Region 9 earned over $100,000 per year, compared to 33.4 percent of households statewide.[149]

The median hourly wage for all occupations in Region 8 was $18.79 in 2021, which was the third lowest wage level of the 13 economic development regions in the state. Region 8's median wage was $4.21 below the state's median hourly wage.[150] The median hourly wage for all occupations in Region 9 was $19.76 in 2021, which was the eighth highest wage level of the 13 economic development regions in the state. Region 9's median wage was $3.24 below the state's median hourly wage.[151]

Local and Regional Labor

The proposed hybrid wind and solar project is located in Minnesota's Economic Development Region 8 and 9. Region 8 had an annual average labor force count of 63,606 workers through 2018[152], and Region 9 had an average annual average labor force count of over 133,200 workers through 2020[153]. In line with the region's population decline, Region 8 has lost about 296.7 workers per year since 2010; and is down from a peak of over 68,000 workers in 2009. 12,116 job vacancies were posted by employers in Region 8 in the 2nd quarter of 2021 across a number of occupations and industries, indicates there is extensive opportunities for job seekers in the Region.[154] Region 9 has lost an average of 21 workers per year between 2010 and 2020. A growing scarcity of workers and an increasingly tight labor market has become a barrier to economic growth in the Region.[155]

The largest occupations in Region 8 include manufacturing, health care and social assistance, and retail trade. Average annual wages for health care and social assistance and retail trade are below the

[149] MN Employment and Economic Development. Regional Profile – Region 9. September 2021. https://mn.gov/deed/assets/2021_EDR9RP_MS_tcm1045-133261.pdf.
[150] MN Employment and Economic Development. Regional Profile – Region 8. November 15, 2021. https://mn.gov/deed/assets/111521_region8_tcm1045-133260.pdf.
[151] MN Employment and Economic Development. Regional Profile – Region 9. September 2021. https://mn.gov/deed/assets/2021_EDR9RP_MS_tcm1045-133261.pdf.
[152] MN Employment and Economic Development. Regional Profile – Region 8. November 15, 2021. https://mn.gov/deed/assets/111521_region8_tcm1045-133260.pdf.
[153] MN Employment and Economic Development. Regional Profile – Region 9. September 2021. https://mn.gov/deed/assets/2021_EDR9RP_MS_tcm1045-133261.pdf.
[154] MN Employment and Economic Development. Regional Profile – Region 8. November 15, 2021. https://mn.gov/deed/assets/111521_region8_tcm1045-133260.pdf.
[155] MN Employment and Economic Development. Regional Profile – Region 9. September 2021. https://mn.gov/deed/assets/2021_EDR9RP_MS_tcm1045-133261.pdf.

average annual wage in the Region, and manufacturing occupations tend to have higher average annual wages when compared to the Region average.[156] The three largest occupations in Region 9 are office and administration support, production, food preparation and serving related jobs. Those three occupation groups also have lower median hourly wages than approximately half of the other occupation groups represented in the Region.[157]

The top three industries of employment in the State of Minnesota are education, health, and social services at 25.2percent, manufacturing at 13.4 percent, and retail trade at 11.0 percent (U.S. Census Bureau, 2018). The top three industries of employment in the counties and townships within the Project Area vary slightly from the state level, with manufacturing playing a larger role in both Cottonwood and Watonwan Counties, 20.0 percent and 22.7 percent, respectively. The retail trade industry employment levels in Cottonwood and Watonwan Counties are similar to State levels.[158]

Wind Facility Construction Labor

Construction of a wind energy facility will require different types of skilled and non-skilled construction workers. In 2010, the US Bureau of Labor and Statistics profiled careers in the wind energy industry, the profiles include job types, education and training requirements, and wages. Typical types of labor for construction of wind farms includes construction laborers, equipment operators and electricians. Education for these jobs can be a combination of on-the-job training, certifications, apprenticeships, and post-secondary education.[159]

Solar Facility Construction Labor

Construction of a solar energy facility will require different types of skilled and non-skilled construction workers. Typical types of labor for construction of solar facilities includes construction laborers, equipment operators, and electricians. Education for these jobs can be a combination of on-the-job training, certifications, apprenticeships, and post-secondary education.

[156] MN Employment and Economic Development. Regional Profile – Region 8. November 15, 2021. https://mn.gov/deed/assets/111521_region8_tcm1045-133260.pdf.
[157] MN Employment and Economic Development. Regional Profile – Region 9. September 2021. https://mn.gov/deed/assets/2021_EDR9RP_MS_tcm1045-133261.pdf.
[158] Amended Wind SPA – Section 8.1.1
[159] Hamilton, James, Liming, Drew. 2010. *Careers in Green Energy*. US Bureau of Labor and Statistics. https://www.bls.gov/green/wind_energy/wind_energy.pdf.

Wind Facilities and Solar Facilities and Local Economies

Several case studies have examined the economic impact of utility-scale wind power development on local economies.[160] These studies have used a variety of methodologies (modeling, observation, post-construction data). The research on the impacts of wind facilities on local economies is evolving, but based on the studies to date, several key factors appear to influence the overall impact a project has on the local economy:

- the remoteness of a project and its proximity to population centers;
- the ownership structure of the project (locally developed and owned, compared to non-local or "absentee" ownership); and
- access to a skilled labor pool.

Local economies that are "well-linked" are those that are nearer other communities, more diversified in terms of types of businesses, and tend to be more stable.[161] As a result, they also tend to have access to a larger, more diverse labor pool. This was also evident in a case study from Texas, which found that in areas where nearby businesses and services are lacking, there is "leakage" outside the project area to areas where those services can be acquired.[162] The same study did find overall economic benefits to rural communities because of utility scale wind development.

Most of these studies use standardized input/output models such as IMPLAN or NREL's wind-project specific JEDI model to estimate local economic impacts. All models have limitations, however, based on one comparison study, these economic models do appear to provide a reasonable estimate of real-world impacts. The study Ex *Post Analysis of Economic Impacts from Wind Power Development in U.S. Counties* compared data from a range of constructed wind projects to modeling results and found that the results were similar to those of the common input/output models when using default assumptions and developer projections. Given the similarities between post construction data and modeled projections, the common input/output models such as IMPLAN and JEDI appear to provide reasonable projections regarding the economic impacts of a project.

A recent study in Minnesota, compared Jedi model predictions and developer projections to determine the number of construction workers hired. The study found an average of between 150 and 200 construction workers for Minnesota wind projects during the approximately six month

[160] Brown et al (2011), Slattery et al (2011), Constani (2004), Lantz (2009), Hatt and Franco, 2018, Kildegaard (2013), and UMD Labovitz School of Business and Economics (2017).
[161] Constani, 2004.
[162] Slattery et al., 2011.

construction period. The study estimates that a generic 150-megawatt project in Minnesota would provide about $12 million in local wages in benefits—about $60,000 per worker.[163]

Educational and training opportunities for those seeking careers in wind energy and other trades are offered through Minnesota State Colleges and Universities, the North American Building Trades Union, and local unions. These programs train the next generation of tradespeople in energy and other fields including energy technologies and natural resources, architecture and construction, and various certification programs.[164]

Landowner and Local Government Economics

Lease payments to landowners and energy production taxes to local units of government where wind and solar projects are located provide additional benefits. Landowners negotiate leases with project developers for the life of the project. Assuming the landowner lives in the project area, the lease payments provide a direct benefit to the local economy.

In addition, in Minnesota, local units of government receive an energy production tax as a result of wind energy development and solar energy development. These payments have a significant impact on rural economies during the life of the project. Over time, these payments are greater than the economic impacts generated during construction of the project.

Statewide, wind projects generate approximately $15.5 million in annual state and local tax payments and approximately $10 - $15 million in annual lease payments.[165]

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

The population densities within five miles of the Big Bend Wind project boundary range from 18.3 persons per square mile in Cottonwood County to 42.4 persons per square mile in Brown County, north and outside of the Project Area.[166]

---

[163] *Catching the Wind: The impact of local vs. non-local hiring practices in construction of Minnesota wind farms,* at pp. 9 10

[164] Minnesota State Colleges and Universities (https://www.minnstate.edu/campusesprograms/index.html) and the North American Building Trades Union (https://nabtu.org/school-resources/).

[165] *Catching the Wind: The impact of local vs. non-local hiring practices in construction of Minnesota wind farms,* at pp. 9 10

[166] Amended Wind SPA – Section 8.1.1

There are 173 residences within the wind portion of the hybrid project area, and there is one residence within the Red Rock Solar project boundary and another residence within the local vicinity of the project boundary, to the west of the solar boundary.[167]

The wind facility and solar facility will increase the local demand for specialized construction labor, and increased demand for contractors and material supplies such as concrete, gravel, fuel, and fill material. The wind portion of the proposed hybrid project is anticipated to require 316 people at the peak of employment during project construction.[168] The solar portion of the proposed hybrid project is anticipated to require up to 200 people during the project's construction.

While some of these workers will be from the local area (within 150 miles), some portion is likely to be from outside the region and will only remain in the counties over the duration of construction (approximately 12 months). It is anticipated that most of the wages earned by local workers will circulate through the local economy. Non-local workers will also inject money into the local economy for food, lodging, fuel, and incidental expenditures. Local contractors and suppliers will be used for portions of the construction. Additional income will be generated for the county and state economy through the circulation and recirculation of dollars paid out by the developer for business expenditures and for state and local taxes. Payments for equipment, fuel, operating supplies, and other products and services benefit local and regional businesses.

Once operational, the Big Bend Wind portion of the hybrid project will need approximately 14 permanent operations and maintenance staff.[169] The operational Red Rock Solar Project will need one permanent operations and maintenance staff for the life of the project.[170]
During operations the project owner, of both the wind and solar portions of the hybrid project, will make lease payments to local landowners as well as production tax payments to local government. On average, each turbine only requires 0.5 acres to 1 acre of land for the turbine foundation and access road. Annual lease payments compensate for potential financial losses due to small areas of land being removed from agricultural production and the inconvenience of farming around the new obstacles in the farm fields. All participating landowners, of both the wind and solar portions of the hybrid project, will receive compensation for facilities constructed on their land, as will landowners who signed a setback waiver.

[167] Amended Wind SPA – Section 8.1.1 and Solar SPA – Section 4.2.4
[168] Amended Wind SPA – Section 8.1.2
[169] Amended Wind SPA – Section 8.1.2
[170] Solar SPA – Section 3.5

The total payout to participating landowners is estimated to $69,600,000 over the 30 year life of the Big Bend Wind Project. Landowners within the buffer zone around turbines and associated project facilities will be $3,600,000 over a 30 year life span. Additionally, the Big Bend Community Fund, developed and funded to support local charitable activities, will receive approximately $1,800,000 over the life of the Big Bend Wind Project.[171]

The Wind Energy Production Tax payment is $0.0012 per kWh of electricity produced. For the Big Bend Wind Project, the annual wind energy production tax payment is estimated to be $1,200,000 annually, and $36,000,000 over the life of the project.[172]

The Red Rock Solar Project will pay local landowners $965,000 annually, a total of $29,000,000 over the 30 year project life span, for land lease and purchase payments.[173] The Red Rock Solar Project will provide approximately $208,000 annually, $6,200,000 over the life of the project, in production tax payments to Cottonwood County. An additional production tax payment of $52,000 annually, $1,600,000 over the life of the project, will be paid to Midway Township.[174]

The Big Bend Wind and Red Rock Solar Hybrid Project are likely to have a negligible impact on local demographics, a short-term positive impact on local labor opportunities, and a short-term (private businesses) and long-term (local governments and lease holders) impact on local economies.

335 MW Solar Facility (No wind component)

Impacts on the host community of a 335 MW solar facility would be dependent on the social and economic characteristics of the local population and surrounding area.

During construction, a 335 MW solar facility would be expected to have similar socioeconomic impacts to that of a proposed hybrid Big Bend Wind and Red Rock Solar Project due to the influx of wages and expenditures made at local businesses during the construction and increased tax revenue for the life of the project.

For example, the North Star Solar Project developer anticipated that approximately 250-300 jobs would be directly created during the construction phase of the project, and once operational, would require up to 12 permanent employees.[175]

---

[171] Amended Wind SPA – Section 8.13.3
[172] Amended Wind SPA – Section 8.13.3
[173] Solar SPA 4.2.5.1
[174] Solar SPA – Section 4.2.5.1
[175] *North Star Solar EA.*

The solar facility would also pay landowners for leases, and County and Township property taxes and production taxes. Solar projects, like wind projects, pay production tax of $1.20 per MWh. Production taxes are calculated based on energy production and are paid to the local governments where the facility is located; 80 percent to the county and 20 percent to the city or township.
Job creation, landowner lease payments, and production tax payments to local governments are anticipated to be similar to the Red Rock Solar portion of the hybrid project, but they will larger in magnitude due to the large size of the solar facility in this system alternative.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

As with the proposed hybrid wind and solar project, impacts on the host community of a 335 MW hybrid wind and solar facility would be dependent on the social and economic characteristics of the local population and surrounding area.

Job creation, landowner lease payments, and production tax payments to local governments are anticipated to be similar to the proposed hybrid project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

During construction, a 335 MW solar facility with battery storage would be expected to have similar socioeconomic impacts to that of a proposed hybrid project and 335 MW Solar Only system alternative, due to the influx of wages and expenditures made at local businesses during the construction and increased tax revenue for the life of the project.

The solar facility, including the battery storage area, would also pay landowners for leases, and County and Township property taxes and production taxes. Production taxes are calculated based on energy production and are paid to the local governments where the facility is located; 80 percent to the county and 20 percent to the city or township.

Job creation, landowner lease payments, and production tax payments to local governments are anticipated to be similar to the Red Rock Solar portion of the hybrid project, but they will larger in magnitude due to the large size of the solar facility in this system alternative.

Mitigation

Impacts to local demographics, labor, and economies from the proposed hybrid project, and the Red Rock Solar Project independently, are anticipated to be positive. No mitigation is proposed at this time.

4.2.2 Potential Impacts to Human Health and Safety

Construction and operation of large energy facilities may have the potential to impact human health and safety. This section discusses potential impacts to transportation, infrastructure, public utilities, emergency services, emergency services, electromagnetic field, stray voltage, implantable medical devices and hazardous materials.

4.2.2.1 *Airports and Aviation*

Airports are valuable transport, tourism, employment, and business assets for the local and national economy. The development of large energy projects needs to consider the potential impacts to air service and operations (airports, landing strips, crop spraying activities, etc.) within a project area. Developments around airports and under flightpaths can constrain operations, either directly where they conflict with safety/operational requirements, or indirectly where they interfere with radar or other navigational aids.

The aviation industry is concerned that the growth of wind energy development will endanger agricultural aviators and restrict the business opportunities for aerial application of seeds, fertilizers and crop protection chemicals. A wind turbine in a farm field subject to aerial spraying represents an obstacle for the pilot; agricultural aviators fly below the height of turbine blades while distributing (as low as 10 feet above ground level) but need to rise to a higher altitude to turn around for their next pass. This turn can take a half mile to complete. In addition to collision risk, the vortices and the turbulence that the wind turbines generate can also be a concern for agricultural aviators.

According to the National Agricultural Aircraft Association (NAAA), there are about 1,560 aerial agricultural application businesses within the United States.[176] Minnesota has approximately 150 agricultural aircraft pilots.[177] Fixed-wing aircraft account for 87 percent of the aircraft used by agricultural applicators, helicopters and other rotorcraft account for the rest. Approximately 208 million acres of U.S. croplands are treated with crop protection products; aerial application accounts for about a fifth to a quarter of that acreage.[178]

The NAAA reports that between 2009 and 2019, nine (9) percent of aerial application fatalities were the result of collisions with various types of towers and 13 percent were the result of collisions with

[176] National Agricultural Aviation Association. 2019. *Industry Facts*, https://www.agaviation.org/industryfacts, accessed March 26, 2019.
[177] Minnesota Agricultural Aircraft Association. https://mnagaviation.com/.
[178] National Agricultural Aviation Association. 2019. *Industry Facts*, https://www.agaviation.org/industryfacts, accessed March 26, 2019.

wires.[179] The Minnesota Agricultural Aviation Association, in previous dockets, has noted in that nationwide, in the past 10 years, there have been 102 aerial collisions with towers and wires, 21 of these have been fatal.[180]

Both participating and non-participating landowner's operations may be affected; if one landowner erects a wind tower that resides too close to an adjacent landowner's field, the second landowner may lose their current or future opportunity to spray their crops, detrimentally affecting agricultural production.

Additionally, where aerial applications in the vicinity of wind facilities are still possible, the increased complexity and time required results in higher cost (most spray policies charge premiums up to 50 percent above standard costs on fields within a mile of the towers, whether a participating landowner or not) to the farmer.[181]

While ground application can be just as effective as aerial spraying, there are certain circumstances where aerial application is preferred or required, such as specific stages of growth (i.e., height of corn and sunflower), weather conditions (i.e., wet, saturated soils subject to compaction), areas requiring split applications of fertilizer (i.e., for groundwater protection), and where timing is urgent (i.e., emergency pest control). Furthermore, ground sprayers can increase the spread of disease by carrying it through the crop on the sprayer components after it brushes by diseased plants.

A Purdue University study shows ground applicator rigs damage approximately 1.5 to 5 percent of soybean crops.[182] Building on the Purdue study, Russ Gasper (Nebraska Department of Aeronautics) calculated a potential economic loss due to trampling from ground applicator rigs on Nebraska corn harvest of 25 million dollars.[183]

[179] National Agricultural Aviation Association. 2014. *Fact Sheet on the Dangerous Effects Low Level Obstacles Pose to the Aerial Application Industry.* https://www.agaviation.org/Files/policyinitiatives/Advocacy%20Papers/Tower%20Issue%20Paper%20FINAL.pdf, accessed March 26, 2019

[180] Minnesota Agricultural Aviation Association, Comment Letter November 1, 2018. eDocket No. 201811-148027-08

[181] Illinois Agricultural Aviation Association. 2019. *Wind Farms.* https://agaviation.com/wind-farms/

[182] Hanna et al. 2007. *Managing Fungicide Applications in Soybeans*. Bulletin SPS-103-W. Purdue University Extension Service. https://www.extension.purdue.edu/extmedia/sps/sps-103-w.pdf.

[183] Gaspar, Russ. 2015. *Agriculture, Aerial Applicators, and Airports.* Agricultural Aviation. September-October 2015. http://www.agaviationmagazine.org/agriculturalaviation/september_october_2015?pg=54#pg54.

Meteorological towers (MET), (Diagram 4-3) used to collect wind data at wind facility sites, can pose a special threat. These towers are typically 197 feet, which fall just under the requirements for FAA lighting and marking.

Diagram 4-3. Typical Meteorological Tower[184]

The type of MET towers that are used in development and siting (pre-construction) typically consist of sections of galvanized tubing that are assembled at the site and raised and supported using guy wires. These towers can be erected or removed in as little as a few hours. The tower may be at one location for a short period of time and then moved to a different location, as the wind developer checks the area for the best wind conditions for the placement of wind turbines. The fact that these towers are narrow, unmarked and grey in color makes for a structure that is nearly invisible under some atmospheric conditions. The temporary and mobile nature of these MET towers makes their location difficult to maintain in a database. In some cases, a wind company may install a temporary met tower to gather information on a potential site without general public knowledge. In some cases, the landowner's contract requires the landowner to keep this information confidential.

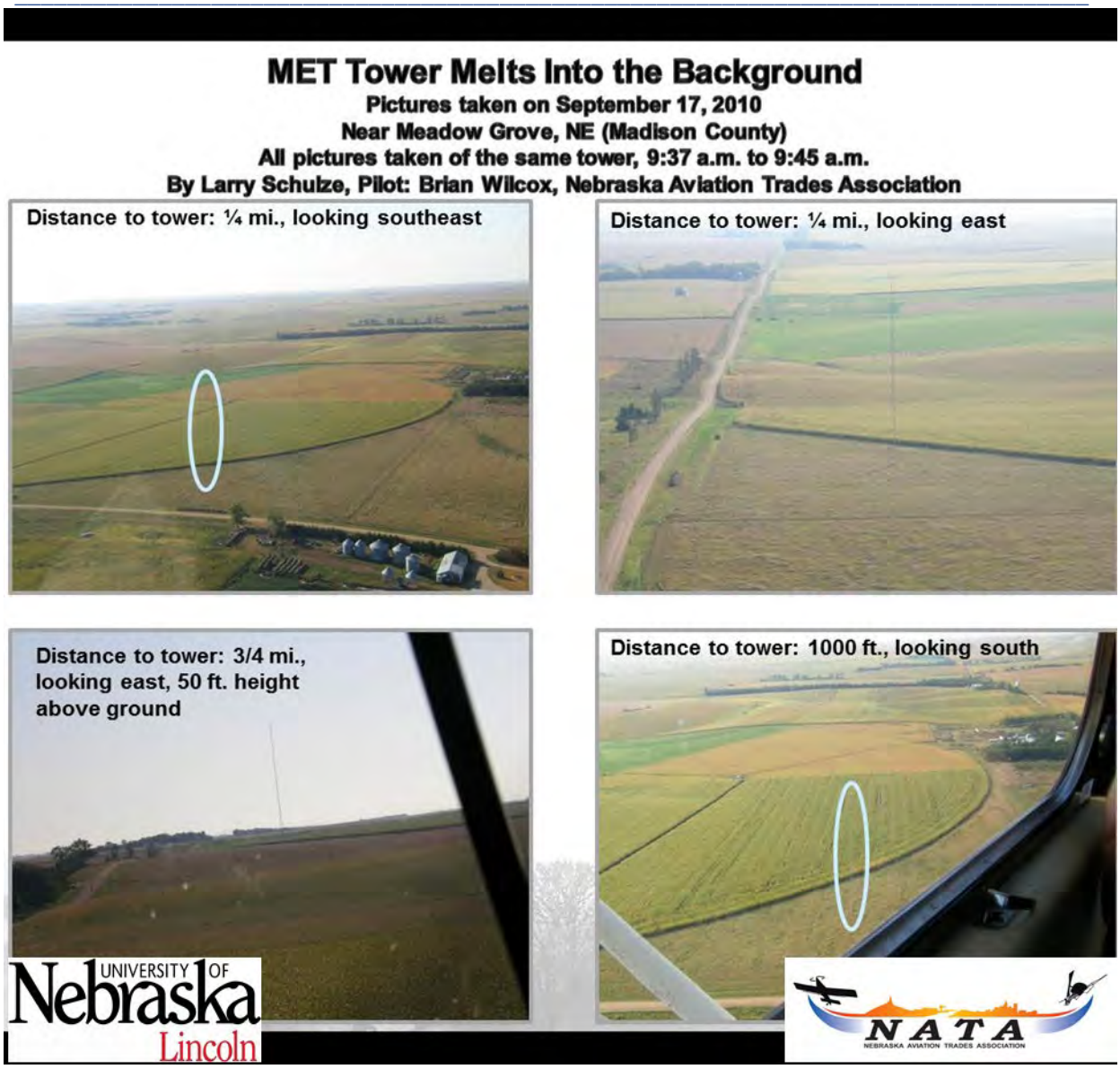
Post-construction MET towers are used to transmit to the control center the meteorological situation in the location and it has a principal importance for the management of the site. The type used during the operation of a wind conversion facility is built heavier and may or may not use guy wires; they usually still fall under the height required for FAA lighting and marking.

The major risk factor for pilots is that the dull metal used for the tower, and the supporting guy wires, are difficult to see from the air, see Diagram 4-4. The tower and wires easily blend into the surroundings, making them a hazard to pilots of low-flying aircraft.

[184] Meteorological (MET) Tower Installation and Wind Data Collection Services. https://www.prlog.org/10197661-meteorological-met-tower-installation-wind-data-collections-services.html.

Diagram 4-4. Met Tower Visibility[185]

[185] Nebraska Institute of Agriculture and Natural Resources. *Wind Measurement (MET) Towers.* https://cropwatch.unl.edu/bioenergy/met-towers



Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

There is one public airport and one private heliport within 10 miles of the Big Bend Wind and Red Rock Solar Project Area (Table 4-7). The nearest airport is the Windom Municipal Airport, located

approximately 4.6 miles southwest of the Big Bend portion of the hybrid project. These airports have runway approaches and restricted airspace for aircraft to approach and take off from. The St. James Medical Center, located approximately 7.8 miles east of the Big Bend portion of the Project Area, has a private heliport for patient transportation. The nearest FAA registered airport to the Red Rock Solar portion of the Project Area is the previously identified Windom Airport, which is located approximately 10 miles from Red Rock.

Table 4-7. Registered/Licensed Airports within 10 Miles of the Hybrid Project Area

Airport Name	City	County	Distance/ Direction[1]	Runway Information[2]	Runway Elevation (feet)[3]
Windom Municipal Airport	Windom	Cottonwood	4.6 miles SW	Concrete, Good	1,410
St. James Medical Center[4]	St. James	Watonwan	7.8 miles E	Heliport	1,077

1 Distance in miles from the nearest portion of the Big Bend Wind Project boundary.
2 Runway surface type and condition.
3 Elevation in feet at the highest point on the centerline of the useable landing surface. Measured to the nearest foot with respect to mean sea level.
4 Private airport/heliport.

There is a private runaway maintained within the Project Area, which could be impacted by the proposed construction and operation of Turbine T47. Big Bend worked with Mr. Theissen to allow construction and operation of the proposed Turbine T47, while still allowing safe operation of Mr. Theisen's private runway.

In addition to air traffic to and from the public and private airports/heliports identified above, air traffic may also be present near the hybrid project area for crop dusting of agricultural fields; small private runways associated with crop dusting activities may exist near the project area.

Big Bend has been in close coordination with the Department of Defense (DoD) regarding potential conflicts between the wind portion of the hybrid project and a military training route on the eastern edge of the wind portion of the Project Area identified by the Air National Guard and U.S. Airforce.[186] Under the Settlement Agreement and turbine location (A06) was proposed in close proximatiy to this military training route to help further mitigate visual impacts to users of the Jeffers Petroglyphs site. After further coordination between Big Bend and DoD, it was determined that this military training

[186] Amended Wind SPA – Section 8.9.2.2

route was no longer in use, and DoD no longer had concerns regarding the use of turbine location A06.[187]

Potential impacts of the Big Bend Wind Project to airports and air traffic can occur during the operational phase of the project. Turbine structures and meterlogical towers poses potential hazards to aviation. With mitigation measures the Big Bend Wind Project potential impacts to airports and air traffic are minimal.

FAA wants to ensure solar systems do not create glint or glare conditions (glint is a momentary flash of bright light, and glare is a continuous source of bright light). The FAA has determined that glint and glare from typical ground-mounted solar energy systems, in the vicinity of airports, could result in an ocular impact to pilots and/or air traffic control facilities and compromise the safety of the air transportation system.[188]

Red Rock does not anticipate any impacts to occur to any FAA registered airports as a result of the construction and operation of the Red Solar portion of the hybrid project.

335 MW Solar Facility (No wind component)

Because of the relatively low profile of PV solar farms, FAA lighting requirements would not be anticipated to be necessary; however, appropriate siting of PV solar projects is necessary to ensure they do not cause safety problems for aviation or otherwise interfere with aeronautical and airport activities. The FAA has determined that glint and glare from typical ground-mounted solar energy systems, in the vicinity of airports, could result in an ocular impact to pilots and/or air traffic control facilities and compromise the safety of the air transportation system. [189]

It is anticipated that an FAA review of the 335 MW solar facility alternative, with proper site prescreening, would result in a "No Hazard" determination.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

[187] Big Bend Wind, LLC and Red Rock Solar, LLC. Comments – BBRR Scoping Comments. November 1, 2021. eDocket ID # **202111-179402-04**

[188] Kandt, A; Romero, R. *Implementing Solar Technologies at Airports*. NREL. 2014. https://www.nrel.gov/docs/fy14osti/62349.pdf.

[189] Kandt, A; Romero, R. *Implementing Solar Technologies at Airports*. NREL. 2014. https://www.nrel.gov/docs/fy14osti/62349.pdf.

A 335 MW hybrid wind and solar facility alternative, sited elsewhere in Minnesota would also have to comply with FAA and the MnDOT Office of Aeronautics and Aviation requirements, requiring both turbines and meteorological towers to be identified and fitted with the appropriate markings and lights. Pre-screening of potential wind farm sites must take into consideration the potential for conflicts between the use of airspace and project infrastructure.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

Because of the relatively low profile of PV solar farms, FAA lighting requirements would not be anticipated to be necessary; however, appropriate siting of PV solar projects is necessary to ensure they do not cause safety problems for aviation or otherwise interfere with aeronautical and airport activities. The FAA has determined that glint and glare from typical ground-mounted solar energy systems, in the vicinity of airports, could result in an ocular impact to pilots and/or air traffic control facilities and compromise the safety of the air transportation system. [190]

It is anticipated that an FAA review of the 335 MW solar facility with battery storage alternative, with proper site prescreening, would result in a "No Hazard" determination.

Mitigation

Site permits granted by the Commission contain requirements for the design and siting of meteorological towers (Appendix B). Permanent towers for meteorological equipment are required to be free standing (no guy wires). Permanent meteorological towers shall not be placed less than 250 feet from the edge of the nearest public road right-of-way and from the boundary of the Permittee's site control, or in compliance with the county ordinance regulating meteorological towers in the county the tower is built, whichever is more restrictive. Meteorological towers shall be placed on property the Permittee holds the wind or other development rights. Meteorological towers shall be marked as required by the FAA.

Big Bend Wind Project planning, construction, and operation will be coordinated with the FAA, local airports and state air traffic agencies to ensure public safety is not negatively impacted by the Project. The Applicant will follow FAA guidelines for marking towers and implement the necessary safety lighting. Notification of construction and operation of the wind farm will be sent to the FAA and steps will be taken to ensure compliance with FAA requirements.[191] Additionally, Big Bend is coordinating

[190] Kandt, A; Romero, R. *Implementing Solar Technologies at Airports*. NREL. 2014. https://www.nrel.gov/docs/fy14osti/62349.pdf.

[191] Amended Wind SPA – Section 8.9.2.3

with the FAA to gain approval for the implementation and use of ADLS lighting systems to be deployed on the proposed turbines.

Under 14 CFR Part 77.9, all structures exceeding 200 feet above ground level must be submitted to the FAA so that an aeronautical study can be conducted. [192] The purpose of the study is to identify obstacle clearance surfaces that could limit the placement of wind turbines. The end result of the aeronautical study is the issuance of a Determination of Hazard or No Hazard.

Additionally, a Tall Towers Permit and approval may be required by the MnDOT prior to constructing the project to ensure the safety of airspace within Minnesota. As identified in Table 2-1, Big Bend will be responsible to complete an Airspace Obstruction Notification to MnDOT Aeronautics for any project related meteorological towers between 50 to 200 feet AGL, which will provide tower location information and identify how the towers will be marked and lighted.

No Impacts to FAA registered airports or air traffic are anticipated from the Red Rock Solar Project, so no mitigation is necessary.

4.2.2.2 Electric and Magnetic Fields

Electromagnetic Fields

Electromagnetic fields (EMF) are invisible regions of force resulting from the presence of electricity. EMF is often raised as a concern with electric transmission facilities. Naturally occurring EMF are caused by the earth's weather and geomagnetic field. Man-made EMF are caused by any electrical device and found wherever people use electricity.

- Electric fields are created by the electric charge (i.e., voltage) on a transmission line. Electric fields are solely dependent upon the voltage of a line (volts), not the current (amps). Electric field strength is measured in kilovolts per meter (kV/m). The strength of an electric field decreases rapidly as the distance from the source increases. Electric fields are easily shielded or weakened by most objects and materials, such as trees and buildings.

- Magnetic fields are created by the electrical current moving through a transmission line. The magnetic field strength is proportional to the electrical current (amps). Magnetic field strength is typically measured in milliGauss (mG). Similar to electric fields, the strength of a magnetic field decreases rapidly as the distance from the source increases. However, unlike electric fields,

[192] https://www.law.cornell.edu/cfr/text/14/77.9.

magnetic fields are not easily shielded or weakened by objects or materials.

EMF associated with wind energy facilities can be generated by collection lines and transformers within the nacelle of operating wind turbines.

While the electricity throughout the majority of a solar site is DC electricity, the inverters convert this DC electricity to alternating current (AC) electricity matching the 60 Hz frequency of the grid. The direct current (DC) electricity produced by PV panels produces what is termed *stationary* (0 Hz) electric and magnetic fields and are of little concern regarding the potential health risks.[193] It is the inverters, collection wires, substation, and the transmission conductors delivering the AC electricity to the grid that produces the *non-stationary* EMF (aka, extremely low frequency (ELF) EMF), which is often a subject of public concern.

The strength of ELF-EMF present at the perimeter of a solar facility is significantly lower than the typical American's average EMF exposure.[194] Researchers in Massachusetts measured magnetic fields at PV projects and found the magnetic fields dropped to very low levels of 0.5 mG or less, and in many cases to less than background levels (0.2 mG), at distances of no more than 150 feet from the utility-scale inverters.[195][196] It is typical that utility scale designs locate large inverters central to the PV panels that feed them because this minimizes the length of wire required and shields neighbors from the sound of the inverter's cooling fans. Thus, it is rare for a large PV inverter to be within 150 feet of a project's security fence.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

EMF from underground electrical collection lines dissipates close to the lines because they are installed below ground, geometrically close to each other, and wound with copper wires in their jackets. The electrical fields around these lines are negligible and the small magnetic field directly above the lines dissipates within 20 feet on either side of the installed cable, based on engineering

[193] World Health Organization. *Electromagnetic Fields and Public Health: Static Electric and Magnetic Fields*. March 2006. Accessed August 2016. http://www.who.int/peh-emf/publications/facts/fs299/en/.

[194] R.A. Tell et al, *Electromagnetic Fields Associated with Commercial Solar Photovoltaic Electric Power Generating Facilities*, Journal of Occupational and Environmental Hygiene, Volume 12, 2015, - Issue 11. Abstract Accessed March 2016: http://www.tandfonline.com/doi/full/10.1080/15459624.2015.1047021.

[195] Massachusetts Department of Energy Resources, Massachusetts Department of Environmental Protection, and Massachusetts Clean Energy Center. *Questions & Answers: Ground-Mounted Solar Photovoltaic Systems*. June 2015. Accessed August 2016. http://www.mass.gov/eea/docs/doer/renewables/solar/solar-pv-guide.pdf.

[196] Ibid.

analysis. Collection lines will be buried underground to a depth of at least 42 inches (with the exception of junction boxes) and will be located no closer than 110 feet from a residence.

EMF associated with the transformers within the turbine nacelle dissipates within 500 feet, so the 1,200-foot turbine setback from residences will be adequate to avoid any EMF exposure to homes.[197]

The primary source of EMF within the Red Rock Solar portion of the proposed hybrid project will be the PV panel arrays, inverters, collector lines, and the transformer. Of these project components the panel arrays and an inverter are anticipated to have the greatest EMF output, and the nearest residence 506 feet from the array and 1,122 feet from an inverter. EMF levels produced at the array and the inverters are anticipated to dissipate to background levels before reaching the nearest residence.[198]

The electrical fields that emanate from buried lines and transformers are generally considered negligible, and magnetic fields often decrease significantly within approximately three feet of stronger EMF sources (such as transmission lines and transformers).

The AC collection line connecting the Red Rock Solar Project transformers to the Red Rock Project Substation will also create EMF, but with the collection line being buried at a minimum depth of four feet EMF levels will dissipate rapidly in the soil and impacts will be negligible.

No health impacts from EMF generated by the Big Bend Wind Project or the Red Rock Solar Project are anticipated.

335 MW Solar Facility (No wind component)

As with the solar portion of the proposed hybrid project, a generic 335 MW PV solar farm would also require the installation of similar infrastructure (transmission lines and substation) beyond on-site facilities (i.e., PV arrays, including electrical cables and conduit, electrical cabinets, step-up transformers, SCADA systems and metering equipment, and access roads) to deliver the generated power to the overall grid.

Potential impacts of EMF for this system alternative are anticipated to be similar to those of the Red Rock Solar portion of the proposed hybrid project.

[197] Amended Wind SPA – Section 8.9.1.2

[198] Solar SPA – Section 4.2.1.3

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

The 335 MW hybrid wind and solar facility alternative, located elsewhere in the State, would have similar facilities and equipment with similar potential impacts. This system alternative would likely require transmission facilities to an interconnection point, similar to those of the proposed hybrid wind and solar project.

Any transmission lines and substation associated with the 335 MW hybrid wind and solar facility alternative would likely be similar to those of the hybrid Big Bend Wind and Red Rock Solar project.

Potential impacts of EMF of this system alternative are anticipated to be similar to those of the proposed hybrid project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

As with the solar portion of the proposed hybrid project and the 335 MW solar facility alternative, the 335 MW solar facility with battery storage alternative, would also require the installation of similar infrastructure (transmission lines and substation) beyond on-site facilities (i.e., PV arrays, including electrical cables and conduit, electrical cabinets, step-up transformers, SCADA systems and metering equipment, and access roads) to deliver the generated power to the overall grid.

The battery storage portion of this alternative is likely to add minimal or no additional EMF. The battery storage banks will be within storage containers and be located within the secure project fenced area. The location of the banks would likely not be placed in close proximity to a residence.

Potential impacts of EMF for this system alternative are anticipated to be similar to those of the Red Rock Solar portion of the proposed hybrid project.

Mitigation

Although EMF is often raised as a concern with generation and transmission projects, the Commission has consistently found that there is insufficient evidence to demonstrate a causal relationship between EMF exposure and human health effects.

Big Bend and Red Rock will design, construct, and operate all electrical equipment, including turbines, transformers, PV panel arrays, inverters, collection lines, and transmission lines in accordance with applicable codes, manufacturer specifications, and required setbacks.

Big Bend Wind Project facilities have been sited appropriately, and setbacks of all EMF generating equipment from residences is sufficient to make the potential impacts negligible. No additional mitigation is proposed or warranted at this time.

Red Rock Solar Project facilities have been sited appropriately, and setbacks of all EMF generating equipment from residences is sufficient to make the potential impacts negligible. No additional mitigation is proposed or warranted at this time.

EMF from underground electrical collection and feeder lines dissipate very quickly and relatively close to the source because they are installed below ground to a depth of approximately 48 inches and are heavily insulated and shielded. No additional mitigation is proposed.

4.2.2.3 Stray Voltage

Stray voltage is sometimes raised as an issue associated with electric transmission. Stray voltage (also referred to as neutral to earth voltage) is an extraneous voltage that appears on metal surfaces in buildings, barns and other structures, which are grounded to earth. Stray voltage is typically experienced by livestock who simultaneously come into contact with two metal objects (i.e. feeders, waterers, stalls). If there is a voltage between these objects, a small current will flow through the livestock. Stray voltage does not cause electrocution and is not related to ground current, EMF, or earth currents. Where distribution lines have been shown to contribute to the propagation of stray voltage on farm facilities, the distribution system was either directly under or parallel to an existing transmission line. These factors are considered in design and installation of transmission lines and can be readily mitigated.

The fact that both objects are grounded to the same place (earth) would seem to prevent any voltage from existing between the objects. However, this is not the case – a number of factors determine whether an object is, in fact, grounded. These include wire size and length, the quality of connections, the number and resistance of ground rods, and the current being grounded. Thus, stray voltage can exist at any house or farm which uses electricity, independent of whether there is a transmission line nearby.

Stray voltage is more commonly associated with small electrical distribution lines, which connect homes to larger transmission lines, and provide electricity to individual residences, farms, businesses, etc. Data analysis has determined that there does not appear to be any link between the distance

between a farm (residence) and substation, or the electrical magnitude of the primary power line, leading to increased risk of stray voltage impacts.[199]

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

There is one dairy operation in the within the Big Bend Wind portion of the hybrid project area. The nearest turbine is sited over one mile from the dairy operation, and the nearest collector line will be located 1.25 miles from the dairy operation. With these setback distances the potential of any stray voltage from project infrastructure reaching the dairy operation is virtually impossible.[200]

If facilities, primarily the underground collection lines, within Big Bend Wind Project are not grounded appropriately they could generate stray voltage.

Components, such as the inverters, transformers, and collection lines within the Red Rock Solar portion of the hybrid project could generate stray voltage if not grounded properly. The potential impacts of stray voltage from the Red Rock Solar Project are negligible when mitigation is taken into consideration.

335 MW Solar Facility (No wind component)

As with the proposed hybrid project, a 335 MW solar facility alternative would also require the installation of similar on-site facilities (i.e., PV arrays, including electrical cables and conduit, electrical cabinets, step-up transformers, SCADA systems and metering equipment, and access roads) to gather the power produced from the individual components (PV arrays, turbines).

As with the proposed hybrid wind and solar project, stray voltage concerns from collector and feeder lines located within the solar farm are addressed through project design of these systems.

Potential impacts of stray voltage of this system alternative are anticipated to be similar to those of the proposed hybrid project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

[199] Wisconsin Public Service. *Answers to Your Stray Voltage Questions: Backed by Research*. 2011. http://www.wisconsinpublicservice.com/business/pdf/farm_voltage.pdf.

[200] Amended Wind SPA – Section 8.9.1.2

A 335 MW hybrid wind and solar facility alternative, located elsewhere in the State, will generally require transmission facilities to an interconnection point, similar to those indicated for the Big Bend Wind and Red Rock Solar hybrid project. Stray voltage concerns from turbines, PV arrays, transformer, inverters, and collector and feeder lines located within the hybrid alternative project would be addressed in the design of these systems.

Potential impacts of stray voltage of this system alternative are anticipated to be similar to those of the proposed hybrid project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

As with the proposed hybrid project, a 335 MW solar facility alternative would also require the installation of similar on-site facilities (i.e., PV arrays, including electrical cables and conduit, electrical cabinets, step-up transformers, SCADA systems and metering equipment, and access roads) to gather the power produced from the individual components (PV arrays). Stray voltage concerns from collector and feeder lines located within the solar facility are addressed through project design of these systems.

The battery storage portion of this alternative is not anticipated to generate any stray voltage, as the project electrical components will be properly grounded.

Potential impacts of stray voltage of this system alternative are anticipated to be similar to those of the proposed hybrid project.

Mitigation

The Big Bend portion of the hybrid project will be designed and constructed to meet electrical grounding requirements in the National Electrical Safety Code, which will make the potential for stray voltage associated with the wind portion of the hybrid project negligible.

The Red Rock Solar portion of the hybrid project will be designed and constructed to meet electrical grounding requirements in the National Electrical Safety Code, which will make the potential for stray voltage associated with the solar portion of the hybrid project to be negligible. Additionally, project monitoring systems will quickly identify and correct any faults within the project grounding system.[201]

[201] Solar SPA – Section 4.2.1.3

4.2.2.4 *Emergency Services*

Construction and operation of a large wind energy facility and a solar generation facility pose risks to the general public, and even more so workers at the facilities.

Large scale construction for wind and solar facilities requires significant equipment, products, and materials to be hauled in via the local road system. Traffic congestion can also result in impacts to the response times of local emergency services.

Local emergency services near the Big Bend Wind and Red Rock Solar project areas consist of the following:

- Cottonwood County and Watonwan County Sheriff Departments
- Mountain Lake, Windom, St. James, and Comfrey Police Departments
- Mountain Lake, Butterfield, Windom, St. James, Danfur, Comfrey, and Jeffers Fire Departments
- Windom, Mountain Lake, St. James, and Jeffers Ambulance Services
- Hospitals and Clinics
  - Windom Area Health
  - Madelia Community Hospital and Clinic
  - Sanford Health, Mountain Lake Clinic
  - Mayo Clinic Health System (St. James and Comfrey)
  - Various eye clinics, dental offices, and chiropractors

The Allied Radio Matrix for Emergency Response (ARMER) system is used across Minnesota as the primary communication tool for state, county, and local public safety entities. ARMER broadcast frequencies range from 851 MHz to 859 MHz.[202]

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

It is possible that if an accident occurs at either, or both, Big Bend Wind and Red Rock Solar local emergency services would be called upon for assistance. However, with the number of emergency services available in the area, it is highly unlikely that an emergency situation at the Big Bend Wind Project and/or the Red Rock Solar Project would overwhelm the existing services in the local communities.

[202] Big Bend Wind HVTL SPA – Section 5.2.1 and 5.2.10

Trucks hauling materials and equipment to and from the Big Bend Wind Project and/or the Red Rock Solar Project could result in minor traffic congestion on the local roads within and around the project areas.

The ARMER system functions radio signal and line of sight between towers within the system, so tall structures, such as wind turbines could create possible interference if placed between the ARMER system towers. To date there have been no reported instances of interference to the ARMER system caused by operating wind turbines.

Impacts of the Big Bend Wind and Red Rock Solar Projects on the use of emergency services are anticipated to be negligible and will be mitigated if impacts are later identified.

Impacts of the additional truck traffic associated with the construction of the Big Bend Wind and Red Rock Solar Projects on emergency services is minimal, and with planned mitigation efforts the impacts will likely be negligible.

The ARMER system will not be impacted by the Red Rock Solar Project, as there are no tall structures that would block line of sight between ARMER towers. The Big Bend Wind Project is anticipated to have negligible impacts on the ARMER system, and if interference between ARMER towers occurs Big Bend Wind will mitigate impacts as they would for any impacts to other communication systems within and around the project area.[xxviii]

335 MW Solar Facility (No wind component)

As with the proposed hybrid project, a 335 MW solar facility system alternative would also pose similar potential impacts to local emergency services. No impacts to the ARMER system would be anticipated, as there are no larger vertical structures associated with solar facilities.

Potential impacts of this system alternative are anticipated to be similar to those of the proposed projects.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

As with the proposed hybrid project, a 335 MW hybrid wind and solar facility system alternative would also pose similar potential impacts to local emergency services. The potential for impacts to the ARMER system would exist because of the presence of tall wind turbine structures, but any potential interference could be mitigated.

Potential impacts of this system alternative are anticipated to be similar to those of the proposed projects.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

As with the proposed hybrid project, a 335 MW solar facility with battery storage system alternative would also pose similar potential impacts to local emergency services. No impacts to the ARMER system would be anticipated, as there are no larger vertical structures associated with solar facilities.

Potential impacts of this system alternative are anticipated to be similar to those of the proposed projects.

Mitigation

To minimize impacts to access of local emergency services, emergency response will be prioritized over project construction activities for the Big Bend Wind and Red Rock Solar Project to the greatest extent possible. Any temporary lane restrictions or slow-moving traffic that might affect emergency response services would be coordinated with local jurisdictions to ensure that safe alternative access is available for police, sheriff, fire, ambulance, and other rescue vehicles.

Big Bend Wind and Red Rock Solar will development, and make available as a pre-construction permit compliance filing, a plan that will identify roads to be used for truck haul routes. This will allow for coordination with local emergency services to ensure access points throughout the project areas are available.

4.2.2.5 Solid and Hazardous Materials

Large electric generation facilities have the potential to generate solid and hazardous wastes. Solid and hazardous wastes, if not properly handled, can contaminate surface and ground waters. This contamination can cause a variety of human and environmental health impacts depending on the type and amount of contamination.

Construction of the Big Bend Wind and Red Rock Solar Projects have the potential to disturb existing environmental hazards on-site, for example, contaminated soils.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

Potential hazardous materials within the site are typical of agricultural uses and may include contamination from petroleum products (diesel fuel, gasoline, natural gas, heating oil, lubricants, and maintenance chemicals), pesticides and herbicides.[203] Older farmsteads may also contain lead-based paint, asbestos-containing building materials (e.g. shingles and siding), and polychlorinated biphenyls

[203] Amended Wind SPA – Section 8.10

("PCBs") in electrical transformers. Unmarked farmstead waste dumps which may contain various types of wastes are also commonly found in rural settings.

The proposed hybrid wind and solar project will generate solid waste during construction including construction debris such as scrap wood, plastics, cardboard and scrap metals. Petroleum products would also be present on site, such as oil and fuel. Operation of the Big Bend Wind or Red Rock Solar Projects are not expected to generate significant quantities of solid and hazardous waste materials. Small quantities of hydraulic oil, lube oil, grease, and cleaning flush will be maintained and stored at the O&M building, and as these fluids are replaced the waste products will be handled and disposed of through an approved disposal firm as required by regulations.

Big Bend and Red Rock reviewed the U.S. Environmental Protection Agency's (EPA) Facility Registry Service (FRS) to identify sites that are listed on the Comprehensive Environmental Response, Compensation, and Liability Information System (also known as Superfund sites); the Resource Conservation and Recovery Act Treatment, Storage, and Disposal and the RCRA hazardous waste generators; the Assessment, Cleanup, and Redevelopment Exchange System; the Minnesota Permitting, Compliance, and Enforcement Information Management System; and the Leaking Underground Storage Tank—American Recovery and Reinvestment Act database.

Big Bend also reviewed the MPCA's *What's in my Neighborhood* (WIMN) database to identify any potential contaminated sites in the Project Area.

Review of the FRS and WIMN databases identified 49 licensed feedlots (four of which are inactive), one aboveground tank, four hazardous waste generators (two of which are inactive), one licensed septic installer, one septic system, three active construction stormwater permits and one inactive construction stormwater permit, one active municipal wastewater National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) permits, one active petroleum remediation and contaminated soil treatment facility, one inactive underground storage tank, and one active site assessment in the wind portion of the Project Area.

No Superfund sites were identified within the Hybrid Project Area.[204]

A review of What's in My Neighborhood, maintained by MPCA, indicates there are two feedlots (one within and one immediately adjacent to the Red Rock Solar Project boundary.

As part of the Project financing process, an ASTM conforming Phase I Environmental Site Assessment (Phase I ESA) was conducted for leased lands within the Hybrid Project Area in July 2021. No recognized

[204] Amended Wind SPA – Section 8.10.1

environmental conditions or historical recognized environmental conditions were identified in the Big Bend Wind Project Area.[205]

In Minnesota, solar panels discarded by commercial entities must be assumed to be hazardous waste due to the probable presence of heavy metals, unless they are specifically evaluated as non-hazardous. Heavy metals in solar panels can include arsenic, cadmium, lead, and selenium. If hazardous waste, they must be properly disposed of in a special facility or recycled if recyclers are available.

Potential impacts of hazardous materials being generated or released as a result of the Big Bend Wind Project or the Red Rock Solar Project are minimal, and negligible with proper materials handling and disposal mitigation measures in place.

335 MW Solar Facility (No wind component)

As with the solar portion of the proposed hybrid wind and solar project, a solar farm will generate solid waste during construction (e.g., scrap wood, plastics, cardboard and wire). Small amounts of hazardous wastes would be generated during operation, (e.g., oils, grease, hydraulic fluids and solvents). The small quantities of hazardous materials would be stored within the O&M facilities.

Depending on the project site selected, the 335 MW Solar Facility system alternative, located elsewhere in the State, is likely to have the same potential for hazardous materials as the proposed hybrid wind and solar project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

As with the proposed hybrid wind and solar project, the 335 MW hybrid wind and solar facility alternative, located elsewhere in the State, will generate similar quantities of solid waste during construction including construction debris such as scrap wood, plastics, cardboard and scrap metals. Petroleum products would also be present on site, such as oil and fuel.

Operation of the 335 MW hybrid wind and solar facility alternative is not expected to generate significant quantities of solid and hazardous waste materials. Small quantities of hydraulic oil, lube oil, grease, and cleaning flush will be maintained and stored at the O&M building, and as these fluids are replaced the waste products will be handled and disposed of through an approved disposal firm as required by regulations.

[205] Amended Wind SPA – Section 8.10.1

Depending on the project site selected, the 335 MW hybrid wind and solar facility alternative, located elsewhere in the State, is likely to have the same potential for hazardous materials as the proposed hybrid wind and solar project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

As with the solar portion of the proposed hybrid wind and solar project, a solar facility with battery storage will generate solid waste during construction (e.g., scrap wood, plastics, cardboard and wire). Small amounts of hazardous wastes would be generated during operation, (e.g., oils, grease, hydraulic fluids and solvents). The small quantities of hazardous materials would be stored within the O&M facilities.

This system alternative would also have the same issues with siting and hazardous material presence as identified for the proposed hybrid project and the previously described system alternatives.

Mitigation

Hazardous materials and any waste generated during construction of the Big Bend Wind Project and the Red Rock Solar Project will be handled and stored appropriately; hydraulic fluid, lubrication oil and grease would be disposed of through an approved waste disposal firm. Leaks or spills will be mitigated using appropriate clean up techniques. A listing of all potentially hazardous materials related to the operation of the facilities will be maintained at the O&M facility for both projects.

It is not anticipated that a hybrid wind and solar facility, stand alone solar facility, or a solar facility with battery storage would require a hazardous waste generators license. Hazardous waste generation would likely fall below the quantity required for a very small quantity generator license (220 pounds per month).

With proper identification, handling, storage, and disposal of hazardous waste materials at the Big Bend Wind Project and the Red Rock Solar Project, no additional mitigation measures are warranted.

4.2.2.6 *Implantable Medical Devices*

Devices such as pacemakers, defibrillators, neurostimulators and insulin pumps can be susceptible to electronic interference, however only at levels (5 kV/m) that will not exist in the Big Bend Wind or Red Rock Solar Project Areas.

Additional mitigation is not proposed.

For additional discussion of potential EMF impacts related to the proposed projects refer to Section 4.3.2.4 Electromagnetic Fields.

4.2.2.7 *Public and Worker Safety*

The proposed projects present risks to the general public and workers on site, just as any construction site would.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

Worker safety issues are primarily associated with construction of the Big Bend Wind Project and Red Rock Solar Project. These include potential injury from falls, equipment and vehicle use, electrical accidents, etc.

During operation of the Big Bend Wind Project and Red Rock Solar Project there are occupational risks similar to those associated with construction of the projects.

Public risks would result from unauthorized entry into the facility.

In Minnesota, solar panels discarded by commercial entities must be assumed to be hazardous waste due to the probable presence of heavy metals, unless they are specifically evaluated as non-hazardous. Heavy metals in solar panels can include arsenic, cadmium, lead, and selenium. If hazardous waste, they must be properly disposed of in a special facility or recycled if recyclers are available.

The impact intensity level is minimal. Potential impacts would be short-and long-term and can be minimized.

335 MW Solar Facility (No wind component)

The 335 MW solar facility system alternative will consist of similar construction and operational related public and worker safety risks as the proposed hybrid Big Bend Wind and Red Rock Solar Project.

This system alternative is anticipated to have similar impacts to public and worker safety as the Red Rock Solar portion of the proposed hybrid project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

The 335 MW hybrid wind and solar facility system alternative will consist of similar construction and operational related public and worker safety risks as the proposed hybrid Big Bend Wind and Red Rock Solar Project.

This system alternative is anticipated to have similar impacts to public and worker safety as the proposed hybrid project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

The 335 MW solar facility with battery storage system alternative will consist of similar construction and operational related public and worker safety risks as the proposed hybrid Big Bend Wind and Red Rock Solar Project.

This system alternative is anticipated to have similar impacts to public and worker safety as the Red Rock Solar portion of the proposed hybrid project.

Mitigation

All project components will be designed and constructed in compliance with applicable electric codes. Electrical inspections will ensure proper installation of all components, and the project will undergo routine inspection. Electrical work will be completed by trained technicians.

Construction is bound by federal and state Occupational Safety and Health Administration requirements for worker safety, and must comply with local, state, and federal regulations regarding installation of the facilities. Established industry safety procedures will be followed during and after construction of the project. Crews will be trained and briefed on safety issues, reducing the risk of injury.

Big Bend Wind Project and the Red Rock Solar Project workers will be handle and store potential hazardous materials appropriately; hydraulic fluid, lubrication oil and grease would be disposed of through an approved waste disposal firm. Leaks or spills will be mitigated using appropriate clean up techniques. A listing of all potentially hazardous materials related to the operation of the facilities will be maintained at the O&M facility for both projects.

The Big Bend Wind Project substation, the Red Rock Solar panel array and project substation will all be fenced to will deter public access, and signage will provide appropriate public warnings.

The decommissioning plan for the Red Rock Solar Project addresses PV panel end of life issues.

The LWECS DSP and sample solar permit address public safety, including landowner educational materials, appropriate signs and gates, development of an emergency response plan, and requirements to disclose extraordinary events.

4.2.2.8 *Existing Infrastructure*

The Project is located in rural southwestern Minnesota. A network of communication systems and utilities provide electricity, water supply, and telephone service to rural residences, farmsteads, small industry, and unincorporated areas. Water wells and septic systems (SSTS) are typically used within the hybrid project area to provide household needs.

South Central Electric Association provides electrical service in the project area and has distribution lines located throughout the project area. Mountain Lake Municipal Utilities provides electrical services to residences within the City of Mountain Lake, and also serves residences within 0.5 miles of the Mountain Lake municipal boundary.

It is assumed that local utilities such as natural gas, telephone, fiber optic cables, and cable television are buried in the project area along road ROWs.

Big Bend Wind and Red Rock Solar are outside of any municipal boundaries; therefore, it is assumed that residences within the hybrid project area not serviced by city water supply or sanitary sewer; these services are provided by individual wells and septic systems. Red Rock Rural Water System does supply water to some residences within Cottonwood and Watonwan counties.

There are no natural gas transmission pipelines or hazardous liquid (oil) pipelines located within the Big Bend Wind or Red Rock Solar Project Areas.

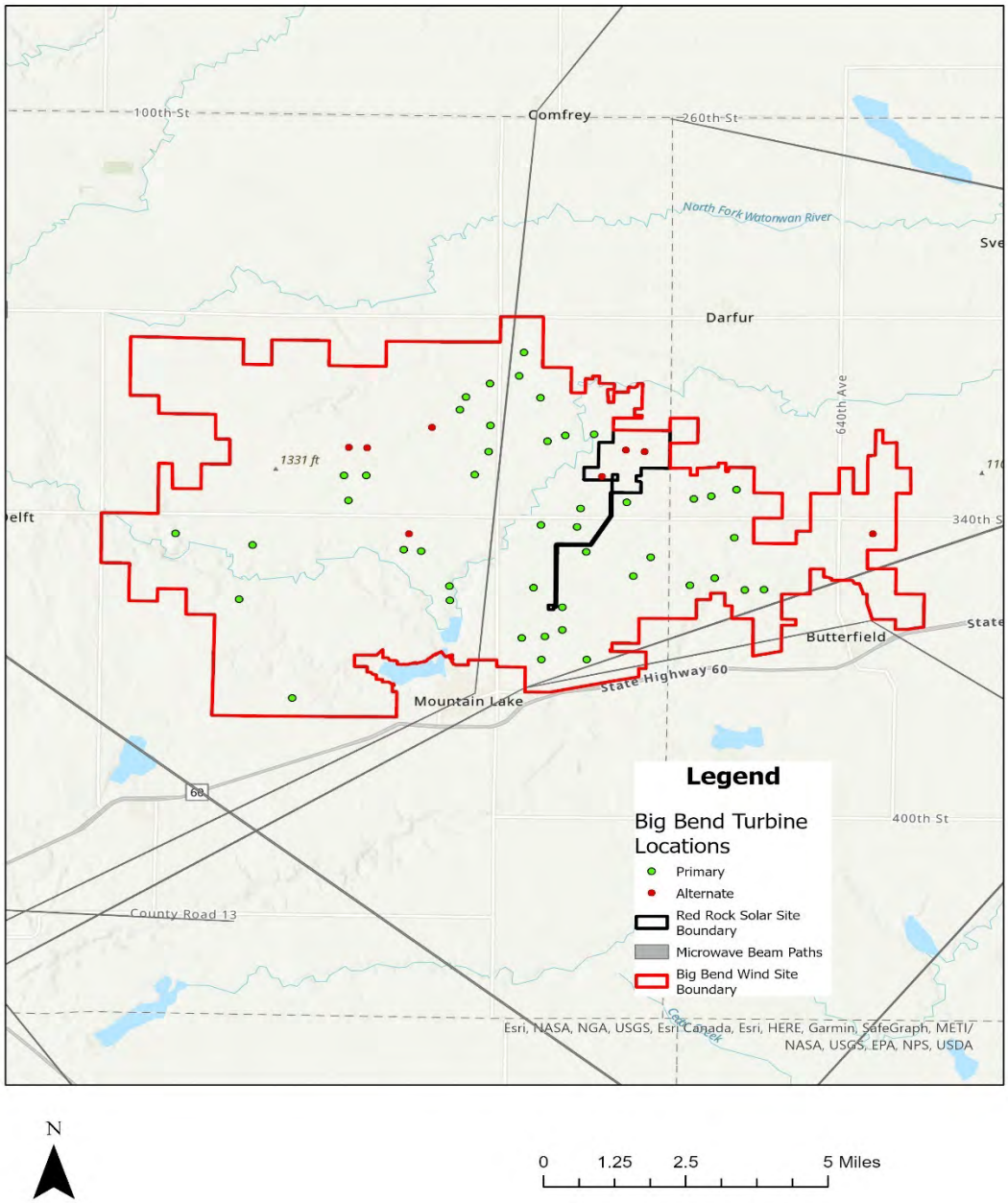
Large electric generation facilities have the potential to impact electronic communications (radio, television, internet, cell phone, and microwave).

Radio

Land mobile and radio facilities are wireless communication systems intended for use by users in vehicles, such as those used by emergency first responder organizations (i.e. ARMER), public works organizations or companies with large vehicle fleets or numerous field staff. FM radio is not impacted by wind turbines or solar arrays; AM radio can be impacted near transmission facilities, e.g., signal fading underneath a transmission line.

Microwave Beam Paths

Microwave bands are a telecommunication system that provides long-distance and local telephone service, backhaul for cellular and personal communication service, data interconnects for mainframe computers and the Internet, network controls for utilities and railroads, and various video services.



Radar

The federal government has a large number of departments and agencies that operate a set of communication systems that are not part of any public databases. The United States Department of Commerce National Telecommunications and Information Administration (NTIA) coordinates government communication systems for all departments and agencies.

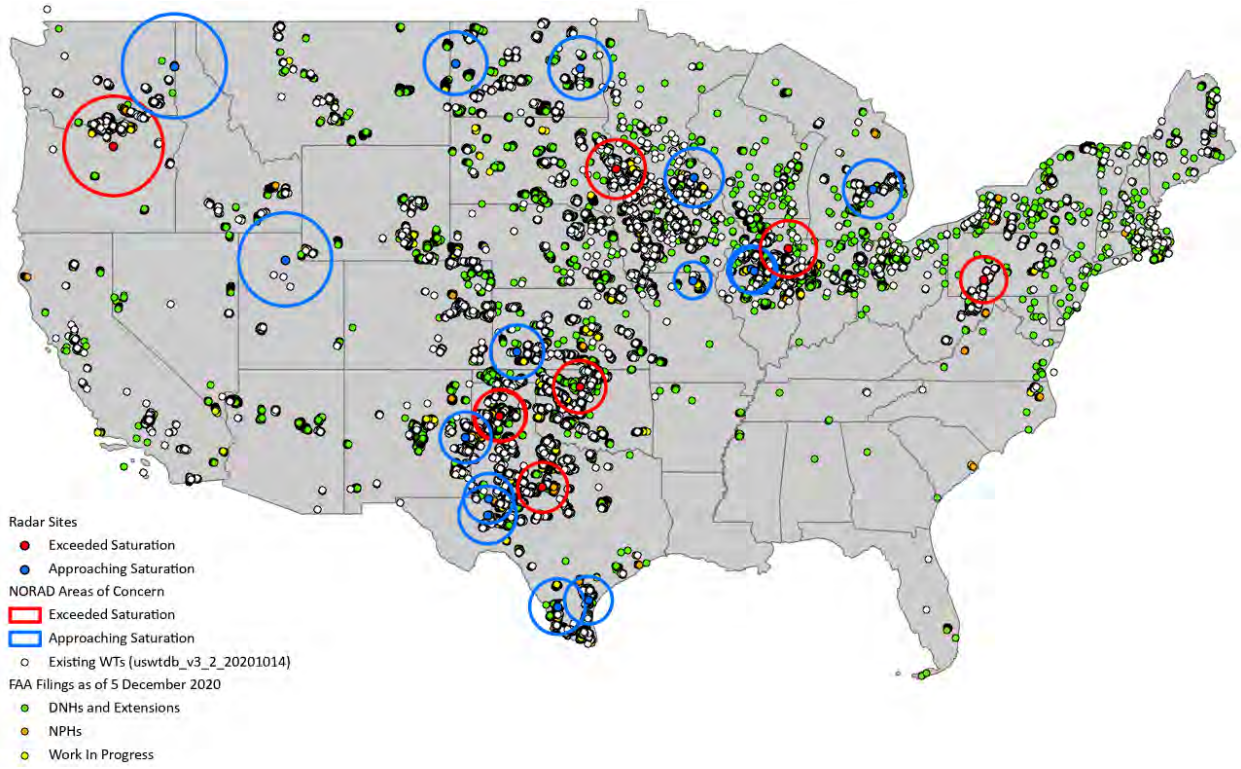
Modern radars differentiate between stationary and moving objects using a phenomenon called "Doppler shift." When wind turbines are in the radar line of sight, the radar detects the Doppler shift of the rotating turbine blades and this interferes with the radar system.[206] Interference from wind turbines, specifically reductions in the radar's performance (ability to identify and track aircraft within the "clutter" created by the wind turbine interference), and the creation of radar "false targets" (from interference from rotating wind turbine blades within the radar line of sight) have been documented.[207]

Proposed wind farms within line-of-sight of a North American Aerospace Defense Command (NORAD) radar require a developer to engage in Mitigation Response Team (MRT) discussions with the Air Force and NORAD. Projects within the line-of-sight of one or more of the 23 radar sites identified by NORAD (Figure 4-5) are at increasing risk of receiving an agency objection, noting that the proposed project potentially rises to an unacceptable risk to national security.

[206] The mission compatibility evaluation process annual report to congress, 2013. USA000657-14_TAB_B_RTC_FINAL AS SIGNED.pdf (osd.mil).

[207] The mission compatibility evaluation process annual report to congress, 2013. USA000657-14_TAB_B_RTC_FINAL AS SIGNED.pdf (osd.mil).

Figure 4-5. NORAD Saturation and Areas of Concern[208]



Telephone Service

Telephone service in the Project Area is provided both through landlines and wireless signals. Landline telephone service in the area is provided to farmsteads, rural residences and businesses by Spectrum and CableOne. Cellular services in the Project Area are provided by many carriers including AT&T, DISH network, Sprint, Standing Rock Telecommunications, TerreStar, T-Mobile, and Verizon.

Land mobile systems are designed with multiple base transmitter stations; therefore, any signal blockage caused by the wind turbines would not perceptibly degrade their reception.

[208] NORAD Saturation, Existing Mitigation, and Need for Short-Term Mitigation, Westslope Consulting, LLC. December 11, 2020.

Television

Broadcast facilities (HDTV and digital television) provide television services to the Big Bend Wind and Rock Solar portions of the hybrid project area. Some residents utilized cable and satellite television options as well.

The Evans Engineering study also identified 35 stations with off-the-air service signal over at least a portion of the hybrid project area. Of these 35 stations, only three are full power TV stations affiliated with major networks, and the remaining 32 are low-power stations or translators. Translator stations are low-power stations that receive signals from distance broadcasters and retransmit the signal to a local audience. These stations serve local audiences and have limited range, which is a function of their transmit power and the height of their transmit antenna.[209]

GPS

Global positioning systems (GPS) use satellite signals to determine locations on the earth's surface and are commonly used to guide agricultural operations.

Wireless Broadband Internet

Wireless broadband internet services utilize a broadband signal towers that transmit to residential antennas within a specific area.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

Impacts to local electric, natural gas, telephone, fiber optic cables, and cable television utilities could occur during the construction of the Big Bend Wind or Red Rock Solar Projects. These impacts would only occur if an overhead distribution line or buried utility line was disturbed or damaged during construction activities. With planned mitigation these types of impacts are anticipated to be negligible to short-term, isolated, and minimal.

Wind turbines can cause interference with electronic communications by obstructing the reception of communication signals. Wind turbines do not impact digital signals (digital television, internet, cell phones), unless the turbines directly obstruct the signal, such as being located in the line-of-sight.[210] Analog signals (e.g., amplitude Modulated (AM) and frequency modulated (FM) radio, microwaves)

[209] Amended Wind SPA – Section 8.6.5.2

[210] Polisky, Lester. *Post Digital Television Transition - The Evaluation and Mitigation Methods for Off-Air Digital* Television Reception in-and-around Wind Energy Facilities. Wireless Pulse, December 2009; http://acvamoonga.comsearch.com/newsletter/archiveWP/WirelessPulseDec09.html

Because the Red Rock Solar portion of the hybrid project does not propose the construction of any significant vertical structures no impacts to any communication systems are anticipated to result from the construction and operation of the solar portion of the hybrid project.

Big Bend commissioned a communication tower study by Evans Engineering, which identified three communication tower structures the Big Bend portion of the Project Area. These three tower structures are registered with the Federal Communications Commission (FCC). No microwave, cellular, AM/FM radio, or other types of communication towers were identified within the Big Bend portion of the Project Area. Big Bend noted that additional communication antennas may be present within the Big Bend portion of the Project Area, but because these structures are typically shorter than 200 feet in height, they are not required to be registered with the FCC.[211]

Wind turbines can interfere with microwave paths by blocking or partially blocking the line-of-sight path between microwave transmitters and receivers. The Electromagnetic Interference Analysis examined microwave beam paths in the vicinity of the Big Bend Wind and Red Rock Solar Projects, and identified three microwave beam paths that cross into the Big Bend Wind Project Area. No proposed wind turbine locations interfere with identified microwave beam paths. No microwave beam paths cross the Red Rock Solar Project. As such, impacts to microwave beam paths are not anticipated.[212]

The NTIA responded to Big Bend's requesting review of the proposed wind portion of the hybrid project, and the NTIA stated that no agencies have issues with the proposed placement of the Big Bend portion of the hybrid project.[213]

There are three land mobile antennas in the Big Bend portion of the Project Area, but no cellular towers.[214] Operation of the wind project or solar project is not anticipated to impact the telephone service in the Project Area; however, physical damage to underground telephone lines may incidentally occur during construction of the Big Bend Wind Project or the Red Rock Solar Project.

There is a possibility that broadcast facilities (HDTV and digital television) would be impacted by the wind project during operation. Outdoor antennas pointed through the turbine area, "rabbit ear" antennas or older HDTV receivers would be more likely to experience signal disruption (in the form of pixilation or "freezing" of a picture).[215] Interference would be more likely to occur where there is

[211] Amended Wind SPA – Section 8.6.4.1
[212] Amended Wind SPA – Section 8.6.4.2
[213] Amended Wind SPA – Section 8.6.4.2
[214] Amended Wind SPA – Section 8.6.6.1
[215] Amended Wind SPA – Section 8.6.5.2

direct interference with digital broadcast paths of local television stations. Occasionally, multipath interference from one or more turbines can cause video failure in HDTV receivers, especially if the receiver location is in a valley or other place of low elevation.

Residences that use 35 off-the-air television stations may experience signal disruption related to the Big Bend portion of the hybrid project operating. Television reception at residences relying on cable or satellite television service will not be impacted by construction or operation of the Project.[216]

Because GPS uses multiple digital satellite signals, interference with the signals or subsequent uses is not anticipated. Obstruction of any one satellite signal would require direct line-of-sight obstruction due to a wind turbine. Such an obstruction would be temporary (i.e., there is concurrent GPS receiver movement, satellite movement, and wind turbine blade movement such that the obstruction should be resolved).

It is unclear if there are impacts to wireless broadband internet signals due to operation of the wind project. For a previous wind project, the Department contacted engineers at the local wireless broadband internet service provider (StarCom/StarNet) for further information.[217] StarCom representatives stated that it is possible that a wind turbine operating along the "line of sight" between a broadband signal tower and residential antenna can cause intermittent signal loss, but that such cases were rare.

Additionally, based on data from the MN DEED, the Project Area is considered an Unserved Area for broadband. As such, impacts to broadband service are not likely or anticipated. Additionally, Big Bend is unaware of potential interference or disruptions to broadband service that could be caused by operation of wind turbines.

Potential impacts of the proposed Big Bend Wind and Red Rock Solar Projects are discussed in **Section 2.3.2.4 Emergency Services**.

The impact intensity level is anticipated to be negligible but could be minimal. Potential impacts can be minimized.

335 MW Solar Facility (No wind component)

Given the relatively low profile of PV solar facility, no impact to digital signals (digital television, internet, cell phones) or analog signals (AM and FM radio, microwaves) would be anticipated. However, if O&M

[216] Amended Wind SPA – Section 8.6.5.2

[217] Elm Creek II Wind Project, Environmental Report, P. 30, eDocket ID: 200911-44359-01.

building components or associated transmission line towers were to be constructed within the "line of sight" between a line-of-sight signal and residential antenna, it is possible the customer could experience intermittent signal loss.

This system alternative is anticipated to have similar impacts to existing infrastructure as the Red Rock Solar portion of the proposed hybrid project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

A 335 MW hybrid wind and solar facility alternative located elsewhere in the State) would have communications impacts similar to the proposed hybrid Big Bend Wind and Red Rock Solar project depending on a variety of factors such as the proximity of homes in relation to the project, number of turbines and the number of communication facilities and types in the area. Impacts and mitigation efforts at a 335 MW hybrid wind and solar facility alternative, located elsewhere in the State, for impacts to communication services would also be similar to the mitigation efforts at the proposed hybrid Big Bend Wind and Red Rock Solar project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

Given the relatively low profile of PV solar facility and the associated battery storage portion of this alternative, no impact to digital signals (digital television, internet, cell phones) or analog signals (AM and FM radio, microwaves) would be anticipated. However, if O & M building components, battery banks, or associated transmission line towers were to be constructed within the "line of sight" between a line-of-sight signal and residential antenna, it is possible the customer could experience intermittent signal loss.

This system alternative is anticipated to have similar impacts to existing infrastructure as the Red Rock Solar portion of the proposed hybrid project.

Mitigation

In order to avoid potential physical impacts to underground utility lines, all lines will be located using a utility locate service, and collection line locations will be coordinated with local telecommunications providers to ensure there will be no direct impacts to existing telephone lines. If inadvertent impacts are identified during or after construction, Big Bend Wind or Red Rock Solar will address these impacts on a case-by-case basis.[218]

[218] Amended Wind SPA – Section 8.6.5.2

Big Bend has sited turbine locations at least 535 meters (1,755 feet) from any communication towers, so no impacts to communication systems are anticipated during the construction and operation of the Big Bend wind facility.

Big Bend has sited the Project's turbines in a manner that avoids all identified microwave beam paths and communication systems (**Figure 4-4**).

If interference to a residence's or business's television service is reported during operation, Big Bend Wind will work with affected parties to determine the cause of interference and, when necessary, reestablish television reception and service.[219]

4.2.2.9 Roads and Railroads

Large energy projects can impact roads. These impacts are usually temporary, for example, road congestion associated with material deliveries. Impacts can be long-term if they change the area in a way that precludes or limits public services.

Electric generation facilities (fossil fuel power plants, wind farm, and solar farms) typically require that the existing transportation infrastructure to be adequate, or improvable, to handle heavy loads and oversized vehicles delivering large equipment or structures (turbine generators, tower segments, blades, etc.) to the site. Delivery of such equipment may require roadways to be upgraded or repaired post-delivery.

Use of heavy equipment during construction also may damage existing road surfaces and local roadways could experience temporary road and/or lane closures during construction. In addition, the influx of construction contractors could increase traffic volumes on local roadways.

Cottonwood and Watonwan Counties have an established transportation network of state, county and township roads. County and township roads generally follow section lines. Private roads, mostly used for agricultural purposes, are also common.

The Minnesota Department of Transportation (MNDOT) conducts traffic counts on roads in Minnesota. The functional capacity of a two-lane paved rural highway is in excess of 5,000 vehicles per day, or Annual Average Daily Traffic (AADT). Based on 2018 data, the highest existing AADT in the

[219] Amended Wind SPA – Section 8.6.5.3

Project Area is 1,700 vehicles per day along CSAH 1 north of Mountain Lake. Along other county and township roads AADTs range from 20 to 890 vehicles per day.[220]

Big Bend Wind will construct access roads will be located to facilitate both construction access (cranes) and access by operation and maintenance crews while inspecting and servicing the wind turbines. The access roads will be between towers, with one road required for each string of wind turbines. The final access roads will be approximately 16 feet wide and of low profile to allow cross-travel by farm equipment.[221]

The Northern Santa Fe Railroad is immediately adjacent to the southern edge of the Big Bend Wind portion of the hybrid project area between Mountain Lake and Butterfield.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

Big Bend Wind estimates that there will be 240 large truck trips per day, 16 tractor-trailer trips per day, and up to 510 small-vehicle (pickups and automobiles) trips per day in the area during peak construction periods.[222]

Red Rock Solar estimates that there will be 15 large truck trips per day, tractor-trailer trips per day while be highly variable, and up to 200 small-vehicle (pickups and automobiles) trips per day in the area during peak construction periods.[223]

The functional capacity of a two-lane paved rural highway is in excess of 5,000 vehicles per day. Currently, the heaviest traffic is on Minnesota Highway 60 located immediately south of the Project Area at 5,400 AADT.

Since many of the area roadways have AADTs that are currently well below capacity, the addition of 766 vehicle trips during peak construction for the wind portion of the proposed hybrid project and the additional 215 vehicle trips during peak construction for the solar portion of the proposed hybrid

[220] Amended Wind SPA – Section 8.6.3.1
[221] Amended Wind SPA – Section 6.3
[222] Amended Wind SPA – Section 8.6.3.2
[223] Solar SPA – Section 4.2.9.1

project would be perceptible, but similar to seasonal variations such as spring planting or autumn harvest.[224]

Depending on final turbine location and established haul routes, intersections may be temporarily widened to accommodate oversize loads. Any improvements to existing roads would consist of re-grading and filling of gravel surfaces. Any temporary modifications to the existing road system would be restored following construction.

Equipment and materials used for the construction of a wind facility and solar facility can be extremely heavy and/or oversized loads. Therefore, increased wear and tear of local roads may be expected from delivery of materials and equipment. Possible weight related impacts to roads include physical damage to the structure of the road itself and/or damage to culverts and bridges.

Impacts to traffic will be short-term, intermittent, and occur during the construction phase of the Big Bend Wind and Red Rock Solar hybrid project. Impacts will be from the transport of project components to the project site and from the movements of construction workers.

The Big Bend Wind Project and Red Rock Solar Project will both have several project access roads that will intersect county or township roads.

Potential impacts associated with construction of the Big Bend Wind Project and the Red Rock Solar Project are anticipated to be short-term, intermittent, and localized. The impact intensity level is expected to be minimal to moderate. Some impacts are unavoidable but can be minimized. The impact intensity level will be minimal. Potential impacts associated with construction are anticipated to be short-term, intermittent, and localized.

No railroads are located within the Big Bend Wind or Red Rock Solar portions of the hybrid project area.[225]

335 MW Solar Facility (No wind component)

As with the proposed hybrid wind and solar project, a 335 MW solar facility system alternative would also require utilization of regional roadways for delivery of employees, materials and equipment to the solar farm site.

[224] Amended Wind SPA – Section 8.6.3.2
[225] Amended Wind SPA – Section 8.6.3.1

This system alternative is anticipated to have similar impacts to roads as the proposed hybrid project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

A 335 MW hybrid wind and solar facility system alternative, located elsewhere in the State, will generally require similar utilization of regional roadways to those identified for the proposed Big Bend and Red Rock hybrid project.

Impacts and mitigations associated with the use of available roadways for the 335 MW hybrid wind and solar facility alternative would be similar to those identified for the proposed Big Bend and Red Rock hybrid project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

As with the proposed hybrid wind and solar project and the 335 MW solar facility, the 335 MW solar facility with battery storage system alternative would also require utilization of regional roadways for delivery of employees, materials and equipment to the solar farm site.

The battery storage portion of this alternative would generate additional truck trips related to the delivery of the battery banks, but these additional deliveries would not be anticipated to be a substantial increase over what the solar facility portion of the alternative would require.

This system alternative is anticipated to have similar impacts to roads as the proposed hybrid project.

Mitigation

Big Bend Wind and Red Rock Solar are currently coordinating with Cottonwood County, Watonwan County, and local townships within the Project Area to develop and execute a single, cooperative Development, Road Use, and Drainage Agreement to minimize and mitigate impacts to existing road ways. The Development Agreement will address items such as communication with the various road authorities during construction, restoring impacted roadways, and planning the movement of large construction equipment.[226]

Big Bend Wind and Red Rock Solar have both committed to obtaining all necessary county permits to allow their proposed access roads to intersection with county and township roads.

[226] Amended Wind SPA – Section 8.6.3.3

The applicant must obtain, file and submit all required MnDOT permits, including permits to complete the necessary work in MnDOT's right-of-way, such as transportation of turbines, PV panels, and equipment to and from the site.

Big Bend has provided additional minimization of impacts to existing roadways and traffic by siting turbines with a minimum setback of at least 1.1 times the total turbine height from all public roads.[227]

The Big Bend Wind Project and Red Rock Solar Project are not anticipated to impact any railroads, so no mitigation is necessary.

4.2.3 Potential Impacts to Land-based Economies

Agriculture

Large generation facilities in agricultural areas will have impacts on cropland and possibly on livestock operations.

According to the USDA's 2017 Census of Agriculture, the average farm size in Cottonwood and Watonwan Counties average 498 acres and 508 acres, respectively, and generally larger than the average size of all Minnesota farms, 371 acres.[228]

Crop revenue accounts for the majority (larger percentage) of the total market value of agricultural products contrasted to livestock sales in Cottonwood County ($194 million vs. $188 million, annually) and in Watonwan County ($146 million vs. $123 million, annually). Corn and soybeans being the dominant agricultural crops by acreage in the two counties, with forage crops in Cottonwood County and vegetables harvested for sale in Watonwan County coming in third. Cattle, hogs and pigs, and poultry (layers) are the most common livestock in Cottonwood County, and in Watonwan County hogs and pigs are the most common livestock, followed by cattle, sheep and lambs, and layers.[229]

Wind farms placed in cultivated areas do take a limited amount of acreage out of production for turbine placement, access roads, Collector Substations, and the O&M facility. However, agricultural cropping and "wind farming" are generally compatible uses.

[227] Amend Wind SPA – Section 8.6.3.3
[228] Amended Wind SPA – Section 8.11.1.1
[229] Amended Wind SPA – Section 8.11.1.1

Solar farms, on a MW basis, require large "footprints" and if sited on croplands (or on prime farmland) will potentially remove more acres from agricultural production.

Refer to Section 4.3.5.6 Soils for additional discussion of prime farmland impacts.

Large electric generation facilities have the potential to impact domesticated animals and livestock indirectly through environmental impacts.

Livestock health depends on ecosystem health (clean water, fresh air, healthy soils and crops). Generation facilities that impair ecosystem functions can also negatively impact livestock health, such as through emissions of hazardous air pollutants or through the contamination of water systems.

Other potential impacts to livestock health include annoyance or stress. Stress may result from a variety of impacts related to generation facility operations, such as lights, noise, and stray voltage. The primary concern with stray voltage has been its potential effect on farm animals that are confined in areas where electrical distribution systems supply the farm (See Section 4.3.2.3 for additional discussion on stray voltage). A great deal of research on the effects of stray voltage (neutral to earth voltage) on dairy cows has been conducted over the past 40 years.[230]

With respect to agriculture, stray voltage is defined by the U.S. Department of Agriculture (USDA) as a small voltage (less than 10 volts) measured between two points that can be contacted simultaneously by an animal.[231] For example, this effect is experienced when livestock come into contact with two metal objects between which a voltage exists, such as feeders, water troughs, or stalls, thereby causing a small current to flow through the livestock. The fact that both objects are grounded to the same place (earth) would seem to prevent any voltage from existing between the objects. However, this is not the case—a number of factors determine whether an object is, in fact, grounded. Factors that could influence the intensity of stray voltage include wire size and length, the quality of connections, the number and resistance of ground rods, and the current being grounded.

The direct effect of animal contact with electrical voltage can range from mild behavioral reactions indicative of sensation, to involuntary muscle contraction (or twitching), to behavioral responses indicative of pain. The indirect effects of these behaviors can vary considerably depending on the specifics of the contact location, level of current flow, body pathway, frequency of occurrence, and

[230] Reinemann, Douglas. *Literature Review and Synthesis of Research Findings on the Impact of Stray Voltage on Farm Operations. Ontario Energy Board. 2*008 https://www.oeb.ca/oeb/Documents/EB-2007-0709/report_Reinemann_20080530.pdf.

[231] Wisconsin Public Service. *Answers to Your Stray Voltage Questions: Backed by Research*. 2011. http://www.wisconsinpublicservice.com/business/pdf/farm_voltage.pdf

other factors related to the daily activities of the animals. Common situations of concern in animal environments include the following:[232]

- Animals avoiding certain exposure locations that may result in reduced water or feed intake if painful exposure occurs while accessing watering or feeding devices or locations.
- Difficulty of moving or handling animals in areas of annoying voltage/current exposure.
- Release of stress hormones produced by contact with painful stimuli.

Studies have been conducted to investigate the potential direct physiological effects that may produce behavioral changes. Research has also been conducted to describe the potential effects that may result from the animal's exposure to voltages less than those which produce sensation and behavioral responses. Reinemann conducted a detailed literature review and synthesis of research findings on the impact of stray voltage on farm operations.[233] Through different controlled and field experiments, these studies have found that sensitive dairy cows may experience mild behavioral modifications at current levels exceeding 2 milliamps and voltages exceeding 1 to 2 volts.

Cattle and other large livestock would require physical barriers to separate the livestock from the solar farm arrays; the panels are fixed relatively low to the ground, so cattle cannot graze beneath them. Sheep have been used to manage vegetation at solar facilities in some states.[234]

Forestry

Tree clearing can impact current and future forestry operations. Trees within the hybrid project area typically consist of rows of trees functioning as shelter belts and windbreaks.

Mining

A search of The *Aggregate Source Information System*[xxix] maintained by MnDOT does not identify any active mining operations within the Big Bend Wind Project Area or the Red Rock Solar Project Area.

The Big Bend Wind Project and Red Rock Solar Project may increase the short-term demand for a sand and aggregate, which could benefit local mines through the purchase of materials. Project demands will not lead to new mines or the expansion of existing mining operations.

Impacts to mining resources are anticipated to be negligible; mitigation is not proposed.

---

[232] Reinemann, Douglas. *Literature Review and Synthesis of Research Findings on the Impact of Stray Voltage on Farm Operations. Ontario Energy Board. 2*008. https://www.oeb.ca/oeb/_Documents/EB-2007-0709/report_Reinemann_20080530.pdf.

[233] Ibid.

[234] Sheep Grazing to Maintain Solar Energy Sites in Pennsylvania (psu.edu).

Tourism

The Big Bend Wind Project will be located adjacent to the City of Mountain Lake and the City of Butterfield, several county and city parks, golf courses, and campgrounds. The local communities have several festivals throughout the year, primarily in the summer and fall months. There are also some public hunting areas and public water accesses within the project area.

Red Rock Solar Projects will be located away from municipalities, county parks, and other public areas typically utilized by visitors to the area.

The Big Bend Wind Project will be approximately 2.7 miles from the Jeffers Petroglyphs site at it's closest point. The Red Rock Solar Project is approximately nine miles form the Jeffers Petroglyphs site, and the solar arrays will not be visible to visitors at the Jeffers Petroglyphs site.

Construction of the Big Bend Wind and Red Rock Solar Projects will result in some additional noise and dust generation, construction activities and operation of the Projects will not preclude future tourist activities in the area.

In 2019 the leisure and hospitality industry accounted for about $11.4 million in gross sales and 299 private sector jobs in Cottonwood County and $7.4 million in gross sales and 252 private sector jobs in Watonwan County.[xxx] The leisure and hospitality industry does not account for a significant portion of the local economies in Cottonwood or Watonwan Counties.

Potential Impact

Hybrid Big Bend Wind and Red Rock Solar Project

Land use within the Big Bend Wind portion of the hybrid project area is primarily agricultural and is the use that accounts for approximately 40,235.2 acres, or approximately 92.5 percent of the land use (**Figure 4-8**). An additional one percent of the wind portion of the Project Area (435.6 acres) of land is indicated as pasture/hay land, much of which is used for livestock grazing.[235]

Land use within the Red Rock portion of the hybrid project area is primarily agricultural and is the use that accounts for approximately 805.4 acres, or approximately 95.2 percent of the land use (**Figure 4-9**). An additional 4.4 percent (37.7 acres) is identified as developed, and a large portion of this area is used for livestock confinements, and 0.1 percent (0.7 acres) of the solar portion of the Project Area of land is indicated as pasture/hay land, much of which is used for livestock grazing.[236]

Table 4-8 provides a summary of land cover impacts anticipated as a result of constructing the hybrid Big Bend Wind and Red Rock Solar project.

[235] Amended Wind SPA – Section 8.19.1.1

[236] Solar SPA – Section 4.2.8.1

Table 4-8. Summary of Land Use/Land Cover Impacts (Hybrid Big Bend and Red Rock Project)

Land Cover Type	Big Bend Portion[237]		Red Rock Portion[238]	
	Permanent	Temporary	Permanent	Temporary
Cultivated Crops	46.5	956.7	479.4	--
Developed (all categories)	2.5	31.5	3.7	--
Emergent Herbaceous Wetlands	--	2.0	--	--
Hay/Pasture	<0.1	0.7	--	--
Herbaceous	--	0.2	--	--
Deciduous/Mixed Forest	--	0.7	0.1	--
Barren Land	--	<0.1	--	--
Open Water	--	0.2	--	--
Total	**49.1**	**992.0**	**483.3**	**0.0**

The ROI for agriculture is the project boundary. The impact intensity level will range from moderate to significant. The intensity of the impact is likely to be subjective. For example, conversion of farmland to energy production can be viewed as a conversion from one type of industrial use to another. Conversely, the conversion of farmland to energy production can be viewed as a negative impact to agricultural production. Restoring the site with native grasses and forbs will reduce soil erosion, provide pollinator and wildlife benefits, and improve soil health.

During the construction of the Big Bend Wind portion of the proposed hybrid project impacts to agricultural land use are expected to be short-term and be isolated. Long-term and isolated impacts are anticipated to occur at the location of individual wind turbines, access roads, the O&M building, and the wind project substation. An estimated 0.5 acres of land per turbine will be taken out of agricultural production for the life of the project to accommodate the turbine pad and access roads. Additionally, land will also be taken out of agricultural production for the collector substations and O&M facility, which together would total approximately 8.3 acres. Landowners may continue to plant crops near, and graze livestock up to the gravel roadway around each turbine pad.[239]

The primary permanent impact to active agricultural land will be the reduction of crop production on a total of approximately 46.5 acres of cultivated crop in the wind portion of the hybrid project area.[240]

[237] Amended Wind SPA – Section 8.19.2 and Table 8.19-2
[238] Solar SPA – Section 4.3.1.1
[239] Amended Wind SPA – Section 8.11.1.2
[240] Amended Wind SPA – Section 8.19.2 and Table 8.19-2

Collector lines will not result in long-term impacts as they will be installed entirely underground below the plow zone.

The construction and operation of the Red Rock Solar Project will remove all cultivated cropland within the fenced portions of the project (solar arrays, access roads, and the solar project substation). This will be a long-term and significant impact to the lands within the project boundary. However, when considered in the full context of Cottonwood County, which is has significant acres of cultivated cropland, the 483.3 acres of land removed from crop production will have negligible impacts on local agricultural production.

Enrollment in the Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), Permanent Wetland Preserve (PWP), and the Reinvest in Minnesota (RIM) programs are voluntary. Based on publicly available data, there are approximately 526 acres (approximately one percent) of the wind portion of the Project Area in Cottonwood and Watonwan Counties are currently enrolled in CREP and RIM easements, which are also shown on **Figure 4-6**.[241] The Big Bend portion of the hybrid project avoids impacts to Farm Services Agency (FSA) conservation easements. Collection line placement and crane paths will temporarily impact 4.4 acres of other conservation easements during the construction of the Big Bend Wind Project.[242]

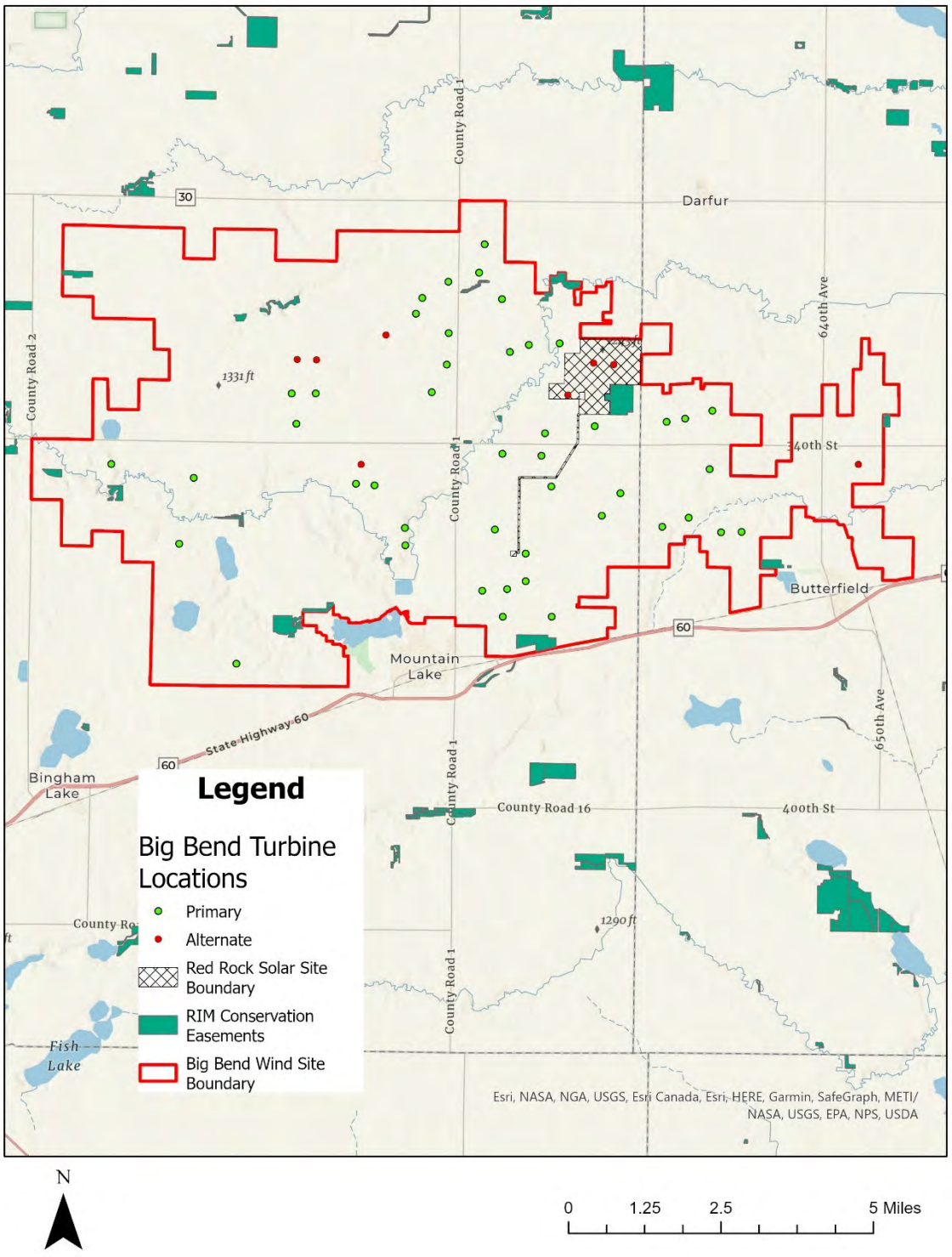
There are no lands enrolled in any conservation easements within the Red Rock Solar portion of the Project Area, so no impacts to lands under conservation easements will occur due to the construction and operation of the Red Rock Solar Project[243]

[241] Amended Wind SPA – Section 8.3.1

[242] Amended Wind SPA – Section 8.3.2

[243] Solar SPA – Section 4.5.8.3

Figure 4-6. Conservation Easements in the Hybrid Project Area



Livestock in and adjacent to the wind portion of the proposed hybrid project would be exposed to noise and shadow flicker created by wind turbines. Exposure levels would depend on factors such as grazing, housing, and the distance between livestock and the turbines. Health impacts from turbine noise and shadow flicker are anticipated to be negligible. Information about impacts to livestock is anecdotal and indicates that livestock are not impacted by turbine operations. Animals do graze near, under and up to turbine towers.

The MPCA is the state agency charged with regulating animal feedlots in Minnesota. One dairy operation has been identified in the Project Area; the Big Bend turbines are sited approximately one mile from this operation, and the nearest collection lines are planned 1.25 miles from this dairy operation.[244] This distance is adequate such that there will be no stray voltage impacts to this dairy operation.

There is a poultry farm located within the Red Rock Solar portion of the Project Area, but the poultry farm is outside of planned construction footprint of the solar facility. All electrical components of the solar facility will be adequately grounded to meet electrical codes, so no stray voltage impacts to the poultry farm are anticipated. The poultry farm may experience some short-term and minimal noise impacts during the construction phase of the Red Rock Solar Project.[245]

Potential impacts to livestock can arise during construction, or during O&M activities. Gates restricting livestock can inadvertently be left open, and livestock fences can be damaged. Cattle, in particular, can be put at risk of walking on to a public roadway and being struck by a vehicle if gates are left open or fences are damaged.

Impacts of the proposed projects to livestock will be negligible.

Red Rock Solar is considering the use of sheep grazing to manage vegetation within the solar array part of the project. Because of the small size of the solar project area, this may have a short-term positive impact on livestock production in the Project Area.

There are no commercial timber companies and no other forestry operations within the within the Big Bend Wind Project Area or within the Red Rock Solar Project Area. Impacts to forestry are anticipated to be negligible.

[244] Amended Wind SPA – Section 8.9.1.2

[245] Solar SPA – Section 4.3.1.1

There are no active mining operations within the Big Bend Wind Project Area or the Red Rock Solar Project Area.

The Big Bend Wind Project and Red Rock Solar Project may increase the short-term demand for a sand and aggregate, which could benefit local mines through the purchase of materials. Project demands will not lead to new mines or the expansion of existing mining operations.

Impacts to mining resources are anticipated to be negligible; mitigation is not proposed.

The ROI for tourism is the project area. Indirect impacts to tourism are associated with direct impacts to recreational opportunities. These unavoidable impacts will be minimal, short-term, and isolated during construction, and negligible during operation.

Impacts from additional noise and dust generated during construction would be short-term, isolated, unavoidable impacts to visitors utilizing public lands in the area, but minimization measures will be implemented to reduce construction equipment noise and a dust control plan will be implemented.

The Big Bend Wind and Red Rock Solar Project construction and operation will have no impact on user access to the Jeffers Petroglyphs site.

335 MW Solar Facility (No wind component)

Ground-mounted PV solar farms require approximately 7 to 10 acres per MW; the North Star 100 MW solar farm project occupies approximately 800 acres, of which approximately 170 acres required grading (i.e., cut and fill).[246] Given the larger footprint required for a 335 MW solar facility, it would be expected that the impacts to agricultural lands would be significant.

Impacts to livestock production is anticipated to be similar to those in the Red Rock Solar portion of the hybrid project, but potentially greater in scale due to the increased project size. While offering some siting and design challenges, solar facilities can be compatible with livestock operations.[247] Cattle and other large livestock would require physical barriers to separate the livestock from the solar farm arrays; the panels are fixed relatively low to the ground, so cattle cannot graze beneath them. Sheep have been used to manage vegetation at solar facilities in some states.[248]

Impacts to forestry, mining, and tourism are anticipated to be similar to the Red Rock Solar portion of the hybrid project, but the impacts would be highly dependent on the final site selected.

---

[246] *North Star Solar EA*.

[247] Kellner, Chelsea. 2018. *Got Sheep? Want a Solar Farm?* North Carolina State University College of Agriculture and Life Sciences News. https://cals.ncsu.edu/news/got-sheep-want-a-solar-farm/.

[248] Sheep Grazing to Maintain Solar Energy Sites in Pennsylvania (psu.edu).

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

Impacts to farming, livestock, forestry, mining, and tourism at a 335 MW hybrid wind and solar facility, located elsewhere in the State, would be similar to those of the proposed hybrid wind and solar project if placed in a predominantly agricultural area.

Livestock are able to utilize grazing lands right up to the access roads and gravel turbine pad areas within a wind facility. While offering some siting and design challenges, solar facilities can be compatible with livestock operations.[249] Cattle and other large livestock would require physical barriers to separate the livestock from the solar farm arrays; the panels are fixed relatively low to the ground, so cattle cannot graze beneath them. Sheep have been used to manage vegetation at solar facilities in some states.[250]

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

Ground-mounted PV solar farms require approximately 7 to 10 acres per MW; the North Star 100 MW solar farm project occupies approximately 800 acres, of which approximately 170 acres required grading (i.e., cut and fill).[251] Given the larger footprint required for a 335 MW solar facility with battery storage, it would be expected that the impacts to agricultural lands would be significant.

Impacts to livestock production is anticipated to be similar to those in the Red Rock Solar portion of the hybrid project, but potentially greater in scale due to the increased project size. While offering some siting and design challenges, solar facilities can be compatible with livestock operations.[252] Cattle and other large livestock would require physical barriers to separate the livestock from the solar farm arrays; the panels are fixed relatively low to the ground, so cattle cannot graze beneath them. Sheep have been used to manage vegetation at solar facilities in some states.[253]

Impacts to forestry, mining, and tourism are anticipated to be similar to the Red Rock Solar portion of the hybrid project, but the impacts would be highly dependent on the final site selected.

---

[249] Kellner, Chelsea. 2018. *Got Sheep? Want a Solar Farm?* North Carolina State University College of Agriculture and Life Sciences News. https://cals.ncsu.edu/news/got-sheep-want-a-solar-farm/.
[250] Sheep Grazing to Maintain Solar Energy Sites in Pennsylvania (psu.edu).
[251] *North Star Solar EA*.
[252] Kellner, Chelsea. 2018. *Got Sheep? Want a Solar Farm?* North Carolina State University College of Agriculture and Life Sciences News. https://cals.ncsu.edu/news/got-sheep-want-a-solar-farm/.
[253] Sheep Grazing to Maintain Solar Energy Sites in Pennsylvania (psu.edu).

Mitigation

For both solar facilities and wind facilities sited on agricultural croplands, the revenue lost by removing land from agricultural production will be offset by the leases and purchase options with the landowners.

Site permits issued by the Commission generally require Agriculture Impact Mitigation Plans and Vegetation Management Plans[254] to ensure that areas disturbed during construction are repaired and restored to pre-construction contours and characteristics to the extent practicable. These restoration efforts allow the land surfaces to drain properly, blend with the natural terrain, re-vegetate, and avoid erosion. In the event that damage occurs to drain tile or private ditches as a result of construction activities, site permits require the repair of any damages.

If possible, constructing the project during winter months would further minimize impacts to agricultural land by avoiding planting and harvesting seasons, avoiding the risk of crop damage, and minimizing the likelihood of rutting, accelerated soil erosion, and introduction of noxious weeds to the soil surface.

Farming activities can continue on the land surrounding turbines and access roads in a wind facility, versus the lands within a solar facility will have to be removed from traditional crop rotation during the life of operation.

Impacts to agriculture associated with the Red Rock Solar Project are unavoidable, but economic losses will be mitigated with the payment of land leasing options. Section 4.3.18 of the sample permit requires permittees fairly restore or compensate landowners for damages to crops, fences, drain tile, etc. during construction. Other sections address impacts to soils, such as erosion, compaction, etc. No additional mitigation is proposed.

Additionally, Red Rock Solar has committed to developing a VMP and AIMP to adequately address short and long term vegetation management methods and goals and to minimize impacts to agricultural lands being impacted by the solar project.

Mitigation for potential stray voltage impacts would include all safety requirements are met during the construction and operation of the project. There are a number of strategies for mitigating stray

[254] PUC Staff Briefing Paper, Site Permit Template, October 30, 2019, eDocket No. 201910-158610-01.

voltage, including improved grounding.[255] Good electrical connections and choosing proper wiring materials for wet and corrosive locations will improve grounding and reduce stray voltage levels. The Big Bend Wind Project and Red Rock Solar Project will be constructed to meet all applicable electrical codes and all electrical project components will be grounded properly.

The LWECS Draft Site Permit (**Appendix B**) has specific conditions requiring the protection of livestock during all phases of the proposed project, and also the immediate repair of any fences or gates damaged during Project construction or O&M activities.

The impacts arising from the common site preparation practice of removing vegetation from solar facility sites can be minimized in certain circumstances by co-locating solar farms with agricultural operations (i.e., harvestable crops, and grazing).[256] Apiary operations have also been collocated with solar facilities. There have been successful examples where solar facilities are co-located with these types of agricultural operations.[257] Red Rock Solar is considering the use of sheep grazing to manage vegetation within the solar array part of the project.

The Big Bend Wind and Red Rock Solar Projects have been developed to minimize tree clearing. No additional mitigation of impacts to forestry resources is necessary.

Impacts to mining resources are anticipated to be negligible; mitigation is not proposed.

Big Bend and Red Rock have committed to minimizing noise from construction equipment and implementing a dust control plan to minimize impacts to celebrations and other activities occurring in the local communities to the greatest extent practicable.

4.2.4 Potential Impacts to Archaeological and Historic Resources

Archeological resources are locations where objects or other evidence of archaeological interest exist, and can include aboriginal mounds and earthworks, ancient burial grounds, prehistoric ruins, or historical remains. Historic resources are sites, buildings, structures, or other antiquities of state or national significance. If present with the proposed hybrid project area archaeological and historic resources could be impacted during construction of the Big Bend Wind and Red Rock Solar Projects.

[255] Wisconsin Public Service. *Answers to Your Stray Voltage Questions: Backed by Research*. 2011. http://www.wisconsinpublicservice.com/business/pdf/farm_voltage.pdf.

[256] Macknick et al. (2013). *Overview of Opportunities for Co-Location of Solar Energy Technologies and Vegetation*. National Renewable Energy Laboratory, NREL/TP-6A20-60240.

[257] Overview of opportunities for co-location of solar energy technologies and vegetation, Jordan Macknick, National Renewable Energy Laboratory, January 2014.

Big Bend and Red Rock also reached out to Native American Tribes, Red Rock Ridge Research Group (RRRRG), the Minnesota Indian Affairs Council (MIAC), the MNHS, and SHPO for additional information or comment on the project. The applicants have worked with Native American Tribes, MNHS, SHPO, and DOC-EERA staff to develop the Phase 1 Survey Plan for the Big Bend Wind Project and the Red Rock Solar Project.

Big Bend Wind included significant detail on Tribal coordination regarding the Jeffers Petroglyphs site in section 8.7.2.2 of their Amended Wind SPA. Because potential impacts of the proposed hybrid project to the Jeffers Petroglyphs site are visual in nature, they are covered in more detail in **Section 4.2.1.1** of this EA.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

There is one archaeological site and nine historic architectural resources (one listed or eligible for listing in the NRHP) within the Big Bend Wind Project boundary. Additionally, there are three archaeological site (one listed in the NRHP) and 91 historic architectural resources (two listed or eligible for listing in the NRHP) within 1.5 miles of the Big Bend Wind Project boundary.

Big Bend Wind has sited project component to avoid impacting known archaeological sites and historic architectural resources within the project boundary.

No previously recorded archaeological or historic sites will be directly impacted by the proposed Red Rock Solar Project. A Phase I archaeological survey of the Red Rock Solar project boundary was completed in May of 2020, no archaeological or historic sites, or historic architectural sites were identified. The literature review identified one historic bridge (Bridge #89504) within one mile of the Red Rock Solar project boundary, it was determined the bridge is not eligible for listing in the NRHP.

The impact intensity level is anticipated to be negligible to minimal. Impacts would be localized. Impacts can be mitigated through siting.

335 MW Solar Facility (No wind component)

The 335 MW solar facility system alternative would likely be sited on agricultural land with limited archaeological sites and historic architectural sites, similar to the proposed hybrid Big Bend Wind and Red Rock Solar Project. This system alternative is anticipated to have similar impacts to archaeological sites and historic architectural sites as the proposed hybrid project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

The 335 MW hybrid wind and solar facility system alternative would likely be sited on agricultural land with limited archaeological sites and historic architectural sites, similar to the proposed hybrid Big Bend Wind and Red Rock Solar Project. This system alternative is anticipated to have similar impacts to archaeological sites and historic architectural sites as the proposed hybrid project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

The 335 MW solar facility with battery storage system alternative would likely be sited on agricultural land with limited archaeological sites and historic architectural sites, similar to the proposed hybrid Big Bend Wind and Red Rock Solar Project. This system alternative is anticipated to have similar impacts to archaeological sites and historic architectural sites as the proposed hybrid project.

Mitigation

Prior to construction, the Big Bend and Red Rock will coordinate with Native American Tribes to prepare an Unanticipated Discoveries Plan outlining steps to be taken if previously unrecorded cultural resources or human remains are encountered during construction.

Prudent siting can avoid impacts to archaeological and historic resources. This is the preferred mitigation.

If previously unidentified archaeological sites are found during construction, the applicant would be required to stop construction and contact SHPO to determine how best to proceed. Ground disturbing activity will stop and local law enforcement will be notified should human remains be discovered.

Because impacts to archeological and historic resources are not anticipated for the Big Bend Wind Project or the Red Rock Solar Project, additional mitigation is not proposed at this time.

The LWECS DSP and sample solar site permit address archeological resources.

4.2.5 Potential Impacts to the Natural Environment

Large electric generation facilities have the potential to impact natural resources, including flora, fauna, habitat, soils and water. This section discusses potential impacts to natural resources from the construction and operation of a proposed hybrid wind and solar project.

4.2.5.1 Ecological Setting

The DNR and the U.S. Forest Service have developed an Ecological Classification System (ECS) for ecological mapping and landscape classification in Minnesota[258]

Ecological land classifications are used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features. The system uses associations of biotic and

[258] DNR *Ecological Classification System*, http://www.dnr.state.mn.us/ecs/index.html.

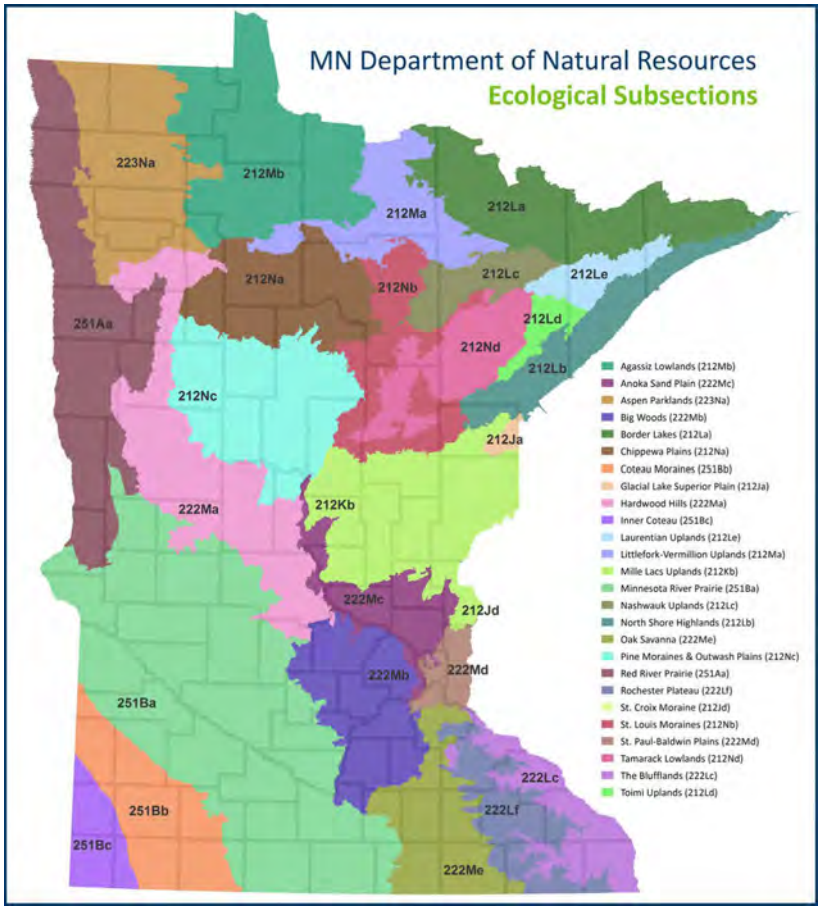
environmental factors, including climate, geology, topography, soils, hydrology, and vegetation. The ECS enables resource managers to consider ecological patterns for areas as large as North America or as small as a single timber stand and identify areas with similar management opportunities or constraints relative to that scale. There are eight levels of ECS units in the United States. Map units for six of these levels occur in Minnesota: Provinces, Sections, Subsections, Land Type Associations, Land Types, and Land Type Phases. Figure 4-7 represents the Ecological Subsections in Minnesota.

The hybrid project area is in both the Minnesota River Prairie (wind and solar portion) and Coteau Moraines (wind portion) subsections of the North Central Glaciated Plains Section in the Prairie Parkland Province, as defined by the ECS of Minnesota. Historically, tallgrass prairie covered most of this area and wet prairies covered a smaller proportion of the landscape. Forest were similarly restricted to floodplains along the Minnesota River and other streams. As a result of settlement in the mid- 1800s, the area was converted to farmland, with only a few remnants of pre-settlement vegetation remaining.[259],[260]

[259] Amended Wind SPA – Section 8.19.1.1

[260] Solar SPA – Section 4.5.6

Figure 4-7. Minnesota Ecological Subsections[261]



4.2.5.2 Land Use/Land Cover

Land cover documents how much of a region is covered by forests, wetlands, impervious surfaces, agriculture, and other land and water types, including wetlands. Wind projects and solar projects may alter current and future land use and land cover.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

The ROI for land cover and land use is the project boundary.

[261] DNR (1999) *Ecological Section of Minnesota*, Available from: https://gisdata.mn.gov/.

The wind portion of the hybrid project area is predominantly rural with sparsely scattered rural residences, farmsteads, commercial livestock operations, agricultural support facilities, and cultivated cropland throughout. The majority of land use in the Wind Project Area is cultivated cropland approximately 40,235.2 acres (92.5 percent); followed by developed (all categories) approximately 1,584.7 acres (3.6 percent) and pasture/hay lands comprise approximately 435.6 acres (1.0 percent) of the wind project area, see Figure 4-8. The remaining land cover types comprise less than one percent of the wind project area per cover type.[262]

Constructing the Big Bend Wind Project will change land use from agricultural to wind energy production, in localized portions of the wind project area, for at least 30 years. After the project's useful lives, the hybrid project area could be restored to agricultural or other planned land uses by implementing appropriate restoration activities. Long-term impacts to agricultural land use will be isolated to areas with turbine foundations, access roads, and the wind project substation. Short-term impacts to agricultural land use will be in areas used for crane pads, construction and laydown areas, and collection line trenching. Impacts to current agricultural uses in the project boundary are unavoidable.

The Red Rock Solar portion of the hybrid project area is predominantly rural with sparsely scattered rural residences, farmsteads, commercial livestock operations, agricultural support facilities, and cultivated cropland throughout. The majority of land use in the Red Rock Solar project boundary is cultivated cropland approximately 479.4 acres (99.2 percent); followed by developed (all categories) approximately 3.7 acres (0.8 percent) and deciduous forest comprise approximately 0.1 acres (< 0.1 percent) of the Red Rock Solar Project Area, see Figure 4-9.

Constructing the Red Rock Solar Project will change land use from agricultural to solar energy production for at least 30 years. After the project's useful lives, the project area could be restored to agricultural use or other planned land uses by implementing appropriate restoration activities. Long-term impacts to agricultural land use will be significant throughout the entire project boundary, including the solar project substation. Short-term impacts to agricultural land use will be in the area outside of the solar array portion of the project used as a construction laydown area and within AC collection line corridor where trenching will occur. Impacts to current agricultural uses in the project boundary are unavoidable.

[262] Amended Wind SPA – Section 8.19.1.1, Table 8.19-1

Figure 4-8. Wind Project Area Land Use/Land Cover

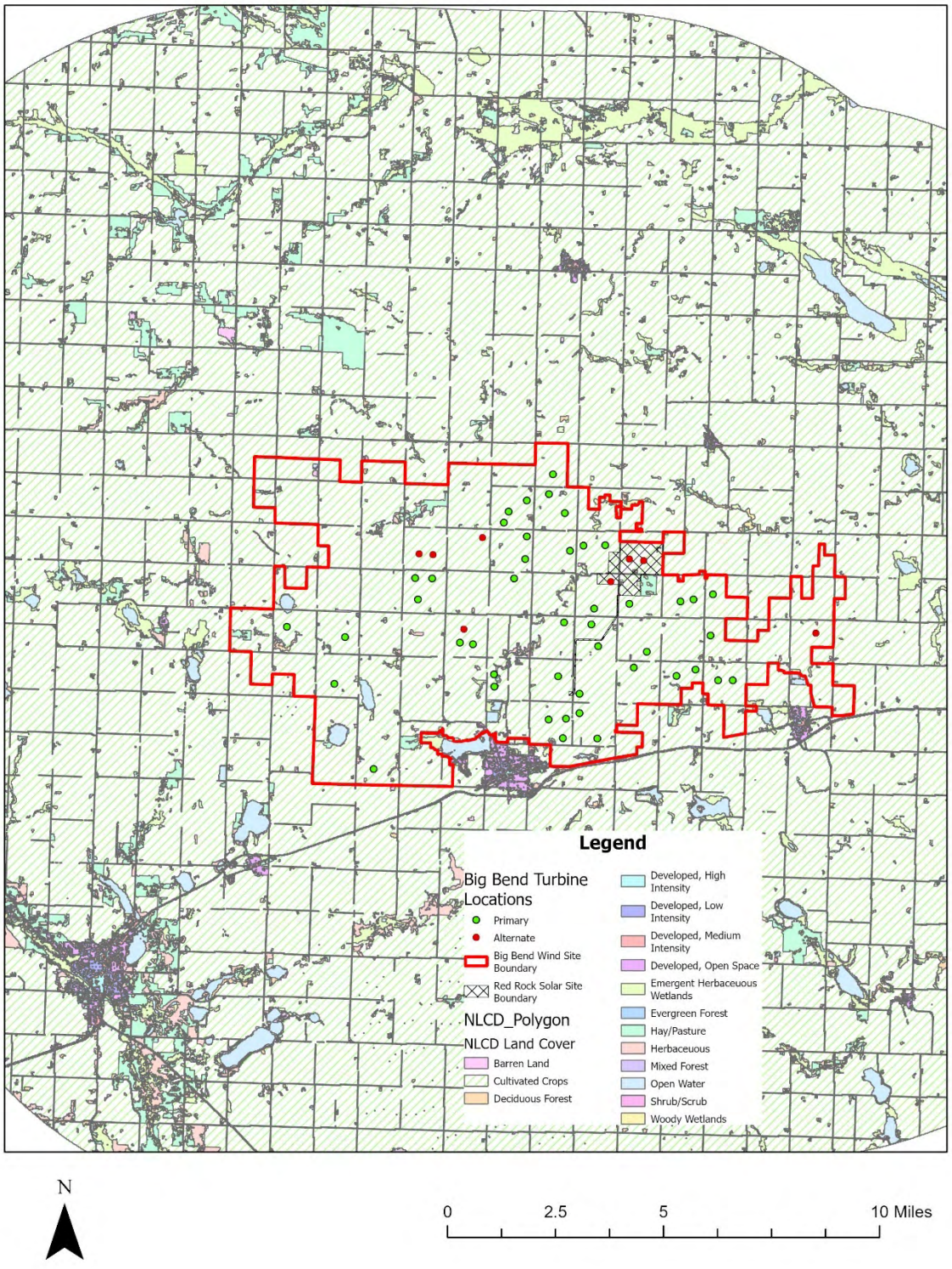


Figure 4-9. Solar Project Area Land Use/Land Cover

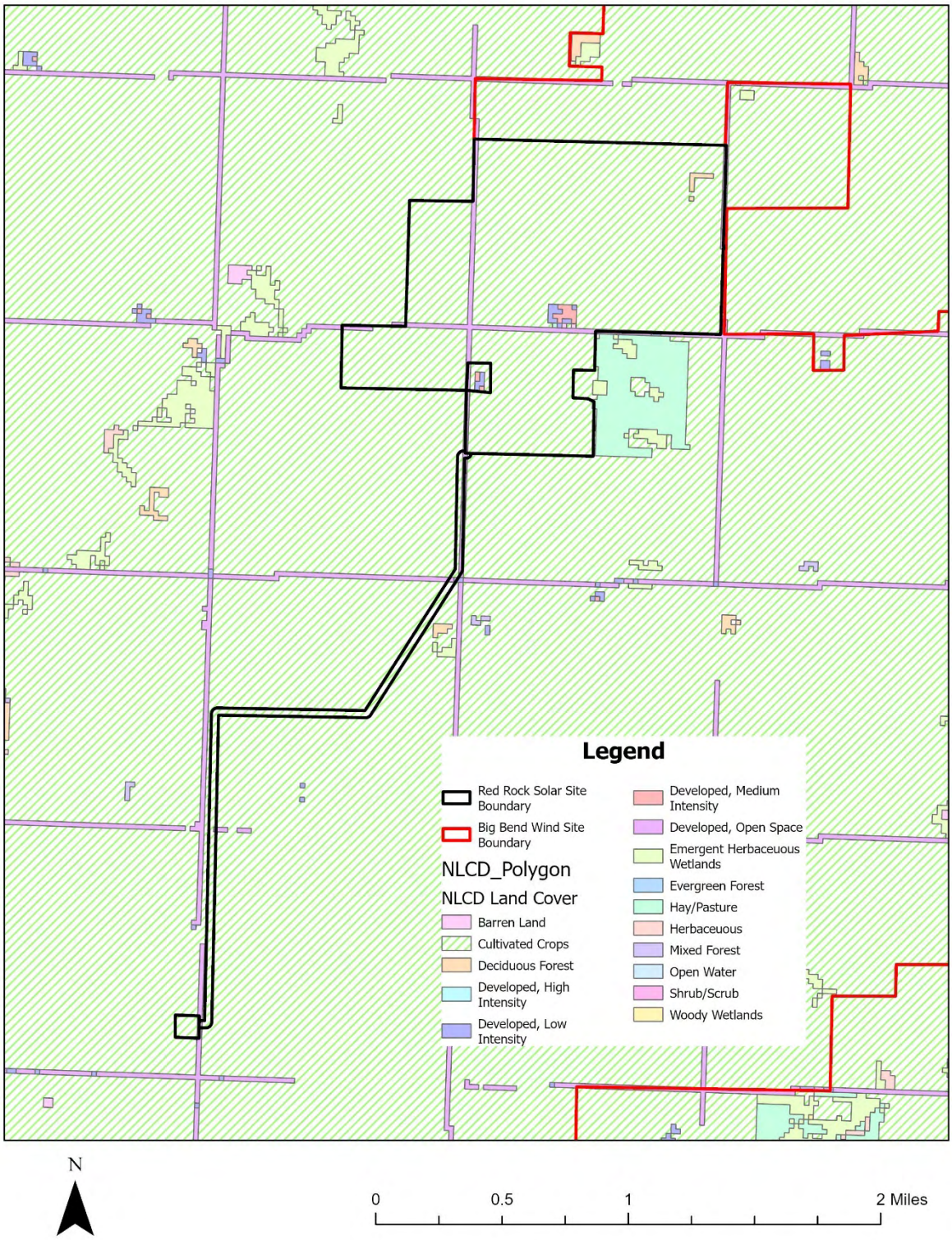


Table 4-9. Summary of Land Use/Land Cover Impacts (acres) in the Hybrid Project Area

Land Cover Type	Big Bend Wind Portion[263]		Red Rock Solar Portion[264]	
	Permanent	Temporary	Permanent	Temporary
Cultivated Crops	46.5	956.7	451	27.6
Developed (all categories)	2.5	31.5	0.7	0.7
Emergent Herbaceous Wetlands	-	2.0	-	-
Hay/Pasture	<0.1	0.7	-	-
Grassland/Herbaceous	-	0.2	-	-
Deciduous/Mixed Forest	-	0.7	-	-
Barren Land	-	0.7	-	-
Open Water	-	0.2	-	-
Total	**49.1**	**992.0**	**451.7**	**28.3**

335 MW Solar Facility (No wind component)

The 335 MW solar facility system alternative would likely be sited on an area with lands primarily used for agricultural purposes, similar to the proposed hybrid Big Bend Wind and Red Rock Solar Project. This system alternative is anticipated to have similar impacts to land use as the Red Rock Solar portion of the proposed hybrid project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

The 335 MW hybrid wind and solar facility system alternative would likely be sited on an area with lands primarily used for agricultural purposes, similar to the proposed hybrid Big Bend Wind and Red Rock Solar Project.

This system alternative is anticipated to have similar impacts to land use as the proposed hybrid project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

The 335 MW solar facility with battery storage system alternative would likely be sited on an area with lands primarily used for agricultural purposes, similar to the proposed hybrid Big Bend Wind and Red Rock Solar Project.

[263] Amended Wind SPA – Section 8.19.2 and Table 8.19-2

[264] Solar SPA – Section 4.5.6.1

This system alternative is anticipated to have similar impacts to land use as the Red Rock Solar portion of the proposed hybrid project.

Mitigation

Big Bend Wind has committed to minimizing long-term impacts to agricultural practices within the project boundary to the greatest extent practicable. Areas of short-term impacts to land use will be rehabilitated to current agricultural land uses following wind project construction.

Impacts to current agricultural uses in the Red Rock Solar project boundary are unavoidable. If the Red Rock Solar Project is decommissioned, versus repowered, at the end of its useful generation life span, the site will be restored and rehabilitated to agricultural land.

4.2.5.3 Air Quality and Climate Change

Electric generation facilities may emit air pollutants during construction and operation.

Criteria Pollutants

Minnesota Rule 7849.1500 requires examination of emissions of the following pollutants: sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon dioxide (CO_2), mercury (Hg), and particulate matter (PM). These common pollutants (other than mercury) are known as criteria pollutants.[265]

Greenhouse Gases

The accumulation of greenhouse gases in the atmosphere and associated warming of the planet is leading to a variety of adverse human and environmental impacts – including more severe droughts and floods, more heat related illnesses, and a decrease in food security. Though a variety of gases contribute to the greenhouse effect, the most prominent greenhouse gas is carbon dioxide.[266]

Hazardous Air Pollutants and Volatile Organic Compounds

Electric generation facilities have the potential to emit air pollutants during construction and operation. Minnesota Rule 7849.1500 requires this review to examine emissions of hazardous air

[265] United States Environmental Protection Agency (EPA). *Criteria Air Pollutants*. https://www.epa.gov/criteria-air-pollutants

[266] Minnesota Environmental Quality Board, Minnesota and Climate Change: Our Tomorrow Starts Today. https://www.eqb.state.mn.us/sites/default/files/documents/EQB%20Climate%20Change%20Communications.pdf

pollutants (HAP) and volatile organic compounds (VOC). These classes of pollutants are known or suspected of causing cancer and other serious health effects.[267]

Ozone

Large electric power generating facilities, such as coal, natural gas, and biomass facilities, have the potential to produce reactive gases, which can lead to ground-level ozone formation. Ozone and nitrous oxide are reactive compounds that contribute to smog and can have adverse impacts on human respiratory systems.[268] Accordingly, these compounds are regulated and have permissible concentration limits. Minnesota has an ozone limit of 0.08 parts per million (ppm).[269] The federal ozone limit is 0.07 ppm.[270] Minnesota Rule 7849.1500, subpart 2 requires that anticipated ozone formation be addressed. Ozone can cause human health risks and can also damage crops, trees and other vegetation.[271]

Climate Change

Minnesota is taking action against climate change. Executive Order (19-37), signed in December 2019, created the Governor's Advisory Council to coordinate climate change mitigation and resilience strategies in the State of Minnesota. The Executive Order describes climate change as an existential threat that impacts all Minnesotans and our ability to thrive. The Next Generation Energy Act of 2017 set statutory goals to reduce greenhouse gas emissions in the state by 30% of 2005 levels by 2025, and 80% by 2050. Minnesota fell short of its 2015 goal of 15% and is not on track to meet the 2025 goal.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

Impacts from the construction of the Big Bend Wind Project and Red Rock Solar Project will be short-term and minimal as a result of the emissions from vehicles, large construction equipment, and haul trucks. Criteria pollutants, GHG, hazardous air pollutants, VOC, and ozone are all generated by internal combustion engines.

---

[267] EPA. *Hazardous Air Pollutants*, https://www.epa.gov/haps.

[268] EPA. *Criteria Air Pollutants*. https://www.epa.gov/criteria-air-pollutants.

[269] Minn. R. 7009.0800, https://www.revisor.mn.gov/rules/?id=7009.0080.

[270] EPA. *2015 National Ambient Air Quality Standards (NAAQA) for Ozone*.https://www.epa.gov/ozone-pollution/2015-national-ambient-air-quality-standards-naaqs-ozone.

[271] EPA. *Ozone Pollution.* https://www.epa.gov/ozone-pollution.

Impacts to air quality would include dust due to earth moving and vehicle travel. Dust and emissions associated with the construction of the project would be similar to large scale outdoor construction activities such as road work and residential developments. The project site includes multiple construction "sites" for installing individual turbines, solar panels, and access roads. Once construction is completed, air and dust emissions related to vehicular traffic would be reduced.

The Big Bend Wind components of the proposed hybrid project would not emit criteria pollutants, GHGs, or ozone during operation. The Big Bend Wind components of the proposed hybrid project would emit minimal HAPs or VOCs during operation. Petroleum-based fluids used in the operation of wind turbines, such as gear box oil, hydraulic fluid and gear grease, have a low vapor pressure and any release of VOCs would be minimal. Short-term and minimal quantities of criteria pollutants, GHGs, HAPs, VOCs, or ozone will be generated by trucks used by staff when accessing the site to complete maintenance activities.

Emissions from construction of the Big Bend Wind and Red Rock Solar projects will occur and will have a short- term negligible impact on climate change. The project will have a positive impact by offsetting carbon and helping Minnesota meet its renewable energy goals. The Big Bend Wind Project and Red Rock Solar Project will further the states' clean energy goals by providing a renewable source of energy that will offset other greenhouse gas emissions, primarily from coal and natural gas.

During the operational phase of the Red Rock Solar Project the facility components will not generate any criteria pollutants, GHGs, HAPs, VOCs, or ozone. Short-term and minimal quantities of criteria pollutants, GHGs, HAPs, VOCs, or ozone will be generated by trucks used by staff when accessing the site to complete maintenance activities.

According to the MnRiskS model developed by MPCA, air pollutants released by permitted and non-permitted sources near the project area are low, and no pollutants are above health benchmarks. The benchmark ratios in the Big Bend Wind and Red Rock Solar Project Areas range from 0.04 and 0.05. These ratios are in the lowest 10 percent of air scores meaning the air quality in the project area is better than 90 percent of Minnesota. Significant air emission contributors in the project area (reported by census tract) include agriculture equipment, agriculture and yard waste, permitted facilities, and traffic emissions.

335 MW Solar Facility (No wind component)

Construction of a 335 MW solar facility would produce criteria pollutants, GHGs, HAPs, VOCs, or ozone from the use of trucks, large equipment, and haul trucks.

During the operational phase of the 335 MW Solar facility system alternative the facility components will not generate any criteria pollutants, GHGs, HAPs, VOCs, or ozone.

Short-term and minimal quantities of criteria pollutants, GHGs, HAPs, VOCs, or ozone will be generated by trucks used by staff when accessing the site to complete maintenance activities.

Impacts to air quality and climate change of this system alternative are anticipated to be similar to the proposed hybrid project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

Construction and operation of a 335 MW hybrid wind and solar facility system alternative, would produce similar quantities of criteria pollutants, GHGs, HAPs, VOCs, or ozone as the proposed hybrid wind and solar project.

Impacts to air quality and climate change of this system alternative are anticipated to be similar to the proposed hybrid project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

Construction of a 335 MW solar facility with battery storage would produce criteria pollutants, GHGs, HAPs, VOCs, or ozone from the use of trucks, large equipment, and haul trucks.

During the operational phase of the 335 MW Solar facility with battery storage system alternative the facility components will not generate any criteria pollutants, GHGs, HAPs, VOCs, or ozone.

Short-term and minimal quantities of criteria pollutants, GHGs, HAPs, VOCs, or ozone will be generated by trucks used by staff when accessing the site to complete maintenance activities.

Impacts to air quality and climate change of this system alternative are anticipated to be similar to the proposed hybrid project.

Mitigation

Generation of criteria pollutants, GHGs, HAPs, VOCs, and ozone by truck, large equipment, and haul trucks during the construction of the Big Bend Wind portion and the Red Rock Solar portion of the hybrid project is generally unavoidable, minimal, and short-term. Emissions would be reduced if vehicles and equipment are not allowed idled longer than necessary, when not in use, and following equipment manufacturer-recommended operations and good combustion practices, including not tampering engines to increase horsepower and using ultra-low sulfur diesel.

Dust from construction activity can be controlled using standard construction BMPs such as watering of exposed surfaces, covering of disturbed areas, and reduced speed limits on site.

The projects have been designed with resiliency in mind as the climate continues to change in Minnesota. Project equipment has been carefully engineered and selected to withstand the potential for an increase in the frequency of severe weather events.

4.2.5.4 Geology and Topography

The Big Bend Wind project area and the Red Rock Solar project area are on glacial moraine landforms, which have been heavily glaciated and are characterized by loamy glacial drift deposits of 100 to 600 feet thick over the bedrock below. More specifically the surface soil depths over bedrock within the wind portion of the hybrid project area are between 100 to 400 feet, and for the solar portion of the hybrid project area, are expected to be 100 to 300 feet.[272]

The Big Bend Wind project area has gently rolling terrain with elevations ranging from 1,109 to 1,421 feet across the entire site. The southwestern portion of the project area has the highest elevation, but there are no areas with significant elevation change.

The Red Rock Solar project area is generally flat, with the highest elevations in the north and northwest portions of the site and sloping down and away from there in all directions. Elevations within area where the solar arrays and invertors will be located range from 1,200 to 1,230 feet. The elevation increases as you travel southwest along the underground AC collection corridor to the solar project substation site, where the elevation increases to approximately 1,270 feet. There are no areas with significant elevation change.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

General grading activities throughout the Big Bend Wind portion and the Red Rock Solar portion of the hybrid project area will be necessary to create level surface to allow for project construction and project component installation.

Grading, trenching, and excavation activities associated with the Big Bend Wind Project are not anticipated to extend to bedrock depth, and blasting or excavation of bedrock is extremely unlikely. No impacts to the site geology and bedrock are anticipated for the Big Bend Wind Project.

[272] Minnesota Geological Survey. 2018

The Big Bend Wind portion of the proposed hybrid project will impact the topography of the site with the grading and construction of access roads, turbine foundations, crane work pads, the O&M building, and the wind project substation.

Grading, trenching, and pile driving activities associated with the Red Rock Solar Project are not anticipated to extend to bedrock depth and blasting or excavation of bedrock is extremely unlikely. No impacts to the site geology and bedrock are anticipated for the Red Rock Solar Project.

The Red Rock Solar portion of the hybrid project will impact the topography of the site by grading and construction of access roads, inverter skid locations, and the solar project substation.

Impacts to topography for the Big Bend Wind Project and the Red Rock Solar Project are anticipated to be minimal.

335 MW Solar Facility (No wind component)

The 335 MW solar facility system alternative would likely be sited on agricultural land with similar surface soil depths to bedrock and topography as the proposed hybrid Big Bend Wind and Red Rock Solar Project.

This system alternative is anticipated to have similar impacts to geology and topography as the Red Rock Solar portion of the proposed hybrid project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

The 335 MW hybrid wind and solar facility system alternative would likely be sited on agricultural land with similar surface soil depths to bedrock and topography as the proposed hybrid Big Bend Wind and Red Rock Solar Project.

This system alternative is anticipated to have similar impacts to geology and topography as the proposed hybrid project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

The 335 MW solar facility with battery storage system alternative would likely be sited on agricultural land with similar surface soil depths to bedrock and topography as the proposed hybrid Big Bend Wind and Red Rock Solar Project.

This system alternative is anticipated to have similar impacts to geology and topography as the Red Rock Solar portion of the proposed hybrid project.

Mitigation

No impacts to geology or bedrock are anticipated for the Big Bend Wind Project or the Red Rock Solar Project, so no mitigation is necessary.

Big Bend Wind and Red Rock Solar project sites have been selected because of their generally flat and gently rolling topography, and they have been designed to minimize the amount of cut, fill, and excavation necessary to construct the projects. No additional mitigation is necessary.

4.2.5.5 Rare and Unique Natural Resources

USFWS and MNDNR (Natural Heritage Information System) databases where searched for federal and state listed species, candidate species and species of concern, and designated or proposed critical habitat that may be present within the proposed Project Area, including a one mile buffer.[273]

The review for the Big Bend Wind portion of the proposed hybrid project, identified records of one state special concern mammal, Plains pocket mouse (*Perognathus flavescens*), one federal and state listed endangered insect, Poweshiek skipperling (Oarisma poweshiek), and one state special concern insect, and an abbreviated underwing (*Catocaia abbreviatella*) were within the project boundary. Records of one state threatened insect, caddisfly (*Ironoquia punctatissima*), two state threatened plants, Sullivant's milkweed (*Asclepias sullivantii*) and hair-like beak rush (*Rhynchospora capillacea*) and one state special concern plant, buffalo grass (*Buchloe dactyloides*) were identified within the one-mile buffer around the Big Bend portion of the Project Area.[274]

Based on a review of the Red Rock Solar Project Area, there were no records of any federal or state listed species within the Project Area, and one state special concern insect, an abbreviated underwing (*Catocaia abbreviatella*) within the one mile buffer around the solar portion of the Project Area.[275]

The abbreviated underwing record identified within the wind portion of the hybrid project, and within one mile of the solar portion of the hybrid project, are the same species record. Federal and state listed species within the Project Area and within one mile of the Project Area are detailed in Table 4-10.

[273] Amended Wind SPA – Section 8.21.1.1 and Solar SPA – Section 4.5.8

[274] Amended Wind SPA – Section 8.21.1.1

[275] Solar SPA – Section 4.5.8

Table 4-10. Federal and State Listed Species Documented Within One Mile of the Hybrid Project Area[276]

Big Bend Wind Portion of the Project Area							
Type	*Federal Status	*State Status	Scientific Name	Common Name	Records within the Project Area (#)	Records within one Mile of Project Area Boundary (#)	Year of Observation
Mammal	--	SPC	*Perognathus flavescens*	Plains Pocket Mouse	1	0	1952
Insect	E	E	*Oarisma poweshiek*	Poweshiek Skipperling	1	0	1974
	--	SPC	*Catocala abbreviatella*	Abbreviated Underwing	1	0	1967
	--	T	*Ironoquia Punctatissma*	A Caddisfly	0	1	2000
Plant	--	T	*Asclepias sullivantii*	Sullivant's Milkweed	0	1	1992
	--	SPC	*Buchloe dactyloides*	Buffalo Grass	0	1	2009
	--	T	*Rhynchospora capillacea*	Hair-like Beak Rush	0	1	2019

[276] Amended Wind SPA – Section 8.21.1.1 and Solar SPA – Section 4.5.8

Red Rock Solar Portion of the Project Area							
Type	*Federal Status	*State Status	Scientific Name	Common Name	Records within the Project Area (#)	Records within one Mile of Project Area Boundary (#)	Year of Observation
Insect	--	SPC	Catocala abbreviatella	Abbreviated Underwing	1	0	1967

*E=Endangered, T=Threatened, SPC=Species of Special Concern, W=Watch list

An observation of the stated-listed, endangered, Henslow's sparrow (*Centronyx henslowii*) was made during avian surveys conducted for the Big Bend Wind portion of the Project.[277] Henslow's sparrow is a grassland dependent species, and primarily utilizes large grasslands dominated by native prairie plant species.

The northern long-eared bat is federally listed threatened and state listed as special concern that may occur within the hybrid project area. Project-specific acoustic surveys (2018) for northern long-eared bats appear to confirm the absence of the species.[278] The big brown bat, little brown bat, and tri-colored bat are also listed as state special concern that may occur within the hybrid project area.

In addition to records of rare and sensitive species, identifying native prairies, native plant communities and Sites of Biological Significance provides a better understanding of essential habitat available for rare species of fauna within the Big Bend Wind and Red Rock Solar portions of the hybrid project area.

Native prairies are typically untilled plant communities that are comprised primarily of native grasses and sedges along with a variety of broad-leaved forbs and scattered shrubs. Approximately 250,000 acres of native prairies ranked good to excellent remain in Minnesota.[279] Based on a review of the MNDNR data base, three records of native prairie are documented in the wind portion of the Project Area as Dry Hill Prairie - Southern Type; with a total of 16.4 acres.[280]

There are no mapped native prairie areas within the Red Rock Solar portion of the project area.[281]

[277] Amended Wind SPA – Section 8.21.1.2
[278] Amended Wind SPA – Section 8.21.1.2
[279] https://www.dnr.state.mn.us/rys/pg/dryprairie.html.
[280] Amended Wind SPA – Section 8.21.2.1
[281] Solar SPA – Section 4.5.8.3

Native Plant Communities (NPCs) are assemblages of native plants that have not been substantially impacted by non-native species or human activities. NPCs are formed and classified by hydrology, soils, landforms, vegetation, and natural disturbance regimes such as floods, wildfires, and droughts. NPCs are named by their dominant or characteristic species and/or natural features.[282] The three records of Dry Hill Prairie – Southern Type, previously mentioned are also mapped and identified as NPCs within the wind portion of the Project Area.

There are no mapped NPCs within the Red Rock Solar portion of the hybrid project area.

In addition to rare and sensitive species, the MNDNR also maps Sites of Biological Significance (SOBS), rare and unique plant communities (e.g., prairie) and higher quality examples of more common plant communities (e.g., wet meadow). The Minnesota Biological Survey (MNDNR) designates and assigns rankings to SOBS, based on landscape context, native plant community, and occurrence of rare species populations. There are four biodiversity significance ranks: outstanding, high, moderate, and below.[283]

Within the Big Bend Wind portion of the hybrid project area, four areas have been evaluated as SOBS by the MBS. These sites within the wind portion of the hybrid project area are ranked as either "below" or "moderate"; there are no sites ranked with "high" or "outstanding" biodiversity significance within the wind portion of the hybrid project area.[284]

There are no mapped SOBSs within the Red Rock Solar portion of the hybrid project area.

Table 4-11 provides a listing of the records of native prairies, native plant communities, and Sites of Biological Significance within the hybrid project area.

Table 4-11. Native Prairie, Native Plant Communities, and SOBS within the Wind Project Area[285]

Native Prairie Type	Number of Sites Within Project Area	Acres
Dry Hill Prairie (southern)	3	16.4
Total		16.4
Native Plant Community Type	**Number of Sites Within Project Area**	**Acres**
Dry Hill Prairie (Southern)	3	16.4

[282] https://www.dnr.state.mn.us/npc/index.html.
[283] https://www.dnr.state.mn.us/mbs/index.html.
[284] Amended Wind SPA – Section 8.21.3.1
[285] Amended Wind SPA – Section 8.21.2 and Section 8.21.3

Total		16.4
Site of Biodiversity Significance Rank	Number of Sites Within Project Area	Acres
Below	2	46.6
Moderate	2	16.5
High	0	0
Outstanding	0	0
Total	4	63.1

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

Big Bend Wind has avoided placing any wind project components in the identified locations of any federal or state listed endangered, threatened, or special concern species within the Big Bend Wind portion of the hybrid project area. Additionally, no wind project components have been designed and sited within habitat types preferred by federal and state listed species known to occur within the Big Bend Wind project area or within one mile of the project area. No impacts to federal or state listed species are anticipated to occur.

Big Bend's current plans do not impact any native prairie areas, there are no permanent planned impacts to any non-native dominated grasslands, and there is proposed temporary impacts to 0.2 acres of non-native grassland within the Project Area. Being the proposed impacts are temporary in nature, and will have minimal to no impact to the plant communities preferred by the Henslow's sparrow, no impacts to the species are anticipated to occur as a result of the proposed hybrid project.

The currently proposed Big Bend Wind components will avoid impacts to MNDNR mapped native prairie areas, native plant communities, and Sites of Biological Significance.[286]

There are no records of any federal or state listed endangered, threatened, or special concern species within the Red Rock Solar portion of the hybrid project area, so no impacts to federal or state listed species are anticipated to occur.

[286] Amended Wind SPA – Section 8.21.2.2 and Section 8.21.3.3

The proposed Red Rock Solar portion of the hybrid project area does not contain any identified native prairies, native plant communities, or Sites of Biological Significance, so no impacts to these resources are anticipated.

335 MW Solar Facility (No wind component)

As with all renewable energy generation facilities, impacts to rare and unique natural resources from solar facility development depends upon specific site characteristics, and it is difficult to assess impacts to rare and unique natural resources for a solar facility without detailed knowledge of the proposed site's environmental setting.

A 335 MW solar farm likely would be sited on agricultural land and similar types of wildlife common to disturbed areas, such as the proposed hybrid Big Bend Wind and Red Rock Solar Project, would be expected. It is assumed that these species' use of agricultural lands is largely limited to occasional foraging in the fields and shelter within wooded areas that may surround the fields.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

Because impacts to rare and unique natural resources would depend upon specific site characteristics, it is difficult to assess rare and unique natural resources impacts for a 335 MW hybrid wind and solar facility alternative, located elsewhere in Minnesota.

Impacts to rare and unique natural resources, from a 335 MW hybrid wind and solar facility alternative, would vary and depend ultimately where the alternative hybrid facility is located within the State. Because the wind resource and solar generation resource in Minnesota are primarily associated with agricultural lands, the 335 MW hybrid wind and solar facility alternative would be located in a similar landscape as the proposed hybrid Big Bend Wind and Red Rock Solar Project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

Impacts to rare and unique natural resources from the 335 MW solar facility with battery storage system alternative depends upon specific site characteristics. It is difficult to assess rare and unique natural resource impacts for a solar farm without detailed knowledge of the proposed site's environmental setting.

The 335 MW solar facility with battery storage alternative impacts to rare and unique natural resources will likely be similar to the 335 solar facility alternative detailed previously in this section. A 335 MW solar farm likely would be sited on agricultural land and similar types of wildlife common to disturbed areas, such as the proposed hybrid Big Bend Wind and Red Rock Solar Project, would be

expected. It is assumed that these species' use of agricultural lands is largely limited to occasional foraging in the fields and shelter within wooded areas that may surround the fields.

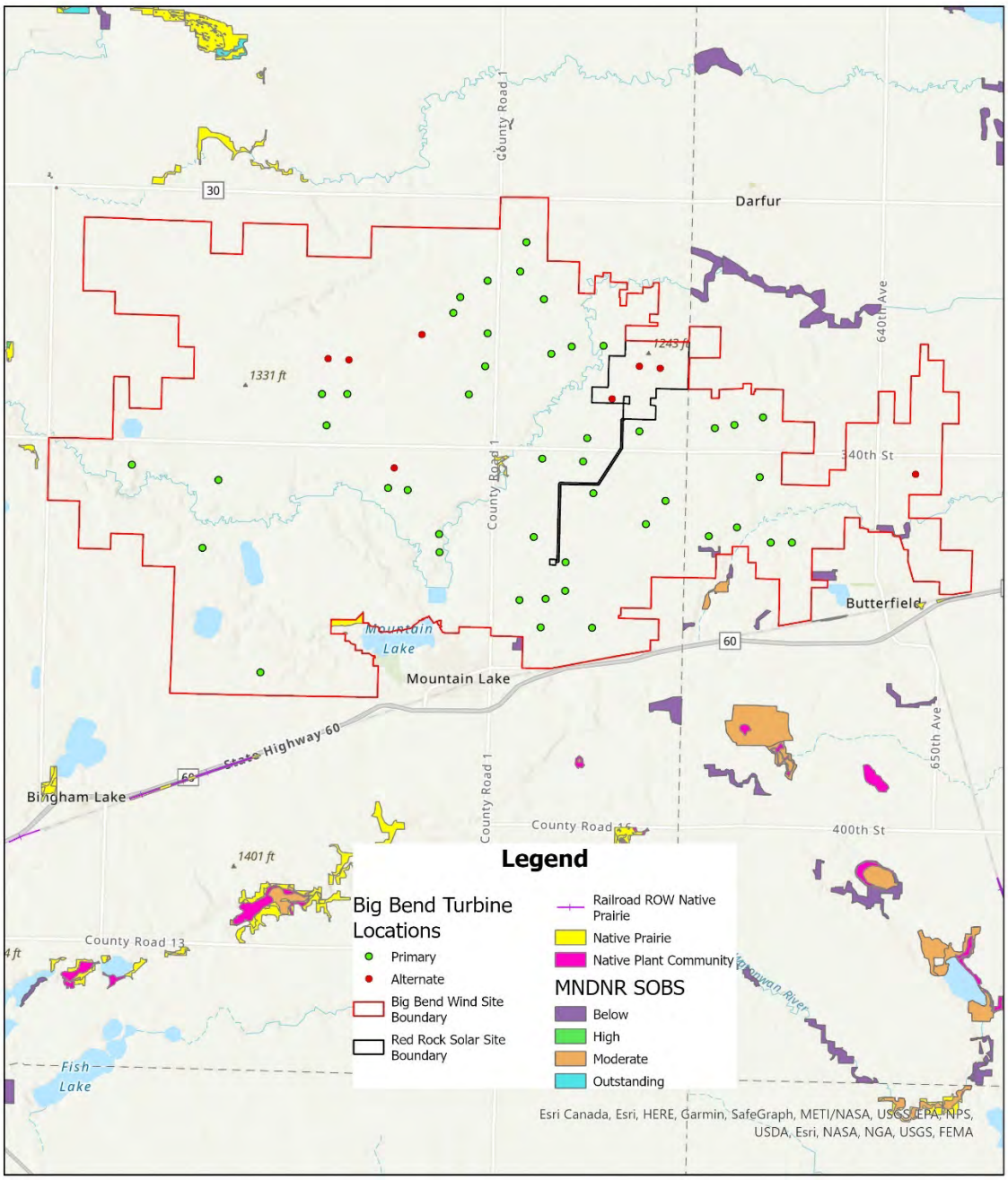
Mitigation

The currently proposed Big Bend Wind portion of the Project has utilized design and siting to identify turbine locations within cultivated cropland, and to layout other wind project components; access roads, met towers, substation, O&M facility, collection lines and crane paths will avoid impacts to MNDNR mapped native prairie areas, native plant communities, and Sites of Biological Significance.[287]

The proposed Red Rock Solar portion of the hybrid project area has been sited to avoid impacts to, native prairie areas, native plant communities, Sites of Biological Significance, and federal and state listed species.

Big Bend states that it will continue to coordinate with the MNDNR and DOC-EERA on potential impacts to native prairies. Big Bend has committed to conducting field assessments of potential native prairie sites and preparing a Native Prairie Protection Plan (NPPP) for review and approval by MNDNR and DOC-EERA prior to beginning any project construction activities.[288] Big Bend's preparation of an NPPP will provide additional detail on the identification of un-mapped native prairies within the Project Area, and address avoidance measures that will be taken during construction of the proposed project.[289]

[287] Amended Wind SPA – Section 8.21.2.2 and Section 8.21.3.3
[288] Amended Wind SPA – Section 8.21.2.3
[289] Amended Wind SPA – Section 8.21.2.3


Darfur
Butterfield
Mountain Lake
Bingham Lake
Fish Lake
County Road 1
County Road 13
State Highway 60
340th St
400th St
640th Ave
650th Ave
1331 ft
1243 ft
1401 ft
Legend
Big Bend Turbine Locations
Primary
Alternate
Big Bend Wind Site Boundary
Red Rock Solar Site Boundary
Railroad ROW Native Prairie
Native Prairie
Native Plant Community
MNDNR SOBS
Below
High
Moderate
Outstanding
Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS, FEMA
N
0
1.25
2.5
5 Miles

4.2.5.6 *Soils*

Soils in the region are characterized by four soils associations; a soil association has a distinctive pattern of soils, relief, and drainage, see **Table 4-12**. Generally, the soils within the hybrid project area are characterized by silty clay loams that are very deep, somewhat poorly to poorly drained and underlain by glacial till.

Table 4-12. Wind Project Area Soil Associations[290]

Soil Association	Area (acres)
Webster-Nicollet-Glencoe-Crippin-Canisteo (s3557)	27,752
Delft-Clarion (s3558)	10,213
Webster-Nicollet-Glencoe-Clarion-Canisteo (s3569)	5,114
Webster-Nicollet-Clarion-Canisteo (s1750)	444
Total	**43,523**

Table 4-13. Solar Project Area Soil Types[291]

Map Unit	Soil Name	Area (acres)	Percent of Solar Portion of the Project Area	Prime Farmland Designation	Hydric Soil
L83A	Webster clay loam, 0 to 2 percent slope	316.7	38%	Yes, if drained	Yes
L85A	Nicollet clay loam, 1 to 3 percent slope	207.6	24%	Yes	No
L79B	Clarion loam, 2 to 6 percent slope	140.6	16%	Yes	No
L84A	Glencoe clay loam, 0 to 1 percent slope	83.5	10%	Yes, if drained	Yes
L78A	Canisteo clay loam, 0 to 2 percent slope	72.5	9%	Yes, if drained	Yes
L167A	Mayer clay loam, depressional, 0 to 1 percent slope	19.7	2%	Yes, if drained	Yes
L98A	Crippin-Nicollet complex, 1 to 3 percent slope	3.0	<1%	Yes	No

[290] Amended Wind SPA – Section 8.15.1 and Table 8.15-1

[291] Solar SPA – Section 4.5.3 and Table 4.5-2

L107A	Canisteo-Glencoe complex, 0 to 2 percent slope	2.1	<1%	Yes, if drained	Yes
L165A	Mayer loam, 0 to 2 percent slope	0.5	<1%	Yes, if drained	Yes
	Total	**846.2**	**100%**		

In addition to soil associations, the United States Department of Agriculture, Natural Resources Conservation Service identifies areas that are important to agricultural use, such as prime farmland and farmland of statewide importance. Prime Farmland as defined by Federal regulation at 7 C.F.R. 657.5(a)(1) "is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses."

Approximately 89 percent of the soils in the Big Bend Wind portion of the hybrid project area is classified as prime farmland, while approximately 6 percent is classified as farmland of statewide importance. Additionally, approximately 5 percent of land within the Big Bend Wind Project Area is not prime farmland.[292] The Big Bend Wind portion of the proposed hybrid project is compatible with restrictions in rule concerning the development of energy projects in areas with prime farmland.

All of the 483.3 acres of land within the Red Rock Solar portion of the hybrid project area is 100% prime farmland (217.8 acres) or prime farmland if drained (265.5 acres) based on soils characteristics. Once construction is complete the revegetation efforts will be focused on seeding and maintaining suitable plant cover through the operation of the solar portion of the hybrid project. During solar facility operations the prime farmland in the solar portion of the proposed hybrid project will be removed from farming rotation.[293]

Table 4-14 and Table 4-15 shows prime farmland classification quantities within the Big Bend Wind project area and the Red Rock Solar project area, respectively.

Table 4-14. Wind Project Area Prime Farmland[294]

Prime Farmland Classification	Acres	Percent of Project Area
Prime Farmland and Prime Farmland if Drained	38,743.0	89.0%
Farmland of Statewide Importance	2,601.7	6.0%
Not Prime Farmland	2,178.4	5.0%

[292] Amended Wind SPA – Section 8.15.1 and Table 8.15-2

[293] Solar SPA – Section 4.5.3.1

[294] Amended Wind SPA – Section 8.15.1 and Table 8.15-2

Total	**43,523.1**	**100%**

Table 4-15. Solar Project Area Prime Farmland[295]

Prime Farmland Classification	Acres	Percent of Project Area
Prime Farmland	217.8	45%
Prime Farmland if Drained	265.5	55%
Farmland of Statewide Importance	-	-
Not Prime Farmland	-	-
Total	**483.3**	**100%**

Construction of the proposed hybrid wind and solar project will result in various impacts to the soils within the Project Area. Construction activities such as clearing, grading, foundation excavation and backfilling, movement of materials and construction will potentially result in soil erosion, soil compaction, reduction in soil fertility, and other soil characteristic changes.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

The current turbine layout would result in long-term impacts to 47.7 acres of prime farmland within the Big Bend Wind portion of the proposed hybrid project, and these impacts will be localized to individual wind turbines, access roads, the O&M building, and the wind project substation.[296] During the construction of the Big Bend Wind Project impacts to prime farmland are expected to be short-term, and will occur at temporary construction areas, laydown areas, and collection line trenching locations.

The current plan for the Red Rock solar portion of the proposed hybrid project will result in long-term, significant impacts to 483.3 acres of prime farmland.[297]

This EA acknowledges that the perceived impacts to prime farmland are subjective and may be difficult to assess given the trade-offs associated with utility scale solar projects.

Rural areas, with large parcels of relatively flat, open land, are ideal for solar development, which require six to eight acres of land to generate one MW of electricity. The Red Rock Solar Project will result in up to 483.3 acres of farmland being removed from agricultural production for the life of the

[295] Solar SPA – Section 4.5.3.1 and Table 4.5-3
[296] Amended Wind SPA – Section 8.15.2
[297] Solar SPA – Section 4.5.3.1 and Table 4.5-3

project. This change in land use would take productive farmland out of production but would result in a negligible loss of farmland in Cottonwood County. The applicant indicates that the land could be returned to agricultural uses after the project is decommissioned and the site is restored.

Minnesota Rule 7850.4400 states that no large electric power generating plant site (including a solar energy generating system) can include more than one-half acres of prime farmland per MW of net generating capacity. This prime farmland exclusion can be waived if "no feasible and prudent alternative" is available or if the commission varies its rules. The applicant conducted a screening analysis to assess whether the project meets the "feasible and prudent alternative" threshold.

The analysis looked at factors such as high solar resource areas, interconnect locations, and efforts to investigate developable sites, focusing on the southwestern portion of the state. Additionally, Red Rock considered the fact that Red Rock Solar was being developed as a hybrid project with Big Bend Wind, so wind resource and land availability to develop the wind portion of the hybrid project were factors to consider. Within this area, Red Rock Solar screened for substations and transmission lines with available capacity, leading to a relatively narrow subset of possible points of interconnection (POIs) with minimal upgrade requirements. A potential development location was identified approximately 15 miles from a POI, and the applicant was able to secure a MISO queue position for a hybrid wind /solar interconnection.

The project site was selected due to its proximity to the POI, supportive landowners, and available land currently not under lease with other potential renewable energy project in the area. There are several wind developments in this area, which limits siting options while remaining close to the Crandall Substation.

Reduced or lost farming revenues may be offset by leasing agreements, which are outside the scope of this document.

335 MW Solar Facility (No wind component)

While the site selection criteria for wind facilities and solar facilities share some common prerequisites (i.e., point of interconnect, adequate roadways and stakeholder concerns), there are sufficient contrasts to expect different siting outcomes (environmental setting). It is likely that a solar facility of the size needed to generate 335 MW, would be limited in terms of site selection in parts of the state with significant amounts of prime farmland. Additionally, the portions of the State with the greatest solar energy potential, correspond with the portions of the State utilized primarily for agricultural purposes.

Because of the large land areas needed to develop solar facilities, this system alternative would require significantly more acres that wind facility of the same generation capacity. If sited in a predominantly agricultural area; most likely exceeding the allowable use of prime farmland per Minn. Rule 7850.4400, subpart 4. This system alternative would have significant impacts to prime farmland soils when compared to the proposed hybrid project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

The 335 MW hybrid wind and solar facility alternative, located elsewhere in the State, will have similar impacts to soils, including prime farmland, as the proposed hybrid Big Bend Wind and Red Rock Solar Project. As the availability of sites for a hybrid wind and solar facility are going to be restricted to portions of the State with the greatest wind resources (**Figure 3-4**) and solar energy potential (**Figure 3-5**), which tend to be in the agricultural areas of the State with a similar ecological setting and features.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

While the site selection criteria for wind facilities and solar facilities share some common prerequisites (i.e., point of interconnect, adequate roadways and stakeholder concerns), there are sufficient contrasts to expect different siting outcomes (environmental setting). It is likely that a solar facility of the size needed to generate 335 MW, would be limited in terms of site selection in parts of the state with significant amounts of prime farmland. Additionally, the portions of the State with the greatest solar energy potential, correspond with the portions of the State utilized primarily for agricultural purposes.

Because of the large land areas needed to develop solar facilities, this system alternative would require significantly more acres that wind facility of the same generation capacity. If sited in a predominantly agricultural area; most likely exceeding the allowable use of prime farmland per Minn. Rule 7850.4400, subpart 4. This system alternative would have significant impacts to prime farmland soils when compared to the proposed hybrid project.

Mitigation

Big Bend and Red Rock will obtain a NPDES permit to discharge stormwater from construction facilities from MPCA. BMPs will be used during construction of the Project to protect topsoil and adjacent resources to minimize soil erosion. BMPs may include containment of excavated material, protection of exposed soil, and stabilization of restored material.

Prior to construction of the Big Bend Wind portion and the Red Rock Solar portion of the proposed hybrid project a Stormwater Pollution Prevention Plan (SWPPP) will be developed, and Erosion Control

Devices (ECDs) will be included; such as silt fencing, revegetation plans, and the management of exposed soils to prevent erosion.[298]

Access roads for the wind portion of the hybrid project will be placed away from steep slopes to the degree possible to minimize the amount of grading and soil disturbance. Access roads, collection lines, and crane paths have been co-located to the extent practicable to minimize the construction footprint and reduce soil disturbance. Geotechnical soil borings will be conducted at wind turbine locations prior to construction to determine if the soils are suitable to support the turbine foundation.[299]

Big Bend Wind and Red Rock Solar will use the following BMPs and mitigation measures to minimize soil impacts:

- During construction, certain activities may be suspended in wet soil conditions to avoid rutting and mixing of topsoil and subsoil. The contractor will cease work until Big Bend or Red Rock determines that site conditions are such that work may continue without damage. Big Bend's or Red Rock's construction management personnel will ultimately decide if wet weather shutdown is necessary in a given location.
- Big Bend and Red Rock will strip topsoil in upland areas as specified in the Project plans, commitments, and/or permits. Excavated topsoil and subsoil will be stockpiled separately in the approved construction workspace, stored in such a way that the area subject to erosion is minimized, and then reestablished post construction.
- Temporary ECDs, such as slope breakers, sediment barriers (e.g., silt fences, straw bales, bio-logs), stormwater diversions, trench breakers, mulch, and revegetation will be installed following soil disturbance and maintained until site is restored. The contractor will maintain erosion and sediment control structures as required in the Big Bend Wind or Red Rock Solar construction documents, and as required by all applicable permits. Nonfunctional ECDs will be repaired, replaced, or supplemented with functional materials within 24 hours after discovery, or as otherwise specific in the Big Bend Wind or Red Rock Solar permits.
- Temporary ECDs installed across the travel lane may be removed during active daytime construction; however, ECDs will be properly reinstalled after equipment has passed, or activities in the area are completed for the day. These ECDs will also be repaired and/or replaced prior to forecasted inclement weather.
- Once construction is complete, Big Bend Wind and Red Rock Solar will backfill graded and excavated areas with the stored native material and reestablish the original grade and drainage pattern of the construction workspace to the extent practicable.

[298] Amended Wind SPA – Section 8.15.3

[299] Amended Wind SPA – Section 8.15.3

- During site restoration, Big Bend Wind and Red Rock Solar will decompact subsoil within the construction workspace, temporary laydown areas, temporary concrete batch plants, temporary access roads, and crane pathways, as appropriate for the specific portion of the hybrid project. The contractor will implement ECDs, including seeding the site with weed-free native plants in accordance with landowner or local agency requests.
- During operations, Big Bend Wind and Red Rock Solar will regularly inspect access roads, utility and transmission line corridors, tower site areas, solar arrays, wind project substation, and the solar project substation, as appropriate for the specific portion of the hybrid project, for damage from erosion, washouts, and rutting. Big Bend Wind or Red Rock Solar will initiate corrective measures immediately upon evidence of damage.

Red Rock Solar developed and is committed to an Agricultural Impact Mitigation Plan (AIMP) that details methods to minimize soil compaction, preserve topsoil, and establish and maintain appropriate vegetation to ensure the project is designed, constructed, operated and ultimately restored in a manner that would allow the land to be returned to agricultural use.

4.2.5.7 Vegetation

Construction and operation of large energy projects may cause short-term and long-term impacts to vegetation. Short-term impacts are associated with construction; once the construction activity (i.e., temporary lay-down areas, grading and excavation of soils, trenching for electric feeder/collector lines, etc.) is completed the disturbed area can be returned to pre-construction conditions. Long-term impacts include those which are permanent in nature and are usually associated with the construction site of individual wind turbines and associated facilities, such as collector and feeder lines, access roads, and O&M building, and PV panels and their associated facilities.

Construction activities could potentially lead to introduction of noxious weeds and invasive species through ground disturbance, extended periods of exposed soils, the introduction of topsoil contaminated with weed seeds, vehicles importing weed seed from a contaminated site to an uncontaminated site, and conversion of land cover types, particularly from forested to open settings. Invasive species and noxious weeds out-compete native plants, alter species composition and natural communities, and diminish ecosystem functions.

Maintenance and emergency repair activities could also result in direct impacts to vegetation from removal of vegetation, localized physical disturbance, and soil compaction caused by the use of equipment. Such impacts on vegetation would be short-term and more localized than construction-related impacts.

Based on the United States Geological Society's National Land Cover Database, land cover in the Project Area is primarily cultivated crops, see **Figures 4-8 and 4-9**, which accounts for 92.5 percent of the land cover in the Big Bend Wind portion of the Project Area, and 95.2 percent of the land cover in the Red Rock Solar portion of the Project Area.[300] Forested areas are primarily surrounding residences as windbreaks in both the wind and solar portions of the Project Area, and riparian areas along Watonwan River and associated tributaries in the wind portion of the Project Area.[301] Wetlands in the Project are associated with streams, and low lying areas in the cultivated cropland. There are several lakes and ponds within the wind portion of the Project Area. Hay/Pasture and grassland/herbaceous lands are present within the Project Area and may contain potential remnant native prairie areas.[302]

There are many kinds of vegetated areas that are not native plant communities. These include places where native species have largely been replaced by exotic or invasive species such as smooth brome grass, buckthorn, and purple loosestrife, and planted areas such as orchards, pine plantations, golf courses, and lawns. Other areas not considered to be native plant communities include areas where modern human activities such as farming, live-stock grazing, logging, and development have greatly altered the vegetation.

The primary impact from construction of the Big Bend Wind portion and the Red Rock Solar portion of the proposed hybrid project would be the cutting, clearing, and removal of existing vegetation within the construction workspace. The degree of impact would depend on the type and amount of vegetation affected, the rate at which the vegetation would regenerate after construction, and whether periodic vegetation maintenance would be conducted during operation. Secondary effects from disturbances to vegetation could include increased soil erosion, increased potential for the introduction and establishment of invasive and noxious weed species, habitat fragmentation and edge effects, and a local reduction in available wildlife habitat.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

In the Big Bend Wind portion of the Project Area, vegetation will be permanently removed and replaced by wind turbines, access roads, and substation components. Temporary vegetation impacts will be associated with crane walkways, the installation of underground collection lines, workspace around turbines, wider access roads, and contractor staging and laydown areas. The turbines and access roads are sited to avoid forests and groves to maximize turbine output and avoid tree removal.

[300] Amended Wind SPA – Section 8.19.1.1 and Solar SPA – Section 4.5.6
[301] Amended Wind SPA – Section 8.19.1.1 and Solar SPA – Section 4.5.6
[302] Amended Wind SPA – Section 8.19.1.1

Less than one percent of the wind portion of the hybrid project will be permanently converted to sites for wind turbines, access roads, and facilities.[303]

The Red Rock Solar portion of the Project Area will covert currently cultivated cropland, within the fenceline, to open herbaceous cover under and around the PV panels. The Solar Project Substation, inverter skids, and access roads will be converted to developed land and impervious surfaces.

In both the Big Bend Wind portion and the Red Rock Solar portion of the proposed hybrid project area cultivated cropland comprises over 95 percent of the areas that will experience permanent and temporary impacts. A summary of vegetation impacts is provided in Table 4-16.

Table 4-16. Summary of Land Cover Impacts (acres) in the Hybrid Project Area

Land Cover Type	Big Bend Wind Portion[304]		Red Rock Solar Portion[305]	
	Permanent	Temporary	Permanent	Temporary
Cultivated Crops	46.5	956.7	451	27.6
Developed (all categories)	2.5	31.5	0.7	0.7
Emergent Herbaceous Wetlands	-	2.0	-	-
Hay/Pasture	<0.1	0.7	-	-
Grassland/Herbaceous	-	0.2	-	-
Deciduous/Mixed Forest	-	0.7	-	-
Barren Land	-	0.7	-	-
Open Water	-	0.2	-	-
Total	**49.1**	**992.0**	**451.7**	**28.3**

335 MW Solar Facility (No wind component)

As with a hybrid wind and solar facility impacts to vegetation from a 335 MW solar facility system alternative depends upon site-specific characteristics; it is difficult to assess the degree and ecological significance of vegetative impacts for a solar facility without knowledge of the land cover types, topography, and general environmental setting of a hypothetical project site.

During the site preparation phase for utility-scale solar facilities, developers often grade land (cut and fill) and remove all vegetation to minimize installation and operational costs, prevent plants (including crops) from shading panels, and minimize potential fire or wildlife risks.

[303] Amended Wind SPA – Section 8.19.2

[304] Amended Wind SPA – Section 8.19.2 and Table 8.19-2

[305] Solar SPA – Section 4.5.6.1

As with other permitted solar facilities in Minnesota it can be anticipated that the majority of the land within the fenced portion of the 335 MW solar facility system alternative will be revegetated with open herbaceous cover under the PV panels.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

The primary impacts to vegetation would be from construction of the 335 MW hybrid wind and solar facility system alternative, and the impacts would be similar to the impacts anticipated to occur from the proposed hybrid project. The degree of impact would depend on the type and amount of vegetation affected, the rate at which the vegetation would regenerate after construction, and whether periodic vegetation maintenance would be conducted during operation.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

The potential impacts to vegetation for the 335 MW Solar Facility with Battery Storage system alternative would be similar to the 335 MW solar facility system alternative, with some additional acres of potential impacts depending on the size and location of the associated battery storage system. The battery storage portion of the facility would be additional permanently impacted acres, converting whatever the existing cover type is at the time of project construction to developed land and impervious surface. Ultimately, impacts to vegetation would depend on site-specific characteristics, existing vegetative communities, and project design and layout.

Mitigation

The potential impacts to vegetation caused by the construction of both wind energy and solar energy facilities can be mitigated by using BMPs and standard construction practices to minimize soil erosion (including the prompt revegetation of disturbed soils) and micro siting of the various project components and infrastructure to avoid existing vegetation.

Preparation and development of a Vegetation Management Plan and a Native Prairie Protection Plan, in consultation with resources agencies, are common requirements of Commission issued site permits.

Continuing mitigation measures to reduce the spread of nonnative plant species during construction should be employed and include: regular, frequent cleaning of construction equipment and vehicles; minimization of ground disturbance to the greatest degree practicable and rapid revegetation of disturbed areas with native or appropriately certified weed-free seed mixes; conducting field surveys prior to construction to identify areas that currently contain noxious weed; attending to new infestations of noxious weed within the project areas by identifying and eradication as soon as practicable in conjunction with property owners input.

Development of a Vegetation Management Plan (VMP) are typically required in Commission permits to formalize measures to minimize the disturbance and removal of vegetation on project sites, prevent the introduction of noxious weeds and invasive species and re-vegetate disturbed areas consistent with the safe and reliable operation of the specific project.

Red Rock Solar will develop a VMP prior to beginning construction, and they will adopt and follow all measures in the VMP through construction and operation of the solar project. The VMP will detail long term management of the vegetation established under and around the solar arrays.

Red Rock Solar has designed the solar portion of the hybrid project to avoid any tree clearing.[306]

4.2.5.8 Water Resources

Different generation options have different water usage and effects on the water quality and water resources.

Water Appropriations

Large electric power generating facilities may require water during construction and during operations.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

During construction of the proposed hybrid wind and solar project a water appropriations permits will likely be needed for temporary dewatering activities specific to construction of the wind energy portion of the project.[307] Additionally, a water appropriations permit may be needed for the water necessary to run a temporary concrete batch plant to meet the concrete needs to construct turbine foundations, and also to utilize water for dust control on local roads during construction.[308] The current plan is to excavate an area of approximately 291 to 737 cubic yards depending geotechnical data, turbine size, turbine loads, and cost considerations.[309]

The minimal need for concrete in the construction the Red Rock Solar Project does not warrant a batch plant. Subsurface work (cables, conduit, grading, and trenching) will be conducted above water

[306] Solar SPA – Section 4.5.6.1
[307] Amended Wind SPA – Section 8.16.2
[308] Amended Wind SPA – Section 8.16.2
[309] Amended Wind SPA – Section 10.4.1

table levels, negating the need for dewatering; however, should dewatering become necessary for the solar portion of the project a water appropriations permit would be acquired.

The determination of need for a Water Appropriations Permit for construction dewatering activities will be determined by the contractor during construction depending on site conditions.[310]

The proposed hybrid wind and solar project will have a shared O&M facility, which will be constructed within the wind portion of the project.[311,312] The shared O&M facility will serve as a center for the wind and solar facilities O&M efforts, provide Project access and storage, and house the SCADA system. The O&M facility will provide office space for the crews, as well as a shop/storage area for spare parts and vehicles. It will also house the central monitoring equipment for the generating facilities where the turbines and PV panels are monitored and controlled. The footprint of the facility is anticipated to be approximately 3,000 to 5,000 square feet and will include an access road and parking lot of approximately 3,000 square feet.[313] The O&M facility will require the installation of a well for potable water and the design and installation of an Individual Sewer Treatment System (septic system).[314] Typical water used for O&M facilities is estimated to be roughly equivalent to the amount consumed by a residence or farmstead in the area (500 gallons per day, or 100 gallons per person per day).

335 MW Solar Facility (No wind component)

A utility scale solar facility such as those recently permitted by the Commission typically include an O&M facility with water use similar to that of the proposed hybrid wind and solar project. Given the rural nature in siting solar farms, it would be anticipated that domestic water and sewer services (operation and maintenance building) would generally be provided by on-site infrastructure (i.e., private well and septic), which would require similar regulatory review and permitting as for the proposed hybrid wind and solar project.

The minimal need for concrete in the construction of solar farms does not warrant a batch plant. Subsurface work (cables, conduit, grading, and trenching) is conducted above water table levels, negating the need for dewatering; however, should dewatering become necessary for the solar facility a comparable regulatory review and permitting process similar to the proposed hybrid wind and solar project would be necessary.

---

[310] Amended Wind SPA – Section 8.16.3
[311] Solar SPA – Section 3.1.5.2
[312] Amended Wind SPA – 10.3.2
[313] Amended Wind SPA – 10.3.2
[314] Amended Wind SPA – 10.3.2

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

A 335 MW hybrid wind and solar facility, sited elsewhere in Minnesota, would essentially have the same dewatering and water appropriation needs and usage as the proposed hybrid wind and solar project. Additionally, the same water appropriation permits would be needed for this alternative, as will be required for the proposed hybrid Big Bend Wind and Red Rock Solar Project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

As identified for the solar facility portion of the proposed hybrid wind and solar project, and the 335 MW Solar Facility alternative, the 335 MW Solar Facility with Battery Storage alternative will essentially have the same dewatering, water appropriations, and permitting requirements.

Mitigation

There would be negligible to minimal impacts concerning water appropriations for the proposed hybrid project, outside of BMPs and standard conditions contained in the DNR Water Appropriations Permit.

No additional mitigation is required.

If temporary dewatering is required during construction activities, discharge of dewatering fluid will be conducted under the National Pollutant Discharge Elimination System (NPDES) permit program and addressed by the Project's Storm Water Pollution Prevention Plan (SWPPP), as required.

Wastewater

Large electric generation facilities have the potential to generate significant amounts of wastewater. This section discusses potential impacts from wastewater generation.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

The hybrid wind and solar project shared O&M facility would generate household amounts of wastewater. Big Bend/Red Rock plans to build an on-site septic system to serve the O&M facility.[315] The potential impacts of this wastewater and septic system are anticipated to be negligible to minimal.

[315] Amended Wind SPA – 10.3.2

No wastewater will be generated within the solar portion of the hybrid project, as the O&M facility will be within the Big Bend Wind project area.

335 MW Solar Facility (No wind component)

Similar to the proposed hybrid wind and solar project and its rural setting, a solar facility would likely require a private well and septic system at the O&M building to provide sanitary services and water for maintenance. Wells and septic system installations require state and local permits.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

Similar to the proposed hybrid wind and solar project, the 335 MW hybrid wind and solar facility alternative, and will likely require a private well and septic system at the shared O&M building to provide sanitary services and water for maintenance. Wells and septic system installations require state and local permits.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

Similar to the proposed hybrid wind and solar project, the 335 MW Solar Facility alternative, and the 335 MW Hybrid Wind and Solar Facility alternative, the 335 MW Solar Facility with Battery Storage alternative will be in a rural setting, a solar facility would likely require a private well and septic system at the O&M building to provide sanitary services and water for maintenance. Wells and septic system installations require state and local permits.

Mitigation

There would be negligible to minimal impacts to wastewater from the hybrid project; outside of BMPs and standard conditions contained in the potable well installations and Individual Sewage Treatment System permits, no mitigation is required.

Groundwater

Ground water in Minnesota is largely a function of local geologic conditions that determine the type and properties of aquifers. The Minnesota DNR divides the state into six ground water provinces based on bedrock and glacial geology.[316] Most groundwater originates from rain and melting snow and ice that infiltrate into the ground; it is the source of water for springs and wells. It is relied on as a source for drinking water, irrigation, and industrial use. Groundwater can be sourced from shallow surficial aquifers or from deeper confined aquifers. Activities that reduce the quantity of available

[316] DNR. *Minnesota Groundwater Provinces* (https://www.dnr.state.mn.us/groundwater/provinces/index.html).

water or introduce contaminants into these aquifers can affect groundwater resources and the people and industries that rely on them.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

The proposed hybrid wind and solar project is located in groundwater province 5 (Western groundwater province).[317] Groundwater in the region is supplied by the Cretaceous aquifer, which consists of thick to thin, discontinuous sandstone beds overlain in places by limestone and shale beds that confine the aquifer.[318]

The aquifer is directly overlain by glacial deposits of clayey glacial drift overlying Cretaceous and Precambrian bedrock. Glacial drift and Cretaceous bedrock contain limited extent sand and sandstone aquifers, respectively.

Homes and farms in the Project Area typically use private wells and septic systems for their household needs. According to the Minnesota Department of Health's Minnesota Well Index online database, there are 122 wells within the Big Bend Wind portion of the hybrid project area, and three wells identified within the Red Rock portion of the Project. Identified well locations are generally associated with residences and livestock operations (Minnesota Department of Health, 2019).[319, 320] The Mountain Lake Wellhead Protection Area is located in the south portion of the proposed wind facility Project Area.[321]

Large scale excavation, dewatering, and water use at the proposed wind facility portion of the project is limited to the turbine pads, the temporary concrete batch plant, and the proposed shared O&M facility (including well and septic) and are temporary. Groundwater resources are not expected to be impacted by these activities. Individual wind turbine locations should not impact the use of existing water wells; to comply with residential and noise setbacks, turbines are generally located at least 1,000 feet from homes, well away from where most residential wells are located.

[317] Amended Wind SPA – Section 8.16.1.3
[318] Amended Wind SPA – Section 8.16.1.3
[319] Amended Wind SPA – Section 8.16.1.3
[320] Solar SPA – Section 4.5.2
[321] Amended Wind SPA – Section 8.16.1.3

Impacts to groundwater resources from construction and operation of the proposed wind portion of the hybrid project will be minimal due to adequate supply, the aquifer depth, and lack of potential sources of contamination.

The proposed solar portion of the project will include direct-embedded piers supporting the PV tracking installations, foundations for inverters, and transmission poles that were typically installed at a depth above the average depth to groundwater of 15-40 feet. The closest identified well to the solar facility footprint of the proposed hybrid project is 320 feet away, and any necessary dewatering activities completed during construction will be discharged to the ground surface near the location of dewatering, allowing for infiltration and minimization of potential impacts.[322]

No impacts to groundwater resources are anticipated to result from construction or operation of the solar portion of the proposed hybrid project.

Water supply needs during project operations are anticipated to be limited to the shared O&M facility requirements, which will be satisfied via a private well. As previously noted, the temporary concrete batch plant may need a water well to provide water for concrete production during the construction phase of the wind facility portion of the hybrid project. A water appropriations permit will be required for all dewatering and water usage associated with the proposed hybrid wind and solar project.

335 MW Solar Facility (No wind component)

The infrastructure at previously reviewed solar projects, included the direct-embedded piers supporting the PV tracking installations, foundations for inverters and the Operations and Maintenance (O&M) facility, and transmission poles that were typically installed at a depth above the average depth to groundwater of 15-40 feet. No impacts groundwater resources would be anticipated as a result of construction or operation of the 335 MW alternative solar facility.

With the shallow subsurface depth requirements for infrastructure at solar facilities it is unlikely these types of projects situated elsewhere in Minnesota would pose a general threat to groundwater quality; however, with certain site specific subsurface conditions (karst or high water table) the risk may increase.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

The 335 MW hybrid wind and solar facility will have similar construction and operational impacts to geologic and groundwater resources as the proposed hybrid wind and solar project. Depending on the

[322] Solar SPA – Section 4.5.2.1

location of the alternative hybrid wind and solar facility, the depth to bedrock and groundwater will likely exceed the excavation depth necessary to construction turbine foundations. Subsurface depths necessary for the solar facility infrastructure makes it unlikely that the solar facility portion of the alternative hybrid wind and solar project on the geologic and groundwater resources.

The alternative hybrid wind and solar facility could likely be located elsewhere in Minnesota with a similar number of private wells within the project area, and similar setback distances from project components and the private wells. If a site was selected with higher numbers of private wells, and increased well density within the alternative project area, there would be increased potential for groundwater contamination during project construction, through dewatering activities and potential spills of contaminates.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

The infrastructure installed at the 335 MW solar facility with battery storage alternative would be similar to the components installed for the 335 MW solar facility alternative, including the direct-embedded piers supporting the PV tracking installations, foundations for inverters and the O&M facility, and transmission poles that were typically installed at a depth above the average depth to groundwater. No impacts groundwater resources would be anticipated as a result of construction or operation of the 335 MW solar facility with battery storage alternative.

With the shallow subsurface depth requirements for infrastructure at solar facilities it is unlikely these types of projects situated elsewhere in Minnesota would pose a general threat to groundwater quality; however, with certain site specific subsurface conditions (karst or high water table) the risk may increase.

Mitigation

During “down-stream” permitting, measures would be taken to identify any nearby wells prior to construction of turbine foundations. Permitting agencies such as the DNR, MPCA, and MDH determine appropriate actions to protect local groundwater resources.

Groundwater use for the wind portion of the hybrid project is anticipated to be minimal, and site-specific supply (O&M building well) and drawdown impacts will be further addressed, if necessary, in appropriations permits.

Impacts to groundwater resources by the Red Rock Solar Project are anticipated to be negligible, and no mitigation measures area planned at this time.

Surface Waters and Floodplains

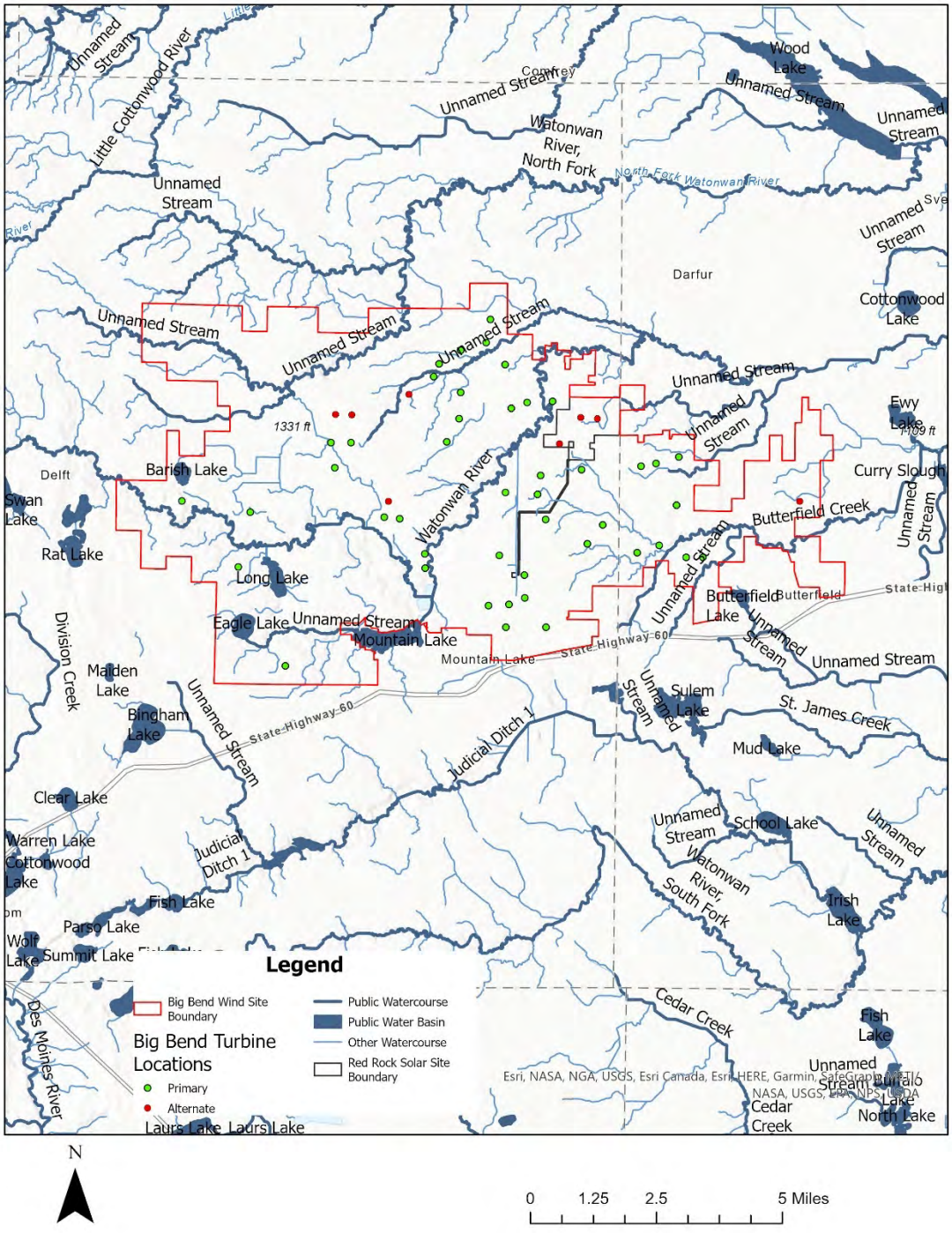
Construction and operation of a wind energy facility and solar energy facility can impact surface waters by creating crossings with access roads or temporary facilities such as crane paths and collection lines. Construction activity can also make soil erosion more prevalent, which can impact water quality.

Some watercourses and water bodies within the project area are designated as public waters and are listed in the public waters inventory (PWI) by the State of Minnesota. Public waters are designated as such to indicate which lakes, wetlands, and watercourses over which DNR has regulatory jurisdiction. Public waters are identified on PWI maps and are designated as public waters under DNR's Public Waters Permit Program (Minnesota Statute 103G.005, Subdivision 15).

During construction of the Big Bend Wind and Red Rock Solar portions of the proposed hybrid project there is the potential for sediment to reach surface waters due to ground disturbances from vegetation clearing, excavation, grading, and construction traffic. Potential impacts to surface water resources from construction of access roads, turbine sites, and collection lines when the ground is disturbed by excavation, grading, trenching, and construction traffic could include erosion from increased surface water runoff, sedimentation, discharges from groundwater dewatering, and diversion of watercourses.

The wind energy portion of the proposed hybrid project is located within the Watonwan River watershed. Portions of the Watonwan River and Butterfield Creek are within the wind energy portion of the Project Area, see Figure 4-11.

Figure 4-11. Wind Project Area Surface Waters

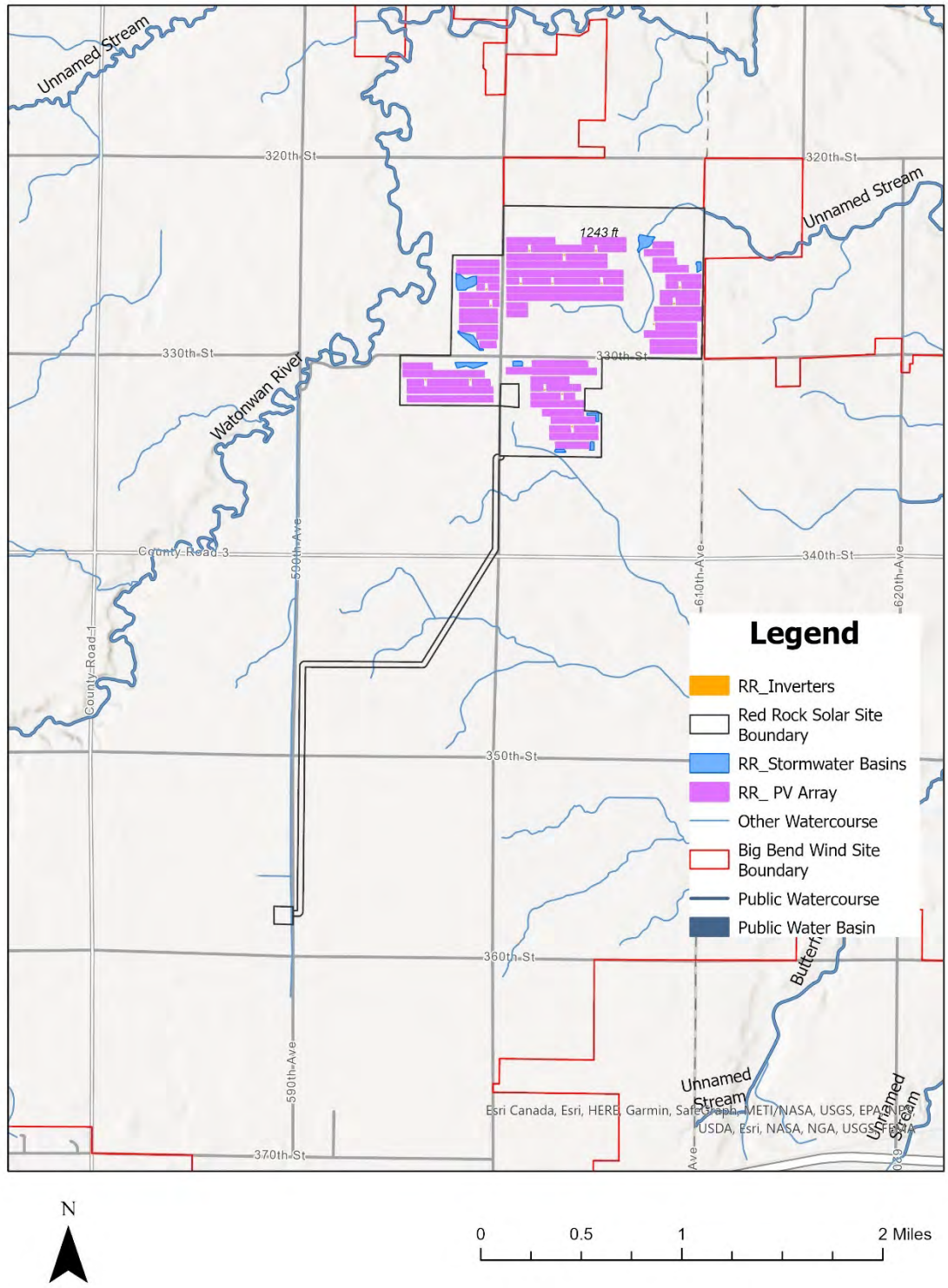


The Red Rock Solar portion of the proposed hybrid project is located within the Minnesota River Watershed basin, and there are two unnamed intermittent streams within the main portion of the Red Rock solar array construction area, and there are three unnamed watercourses crossed by the AC collection line corridor for solar facility, see Figure 4-12. There are no designated trout streams within the hybrid wind and solar project area.[323, 324] The closest designated trout stream is Scheldorf Creek, which is located approximately seven miles west of the proposed hybrid Project Area.[325]

[323] Amended Wind SPA – Section 8.17.1

[324] Solar SPA – Section 4.5.4

[325] Amended Wind SPA – Section 8.17.1


Unnamed Stream
320th St
320th St
Unnamed Stream
1243 ft
330th St
330th St
Watonwan River
County Road 3
590th Ave
610th Ave
340th St
620th Ave
County Road 1
Legend
RR_Inverters
Red Rock Solar Site Boundary
RR_Stormwater Basins
RR_ PV Array
Other Watercourse
Big Bend Wind Site Boundary
Public Watercourse
Public Water Basin
350th St
360th St
Butterfi
590th Ave
Unnamed Stream
Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS, FEMA
Unnamed Stream
370th St
N
0
0.5
1
2 Miles

No waterbodies within the Big Bend Wind portion or the Red Rock Solar portion of the hybrid project area are identified as Outstanding Resource Value Waters under Minn. R. 7050.0335, subpart 3.[326]

There are 16 PWI watercourses, five PWI basins, and no PWI wetlands in the Big Bend Wind portion of the proposed hybrid project area that are listed as MNDNR PWI public waters.

There are no designated PWI watercourses or waterbodies within the Red Rock Solar portion of the proposed hybrid project area.

Table 4-17. Hybrid Project Area Public Waters Inventory

PWI Type	PWI Feature Name
PWI Watercourse	Watonwan River (M-055-076-003-B005)
	Unnamed Stream (M-055-076-003-037-017-003)
	Unnamed Stream (M-055-076-003-041-001)
	Watonwan River (M-055-076-003-B002)
	Unnamed Stream (M-055-076-003-043)
	Watonwan River (M-055-076-003-B004)
	Unnamed Stream (M-055-076-003-037-017)
	Butterfield Creek (M-055-076-003-034-001)
	Unnamed Stream (M-055-076-003-041)
	Watonwan River (M-055-076-003-B006)
	Watonwan River (M-055-076-003-B001)
	Unnamed Stream (M-055-076-003-034-001-008)
	Unnamed Stream (M-055-076-003-041-001-001)
	Watonwan River (M-055-076-003-B003)
	Unnamed Stream (M-055-076-003-052)
	Watonwan River (M-055-076-003)
PWI Basin	Eagle Lake
	Long Lake
	Butterfield Lake
	Mountain Lake
	Barish Lake

[326] Amended Wind SPA – Section 8.17.1

The Clean Water Act (Section 303(d)) requires each state to list streams and lakes that are not meeting their designated uses (i.e., impaired) because of excess pollutants. There are eight impaired waters within the wind portion of the Project Area, three basins and five watercourses.

There are no impaired waters within the solar portion of the hybrid project area.

Table 4-18 lists all the impaired waters within the wind portion of the hybrid project area, including the Assessment Unit Identifier (AUID) and the identified impairment for each water course or basin.[327]

Table 4-18 Impaired Waters in the Wind Portion of the Hybrid Project Area

Impaired Waters Inventory			
Water Type	Feature Name	AUID	Impairment
Watercourse	Unnamed Creek (Mountain Lake Inlet)	07020010-505	Aquatic macroinvertebrate bioassessment
	Unnamed Creek	07020010-549	Fishes bioassessment; Aquatic macroinvertebrate bioassessment
	Unnamed Creek	07020010-583	Fishes bioassessment; Aquatic macroinvertebrate bioassessment
	Butterfield Creek	07020010-516	Escherichia coli; Fishes bioassessment; Aquatic macroinvertebrate bioassessment; Turbidity
	Watonwan River	07020010-566	Fecal coliform; Fishes bioassessment; Aquatic macroinvertebrate bioassessment; Turbidity; Mercury in fish tissue
	Mountain	17-0003-00	Fishes bioassessments; Mercury in fish tissue

[327] Amended Wind SPA – Section 8.17.1.2 AND Table 8.17-2

Basin	Eagle	17-0020-00	Nutrient/eutrophication biological indicators
	Butterfield	83-0056-00	Nutrient/eutrophication biological indicators
AUID = Assessment Unit Identifier Source: MPCA, 2020. MPCA creates a list of impaired waters that do not meet water quality standards every two years.			

There are no DNR designated wildlife lakes or Migratory Waterfowl Feeding and Resting Areas in Cottonwood or Watonwan Counties.[328]

Floodplains are areas susceptible to flooding that are adjacent to rivers, streams, and lakes. In flat areas, the floodplain can extend more than a mile from the flooding source. Floodplains can also be the normally dry areas adjacent to wetlands, small ponds, or other low areas that cannot drain as quickly as the rain falls. Siting permanent facilities within a floodplain can impact its flood storage capacity.

Federal Emergency Management Agency (FEMA) designated floodplains maps for Cottonwood and Watonwan Counties indicate that there are approximately 1,651 acres of 100-year floodplains within the wind portion of the Project Area that are associated with the Watonwan River, an unnamed tributary to the Watonwan River, and Butterfield Creek, see Table 4-19.[329]

Table 4-19. Wind Project Area FEMA Floodplains

County	Associated Streams	Acres
Cottonwood	Watonwan River and Unnamed Tributary to the Watonwan River	1,578.1
Watonwan	Butterfield Creek	73.3
Total		1,651.4

The Red Rock Solar portion of the hybrid project is not located within any designated flood hazard areas.[330]

[328] Amended Wind SPA – Section 8.17.1.4
[329] Amended Wind SPA – Section 8.17.1.5
[330] Solar SPA – Section 4.5.4

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

The Big Bend Wind portion of the proposed hybrid project will not directly impact any identified PWI watercourses, PWI waterbodies, impaired waters, designated wildlife lakes, Migratory Waterfowl Feeding and Resting Areas, designated trout streams, or Outstanding Resource Value Waters.

None of the proposed turbines, substation or access roads are located within a FEMA designated 100-year floodplain.[331] The Big Bend Wind Project is not anticipated to have any impacts on designated floodplains.

The Red Rock Solar portion of the proposed hybrid project will not directly impact any identified PWI watercourses, PWI waterbodies, impaired waters, designated wildlife lakes, Migratory Waterfowl Feeding and Resting Areas, designated trout streams, or Outstanding Resource Value Waters. Based on an aerial review by EERA staff, the watercourses within the Red Rock Solar project area appear to be surficial drainage courses. Impacts to these areas are anticipated to be minimal, and negligible with appropriate mitigation.

The Red Rock Solar Project will not impact any designated floodplains.

335 MW Solar Facility (No wind component)

Similar to the proposed hybrid wind and solar project, potential impacts to surface waters and their associated floodplains from a solar facility could occur during the construction phase; there is the possibility of sediment reaching nearby surface waters as the ground is disturbed by excavation, grading and construction traffic. The potential for impacts to surface waters is affected by the solar facility's design and proximity to surface water features.

Maintenance and operation activities for the PV facilities are not expected to have an adverse impact on surface water quality.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

[331] Amended Wind SPA – Section 8.17.2

Similar to the proposed hybrid wind and solar project, potential impacts to surface waters and their associated floodplains from a hybrid wind and solar facility located elsewhere in Minnesota could occur during the construction phase; there is the possibility of sediment reaching nearby surface waters and wetlands as the ground is disturbed by excavation, grading and construction traffic. The potential for impacts to surface waters is affected by the hybrid wind and solar facility's design and proximity to surface water features.

Maintenance and operation activities for the hybrid wind and solar facility is not expected to have adverse impacts on surface water quality.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

Similar to the proposed hybrid wind and solar project, potential impacts to surface waters and their associated floodplains from a solar facility with battery storage could occur during the construction phase; there is the possibility of sediment reaching nearby surface waters and wetlands as the ground is disturbed by excavation, grading and construction traffic. The potential for impacts to surface waters is affected by the solar facility's design and proximity to surface water features.

Maintenance and operation activities for the PV facilities are not expected to have an adverse impact on surface water quality.

Mitigation

Protection of surface waters from construction and operation of the Big Bend Wind portion and the Red Rock Solar portion of the proposed hybrid project is implemented through the NPDES permit and the associated SWPPP. The MPCA issues NPDES permits for construction activities when more than an acre of land is disturbed. A SWPPP will be developed for the Big Bend Wind Project and the Red Rock Solar Project prior to construction. BMPs such as silt fencing, management of exposed soils and revegetation plans to prevent erosion will be included in the SWPPPs. In areas where a surface water body is identified as impaired, the SWPPP would provide detailed mitigation to prevent or reduce impacts to impaired water bodies.

In addition to erosion control measures, fueling and lubricating construction equipment away from waterways will ensure that fuel and lubricants do not enter waterways.

Estimating stormwater retained for development of the NPDES/ SDS construction stormwater permit for a PV solar facility can be challenging because the panels are impervious, but the area beneath the panels is often pervious. Since the standard calculation for the water quality volume (1 inch times the impervious surface) required by the NPDES construction stormwater permit doesn't recognize the

vegetated surface left in place under the panels, the calculation may be done using the disconnected impervious credit described in the MPCA's methodology and guidelines.[332] For solar installations, the remaining water quality volume after applying the credit will still need to be treated using more traditional stormwater management practices.

The Red Rock Solar Project is currently designed to construct 10 stormwater basins to help control runoff within the solar facility during rain events.[333]

Site permits issued by the Commission require permits and approvals from the DNR, USFWS and/or Army Corps of Engineers (USACE) for any access roads constructed across streams or drainage ways. If access roads are constructed across streams or drainage ways, roads must be designed to ensure that runoff from the upper portions of the watershed can readily flow to the lower portions of the watershed. If access roads or crane paths cross waterbodies, they will be designed to maintain stream flow by using culverts. A Utility Crossing License would be required for any crossings of PWI by roads, or electric feeder and collector lines; this license would specify methods and mitigation requisites.

Turbine siting and general site design of the Big Bend Wind Project will reduce impacts to surface waters and the associated floodplains. Optimal turbine locations are those which are topographically elevated from their surroundings. Ideally, turbines are located on elevated uplands where they are not expected to affect streams or surface water bodies directly.

The Red Rock Solar Project was sited is a location outside of designated floodplains, and no additional mitigation is necessary to avoid impacts to floodplains.

Wetlands

Wetlands provide a multitude of ecological, economic and social benefits and vary in type and extent. Some wetlands are dry for much of the year while others are almost always covered by several feet of water. [334] Some wetlands are dominated by grasses and forbs, others by shrubs and trees. Wetlands also vary in size and extent, with some extending for miles, with annual and seasonal variation. They provide important habitat for wildlife and plants and ecological services such as recharging groundwater, reducing floods, and filtering pollutants from surface water. They are also a source of

[332] https://stormwater.pca.state.mn.us/index.php?title=File:Solar_panels_1.png.

[333] Solar SPA – Section 4.5.4.1

[334] DNR. *Wetlands*. http://www.dnr.state.mn.us/wetlands/index.html.

food and fiber and support cultural and recreational activities. It is estimated that Minnesota has lost about 50 percent of its original wetland acreage.[335]

The USFWS is the principal US Federal agency tasked with providing information on the status and trends of wetlands. The USFWS National Wetlands Inventory (NWI) is a publicly available resource that provides detailed information on the abundance, characteristics, and distribution of US wetlands. NWI wetlands are based on aerial imagery and are not field verified.

In Minnesota, agencies representing three levels of government (federal, state and local) regulate certain activities that affect wetlands, lakes and watercourses. Any wetland listed in the PWI is protected by the Minnesota Public Waters Work Permit. A public waters work permit must be obtained from the DNR for work affecting the course, current or cross-section of public waters, including public waters wetlands. Most other wetlands not listed in the PWI are regulated under the Minnesota Wetland Conservation Act of 1991 (WCA). The LGU (counties) administer the WCA, with oversight by the Board of Water & Soil Resources (BWSR). Generally, a Replacement Plan is required by the WCA for an impact that wholly or partially drains or fills a wetland. Wetlands are also federally protected under Section 404 of the Clean Water Act. A wetland permit from the USACE is required when discharging dredged or fill material into jurisdictional wetland and/or non-wetland Waters of the United States. A permit and/or preconstruction notification may also be required by the local watershed district depending upon the location, size and type of impact.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

Wetlands can be impacted directly or indirectly from construction activities (i.e., access roads, turbine sites, PV panel installation, substation sites, and collection lines) associated with development of a hybrid wind and solar project. Direct impacts result from disturbances that occur within the wetland. Indirect impacts result from disturbances that occur in areas outside of the wetland, such as uplands or up-stream waterways.

Wetlands are not a common feature in the hybrid project area. There are scattered wetlands and wetland complexes associated with watercourses across the wind portion of the hybrid project area. Most are classified as freshwater emergent with some freshwater ponds and lakes, forested wetlands, riverine, and shrub/scrub wetland types.

[335] DNR. *Wetlands*. http://www.dnr.state.mn.us/wetlands/index.html.

The wind portion of the Project Area has a total of 1,137.5 acres of wetlands present within it, as identified by the National Wetland Inventory (NWI), which is less than one percent of the total Project Area in the wind portion of the project.[336] Approximately 48 percent (543.9 acres) of the NWI wetland acreage is mapped as palustrine emergent wetlands (PEM).[337] Figure 4-13 illustrate the NWI wetlands in the Project Area. Table 4-20 list the NWI wetland types, and the acreages of each type, found in the Project Area.

There is one wetland (0.33 acres in size) identified on the NWI within the solar portion of the hybrid project area, and it is identified as a freshwater emergent wetland that is seasonally flooded/saturated emergent wetland. Grading of the Red Rock Solar project area could directly impact the 0.33 acre wetland.

[336] Amended Wind SPA – Section 8.18.1

[337] Amended Wind SPA – Section 8.18.1

Figure 4-13. Hybrid Project Area NWI

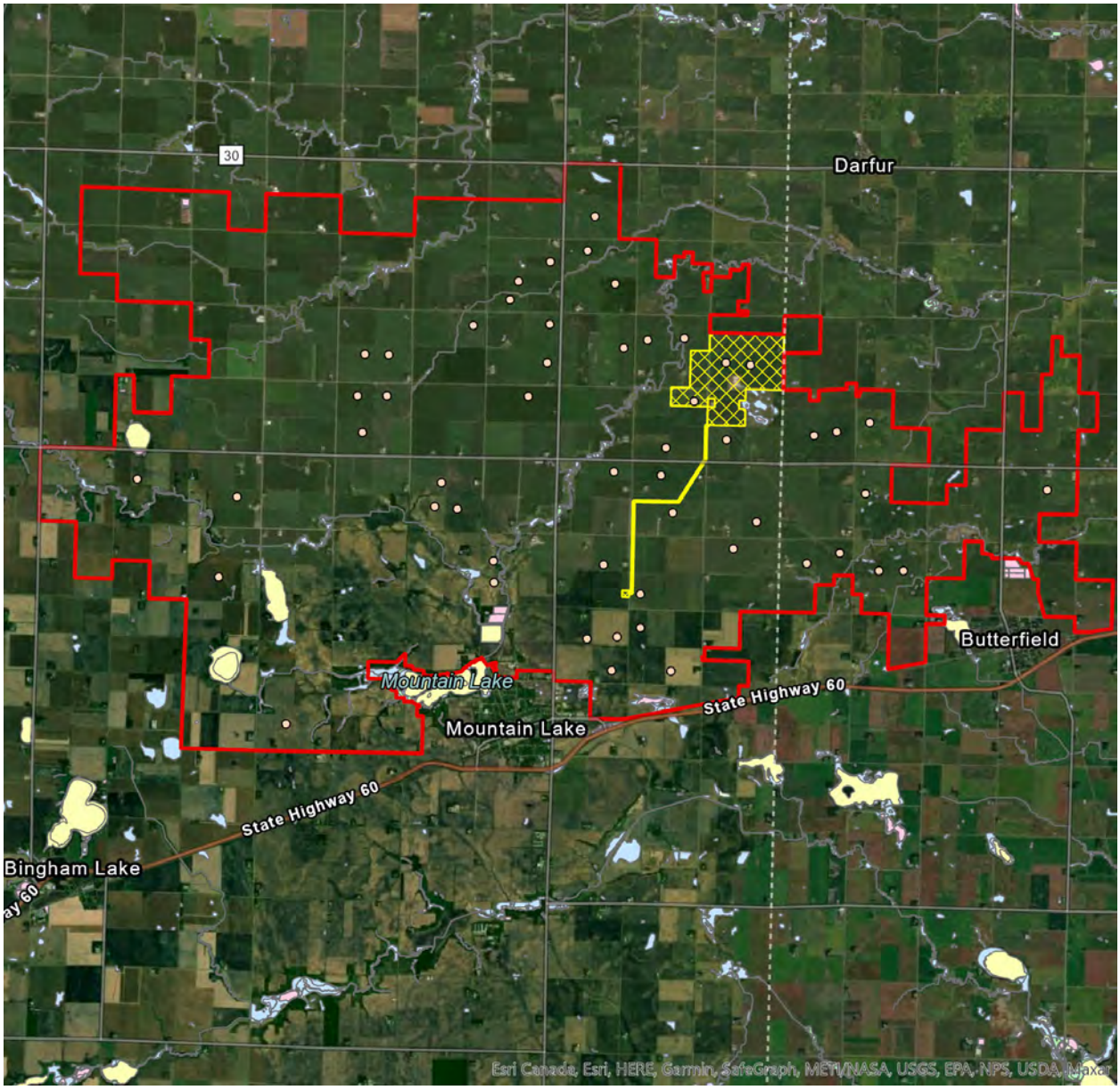


Table 4-20. NWI Wetland Types within the Wind Portion of the Hybrid Project Area[338]

NWI Type	Acres
Freshwater Emergent Wetland (PEM)	543.9
Freshwater Pond/Lakes (Open Waters)	370.2
Palustrine Forested Wetland (PFO)	113.6
Riverine Waters	104.8
Freshwater Forested/Shrub Wetland (PFO/PSS)	5.0
Total	1137.5

All three of the wind turbine models under consideration essentially utilize the same turbine layout, and the plans for construction are the same as well. Table 4-21 identifies the potential permanent and temporary wetland impacts, based on NWI maps, associated with the wind portion of the Proposed Project.

Table 4-21. Summary of NWI Wetland Impacts (acres)[339]

NWI Wetland Type	Wind Portion of the Project	
	Permanent	Temporary
Palustrine Emergent Wetland (PEM)	-	2.9
Palustrine Forested Wetland (PFO)	-	0.7
Riverine	-	0.7
Freshwater Pond/Lake	-	0.0
Palustrine Scrub-shrub Wetland (PSS)	-	0.0
Total	**0.0**	**4.3**

Turbine layouts under consideration are expected to have minimal impacts to wetlands based on completed field surveys of proposed turbine locations, access roads, and the O&M site, and desktop review of NWI data of collection lines and crane path areas associated with the wind farm.[340]

335 MW Solar Facility (No wind component)

Construction and maintenance of a solar facility has the potential to result in long-term and temporary loss of wetlands or wetland function. The preferred method for minimizing impacts to wetlands is to

[338] Amended Wind SPA – Section 8.18.2

[339] Amended Wind SPA – Section 8.18.2 and Table 8.18-2

[340] Amended Wind SPA – Section 8.18.2 and Table 8.18-2

avoid disturbance of the wetland through project siting and design. Similar to wind farms, potential impacts to wetlands from a solar farm can occur during the construction phase; there is the possibility of sediment reaching nearby wetlands as the ground is disturbed by excavation, grading and construction traffic, potential introduction of invasive species, and changes in wetland type and function.

Post-construction impacts from the development of a solar farm may continue to affect the wetland ecosystem. The solar panel itself will decrease the amount of light reaching the soil surface, which may change the plant community, decrease plant productivity and reduce carbon sequestration. As part of maintaining any solar site, vegetation is controlled through mechanical and chemical techniques, which may cause disturbance, damage vegetative populations, and create the potential for contamination due to pesticides.

While the surface area or footprint (PV panels vs turbine tower) of a solar farm is larger than that associated with a wind farm, the mitigation strategies (avoidance through siting and minimization through BMPs) would be similar to those of the hybrid Big Bend Wind and Red Rock Solar Project, however the extent and degree of these strategies would be dependent on site specific features of the generic project.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

The primary source of impacts to wetlands from a 335 MW hybrid wind and solar facility, sited elsewhere in Minnesota, would be similar to those for the hybrid Big Bend Wind and Red Rock Solar Project (erosion and runoff, dewatering discharges, direct impacts such as compaction from crossing wetlands during construction). Generally, mitigation strategies would be similar to those of the proposed project, however, the extent and degree of these strategies would be dependent on-site specific features of the generic project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

The primary source of impacts to wetlands from a 335 solar facility with battery storage, sited elsewhere in Minnesota, would be similar to those for the 335 MW solar facility alternative (erosion and runoff, dewatering discharges, vegetative shading, vegetative cutting, and hydrologic redirection). Generally, mitigation strategies would be similar to those of the proposed project, however, the extent and degree of these strategies would be dependent on-site specific features of the generic 335 MW solar facility and battery storage project.

Mitigation

Turbines and meteorological towers for the wind farm will be sited and built-in uplands, higher elevation areas to maximize the wind resources and, in doing so, will avoid direct impacts to wetlands and surface waters. Access roads and operation facilities will be designed and sited to reduce direct impacts on wetlands to the greatest extent feasible. Temporary impacts associated with electric feeder and collector lines, and crane paths will also be minimized by siting to avoid wetland features.

Access roads and project infrastructure will be designed and sited to avoid or minimize permanent impacts to wetlands to the greatest extent feasible. Field work to delineate wetlands is ongoing so that wetland areas can be avoided. In the event that permanent wetland impacts cannot be avoided during the siting of project infrastructure, Big Bend/Red Rock will coordinate with the appropriate agencies including USACE, WCA, BWSR, and the counties Cottonwood and Watonwan.[341]

Red Rock will conduct a wetland investigation in the field, and all wetland areas identified will be delineated. If wetland impacts will occur due to the solar project, a wetland permit may be required, which will identify necessary measures to minimize impacts or provide replacement for impacted wetlands.

4.2.5.9 *Wildlife*

Wildlife can potentially be impacted by large energy projects. Wildlife such as birds, mammals, fish, reptiles, amphibians and insects, can be permanent or migratory. Many species utilize the available habitat in and adjacent to projects for forage, breeding and shelter.

Historically, the proposed hybrid Big Bend Wind and Red Rock Solar Project Area, and surrounding region contained a variety of natural communities and habitat that supported diverse species of wildlife. As the historic vegetation has been converted to agricultural use, the wildlife species that occupy the landscape reflect the changes in habitat type and availability. The most common species within the site tend to be generalists and are able to utilize rural, urban or agricultural habitats. Based on the wildlife in the region and their habitat preferences, a variety of common and widespread species have the potential to occur within the site at some time during the year.

Local and migratory species use the grasslands, farm woodlots, wetlands and other areas for food and cover. Mammals common to this landscape include opossum, skunk, squirrels, rodents, rabbits, deer, fox, coyotes, and raccoons. Reptiles and amphibians that may be present within the Project Area are

[341] Amended Wind SPA – Section 8.18.2

those typically found within agricultural lands and grasslands. Reptiles and amphibians may include the Great Plains toad, northern leopard frog, and plains garter snake. Several species of birds and bats are also known to occur in this landscape, including grassland birds, migratory birds, raptors and waterfowl.[342] The majority of migratory wildlife species that utilize the habitat within the hybrid project area for stopover, resting, and feeding are birds, including waterfowl, raptors and songbirds and migratory bat species.

Based on results from Big Bend's Tier I and Tier II (USFWS WEG) studies, limited types of wildlife habitats were identified within and adjacent to the wind portion of the Project Area including; native prairie, the Mountain Lake Wildlife Management Areas (WMA), Native Plant Communities (NPCs), conservation easements, and Sites of Biological Significance (SOBS) ranked as moderate (**Figure 13**).[343]

The Red Rock Solar portion of the hybrid project area is highly fragmented, and 99.6 percent of the land is utilized for agricultural production. Only small areas of forested land and lawn area exist around residences and commercial livestock facilities within the solar portion of the project area.[344]

Wildlife that resides within the construction zone would likely be temporarily displaced to adjacent habitats during the construction process. The wildlife species found near these agricultural lands do not generally require specialized habitats and are able to find suitable habitat nearby and would only be displaced a short distance for a limited time (during construction activity).

The majority of the potential impacts to wildlife that utilize the agricultural lands within the project area are due to the relatively large footprint of a solar farm and the corresponding changes to the habitat (i.e., loss and fragmentation). Once restoration of the facilities is established after construction, the existing agricultural landscape that is used by habitat generalists will be replaced by a modified habitat that may be attractive to some species and less attractive to species that use open farmland and pasturelands.

The Red Rock Solar Project will be enclosed by a fence, limiting movement of animals in and out of the facility, as well as potentially disrupting wildlife movement corridors. Solar facilities permitted by the Commission typically have fences designed to allow small animals to enter the property. Although a variety of birds, small mammals, reptiles and amphibians are likely to still be able to gain access to the property to use the habitats under and around the solar arrays, access will be limited for larger

[342] Amended Wind SPA – Section 8.20.1.1
[343] Amended Wind SPA – Section 8.20.1.1
[344] Solar SPA – Section 4.5.7

wildlife. With a change in habitat type and access to the facility; hiding spots, preying strategy, and food availability will all be affected.

Migratory Waterfowl Feeding and Resting Areas (MWFRAs) were authorized by the Minnesota legislature in 1969 to protect migratory waterfowl from disturbance. During the waterfowl season, electric motors are either prohibited or limited in size, depending on the MWFRA. In 2011, 30 MWFRAs were designated across the state. MWFRA are typically nominated by local conservation groups for the MNDNR to consider and approve or deny.[345]

The MNDNR commissioner may formally designate lakes for wildlife management under the authority of Minn. Stat. § 97A.101, subd. 2. This designation allows the MNDNR to temporarily lower lake levels periodically to improve wildlife habitat and regulate motorized watercraft and recreational vehicles on the lake.[346]

Important Bird Areas (IBAs) are created under voluntary, non-regulatory, international conservation effort that identifies critically essential habitats for birds, designates these habitats as IBAs, monitors the IBAs for changes in avian distribution and abundance, and conserves IBAs to protect birds in the long- term. In Minnesota, the IBA program is led by the MNDNR's Nongame Wildlife Program and Audubon Minnesota.[347]

The Reinvest in Minnesota Reserve program (RIM Reserve) is administered by BWSR and establishes conservation easements on private lands utilizing state funds. RIM Reserve easements are intended to provide wildlife habitat, soil conservation, and water quality benefits by establishing permanent habitat and removing marginal crop lands from agricultural production. There is one RIM Reserve easements along any of the routing options.

Table 46 Stressors Affecting SGCN Populations (statewide)

Stressors	% predominant factor*
Habitat Stressors	**70%**
Habitat degradation	38%
Habitat is rare, vulnerable, or declining	35%
Habitat loss	31%
Habitat fragmentation	23%

[345] Amended Wind SPA – Section 8.17.1.4

[346] Amended Wind SPA – Section 8.17.1.3

[347] Amended Wind SPA – Section 8.20.3.1

Depends on natural processes that are no longer within natural range of variation	10%
Contaminants	9%
Requires large home range or multiple habitats as part of their life cycle	4%
Depends on large habitat patch	4%
Other Stressors: Specific Threats	**13%**
Invasive animal species	9%
Disease	3%
Overexploitation, collecting, bounty killing	2%
Deliberate killing	1%

* The inverse of the percentages for each problem does not necessarily represent the percentage of SGCN for which the factor is not a problem, but instead might indicate that there is not sufficient information available to determine the level of influence the problem has on SGCN.

Source: DNR Minnesota's Wildlife Action Plan 2015-2025

Habitats in the local vicinity consist of open land, wood land, and wetland habitats. Open land habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Woodland habitat consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wetland habitats consists of herbaceous and forested areas.[xxxi]

Habitat fragmentation is "usually defined as a landscape-scale process involving both habitat loss and the breaking apart of habitat."[xxxii] This definition, however, does not isolate the impact of fragmentation independent of habitat loss. The potential impact from habitat fragmentation—when controlled for habitat loss—is "generally much weaker than the effects of habitat loss," and is "at least as likely to be positive as negative."[xxxiii] Negative impacts associated with habitat fragmentation include 1) an increased number of smaller habitat patches interspersed among larger areas of non-suitable habitat, and 2) increased "edge for a given amount of habitat."[xxxiv]

"An 'edge' is the boundary, or interface, between two biological communities or between different landscape elements."[xxxv] Edge effects may alter habitats that are important to interior forest dwellers through microclimate changes to these areas. Additionally, increased predation, competition, and parasitism from plants and animals intruding on interior forest environments can become more prevalent, as well as interior forest species increasingly moving through and along edges, that is, habitat transition areas.[xxxvi,xxxvii] In locations where the proposed transmission line will parallel existing ROW, edge effects will be limited to one side of the ROW. As a result, edge effects are expected to intensify in locations where new ROW will be created and lessen where existing ROW is expanded, but this is also expected to be relative to the level of expansion.

Based on the results of the Tier 1 and Tier 2 studies, Big Bend and Red Rock, contracted with WEST to conduct USFWS Tier 3 field studies to obtain additional data on birds and bats. These activities serve to inform Big Bend and Red Rock of the types and extent of wildlife present within and adjacent to the Project Area, wildlife useage, risk evaluation, inform infrastructure siting, and possible operational concerns.[348]

The studies and surveys conducted in the Project Area include the following:

- Avian Use (Year 1) – November 2017 to October 2018
- Avian Wetland Use – March 15 to June 15, 2018
- Raptor Nest – April 2018
- Eagle Nest Monitoring – May 2018 to July 2018
- General Acoustic Bat – May 2018 to August 2018
- Avian Use (Year 2) – November 2018 to February 2020
- Aerial Eagle Nest – May 2019
- Northern Long-eared Bat Habitat Assessment – May 2019 to May 2020
- Raptor Nest Survey – March 2020
- Eagle Nest Monitoring – March 2020 to August 2020
- Avian Wetland Use (Watonwan County) – March 2020 to June 2020
- Native Prairie Habitat Assessment – June 2020
- Avian Use (Watonwan County – March 2020 to February 2021

Birds

The potential for habitat fragmentation impacts as a result of the proposed hybrid wind and solar project is low because the Project Area is sited in an highly agricultural landscape and much of the remaining habitat is disturbed or associated with rural residences and farm sites. The wind portion of the proposed project is designed to avoid placing turbines and access roads in DNR-mapped native prairie, the Mountain Lake WMA, native plant communities, and sites of biodiversity significance, and the Red Rock Solar portion of the proposed project does not have any notable wildlife habitat within it.

It can be expected that, similar to other LWECS projects in the region, there is a high likelihood that individual bird fatalities will occur at the wind portion of the hybrid Big Bend Wind and Red Rock Solar Project. Small passerine species tend to make up the majority of bird fatalities at wind projects, with noted increases during migration in the spring and fall seasons.[349]

[348] Amended Wind SPA – Section 8.20.1.1

[349] Amended Wind SPA – Section 8.20.1.2

Studies have shown that placement of turbines and auxiliary structures can result in decreased densities of songbirds and other species. Species of grassland birds, such as various grouse species, are particularly susceptible to displacement due to their high site fidelity.[350] The potential for habitat avoidance by wildlife in response to wind turbines and associated infrastructure is highly variable depending on the species, seasonal and annual variation in weather, migration patterns, and individual behavior patterns. Based on these studies of existing wind power projects in the United States and Europe, the impact to wildlife would primarily occur to avian and bat populations.[351]

Studies of bird fatalities near wind facilities indicate that fatalities will occur, and they will vary with bird type (e.g., raptor, waterfowl, passerine), habitat availability, and other resources available within the site. At this time, it is unclear how these fatalities will impact avian populations on a broader scale.

Bald eagle collisions with wind turbines are of additional concern as bald eagles' populations continues to grow and expand throughout Minnesota. Bald eagles are afforded additional protections under the Bald and Golden Eagle Protection Act, which is administered by the USFWS. Wind energy facilities are eligible to apply for Incidental Take Permits and Nest Removal Permits issued by the USFWS, which will allow for the non-intentional take of bald eagles and the removal of bald eagle nests, respectively. Bald eagle incidental take permits and nest removal permits are considered to be voluntary permits, meaning a project proposer must make the determination to pursue a permit based on the respective risk of their project's potential to take a bald eagle.

Eagle Use Surveys were incorporated into three years of Avian Use Surveys at the proposed Project Area, Year 1 survey period was November 2017 to October 2018, Year 2 survey period was November 2018 to February 2020, and Year 3 survey period March 2020 to February 2021. Year 1 survey consisted of 433 of survey hours, 32 bald eagles were identified, and only 13 of those eagles were observed in flight. Year 2 surveys consisted of 554 hours of survey time, 28 bald eagles were observed during surveys, and 27 of those eagles were observed in flight. Seasonal bald eagle use varied slightly between Survey Year 1 and Survey Year 2, with fall having the greatest use in Year 1 and winter having the greatest use in Year 2. Although eagle use was not particularly concentrated in one particular portion of the Project Area, there was slightly higher bald eagle use of rivers and lakes within and adjacent to the Project Area. Years 1 and 2 of survey data shows the proposed Project Area had 0.11

[350] National Wind Coordinating Committee. *Wind Turbine Interactions with Birds, Bats, and their Habitats*, (2010) https://www1.eere.energy.gov/wind/pdfs/birds_and_bats_fact_sheet.pdf.
[351] National Wind Coordinating Committee. *Wind Turbine Interactions with Birds, Bats, and their Habitats*, (2010) https://www1.eere.energy.gov/wind/pdfs/birds_and_bats_fact_sheet.pdf.

eagle risk minutes/survey hour, which is at the lower end of the range when comparing it to other permitted wind projects in Minnesota.[352]

Raptor nest surveys were conducted within the Project Area and within a 10 mile buffer around the Big Bend Wind portion of the hybrid project area in 2018 and 2020, and an eagle nest survey looking at the wind portion of the hybrid project area, within a two mile buffer area around the wind portion of the project area, and to check previously identified nests within 5.6 miles of the Project Area (half mean inter-nest distance) in 2019.

In 2018 no bald eagle nests were identified within the hybrid project area, 16 eagles nests were identified within 10 miles of the hybrid project area, and three additional stick nests were identified within the 10 mile buffer area; one occupied great horned owl nest and two inactive unidentified raptor nests.

The 2019 nest survey did not identify any eagle nests within the hybrid project area, one previously identified eagle nest was located 2.2 miles from the nearest proposed turbine location, three previously identified eagle nest locations were confirmed again within the 5.6 mile buffer area, and one new eagle nest was identified within the 5.6 mile buffer area.

The 2020 raptor nest survey identified 14 raptor nests, of which 11 were determined to be occupied bald eagle nests. One occupied eagle nest was identified within the expanded Project Area, one nest was 1.1 miles of the hybrid project area, and the remaining nine eagle nests were located more than two miles from the hybrid project areea. The remaining three identified nests were considered to be inactive in 2020.

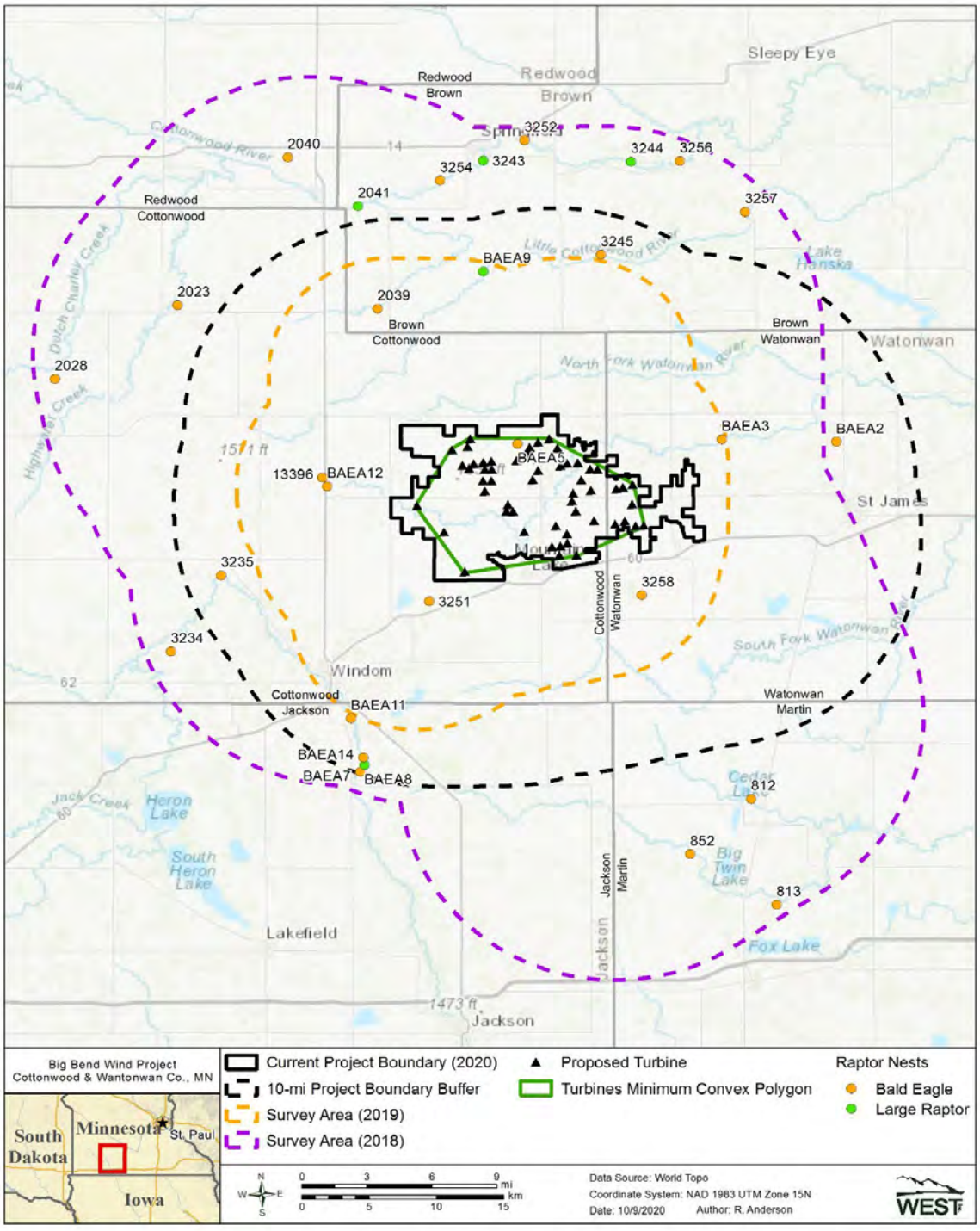
Surveys to monitor activity at two specific eagles nest were conducted in 2018 and 2019. Both of these monitored eagle nests are outside of the currently proposed hybrid project area, as the project boundary has changed throughout the development and project siting process. One of the monitored nests is located 3.4 miles from the nearest proposed turbine location, and the other nest is located 2.2 miles from the nearest proposed turbine location. There is one eagle nest within the proposed hybrid project area, identified in 2020, which is 0.6 miles from the nearest proposed turbine location. The 2020 survey work specific to this nest location determined that the nest was active and successful, documented flight paths from eagles using the nest were low in the areas where turbines are proposed to the south and east of the nest, and documented flight paths were low to medium around the proposed turbine locations to the south-east of the nest.[353]

[352] Amended Wind SPA – Appendix L – Eagle Management Plan
[353] Amended Wind SPA – Appendix L – Eagle Management Plan

No golden eagles have been recorded at the project site, but there is the potential that golden eagles may occasionally occur within the hybrid project area. The proposed Big Bend Wind Project is expected to pose a low risk to golden eagles.[354]

[354] Amended Wind SPA – Section 8.20.3.1

Figure 4-14. Locations of Raptor Nests and Nest Survey Areas Map[355]



Bats

Bat fatality studies indicate a broad range of fatalities across the United States as a result of wind development. Fatality rates are highest for migrating-tree roosting bat species, with the majority of fatalities occurring during the late summer and early fall migration (roughly July-October). Documented bat fatalities are highest in the eastern United States, while those in the Midwest represent a wide range of fatality rates. Post-construction fatality studies completed in Iowa, Minnesota and Wisconsin show bat fatality estimates ranging from 1 to 24 bats/MW/year.[356]

Bat species present in Minnesota include the hoary bat, eastern red bat, big brown bat, silver-haired bat, tri-colored bat, little brown bat, northern long-eared bat, and evening bat. The northern long-eared bat is federally listed threatened and state listed as special concern. The big brown bat, little brown bat, and tri-colored bat are also listed as state special concern. Project-specific acoustic surveys (2018) for northern long-eared bats appear to confirm the absence of the species.[357]

It is presumed that projects in areas with similar habitat and cover types would have similar fatality rates, depending on migration patterns, known roosting and foraging areas, and hibernacula. However, bat migration routes and behavioral patterns are poorly understood and there is a lack of comparative studies of bat fatalities from wind facilities, making it difficult to determine fatality rates at regional levels much less at broader scales.

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

The Big Bend Wind and Red Rock Solar hybrid project has the potential to cause displacement of some wildlife species from the site due to increased human activity, presence of tall structures, gravel pads and access roads, and PV panel installation, though clearing of habitat will be minimal. Many of the observed bird species within the site were prevalent and abundant, and most of these species are common, disturbance-tolerant.

There are no DNR WMAs, SNAs, or Migratory Waterfowl Feeding and Resting Areas or National Audubon Society Important Bird Areas within the Big Bend Wind or Red Rock Solar project areas. The Mountain Lake WMA is located adjacent to the southern border of the wind project area. Additionally,

[355] Amended Wind SPA – Appendix L – Eagle Management Plan, Figure 9

[356] National Wind Coordinating Committee. *Wind Turbine Interactions with Birds, Bats, and their Habitats*, (2010) https://www1.eere.energy.gov/wind/pdfs/birds_and_bats_fact_sheet.pdf.

[357] Amended Wind SPA – Section 8.21.1.2

there are no WPAs or National Wildlife Refuge lands within the Big Bend Wind or Red Rock Solar Project Areas.

Studies looking at avian fatalities caused by wind turbines at facilities in similar habitat settings and in relatively close proximity to the proposed hybrid wind and solar project have fatality estimate ranges between 0.44 and 8.73 bird fatalities/MW/year.[358]

A National Fish and Wildlife Forensics Laboratory report[359] has identified some avian risks associated with PV facilities. Some birds in the study suffered impact trauma, and related predation. Preliminary findings, based on limited data, suspect the danger is the possible appearance of the facility as a large body of water. Migrating birds may attempt to land, consequently incurring the trauma.

Adverse impacts to any small or large bird species at the population level due to the proposed Big Bend Wind and Red Rock Solar Hybrid Project is unlikely.[360]

Table 4-22. Avian Fatality Estimates at nearby Wind Facilities[361]

Project Name	Estimated Bird Fatalities/MW/Year
Odell (2016-2017)	4.69
Red Pine (2018) – Full Plot Searches	4.47
Red Pine (2018) – Road and Pad Searches	2.68
Lakefield (2012)	2.75
Lakefield (2014)	1.07
Elm Creek I (2009-2010)	2.32
Elm Creek II (2011-2012)	8.73
Prairie Rose (2014)	0.44

Estimated bat fatality rates at the Big Bend Wind portion of the proposed hybrid project would be expected to be within the range reported from studies at other wind facilities in the region, see **Table 4-23**.

[358] Amended Wind SPA – Section 8.20.1.2

[359] Kagan et al. 2014. *Avian Mortality at Solar Energy Facilities in Southern California: A Preliminary Analysis*. USFWS Forensics Lab., https://www.ourenergypolicy.org/wp-content/uploads/2014/04/avian-mortality.pdf

[360] Amended Wind SPA – Section 8.20.1.2

[361] Amended Wind SPA – Section 8.20.1.2 and Table 8.20-2

Table 4-23. Bat Fatality Estimates at nearby Wind Facilities[362]

Project Name	Estimated Bat Fatalities/ Megawatt/Year
Odell (2016-2017)	6.74
Red Pine (2018) – Full Plot Searches	11.35
Red Pine (2018) – Road and Pad Searches	18.74
Lakefield (2012)	19.97
Lakefield (2014)	20.19
Elm Creek I (2009-2010)	1.49
Elm Creek II (2011-2012)	2.81
Prairie Rose (2014)	0.41

Wildlife impacts caused by construction of the Big Bend Wind Project and the Red Rock Solar Project are anticipated to be short-term and minimal. Construction of the Big Bend Wind Portion and the Red Rock Solar portion of the Project will have some short-term, minimal, and unavoidable impacts such as, vehicle and equipment noise emissions, increased daily traffic, air quality impacts, fugitive dust generation, potential soil erosion, wildlife disturbance and displacement.[363]

The operational phase of the Big Bend Wind Project could have long-term moderate to significant impacts on wildlife, birds and bats specifically.

Red Rock Solar will have long-term, moderate, positive impacts on small mammals, grassland birds, small to medium size raptors, and insects from the additional habitat provided under and around the solar arrays. Large wildlife species may experience some short-term, minimal impacts from disruption of typical travel corridors due to the fencing installed around the Red Rock Solar Project. Because the large wildlife species that utilize the site are generalist, it is anticipated they will adapt quickly and utilize alternate habitats and travel corridors.

335 MW Solar Facility (No wind component)

As with all renewable energy generation facilities, impacts to wildlife from solar facility development depends upon specific site characteristics, and it is difficult to assess wildlife impacts for a solar facility without detailed knowledge of the proposed site's environmental setting.

[362] Amended Wind SPA – Section 8.20.1.2 and Table 8.20-2

[363] Solar SPA – Section 4.6

The 335 MW solar facility system alternative would likely be sited on agricultural land and similar types of wildlife common to disturbed areas, such as the proposed hybrid Big Bend Wind and Red Rock Solar Project, would be expected. It is assumed that these species' use of agricultural lands is largely limited to occasional foraging in the fields and shelter within wooded areas that may surround the fields.

A 335 MW solar facility would have fewer direct fatality impacts on avian and bat species than a wind facility due to its low profile and near-static nature of the component parts.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

Because impacts to wildlife would depend upon specific site characteristics, it is difficult to assess wildlife impacts for a 335 MW hybrid wind and solar facility alternative, located elsewhere in Minnesota. As discussed above, impacts to birds and bats are the primary concern with the wind portion of the hybrid project alternative. Impacts of the solar portion of the hybrid wind and solar facility, located elsewhere in the State, will be similar to the anticipated impacts to wildlife of the proposed Red Rock Solar portion of the Project.

Short-term and long-term impacts to wildlife, from a 335 MW hybrid wind and solar facility alternative, would vary and depend ultimately where the alternative hybrid facility is located within the State. Because the wind resource and solar generation resource in Minnesota are primarily associated with agricultural lands, the 335 MW hybrid wind and solar facility alternative would likely located in a similar landscape as the proposed hybrid Big Bend Wind and Red Rock Solar Project.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

The 335 MW solar facility with battery storage alternative impacts to wildlife will likely be similar to the 335 solar facility system alternative detailed previously in this section. The battery storage portion of this system alternative would potentially remove additional wildlife habitat from the landscape, depending on where the facility was sited.

Mitigation

Big Bend states that it has designed its turbine layout to minimize avian impacts by siting turbines in cultivated crop lands and avoiding high use wildlife habitat (woodlands adjacent to farmsteads), using tubular towers to minimize perching, placing electrical collection lines underground as practicable, and minimizing infrastructure, and maintain a minimum three by five rotor diameter turbine setbacks from the Mountain Lake WMA within the Project Area and WMAs adjacent to the wind project boundary.

Additionally, turbines have been sited outside northern-long-eared-bat connected-habitat buffer (1,000 feet from forested areas).

The proposed Big Bend Wind Project and Red Rock Solar Project will avoid or minimize disturbance to individual wetlands, protect existing trees and shrubs, and maintain sound water and soil and water conservation practices during project construction. Non-cropland and pasture areas disturbed during construction or operation will be revegetated with an appropriate native seed mix, and noxious weeds will be inspected for and controlled in areas disturbed during construction and operation.

Big Bend Wind has developed a Bird and Bat Conservation Strategy (BBCS) and an Eagle Management Plan (EMP) to implement during Project construction and operation. The BBCS identifies the implementation of construction practices, design standards, operational practices, permit compliance, staff training, and potential avoidance and minimization measures that can be implemented to lower bird and bat fatalities. The EMP specifically addresses potential impacts to bald eagles during project construction and operation, and possible avoidance and minimization measures to address these impacts. Big Bend has committed to conducting two years of post-construction monitoring to assess the Project's operational impacts to birds and bats.[364]

Wind turbines require a minimum wind speed (cut-in speed) for operation. Impacts to birds and bats could be mitigated by "feathering" or locking the turbine blades up to the manufacture's designated cut-in speed, or by increasing the cut-in speed during periods of high activity.[365] Curtailment of turbines has been found to effectively reduce bat fatalities by a minimum of 50 percent by raising operational cut-in speeds.[366] Recent Commission issued site permits for wind facilities have include curtailment provisions. Feathering turbines, up to the manufacturer's standard cut-in speed, from one-half hour before sunset to one-half hour after sunrise, from April 1 to October 31, of each year of operation through the life of the Big Bend Wind portion of the proposed hybrid project will reduce turbine impacts on bats during low wind speed conditions.

The Red Rock Solar Project has been sited in a location that will avoid or minimize impacts to wildlife habitat. The Red Rock Solar portion of the hybrid project area does not contain any large block habitats, lakes, streams, rivers, wetlands, public conservation and recreation lands, state or federal wildlife lands, or lands under conservation easements.[367] Field surveys to identify any known wildlife

[364] Amended Wind SPA – Section 8.20.1.3
[365] Arnett et al. *Effectiveness of Changing Wind Turbine Cut-In Speeds to Reduce Bat Fatalities at Wind Facilities*. (2009), http://www.batsandwind.org/pdf/Curtailment_2008_Final_Report.pdf.
[366] Arnett et al. *Effectiveness of Changing Wind Turbine Cut-In Speeds to Reduce Bat Fatalities at Wind Facilities*. (2009), http://www.batsandwind.org/pdf/Curtailment_2008_Final_Report.pdf.
[367] Solar SPA – Section 4.5.8.4

movement corridors within, or through, the Red Rock Solar portion of the hybrid project should be considered.

Planting wildflower meadows and restoring natural grasslands in the "unused" margins between solar panel rows to attract insects, bees, and butterflies to the sites may provide food and nesting spots for birds. Avoiding the use of photodegradable erosion-control materials where possible and using biodegradable materials (typically made from natural fibers) instead, preferably those that will biodegrade under a variety of conditions, can minimize the impact to wildlife. Checking open trenches and removing trapped turtles before filling trenches can minimize impacts to turtles.

Red Rock will utilize a seven-foot-high woven wire fence topped with a one foot section including three or four smooth wire, as opposed to barbed wire fence, as recommended by MNDNR. Construction of the Red Rock Solar portion of the Project will have some short-term, minimal, and unavoidable impacts such as, vehicle and equipment noise emissions, increased daily traffic, air quality impacts, fugitive dust generation, potential soil erosion, wildlife disturbance and displacement.[368] Red Rock will utilize BMPs to further minimize these impacts during construction to the greatest extent practicable.

These conservation lands are non-participating landowners and are treated as such with respect to setbacks from turbines and associated facilities. At a minimum, wind turbines will be placed at least five rotor diameters or three rotor diameters, depending on wind direction and property location, from identified management areas within and adjacent to the Big Bend Wind portion of the Project Area.[369]

4.2.6 Associated Electrical Facilities and Existing Infrastructure

Electric generation facilities (fossil fuel power plants, wind facilities, and solar facilities) typically require construction of electrical facilities beyond the project boundaries, such as transmission lines and substations to deliver the generated power to the overall grid.

Impacts associated with construction of new transmission lines and substations can include impacts to plants and animals due to the loss of vegetation, habitat fragmentation, potential migratory bird collisions with the transmission line, visual impacts due to placement of poles or structures, and concerns over additional impacts to farmland.

[368] Solar SPA – Section 4.6

[369] Amended Wind SPA – Section 8.20.1.1

Potential Impacts

Hybrid Big Bend Wind and Red Rock Solar Project

Impacts from the 161 kV transmission project associated with the Big Bend Wind and Red Rock Solar hybrid project are discussed in Chapter 6 of this EA.

335 MW Solar Facility (No wind component)

As with the proposed hybrid project, a 335 MW solar facility alternative would also require the installation of similar infrastructure (substations, switching stations, and transmission lines) beyond the necessary on-site facilities such as PV arrays, electrical cables and conduit, electrical cabinets, step-up transformers, SCADA systems and metering equipment, and access roads, in order to deliver the generated power to the overall grid. Impacts associated with construction of new transmission lines and substations can include impacts to plants and animals due to the loss of vegetation, habitat fragmentation, potential migratory bird collisions with the transmission line, visual impacts due to placement of poles or structures, and concerns over EMF exposure.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

A 335 MW hybrid wind and solar facility alternative, located elsewhere in the State, may require construction of transmission facilities to an interconnection point or may require new transmission infrastructure at existing facilities. These additional infrastructure components would have the same potential impacts as identified for the 335 solar facility alternative.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

As with the proposed hybrid project and the 335 MW solar facility alternative, the 335 MW solar facility with battery storage alternative, would also require the installation of similar infrastructure (substations, switching stations, and transmission lines) beyond the necessary on-site facilities such as PV arrays, electrical cables and conduit, electrical cabinets, step-up transformers, SCADA systems and metering equipment, and access roads, in order to deliver the generated power to the overall grid. Impacts associated with construction of new transmission lines and substations can include impacts to plants and animals due to the loss of vegetation, habitat fragmentation, potential migratory bird collisions with the transmission line, visual impacts due to placement of poles or structures, and concerns over EMF exposure.

Mitigation

The primary measures to reduce the potential impacts from the construction and operation of these associated facilities is avoidance. This is accomplished largely through siting and routing, to the extent practicable, followed by the implementation of BMPs to minimize potential impacts and finally, the mitigation (e.g. restoration, direct compensation, wetland banking) of those impacts which are unavoidable.

Potential impacts and mitigation strategies would be similar to those for any energy project. The extent of impacts would be determined by the length and voltage of the transmission line required to connect the electric generating facility to the transmission grid. A relatively longer line or higher voltage would increase the potential construction and operation impacts.
Additional mitigation measure details for the 161 kV transmission project associated with the Big Bend Wind and Red Rock Solar hybrid project are discussed in Chapter 6 of this EA.

4.2.7 Fuel Availability

Large electric power generating facilities require some type of fuel. Depending upon the amount and type of fuel required and the location of the fuel relative to the proposed project, the project can create impacts related to harvesting and delivery of the fuel. This EA examines the sources of fuel as required by Minnesota Rule 7849.1500, subpart 2.

Hybrid Big Bend Wind and Red Rock Solar Project

Wind farms rely on wind, a renewable energy source as the fuel source, to generate electricity. Wind turbine blades extract kinetic energy as the wind passes through the blades and creates turbulence downstream. To operate effectively, turbines must be setback from other turbines to compensate for this turbulence known as wake loss.[370]

Wind capacity varies across Minnesota. Extensive wind measurements have been taken and analyzed by the Minnesota Department of Commerce (Figure 3-4). Local data collection suggests the mean annual wind speeds at the turbine locations is approximately 8.64 to 8.67 m/s.[371] Power generation by the Big Bend portion of the hybrid project depends not only on wind speed (how much energy it contains), but also the frequency of attaining optimal wind speeds. Wind turbines generate power only when the wind is blowing, and the developer anticipates a net capacity factor of approximately 41.5 percent to 43.5 percent annually. Additionally, the projected average annual output of between

[370] https://www.awea.org/wind-101/basics-of-wind-energy.
[371] Amended Wind SPA – 9.1.2

approximately 1129 and 1225 gigawatt hours (GWh) is anticipated for the Big Bend Wind portion of the hybrid project.[372]

The Red Rock Solar portion of the proposed hybrid project will generate electricity using sunlight as its fuel, and no consumption of traditional fuel is necessary for generation.[373] The Red Rock Solar portion of the hybrid project will have a net capacity factor between approximately 24 to 27 percent with a projected average annual output of approximately 115,632 to 135,034 MWhs.[374] Electrical generation from the solar portion of the hybrid project will be enough to support the electricity needs of 12,000 homes annually.[375]

335 MW Solar Facility (No wind component)

PV systems uses both direct and indirect solar energy (direct and scattered sunlight) as its fuel source to generate electrical energy by capitalizing on nature's inherent desire to keep electrical charges in balance. At the most basic level, electrical current is the flow of electrons through a conductor. When solar radiation strikes a PV cell some of it is absorbed exciting electrons within the cell. Some of these electrons move freely between layers from negative to positive. In the process, electrons from the positive layer are disrupted and "flow" back to the negative layer through the external load creating a continuous flow of electrons, or a continuous flow of electric current. Solar farms of varying sizes are operational and in development throughout many regions of the state.

PV panels generate power only when the sun is shining, and typically have a net capacity factor of approximately 24.0 percent annually.

335 MW Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

To be economically feasible, a 335 MW hybrid wind and solar facility alternative elsewhere in Minnesota would need to be sited in an area with sufficient wind resources (fuel) to meet generation projections. Few areas of the State have wind resources that are equal to the southern portion of the State where the proposed hybrid Big Bend Wind and Red Rock Solar is sited. Although areas with the highest areas of good wind resources are located in southwestern Minnesota (Figure 9), due to transmission constraints in that region, as well as advances in turbine technology, wind projects have become operational, and more have been proposed throughout the state. Productive, undeveloped wind resources (fuel sources) in Minnesota are still available.

[372] Amended Wind SPA – 10.9.2
[373] Solar CNA – Section 5.1.3
[374] Solar CNA – Section 5.1.2
[375] Solar CNA – Section 5.1.1

The solar portion of the hybrid alternative will also need to be sited in an area with a strong solar generation resources (fuel source) to make the alternative site economically feasible, and to keep the net capacity factor within a reasonable range.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

PV systems convert both direct and indirect solar energy (direct and scattered sunlight) as its fuel source to generate electrical energy by capitalizing on nature's inherent desire to keep electrical charges in balance. At the most basic level, electrical current is the flow of electrons through a conductor. When solar radiation strikes a PV cell some of it is absorbed exciting electrons within the cell. Some of these electrons move freely between layers from negative to positive. In the process, electrons from the positive layer are disrupted and "flow" back to the negative layer through the external load creating a continuous flow of electrons, or, a continuous flow of electric current. Solar farms of varying sizes are operational and in development throughout many regions of the state.

PV panels generate power only when the sun is shining, and typically have a net capacity factor of approximately 24.0 percent annually.

The battery storage portion of this alternative does not technically consume any type of fuel, but rather the lithium battery banks will allow for the storage of energy generated at the PV panels. The battery storage units would also interact with the grid's electrical needs.

Mitigation

Renewable energy is energy that is collected from renewable resources (fuel), which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat. Renewable energy plays an important role in reducing greenhouse gas emissions. When renewable energy sources are used, the demand for fossil fuels is reduced. Unlike fossil fuels, non-biomass renewable sources of energy (hydropower, geothermal, wind, and solar) do not directly emit greenhouse gases.

Overall, using wind and solar resources to produce energy has fewer effects on the environment than many other energy sources. Wind turbines and solar panels do not release emissions that can pollute the air or water, and they do not require water for cooling.

Solar energy does not produce air or water pollution or greenhouse gases, although present technology requires large areas of land. Solar energy can have a positive, indirect effect on the environment when using solar energy replaces or reduces the use of other energy sources that have larger effects on the environment.

4.2.8 Availability and Feasibility of Alternatives

This section describes the feasibility and availability of alternatives to the hybrid Big Bend Wind and Red Rock Solar project.

Hybrid Big Bend Wind and Red Rock Solar Project

The hybrid Big Bend Wind and Red Rock Solar project is located in a rural area with a primarily farm-based economy. Wind projects have typically been well integrated into similar settings. Wind resources in this region are among some of the best in the State of Minnesota. In addition, access to the grid is available in the area, with the need to construct approximately 18 miles of new transmission facilities, including the two-collector substations.

The proposed hybrid Big Bend Wind and Red Rock Solar Project is feasible and available to be implemented once interconnection details and designs have been completed.

335 MW Solar Facility (No wind component)

A 335 MW Solar Facility is potentially feasible, however a site with adequate space and interconnection to the grid has not been identified as part of this review process. Recently permitted solar farms include the 100 MW Aurora Distributed Solar Project (eDocket No. 14-515), the 100 MW North Star Solar Project (eDocket No. 15-33), the 62.25 MW Marshall Solar Project (eDocket 14-1052), the 100 MW Regal Solar Project (eDocket No. 19-395) and the 80 MW Elk Creek Solar Project (eDocket No. 19-495).

In 2013, Minnesota established a Solar Energy Standard that mandates Minnesota's investor-owned electric utilities to generate 1.5 percent of their electric power from solar by the end of 2020. Minnesota Power and Otter Tail Power are planning for additional solar development to reach their solar targets by 2020. In addition, Xcel Energy included a target of 650 MW of solar generation by 2020 and an additional 750 MW by 2030 in its 2016-2030 resource plan approved by the Minnesota Public Utilities Commission in 2016 as a least-cost plan for the utility's system needs.[376]

The cost and reliability of wind power continues to be more favorable than for solar power despite recent substantial decreases in cost for solar. Wind continues to be more cost-effective than solar-powered electricity and remains the lowest-cost new source of renewable energy. The United States Energy Information Administration projects the levelized total system cost for new generation

[376] Minnesota Department of Commerce. 2018. *Minnesota Renewable Energy Update*. https://mn.gov/commerce-stat/pdfs/2017-renewable-energy-update.pdf

resources entering service in 2023 to be $42.8/MWh (36.6 with tax credit) for onshore wind compared with $48.8/MWh ($37.6/MWh with tax credit) for solar photovoltaic entering service.[377]

From a land-use perspective, a MW of solar requires more land be used for the life of the project to achieve the same number of MW. Additionally, crop production within the wind portion of the proposed hybrid project will not be significantly impacted, whereas for a 335 MW solar facility alternative a large area of land, approximately 2,345 to 3,350 acres, would be taken out of production for the life of a 335 MW solar facility.

Access to transmission interconnection is also important for a project to be viable. A 335 MW solar facility is feasible and available.

335 Hybrid Wind and Solar Facility (Located elsewhere in Minnesota)

An alternative to proposed Big Bend Wind and Red Rock Solar hybrid project would be a hybrid wind and solar facility, sited elsewhere in Minnesota. There are good wind and solar generation resources in other parts of the state, and a hybrid wind and solar facility alternative could be placed in these areas. Such a project could be a single 335 MW hybrid project or a combination of smaller dispersed projects.

In addition to wind resource and solar resource availability, access to transmission interconnection is also important for a project to be viable; in the past, transmission access has been a constraint for the development of wind energy facilities in Minnesota.[378] A 335 MW hybrid wind and solar facility is feasible and available.

335 MW Solar Facility with Battery Storage (Located elsewhere in Minnesota)

A 335 MW Solar Facility with Battery Storage is potentially feasible, however a site with adequate space and interconnection to the grid has not been identified as part of this review process. Recently permitted solar farms include the 100 MW Aurora Distributed Solar Project (eDocket No. 14-515), the 100 MW North Star Solar Project (eDocket No. 15-33), the 62.25 MW Marshall Solar Project (eDocket 14-1052), the 100 MW Regal Solar Project (eDocket No. 19-395) and the 80 MW Elk Creek Solar Project (eDocket No. 19-495).

---

[377] U.S. Energy Information Administration. 2019. *Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook* 2018, *available at:* https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf.

[378] Minnesota Renewable Energy Integration and Transmission Study, October 31, 2014. https://mn.gov/commerce-stat/pdfs/mrits-report-2014.pdf.

In 2013, Minnesota established a Solar Energy Standard that mandates Minnesota's investor-owned electric utilities to generate 1.5 percent of their electric power from solar by the end of 2020. Minnesota Power and Otter Tail Power are planning for additional solar development to reach their solar targets by 2020. In addition, Xcel Energy included a target of 650 MW of solar generation by 2020 and an additional 750 MW by 2030 in its 2016-2030 resource plan approved by the Minnesota Public Utilities Commission in 2016 as a least-cost plan for the utility's system needs.[379]

The cost and reliability of wind power continues to be more favorable than for solar power despite recent substantial decreases in cost for solar. Wind continues to be more cost-effective than solar-powered electricity and remains the lowest-cost new source of renewable energy. The United States Energy Information Administration projects the levelized total system cost for new generation resources entering service in 2023 to be $42.8/MWh (36.6 with tax credit) for onshore wind compared with $48.8/MWh ($37.6/MWh with tax credit) for solar photovoltaic entering service.[380]

From a land-use perspective, a MW of solar requires more land be used for the life of the project to achieve the same number of MW. Additionally, crop production within the wind portion of the proposed hybrid project will not be significantly impacted, whereas for a 335 MW solar facility alternative a large area of land, approximately 2,345 to 3,350 acres, would be taken out of production for the life of a 335 MW solar facility. Large scale lithium battery storage facilities have not been constructed in the State of Minnesota at this time. The primary impacts associated with large battery storage banks would be possible aesthetic impacts and the additional land necessary to construct and maintain the facilities.

A 335 MW solar facility with battery storage is feasible and available.

No-build Alternative

The no build alternative is feasible and available.

Big Bend and Red Rock state that the hybrid project has been proposed to meet growing electric demand in Minnesota and growing demand for additional renewable resources in Minnesota and neighboring states. Minnesota has committed to a renewable energy objective of generating 25

[379] Minnesota Department of Commerce. 2018. *Minnesota Renewable Energy Update*. https://mn.gov/commerce-stat/pdfs/2017-renewable-energy-update.pdf

[380] U.S. Energy Information Administration. 2019. *Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook* 2018, *available at:* https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf.

percent of its electricity from eligible renewable sources by the year 2025.[381] Minnesota utilities had approximately 3,700 MW of wind generation in their portfolios at the end of 2017, with an additional 3,000 MW of wind generation planned for the Minnesota Market.[382] In addition to Minnesota's renewable energy objective, there is a regional need and desire for wind energy. It is not clear what the effect of a no-build alternative would be on meeting Minnesota and regional demand for electric power and for renewable generation.

[381] Minn. Statute 216B.1691

[382] Minnesota Department of Commerce. 2018. *Minnesota Renewable Energy Update*. https://mn.gov/commerce-stat/pdfs/2017-renewable-energy-update.pdf