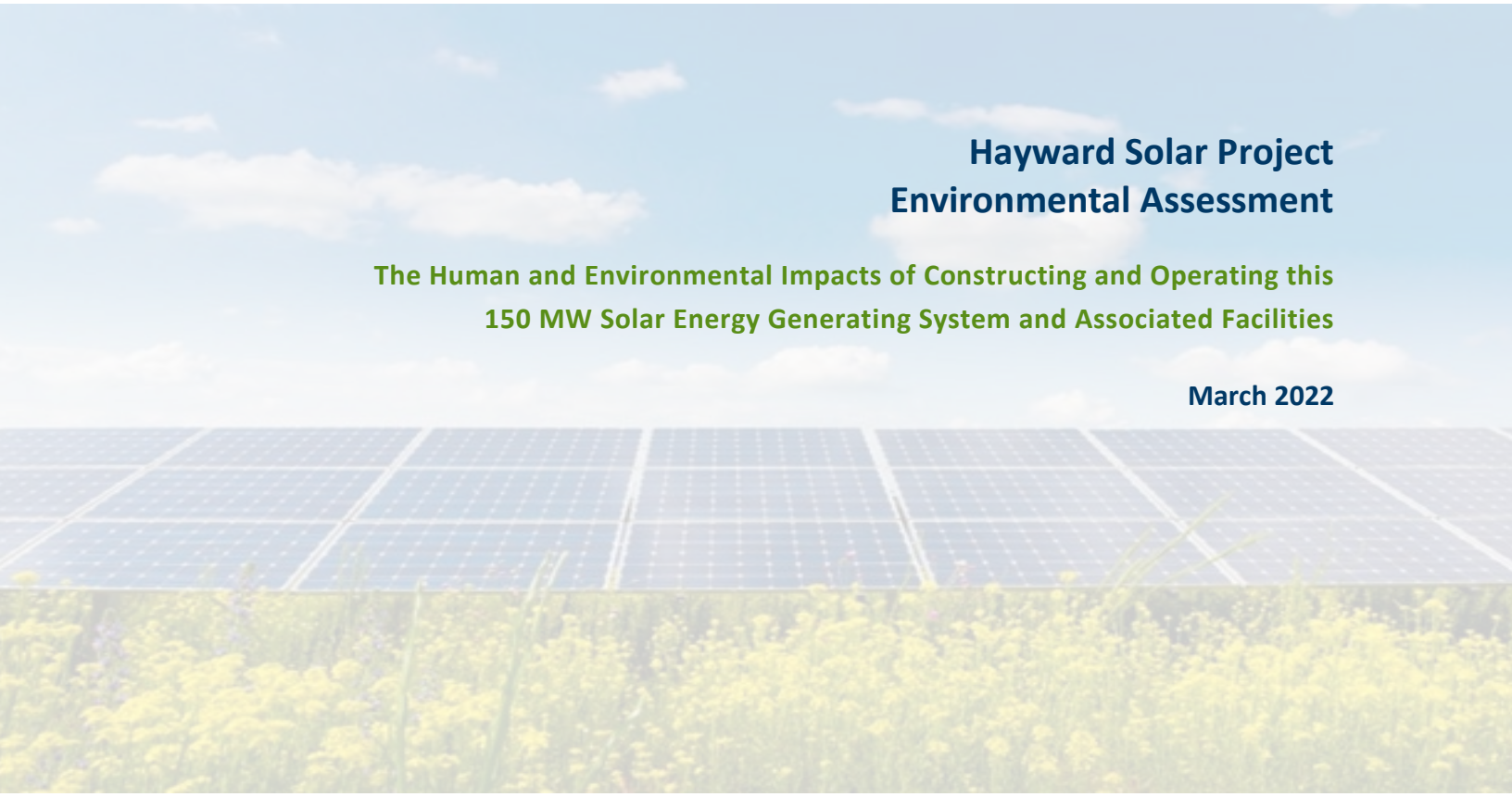

Hayward Solar Project
Environmental Assessment

The Human and Environmental Impacts of Constructing and Operating this 150 MW Solar Energy Generating System and Associated Facilities

March 2022

PUC Docket No. CN-12-112
PUC Docket No. GS-12-113
OAH Docket Nos. 5-2500-37666, 37667

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What Is This Document?

This document is an environmental assessment. The Public Utilities Commission will use the information in this document to inform their decisions regarding a certificate of need and site permit for the project. This environmental assessment contains an overview of the resources affected by the project. It analyzes and describes potential impacts and mitigation measures so that citizens, agencies, and governments can work from a common set of facts. Energy Environmental Review and Analysis staff within the Commerce Department has prepared this document as part of the state's environmental review process.

Sources

Much of the information used to prepare this environmental assessment comes from Hayward Solar, LLC's site permit application and application amendment. Additional sources include new information provided by Hayward Solar, LLC, as well as information from relevant federal and state environmental review documents for similar projects. Spatial data was used. Information was gathered from multiple site visits. Unless otherwise noted, all URL addresses were current as of March 1, 2022.

Document Availabiltiy

This environmental assessment and other materials related to this project are available (1) on the Commerce Department's website: https://mn.gov/commerce/energyfacilities, select *Power Plants*, and then select *Hayward Solar Project*, and (2) the Commission's website: https://mn.gov/puc, select *eDockets*, enter the year (21) and docket number (112 or 113), and then select *Search*. This document can be made available in alternative formats, that is, large print or audio, by calling (651) 539-1530 (voice).

Project Mailing List

To place your name on the project mailing list contact docketing.puc@state.mn.us or (651) 201-2246. You will need to provide the docket numbers (21-112 and 21-113), your name, email address, and mailing address. You can indicate how you would like to receive notices—by email or U.S. mail.

How is this document organized?

This EA is based on the applicant's certificate of need and site permit applications (as amended) and public scoping comments. It addresses the matters identified in the November 30, 2021, scoping decision (**Appendix A**). The EA is organized as follows:

Chapter 1 briefly describes the state of Minnesota's role; discusses how this EA is organized; and provides a summary of potential impacts and mitigation. This chapter also analyzes the siting factors that the Public Utilities Commission must consider for the project.

Chapter 2 describes the project—its design, construction, operation, and decommissioning.

Chapter 3 discusses the regulatory framework, including the certificate of need and site permit processes, the environmental review process, and the other approvals that may be required for the project.

Chapter 4 describes the environmental setting; details potential human and environmental impacts; and identifies measures to mitigate adverse impacts. It summarizes the cumulative potential effects of the project and other projects, and lists unavoidable impacts and irreversible and irretrievable commitments of resources.

Chapter 5 discusses the feasibility, availability, and potential impacts of system alternatives.

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ALJ administrative law judge 10
applicant Hayward Solar, LLC 1
BWSR Board of Water and Soil Resources 29, 84
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Commerce Department of Commerce 1, 17
Commission Public Utilities Commission 1
CSW construction stormwater permit 50
dBA A-weighted scale 29
DC direct current 13
DNR Department of Natural Resources 29
EA environmental assessment 1
EJ environmental justice 27
ELF-EMF extremely low frequency electromagnetic fields 37
EMF electromagnetic fields 22, 37
FAA Federal Aviation Administration 72
GHG greenhouse gases 46
I-90 Interstate Highway 90 69
KOA Kampgrounds of America 25
kV kilovolt or 1,000 volts 1
kV/m kilovolts per meter 38
LGU Local Government Unit 84
MDA Minnesota Department of Agriculture 84
mG milliGuass 38
MNDOT Minnesota Department of Transportation 84
MPCA Pollution Control Agency 82
MW megawatt 1
NAC noise area classification 30
NESC National Electric Safety Code 84
NPDES/SDS national pollutant discharge elimination system/sanitary disposal system 82
NRHP National Register of Historic Places 44
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ROI region of influence 21
SCADA supervisory control and data acquisition 16
SHPO State Historic Preservation Office 45, 84
Southern Municipal Southern Minnesota Municipal Power Agency 1
SWPPP stormwater pollution prevention plan 82
USACE U.S. Corps of Engineers 82
USFWS U.S. Fish and Wildlife Service 23, 82
VMP Vegetation Management Plan 17
WCA Wetland Conservation Act 84

Definitions

Several terms used in this document have a specific meaning in Minnesota law or regulation. Other terms are defined for clarity.

associated facilities means buildings, equipment, and other physical structures that are necessary to the operation of a large electric power generating plant or high voltage transmission line (Minnesota Rule 7850.1000, subpart 3).

construction means any clearing of land, excavation, or other action that would adversely affect the natural environment of the site or route but does not include changes needed for temporary use of sites or routes for nonutility purposes, or uses in securing survey or geological data, including necessary borings to ascertain foundation conditions (Minnesota Statute 216E.01, subdivision 3).

distribution line means power lines that operate below 69 kilovolts.

gen-tie transmission line means an approximately 650-foot above-ground 161 kV transmission line proposed by the applicant to connect the project substation to the switching station.

high voltage transmission line means a conductor of electric energy and associated facilities designed for and capable of operation at a nominal voltage of 100 kilovolts or more and is greater than 1,500 feet in length (Minnesota Statute 216E.01, subdivision 4).

land control area means land for which the applicant maintains lease agreement options.

large electric power generating plant means electric power generating equipment and associated facilities designed for or capable of operation at a capacity of 50,000 kilowatts or more (Minnesota Statute 216E.01, subdivision 5).

large energy facility means any electric power generating plant or combination of plants at a single site with a combined capacity of 50,000 kilowatts or more and transmission lines directly associated with the plant that are necessary to interconnect the plant to the transmission system (Minnesota Statute 216B.2421, subdivision 2(1)).

power line means a distribution, transmission, or high voltage transmission line.

project area means one mile from the land control area.

project vicinity means 1,600 feet from the land control area and collection line corridor.

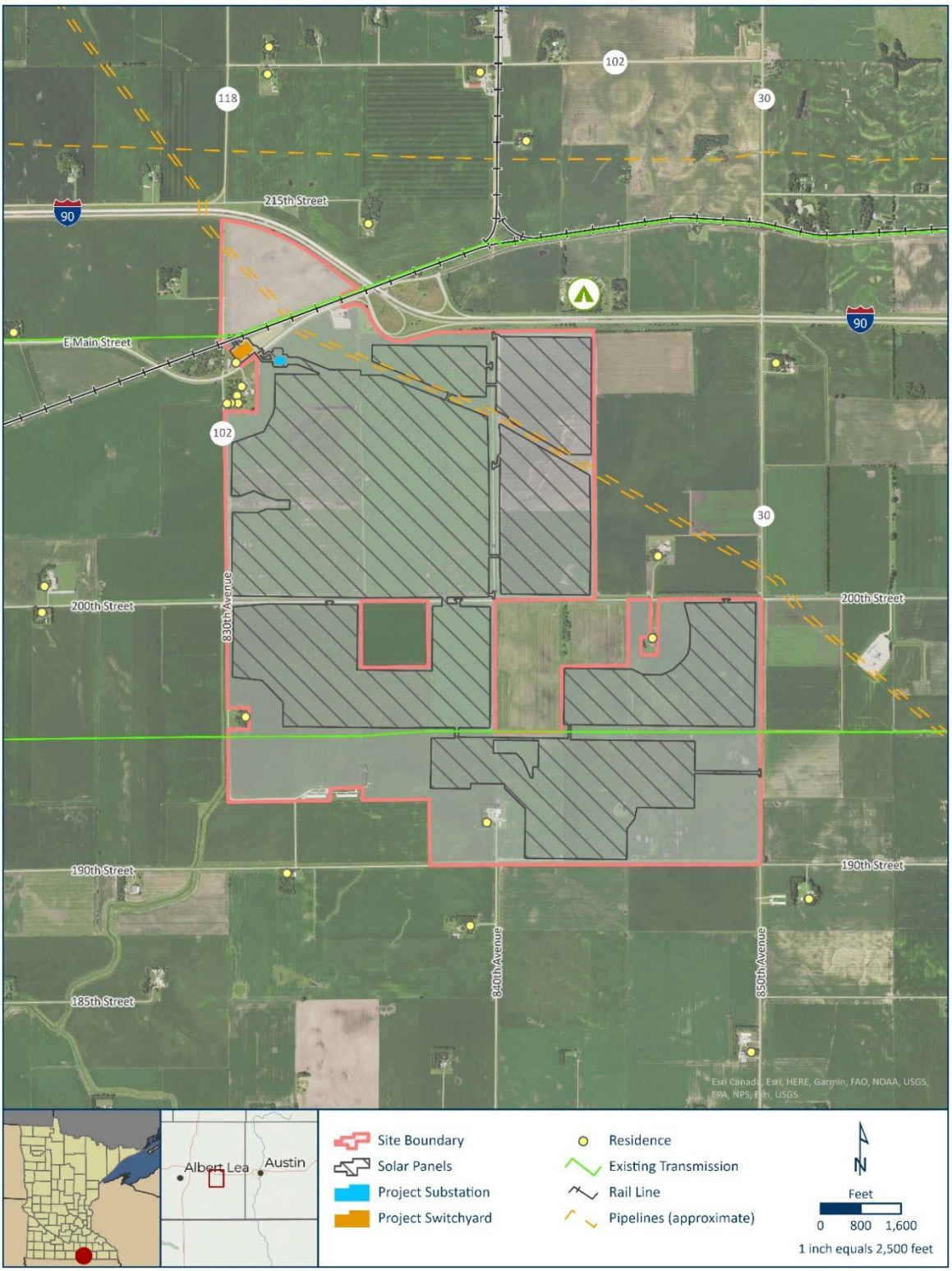
solar farm means ground-mounted photovoltaic equipment capable of operation at 5,000 kilowatts or more connected directly to the electrical grid.

solar energy generation system means a set of devices whose primary purpose is to produce electricity by means of any combination of collecting, transferring, or converting solar-generated energy (Minnesota Statute 216E.01, subdivision 9a).

transmission line means power lines that operate at 69 kilovolts and above.

Project Overview Map

Figure 1 Project Overview and Location



Chapter 1 Summary

Hayward Solar, LLC (applicant) must obtain a certificate of need (CN) and site permit from the Public Utilities Commission (Commission) before it can construct the Hayward Solar Project (project). The project is an up to 150 megawatt (MW) photovoltaic (PV) solar energy generating system in Hayward Township, Freeborn County, Minnesota.

The land control area, which is defined as land for which the applicant maintains lease agreement options, occupies approximately 1,970 acres east of the city of Hayward and just south of Interstate 90 (**Figure 1**). Solar equipment and supporting infrastructure are expected to occupy about 1,270 acres within this area. The project will use PV solar panels mounted on linear, single axis tracking systems. Underground collection lines will gather the electric power and route it to a project substation. The project substation will interconnect with the electrical grid via a proposed switching station on the existing Hayward – Murphy Creek 161 kilovolt (kV) high voltage transmission line. The switching station would be constructed, owned, and operated by the Southern Minnesota Municipal Power Agency (Southern Municipal).

Pending receipt of necessary permits and approvals, construction is anticipated to begin in fall/winter 2022 with completion and operation in winter 2023. The project is estimated to cost approximately $130 million.

The applicant indicates that the project will assist Minnesota in meeting the state's renewable energy objectives. They also note that the project could meet consumers' growing demand for renewable energy. This includes wholesale customers, for example, utilities and cooperatives, that have an identified a need for additional renewable energy, or commercial and industrial customers that have set renewable energy goals.

The Department of Commerce (Commerce) has prepared this environmental assessment (EA). The EA describes the project, highlights resources affected by the project, and discusses potential human and environmental impacts to these resources.[1] It also discusses ways to mitigate potential impacts. These mitigation strategies can become enforceable conditions of the Commission's site permit.

An EA is not a decision-making document, but rather an information document. The EA is intended to facilitate informed decisions by state agencies, particularly with respect to the goals of the Minnesota Environmental Policy Act: "to create and maintain conditions under which human beings and nature can exist in productive harmony and fulfill the social, economic, and other requirements of present and future generations of the state's people."[2]

1.1 What is Minnesota's role?

The applicant needs two approvals from the Public Utilities Commission. Commerce prepared this EA. An administrative law judge will conduct a public hearing.

To build the project, the applicant needs two approvals—a certificate of need and site permit—from the Commission. A site permit supersedes local zoning, building, and land use rules. The Commission's site permit decision must be guided, in part, however, by consideration of impacts to local zoning and land use in accordance with the legislative goal to "minimize human settlement and other land use conflicts."[3] In addition, various federal, state, and local approvals may be required for activities related to the construction and operation of the project. These subsequent permits are

referred to as *downstream* permits and must be obtained by the applicant prior to constructing the project.

The applicant applied to the Commission for a certificate of need[4] and a site permit[5] for the project in May 2021. The applicant amended these applications in October 2021.[6] With these applications, the Commission has before it two distinct considerations:

- Is the project needed? Or would another project 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 project is needed, where is it best located[7] and what conditions should be placed on the site permit?

To ensure a fair and robust airing of the issues, the Minnesota Legislature has set out a process for the Commission to follow when considering certificate of need and site permit applications.[8] In this instance an 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 project (*what the facts mean*). The record developed during this process—including all public input—will be considered by the Commission when it makes its decisions on the applicant's certificate of need and site permit applications.

1.2 What is the public's role?

Minnesota needs your help to make informed decisions.

During scoping, you told us your concerns about the project so that we could collect the right facts. At the public hearing, which comes next, you can tell us what those facts mean, and if you think we have represented them correctly in this EA. Your help in pulling together the facts and determining what they mean will help the Commission make informed decisions regarding the project.

1.3 What potential impacts were identified?

The project will impact human and environmental resources. Distinct impacts will occur during construction and operation.

A potential impact is the anticipated change to an existing condition caused either directly or indirectly by the project. Potential impacts can be positive or negative, short- or long-term, and, in certain circumstances, can accumulate incrementally. Impacts vary in duration and size, by resource, and across locations.

Select resources received abbreviated study in this EA because impacts to these resources are anticipated to be negligible and of relatively minor importance to the Commission's site permit decision. Potential impacts are anticipated to be negligible for: airports, displacement, electronic interference, implantable medical devices, floodplains, forestry, geology, mining, stray voltage, topography, and wetlands.

Human Settlement

Aesthetics Visual impacts are subjective. Thus, potential impacts are unique to the individual and can vary widely. Visual impacts are expected to be minimal for those with low viewer sensitivity,

such as people traveling near the project on I-90. For those with high viewer sensitive, for example, neighboring landowners, visual impacts are anticipated to be moderate to significant. Potential impacts might dissipate over time depending on the individual. Impacts will be short- and long-term, and localized. Aesthetic impacts are unavoidable but can be mitigated by screening, preserving natural landscapes, and by using shielded lighting.

Cultural Values Impacts associated with rural character and sense of place are expected to be dependent on the individual. Tension between renewable energy and rural character has the potential to influence cultural values over time. Negative impacts to community unity are not expected to occur. The project is not expected to impact the work and leisure pursuits of residents in the project area or land use in such a way as to impact the cultural values of the area. Impacts are anticipated to be long-term, but minimal. Impacts are unavoidable.

Environmental Justice A meaningfully greater low-income or minority population does not reside in the census tract intersected by the project. This means that when compared to the population of Freeborn County, the percentage of people living in poverty or not self-identifying as white alone were either: 1) not greater than 50 percent, or 2) not 10 percentage points or more than the percentage of the same population in Freeborn County. Therefore, disproportionate and adverse impacts to these populations are not expected. Mitigation is not proposed.

Land Use and Zoning Potential impacts to zoning are anticipated to be long-term, localized, and minimal. Constructing the project will change land use from agricultural to industrial for at least 30 years. After the project's useful life, the land control area could be restored to agricultural use by implementing appropriate restoration measures, thus making the project compatible with the county's interest in preserving agricultural land. Impacts are unavoidable but can be minimized.

Noise Distinct noises are associated with the different phases of project construction. These impacts will be temporary and intermittent and range from negligible to significant depending on the construction equipment used and the location of the listener. Impacts to state noise standards can be mitigated by timing restrictions, that is, limiting the duration of certain construction activities. Noise impacts during operation are unavoidable and anticipated to be negligible to minimal.

Property Values A property's value is influenced by a complex interaction of factors. The presence of an HVTL or substation becomes one of these factors. On whole, impacts to property values are anticipated to be minimal and to decrease with distance and over time. Impacts to a specific property's value are difficult to determine. Because of this uncertainty, impacts to specific properties could be minimal to moderate. Impacts are unavoidable.

Public Services Potential impacts to the electrical grid, roads and railroads, and other utilities are anticipated to be short-term, intermittent, and localized during construction. Impacts to water (wells and septic systems) are not expected to occur. Impacts to pipelines in the project area could be significant if proper coordination and mitigation are not used. Overall, construction-related impacts are expected to be minimal, and are associated with short electrical outages and possible traffic delays. During operation, negligible traffic increases would occur for maintenance. Impacts are unavoidable but can be minimized.

Recreation Because few recreational resources exist in the project area, potential impacts to these resources are anticipated to be minimal and temporary. Impacts to a snowmobile trail can be mitigated.

Socioeconomics Economic impacts from the project are anticipated to be positive. Effects associated with construction will, overall, be short-term and minimal. Significant positive effects might occur for individuals. Impacts from operation will be long-term and significant. Adverse impacts are not anticipated.

Human Health and Safety

Electronic and Magnetic Fields Impacts to human health from possible exposure to EMFs are not anticipated. Potential impacts will be long-term and localized. These unavoidable impacts will be of a small size. Impacts can be mitigated.

Public and Worker Safety Like any construction project, there are risks. These include potential injury from falls, equipment and vehicle use, electrical accidents, etc. Public risks involve electrocution. Electrocution risks could also result from unauthorized entry into the project area. Potential impacts are unavoidable but anticipated to be minimal. Impacts would be short- and long-term, and can be minimized.

Land Based Economies

Agriculture Potential impacts to agricultural producers are anticipated to be minimal—lost farming revenues will be offset by easement agreements. A negligible loss of farmland in Freeborn County would occur for the life of the project. With respect to prime farmland, the applicant indicates that no feasible or prudent alternatives to the project exist. Potential impacts are localized and unavoidable but can be minimized.

Tourism Indirect impacts to tourism are associated with direct impacts to recreational opportunities. Potential impacts are anticipated to be minimal. Potential impacts can be mitigated.

Archeological and Historic Resources

Potential impacts are not expected. Impacts, should they occur, will be localized and affect a unique resource. Impacts can be mitigated.

Natural Resources

Air Quality and Climate Change Distinct impacts occur during construction and operation of the project. Potential impacts to air quality during construction would be intermittent, localized, short-term, and minimal. Impacts are associated with fugitive dust and exhaust. Impacts can be mitigated. Once operational, the solar array will not generate criteria pollutants or carbon dioxide. Negligible fugitive dust and exhaust emissions would occur as part of routine maintenance activities. Impacts are unavoidable and do not affect a unique resource. Impacts can be minimized.

Groundwater Potential impacts to domestic water supplies are not expected. Localized impacts to groundwater resources, should they occur, would be intermittent, but have the potential to occur over the long-term. Indirect impacts from surface waters might occur during construction. Impacts can be mitigated.

Soils The impact intensity level is expected to be minimal. Potentials impacts will both positive and negative, and short- and long-term. Isolated moderate to significant negative impacts associated with high rainfall events could occur. Because the soil would be covered with native perennial vegetation for the life of the project, soil health would likely improve. Impacts are unavoidable and anticipated to be positive over the long-term.

Surface Waters Potential impacts are anticipated to be minimal. Direct impacts to surface waters are not expected. Indirect impacts to surface waters might occur. These impacts will be short-term, of a small size, and localized. Impact can be mitigated.

Vegetation The project will convert row crop farmland to perennial vegetation for the life of the project. Potential impacts are unavoidable and are anticipated to be positive and long-term (30 years). Potential negative impacts can be mitigated through development of a vegetation management plan. No additional mitigation is proposed.

Wildlife and Habitat Potential impacts are positive or negative, and species dependent. Long-term, positive impacts to birds, small mammals, insects, snakes, etc. would occur. Impacts to large wildlife species, for example, deer, will be negligible. Negative impacts could occur to individuals during construction and operation of the project. Once restored, the land control area will provide native grassland habitat for the life of the project. Impacts are unavoidable and anticipated to be minimal.

1.4 What factors guide the Commission's decision?

The analysis that follows describes the factors that guide the Commission's decision and applies the information and data available in the site permit application and this EA to the factors the Commission must consider when making a site permit decision.

The Minnesota Legislature has directed the Commission to select sites for large electric power generating plants that minimize adverse human and environmental impacts while insuring continuing electric power system reliability and integrity.[9] The site must be compatible with environmental preservation and the efficient use of resources while also ensuring electric energy needs are met and fulfilled in an orderly and timely fashion.[10]

Minnesota Statute 216E.03, subdivision 7(b) identifies 12 considerations that guide commission decisions when designating a site for a large electric power generating plant. These considerations are further clarified and expanded by Minnesota Rule 7850.4100, which identifies 14 factors the commission must consider when making a 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.

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 right-of-way (ROW), 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 systems 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.

Some factors are described in just a few words. Other factors are more descriptive and include a list of elements that, when grouped, make up the factor. Finally, certain factors are relatively succinct, but the scoping process identified elements to be analyzed in this EA. For example, the public health and safety factor includes an EMF element.

Factor M (unavoidable impacts) and **Factor N** (irreversible and irretrievable resource commitments) are discussed in Section 3.9 and Section 3.10, respectively, of this EA. **Factor H** (use of existing rights-of-way) and **Factor J** (use of existing infrastructure rights-of-way) apply solely to high voltage transmission lines. **Factor G** (application of design options) and **Factor L** (costs dependent on design) do not apply as the design of the proposed project is the only design under consideration. Other factors are ranked as follows:

Impacts are anticipated to be negligible to minimal and able to be mitigated or consistent with factor

Impacts are anticipated to be minimal to moderate and able to be mitigated in part or less consistent with factor, but nonetheless consistent

Impacts are anticipated to be moderate to significant and unable to be mitigated fully or consistent in part or not consistent with factor

Application of siting factors

This analysis applies the siting factors to the project.

Graphics (described above) are used to illustrate distinct impacts associated with construction and operation. A discussion highlighting differences in the types of impacts follows.

Table 1 Application of Siting Factors

Factor A: Human Settlement		
Element	**Construction**	**Operation**
Aesthetics	○	○
Displacement	●	●
Cultural Values	●	●
Electric Interference	●	●
Environmental Justice	●	●
Floodplains	●	●
Land Use and Zoning	●	●
Noise	⊘	●
Property Values*	●	○
Recreation	○	●
Socioeconomics	●	●

* On whole, impacts in the local vicinity are anticipated to be minimal and dissipate at distance.

Factor A: Public Services		
Element	**Construction**	**Operation**
Airports	●	●
Roads and Highways	●	●
Utilities	●	●

Factor B: Public Safety		
Element	**Construction**	**Operation**
EMF	●	●
Emergency Services	●	●
Medical Devices	●	●
Public Safety	●	●
Stray Voltage	●	●
Worker Safety	●	●

Factor C: Land-based Economies

Element	Construction	Operation
Agriculture	●	●
Forestry	●	●
Mining	●	●
Tourism	●	●

Factor D: Archaeological and Historic Resources

Element	Construction	Operation
Archeological	●	●
Historic	●	●

Factor E: Natural Resources

Element	Construction	Operation
Air Quality	●	●
Climate Change	●	●
Geology	●	●
Groundwater	●	●
Soils	●	●
Surface Water	●	●
Topography	●	●
Vegetation	●	●
Wetlands	●	●
Wildlife	●	○
Wildlife Habitat	●	●

Factor F: Rare and Unique Resources

Element	Construction	Operation
Fauna	●	●
Flora	●	●

Factor I: Use of Existing Generating Plants

Element	Construction	Operation
Existing Plants	⊘	⊘

Discussion

The following discussion highlights potential impacts to factor elements that are anticipated to be moderate to significant, as well as siting factors that are less consistent, consistent in part, or not consistent.

Factor A Human Settlement

Aesthetics Visual impacts are subjective. Thus, potential impacts are unique to the individual and can vary widely. For those with high viewer sensitive, for example, neighboring landowners, visual impacts are anticipated to be moderate to significant.

Noise Distinct noises are associated with the different phases of project construction. These impacts will be temporary and intermittent and range from negligible to significant depending on the construction equipment used and the location of the listener.

Property Values On whole, impacts to property values are anticipated to be minimal and to decrease with distance and over time. However, impacts to a specific property's value are difficult to determine. Because of this uncertainty, impacts to specific properties could be minimal to moderate.

Factor E Natural Resources

Wildlife and Habitat Impacts to wildlife are anticipated to be minimal to moderate during construction and operation of the project.

Factor I Use of Existing Sites

Power Plants The project is not constructed at an existing power plant site; therefore, it is not consistent with this siting factor.

Mitigation measures

The following summarizes mitigation measures noted in this EA that are not part of the sample route permit issued by the Commission for the project. In addition to the measures summarized below, the Commission could require that a third-party monitor, reporting directly to EERA staff, be employed to monitor compliance with the conditions of any Commission site permit issued for the project.

Aesthetics The Commission could require downward illumination (shielded lighting) at all locations where lighting is required to mitigate impacts to night sky.

Noise The Commission could require construction timing restrictions, that is, limiting the duration of certain construction activities, to mitigate impacts to state noise standards.

Emergency Services The Commission could require notification to emergency responders of traffic interruptions to mitigate impacts to emergency response.

Recreation The Commission could require time-of-day or time-of-year restrictions for certain construction activities to mitigate impacts to the KOA campground. Additionally, the Commission

could require documentation of discussions with the local snowmobile club regarding rerouting Trail 133.

Vegetation The Commission could require continued coordination with state agencies in developing a vegetation management plan to mitigate impacts to vegetation.

Wildlife The Commission could require that visibility markers be placed at appropriate locations on perimeter fencing to mitigate impacts from wildlife entanglement.

1.5 What happens next?

Public hearings will be held for the project – an in-person hearing and a virtual hearing. The public can provide comments at either hearing or as part of an associated public comment period. An administrative law judge will consolidate public comments and prepare a report and make recommendations for the Commission to consider. The Commission will then review the record and decide whether to grant a CN and a site permit.

An administrative law judge (ALJ) from the Office of Administrative Hearings (OAH) will hold an in-person public hearing in the project area. After the in-person hearing, a virtual hearing will be held. At either hearing, persons may ask questions or submit verbal comments about the project. An associated public comment period provides an opportunity to provide written comments. After the public comment period closes, the ALJ will provide a written report to the Commission summarizing the public hearings and comment period, and any spoken or written comments received. The ALJ report may recommend ways to mitigate potential impacts of the project.

The record developed during the environmental review process—including public input received during the public hearing and comment period—will be considered by the Commission when it makes its decisions. The Commission may grant a CN for the project as proposed, grant a CN contingent upon modifications to the project, or deny the CN. The Commission may also place conditions on the granting of a CN. If a CN is granted, the Commission will then decide whether to issue a site permit. Site permits define the location of the project and include conditions specifying mitigation measures.

Decisions by the Commission on the CN and site permit applications are anticipated in summer 2022.

1.6 Where do I get more information?

For additional information don't hesitate to contact Commerce or Commission staff.

If you would like more information or if you have questions, please contact Commerce staff: Ray Kirsch (raymond.kirsch@state.mn.us or (651) 539-1841) or the Commission public advisor: Charley Bruce (publicadvisor.puc@state.mn.us or (651) 201-2251).

Additional documents and information, including the site permit application, can be found on the state of Minnesota's eDockets system: https://www.edockets.state.mn.us/EFiling/search.jsp (enter year "21" and number "112" or "113") and on the EERA website: https://mn.gov/eera/web/project/14408/.

Notes

[1] In this document the words “effect” and “impact” are synonymous and could be beneficial or harmful.

[2] Minnesota Statute 116D.02.

[3] Minn. Stat. 216E.03, subd. 7.

[4] Hayward Solar, LLC (May 5, 2021) *Hayward Solar Project Certificate of Need Application*, eDockets Nos. 20215-173903-01 thru -08; Hayward Solar, LLC (May 6, 2021) *Hayward Solar Project Certificate of Need Application*, eDockets Nos. 20215-173941-01 thru -02.

[5] Hayward Solar, LLC (May 5, 2021) *Hayward Solar Project Site Permit Application*, eDocket Nos. 20215-173906-01 thru -10, 20215-173907-01 thru -10, 20215-173909-01 thru -06, 20215-173920-01 thru -02; Hayward Solar, LLC (May 6, 2021) *Hayward Solar Project Site Permit Application*, eDocket Nos. 20215-173939-01 thru -03.

[6] Hayward Solar, LLC (October 15, 2021) *Amended Hayward Solar Project Application*, eDockets Nos. 20218-178857-01 thru 06.

[7] If the Commission grants a site permit, it chooses which of the studied locations is most appropriate. In this matter only one location is studied.

[8] Minn. Stat. 216B and 216E.

[9] Minn. Stat. 216E.02, subd. 1.

[10] *Ibid*.

Chapter 2 Proposed Solar Farm

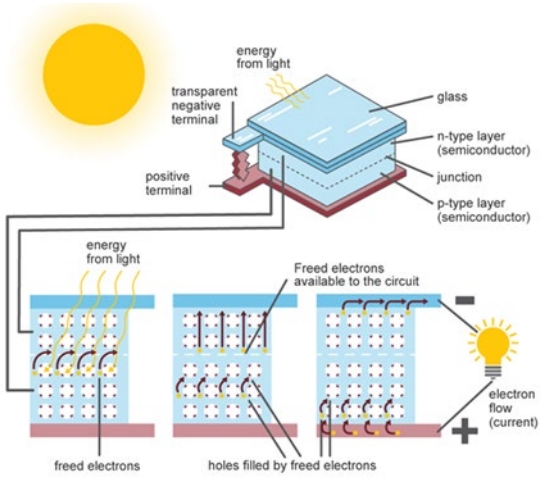
The applicant proposes to construct an up to 150 MW solar farm in Freeborn County. This chapter describes the project and how it would be constructed. Additionally, it describes operation of the project and its future decommissioning. Unless otherwise noted, the sources of information for this chapter are the site permit application and application amendment.

2.1 How do solar farms generate electricity?

The *photovoltaic effect* is the physical process through which a PV cell coverts sunlight directly into electricity by capitalizing on nature's inherent desire to keep electrical charges in balance.

When direct and indirect solar radiation (direct and scattered sunlight) strikes a PV cell, some radiation is absorbed, which excites electrons within the cell. This results in a continuous flow of electrons from the front to the back of the panel through electrical connections, which results in a continuous flow of electric current as depicted in **Figure 2**.[1]

Figure 2 Inside a PV Cell



PV cells generate direct current (DC) electricity, which must be converted to alternating current (AC) electricity before reaching the electrical grid. Solar panels are arranged into electrically connected blocks and connected to inverters. An inverter converts DC electricity to AC electricity. Transformers then step up the electrical voltage before the electrical power is collected through an above- or below-ground collection system. Collection systems combine the electricity from across the array and deliver it to a project substation.

2.2 Where is the project located?

The project is located within Hayward Township in Freeborn County, Minnesota (Figure 1).

Table 2 summarizes the project location. Located directly east of the city of Hayward and just south of Interstate 90, the project is entirely within Hayward Township.

Table 2 Project Location

Township	Range	Section	Political Township	County
102N	20W	1, 2, 3, 11 – 15	Hayward	Freeborn

The solar array would be located on approximately 1,272 acres of row crop farmland. The applicant holds lease option agreements for this portion of the project on about 1,958 acres. This includes the project substation, operation and maintenance facility, and project gen-tie line. Southern Municipal will purchase the underlying land for its switching station, tap line, and point of interconnect.

2.3 How is the project designed?

The project consists of PV solar panels, an electrical collection system, project substation, switchyard, a short transmission line to connect the project to the electrical grid, an operations and maintenance building, fencing, and access roads.

The applicant proposes to place solar panels on a tracking system oriented north and south that will allow the panels to track the sun from east to west each day (**Figure 3**).[2] The panels will face east in the morning, will be parallel to the ground mid-day, and will face west in the afternoon. Tracking the sun maximizes the project's electrical production. When tilted to their highest position (early and late in the day), the top edge of the solar panels will be, at most, 15 feet above the ground. The tracking system will rely on up to 10 weather stations. These weather stations, up to 15 feet in height, would be located throughout the project area.

A specific solar panel has not been selected for the project. The applicant notes that new solar panels, with higher efficiencies or outputs, are being introduced into the market regularly and delaying the selection of solar panels for the project might result in a project with a smaller footprint.

Figure 3 Tracking System and Foundation Posts

2.3.1 Electrical Collection System

The DC electrical energy generated by the solar panels will be collected and routed either below- or above-ground (underneath the panels) to power inverters located throughout the project area (**Figure 4**). If buried underground, the cabling will be placed two to five feet deep. If placed above-ground, the cabling will be attached to the pile foundations.

The electrical collection system will lead to power inverters and step-up transformers. These will be placed on inverter "skids" that will be located throughout the project area (**Figure 5**). Skids are steel pads approximately 10 feet wide by 25 feet long. The power inverters will be about eight to 12 feet tall; the transformers about nine feet tall. The skids will be placed on concrete slab foundations or on pier foundations.

The inverters will change the DC electrical energy from the solar panels (about 1.5 kV volts DC) to AC energy (about 0.6 to 0.9 kV AC). A step-up transformer will convert this low voltage AC energy to 34.5 kV, which will be transmitted from each inverter skid to the project substation via an underground collection system. The underground collection system will generally be placed two to five feet underground. The collection cables may be placed deeper to avoid existing utilities or other underground obstacles.

The applicant has not yet selected power inverters (and associated step-up transformers) for the project. The final number of inverters will depend on the inverters selected as well as the final solar panel configuration.

Figure 4 Electrical Collection System

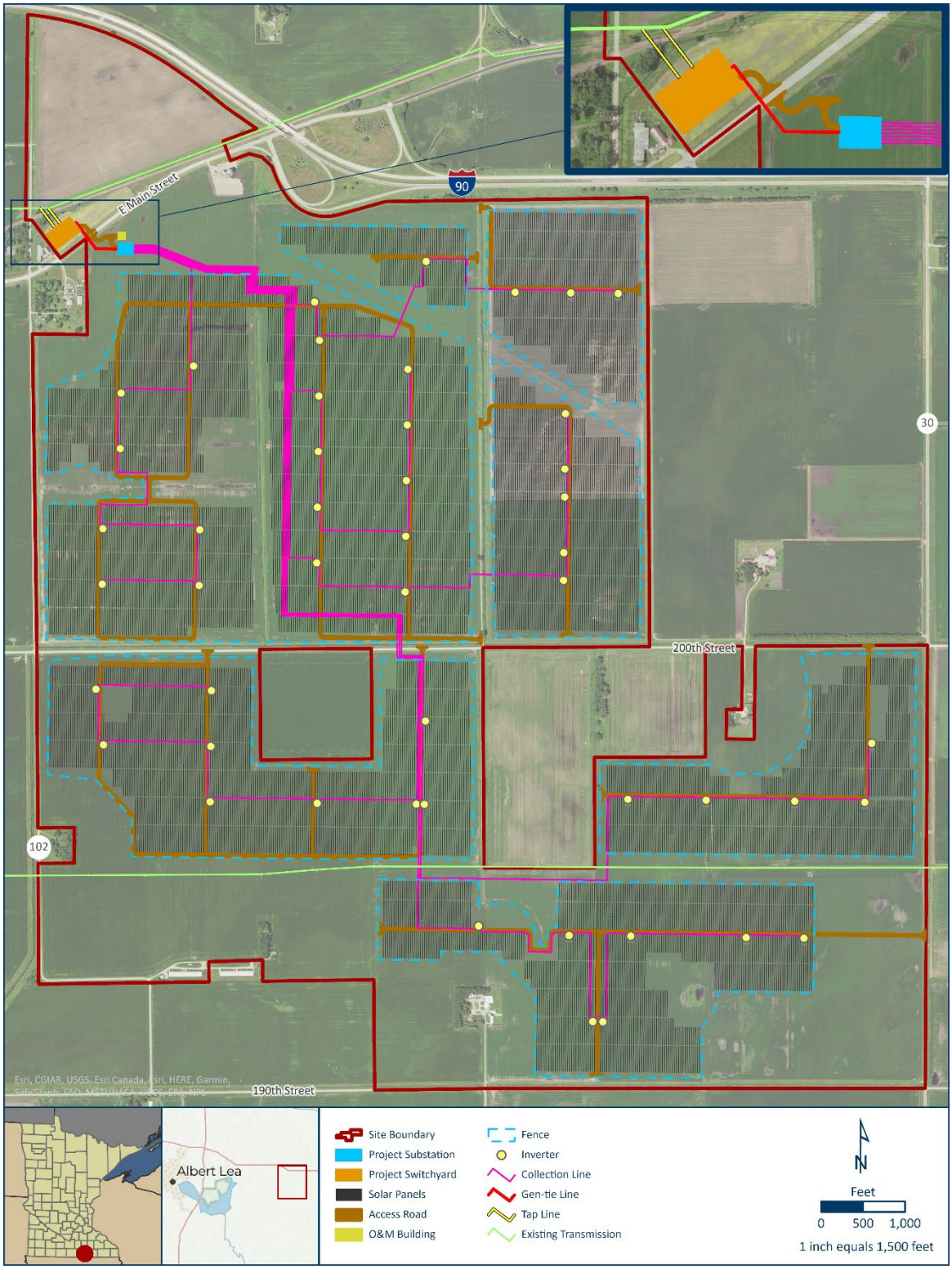
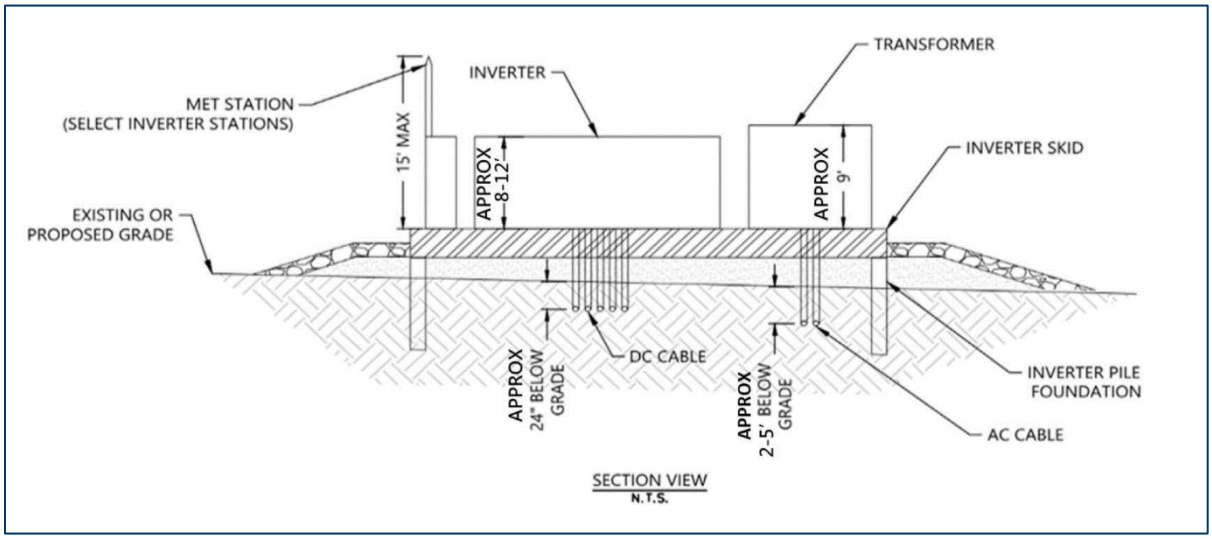


Figure 5 Inverter Skids



2.3.2 Project Substation

The project substation would be in the northwest corner of the project area (**Figure 4**). It will occupy about seven-tenths of an acre (150 feet by 200 feet). The substation will be fenced, and include a transformer, breakers, transmission line structures, and control equipment. Underground 34.5 kV collection lines would deliver electrical energy from the project's inverters to the substation. At the substation, the energy would be transformed from 34.5 kV to 161 kV. The energy would then be transmitted to the project switchyard by a 650-foot-long transmission line (known as a generation tie line or "gen-tie" line) that crosses County Highway 46.

2.3.3 Project Switchyard

A switching station (switchyard) provides a means to safely connect and disconnect, as needed, the project to and from the electrical grid. Two approximately 250-foot-long transmission lines would run northwest from the switchyard to the existing Hayward – Murphy Creek 161 kV transmission line. The switchyard would be constructed, owned, and operated by Southern Municipal. The applicant would obtain land rights for the switchyard and associated transmission line and would then transfer them to Southern Municipal upon completion of switchyard construction.

2.3.4 Operations and Maintenance Building

The project includes the construction and use of an operations and maintenance (O&M) building. The O&M building would be located on about 0.2 acres in the northwest corner of the project area near the project substation. The O&M building will be used to store maintenance supplies and conduct maintenance and repairs. It will also house the supervisory control and data acquisition (SCADA) system which allows for remote project monitoring.

2.3.5 Fencing

All solar arrays will be fenced within an 8-foot fence made of lightweight agricultural woven wire fence on wooden posts. Two feet of three or four smooth wire strands will be used at the top of the fence. The fencing will be designed to prevent the public and larger wildlife from entering the

project area and accessing electrical equipment that could cause harm or injury. Electric code requires a six-foot chain-link fence with one foot of barbed wire at the top be used around the project substation and switchyard.

2.3.6 Access Roads

The project will include about 11 miles of gravel access roads. These roads would be used for general access and operations and maintenance activities. While possibly wider during construction, access roads would be 12 to 16 feet in width, with some wider sections at curves and intersections once the project is operational.

2.4 Project Construction

Hayward Solar indicates that project construction would begin only after all necessary permits and approvals have been received. All activities must comply with permit conditions. Construction would begin with initial site preparation including grading, improving access, and preparing staging/laydown areas. The applicant estimates that about 19 acres of the project area (1.5 percent) will require grading. Mass grading will not occur. Typical construction equipment will be used for the project—scrapers, bulldozers, dump trucks, and backhoes. Additional specialty equipment could include a pile driver, crane, all-terrain forklift, and drill rig.

After initial site preparation, solar arrays and associated access roads would be constructed. 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 8 to 15 feet into the ground. Final depth will depend on 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, are installed next, typically by crews using hand tools.

Inverter skids will be installed on concrete or pier foundations. Concrete foundations may be poured on-site or pre-cast and then assembled. Cable for the AC electrical collection system will be placed two to five feet underground. A trench will be excavated for the cabling; topsoil and subsoil will be segregated and stockpiled. Once cabling is installed in the trench, the trench will be backfilled with subsoil followed by topsoil.

The project substation and switchyard will be constructed at the same time as the solar array. After foundations and grounding grids are installed, the substation equipment will be delivered and stored on the foundation until it is installed. Transmission line structures would be installed.

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 about 204 temporary construction jobs and four full-time operational jobs. The applicant will prioritize local, union construction craft employees to the greatest extent feasible consistent with other project constraints.

2.5 Restoration

After construction, the project area will be graded to natural contours (as necessary and possible). Soils will be de-compacted. Disturbed areas will be reseeded with native seed mixes in accordance with the project's vegetation management plan (VMP, **Appendix D**) and stormwater pollution prevention plan (SWPPP). Erosion control measures such as silt fences, hydro-mulch, and sediment control logs, will be used until seeded vegetation has established. Additionally, a cover crop will be planted to prevent erosion during the time it takes for native seeds to establish. The applicant indicates that post-construction clean-up and restoration will take two to four months.

In accordance with the VMP, the project will use adaptive management to establish and manage vegetation at the site. Mowing, grazing, and selective use of herbicides are possible management strategies. Regular monitoring will be conducted to guide vegetation management.

2.6 Operation and Maintenance

The estimated service life of the project is 30 to 35 years. Project maintenance will include inspection of electrical equipment, vegetation management, and snow removal along access roads as needed. The electrical performance of the project will be monitored in real-time by a SCADA system. The SCADA system allows for early notification of abnormal operations, which facilitates prompt maintenance and repair.

2.7 Repowering and Decommissioning

As the project progresses through its service life, the applicant indicates it may seek to repower the project with new, more efficient solar panels. Repowering with more efficient panels could result in a smaller project footprint or a project of the same size with a greater electrical capacity. The applicant indicates that it would obtain all federal, state, and local approvals for repowering including, if needed, a new site permit from the Commission.

If the project is not repowered, Hayward Solar will decommission the project by removing the project facilities. The applicant estimates that it will take about 40 weeks to decommission the project. Decommissioning would include removal of the solar arrays (panels, racking, and steel posts), inverters, fencing, access roads, lighting, the project substation, and the project O&M building. 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.

The applicant expects the project site being returned to agricultural use and 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.

The applicant will be responsible for all costs associated with decommissioning the project. The applicant will ensure funds are available to cover the costs of decommissioning if the applicant is unable to perform the decommissioning.

2.8 Project Costs

The total cost to construct the project is estimated to be $130 million (**Table 3**). Operating and maintenance costs are estimated to be about $2.2 million per year. The primary components of these costs are vegetation management, solar array cleaning, and inspections and maintenance.

Table 3 Project Costs

Project Component	Cost (dollars)
Solar Farm – Panels, Racking, Fencing, Access Roads, and Labor	$105 million
Generation Tie Line	$5 million
Project Development	$5 million
Interconnection	$10 million
Financing	$5 million
Total Costs	**$130 million**

Notes

[1] U.S. Energy Information Administration (October 7, 2019) *Solar Explained: Photovoltaics and Electricity*, retrieved from: https://www.eia.gov/energyexplained/solar/photovoltaics-and-electricity.php.

[2] Foundation Engineering Consultants, Inc. (2022) *Image*, retrieved from: https://www.foundeng.com/services/solar-farm-soils-report/.

Chapter 3 Regulatory Framework

This chapter discusses the approvals required from the Commission for the project—a CN and a site permit. The project will also require approvals from other state and federal agencies with permitting authority for actions related to the project.

3.1 Certificate of Need

Construction of a large energy facility in Minnesota requires a CN from the Commission.[1] The project, a solar energy generating system with a capacity of up to 150 MW, meets the definition of a large energy facility and, as a result, requires a CN. The applicant submitted a CN application to the Commission on May 5, 2021. The Commission accepted the application as complete, and directed the application be evaluated using the informal comment process.[2] The applicant amended its CN application on October 15, 2021.

Certificate of Need Criteria

The Commission must determine whether the proposed project is needed or if another project would be more appropriate for the state of Minnesota. Minnesota Rule 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, it will grant a CN for the project. The Commission's CN decision determines the type and size of the project. The CN decision does not determine the location of the project or appropriate site permit conditions; these matters are determined by the Commission's site permit.

The Commission could place conditions on the granting of a CN; likewise, it has discretion to approve the project as proposed or with modifications. If the Commission denies the CN, the project cannot be constructed. This would indicate that the Commission believes building the project is not in the best interest of Minnesota at this time.

The Commission must approve or deny a CN within 12 months of submission of a CN application but may extend this time for good cause.

3.2 Site Permit

In Minnesota, no person may construct a large electric power generating plant without a site permit from the Commission.[3] A large electric power generating plant is defined as a facility capable of operating at a capacity of 50 MW or more. Because the project will be capable of operating at a capacity up to 150 MW, it requires a site permit from the Commission. Projects powered by solar energy qualify for Commission review under the alternative permitting process described in Minnesota Statute 216E.04.

The applicant submitted a site permit application to the Commission on May 5, 2021. The Commission accepted the application as complete and authorized the Department to conduct environmental review jointly with the CN application.[4] The Commission referred the matter to the OAH for a public hearing, to be conducted jointly with the hearing for the CN application after the environmental document is available.[5] The applicant amended its site permit application on October 15, 2021.

Site Permit Criteria

The Commission is charged with selecting large electric power plant sites that minimize adverse human and environmental impacts while ensuring electric power system reliability and integrity.[6] Site permits issued by the Commission include the permitted location of the project and conditions to mitigate construction and operational impacts. The Commission's sample permit template is included in **Appendix B**.

Minnesota Statute 216E.03 identifies issues the Commission must consider when designating large electric power plant sites. These include minimizing impacts to human settlements and the environment, as well as other land-use conflicts. Minnesota Rule 7850.4100 lists 14 factors for the Commission to consider when making a decision on a site permit. These factors are discussed in Chapter 1.4.

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. The Commission is charged with making a final decision on a site permit within six months after finding the site permit application is complete but may extend this time for good cause.

3.3 Environmental Review

The Minnesota Environmental Policy Act requires that state agencies and local units of government, prior to authorizing a project, conduct an environmental review so that agencies and governments can make informed decisions with respect to the human and environmental impacts of the project.[7]

For solar electric power generating plants, the environmental review document required is an EA.[8] EERA staff prepares the EA on behalf of the Commission. An EA describes the potential human and environmental impacts of a proposed project and possible mitigation measures. It does not advocate or state a preference for a specific project. It may recommend specific mitigation measures. The EA analyzes and describes potential impacts and mitigation measures so that citizens, agencies, and governments can work from a common set of facts.

When there are two applications before the Commission for an electric power generating plant—a CN and a site permit application—the environmental reviews required for each application may be combined. For this project, the Commission has authorized EERA staff to combine the environmental reviews required for the CN and site permit. Thus, the Department developed a combined EA—an EA that addresses both the CN and site permit applications.

3.3.1 Environmental Assessment

The first step in preparing an EA is scoping. The purpose of scoping is to provide citizens, local governments, tribal governments, and agencies an opportunity to focus the EA on those issues and alternatives that are most relevant to the proposed project.

Commission and EERA staff held an in-person public information and environmental assessment scoping meeting on August 11, 2021, in the city of Albert Lea. The following evening, August 12, 2021, Commission and EERA staff held a virtual public meeting. Approximately 25 people attended the in-person meeting and nine people attended the virtual meeting. Comments were received from four individuals at these meetings.

A written comment period, closing on August 26, 2021, provided the public an opportunity to submit comments to Department staff on potential impacts and mitigation measures for consideration in the scope of the EA. Comments were received from three state agencies, one local unit of government, one labor union, and five citizens.

The Department issued a scoping decision for the EA on November 30, 2021 (**Appendix A**). The scoping decision identified the issues to be evaluated in this EA. Staff provided notice of the scoping decision to those persons on the Commission's service list. Based on the scoping decision, EERA staff has prepared this EA.

3.3.2 Public Hearing

After the EA is issued, an ALJ will conduct an in-person and a virtual public hearing for the project. The in-person hearing will be held in the project area. At either hearing, interested persons will have an opportunity to ask questions, provide comments, and advocate for mitigation measures they believe are appropriate for the project. After the hearing comment period closes, the ALJ will provide the Commission with a report 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 recommendations regarding a CN and site permit for the project.

3.4 Commission Decision

The record developed during the environmental review process—including public input received during the public hearing and comment period—will be considered by the Commission when it makes its decision. The Commission may grant a CN for the project as proposed, grant a CN contingent upon modifications to the project, or deny the CN. The Commission may also place conditions on the granting of a CN. If a CN is granted, the Commission will then decide whether to issue a site permit. Site permits define the location of the project and include conditions specifying mitigation measures.

3.5 Other Permits and Approvals

A site permit from the Commission is the only state permit required for siting the project (that is, the Commission's site permit determines where the project will be located). A site permit supersedes local planning and zoning and binds state agencies; therefore, state agencies are required to participate in the Commission's permitting process to aid the Commission's decision-making and to indicate sites that are not permittable.[9]

However, various federal, tribal, state, and local approvals may be required for activities related to the construction and operation of the project. All subsequent permits 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 to evaluate impacts to resources. **Table 4** lists permits and approvals that could be required for the project, depending on the final design.

3.5.1 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.

3.5.2 State Approvals

Like 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 one acre or more of land. The general NPDES/SDS permit requires 1) use of best management practices, 2) a stormwater pollution prevention plan (SWPPP), and 3) adequate stormwater treatment capacity once the project is constructed. The NPDES/SDS permit ensures that state water quality standards are not compromised.

Table 4 Potential Permits

Unit of Government	Type of Application	Purpose
Federal		
Environmental Protection Agency	Spill Prevention, Control, and Countermeasures Plan	Response plan to respond to a worst-case oil discharge or threat of a discharge
U.S. Army Corps of Engineers	Section 404 Clean Water Act – Dredge and Fill	Protects water quality by controlling discharges of dredged and fill material
	Section 10 – Rivers and Harbor Act	Protects water quality by controlling crossings of navigable waters
U.S. Fish and Wildlife Service	Threatened and Endangered Species Consultation	Consultation to mitigate impacts to federally-listed species
Tribal		
American Indian Tribes	National Historic Preservation Act Section 106 Coordination	Coordination to prevent impacts to traditional cultural properties
State		
Department of Natural Resources	State Threatened and Endangered Species Consultation	Consultation to mitigate impacts to state-listed species
	Water Appropriation Permit	To balance competing management objectives
Pollution Control Agency	Construction Stormwater Permit	Minimizes temporary and permanent impacts from stormwater
	Section 401 Clean Water Act – Water Quality Certification	Ensures project will comply with state water quality standards
State Historic Preservation Office	National Historic Preservation Act Section 106 Consultation	Ensures adequate consideration of impacts to significant cultural resources
Department of Agriculture	Agricultural Impact Mitigation Plan	Establishes measures for protection of agricultural resources
Department of Labor and Industry	Electrical Inspection	Necessary to comply with electric codes.
Department of Transportation	Utility Permit	Controls utilities being placed along highway rights-of-way
	Driveway Access	Controls access to driveways along highways
	Oversize/Overweight Permit	Controls use of roads for oversize or overweight vehicles
Department of Health	Well Notification	Needed to install a water-supply well
Board of Water and Soil Resources	Wetland Conservation Act	Coordination with BWSR and Freeborn County to ensure conservation of wetlands

Unit of Government	Type of Application	Purpose
Local		
Freeborn County	Building Permit	Needed for new construction in Freeborn County
	Septic Permit	Needed prior to installation of a septic system
	Utility Permit	Needed to construct or maintain electrical lines along or across county highway right-of-way
Freeborn County/ Local Governments	Road Crossing, Driveway, Oversize or Overweight, and Land Permits	Ensures proper use of local roads and lands

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 through literature review and field survey. SHPO requires mitigation measures 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 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. 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.

The Minnesota Board of Water and Soil Resources (BWSR) oversees implementation of the Minnesota 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 (1) try to avoid the impact, (2) try to minimize any unavoidable impacts, and (3) replace any lost wetland functions.

3.5.3 Local Approvals

The Commission's site permit supersedes 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 permit, for example, approvals for the safe use of local roads.

3.6 Electric Safety Codes

The project must meet the requirements of the National Electrical Safety Code (NESC). Utilities 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.[10]

The NESC is designed to protect human health and the environment. It also ensures that 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.

Notes

1 Minnesota Statute 216B.243.

2 Public Utilities Commission (June 29, 2021) *Certificate of Need Application Completeness Order*, eDockets No. 20216-175528-01.

3 Minn. Stat. 216E.03, subd. 1.

4 Public Utilities Commission (June 29, 2021) *Site Permit Application Completeness Order*, eDockets No. 20216-175529-01.

5 *Ibid*.

6 Minn. Stat. 216E.02.

7 Minn. Stat. 116D.04.

8 Minn. Stat. 216E.04, subdivision 2.

9 Minn. Stat. 216E.10.

10 Minnesota Statute 326B.35.

Chapter 4 Potential Impacts and Mitigation

This chapter describes the environmental setting, affected resources, and potential impacts. It also discusses ways to mitigate potential impacts.

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.

This EA analyzes potential impacts of the project on various resources. Impacts are given context through discussion of their duration, size, intensity, and location. This context is used to determine an overall resource impact level. Impact levels are described using qualitative descriptors, 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 ways to mitigate potential impacts by avoiding, minimizing, or correcting an on-the-ground impact. 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.

4.1.1 Regions of Influence

Potential impacts to human and environmental resources are analyzed within specific geographic areas known as regions of influence (ROI). The ROI for each resource is the geographic area where the project might exert some influence (**Table 5**). It is used in this EA 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. This EA uses the following ROIs:

Land Control Area The land control area is the fenced area containing the solar panels and includes the project substation. Most of the potential impacts of the project will occur in this area.

Project Vicinity The project vicinity is the area within 1,600 feet of the land control area.

Project Area The project area is the area within 1 mile of the land control area.

County Freeborn County is the ROI for certain impacts, including socioeconomic impacts.

Table 5 Regions of Influence

Siting Factor	Resource Element	Region of Influence
A. Human Settlements	Displacement, Electronic Interference, Land Use and Zoning	Land Control Area
	Aesthetics, Noise, Property Values, Electronic Interference	Project Vicinity
	Cultural Values, Recreation, Public Services	Project Area
	Socioeconomics	County
B. Public Health and Safety	Electric and Magnetic Fields, Implantable Medical Devices, Worker and Public Safety	Land Control Area
C. Land-based Economies	Agriculture, Forestry, Mining	Land Control Area
	Tourism	Project Area
D. Archaeological and Historic Resources	—	Project Area
E. Natural Environment	Habitat, Ground Water, Surface Water, Soils, Vegetation, Wildlife	Land Control Area
	Air Quality and Climate Change	Freeborn County
F. Rare and Unique Species	—	Project Area

4.2 Environmental Setting

The project area is rural open space. Agricultural row crop fields are present throughout the project area, as are farmsteads and homesteads.

The project is proposed in Hayward Township in Freeborn County, Minnesota. It is about two miles east of the city of Hayward (**Figure 1**). The project is bounded on its northern edge by I-90, a rail line, and a 161 kV transmission line. Local roads run throughout the project area. A natural gas pipeline and an oil pipeline run through the project area northwest to southeast. Farmsteads are scattered throughout the project area.

The project is located on about 1,960 acres of relatively flat, agricultural land. Row crops (corn and soybeans) are grown on about 96 percent of the land. Some of the land is tiled to facilitate drainage. Prior to European settlement, the area was primarily oak savanna and tallgrass prairie. Few remnants of pre-settlement vegetation remain. Other than agricultural ditches, water resources are uncommon in the project area. Peter Lund Creek is about one mile southwest of the project area. Albert Lea Lake is about three miles west of the project area.

4.3 Effects on Human Settlement

Solar farms have the potential to impact human settlement in a variety of ways. A solar farm could change the aesthetics of the project area, introduce new noise sources, and affect property values. Impacts could be short term, for example, construction noise, or long term, for example, changes to the aesthetics in the project area.

4.3.1 Aesthetics

The ROI for aesthetics is the project vicinity. Visual impacts are subjective. Thus, potential impacts are unique to the individual and can vary widely. Visual impacts are expected to be minimal for those with low viewer sensitivity, such as people traveling near the project on I-90. For those with high viewer sensitivity, for example, neighboring landowners, visual impacts are anticipated to be moderate to significant. Potential impacts might dissipate over time depending on the individual. Impacts will be short- and long-term, and localized. Aesthetic impacts are unavoidable but can be mitigated by screening, preserving natural landscapes, and by using shielded lighting.

Aesthetics refers to the visual quality of an area as perceived by the viewer and forms the impression a viewer has of an area. Aesthetics are subjective, meaning their relative value depends upon the perception and philosophical or psychological responses unique to individuals. Impacts to aesthetics are equally subjective and depend upon the sensitivity and exposure of an individual. How an individual values aesthetics, as well as perceived impacts to a viewshed, can vary greatly.

A viewshed includes the natural landscape and built features visible from a specific location. Natural landscapes can include wetlands, surface waters, distinctive landforms, and vegetation patterns. Homes, businesses, roads, bridges, cell towers, and power lines are examples of built features. Generally, an intact and harmonious viewshed is considered by many to be more aesthetically pleasing. Viewsheds might be important regardless of whether they are considered beautiful by the observer, for example, a scattered stone foundation of a historical resource.

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. High viewer sensitivity is generally associated with individuals engaged in recreational activities; traveling to scenic sites for pleasure and to or from recreational, protected, natural, cultural, or historic areas; or experiencing viewsheds from resorts, road-side pull-outs, or residences. Residents have a higher sensitivity to potential aesthetic impacts than temporary observers. Low viewer sensitivity is generally associated with individuals commuting, working, or passing through an area.

Viewer exposure refers to variables associated with observing a viewshed, and can include the number of viewers, frequency and duration of views, and view location. Viewer exposure would typically be highest for views experienced by high numbers of people, frequently, and for long periods. These variables, as well as other factors such as viewing angle or time of day, all affect the aesthetic impact.

The existing landscape in the project is area is rural and agricultural consisting of flat to gently rolling row crop fields of corn and soybeans. The built environment includes roads (including I-90), a rail line, and a transmission line. Residences and farmstead are scattered throughout the project area. There are 11 residences within the project vicinity. A *Kampgrounds of America* (KOA) campground is located just north of I-90 and the project.

Potential Impacts

For residents in the project vicinity and for others with high viewer sensitivity traveling on local roads in the project vicinity, aesthetic impacts are anticipated to be moderate to significant. Current fields of corn and soybeans will be replaced with acres of solar panels. At 15 feet tall at maximum tilt, panels will have a relatively low profile. This low profile will limit the extent of aesthetic impacts. Further, solar panels are constructed of dark, light-absorbing material and covered with an anti-reflective coating to limit reflection. Because of this, glare and reflection are expected to be minor.

In addition to the visual change, the project will also introduce a temporal change that has aesthetic implications. Current agricultural production has a definitive pattern, for example, planting, crop growth, harvesting, cover crop planting, and field rest. Activities at a solar farm do not change over the year. The panels will rotate daily to follow the sun. Vegetation under the panels will be perennial and limited, sporadic maintenance activities will occur.

How an individual viewer perceives the change from a field of corn to a field of solar panels depends, in part, on how a viewer perceives solar panels. Will the viewer consider the harvesting of solar energy to be like harvesting crops or will the viewer see an agricultural use be replaced by an industrial use?

For residents outside the project vicinity and for others with low viewer sensitivity, such as travelers on I-90, aesthetic impacts are anticipated to be minimal. For these viewers, the solar panels would be relatively difficult to see or would be visible for a very short period. For all residents and viewers, the aesthetic impacts of the project substation, switchyard, and transmission line are anticipated to be minimal. The substation and switchyard are relatively low-profile and are situated next to a rail line and I-90.

Mitigation

The primary strategy for minimizing aesthetic impacts is prudent siting, that is, selecting a site where solar panels would be, to the extent possible, harmonious with the existing landscape. Aesthetic impacts can also be minimized by siting a solar farm away from residences and other viewers.

Aesthetic impacts can be mitigated by screening such as vegetative tree rows, berms, or fences. Vegetative screening would be most effective in select lines of sight and if the vegetation was coniferous and functional year-round. Aesthetic impacts can be further mitigated by ensuring that damage to natural landscapes during construction is minimized.

The applicant indicates that lighting at the project will be minimal and will be used primarily for repair or maintenance work. The project substation and O&M building will have security lighting, and project entrances will have motion activated down lit security lights. Aesthetic impacts due to lighting can be minimized by using lighting that provides only downward illumination (shielded lighting) at all locations where lighting is required.

4.3.2 Cultural Values

The ROI for cultural values is the project area. Impacts associated with rural character and sense of place are expected to be dependent on the individual. Tension between renewable energy and rural character has the potential to influence cultural values over time. Negative impacts to community unity are not expected to occur. The project is not expected to impact the work and leisure pursuits of residents in the project area or land use in such a way as to impact the cultural values of the area. Impacts are anticipated to be long-term, but minimal. Impacts are unavoidable.

Cultural values can be described as shared community beliefs or attitudes that define what is collectively important to the group. These values provide a framework for individual and community thought and action. Infrastructure projects believed inconsistent with these values can deteriorate community character. Those found consistent with these values can strengthen it. Projects often invoke varying reactions and can, at times, weaken community unity.

Individual and community-based renewable energy is becoming more valued across the nation. Utility scale renewable projects—generally located far from load centers in rural areas—are also valued, but, at times, opposed by residents. The highly visible, industrial look and feel of these projects can erode the rural feeling that is part of a residents' sense of place.

Cultural values can be informed, in part, by ethnic heritage. Residents of Freeborn County derive primarily from European ancestry. Cultural values are also informed by work and leisure pursuits, for example, farming and fishing, as well as land use, such as agricultural cropland. Community events in the county are usually tied to geographic features, seasonal/municipal events, and national holidays.

Potential Impacts

Impacts to cultural values are not anticipated. The project is not expected to impact the work and leisure pursuits of residents in the project area or land use in such a way as to impact the cultural values of the area.

The project contributes to the growth of renewable energy and is likely to strengthen and reinforce this value in the area, should it currently exist. Should it not currently exist, it might foster this value. At the same time, the development of the project will change the character of the area. 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.

Mitigation

No impacts to cultural values are anticipated; thus, no mitigation is proposed.

4.3.3 Environmental Justice

The ROI for environmental justice includes the census tract intersected by the project. A meaningfully greater low-income or minority population does not reside in this census tract. Therefore, disproportionate and adverse impacts to these populations are not expected. Mitigation is not proposed.

Environmental justice (EJ) refers to 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.[1]

Potential Impacts

The ROI for this analysis includes the census tracts intersected by the project. This census tract is the best approximation of the geographic area within which potential disproportionate adverse impacts from the project could occur. Freeborn County, which contains this census tract, is considered representative of the general population in the project area against which census tract poverty and demographic data can be compared.

Staff conducted a demographic assessment of the affected community to identify low-income and minority populations that might be present. U.S. Census data was used to identify low-income and minority populations. Low-income and minority populations are determined to be present in an area when the low-income percentage or minority 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 6 lists the percentage of individuals living below the poverty level and household income. It also lists the percentage of those persons who did not self-identify as non-Hispanic white alone. Information about Minnesota is provided for context.

Table 6 Low-Income and Minority Population Characteristics

Area	% Below Poverty	Median Household Income ($)	% Minority**
Minnesota	10.13	68,411	19.71
Freeborn County	12.25	52,447	14.25
Census Tract 1810	5.29	55,351	2.61

The low-income and minority populations in the ROI census tract, represented by the percentage living in poverty and those not self-identifying as non-Hispanic white alone, were compared with the Freeborn County to determine if any were greater than 50 percent or 10 percentage points or more. None of the percentages for the census tract exceed 50 percent or the Freeborn County percentage by 10 percentage points or more, which is the defined threshold of significance for potential environmental justice impacts from the project.

Mitigation

A meaningfully greater low-income or minority population does not reside in the project area; therefore, disproportionate and adverse impacts to these populations are not expected. Mitigation is not proposed.

4.3.4 Land Use and Zoning

The ROI for land use and zoning is the land control area. The impact intensity level is anticipated to be minimal. Potential impacts to zoning are anticipated to be long-term and localized. Constructing the project will change land use from agricultural to industrial for at least 30 years. After the project's useful life, the land control area could be restored to agricultural or other planned land uses by implementing appropriate restoration measures, making the project compatible with the county's interest in preserving agricultural land. Impacts can be minimized.

Land use is the use of land by humans, such as residential, commercial, or agricultural uses, and often refers to zoning. Zoning is a regulatory tool used by local governments to promote or restrict certain land uses within specific geographic areas. Solar farms may impede current and future land use.

A site permit from the Commission supersedes local zoning, building, or land use rules.[2] Though zoning and land use rules are superseded, the Commission's site permit decision must be guided, in part, by consideration of impacts to local zoning and land use in accordance with the legislative goal to "minimize human settlement and other land use conflicts."[3]

Land use in the project area is agricultural. Over 96 percent of the land in the project is dedicated to row crops, for example, corn and soybeans.[4] The project area is zoned agricultural.[5] Per the Freeborn County Code of Ordinances, the purpose of the Agricultural District is to:

> Provide a district which will allow suitable areas of the county to be retained in agricultural use; regulate scattered non-farm development; regulate wetlands and woodlands, which,

> because of their unique physical features, provide a valuable natural resource; and secure economy in governmental expenditures for public services, utilities, and schools.[6]

Freeborn County has adopted a renewable energy ordinance that allows for large solar energy systems (solar farms) within agricultural districts as a permitted or conditional use.[7] The applicant points out that this ordinance is preempted by the Commission's authority. The applicant indicates that it worked with Freeborn County to develop the project and has applied Freeborn County's standards to the project to the extent feasible.[8]

Potential Impacts

The ROI for land use and zoning is the land control area. Constructing the project will change land use from agricultural to industrial for at least 30 years. During this time, the project may or may not be considered compatible with county zoning ordinances—it depends on one's perspective. Individuals might believe the project is compatible with local zoning because it furthers the county's goals of preserving agricultural land and providing long-term agricultural opportunities to residents. However, the project will remove agricultural land from production, which could be interpreted as being incompatible with the county's zoning.

After the project's useful life, the land control area could be restored to agricultural or other planned land uses by implementing appropriate restoration measures. The applicant has indicated that the project will be decommissioned such that agricultural activities can resume once decommissioning has been completed.[9] Assuming this occurs, the project appears compatible with county zoning and its goal to preserve agricultural land.

Mitigation

The primary means to ensure the project is compatible with county zoning is to ensure that the project preserves agricultural land. Preservation can occur at all phases of the project's life:

- Construction: Agricultural Impact Mitigation Plan (AIMP)
- Operation: Vegetation Management Plan (VMP)
- Decommissioning: Decommissioning Plan

The applicant has worked with the Minnesota Department of Agriculture (MDA) to prepare an AIMP for the project (**Appendix C**).[10] The AIMP is designed to prevent impacts to soil health and productivity. The applicant has also prepared a VMP in coordination with MDA, EERA, DNR and BWSR (**Appendix D**).[11] The VMP helps to prevent soil erosion and invests in soil health by establishing a plan to protect soil resources by ensuring perennial cover. Finally, the applicant has prepared a decommissioning plan focused on returning the project area to agricultural production.[12]

Impacts to county zoning can be mitigated by ensuring the project is consistent, to the greatest extent practicable, with the county's renewable energy ordinance. The applicant notes that the project meets or exceeds all county setback requirements for renewable energy facilities.[13] Lastly, landscaping can minimize visual impacts to adjacent land uses. Specific landscaping techniques are suggested to minimize aesthetic impacts (Chapter 4.3.1). No additional mitigation is proposed.

4.3.5 Noise

The ROI for noise is the project vicinity. Distinct noises are associated with the different phases of project construction. These impacts will be temporary and intermittent and range from negligible to significant depending on the construction equipment used and the location of the listener. Impacts to state noise standards can be mitigated by timing restrictions, that is, limiting the duration of certain construction activities. Noise impacts during operation are anticipated to be negligible to minimal.

Noise can be defined as any undesired sound.[14] It is measured in units of decibels on a logarithmic scale. The A-weighted scale (dBA) is used to duplicate the sensitivity of the human ear.[15] A three dBA change in sound is barely detectable to average human hearing, whereas a five dBA change is clearly noticeable. A 10 dBA change is perceived as a sound doubling in loudness. Noise perception is dependent on many factors: wind speed, wind direction, humidity, and natural and built features between the noise source and the listener. **Table 7** provides decibel levels for common indoor and outdoor activities.

Table 7 Common Sound Levels

Sound Pressure Level (dBA)	Typical Sources
140	Jet engine at 80 feet
130	Jet engine at 400 feet
120	Rock concert
110	Pneumatic chipper
100	Jackhammer at 3 feet
90	Chainsaw at 3 feet
80	Heavy truck traffic
70	Business office
60	Conversational speech
50	Library
40	Bedroom at night
30	Secluded woods
20	Whisper
0	Perception of human hearing

Source: MPCA

Because sounds levels are measured on a logarithmic scale, they are not directly additive. "A doubling of sound energy yields an increase of three decibels."[16] For example, if a sound level of 50 dBA is added to another sound level of 50 dBA, the total sound level is 53 dBA, not 100 dBA. This change in sound level (three dBA) would be barely detectible.

All noises produced by the project must be within state noise standards (**Table 8**). Noise standards in Minnesota are based on noise area classifications (NAC) that correspond to the location of the listener—referred to as a receptor. These classifications are not necessarily synonymous with zoning classifications. NACs are assigned to areas based on the type of land use activity occurring at that location.

Noise standards are expressed as a range of permissible dBA over a one-hour period. L_{10} may be exceeded 10 percent of the time, or six minutes per hour, while L_{50} may be exceeded 50 percent of the time, or 30 minutes per hour. Standards vary between daytime and nighttime hours. There is no limit to the maximum loudness of a noise.[17]

Table 8 Noise Standards

Noise Area Classification	Daytime (7:00 a.m. to 10:00 p.m.)		Nighttime (10:00 p.m. to 7:00 a.m.)	
	L_{10}	L_{50}	L_{10}	L_{50}
1	65	60	55	50
2	70	65	70	65
3	80	75	80	75

Source: MPCA

The MPCA noise standards are public health standards. That is, they protect people from noise generated by all sources at a specific time and place. The total sum of noise at a specific time and location cannot exceed the standards. The MPCA evaluates whether a specific noise source is in violation by determining if the source causes or significantly contributes to a violation of the standards.

Potential Impacts

The ROI for noise is the project vicinity (1,600 feet). The primary noise receptors are the 11 local residences and the KOA campground to the north of I-90. Residences and the campground are in NAC 1. Noise receptors could also include individuals working outside in the project vicinity. Ambient noise levels in the project area are generally in the range of 30 to 60 dBA.[18] Potential noise impacts from the project are associated with construction noise and operational noise.

Construction Distinct noise impacts during construction are anticipated to be minimal to significant depending on the activity occurring and equipment being used. Construction noise impacts will be temporary, localized, and intermittent.

Major noise producing activities related to installation of the solar arrays are associated with clearing and grading, material delivery, and driving foundation posts. Noise associated with grading equipment ranges between 76 and 85 dBA at 50 feet from the source.[19] Grading equipment will be used during initial site preparation; this phase of construction will last 8 to 12 weeks.[20]

Point source sounds, like construction equipment, decrease by six decibels for every doubling in distance.[21] The closest residences in the project area are about 750 feet from solar arrays.[22] Thus, noise impacts from grading should be within daytime state noise standards. This does not mean that noise impacts will not occur; residents and others in the project area will be able to hear grading equipment. These noises could be disruptive.

Driving foundation posts will be the loudest construction activity (101 dBA at 50 feet).[23] Approximately 60,000 posts will be needed. Installation of each post will take between 30 seconds to two minutes, depending on the soil conditions, and driving all posts will take three to five months to complete.[24] This activity would exceed state L_{10} noise standards to 3,200 feet from the source because a 101 dBA sound at 50 feet is perceived as a 65 dBA at 3,200 feet. Thus, this construction noise would exceed state noise standards at select times and locations. Exceedances would be short-term and confined to daytime hours. Even without an exceedance, noise impacts will occur. Rhythmic pounding of foundations posts, even if the concomitant noise is within state standards, would be disruptive.

Other construction activities, for example, installation of solar panels, are anticipated to have minimal noise impacts. A forklift is typically used to place solar panels on the racking system.[25] Construction activities will be sequenced, that is, site grading may occur at one location while posting driving occurs at another location while racking and panel assembly might occur at another location, at the same time.[26]

Operation Operational noise impacts are anticipated to be minimal. Noises will be produced by the project's inverters and substation. Noise levels from these sources are estimated to be 45 dBA at 129 feet for the inverters and 97 feet for the substation.[27] The distance to the nearest residence is over 1,000 feet for the inverters and 500 feet for the substation and switchyard.[28] Thus, operational

noise levels will be within state noise standards. This does not mean that minor noise impacts will not occur. A person standing outside in the project vicinity during periods of low background noise might be able to discern some portion of the humming noise created by the project's inverters, substation, or switchyard.

Noise from routine maintenance activities is anticipated to be minimal. Noise from the electrical collection system, including collection lines, the gen-tie line, and the transmission line is not anticipated to be perceptible.

Mitigation

Sound control devices on vehicles and equipment, for example, mufflers; conducting construction activities during daylight hours, and, to the greatest extent possible, during normal business hours; and running vehicles and equipment only when necessary are common ways to mitigate noise impacts. Impacts to state noise standards can be mitigated by timing restrictions, that is, limiting the duration of certain construction activities. The Commission's sample permit (**Appendix B**) requires that "construction and maintenance activities shall be limited to daytime working hours to the extent practicable to ensure nighttime noise level standards will not be exceeded."[29]

4.3.6 Property Values

The ROI for property values is the project vicinity. A property's value is influenced by a complex interaction of factors. The presence of a HVTL or substation becomes one of these factors. On whole, impacts to property values are anticipated to be minimal and to decrease with distance and over time. Impacts to a specific property's value are difficult to determine. Because of this uncertainty, impacts to specific properties could be minimal to moderate.

Impacts to property values can be measured in three ways: sale price, sales volume, and marketing time. These measures are influenced by a complex interaction of factors. Many of these factors are parcel specific, and can include condition, size, acreage, improvements, and neighborhood characteristics; the proximity to schools, parks, and other amenities; and the presence of existing infrastructure, for example, highways or transmission lines. In addition to property-specific factors, local and national market trends, as well as interest rates, can affect all three measures. The presence of a solar farm becomes one of many interacting factors that could affect a specific property's value.

Electrical generating facilities can impact property values. Often, negative effects result from impacts that extend beyond the project location. Examples include emissions, noise, and visual impacts. Unlike fossil-fueled electric generating facilities, the project would not generate emissions. Potential impacts from operational noise are not anticipated. Aesthetic impacts will occur, but because the project is relatively short – as compared to a wind turbine or a smokestack – impacts would be limited in geographic scope.

A review of the literature did not identify peer-reviewed journal articles that addressed impacts to property values based on proximity to utility-scale, photovoltaic (PV) solar farms. However, comparably sized PV solar farms exist in Minnesota, and limited sales information is available.

The 100 MW North Star Solar project is located in Chisago County. It covers 800 acres. Chisago County found that between January 2016 and October 2017, the median ratio between sales price and assessed value of homes near the North Star project was 87.8 percent—this includes properties

surrounded by the solar array. This ratio is comparable with Sunrise and North Branch Townships, which had median ratios of 88.2 percent and 85.6 percent, respectively.[30] This means that house sale prices exceeded assessed values near the solar farm at a rate comparable to the general real estate market in the area.

Potential Impacts

Impacts to property values are anticipated to be minimal and to decrease with distance from the project and with time. Aesthetic impacts that might affect property values would be limited to residences and parcels in the project vicinity where the solar panels are easily visible. Impacts to a specific property's value are difficult to determine. Because of this uncertainty, impacts to specific properties could be minimal to moderate.

Note: Every landowner has a unique relationship and sense of value associated with their property. Thus, a landowner's assessment of potential impacts to their property's value is often a deeply personal comparison of the property "before" and "after" a proposed project is constructed. These judgments, however, do not necessarily influence the market value of a property. Rather, appraisers assess a property's value by looking at the property "after" a project is constructed. Moreover, potential market participants likely see the property independent of the changes brought about by a project; therefore, they do not take the "before" and "after" into account the same way a current landowner might. Staff acknowledges this section does not and cannot consider or address the fear and anxiety felt by landowners when facing the potential for negative impacts to their property's value.[31]

Mitigation

Impacts to property values can be mitigated by reducing aesthetic impacts. Impacts can also be mitigated through inclusion of specific conditions in individual land use agreements with landowners.

4.3.7 Public Services

The ROI for public services is the project area. Potential impacts to the electrical grid, roads and railroads, and other utilities are anticipated to be short-term, intermittent, and localized during construction. Impacts to water (wells and septic systems) are not expected to occur. Impacts to pipelines in the project area could be significant if proper coordination and mitigation are not used. Overall, construction-related impacts are expected to be minimal, and are associated with short electrical outages and possible traffic delays. During operation, negligible traffic increases would occur for maintenance. Impacts are unavoidable but can be minimized.

Large energy projects can impact public services, such as buried utilities or 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.

Public services are services provided by a governmental entity or by a regulated private entity to provide for public health, safety, and welfare. Electricity in the project area is provided by the Freeborn Mower Electric Cooperative. There are two high voltage transmission lines in the project area: (1) the Hayward – Murphy Creek 161 kV line, which runs along I-90 and the northern edge of the project area, and (2) the ITC Midwest LLC 161 kV line, which runs through the southern part of the project area.

Water in the project area is provided by private wells, and wastewater is managed by septic systems. Telephone and internet service is provided by many companies. There are two pipelines that run through the project area—the Pembina Cochin oil pipeline and the Alliance natural gas pipeline. The pipelines run parallel to each other, roughly in a northwest to southeast direction (**Figure 1**). There are several roads in the project area. Interstate 90 is located on the northern edge of the project area. County Road 102 (830th Avenue) and County Road 30 (850th Avenue) run along the west and east boundaries, respectively, of the land control area. County Road 20 (200th Street) runs through the land control area.

Freeborn County provides police services in the project area. The Hayward volunteer fire department provides fire and first responder medical services.

Potential Impacts

Impacts to public services because of the project are anticipated to be minimal. Impacts that do occur are anticipated to be temporary. Delivery of project materials might cause minor traffic delays. Additionally, delays might be caused by construction worker traffic or slow-moving construction equipment.

Electrical interconnection of the project may require a brief, scheduled electric outage. Any outage would be coordinated with the interconnecting utility (SMMPA) and communicated to electric customers in the project area.

Impacts to the oil and gas pipelines that cross the project could be significant if proper coordination and mitigation are not employed. As part of the project design, underground electric collection lines are planned to cross underneath these existing pipelines. The applicant indicates that it will coordinate with the pipeline companies to avoid impacting the pipelines.

During construction, localized traffic delays could interrupt or delay traffic, including emergency vehicles. These impacts, should they occur, would be intermittent, temporary, and short-term.

Mitigation

Impacts to roads can be mitigated by coordinating with local road authorities. The applicant indicates that it is working with the county on a road use agreement to address road use concerns. Impacts can also be mitigated by proper timing of personnel, equipment, and material movement to avoid roadblocks and delays.

Impacts to the existing oil and natural gas pipelines and electrical infrastructure that cross the project can be mitigated by appropriate coordination. The applicant indicates that it will enter into agreements that ensure the safety of the pipelines. Keeping a proper clearance between the pipelines and the project's collection lines and crossing at an angle close to 90 degrees are basic safety guidelines.

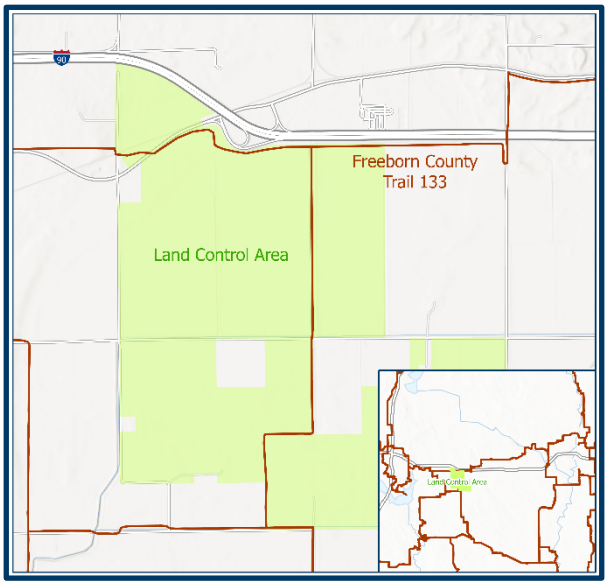
Notifying emergency responders of traffic interruptions can mitigate impacts to emergency response. Long-term impacts are not anticipated. No additional mitigation is proposed.

4.3.8 Recreation

The ROI for recreation is the project area. Because few recreational resources exist in the project area, potential impacts to these resources are anticipated to be minimal and temporary. Impacts to a snowmobile trail can be mitigated.

Impacts to recreation can be direct or indirect. Direct impacts are impacts that directly impede the use of a recreational resource, for example, closing of a trail to facilitate project construction. Indirect impacts reduce the enjoyment of a recreational resources but do not prevent use, for example, aesthetic impacts visible from a scenic overlook.

Figure 6 Local Snowmobile Trail



There are limited recreational resources in the project area. The two closest resources are a snowmobile trail—Freeborn County Trail 133—that passes through the project area, and the KOA campground on the extreme northeast side of the project, and to the north of I-90 (**Figures 6** and **7**). The snowmobile trail serves as an important east/west connector between Albert Lea and Austin. Other resources nearby but outside of the project area include Albert Lea Lake, the Blazing Star Trail, Juglan Woods Aquatic Management Area, and Myre-Big Island State Park. There are no state forests, national forests, or national wildlife refuges in the project area. There are no city or county parks in the project area.

Figure 7 KOA Campground

Potential Impacts

The ROI for recreation is the project vicinity. Impacts to recreation are anticipated to be minimal and temporary. Construction of the project may temporarily impact a snowmobile trail. The applicant has discussed re-route options with the local snowmobile association, and the association indicates it agrees with rerouting the trail to maintain its use.

Construction of the project will also temporarily impact the KOA campground. Construction noise will be audible at the campground and will reduce the enjoyment of this recreational resource. Given the campground is on the north side of I-90, potential impacts are anticipated to be minimal.

Impacts to recreation due to operation of the project are not anticipated.

Mitigation

Potential impacts to the snowmobile trail can be mitigated by a trail reroute and close coordination with trail operators. The Commission could require documentation of this coordination. Non-winter construction can also mitigate impacts. Noise impacts to the KOA campground can be mitigated by time-of-day or time-of-year restrictions for certain construction activities. For example, normal working hours could be delayed (moved later in the morning) or avoided entirely (holiday weekends). Various sections of the sample permit indirectly address impacts to recreation, such as noise, aesthetics, soils, etc. No additional mitigation is proposed.

4.3.9 Socioeconomics

The ROI for socioeconomics is Freeborn County. Socioeconomic impacts from the project are anticipated to be positive. Effects associated with construction will, overall, be short-term and minimal. Significant positive effects might occur for individuals. Impacts from operation will be long-term and significant. Adverse impacts are not anticipated.

The project is in Hayward Township—a rural township in Freeborn County. The nearest communities are the cities of Hayward (1.6 miles west), Albert Lea (6.5 miles west) and Austin (8 miles east). Freeborn County's economy is strongly based on agricultural products and services.[32] Other industries include manufacturing, health care, and retail trade.[33]

Freeborn County has economic characteristics similar to the state (**Table 9**). The county has a slightly larger minority population than the state as a whole and a lower median household income. Median household income in Hayward Township is greater than Freeborn County, but less that the state. The percentage of persons living below the poverty level in Hayward Township is less than both the county and the state.

Potential Impacts

The ROI for socioeconomics is the county. The impact intensity level is anticipated to be positive. Potential impacts associated with construction will be positive, but minimal and short-term. Significant positive effects might occur for individuals. Impacts from operation will be long-term, positive, and significant. The project will not disrupt local communities or businesses. Adverse impacts are not anticipated.

Construction of the project will increase local demand for food, lodging, fuel, and other supplies. Hayward Solar estimates that direct construction spending in Minnesota will be about $33.8 million with $15.8 million of that total in Freeborn County.[34] Construction of the project will create about

200 temporary jobs.[35] In total, these jobs will pay about $7.9 million in wages and benefits.[36] Hayward Solar indicates that it will use local, union construction employees to the greatest extent feasible.[37] It is difficult to predict how many jobs will be filled by local labor. Local contractors will likely be used for gravel, fill, and civil construction work.[38]

Table 9 Population and Economic Characteristics

Location	Total Population*	Percent Minority Population*	Median Household Income**	Percent Below Poverty**
Minnesota	5,303,925	17.91	$74,593	9.0
Freeborn County	30,895	18.85	$53,631	11.0
Hayward Township	339	7.08	$68,929	8.0

Sources:
*2020 Decennial Census
**2019 American Community Survey 5-Year Estimates

Operation of the project will create four permanent jobs in the project area.[39] Operation will also generate income for local landowners and governments. Landowners will receive lease and purchase payments for the land required for the project. Through taxes, the project will generate about $305,000 annually for Freeborn County and $76,000 annually for Hayward Township.[40]

Mitigation

Socioeconomic impacts are anticipated to be positive. Recent Commission site permits have required permittees to submit quarterly reports during project construction regarding their efforts to hire Minnesota workers. No additional mitigation is proposed.

4.4 Human Health and Safety

Construction and operation of a solar farm has the potential to impact human health and safety.

4.4.1 Electronic and Magnetic Fields

The ROI for EMF is the land control area. Impacts to human health from possible exposure to EMFs are not anticipated.

Electromagnetic fields (EMFs) are invisible forces that result from the presence of electricity. They occur naturally and are caused by weather or the geomagnetic field. They are also caused by all electrical devices and found wherever people use electricity. EMFs are characterized and distinguished by their frequency, that is, the rate at which the field changes direction each second. Electrical lines in the United States have a frequency of 60 cycles per second or 60 hertz, which is extremely low frequency EMF (ELF-EMF).

Voltage on a conductor creates an electric field that surrounds and extends from the wire. Using water moving through a pipe as an analogy, voltage is equivalent to the pressure of the water moving through the pipe. The strength of the electric field produced is associated with the voltage of the power line and is measured in kilovolts per meter (kV/m). The strength of an electric field

decreases rapidly as it travels from the conductor and is easily shielded or weakened by most objects and materials.

Current moving through a conductor creates a magnetic field that surrounds and extends from the wire. Using the same analogy, current is equivalent to the amount of water moving through the pipe. The strength of a magnetic field produced is associated with the current moving through the power line and is measured in milliGauss (mG). Like electric fields, the strength of a magnetic field decreases rapidly as the distance from the source increases; however, unlike electric fields, magnetic fields are not easily shielded or weakened.

"The strongest . . . electric fields that are ordinarily encountered in the environment exist beneath high voltage transmission lines. In contrast, the strongest magnetic fields . . . are normally found very close to motors and other electrical appliances, as well as in specialized equipment…."[41] **Table 10** provides examples of electric and magnetic fields associated with common household items.

Table 10 Electric and Magnetic Field Strength of Common Household Items

Electric Field*		Magnetic Field**			
Appliance	kV/m	Appliance	mG		
	1 foot		1 inch	1 foot	3 feet
Stereo	0.18	Circular saw	2,100 to 10,000	9 to 210	0.2 to 10
Iron	0.12	Drill	4,000 to 8,000	22 to 31	0.8 to 2
Refrigerator	0.12	Microwave	750 to 2,000	40 to 80	3 to 8
Mixer	0.10	Blender	200 to 1,200	5.2 to 17	0.3 to 1.1
Toaster	0.08	Toaster	70 to 150	0.6 to 7	< 0.1 to 0.11
Hair Dryer	0.08	Hair dryer	60 to 200	< 0.1 to 1.5	< 0.1
Television	0.06	Television	25 to 500	0.4 to 20	< 0.1 to 1.5
Vacuum	0.05	Coffee maker	15 to 250	0.9 to 1.2	< 0.1

Source:
* German Federal Office for Radiation Safety
** Long Island Power Institute

Health Studies In the late-1970s, epidemiological studies indicated a weak association between childhood leukemia and ELF-EMF levels.[42] "Epidemiologists observe and compare groups of people who have had or have not had certain diseases and exposures to see if the risk of disease is different between the exposed and unexposed groups, but does not control the exposure and cannot experimentally control all the factors that might affect the risk of disease."[43]

Ever since, researchers have examined possible links between ELF-EMF exposure and health effects through epidemiological, animal, clinical, and cellular studies. To date, "no mechanism by which ELF-EMFs or radiofrequency radiation could cause cancer has been identified. Unlike high-energy (ionizing) radiation, EMFs in the non-ionizing part of the electromagnetic spectrum cannot damage DNA or cells directly."[44] "The few studies that have been conducted on adults show no evidence of a link between EMF exposure and adult cancers, such as leukemia, brain cancer, and breast cancer."[45] "Overall there is no evidence that exposure to ELF magnetic fields alone causes tumors. The

evidence that ELF magnetic field exposure can enhance tumor development in combination with carcinogens is inadequate."[46]

In 2002, the Minnesota State Interagency Working Group on EMF Issues, comprised of staff from state agencies, boards, and Commission, was tasked to study issues related to EMF. The group published *A White Paper on Electric and Magnetic Field Policy and Mitigation Options*, and concluded the following:

> Some epidemiological results do show a weak but consistent association between childhood leukemia and increasing exposure to EMF…. However, epidemiological studies alone are considered insufficient for concluding that a cause-and-effect relationship exists, and the association must be supported by data from laboratory studies. Existing laboratory studies have not substantiated this relationship…, nor have scientists been able to understand the biological mechanism of how EMF could cause adverse effects. In addition, epidemiological studies of various other diseases, in both children and adults, have failed to show any consistent pattern of harm from EMF.

The Department of Health concludes that the current body of evidence is insufficient to establish a cause-and-effect relationship between EMF and adverse health effects. However, as with many other environmental health issues, the possibility of a health risk cannot be dismissed.[47]

Regulations and Guidelines Currently, there are no federal regulations regarding allowable ELF-EMF produced by power lines in the United States; however, state governments have developed state-specific regulations. For example, Florida limits electric fields to 2.0 kV/m and magnetic fields to 150 mG at the edge of the right-of-way for 161 kV transmission lines.[48] Additionally, international organizations have adopted standards for exposure to electric and magnetic fields. The Commission limits the maximum electric field under high voltage transmission lines in Minnesota to 8.0 kV/m.[49] It has not adopted a standard for magnetic fields.

Potential Impacts

The ROI for EMF is the land control area. Potential impacts are anticipated to be negligible and are not expected to negatively affect human health. The maximum electric field level for the project gen-tie line is estimated to be 1.77 kV/m.[50] The maximum electric field level for the 161 kV tap lines is estimated to be 1.04 kV/m.[51] Electric field strengths decrease with distance; at 100 feet from the lines, electric field levels are less than 0.1 kV/m.[52] These electric field levels are consistent with the Commission's electric field limit (less than 8.0 kV/m). Potential health impacts from these electric field levels are anticipated to be negligible.

The maximum magnetic field level for the project gen-tie line is estimated to be 117.2 mG.[53] The maximum magnetic field level for the 161 kV tap lines is estimated to be 55.3 mG.[54] Magnetic field strengths also decrease with distance. At 100 feet from the lines, magnetic field levels are less than 20 mG.[55] Potential health impacts from these magnetic field levels are anticipated to be negligible.

Mitigation

No health impacts from EMF are anticipated; however, the Commission has adopted a prudent avoidance approach regarding high voltage transmission lines. If warranted, the Commission considers, and may require, mitigation strategies to minimize EMF exposure levels. Consistent with

this approach, basic mitigation measures are prudent. EMF diminishes with distance from a conductor; therefore, EMF exposure levels can be minimized by routing power lines away from residences and other locations where citizens congregate to the extent practicable. No additional mitigation is proposed.

4.4.2 Public and Worker Safety

The ROI for public and work safety is the land control area. Like any construction project, there are risks. These include potential injury from falls, equipment and vehicle use, electrical accidents, etc. Public risks involve electrocution. Electrocution risks could also result from unauthorized entry into the project area. Potential impacts are anticipated to be minimal. Impacts would be short- and long-term, and can be minimized.

Construction crews must comply with local, state, and federal regulations when installing the project. This includes standard construction-related health and safety practices. This generally includes safety orientation and training, as well as daily/weekly safety meetings.

The project 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.

Fencing will deter public access, and signage will provide appropriate public warnings. An *Operations and Emergency Action Plan* will be developed with local first responders to outline "emergency procedures for evacuation, fire response, extreme weather, injury, and criminal behavior".[56]

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.[57]

Potential Impacts

The ROI for worker and public safety is the land control area. Worker safety issues are primarily associated with construction. Public safety concerns would be most associated with unauthorized entry to the project.

Like any construction project, there are risks. These include potential injury from slips and falls, equipment and vehicle use, electrical accidents, etc. Construction might disturb existing environmental hazards on-site, for example, contaminated soils. A review of *What's in My Neighborhood*, maintained by MPCA, indicates that potentially contaminated sites do not occur within the land control area.[58]

During operation there are occupational risks like those associated with construction, but to a much lesser degree. Public risks would result from unauthorized entry into the facility. PV panels contain hazardous materials, as a result proper disposal of panels at the end of their useful life is necessary to ensure that leaching of the materials, especially lead, does not reach the environment.

Mitigation

Construction companies are bound by federal and state Occupational Safety and Health Administration requirements for worker safety,[59] 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. The project will be fenced to prevent unauthorized access. A decommissioning plan addresses PV panel end of life issues.

Commission permits address public safety, including landowner educational materials, signage, and gates, etc. Permittees are required to file an emergency response plan with the Commission prior to operation. Commission permits also require disclosure of extraordinary events, such as fires, etc. No additional mitigation is proposed.

4.5 Land Based Economies

Solar farms impact land-based economies by precluding or limiting land use for other purposes.

4.5.1 Agriculture

The ROI for agriculture is the land control area. Potential impacts to agricultural producers are anticipated to be minimal—lost farming revenues will be offset by easement agreements. A negligible loss of farmland in Freeborn County would occur for the life of the project. With respect to prime farmland, the applicant indicates that no feasible or prudent alternatives to the project exist. Potential impacts are localized and unavoidable but can be minimized.

Farming occurs throughout Freeborn County. The following summary is based on information from the Census of Agriculture, which is conducted by the U.S. Department of Agriculture (USDA). The agricultural census is a complete count of farms and ranches and the people who operate them, including small plots with at least $1,000 in annual sales.[60] In 2017, there were 1,076 individual farms using 399,024 acres of farmland in Freeborn County—a decrease in number but increase in acres from 2012. The value of products sold, both crop sales and livestock sales, decreased, on average, nine percent per farm to $338,289. Average farm size increased by about eight percent. Cropland is by far the dominant agricultural land use. Farmers in Freeborn County raise a variety of commodities. The most common crops, by acreage, are corn and soybeans. The primary livestock product is hogs.

NCLD data indicates that 97 percent of the land control area is agricultural land.[61]

Prime Farmland Although much of the land in Freeborn County has historically been used for agriculture, there are differences in the quality and suitability of land for agricultural production. "Under current drainage conditions, approximately 128,503 acres in Freeborn County are considered prime farmland or farmland of statewide importance."[62] Federal regulation 7 C.F.R. 657.5(a)(1) defines prime farmland, in part, as:

> 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. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and

> growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.

Although prime farmland characteristics are the same nationwide, certain soils that do not meet these specific characteristics can nevertheless be important at a statewide level. Criteria for defining and delineating farmland of statewide importance are determined by the appropriate state agency or agencies. Generally, additional farmlands of statewide importance include those that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some soils might produce as high a yield as prime farmlands if conditions are favorable. In some states, additional farmlands of statewide importance may include tracts of land that have been designated for agriculture by state law.[63]

Table 11 Farmland Classification in Land Control Area

Soil Type	Acres	Percent
All areas are prime farmland	107.67	5.46%
Farmland of statewide importance	756.38	38.36%
Prime farmland if drained	1107.57	56.18%
Total	**1971.62**	**100.00%**

Source: SSURGO

Potential Impacts

The ROI for agriculture is the land control area. The impact intensity level is anticipated to be minimal. Potential impacts are localized and unavoidable but can be minimized.

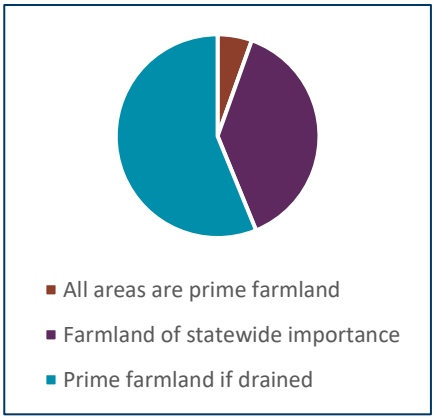
Farming Rural farmland areas, with large parcels of relatively flat, open land, tend to be attractive locations for developers seeking to site ground-mounted PV projects, which require six to eight acres of land to generate one MW of electricity. The project will result in in approximately 1,272 acres of farmland being removed from agricultural production for at least the life of the project.[64] This change in land use would take productive farmland out of production but would result in a negligible loss of farmland in Freeborn County (399,024 acres of land in farms). The applicant indicates that the land could be returned to agricultural production after the project is decommissioned.

Prime Farmland In Minnesota, no large electric power generating plant site may be permitted where the developed portion of the plant site includes more than 0.5 acres of prime farmland per megawatt of net generating capacity, unless there is no feasible and prudent alternative.[65] Economic considerations alone do not justify the use of more prime farmland.[66]

With a generating capacity of up to 150 MW, the project, by rule, should impact no more than 75 acres of prime farmland. Approximately 62 percent of farmland in the area is prime farmland (**Table 11**, **Figure 8**). Based on this percentage and the proposed layout of the project, the project is anticipated to impact about 648 acres of prime farmland.[67]

Thus, an assessment of the availability of feasible and prudent alternatives is an important component in the Commission's review of the project. The Department, along with the Department of Agriculture, has developed a guidance document to assist developers when evaluating potential solar sites relative to the feasible and prudent language in the rule.[68] Since the state of Minnesota has mandates to both advance solar energy production and protect prime farmland, and due to the inherent difficulties in avoiding prime farmland, the guidance document is meant to assist developers in defining feasible and prudent in relation to siting alternatives, and to encourage them to build a record early in the site selection process showing whether or not an exception to the prime farmland exclusion is warranted.

Figure 8 Prime Farmland in Project Area



The applicant "identified and assessed two other potential sites for the [p]roject in an attempt to find a site that would otherwise be complaint with the 'prime farmland exclusion rule' found in Minnesota Rules 7850.4400, subp.4."[69] To make this determination, the applicant "conducted a prime farmland assessment to review the feasibility and prudency of potential sites as well as the prime farmland impacts."[70] This assessment "identified no other feasible or prudent sites in comparison to the [project] (concerning prime farmland impacts) and concluded that the two [other potential] sites were not feasible or prudent areas for siting the [p]roject."[71] As such, the applicant indicates that no feasible or prudent alternatives to the project exist.

Mitigation

Farming revenues lost due to the project will be offset by easement agreements. The applicant has developed and is committed to an AIMP (**Appendix C**) 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.

Commission permits require permittees to 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.

4.5.2 Tourism

The ROI for tourism is the project area. Indirect impacts to tourism are associated with direct impacts to recreational opportunities. Potential impacts are anticipated to be minimal. Potential impacts can be mitigated.

In 2019, the leisure and hospitality industry in Freeborn County accounted for about $47 million in gross sales, and 1,171 private sector jobs.[72] Tourist activities within the project area are related to the recreational activities discussed in Chapter 4.3.8. These activities are primarily associated with a snowmobile trail and campground. Electrical infrastructure can impact tourism if they affect visitor experiences at tourism sites, primarily through aesthetic or noise impacts, or degrade natural or human-made resources that provide tourist-type activities.

Potential Impacts

The ROI for tourism is the project area. The impact intensity level is anticipated to be minimal to moderate during construction. Impacts will be localized and affect a unique resource. Impacts will be unavoidable, but minimal during operation.

Tourism in the project area is associated with the limited recreational activities previously described. Construction noise related impacts would be short-term and intermittent, and range from negligible to significant. Operational noise is expected to be below ambient noise levels. Aesthetic impacts would be subjective to the individual.

The project will not preclude future tourist activities. Some recreationalists might not prefer to recreate near an industrial type of facility, thereby limiting visitor use. Such preferences would be highly dependent on the individual user and are not anticipated to be a common enough feeling to impact tourism in the project area especially given the campground is located adjacent to I-90.

Mitigation

Impacts to tourism can be mitigated by selecting locations that avoid natural and human-made resources utilized for tourist-type activities. Potential impacts to tourism can also be mitigated by reducing noise and aesthetic impacts, as well as impacts to natural landscapes. Long-term impacts can be mitigated through appropriate screening. Various sections of the sample permit indirectly address impacts to recreation, such as noise, aesthetics, soils, etc., and, as a result, indirectly mitigate impacts to tourism. No additional mitigation is proposed.

4.6 Archeological and Historic Resources

The ROI for archeological and historic resources is the land control area. Potential impacts are not expected. Impacts, should they occur, will be localized and affect a unique resource. Impacts can be mitigated.

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.[73] Historic resources are sites, buildings, structures, or other antiquities of state or national significance.[74] The land control area is within actively cultivated farmland.

Potential Impacts

Tetra Tech, Inc., was contracted by the applicant to conduct a Phase I Cultural Resource Survey for the project. SHPO offices were closed due to the COVID-19 pandemic; therefore, an in-person review at SHPO and the Office of the State Archaeologist was not completed.[75] Tetra Tech determined that most of the land control area "appears to have been a large, shallow wetland" prior to European contact.[76] This wetland might "have been used for hunting and gathering activities opposed to long-term habitation."[77] Field surveys did not identify archaeological sites.

Petran Farms is located adjacent to the land control area (**Figure 9**). It is an archeological site "currently unevaluated for listing in the [National Register of Historic Places (NRHP)]."[78] Tetra Tech concluded that because Petran Farms "is currently unevaluated for listing in the NRHP, no additional assessment activities are recommended."[79]

Impacts to archaeological and historic resources are not expected.

Mitigation

Prudent siting can avoid impacts to archaeological and historic resources. Section 4.3.13 of the sample permit addresses archeological resources (**Appendix B**). If previously unidentified archaeological sites are found during construction, the applicant would be required to stop construction and contact SHPO and the state archaeologist to determine how best to proceed.[80] Ground disturbing activity will stop and local law enforcement will be notified should human remains be discovered.[81] Because impacts to archeological and historic resources are not anticipated, additional mitigation is not proposed.

Figure 9 Petran Farms

4.7 Natural Resources

Solar farms impact the natural environment. Impacts are dependent upon many factors, such as how the project is designed, constructed, maintained, and decommissioned. Other factors, for example, the environmental setting, influence potential impacts.

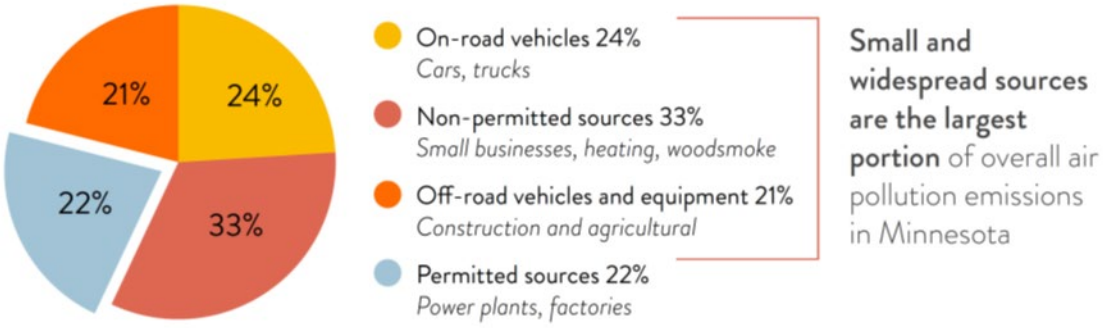
4.7.1 Air Quality and Climate Change

The ROI for air quality and climate change is Freeborn County. Distinct impacts occur during construction and operation of the project. Potential impacts to air quality during construction would be intermittent, localized, short-term, and minimal. Impacts are associated with fugitive dust and exhaust. Impacts can be mitigated. Once operational, the solar array will not generate criteria pollutants or carbon dioxide. Negligible fugitive dust and exhaust emissions would occur as part of routine maintenance activities. Impacts are unavoidable and do not affect a unique resource. Impacts can be minimized.

"In general, the state of Minnesota's air quality is improving. Levels of pollution in outdoor air have been going down for nearly all measured air pollutants. Since 1990, annual air pollution emissions in Minnesota have fallen by nearly half."[82] "Today, most of our air pollution comes from smaller, widespread sources … the rest comes from a wide variety of things we use in our daily lives: our vehicles, local businesses, heating and cooling, and yard and recreational equipment" (**Figure 10**).[83] According to MPCA models, air pollution in the project area is in the lowest 20 percent within Minnesota.[84]

Climate change refers to any significant change in measures of climate lasting for an extended period. Greenhouse gases (GHG) are gaseous emissions that trap heat in the atmosphere. These emissions occur from natural processes and human activities. The most common GHGs emitted from human activities include carbon dioxide, methane, and nitrous oxide.

Figure 10 Air Pollution Sources by Type



Potential Impacts

The ROI for air quality is Freeborn County. During construction, minimal intermittent air emissions are expected.

Air Quality Air emissions associated with construction are highly dependent upon weather conditions and the specific activity occurring. For example, traveling to a construction site on a dry gravel road will result in more fugitive dust than traveling the same road when wet. Once operational, the solar array would not generate criteria pollutants or carbon dioxide.

Motorized equipment will emit exhaust. This includes construction equipment and vehicles travelling to and from the project. Exhaust emissions, primarily from diesel equipment, would vary according to the phase of construction.

All projects that involve movement of soil, or exposure of erodible surfaces, generate some type of fugitive dust emissions.[85] The project will generate fugitive dust from travel on unpaved roads, grading, and excavation. "The impact of a fugitive dust source on air pollution depends on the quantity and drift potential of the dust particles injected into the atmosphere. In addition to large dust particles that settle out near the source (often creating a local nuisance problem), considerable amounts of fine particles also are emitted and dispersed over much greater distances from the source."[86]

Emissions associated with maintenance are dependent upon weather conditions and the specific activity occurring. The applicant indicates that, over the life of the project, fugitive dust emissions will be reduced by the elimination of farming and establishment of permanent vegetative cover.

Greenhouse Gas Emissions Construction activities will result in short-term increases in GHG emissions because of the combustion of fossil fuels in construction equipment and vehicles. Sulfur hexafluoride, a GHG, will be used at the substation and switchyard. Small releases will occur as part of regular breaker operation and maintenance.

Total GHG emissions for project construction are estimated to be approximately 5,119 tons of carbon dioxide (CO_2).[87] The majority of emissions are due to the use semi-trucks and trailers and light-duty pickup trucks.[88] Total emissions for the state of Minnesota in 2018 were approximately 161 million tons.[89] Thus, GHG emissions for project construction are anticipated to be an insignificant amount relative to the state's overall annual emissions. Potential impacts due to construction GHG emissions are anticipated to be negligible.

Once operational, the project will generate minimal GHG emissions. Emissions that do occur would result from vehicle usage to and from the solar array and substation for maintenance and operation of the substation and switchyard. GHG emissions for project operation are estimated to be approximately 81 tons of CO_2 annually.[90] Potential impacts due to operational GHG emissions are anticipated to be negligible.

If electrical energy from the project displaces energy that would otherwise be generated by carbon-fueled power plants (e.g., coal, natural gas), the project could reduce GHG emissions by up to 118,784 metric tons of CO_2 annually.[91] Thus, compared to non-renewable energy generation, the project would be beneficial with respect to GHG emissions.

A warming climate is expected to cause increased flooding, storms, and heat wave events. These events, especially an increased number and intensity of storms, could increase risks to the project, e.g.,. storms and high winds could damage solar panels. More extreme storms also mean more frequent heavy rainfall events. The project is in a low-lying area; therefore, extreme rain events might cause localized flooding. Flooding could damage the project's electrical collection system including inverters and collection wiring. Heat wave events could change demands on the electrical transmission and generation systems, especially as more indoor space is equipped with cooling systems. Because this is a solar project, it may improve the resiliency of the electrical transmission system by reducing the potential for peak overloads during heat wave events.

Mitigation

Emissions of air pollutants and greenhouse gases can be minimized by keeping vehicles and equipment in good working order, and not running equipment unless necessary.

"Control techniques for fugitive dust sources generally involve watering [or] chemical stabilization … Watering, the most common and, generally, least expensive method, provides only temporary dust control. The use of chemicals to treat exposed surfaces provides longer dust suppression, but may be costly, have adverse effects on plant and animal life, or contaminate the treated material."[92] Watering exposed surfaces, covering disturbed areas, and reducing speed limits on-site are all standard construction practices.

Impacts resulting from a warmer, wetter, and more energetic climate can be mitigated by: (1) designing solar panels and solar arrays to withstand stronger storms and winds, (2) planning for the potential repair and replacement of solar arrays damaged by storms, (3) designing the project's stormwater system to prevent flooding during heavy rainfall events, and (4) designing the project's electrical collection system to be resistant to flooding damage.

4.7.2 Groundwater

The ROI for groundwater is the land control area. Potential impacts to domestic water supplies are not expected. Localized impacts to groundwater resources, should they occur, would be intermittent, but have the potential to occur over the long-term. Indirect impacts from surface waters might occur during construction. Impacts can be mitigated.

The project is within the South-Central Groundwater Province, where "thick loam and clay loam glacial sediment ... [overlay] thick and extensive Paleozoic (sandstone and carbonate) aquifers."[93] "Sedimentary bedrock aquifers ... are commonly used."[94] General availability of groundwater in the province is good, limited, and moderate in bedrock, surficial sands, and buried sands, respectively.[95]

According to the *Pollution Sensitivity of Near-Surface Materials* the land control area is in an area of low sensitivity.[96] The sensitivity to pollution of near-surface materials is an estimate of the time it takes for water to travel through the unsaturated zone to reach the water table, which for the purposes of the model was assumed to be 10 feet below the land surface.[97] A rating was applied across the state, defining the vertical travel time of water to reach a depth of 10 feet. Water travels through an area of low sensitivity to a depth of 10 feet in 430 to 1,600 hours.[98]

Wellhead protection areas exist "to prevent contamination of public drinking water supplies by identifying water supply recharge areas and implementing management practices for potential pollution sources found within those areas."[99] There are no wellhead protection areas in the land control area.[100]

"The *Minnesota Well Index* provides basic information about location, depth, geology, construction and static water level, for many wells and borings drilled in Minnesota. It by no means contains information for all the wells and borings and the absence of information about a well on a property does not mean there are not wells on that property."[101] Private wells exist throughout the project vicinity; however, no verified drinking water wells are within the land control area.[102] Two irrigation wells are present in the land control area.[103]

Potential Impacts

The ROI for groundwater is the land control area. The impact intensity level is anticipated to be minimal. Localized impacts, should they occur, would be intermittent, but have the potential to occur over the long-term. Impacts can be mitigated.

Potential impacts to groundwater can occur directly or indirectly. Direct impacts are generally associated with construction, for example, driving steel post foundations into the ground could penetrate shallow water tables. There would be approximately 60,000 of these posts, which—based on information from other projects—will be driven to a depth of approximately eight to 14 feet deep depending on soil type. Although there is potential that subsurface activity might disturb shallow groundwater resources, the disturbance area would be well above well-depth in the land control area.

Impacts to surface waters can lead to indirect impacts to groundwater. Surface water impacts are anticipated to be minimal (see Chapter 4.7.4).

Mitigation

Commission permits require permittees to "implement erosion prevention and sediment control practices recommended by the [MPCA]" and to "obtain a [CSW Permit]."[104] Impacts to groundwater can also be minimized by mitigating impacts to surface waters and soils. Additional mitigation is not proposed.

4.7.3 Soils

The ROI for soils is the land control area. The impact intensity level is expected to be minimal. Potentials impacts will both positive and negative, and short- and long-term. Isolated moderate to significant negative impacts associated with high rainfall events could occur. Because the soil would be covered with native perennial vegetation for the life of the project, soil health would likely improve.

Soil types within the land control area are "typically drained muck or loamy muck soils or silt loam soils suited for the existing agricultural production when drained" (**Table 12**).[105] These hydric soils "formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part."[106]

Table 12 Soil Types in the Land Control Area

Soil Type	Acres	%	Soil Type	Acres	%
Biscay clay loam, 0 to 2 percent slopes	76.30	3.87	Marshan silt loam	15.49	0.79
Canisteo clay loam, 0 to 2 percent slopes	57.00	2.89	Maxcreek-Barbert complex	23.63	1.20
Cylinder loam, 0 to 2 percent slopes	1.08	0.05	Maxcreek silty clay loam	63.35	3.21
Dakota loam, 0 to 2 percent slopes	4.92	0.25	Maxcreek silty clay loam, swales	0.93	0.05
Dassel loam	6.24	0.32	Mayer loam, 0 to 2 percent slopes	105.91	5.37
Dassel mucky loam	54.64	2.77	Mayer loam, swales	0.67	0.03
Dundas silt loam, 0 to 2 percent slopes	7.72	0.39	Merton silt loam, 1 to 3 percent slopes	15.75	0.80
Fieldon loam, 0 to 2 percent slopes	95.88	4.86	Newry silt loam, 1 to 3 percent slopes	0.13	0.01
Glencoe clay loam, 0 to 1 percent slopes	26.15	1.33	Nicollet clay loam, 1 to 3 percent slopes	5.45	0.28
Hanska loam, 0 to 2 percent slopes	53.16	2.70	Okoboji silty clay loam, 0 to 1 percent slopes	65.91	3.34
Havana silt loam	0.61	0.03	Spicer silt loam, depressional	37.95	1.92
Hayfield silt loam, 1 to 3 percent slopes	7.80	0.40	Spicer silty clay loam, 0 to 2 percent slopes	119.52	6.06
Klossner muck, 0 to 1 percent slopes	718.43	36.44	Udolpho silt loam	8.52	0.43
Le Sueur loam, 1 to 3 percent slopes	62.47	3.17	Wacousta mucky silt loam	108.40	5.50
Lemond loam, 0 to 2 percent slopes	6.04	0.31	Wacousta silt loam	106.75	5.41
Linder sandy loam, 0 to 3 percent slopes	10.07	0.51	Webster clay loam, 0 to 2 percent slopes	16.43	0.83
Madelia silty clay loam, 0 to 2 percent slopes	88.33	4.48	**Total (rounded)**	**1972**	**100.00**

Source: SSURGO

Potential Impacts

The ROI for soils is the land control area. The impact intensity level is expected to be minimal. Potentials impacts will both positive and negative, and short- and long-term. Isolated moderate to significant negative impacts associated with high rainfall events could occur. Because the soil would be covered with native perennial vegetation for the life of the project, soil health would likely improve.

Construction will disturb approximately 1,050 acres within the land control area.[107] Of this, about 19 acres will be graded. A total of 2,700 cubic yards of earth will be cut and filled to provide a level and stable base for solar arrays.[108] Some cutting and filling will be necessary for access roads, stormwater basins, foundations, etc.[109] "Mass grading of the site will not be employed and will generally occur to 'flatten' various areas of the site to facilitate installation [of equipment]."[110] Construction requires removing and handling soils, which will expose soils to wind and water erosion. Topsoil could be lost to improper handling or erosion. Soil compaction and rutting will occur from movement of construction vehicles. Should high rainfall events occur during construction or prior to establishment of permanent vegetation, significant sedimentation might occur.

Soil cover and management will change from cultivated cropland to a mixture of impervious surfaces, for example, PV panels, access roads, project substation, switchyard, etc., underlain and surrounded by native groundcover plantings. Once permanent vegetation is established, stormwater management, as well as general soil health, might improve due to use of native plants. These benefits could extend beyond the life of the project if these benefits are preserved through decommissioning practices and the land control area is returned to agricultural use. Benefits would likely not extend to access roads and foundation footprints.

DNR has indicated that hydric soils such as those in the project area become wetter over time if they are removed from annual row-crop production.[111] DNR noted that maintenance of existing drainage systems (e.g., tiling) could minimize impacts to soils.[112] The applicant indicates that it will maintain existing drainage systems in the project area, including repairing drain tile damaged during construction (**Appendix C**).

The type of electrical collection system used would affect soils differently. In all systems, some trenching will be required to bury electrical cables. Impacts are most substantial with the below-ground system and decrease substantially with above-ground systems because trenching is not required.

Impacts to prime farmland are discussed in Chapter 4.5.1.

Mitigation

The use of best management practices can protect topsoil and minimize the potential for soil erosion. These practices include temporary and permanent topsoil stabilization measures in accordance with the project's construction stormwater (CSW) permit; restoring disturbed areas to pre-construction conditions to the extent practicable; minimizing erosion by implementing environmental control measures, such as, temporary and permanent seeding, mulching, filter strips, erosion blankets, and sod stabilization.

Commission permits address soil related impacts: they require protection and segregation of topsoil; require measures to minimize soil compaction; and require permittees to "implement erosion prevention and sediment control practices recommended by the [MPCA]" and to "obtain a [CSW permit]." A CSW permit requires both temporary and permanent stormwater controls. Permits also require implementation of reasonable erosion and sediment control measures, contours graded to provide for proper drainage, and all disturbed areas be returned to pre-construction conditions. Lastly, "site restoration and management" practices must enhance "soil water retention and reduces storm water runoff and erosion."

The applicant has developed an 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 preserve soils to allow for the land to be returned to agricultural used (**Appendix C**).

4.7.4 Surface Waters

The ROI for surface waters is the land control area. Potential impacts are anticipated to be minimal. Direct impacts to surface waters are not expected. Indirect impacts to surface waters might occur. These impacts will be short-term, of a small size, and localized. Impact can be mitigated.

The project is within the Shell Rock River watershed, which is part of the Upper Mississippi River Basin. County Ditch No. 62 and County Ditch No. 47 are within the land control area (**Figures 11** and **12**). These flow to Peter Lund Creek.

Figure 11 Water Resources

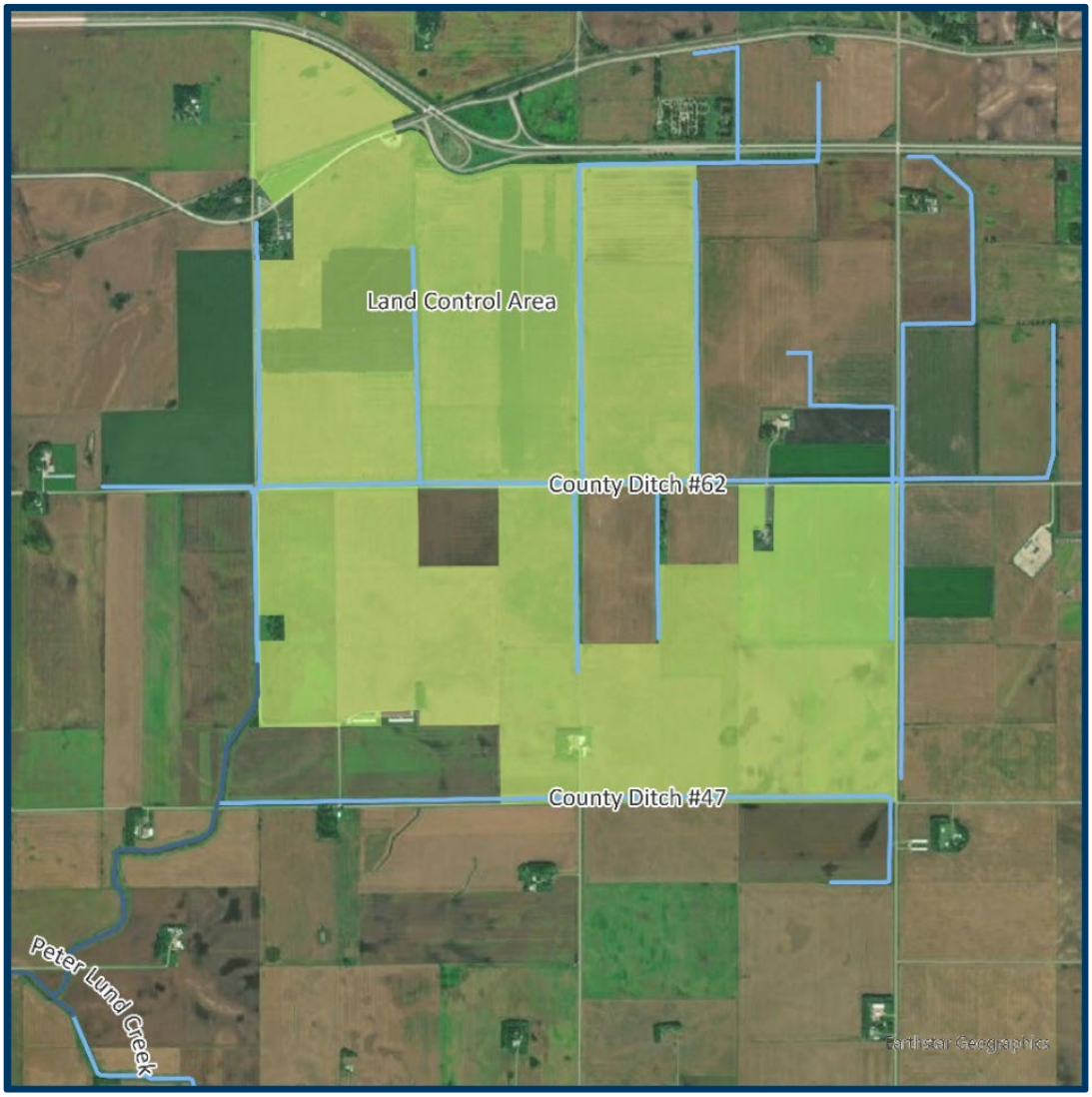


Figure 12 County Ditch 62

There are no public waters in the land control area; however, a public water, Peter Lund Creek, does skirt the extreme southwest boundary on the opposite side of the of 830th Avenue. Public waters are wetlands, water basins, and watercourses of significant recreational or natural resource value in Minnesota. A public waters designation means that DNR has regulatory jurisdiction over the water.

Potential Impacts

The ROI for surface waters is the land control area. The project is currently designed to avoid directly impacts to surface waters, that is, project components such as access road, solar arrays, etc. will not be placed in surface waters. Indirect impacts during construction include sediment or fugitive dust created by excavation, grading, vegetation removal, and construction traffic reaching nearby surface waters. Overall, and due to the establishment of perennial vegetation, the project is expected to have a positive impact on water quality.

Mitigation

Standard construction management practices, including, but not limited to sediment control devices, containment of excavated soils, protection of exposed soils, stabilization of restored soils, and controlling fugitive dust, would minimize the potential for eroded soils to reach surface waters.

4.7.5 Vegetation

The ROI for vegetation is the land control area. The project will convert row crop farmland to perennial vegetation for the life of the project. Potential impacts will be positive and long-term (30 years). Potential impacts can be mitigated through development of a vegetation management plan. No additional mitigation is proposed.

The land control area is dominated by cultivated crops established and maintained by humans (**Table 13**). Non-native invasive species are limited due to weed management associated with

agriculture. Few areas with trees exist in the land control area, although one windbreak remnant exists.

Potential Impacts

The ROI for vegetation is the land control area. Construction of the project will eliminate vegetative cover at access roads, project substation, operation and maintenance building, and parking lot. Tall growing woody vegetation in the land control area will be removed. In the land control area, agricultural row crop fields would be converted to perennial, low growing vegetative cover, resulting in a net increase in vegetative cover for the life of the project. Native seed mixes developed in cooperation with DNR will be used. Once established, vegetation would most likely be maintained by mowing. There is no mapped native prairie within the land control area. Construction activities could introduce invasive species.

Table 13 Land Cover

Type	Acres (rounded)
Developed	66
Grassland	3
Hay/Pasture	<1
Cultivated Crops	1890

Source: NLCD

Land cover in the land control area.

Mitigation

The applicant has prepared a VMP to guide site preparation, installation of prescribed seed mixes, and management of invasive species and noxious weeds (**Appendix D**). The applicant has also developed an 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 preserve soils to allow for the land to be returned to agricultural use (**Appendix C**).

Recent Commission permits have required permittees to develop a VMP in coordination with state agencies. Recent permit language requires permittees to file their VMP prior to a pre-construction meeting: [113]

> The Permittee shall develop a vegetation management plan using best management practices established by the DNR and BWSR. The vegetation management plan shall be prepared in coordination with the Department of Commerce, DNR, and BWSR. The vegetation management plan and documentation of the coordination efforts between the permittee and the coordinating agencies shall be filed at least 14 days prior to the preconstruction meeting. The Permittee shall provide all affected landowners with copies of the plan.
>
> The vegetation management plan must include the following:
>
> - Management objectives addressing short term (Year 0-3, seeding and establishment) and long term (Year 4 through the life of the permit) goals.

- A description of planned restoration and vegetation management activities, including how the site will be prepared, timing of activities, how seeding will occur (broadcast, drilling, etc.), and the types of seed mixes to be used.
- A description of how the site will be monitored and evaluated to meet management goals.
- A description of the management tools used to maintain vegetation (e.g., mowing, spot spraying, hand removal, fire, grazing, etc.), including the timing and frequency of maintenance activities.
- Identification of the third-party (e.g., consultant, contractor, site manager, etc.) responsible for restoration, monitoring, and long-term vegetation management of the site.
- Identification of on-site noxious weeds and invasive species (native and non-native) and the monitoring and management practices to be utilized.
- A site plan showing how the site will be revegetated and that identifies the corresponding seed mixes. Best management practices should be followed concerning seed mixes, seeding rates, and cover crops.

DNR has indicated that soils such as those in the project area become wetter over time if they are removed from annual row-crop production.[114] DNR noted that maintenance of existing drainage systems (e.g., tiling) could minimize impacts to soils and vegetation.[115] DNR encouraged coordination to ensure that seed mixes used to vegetate the site are compatible with current and future soil and hydrologic conditions.

The applicant indicates that it will maintain existing drainage systems in the project area, including repairing drain tile damaged during construction (**Appendix C**). The applicant notes that it will take several steps during the 2022 growing season to ensure proper seed mixes for the site including:[116]

- Collecting and analyzing soil samples.
- Interviewing landowners and farmers who are familiar with the project area.
- Re-evaluating the VMP to determine if any changes are needed.
- Reviewing the availability of seed mixes for the 2023 growing season (the anticipated construction timeframe).
- Coordinating with DNR staff.

4.7.6 Wildlife and Habitat

The ROI for wildlife and their habitats is the land control area. Potential impacts are positive or negative, and species dependent. Long-term, positive impacts to birds, small mammals, insects, snakes, etc. would occur. Impacts to large wildlife species, for example, deer, will be negligible. Negative impacts could occur to individuals during construction and operation of the project. Once restored, the land control area will provide native grassland habitat for the life of the project. The impact intensity level is expected to be minimal.

Wildlife utilizing the land control area are common species associated with disturbed habitats, and are accustomed to human activities occurring in the area, for example, agricultural activities and road traffic. Mammals, reptiles, amphibians, and insects are present.

The land control area consists of open land habitat. 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.[117]

Potential Impacts

The ROI for wildlife and wildlife habitat is the land control area and collection line corridor. The ROI for birds is the local vicinity. The impact intensity level is expected to be minimal. Impacts could be positive or negative depending on species type. Potential impacts will be short- and long-term and can be mitigated.

Wildlife Individuals will be displaced to adjacent habitats during construction. Because the land control area does not provide important habitat, this should not impact life cycle functions, for example, nesting. Direct significant impacts to individuals might occur, that is, small species might be crushed or otherwise killed during construction. Population level impacts are not anticipated.

The single largest impact to wildlife associated with the project is fencing. Studies estimate that one ungulate per year becomes entangled for every two and one-half miles of fence.[118] Deer can jump many fences, "but smooth or barbed-wire can snag animals and tangle legs, especially if wires are loose and spaced too closely together."[119] Predators can use fences to corner and kill prey species.[120] Bird injuries or mortality occurs from fencing "due to lack of visibility" and raptors in pursuit of prey "are particularly vulnerable to the nearly invisible wire strands."[121] Other low flying birds such as grouse and owls are also vulnerable to fence collisions.

Plastic erosion control netting is frequently used for erosion control during construction and landscape projects and can negatively impact wildlife populations. Wildlife entanglement and death from plastic netting and other plastic materials has been documented in birds, fish, mammals, and reptiles.[122]

Risks to birds have been identified near PV solar farms. PV panels are "movable and generally directed upward, reflecting the sky."[123] "[A] large expanse of reflective, blue panels may be reminiscent of a large body of water."[124] Preliminary findings, based on limited data, suspect the danger is this appearance of water causing migrating birds to attempt to land, consequently incurring trauma and related predation.

Reduced pesticide use, as compared to agricultural production, should benefit insects, including pollinators, and smaller wildlife such as rodents, birds, insects, and reptiles. These same species might benefit from increased cover and foraging habitat.

Habitat Row crop habitat is not crucial to wildlife populations. The land control area is likely used as a travel corridor or, occasionally, as a food source (for example, standing corn). Once restored, the land control area will provide native grassland habitat for the life of the project. This change might be attractive to some species, and not others. Fencing will restrict ingress and egress of larger wildlife, and habitat benefits will be limited to small mammals, birds, insects, etc. accustomed to human disturbance. Depending on timing, mowing might limit nesting opportunities, etc. Overall, the project does not contribute to significant habitat loss or degradation.

Mitigation

Siting facilities away from wildlife movement corridors can avoid or minimize impacts to wildlife movement. Avoiding use of plastic erosion-control materials where possible and using biodegradable materials (typically made from natural fibers) instead can minimize the impact to wildlife. The site permit could include the use of natural fiber materials as a standard condition or as a special condition for facilities where there is greatest concern.

Fencing "The 'friendliest' fences for wildlife are very visible and allow animals to easily jump over or slip under the wires or rails."[125] This type of fence would not preclude human entry—an indicated purpose of the security fence. Therefore, to maintain a human barrier, but minimize impacts to wildlife, especially deer, the site permit could require that an eight-foot fence be used with the wire brought tight to the ground. "The fence can be completely built from woven wire or a combination of a bottom section of woven wire and top strands of smooth wire."[126] This type of barrier or exclusion fence should be set back sufficiently to encourage wildlife (primarily deer) to follow the fence line around the project away from roads, instead of pushing them into the roadway.[127]

The site permit could require that visibility markers be placed at appropriate locations on perimeter fencing.

> High visibility helps wildlife negotiate fences. Visibility is especially important in grasslands and near creeks and wetlands to protect low-flying birds, such as grouse, owls, and waterfowl. For big game, increased visibility helps animals judge their jumps…. Using a vinyl coated high-tensile wire for the top wire, or covering [it] with PVC pipe, flagging, or tape helps wildlife see fences and dramatically reduces wildlife damage to fences of all heights.[128]

Should wildlife, such as deer, enter the fenced area they would need an escape. The site permit could require that wildlife ramps be constructed "at corners where an accidentally trapped animal is more likely to find an escape."[129]

Trenching Should the below-ground collection system be used, checking open trenches for wildlife, and removing wildlife before backfilling mitigates impacts.

Erosion Control Due to entanglement issues with small animals, limiting use of erosion control blankets to those that do not contain plastic mesh netting or other plastic components mitigates impacts.

Habitat Once permanent vegetation is established, restricting mowing from April 15 to August 15 would improve the potential for ground nesting habitat.

4.8 Unavoidable Impacts

Resource impacts are unavoidable when an impact cannot be avoided even with mitigation strategies.

Potential impacts and the possible ways to mitigate against them are discussed in this chapter. However, even with mitigation strategies, certain impacts cannot be avoided. Most adverse unavoidable impacts are associated with construction; therefore, they would be temporary.

Unavoidable adverse effects associated with construction of the project (in some instances a specific phase of construction) would last as long as the construction period, and include:

- Fugitive dust.
- Noise disturbance to nearby residents and recreationalists.
- Visual disturbance to nearby residents and recreationalists.
- Soil compaction and erosion.
- Disturbance and temporary displacement of wildlife, as well as direct impacts to wildlife inadvertently struck or crushed.
- Minor amounts of marginal habitat loss.
- Possible traffic delays.

Unavoidable adverse impacts associated with the operation would last as long as the life of the project, and include:

- Visual impacts of the project.
- Cultural impacts due to a change in the sense of place for local residents.
- Loss of land for agricultural purposes.
- Injury or death of birds that collide with or are electrocuted by conductors.
- Injury or death of birds that collide with PV panels
- Injury or death of birds and mammals from fencing.
- Potential decrease to property values.

4.9 Irretrievable or Irreversible Impacts

Resource commitments are irreversible when it is impossible or very difficult to redirect that resource to a different future use; an irretrievable commitment of resources means the resource is not recoverable for later use by future generations.

Irreversible and irretrievable resource commitments are primarily related to project construction, including the use of water, aggregate, hydrocarbons, steel, concrete, wood, and other consumable resources. Some, like fossil fuel use, are irretrievable. Others, like water use, are irreversible. Still others might be recyclable in part, for example, the raw materials used to construct PV panels would be an irretrievable commitment of resources, excluding those materials that may be recycled at the end of the panels' useful life. The commitment of labor and fiscal resources to develop, construct, and operate the project is considered irretrievable.

4.10 Resource Elements for which Impacts are Anticipated to be Negligible

Select resource elements received abbreviated study in this EA because impacts to these resources are anticipated to be negligible and of relatively minor importance to the Commission's site permit decision.

Potential impacts to the resources in this subsection are anticipated to be negligible. This determination is based on information provided by the applicant, field visits, scoping comments received, environmental analysis, and staff experience with similar projects. Additional information regarding these topics is provided in the site permit application.

4.10.1 Airports

According to aeronautical navigation charts, the closest airport is in Albert Lea.[130] The project will not affect airport operations. Impacts will not occur.

4.10.2 Displacement

Displacement is the forced removal of residences or buildings.[131] Displacement will not occur.

4.10.3 Electronic Interference

Electronic interference associated with electrical infrastructure is related to a phenomenon known as corona. Impacts are not expected, because anticipated electric fields are below levels expected to produce significant levels of corona. Commission permits require permittees to take whatever action is feasible to restore or provide equivalent reception should interference occur to "radio or television, satellite, wireless internet, GPS-based agriculture navigation systems or other communication devices" (**Appendix B**).

4.10.4 Implantable Medical Devices

Electromagnetic fields (EMF) might interfere with implantable electromechanical medical devices, such as pacemakers, defibrillators, neurostimulators, and insulin pumps. Impacts to implantable medical devices and persons using these devices are not expected to occur, but, if they did occur, moving away from the project would return the pacemaker to normal operation. Commission permits require permittees to provide educational materials about the project to adjacent landowners. Additional mitigation is not proposed.

4.10.5 Floodplains

The land control area is within an area of minimal flood hazard—above the 500-year flood level—as determined by the Federal Emergency Management Agency. [132] It is not in a mapped floodplain; therefore, impacts to floodplains will not occur.

4.10.6 Forestry

Active forestry operations, including commercial timber harvest, woodlots, or other forestry resources do not occur within the land control area. Impacts to forestry operations will not occur.

4.10.7 Geology

Depth to bedrock is between 100 and 150 feet in the land control area.[133] There are no mapped karst features in the land control area and the project is outside of areas prone to surface karst development.[134] Impacts to geology are not expected to occur.

4.10.8 Mining

There are no gravel or commercial aggregate pits, or rock quarries in the project area.[135] The applicant will lease or purchase the underlying land; therefore, even if mining resources were available, the current and new landowners choose energy production as the higher and greater economic use. Impacts to mining will not occur.

4.10.9 Rare and Unique Resources

DNR does not believe "the proposed project will negatively affect any known occurrences of rare features."[136] Therefore, potential impacts are not anticipated.

4.10.10 Stray Voltage

The project will not result in the construction of large transmission lines; interconnect to businesses, farms, or residences; or change local electrical service. Therefore, impacts from stray voltage are not expected. Mitigation is not proposed.

4.10.11 Topography

While grading will occur, significant impacts to topography, such as the creation of abrupt elevation changes or modifications to natural drainage patterns, are not expected. The project substation, switchyard, O&M building, and access road will be constructed at grade to the extent possible. Appropriate permanent stormwater management measures will address drainage from the newly established impervious areas. Impacts to topography will be negligible.

4.10.12 Wetlands

The *National Wetlands Inventory* is a publicly available resource maintained by the U.S. Fish and Wildlife Service (USFWS) that provides "detailed information on the abundance, characteristics, and distribution of wetlands" in the United States.[137] Review of this dataset shows seven non-delineated wetlands within the southeast corner of the land control area. Field review identified several additional delineated wetlands. Both the delineated and non-delineated wetlands are farmed. The preliminary site layout avoids wetlands. With proper sediment control measures, potential impacts are expected to be negligible. Impacts to undisturbed wetlands will not occur.

4.11 Cumulative Potential Effects

Cumulative potential effects result from the incremental effects of a project in addition to other projects in the environmentally relevant area. Impacts will be "cumulative" with the Southern Municipal switching station.

Minnesota Rule 4410.0200, subpart 11a, defines "cumulative potential effects," in part, as the "effect on the environment that results from the incremental effects of a project in addition to other projects in the environmentally relevant area that might reasonably be expected to affect the same environmental resources, including future projects ... regardless of what person undertakes the other projects or what jurisdictions have authority over the project."

The "environmentally relevant area" includes locations where the potential effects of the project coincide with the potential effects of other projects to impact the elements studied in this EA. Generally, this area includes the ROI for the different resource elements.

EERA staff analyzed what projects are "reasonably likely to occur."[138] To staff's knowledge, there are no planned, privately-sponsored projects in the project area.[139] Additionally. there are no public projects (e.g., Freeborn, MnDOT) planned for the project area.[140] Thus, the only reasonably likely project to occur in the environmentally relevant area is Southern Municipal's construction and operation of the switching station for the project. The following subsection analyses the cumulative potential effects of the project and the switching station where potential effects coincide.

Analysis Assumptions

The following assumptions regarding the construction and operation of the project were used for the purposes of this cumulative potential effects analysis:

- The switching station will be constructed, maintained, and operated in a similar manner as the project's project substation.
- The switching station will not be decommissioned and removed at the end of the project's useful life.

Analysis Background

The ROI for cumulative potential effects varies across elements and is consistent with the ROI identified in Chapter 4.1. Cumulative potential effects—where they coincide—increase or decrease the breadth of the impact to the resources and elements studied in this section. This may or may not change the impact intensity level assigned to the resource or element.

The following graphics are used to illustrate the potential for cumulative potential effects:

▲ Cumulative potential effects are anticipated.

▼ Cumulative potential effects are NOT anticipated.

◆ Cumulative potential effects are uncertain.

Where cumulative effects are anticipated, a written description is provided. Where cumulative potential effects are not anticipated no further analysis is provided. For the purposes of this EA, actions that have occurred in the past and their associated impacts are considered part of the existing environmental and were analyzed in this section. The sources of information regarding the switching station are the site permit application and application amendment.

Human Settlement

This section describes cumulative potential effects to human settlement. **Table 14** illustrates the potential for cumulative effects.

Aesthetics The ROI for aesthetics is the project vicinity. During construction increased vehicle traffic and construction activities will occur. An additional industrial feature will be added to the landscape. This feature will be lit at night. Impacts to the travelling public are not anticipated. Potential impacts are unavoidable, but can be mitigated in part. The overall impact intensity level is anticipated to remain moderate to significant for those with high viewer sensitivity, for example, neighboring landowners.

Cultural Values The ROI for cultural values is the project area. An additional industrial feature will be added to the landscape. This might lead to further tension between renewable energy and rural character. The overall impact intensity level is expected to remain minimal.

Land Use The ROI for land use is the land control area. Land use will be permanently converted to an industrial type of use for the life of the project. The overall impact intensity level will remain minimal.

Noise The ROI for noise is the project vicinity. Heavy truck traffic along established haul routes will generate noise during materials delivery. Construction noise related to the switching station is typical of a construction site. The switching station is not anticipated to cause noise impacts once in operation. Impacts can be mitigated. The overall impact intensity level will not change.

Property Values The ROI for property values is the project vicinity. Residences within the local vicinity might see both the project and the switching station within their viewsheds. Short-term cumulative effects will occur. Staff is uncertain if long-term impacts will occur. It is unlikely that impacts will be permanent. Impacts can be mitigated. The overall impact intensity level is anticipated to remain minimal and dissipate at distance. Because of the uncertainty associated with property value impacts, potential impacts to specific properties could be moderate to significant.

Table 14 Cumulative Potential Effects: Human Settlement

Element/Resource	Region of Influence	Potential for Cumulative Effects		
		Short-term	Long-term	Permanent
Aesthetics	Project Vicinity	▲	▲	▼
Cultural Values	Project Area	▲	▲	▼
Displacement	Land Control Area	▼	▼	▼
Electrical Interference		▼	▼	▼
Environmental Justice	Census Tract	▼	▼	▼
Land Use	Land Control Area	▲	▲	▼
Noise	Project Vicinity	▲	▼	▼
Property Values		▲	◆	▼
Recreation		▲	▼	▼
Socioeconomics	Freeborn County	▲	▲	▼

Recreation The ROI for recreation is the project vicinity. Potential impacts to a snowmobile trail could occur during construction. This trail will be rerouted as part of the project. The overall impact intensity level is expected to remain minimal.

Socioeconomics The ROI for socioeconomics is Freeborn County. Construction of the switching station will generate construction related jobs and material sales. These jobs and materials may or may not be sourced locally. Impacts are anticipated to be positive, but negligible. Adverse impacts will not occur.

Public Health and Safety

This section describes cumulative potential effects to public health and safety. **Table 15** illustrates the potential for cumulative effects.

Electromagnetic Fields The ROI for EMF is the land control area. The switching station will add to background EMF levels. Impacts are anticipated to be negligible. Impacts can be mitigated. The overall impact intensity level is anticipated to remain minimal.

Table 15 Cumulative Potential Effects: Public Health and Safety

Element/Resource	Region of Influence	Potential for Cumulative Effects		
		Short-term	Long-term	Permanent
EMF	Land Control Area	▲	▲	▼
Electrical Interference		▼	▼	▼
Stray Voltage		▼	▼	▼
Medical Devices		▼	▼	▼
Public Safety		▼	▼	▼
Worker Safety		▲	▲	▼

Worker Safety The ROI for worker safety is the land control area. Construction activities and maintenance of electrical equipment has inherent risks. These risks are minimal to trained personal. Potential impacts can be mitigated through worker training, safety equipment, etc. The overall impact intensity level is anticipated to remain minimal.

Public Services

This section describes cumulative potential effects to public services. **Table 16** illustrates the potential for cumulative effects.

Table 16 Cumulative Potential Effects: Public Services

Element/Resource	Region of Influence	Potential for Cumulative Effects		
		Short-term	Long-term	Permanent
Airports	Project Area	▼	▼	▼
Emergency Services		▲	▼	▼
Roads		▲	▼	▼
Utilities		▲	▼	▼

Emergency Services The ROI for emergency services is the project area. Increased traffic might cause minor traffic delays, which could impact emergency response vehicles. The overall impact intensity level is anticipated to remain minimal.

Roads The ROI for roads is the project area. Increased construction and delivery traffic might cause minor traffic delays along local roads. Potential impacts can be mitigated. The overall impact intensity level is anticipated to remain minimal.

Utilities The ROI for utilities is the project area. Minor electrical outages might be associated with construction of the switching station. Potential impacts can be mitigated. The overall impact intensity level is anticipated to remain minimal.

Land Based Economies

This section describes cumulative potential effects to land-based economies. **Table 17** illustrates the potential for cumulative effects.

Table 17 Cumulative Potential Effects: Land Based Economies

Element/Resource	Region of Influence	Potential for Cumulative Effects		
		Short-term	Long-term	Permanent
Agriculture	Land Control Area	▲	▲	▼
Forestry		▼	▼	▼
Mining		▼	▼	▼
Tourism	Project Area	▼	▼	▼

Agriculture The ROI for agriculture is the land control area. Additional lands will be taken out of agricultural production. Impacts to the total amount of agricultural land in Freeborn County are negligible. Farming revenues lost will be offset by easement agreements. Potential impacts can be mitigated. The overall impact intensity level will remain minimal.

Archaeological and Historic Resources

This section describes cumulative potential effects to archaeological and historic resources. **Table 18** illustrates the potential for cumulative effects.

Table 18 Cumulative Potential Effects: Archaeological and Historic Resources

Element/Resource	Region of Influence	Potential for Cumulative Effects		
		Short-term	Long-term	Permanent
Archaeological	Project Area	◆	◆	◆
Historic	Project Area	▲	▲	▼

The ROI for archaeological and historic resources is the project area. Because archaeological resources are unidentified, cumulative potential effects are unknown. The overall impact intensity level is expected to remain negligible. The switch yard is adjacent to a potential historic property. This property is currently unevaluated for listing in the NRHP.

Natural Resources

This section describes cumulative potential effects to natural resources. **Table 19** illustrates the potential for cumulative effects.

Table 19 Cumulative Potential Effects: Natural Resources

Element/Resource	Region of Influence	Potential for Cumulative Effects		
		Short-term	Long-term	Permanent
Air Quality and Climate Change	Freeborn County	▲	▲	▼
Geology/Topography	Land Control Area	▼	▼	▼
Groundwater		▼	▼	▼
Rare Resources	Project Area	▼	▼	▼
Soils	Land Control Area	▲	▲	◆
Surface Water		▼	▼	▼

Element/Resource	Region of Influence	Potential for Cumulative Effects		
		Short-term	Long-term	Permanent
Vegetation		▲	▲	◆
Wetlands		▼	▼	▼
Wildlife and Habitat		▲	▲	▼

Air Quality The ROI is Freeborn County. Impacts associated with construction vehicles will occur over the short term (emissions and fugitive dust). Electrical lines within the switching station will produce ozone and nitrous oxide through the corona effect. Impacts would be long term to permanent, and be negligible. The overall impact intensity level is expected to remain minimal.

Soils The ROI is the land control area. Soils within the footprint of the switching station will be permanently compacted. Soils around the switching station may experience compaction and rutting from movement of construction vehicles. The overall impact intensity level is expected to remain minimal.

Wildlife The ROI for wildlife is the land control area. Wildlife might be inadvertently harmed or killed during construction. Long term impacts include a greater risk of bird electrocution or collision due to increased electrical equipment on the landscape. Potential impacts can be mitigated. The overall impact intensity level is expected to remain minimal.

Notes

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Chapter 5 Alternatives to the Project

The applicant proposes to construct the project to (1) assist Minnesota in meeting its renewable energy objectives, and (2) meet consumers' growing demand for renewable energy. Before the applicants can construct the project, the Commission must determine if the project is needed or if another project is more appropriate for Minnesota, such as a project of a different size or type. These alternatives to the project itself are referred to as "system alternatives."

To aid the Commission in its decision-making, this section discusses and compares the potential human and environmental impacts of system alternatives. Because the project is powered by renewable energy (solar power), and in accordance with the scoping decision for this EA (**Appendix A**), this chapter discusses the following system alternatives:

- A no-build alternative
- A generic 150 MW solar farm
- A generic 150 MW wind farm

As discussed further below, each of these alternatives is feasible and available. Impacts of the no-build alternative include: (1) a possible reduction in the state's ability to meet its renewable energy objectives; (2) the loss of economic benefits to the project area; and (3) potential negative impacts resulting from replacing renewably-generated electrical energy (solar) with energy generated from a non-renewable source (for example, coal or natural gas).

Impacts of a generic 150 MW solar farm and a generic 150 MW wind farm would be similar to the impacts of the Hayward Solar Project. A wind farm would have relatively greater impacts on human settlements due to aesthetic impacts, shadow flicker, and noise impacts. A wind farm would also have relatively greater impacts on wildlife, particularly birds and bats.

A generic 150 MW solar farm would have relatively greater impacts on land use and agriculture than a wind farm – solar farms require 6 to 10 acres of land per MW; wind farms require about 0.3 acres of land per MW. Accordingly, a generic 150 MW wind farm would be relatively more compatible with agricultural production.

5.1 Need for the Project

The project could contribute to satisfying demands for renewable energy.

The applicant proposes to construct the project to assist Minnesota meet its renewable energy objectives, which require that 25 percent of utility electric sales be generated by renewable energy technologies by the year 2025.[1] In addition, the state has a solar-specific goal that requires certain electric utilities to obtain at least one and one-half percent of their total Minnesota retail sales from solar energy by the end of 2020, with a goal of obtaining 10 percent of these sales from solar energy by 2030.[2] Moreover, Minnesota utilities and cooperatives are responding to climate change with ambitious carbon reduction goals, for example, Xcel Energy's goal to be carbon free by 2050.[3]

The applicant also points out that the project can help meet the growing demand for renewable energy. For example, corporations are setting carbon reduction and renewable energy goals.[4] It is estimated that U.S. companies will purchase 85 gigawatts of renewable energy by 2030.[5]

The applicant is working to secure a power purchase agreement(s) to sell the energy, capacity, and renewable energy credits generated by the project to electric utilities or commercial customers.[6]

5.2 No-Build Alternative

Under the no-build alternative, the project would not be constructed. This could occur if the Commission determines that the need for additional solar generation is not clearly established; no certificate of need would be issued, and the project would not be constructed. This alternative is both feasible and available.

If the project is not constructed, the potential human and environmental impacts associated with the project would not occur. For example, land that would otherwise be removed from agricultural production would remain in production. While there are solar and wind resources in other parts of the state that could replace the project, the land on which to site these resources is finite. If the project is not built, it would reduce the available options to meet, or as easily meet, the state's renewable energy objectives and solar energy goals.

If the project is not built, certain economic benefits would be lost. Project landowners would lose land lease payments.[7] Wages to employees, including union employees, to construct the project would not be paid. Local governments would lose energy production tax revenues. The estimated annual revenue for this tax is $305,000 for Freeborn County and $76,000 for Hayward Township.[8]

Finally, if the project is not constructed, and electricity consumption increases in the Upper Midwest, the electrical energy that would have been produced by the project might be replaced by a carbon-emitting, non-renewable energy source, for example, coal or natural gas, which would lead to further global climate change.

5.3 150 MW Solar Farm

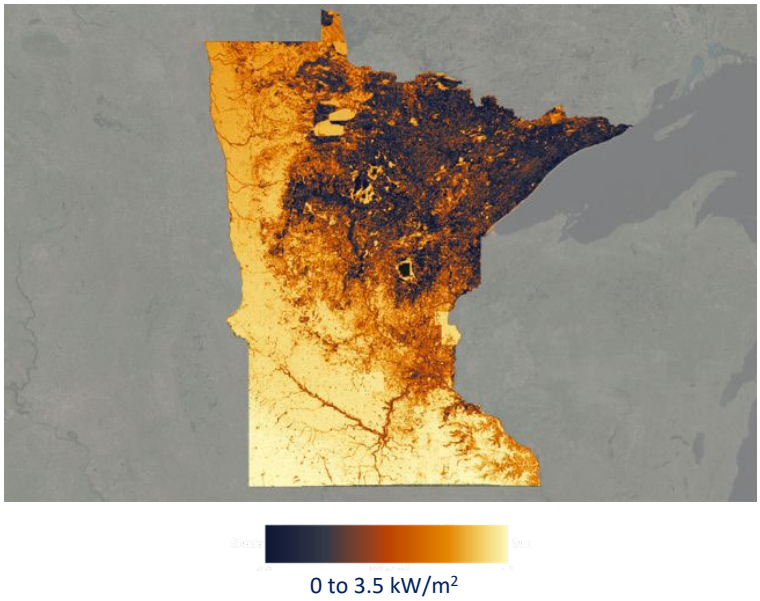
A generic 150 MW solar farm is a solar farm sited elsewhere in Minnesota that would have operating characteristics similar to the project. It could be a single 150 MW solar farm or a combination of smaller solar farms with a total, combined capacity of 150 MW. A 150 MW solar farm sited elsewhere in Minnesota could address potential human and environmental impacts associated with the project. That is, an alternative site might have fewer potential impacts or a different mix of impacts.

A generic 150 MW solar is feasible and available. The Commission has permitted several solar farms in Minnesota.[9] Solar irradiance in Minnesota is highest in southwest and south-central Minnesota in areas of the state that are primarily agricultural (**Figure 13**).[10] Accordingly, a generic 150 MW solar farm would likely be located in southern Minnesota in a row-crop agricultural setting, similar to the project. The analysis that follows makes this assumption.

The locality, capacity, and availability of the interconnection point to the electrical grid is a significant consideration in planning new solar farms—not unlike wind farms—and can be a significant contributor to overall cost. Most renewable energy projects are sited as close as possible to a suitable interconnection point. The developer absorbs costs associated with permitting and constructing power lines to the interconnection point, making the interconnection, and needed upgrades to the electrical grid so that it can accommodate output from the facility.

5.3.1 Human Settlement

Figure 13 Solar Irradiance in Minnesota



Impacts to human settlements are impacts related to quality of life, for example, aesthetics, noise, cultural values, public services. For a generic 150 MW solar farm, these impacts are anticipated to be minimal and comparable to impacts associated with the project.

Aesthetic and noise impacts depend on the number of neighboring receptors and their distance from the project. A generic 150 MW solar farm would also be located in a rural, agricultural setting, similar to the project, where sensitive receptors (residences) are relatively sparse and can be avoided with prudent siting. The project is located next to I-90. While highway travelers will likely have low sensitivity to the project, a generic 150 MW solar farm constructed away from a major highway would have less visual exposure, and, as a result, less potential for aesthetic impacts. Conversely, locating a solar farm near existing infrastructure like a highway, could minimize aesthetic impacts by placing like-with-like, that is, by putting new infrastructure next to existing infrastructure.

A solar farm can change neighboring landowners' sense of place. Differing views regarding a solar farm (or any large infrastructure project) can erode a community's shared sense of self. These impacts to cultural values can, at times, be mitigated by the presence of existing infrastructure, such as highways or electric infrastructure. The project is located near I-90 and a railroad, which may mitigate potential impacts to cultural values in the project area. A generic 150 MW solar farm may or may not be located near existing infrastructure.

Potential impacts to public services due to a solar farm are not anticipated. A generic 150 MW solar farm would not disrupt local businesses or have negative socioeconomic impacts, but would likely have positive socioeconomic impacts like the project, for example, land payments, construction wages, and energy production taxes. Potential impacts to property values are difficult to determine because they are influenced by a complex interaction of factors; however, impacts for a generic 150 MW solar farm are expected to be similar to those of the project.

5.3.2 Public Health and Safety

Impacts to public health and safety relate to the generation of electrical energy. This energy has the potential to cause harm or injury. For a generic 150 MW solar farm, these impacts are anticipated to be minimal and similar to the impacts anticipated for the project.

A generic 150 MW solar farm and substation, like the project, would be fenced and signed to indicate the danger of electrocution. Further, solar projects are monitored remotely in real time and

in person on a regular schedule to ensure electrical safety mechanisms (for example, circuit breakers) are working correctly. No health impacts from electrical cabling, including impacts to implantable medical devices (pacemakers) are anticipated for the project and none would be anticipated for a generic 150 MW solar farm.

There is a possibility that components of a solar farm, such as solar panels, could be removed by high winds or other strong weather. Components leaving the project site could injure nearby persons. The project is designed to prevent solar farm components from the leaving the project site; a generic 150 MW solar farm would include similar design measures.

5.3.3 Land-Based Economies

For a generic 150 MW solar farm, impacts to agriculture, forestry, mining, and tourism are anticipated to be similar to the impacts of the project.

Because solar farms require relatively large acreages of unshaded, contiguous land, they are not sited in areas that support forestry or mining. No impacts to these resources are anticipated for the project or for a generic 150 MW solar farm. Solar farms could impact tourism if they were located fairly near a tourist or recreational attraction. Though there are tourism attractions in southern Minnesota, these attractions are typically located in urban areas or state parks and recreation areas and not in agricultural fields. Accordingly, impacts to tourism from a generic 150 MW solar farm are not anticipated.

Both a generic 150 MW solar farm and the project will remove land from agricultural production. The project will remove about 1,270 acres of agricultural land; a generic 150 MW solar farm would remove a similar amount.[11] Though this is a relatively large acreage, it is a relatively small percentage of the farmland in Minnesota (25.5 million acres).[12]

Minnesota has a policy to avoid placing electrical generating infrastructure on prime farmland.[13] Prime farmland can be used for such a project only if there is no feasible or prudent alternative.[14] Projects in Minnesota have been sited on both high and low percentages of prime farmland in terms of total acres impacted.[15] The project is proposed to be sited on approximately 648 acres of prime farmland.[16] As there is a considerable amount of prime farmland in southern Minnesota, a generic 150 MW solar farm located there would likely have similar or greater impacts on prime farmland, though there are locations in the state where impacts to prime farmland would not be as great.

Finally, though solar farms remove land from agricultural production, Commission permits require permittees to conserve and maintain soil resources at each project site so that projects can be decommissioned at the end of their lives and the land returned to agricultural production.

5.3.4 Archaeological and Historic Resources

For a generic 150 MW solar farm, impacts to archaeological and historic resources are anticipated to be minimal and similar to the impacts of the project. Surveys for archaeological and historic resources are conducted prior to selecting a solar farm site; thus, impacts to these resources can generally be avoided by prudent siting.

5.3.5 Natural Environment

For a generic 150 MW solar farm, impacts to air and water resources, flora, and fauna are anticipated to be minimal and similar to the impacts of the project.

There are few water resources in the project area. Though there are water resources in southern Minnesota, many wetlands were drained during settlement of the land and conversion from prairie to farmland. Further, Minnesota now has a policy to protect wetlands.[17] Thus, it is likely that a generic 150 MW solar farm would have minimal impacts on wetlands.

Because this analysis assumes that a generic 150 MW solar farm, like the project, would be constructed on row-crop farmland, impacts to wildlife and wildlife habitat are anticipated to be minimal. If the generic 150 MW solar farm was constructed near quality wildlife habitat (for example, a DNR wildlife management area) impacts to large wildlife could be greater due to wildlife movement or the impediment of such movement by solar farm fencing.

Impacts to vegetation due to a generic 150 MW solar farm are anticipated to be minimal; the solar farm would be located on agricultural land with no or minimal impacts on woody vegetation.

5.3.6 Rare and Unique Natural Resources

For a generic 150 MW solar farm, impacts to rare and unique resources are anticipated to be minimal and similar to the impacts of the project. Rare and unique resources are recorded by natural resource agencies, that is, DNR and USFWS. Database queries for rare and unique resources can be conducted prior to selecting a solar farm site. Additionally, on-the-ground surveys can be conducted. Thus, impacts to these resources can generally be avoided by prudent siting.

5.4 150 MW Wind Farm

A generic 150 MW large wind energy conversion system (LWECS) or “wind farm” sited elsewhere in Minnesota would have a similar electrical capacity to the project. It could be a single 150 MW wind farm or a combination of smaller wind farms with a total, combined capacity of 150 MW. A 150 MW wind farm sited elsewhere in Minnesota could address potential human and environmental impacts associated with the project. That is, this alternative type of project might have fewer potential impacts or a different mix of impacts.

Wind farms consist of individual wind turbines connected via electrical collection lines, typically buried, which collect and funnel the generated electricity to a project substation. Modern wind turbines are mounted on towers that are 80 to 100 meters tall. Wind turbine rotors range from 120 to 150 meters in diameter. Total tip heights are usually between 195 and 200 meters.

Wind farms are generally located within a relatively large project boundary for which a developer has obtained wind rights. However, individual turbines have a small footprint. Turbines are sited in discrete locations that avoid impeding air flow between the other turbines. A large land area is necessary because of the internal and external setbacks required to assure wind efficiencies, and to protect wind rights and nearby receptors (residences). Like solar farms, wind farms include multiple construction sites for installing individual components, such as turbines, collection lines, substation, access roads, etc.

A generic 150 MW wind farm is feasible and available. The Commission has permitted many wind farms in Minnesota. Wind resources in Minnesota are greatest in the southwest portion of the state (**Figure 14**). This area of the state is primarily agricultural. Accordingly, a generic 150 MW wind farm would likely be located in southwest Minnesota in an agricultural setting similar to the project.

5.4.1 Human Settlement

For a generic 150 MW, wind farm impacts to human settlements would be greater than those of the project—specifically, with respect to aesthetics, shadow flicker, and noise.

Because of their height, size, and movement, wind turbines cause aesthetic impacts. Whether this is a positive or negative impact depends on the viewer—some viewers would find wind turbines consistent with a traditional harvesting of natural resources; others would find wind turbines to be industrial infrastructure that is inconsistent with a rural landscape. The extent of aesthetic impacts would be greater for a generic 150 MW wind farm than for the project. Wind turbines can be seen for several miles in an agricultural landscape; solar panels have a lower profile and would be visible only to neighboring properties and to travelers on adjacent roads and highways.

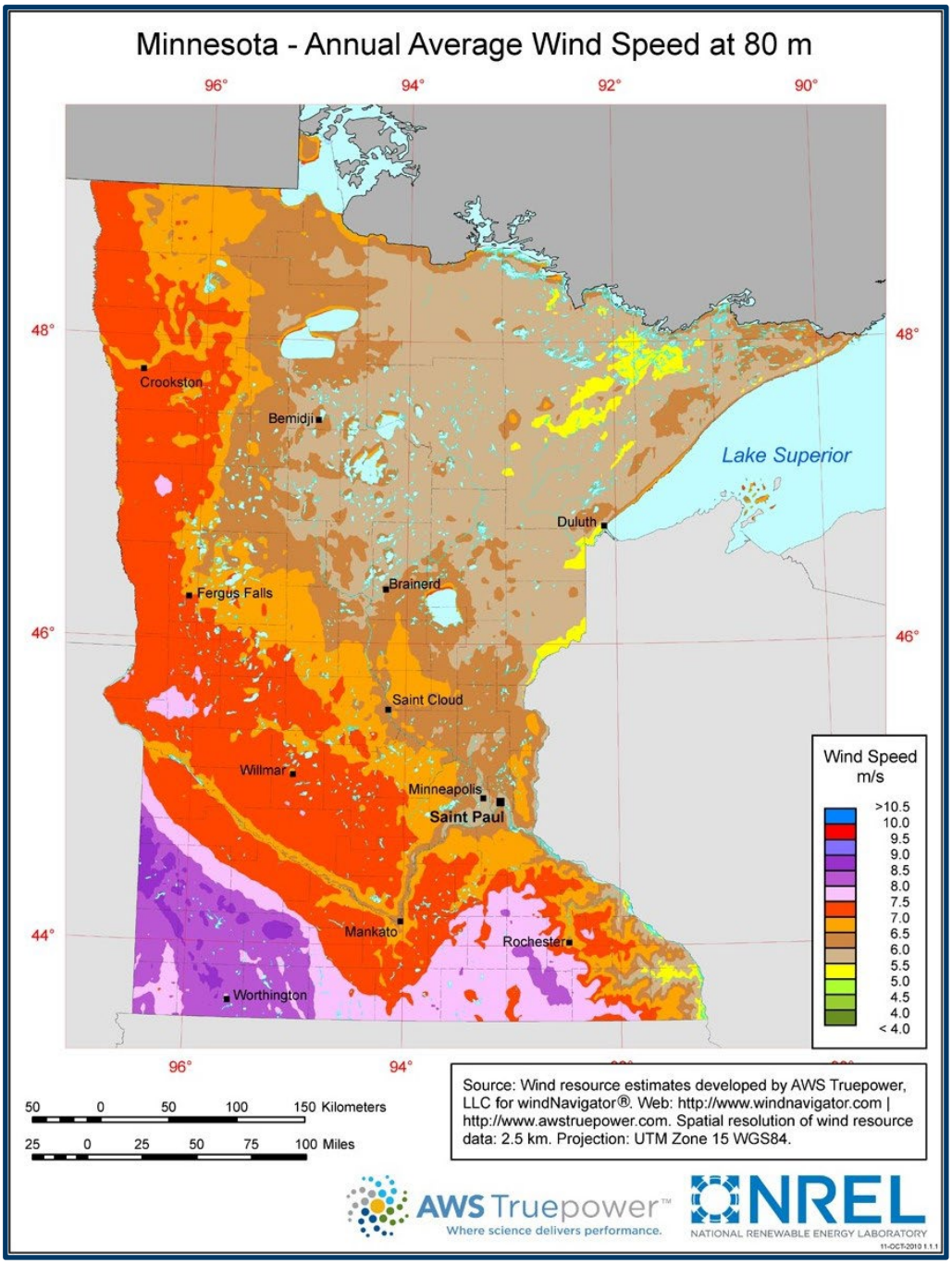
Sunlight on rotating wind turbine blades creates moving shadows on the landscape, a phenomenon known as “shadow flicker.” Shadow flicker can cause adverse aesthetic and quality of life impacts. Though Commission permits minimize shadow flicker through prudent siting of wind turbines, shadow flicker will occur to some extent in the project area. Solar farms do not produce shadow flicker and are designed to absorb sunlight.

Both a generic 150 MW wind farm and the project will produce noise while generating electricity and must operate within Minnesota state noise standards. However, a generic 150 MW wind farm is louder. Wind turbine generators and blades create higher noise levels than solar farm inverters. Additionally, wind turbines can operate around the clock, whenever the wind is blowing; solar inverters are working at full power (at their rated noise level) only on clear days. Thus, a generic 150 MW wind farm would be noisier than the project.

Potential impacts to public services due to a wind farm are not anticipated. Due to the height of wind turbines, a generic 150 MW wind farm has relatively greater potential to impact aviation. Wind farms can negatively affect airport operations and air traffic. Potential impacts are mitigated by siting wind farms away from airports. Additionally, proposed turbine locations must be reviewed by the Federal Aviation Administration (FAA) and appropriately lighted per FAA requirements.

A generic 150 MW wind farm would not disrupt local businesses or have negative socioeconomic impacts. Rather, a generic 150 MW wind farm would, like the project, have positive socioeconomic impacts, for example, land payments, construction wages, and energy production taxes. Potential impacts to property values are difficult to determine because they are influenced by a complex interaction of factors. Impacts for a generic 150 MW wind farm would be similar to the project; however, any impacts would likely be distributed over a larger area.

Figure 14 Wind Speeds in Minnesota



5.4.2 Public Health and Safety

Impacts to public health and safety relate to the generation of electrical energy. This energy has the potential to cause harm or injury. For a generic 150 MW wind farm, these impacts are anticipated to be minimal and similar to the impacts for the project.

A generic 150 MW wind farm, like the project, would have limited access and would be signed to indicate the danger of electrocution. Further, wind projects are monitored remotely in real time and

in person on a regular schedule to ensure electrical safety mechanisms are in place and working correctly. No health impacts from electrical cabling, including impacts to implantable medical devices (pacemakers), are anticipated for the project and none would be anticipated for a generic 150 MW wind farm.

5.4.3 Land-Based Economies

For a generic 150 MW wind farm, impacts to agriculture, forestry, mining, and tourism are anticipated to be comparable with the impacts of the project, except for agriculture. A generic 150 MW wind farm would impact fewer acres of agricultural land than the project.

Because individual turbines are sited at discrete locations within the wind farm boundary, turbines can be located to avoid impacts to forestry and mining. A generic 150 MW wind farm could impact tourism if it were located near a tourist or recreational attraction. Though there are tourism attractions in southern Minnesota, these attractions are typically located in urban areas or state parks and recreation areas, and not in agricultural fields. Wind turbines are significantly taller than solar panels; accordingly, they can be seen from a greater distance. This greater visibility could create impacts to tourist or recreational attractions, with the extent of the impact decreasing with distance from the wind farm. However, on whole, impacts to tourism from a generic 150 MW wind farm are not anticipated.

Both a generic 150 MW wind farm and the project would remove land from agricultural production; however, a generic 150 MW wind farm would remove substantially less. The project will remove about 1,270 acres of agricultural land; a generic 150 MW wind farm would remove about 45 acres.[18] In general, wind farms require about 0.3 acres of land per MW; solar farms about 6 to 10 acres of land per MW. Further, the land removed for a wind farm is discrete, whereas the land removed for a solar farm is typically contiguous.

Because wind farms require relatively few acres of land per MW of generation, a generic 150 MW wind farm would be consistent with Minnesota's prime farmland rule (see Chapter 4.5.1). This would be true even in areas of the state that are entirely prime farmland. In contrast, the project is not consistent with the 0.5 acres per MW limit in the prime farmland rule and conforms with the rule only to the extent that there are no feasible or prudent alternatives.

Commission permits require wind farm and solar farm permittees to conserve and maintain soil resources so that projects can be decommissioned, and the land returned to agricultural production. Thus, both a generic 150 MW wind farm and the project would return their respective agricultural acreages to production at the end of the project unless otherwise directed by the landowner.

5.4.4 Archaeological and Historic Resources

For a generic 150 MW wind farm, impacts to archaeological and historic resources are anticipated to be minimal and similar to the impacts of the project. Surveys for archaeological and historic resources can be conducted prior to locating wind turbines; thus, impacts to these resources can generally be avoided by prudent siting.

5.4.5 Natural Environment

For a generic 150 MW wind farm, impacts to air and water resources, flora, and fauna are anticipated to be similar to the project, except for impacts to fauna. A generic 150 MW wind farm would negatively impact birds and bats, which can be struck and killed by moving turbine blades.

There are few water resources in the project area. Though there are water resources in southern Minnesota, many wetlands were drained during settlement of the land and conversion from prairie to farmland. Further, Minnesota now has a policy to protect wetlands.[19] Thus, it is likely that a generic 150 MW wind farm would have minimal impacts on wetlands.

Impacts to vegetation due to a generic 150 MW wind farm are anticipated to be minimal; the wind farm would be located on agricultural land with no or minimal impacts on woody vegetation. Further, individual wind turbines could be located away from woody vegetation.

Because this analysis assumes that a generic 150 MW wind farm, like the project, would be constructed on row crop farmland, impacts to non-avian wildlife and wildlife habitat are anticipated to be minimal. Impacts to avian wildlife will be substantially greater for a generic 150 MW wind farm. Wind farms in the United States kill 1 to 14 birds per MW per year (birds/MW/year), with most wind farms killing less than 4 birds/MW/year.[20] Wind farms kill 1 to 40 bats/MW/year, with most wind farm killing less than 15 bats/MW/year.[21] Thus, a generic 150 MW wind farm could cause about 600 bird fatalities and 2,250 bat fatalities each year, while the project is anticipated to cause minimal bird and bat fatalities.

5.4.6 Rare and Unique Natural Resources

For a generic 150 MW wind farm, impacts to rare and unique resources are anticipated to be minimal and similar to the impacts of the project. Rare and unique resources are recorded by natural resource agencies, for example, DNR and USFWS. Database queries for rare and unique resources can be conducted prior to selecting wind turbine locations. Additionally, on-the-ground surveys can be conducted. Thus, impacts to these resources can generally be avoided by prudent siting.

5.5 Fossil Fuel Power Plant Pollutants

Minnesota Rule 7849.1500 requires that this EA discuss certain pollutants that can be emitted from large electric power generating plants. The rule is directed primarily at generating plants that use fossil fuels that have air emissions and that reject waste heat into the environment, typically through cycled water. Though the rule is not directed to generating plants that use solar or wind energy, the pollutants noted in the rule are discussed here.

5.5.1 Air Pollutants

Sulfur dioxide, nitrogen oxides, carbon dioxide, mercury, and particulate matter are known as primary pollutants. Primary pollutants form directly and must be emitted by a source.[22] Because solar farms and wind farms do not burn fuel, they do not emit primary pollutants during operation.

Air pollutants would be emitted during construction of both solar farms and wind farms. These pollutants include construction equipment exhaust and fugitive dust. Exhaust emissions from construction equipment and vehicles traveling to and from the facility would occur during

construction. Fugitive dust occurs from earth moving activities and vehicle travel on unpaved roads. These impacts are influenced by weather conditions and the type of construction activity. Once the solar farm or wind farm is constructed, exhaust and dust emissions would be greatly reduced. Limited emissions would occur during routine maintenance and repairs.

5.5.2 Hazardous Air Pollutants and Volatile Organic Compounds

Hazardous air pollutants are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.[23] Minor emissions of toxic air pollutants at solar farms would occur from vehicle and equipment use and from solvents and coatings used during equipment maintenance and building upkeep. Emissions at wind farms would be similar, with the addition of petroleum-based fluids used in the operation of wind turbines, such as gear box oil, hydraulic fluid, and grease.

5.5.3 Ozone

Ozone is not emitted directly into the air but is created by chemical reactions between nitrogen oxides and volatile organic compounds. This happens when pollutants emitted by a variety of sources chemically react in the presence of sunlight.[24] Solar farms and wind farms do not produce ozone or ozone precursors during operation. Minimal amounts of nitrogen oxides would be produced during construction of these projects; these oxides could result in the local production of ozone.

5.5.4 Water Appropriation and Wastewater Streams

According to the U.S. Geological Survey, 133 billion gallons of water are withdrawn each day in the United States to cool thermoelectric power plants in 2015.[25] The vast majority of this water is recycled and returned to the water source. Solar farms and wind farms are not thermoelectric power plants—they do not use water to generate electricity or for cooling. Water is not appropriated to operate these facilities, and they do not discharge wastewater.

5.5.5 Solid and Hazardous Wastes

If not properly handled, solid and hazardous wastes can contaminate air, soils, and water, which can cause a variety of human and environmental impacts depending on the type and amount of contamination.

Solar farm and wind farm construction generates solid waste, such as scrap wood and metal, plastics, and cardboard. Petroleum products would be present on-site, including engine and hydraulic oil, lubricants, grease, cleaning solvents, and fuel. Operation of these projects is not expected to generate significant qualities of solid and hazardous wastes. Petroleum products would be kept onsite for routine maintenance activities.

Decommissioning of solar farms and wind farms will generate solid wastes. Certain electronic components in both solar farms and wind farms, such as circuit boards, contain hazardous materials commonly found in electronic devices. In Minnesota, solar panels 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. Panels must be properly disposed of in a special facility or recycled if recyclers are available.[26]

About 85 percent of wind turbine components can be recycled or reused, including steel, copper, and electronics.[27] Wind turbine blades are difficult to recycle and must be cut into pieces for proper disposal.[28]

Notes

[1] Minnesota Statute 216B.1691.

[2] *Ibid*. at subdivision 2(f).

[3] Certificate of Need Application, Section 3.1.

[4] *Ibid*.

[5] *Ibid*.

[6] *Ibid*.

[7] Certificate of Need Application, Section 4.3.2.

[8] *Ibid.*

[9] *E.g.*, the Aurora (GS-14-515), Marshal (GS-14-1052), North Star (GS-15-33), Regal (GS-19-395), and Elk Creek (GS-19-495) Solar Projects.

[10] MN Solar Suitability Analysis App, retrieved from: https://solar.maps.umn.edu/app/.

[11] Site Permit Application, Section 4.3.1.

[12] USDA, National Agricultural Statistics Service (2017) *Census of Agriculture, Historical Highlights: Minnesota*, retrieved from: https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/Minnesota/.

[13] Minnesota Rule 7850.4400.

[14] *Ibid.*

[15] *E.g.*, The Elk Creek Solar Project is sited on 680 acres of prime farmland, whereas the Regal Solar Project is sited on 2 acres of prime farmland.

[16] Site Permit Application, page 60.

[17] Wetland Conservation Act; Minnesota Rule 8420.

[18] National renewable Energy Laboratory (August 2009) *Land-Use Requirements of Modern Wind Power Plants in the United States*, retrieved from: https://www.nrel.gov/docs/fy09osti/45834.pdf.

[19] *Supra* note 17.

[20] National Wind Coordinating Collaborative (Spring 2010) *Wind Turbine Interactions with Birds, Bats, and their Habitats: A Summary of Research Results and Priority Questions*, https://www1.eere.energy.gov/wind/pdfs/birds_and_bats_fact_sheet.pdf.

[21] *Ibid*.

[22] University of Calgary (September 3, 2018) *Energy Education: Primary Pollutant*, retrieved from: https://energyeducation.ca/encyclopedia/Primary_pollutant.

[23] U.S. Environmental Protection Agency (February 9, 2017) *What are Hazardous Air Pollutants?*, retrieved from: https://www.epa.gov/haps/what-are-hazardous-air-pollutants.

[24] U.S. Environmental Protection Agency (October 31, 2018) *Ground-level Ozone Basics*, retrieved from: https://www.epa.gov/ground-level-ozone-pollution/ground-level-ozone-basics#formation.

[25] U.S. Geological Survey (n.d.) *Total Water Use*, retrieved from: https://www.usgs.gov/mission-areas/water-resources/science/total-water-use?qt-science_center_objects=0#qt-science_center_objects.

[26] Pollution Control Agency (April 2018) *2017 Toxics and Pollution Prevention Evaluation Report*, retrieved from: https://www.pca.state.mn.us/sites/default/files/lrp-p2-2sy17.pdf, page 22; see also California Department of Toxic Substance Control (n.d.) *Solar Panel FAQs*, retrieved from: https://dtsc.ca.gov/solar-panel-faqs/#easy-faq-348310 (solar panel wastes include heavy metals such as silver, copper, lead, arsenic, cadmium, selenium that at certain levels may be classified as hazardous wastes).

[27] Martin, C. (February 7, 2020) *Wind Turbine Blades Cant' be Recycled, So They're Piling up in Landfills*, retrieved from: https://www.bloomberg.com/news/features/2020-02-05/wind-turbine-blades-can-t-be-recycled-so-they-re-piling-up-in-landfills.

[28] *Ibid*.