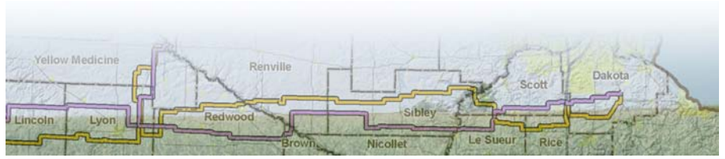


This section of the environmental impact statement (EIS) provides an overview of resources that could be affected by the proposed Project and summarizes potential impacts to these features.

6.1 Human Settlement

This section summarizes visual impacts, noise, proximity, wind breaks, and other impacts typically associated with human settlement. Methods to reduce these impacts (mitigation) are also summarized. Related issues such as health and safety (Section 6.2), property values (Section 6.5), archaeological and historical resources (Section 6.6), and land based economies (Section 6.8) are addressed elsewhere in this document.

6.1.1 Visual and Aesthetic Impacts

Aesthetics refer to the natural and human modified landscape features or visual resources that contribute to the public's experience and appreciation of the environment. Wetlands, surface waters, landforms, forests, and vegetation patterns are among the natural landscape features that define an area's visual character, whereas buildings, roads, bridges, and other structures reflect human modifications to the landscape. The level of impact to visual resources generally depends on the sensitivity and exposure of a particular viewer and can vary greatly from one individual to the next. It is, therefore, difficult to predict whether a transmission line project would alter the perceived visual character of the environment, or viewshed, and constitute a negative visual impact.

The landscape from the South Dakota border to the western edge of the Twin Cities is mostly flat to rolling agricultural land. In these agricultural areas, the power poles would be visible on clear days from up to two miles. The transmission line conductors are unlikely to be seen clearly beyond distances of one-half to three-quarters of one mile. Most of the trees in these areas that might block the view of the transmission lines are wind breaks near farmsteads. Figure 6.1.1-1 is a photograph of a single-pole transmission line in a rural area.

The proposed transmission line and structures would add to the changing landscape of the area in more developed urban and semi-rural areas closer to the Twin Cities. There are areas where the transmission line structures would clearly be visible along roads and through private lands. There would however be opportunities to construct the transmission line in areas that lessen the potential visual impacts. Areas or alignments may include constructing near existing industrial areas, using existing transmission and road ROW (ROW), or crossing to opposite sides of the road, when beneficial.

Distinctive scenic or higher-quality areas along the routes, such as river crossings or unusual land forms, would have distinct visual impacts when compared with other areas.

Potential Mitigation

There are several methods to reduce visual impacts, including:

Figure 6.1.1-1. A single pole transmission line in rural area (note: typical structures for the Project would be single pole self weatherizing steel double circuit 345 kV structures as shown in Section 4.4)

Source: Barr photograph, 2009

- Avoid routing through areas with high-quality, distinctive view sheds, including scenic highways, river crossings, and similar areas when feasible.
- Cross rivers and streams where there is already a transmission line, pipeline, or roadway, especially at the Minnesota, Yellow Medicine, and Redwood Rivers.
- Cross rivers and streams using the shortest distance possible (perpendicular to the water body).
- Use uniform structure types to the extent practical. The height of the structure may be reduced (including using the shorter H-frame structures) to minimize impacts within scenic areas.
- Construct the lines carefully so as to prevent any unnecessary destruction, scarring or defacing of the natural surroundings in the vicinity of the work.
- Select routes that run parallel to existing roads or transmission lines to the extent practicable to minimize the proliferation of visual impacts to open spaces and developed areas alike.

6.1.2 Noise

Noise levels capable of being heard by humans are measured in decibels (dBA). A noise level change of three dBA is barely perceptible to average human hearing. A five dBA change in noise level, however, is clearly noticeable. A ten dBA change in noise levels is perceived as a doubling or halving of noise loudness, while a 20 dBA change is considered a dramatic change in loudness. Cumulative noise increases occur on a logarithmic scale. If a noise source is doubled, there is a three dBA increase in noise, which is barely discernible to the human ear.

Transmission lines can produce noise under certain conditions. The level of noise depends on conductor conditions, voltage level, and weather conditions. In foggy, damp, or rainy weather, transmission lines can create a crackling sound due to the small amount of electricity ionizing the moist air near the conductors. For cumulative

Table 6.1.2-1. Examples of common noises

Sound Pressure Level (dBA)	Noise Source
140	Jet Engine (at 25 meters)
130	Jet Engine (at 100 meters)
120	Rock Concert
110	Pneumatic Chipper
100	Jackhammer (at 1 meter)
90	Chainsaw, Lawn Mower (at 1 meter)
80	Heavy Truck Traffic
70	Business Office, Vacuum Cleaner
60	Conventional Speech, Typical TV Volume
50	Library
40	Bedroom
30	Secluded Woods
20	Whisper

Source: A Guide to Noise Control in Minnesota, MPCA (revised, 2008), http://www.pca.state.mn.us/programs/noise.html

Table 6.1.2-2. Noise limits

Noise Area Classification	Daytime		Nighttime	
	L_{50}	L_{10}	L_{50}	L_{10}
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

Source: A Guide to Noise Control in Minnesota, MPCA (revised, 2008) http://www.pca.state.mn.us/programs/noise.html

Table 6.1.2-3. Noise model

Structure Type	Noise L_5 (Edge of ROW) (dBA)	Noise L_{50} (Edge of ROW) (dBA)
Single Pole, Davit Arm, 345 kV / 345 kV Double Circuit with both circuits in service	51.6	41.8
Single Pole, Davit Arm, 345 kV / 345 kV Double Circuit with one circuit in service	54.1	45.8
Single Pole, Davit Arm, 345 kV / 345 kV / 69 kV Triple Circuit	57.4	49.7
Single Pole, Davit Arm, 345 kV / 345 kV / 115 kV Triple Circuit	57.5	49.8
Single Pole, Davit Arm, 115 kV Single Circuit	24.3	19.3
Single Pole, Davit Arm, 345 kV / 345 kV Double Circuit with one circuit operating at 230 kV	36.0	26.0

Source: Great River Energy and Xcel Energy. Application to the Minnesota Public Utilities Commission for a Route Permit for the Brookings County – Hampton 345 kV Transmission Line Project

increases resulting from sources of different magnitudes, the rule of thumb is that if there is a difference of greater than ten dBA between noise sources, there would be no additive effect (i.e., only the louder source would be heard and the quieter source would not contribute to noise levels).

Therefore, predicted noise levels associated with the transmission line are typically much lower than the ambient noise in the Project area and would not increase the existing background noise levels in the Project area.

What is noise?

Noise is defined as unwanted sound. It may include a variety of sounds of different intensities across the entire frequency spectrum

During heavy rain the background noise level of the rain is usually greater than the noise from the transmission line. As a result, people do not normally hear noise from a transmission line during heavy rain. During light rain, dense fog, snow, and other times when there is moisture in the air, transmission lines would produce audible noise approximately equal to household background levels. Table 6.1.2-1 shows examples of common noise levels.

Generally, activity-related noise levels during the operation and maintenance of transmission lines are minimal and do not exceed the Minnesota Pollution Control Agency (PCA) noise limits outside of the ROW. Noise limits are shown in Table 6.1.2-2.

What is L50?

L50 is the dBA that may be exceeded 50 percent (30 minutes) of the time within an hour.

What is L10?

L10 is the dBA that may be exceeded 10 percent (six minutes) of the time within an hour.

The applicants modeled the expected noise levels from the Project using the Bonneville Power Administration CFI8X model. Where possible, the model was executed as a worst-case scenario benchmark, to ensure that noise was not under-predicted. Modeled worst-case noise levels would be below applicable state standards. Modeled noise levels for the structure types that would be used for the Project are shown in Table 6.1.2-3.

6.1.3 Proximity to Structures

Regulators and utilities try to select routes that avoid residences as much as possible. In rural areas, there is a trade-off between routing the line down section-lines in farm fields (which helps avoid homes) or down roadways (which avoids impacts to agricultural lands but potentially increases the number of nearby farmsteads). In more developed areas near the Twin Cities, such as in Dakota, Scott, and Rice Counties, residences and businesses may not easily be avoided.

House Count Methodology

Section 7 of this EIS includes detailed tables and maps showing the number and location of residences along the various route options. These data were developed by (1) reviewing the applicants' information (2) updating it using high-resolution aerial photographs, and (3) ground verification of the applicant's data including locations of houses and other human settlement features. Based on this review, there are 316 homes located within 500 feet of the applicants' Preferred Route, and about the same number along the Alternate Route.

Mitigation

The primary way to reduce proximity to homes and buildings is through careful route selection. As stated in the route permit application, the applicants tried to avoid residences and buildings when selecting their proposed routes. Avoiding homes would also be an important criterion for final route selection. Section 7 of this impact statement compares the impacts to residential and other structures on the various route options under consideration. In addition, the applicants have selected route centerlines that run along the side of the street without homes or building conflicts when possible (see Appendix A).

Finally, while low-voltage residential distribution lines can be placed underground, it is generally not feasible to install the proposed high-voltage transmission line underground for more than a mile or two because of the state of technology, high-cost, and reliability concerns (See Section 4).

6.1.4 Displacement

For electrical safety code and maintenance reasons, utilities would not generally allow residences or other buildings within the actual ROW easement for a high-voltage transmission line. In this case, the proposed ROW is to be 150 feet wide. Therefore, any residences or other buildings within 75 feet of the ROW centerline may be displaced. Based on a aerial photograph review and field check completed in August, 2009, there are three homes along the Preferred Route and one residence along the Alternate Route within the ROW that may have to be displaced if the routes are not modified. Further information on route-specific displacement issues and potential route modifications, is provided in Section 7. Figure 6.1.4-1 is a photograph of a narrow, restricted area along a transmission line route.

Since this Project is a 345-kV transmission line, landowners on the selected route may sell their property to the utility per Minnesota Statute Section 216E.12, Subdivision 4 (sometimes referred to as the "Buy the Farm" provision). This gives the owner of certain types of property the option of having the applicants purchase the property that the transmission line crosses for the fair market value of the land. Generally, the statute applies to residential, recreational, and agricultural property. A parcel's eligibility under the statute depends on its classification under Minnesota Statutes Section 273.13. Only those parcels falling within the enumerated classifications are covered; unlisted classifications are excluded. The statute extends to the following types of property: agricultural or nonagricultural homestead, non-homestead agricultural land, rental residential property, and both commercial and noncommercial seasonal residential recreational property. It is unclear at this time which landowners may exercise this option.

6.1.5 Tree Groves/Windbreaks

During public scoping meetings, residents of western Minnesota identified the importance of trees for privacy, shade, and wind screen protection around rural residences and farmsteads. Figure 6.1.5-1 is a photograph of a typical farmstead windbreak in the area. In eastern Minnesota, where tree cover is more abundant, meeting participants identified the importance of trees for helping maintain the rural character of the region, providing a source of economic activity for some residents, and playing a role in recreational activities.

Additionally, trees often help to protect wildlife corridors, particularly near water and wetland features. Throughout the routing process, the applicants have indicated that they sought routes that would minimize the removal of trees. Much of the land area crossed by the transmission line is open agricultural land. Most of the tree cover in proximity to the proposed Project is located around water features or on lands deemed unsuitable for farming.

The applicants indicate that the Preferred Route and Alternate Route have been located to avoid the removal of trees to the greatest extent possible. In an effort to avoid agricultural impacts or impacts to wildlife corridors through the removal of tree canopy, the transmission line may share portions of the public ROW along some of the roads paralleled. For the safe operation and maintenance of the transmission line, trees of a certain size or species within the transmission line ROW may need to be removed.

6.1.6 Existing Utilities

Construction of the Project is not anticipated to affect any public utilities. The applicants have stated they would work with landowners and the rural utility providers to avoid direct or indirect impacts to public utilities. In western Minnesota, many rural residences and farmsteads are served by Lincoln Pipestone Rural Water, as well as other agencies providing service to rural residents and communities, such as the U.S. Department of Agriculture's Rural Development Office. In metropolitan areas, such as the City of Marshall, municipal utility associations or cooperatives provide utility electrical and water service to city residents. The Twin Cities metropolitan region is

Figure 6.1.4-1 A house within the right-of-way

Source: Barr photograph, 2009

Figure 6.1.5-1 A typical farmstead windbreak

Source: Barr photograph, 2009

defined by the Metropolitan Urban Service Area (MUSA), a growth management tool adopted by the Metropolitan Council to stage development and regional infrastructure improvements. As part of the MUSA, an underground network of wastewater sewer lines extends throughout the seven-county metropolitan region.

Where any impacts to utilities have the potential to occur, the applicants have stated that they can work with both landowners and local agencies to determine the most appropriate placement for pole structures. It may be necessary for the applicants to work with other public service utilities to relocate their facilities if they conflict with the location of the transmission line. At times, the route would cross over existing transmission lines, follow existing transmission line corridors, and likely pass over or cross small power distribution lines. Disruptions to public services during construction may occur; however, these would be temporary with service restored promptly. No direct long-term impacts to public buildings or infrastructure are expected, and as such, no mitigation would be required for the Project.

6.1.7 Domestic Water Well Installation/ Maintenance

Outside of urban areas, landowners and rural residences are typically serviced by privately owned septic systems and wells or by rural water districts. The availability of data and information regarding the location of rural water services is limited and sometimes incomplete. The applicants can minimize any disruption of maintenance and service by working with local providers and landowners .

6.2 Public Health and Safety

This section summarizes the potential impacts of the proposed transmission line on health and safety, including:

- electric and magnetic fields;
- implantable medical devices;
- induced voltage and current;
- stray voltage; and
- explosives and firework hazards.

6.2.1 Electric and Magnetic Fields

Wherever there is electricity there are electric and magnetic fields (EMF). We live in an age of electric power and most everything we do requires it. Electric and magnetic fields are not only created by high-voltage transmission and distribution lines, but also by the appliances, lights, and wiring in homes, businesses, and schools. As a result, we are all exposed on a daily basis to a complex mix of electric and magnetic fields at many different frequencies.

Concerns about health effects of electric and magnetic fields (EMF) from power lines were first raised in the late 1970s. Since then, considerable research has been conducted to determine if exposure to magnetic fields, such as those from high-voltage power lines, causes biological responses and health effects. In summary:

- Initial epidemiological studies done in the late 1970s showed a weak correlation between surrogate indicators of magnetic field exposure (such as wiring codes or distance from roads) and increased rates of childhood leukemia. (Wertheimer et. al, 1979);
- More recent studies that used direct measurements of magnetic field exposure show either a very weak, or no statistical correlation with adverse health affects, e.g., Savitz, et. al. 1988; and
- Toxicological and laboratory studies have not been able to show a biological mechanism between EMF and cancer or other adverse health effects.

While there are numerous internet sites devoted to EMF dangers (whether from power lines, cell phones, or radio frequency signals), the vast majority of experts believe that EMF from power lines does not cause leukemia or any other health problem. In part, these experts argue the physical impossibility of any health effect due to such low-frequency, low-energy magnetic fields.

The history and science surrounding the issue is summarized in detail below. First, however, it is helpful to understand EMF.

What is EMF?

In this context, EMF refers to electric and magnetic fields. Electric and magnetic fields are invisible just like radio, television, and cellular phone signals, all of which are part of the electromagnetic spectrum. The frequency of transmission line EMF in the United States is 60 hertz and falls in the extremely low frequency (ELF) range of the electromagnetic spectrum (any frequency below 300 hertz). By comparison, cellular phone communications operate at frequencies almost one billion times higher than EMF resulting from electric power.

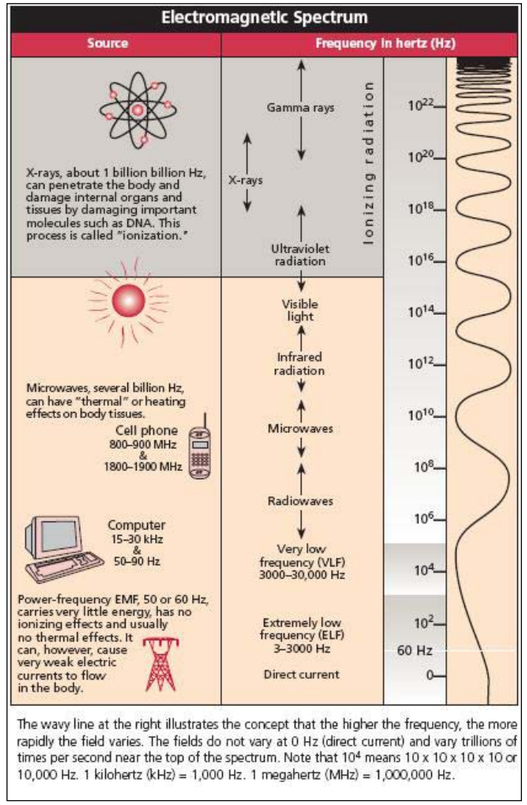
Natural and human-made electromagnetic fields are, in fact, present everywhere in our environment. Natural electric fields for example are produced by the local build-up of electric charges in the atmosphere that are associated with thunderstorms. The natural static background electric field is approximately 120 volts per meter (V/m). The Earth itself has a magnetic field that ranges from approximately 300 to 700 milligauss (mG). The Earth has a steady-state or static (zero hertz) magnetic field, but has similar characteristics to the magnetic fields emanating from human-made sources.

Electromagnetic fields created by humans include X-rays and magnetic resonance imaging (MRIs) machines, electric and magnetic passenger trains, electric cars, and cellular telephones. The general wiring and appliances located in a typical home can produce an average background magnetic field of 0.5 mG to 4 mG.

For the frequencies associated with power lines, it is useful to discuss separately electric and magnetic fields, which arise from the voltage of a power line and the flow of electricity, respectively.

- Electric fields are measured in kilovolts per meter (kV/m).
- Magnetic fields—or flux density—is measured in mG or microTesla (μT).
- Electric field intensity is proportional to the voltage of the transmission line.
- Magnetic field intensity is proportional to the current flow.
- Electric fields are easily shielded or weakened by objects such as trees or walls.
- Magnetic fields are difficult to shield and, thus, more easily penetrate objects.

Figure 6.2.1-1 Electromagnetic spectrum



Source: NIH, 2002 http://www.niehs.nih.gov/emfrapid

Low frequency EMF from alternating current power lines fall within the low-energy part of the electromagnetic spectrum. The electromagnetic spectrum (Figure 6.2.1-1) is a range of frequencies that includes visible light, X-rays, magnetic resonance imaging (MRI) machines, radios, televisions, and cellular telephones.

6.2.1.1 Electric Fields

Electric fields are created by voltage or the difference in the electric charge between two points, and are measured in V/m or kV/m. The higher the voltage, the stronger the electric field.

Electric fields may interact directly with the human body by inducing a surface electric discharge or contact currents. Indirect effects occur when a person is in contact with an electrically charged conducting object (e.g. vehicle or a metal fence).

The available data for exposure to static electric fields suggest that the only negative human health effects are the direct perception of body hair movement and small shocks, similar to the shock received by the induced friction from walking on a carpet and touching a doorknob. On the whole, scientific evidence indicates that chronic exposure to electric fields at or below levels traditionally established for safety does not cause adverse health effects. Safety concerns related to electric fields are sufficiently addressed by adherence to the National Electric Safety Code (NESC) standards.

There are currently no federal guidelines on the strength of electrical fields beneath high voltage transmission lines. However, around six states have established their own regulations or guidelines with regard to transmission line electric fields (Table 6.2.1.1-1).

The 8 kV/m guideline used by the Minnesota Public Utilities Commission (commission) is designed to prevent injury from shocks when touching large objects such as a bus or agricultural equipment parked under high-voltage transmission lines of 345 kV or greater. A route permit for a high-voltage transmission line typically states the line shall be designed, constructed, and operated in such a manner that the electric field measured one meter above ground level immediately below the transmission line shall not exceed 8.0 kV/m.

In addition to the state guidelines identified above, there are a number of national and international boards, committees, and commissions that have recommended electric field exposure guidelines or thresholds that pertain to 60 hertz high-voltage transmission lines. Table 6.2.1.1-2 summarizes the suggested electric field guidelines from a number of these internationally recognized organizations.

The proposed 345 kV transmission line would operate at a power frequency of 60 cycles per second (60 Hz). The varying topography and other situations encountered along the proposed 237-mile-long transmission line route will require different structure types and configurations. This variation would have an effect on the electric field strength emitted from the transmission line in certain areas.

As described in previous sections (Section 4.0) the structure type would vary, as would the number of circuits carried depending on the area in question. As indicated by the applicants in the route permit application, the majority of the Project would be constructed using single-pole double-circuit davit arm structures. In some areas both circuits would be utilized and may carry two 345 kV lines and in other locations the double circuit structure may on carry a single 345 kV circuit. In addition, there may be some locations where an H-frame design may be required and would carry three circuits (i.e. 345 kV/345 kV/115kV). Figure 6.2.1.1-1 identifies the different structure configurations proposed along with the calculated electric fields at various distances from the transmission centerline. Figure 6.2.1.1-1 also shows, as discussed in Section 6.2.1-4, that

Table 6.2.1.1-1 State electric field regulations or guidelines

State	Electric Field	
	On ROW	Edge ROW
Florida	8 kV/m[a]	2 kV/m
	10 kV/m[b]	
Minnesota	8 kV/m	
Montana	7 kV/m	1 kV/m[d]
New Jersey		3 kV/m
New York	11.8 kV/m	1.6 kV/m
	11 kV/m[e]	
	7 kV/m[c]	
Oregon	9 kV/m	

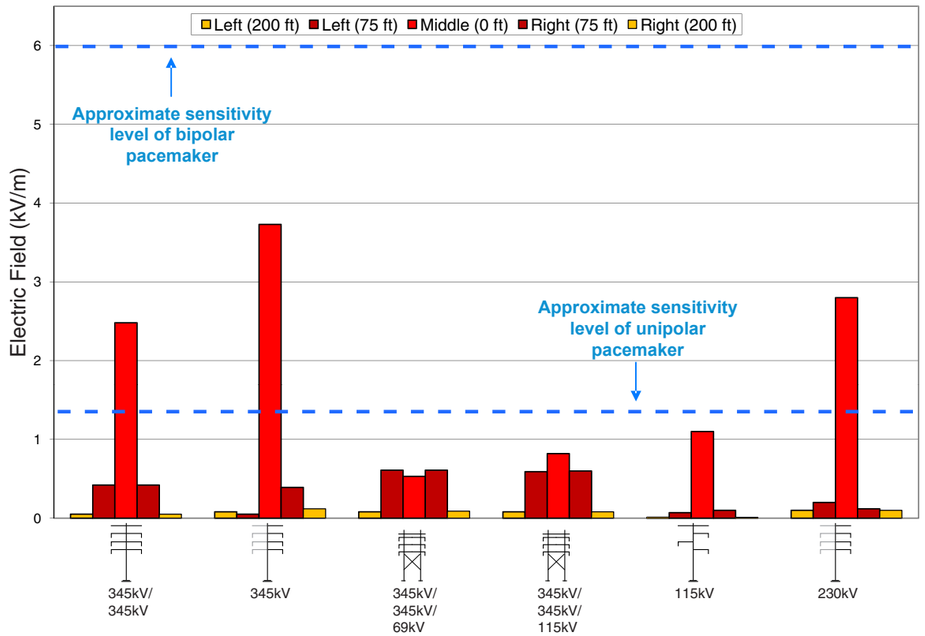
[a] For lines of 69-230 kV
[b] For 500 kV line
[c] Maximum for highway crossings
[d] May be waived by the landowner
[e] Maximum for private road crossings

Table 6.2.1.1-2 International electric field strength guidelines

Organization	Electric Field (kV/m)	
	General Public	Occupational
IEEE (10) (2002)	5	20
ICNIRP (7) (2009)	4.2	8.3
ACGIH (11) (2000)	—	25
NRPB (8) (2004)	4.2	—
EU (9) (1999)	4.2	—

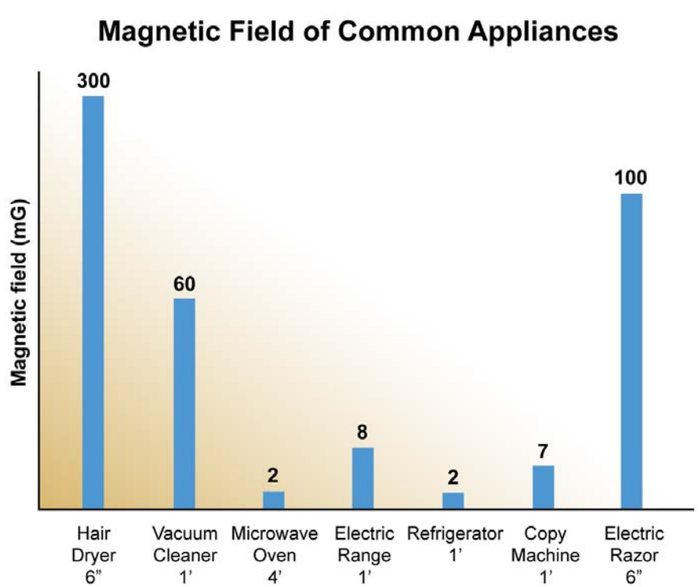
IEEE – Institute of Electrical and Electronic Engineers
ICNIRP – International Commission on Non-Ionizing Radiation Protection
ACGIH – American Conference of Governmental Industrial Hygienists
NRPB – National Radiological Protection Board
EU – European Union

Figure 6.2.1.1-1. Structure variations and calculated electric fields at various distances from transmission centerline



Source: Barr, 2009

Figure 6.2.1.2-1 Magnetic field of common household appliances



Source: NIH, 2002 http://www.niehs.nih.gov/emfrapid

potential impacts to implantable medical devices from electric fields associated with the structures for the proposed Project are limited.

The maximum calculated electric field on the entire length of Project would be in the areas where the transmission would be configured as a single pole 345 kV double-circuit davit arm structure. The maximum electric field for this configuration directly beneath transmission centerline is estimated at 3.73 kV/m and falls below any of the national and international recognized electric field guidelines as identified in Tables 6.2.1.1-1 and 6.2.1.1-2.

The highest electric field calculated by the applicants at the edge of the transmission line ROW, 75 feet from centerline, is 0.61 kV/m, and is also below any of the state established guidelines for electric fields at transmission ROW as indicated in Table 6.2.1.1-1. In addition, this calculation is for a segment of the route that would require an H-frame 345 kV/345 kV/69 kV triple-circuit structure that would likely be used only in areas where topography dictates engineering, such as river crossings, where few residences are located. For the proposed Project the highest calculated electric fields at 100 and 200 feet from transmission centerline would be 0.35 kV/m and 0.12 kV/m, respectively, with the lowest overall field strength of 0.02 kV/m at 300 feet from centerline. These electric field strengths are well within the range of electric fields generated by other common household and business sources. No adverse effects from electric fields on health are expected for persons living or working at locations along or near the proposed Project.

6.2.1.2 Magnetic Fields

Magnetic fields are created by electric current or flow (measured in amperes). The higher the current the stronger the magnetic field. However, unlike electric fields, magnetic fields are not easily shielded and would pass through most structures or objects. Consequently health concerns regarding EMF have focused more on magnetic fields than electric fields.

We encounter magnetic fields from every-day things such as radar and microwave towers, television and computer screens, motors, fluorescent lights, microwave ovens, cell phones, electric blankets, house wiring and hundreds of other common electrical devices. The general wiring and appliances located in a typical home can produce an average background magnetic field of 0.5 mG to 4 mG (National Cancer Institute, 2009). Magnetic fields of common household appliances are shown in Figure 6.2.1.2-1.

For example, the electrical wiring in a house, TVs, hairdryers, refrigerators, coffeepots, computers, toasters, lamps, and all other electrical appliances contribute to the EMF within a home.

There are currently no state or federal standards establishing a threshold for magnetic fields produced by high voltage transmission lines. There are a few states that have set magnetic field exposure standards (Table 6.2.1.2-1). These exposure limits were not based on potential human or environmental impact, but to maintain electric transmission systems within current levels or as benchmarks for comparing different design alternatives.

Table 6.2.1.2-2 International magnetic field guideline

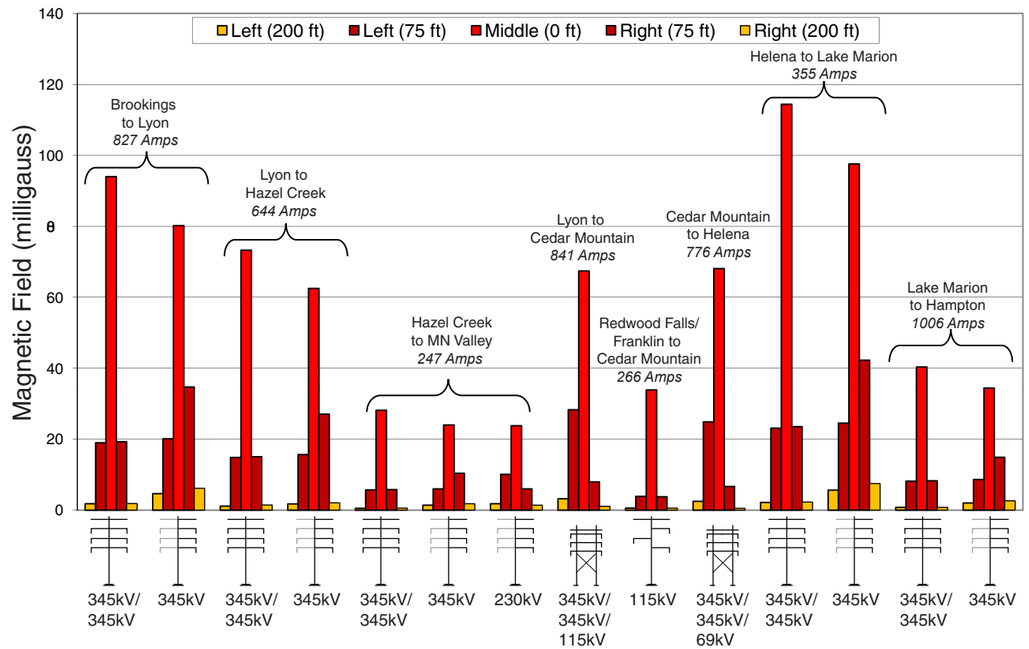
Organization	Magnetic Field (mG)	
	General Public	Occupational
IEEE (10) (2002)	9,040	27,100
ICNIRP (7) (2009)	830	4,200
ACGIH (11) (2000)	—	10,000/1,000[a]
NRPB (8) (2004)	830	4,200
EU (9) (1999)	830	—

[a] For persons with cardiac pacemakers or other medical electronic devices

IEEE – Institute of Electrical and Electronic Engineers
ICNIRP – International Commission on Non-Ionizing Radiation Protection
ACGIH – American Conference of Governmental Industrial Hygienists
NRPB – National Radiological Protection Board
EU – European Union

Source: NIH, 2002 http://www.niehs.nih.gov/emfrapid

Figure 6.2.1.2-2 Structural variations and calculated magnetic field strength at various distances from transmission centerline



Source: Barr-created figure, 2009, EPRI, 2004

Table 6.2.1.2-1 State magnetic field regulations or guidelines

State	Magnetic Field at Edge of ROW
Florida	150 mG[a] (max load)
	200 mG[b] (max load)
	250 mG[c] (max load)
New York	200 mGg (max load)

[a] For lines of 69-230 kV
[b] For 500 kV lines
[c] For 500 kV lines in certain existing ROW

The maximum calculated magnetic field on the entire length of Project would be in the areas where the transmission would be configured as a single pole 345 kV double-circuit davit arm structure (specifically Helena to Lake Marion) operating at peak conditions. The maximum magnetic field for this configuration directly beneath transmission centerline is estimated at 114.42 mG and falls well below any of the national and international recognized magnetic field guidelines as identified in Table 6.2.1.2-1.

The highest magnetic field calculated by the applicants for the edge of the transmission line ROW (75 feet from centerline) is 42.28 mG, and is also well below any of the state established guidelines for magnetic fields at transmission ROW as indicated in Table 6.2.1.2-1. This calculation is for a segment of the route that would require a single pole 345 kV double-circuit structure with only one 345 kV circuit in service and operation at peak conditions.

As with electric fields, magnetic fields also decrease in strength as one moves farther from the source. Magnetic fields also vary in intensity depending on the type of structure and the amount of current flowing through the transmission line in a given area. Figure 6.2.1.2-2 shows the calculated magnetic field strengths at various distances from the transmission centerline, for a variety of structure types.

There are currently no state or federal guidelines for magnetic fields generated by high-voltage transmission lines. However, the exposure guidelines established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) have typically been the guidelines adopted by most countries and organizations. In comparing the magnetic fields expected to be generated by this proposed Project with the ICNIRP guidelines; the highest anticipated magnetic field of 114.42 mG would be 86 percent less than the 830 mG ICNIRP general public magnetic field exposure limit and 95 percent less at the transmission lines highest calculated ROW level (42.28 mG).

6.2.1.3 EMF Heath Effects Overview

Scientific review panels have generally concluded that the combined data show at best a weak association with ELF/EMF and at worst that the findings are mutually inconsistent and inconclusive.

The study of cancer in relation to ELF electric and magnetic fields has been a topic of study since the late 1970s. Since that time there have been several epidemiological studies that have explored the possible association of not only cancer risks, but other potential human maladies (brain tumors, leukemia, breast cancer, and mental health issues). Studies have focused on both occupational exposures for individuals working

Suspected risk factors for childhood cancer

- Paint solvents and petroleum products
- ELF, EMF
- Exposure to pesticides during pregnancy
- Diagnostic irradiation (CAT scans, MRIs, X-Rays)
- Paternal smoking during pregnancy
- Sleeping with the lights on.
- Indoor radon
- Mobile phones (bone marrow in children's hands)
- Ionizing radiation
- Inappropriate response to an infection (virus/bacteria) in early childhood.
- Parental age
- Parental occupation
- Vitamin K
- Genetics

in electrical industries and public exposures for children and adults living and working around common EMF sources (in-home wiring, transmission lines, home, and office appliances/equipment). The results of the various studies conducted over the last three decades, specifically those regarding the relationship between EMF and childhood leukemia and other cancer risks, have been mixed; some have found an association while others have not.

Where there is association suggested in epidemiological studies, it is usually very near the statistical threshold of significance. However, when these studies are repeated in a laboratory, the results have not reproduced or identified a biological mechanism to support a link between childhood leukemia and magnetic fields. The replication of field results in a laboratory setting is a basic test of scientific validity. Researchers continue to look at magnetic fields until more certain conclusion can be reached.

In fact, the World Health Organization (WHO), in 1996, launched a large multidisciplinary research effort to address growing public concerns over the possible health effects from exposure to EMF. In their conclusions WHO indicated that, "…in the area of biological effects and medical applications of non-ionizing radiation approximately 25,000 articles have been published over the past 30 years. Despite the feeling of some people that more research needs to be done, scientific knowledge in this area is now more extensive than for most chemicals."

Based on in-depth review of scientific literature the WHO concluded that, "…current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields. However, some gaps in knowledge about biological effects exist and need further research."

Leukemia is the most common childhood cancer worldwide for children ages zero to 14, with approximately 2,600 cases diagnosed in the United States annually. Unfortunately, the exact cause of childhood leukemia is not known. Many suspected risk factors that have been studied and evaluated, but ultimately most children with leukemia do not have any risk factors, and as stated above, the cause of their cancer is not known at this time. In the case of high-voltage power lines as a suspected risk factor, the WHO indicates that few children have time-averaged exposures to residential 60 Hz magnetic fields in excess of the levels suspected to be associated with an increased incidence of childhood leukemia. Approximately one percent to four percent have mean exposures above 0.3 μT and only one percent to two percent have median exposures in excess of 0.4 μT. If there are any risks such as childhood leukemia associated with living near power lines, then it is clear those risks are very small, otherwise we should be witnessing an observable epidemic of childhood cancers. However, there is little, if any evidence of such an epidemic of childhood cancer.

6.2.1.4 Implantable Medical Devices

Implantable medical devices such as pacemakers, defibrillators, neurostimulators, and insulin pumps may be subject to interference from strong electric and magnetic fields. It is important that their function is not impaired. Most of the research on electromagnetic interference and medical devices is related to pacemakers. According to a 2004 EPRI report, implantable cardiac devices are much more sensitive to electric fields than to magnetic fields. The earliest interference from magnetic fields in pacemakers was observed at 1,000 mG, far greater than the magnetic fields associated with high-voltage transmission lines.

Therefore, the focus of research has been on electric field impacts. Possible effects of electric fields on pacemakers are:

How can I tell if my medical device would be impacted?

Research is not available for all types and models of medical devices. Information may be available from the device manufacturer regarding how sensitive the device is to either electric and/or magnetic fields. This information would help you determine a safe distance from a source of EMF such as a transmission line.

- rate increase,
- erratic pacing,
- switch to asynchronous pacing or fixed-rate pacing,
- single beat inhibition (i.e. a single beat is missed by the pacemaker), and
- total inhibition.

These effects are usually temporary and normal function of the device resumes once the person is removed from the source of EMF. Older unipolar models of pacemakers are expected to be relatively more sensitive to electric fields, with interactions starting at 1.2-1.7 kV/m. Modern bipolar devices are much less susceptible to interactions with electric fields, with interaction starting around six kV/m (see Figure 6.2.1.1-1).

6.2.1.5 EMF Mitigation Strategies

The three primary methods to reduce EMF and the results are explained below.

Distance. Magnetic field exposure is directly related to distance from the transmission line.

The strength of both the electric and magnetic fields from transmission lines is inversely proportional to the square of the distance from the source conductors. As indicated in the route permit application, the applicants have selected route options and designs in part to avoid residences to the greatest possible extent. Several of the factors described on page 3-3 that guide the commission's route selection take into account impacts on residences and farmsteads. Also, the proposed ROW and the structures can be designed to help minimize EMF exposure because of public concern.

Compaction. The configuration and distance between transmission line phases has an impact on EMF exposure. The amount of EMF exposure is reduced when the phases are compacted. The applicants could consider compacted structure designs where feasible.

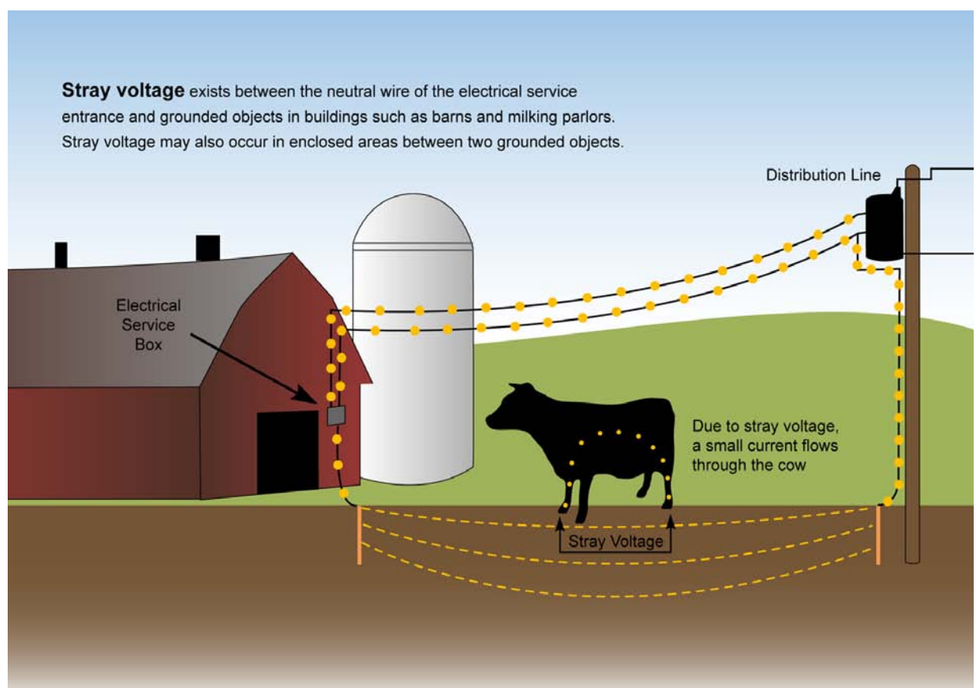
Phase cancellation. Phase cancellation significantly reduces EMF from transmission lines. For the double-circuit lines, rearranging phase conductors may help to reduce magnetic field strength. The applicants could consider these options during the detailed Project design phase.

6.2.2 Stray Voltage

Stray voltage is a grounding issue that can occur on the electric service entrances to structures from distribution lines—not transmission lines. More precisely, stray voltage exists between the neutral wire of the electrical service entrance and objects connected to the ground to prevent voltage buildup (grounded) in buildings such as barns and milking parlors. Stray voltage may also occur in enclosed areas between two grounded objects. When an animal comes into contact with the earth between two grounded objects when a current is passing through the earth, this is commonly known as stray voltage. Stray voltage has been raised as a concern on some dairy farms because it can impact operations and milk production.

Transmission lines do not, by themselves, create stray voltage because they do not connect to businesses or residences. However, transmission lines can induce stray voltage on a distribution circuit that is parallel to and immediately under the transmission line. Proper design and pole placement can reduce or eliminate stray voltage effects from the transmission lines. The applicants would be required to remedy any stray voltage issues as a condition of a route permit.

Figure 6.2.2-1 Stray voltage



Source: Barr-created figure, 2009

6.2.3 Induced Voltage/Current

The electric field from a transmission line can couple with a conductive object, such as a vehicle or a metal fence, which is in close proximity to the transmission line. This would induce a voltage on the object, which is dependent on many factors, including the weather, object shape, size, orientation, and location along the ROW. If these objects are insulated or semi-insulated from the ground and a person touches them, a small current would pass through the person's body to the ground. This might be accompanied by a spark discharge and mild shock, similar to what can occur when a person walks across a carpet and touches a grounded object or another person.

This current flow through the person to ground if a person were to touch the object is the main concern of induced voltage. Proper grounding of metal objects under the transmission line is the best method of avoiding these shocks. Most shocks from induced current are considered more of a nuisance than a danger. The Minnesota PUC electric field limit of eight kV/m was designed to prevent serious hazard from shocks due to induced voltage under transmission lines. The National Electric Safety Code has set an induced current limit of five milliamps (mA) for objects under transmission lines.

Another issue that arises when operating vehicles near power lines is whether vehicles can be safely refueled. Although the possibility of fuel ignition under a power line is remote, it is not recommended to refuel vehicles directly under or within 100 feet of a 345 kV transmission line.

6.2.4 Proximity to Explosives and Fireworks Storage

Storage of explosives is highly regulated for safety reasons. Regulations and best practices exist to ensure that any source of spark or electrical discharge does not come in contact with the explosives. There are also minimum required distances between storage magazines for explosives and other buildings and highways. An accident or failure at a transmission line in close proximity to an explosives storage magazine could have severe results if any spark came in contact with the explosives. Induced voltage and

current from a transmission line could also cause problems with explosives near the line if the storage magazine is not properly grounded and any sparks were generated.

6.3 Air Quality

The only direct air quality emission directly related to high-voltage transmission lines are a small amount of ozone and oxides of nitrogen due to the "corona effect," and these are limited. The other potential air quality issue is the release of sulfur hexafluoride (SF_6), which is an inorganic, colorless, odorless, non-toxic, and non-flammable gas that is used in substation transformers and other electrical equipment.

6.3.1 Ozone and Nitrogen Oxides

Corona consists of the breakdown or ionization of air in a few centimeters or less immediately surrounding conductors and can produce ozone and oxides of nitrogen in the air surrounding the conductor.

Currently, both the state and federal governments have similarly restrictive regulations regarding permissible concentrations of ozone and oxides of nitrogen. Both standards are shown in Table 6.3.1-1.

Studies designed to monitor the production of ozone under transmission lines have generally been unable to detect any increase due to the transmission line facility. The operation of the proposed transmission lines would not create any potential for the concentrations of these pollutants to exceed the nearby (ambient) air standards.

What causes corona?

Usually corona is only caused when there is some imperfection on a conductor such as a sharp edge, a protrusion on hardware, a scratch on the conductor, or if moisture collects on the line.

6.3.1 SF_6 and PFC use in Electricity Transmission and Distribution

The proposed Project includes the construction of four new substations and the expansion of two existing substations under all route alternatives considered.

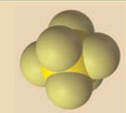
SF_6 is used in the electrical industry as an insulator for high-voltage equipment that transmits and distributes electricity. The gas has been employed by the electric power industry in the United States since the 1950s because of its effectiveness in managing the high voltages carried between generating stations and customer load centers.

Table 6.3.1-1. State and national standards of permissible concentrations

	Standard	Averaging Period	Rule
National	0.08 ppm	Highest eight-hour average	40 CFR Part 50
State	0.08 ppm	Fourth-highest eight-hour daily maximum average	Minn. R. 70009.0080
Worst case 345 KV transmission line emissions	0.0007 ppm	Highest one-hour average	N/A

What is ozone?

Ozone is a very reactive form of oxygen molecules and combines readily with other elements and compounds in the atmosphere. Because of its reactivity, ozone is relatively short-lived.



What is SF_6?

SF_6 is used in the electrical industry as an insulator for high-voltage equipment that transmits and distributes electricity. The gas has been employed by the electric power industry in the United States since the 1950s because of its effectiveness in managing the high voltages carried between generating stations and customer load centers.

SF_6 Emissions and Management

The applicants would contain SF_6 within a closed system. However, fugitive emissions of SF_6 can escape from gas-insulated substations and switch gear through seals, particularly in older equipment. Current technologies require less SF_6 at lower pressures than older technologies, resulting in a more secure system. The gas can also be released during equipment manufacturing, installation, servicing, and disposal.

Several methods can be used to minimize SF_6 emissions from electric power systems, including improvements in the leak rate of new equipment, refurbishing of older equipment, and the use of more efficient operation and maintenance techniques. The USEPA's SF_6 Emission Reduction Partnership for Electric Power Systems focuses on reducing the nation's SF_6 emissions through cost-effective operational improvements and equipment upgrades.

Potential Mitigation

For the proposed Project, potential impacts from SF_6 emissions are expected to be limited and are not expected to vary by route. The substation equipment that would be installed as part of the Project includes state of the art circuit breakers designed to minimize the risk of sulfur hexafluoride. The applicant currently participates in U.S. Environmental Protection Agency SF_6 Emission Reduction Partnership for Electric Power Systems. Program participants are active partners in applying strategies to minimize SF_6 emissions, including:

- **Leak detection and repair.** The EPA estimates that if consistently and aggressively implemented in the United States, SF_6 emissions could be reduced by 20 percent.
- **Use of recycling equipment.** The EPA estimates that SF_6 recycling could eliminate 10 percent of total related emissions from the U.S. electric industry.
- **Employee education/training.**

6.4 Electronic Device Interference

This section summarizes the potential impacts on electronic communication and similar devices, including radios, televisions, microwave communications, and GPS-based agricultural navigation systems.

6.4.1 Radio Interference

Corona from transmission line conductors can generate electromagnetic "noise" in the radio frequency range. This noise may cause broadband interference at the same frequencies that many communication and media signals are transmitted. This noise can cause interference with the reception of these signals depending on the frequency and strength of the signal. Loose hardware on the transmission line may also cause interference. However, AM radio frequency interference typically occurs immediately under a transmission line and dissipates rapidly to either side.

FM radio receivers usually do not pick up interference from transmission lines because:

- Corona-generated radio frequency noise currents decrease in magnitude with increasing frequency and are quite small in the FM broadcast band (88-108 MHz).
- The excellent interference rejection properties inherent in FM radio systems make them virtually immune to amplitude type disturbances.

The steel towers of a transmission line could interfere, or cause signal blocking effects, on two-way mobile radio communication if the tower were directly between the two mobile units. Moving either mobile unit so that the tower is not immediately between the two units should restore communications. This would generally require a movement of less than 50 feet by the mobile unit adjacent to a metallic tower.

6.4.2 Television

Both digital and satellite television (TV) are expected to have little interference from corona-generated noise, but may experience other types of interference.

- Digital TV broadcast frequencies are high enough that any noise currents, if they were to exist at all, would be very small.
- Compared to previously used analog broadcasts, digital reception is somewhat less resistant to multipath reflections.
- An outdoor antenna may be necessary to solve issues with multipath reflections.
- Satellite TV is transmitted in the K_u band of radio frequency and is not very susceptible to corona generated noise.
- Line of sight for satellite TV users could be obstructed by a transmission line structure.

Line of sight can usually be restored by moving the consumer satellite dish to a slightly different location.

What are multipath reflections?

They are a shadow effect that occurs when a structure is aligned between the TV receiver and a weak distant signal—sometimes called "ghosting."

6.4.3 Internet and Cellular Phones

Wireless internet and cellular phones also use frequencies in the ultra-high frequency (UHF) range. The specific UHF frequency used by a cellular phone would depend on the technology (global system for mobile communications (GSM), 3G, etc.) of the provider. All radio frequencies used for both cellular phones and wireless internet are high enough that the effect of corona generated noise near the line would be negligible.

6.4.4 Microwave Communications

Electromagnetic noise from transmission lines is not an issue for microwave communication corridors; however, the large tower structures (over 130 feet tall) required for this transmission line could obstruct microwave communications.

- Microwave communication corridors can extend as close as 150 feet to the ground
- Any structure over 100 feet is considered to be a structure of concern for the beam paths.
- Placement of the towers outside the microwave communication corridors eliminates any potential obstruction.

The location of microwave communication towers are provided on the detailed route maps in Appendix A. Any necessary microwave beam path analysis for the Project cannot be completed until final design, which would be completed only after the route is selected.

6.4.5 GPS-Based Agricultural Navigation Systems

Corona-generated noise and not the EMF from transmission lines could be a source of interference for agricultural GPS systems.

- Satellite GPS signals are broadcast at 1.57542 GHz (L1 signal) and 1.2276 GHz (L2 signal) and are high enough that they would have minimal interference.
- Differential correction signal beacons on the nationwide Coast Guard network transmit at frequencies around 283-325 kHz and are susceptible to electrical noise.
- Satellite based correction signals are not susceptible to electrical noise.
- Interference with correction signals could result in reduced accuracy while operating directly under a high-voltage transmission line.

Any transmission line structure that is placed in an agricultural field would have GPS coordinates that may be added to the farmer's GPS unit coordinates. However, if the GPS unit is not configured to accept new coordinates, the user would have to manually divert around any structures placed in fields.

6.5 Property Values

One of the first concerns of many residing near existing or proposed transmission lines is how lines could affect the value of their property. Research on this issue does not identify a clear cause-and-effect relationship. Instead, the presence of a transmission line becomes one of several factors that interact to affect the value of a particular property. The impacts on residential property values do not appear to be significantly different within various land use types (i.e. agricultural versus suburban or urban)—or at least any difference is too subtle for current research to detect. Therefore, property values impacts appear to be similar for any of the various route options under consideration.

6.5.1 Property Value Concerns

In general there are three primary concerns raised regarding the potential impact of a nearby high-voltage transmission line on property value:

- **Concern or fear of possible health effects from electric or magnetic fields:** While no conclusive evidence of the effects of EMF on health exists, it is recognized that people's concerns about this issue can influence their decisions related to purchase of property.

- **The potential noise and visual unattractiveness of the transmission line:** The visual profile of transmission lines structures and wires may decrease the perceived aesthetic quality of property. The transmission facility would not generate noise above the state noise standards, and is not considered an issue.

- **Potential interference with farming operations or foreclosure of present or future land uses:** On properties that are farmed, installation of a power line can remove land from production, interfere with operation of equipment, create safety hazards, and foreclose the opportunity to consolidate farmlands or develop the land for another use.

On the other hand, the perceived value of a piece of property could increase when:

- A cleared ROW provides better access to interior lands or water.

- Increased local electrical reliability enhances opportunities for development of residential, commercial, or industrial development.

- In rural areas, especially in the vicinity of large wooded parcels, utility ROW may provide improved access for hunting, snowmobiling, or other recreational activities.

- White-tailed deer and some other animals use forest openings for foraging and travel.

- In urban or suburban residential areas, lots on or adjacent to power line corridors are often sized larger than neighboring lots but similarly priced, allowing residents to benefit from the added buffer and space the ROW provides.

- Integrating the open space of the utility corridor into a neighborhood and developing it as usable space can also diminish or avoid adverse effects on property values.

6.5.2 Property Value Research

The relationship between power lines and property values is complicated by a variety of factors including variability over time and across different areas of the world, variability due to different land uses, and limited sale data for similar properties before and after installation of a transmission line. Because of these complexities, real estate appraisers, utility consultants, and academic researchers have studied the issue of how to assess the impacts of power lines on property values since the 1950s. A summary of these study types is provided in Table 6.5.2-1.

Potential impacts related to the marketability of a property include factors such as sale price, the amount of time required to sell, and the debt carried over this time. The types of studies done to assess changes in sale price of property containing a transmission line have evolved over time.

Table 6.5.2-1. Property value study types

Study Type	Description	Pros	Cons
Attitudinal Studies	Surveys to assess perceptions about property value impacts.	One of the first techniques used to study property value impacts from power lines.	Substantial differences may exist between people's perceptions about how they would behave and their actual behavior when confronted with the purchase of property.
Valuation Studies	Comparison of sales prices for properties that are similar except for proximity to a power line.	Avoids uncertainties related to personal perception of value.	Value judgment involved in choosing similar pairs; limitations in the number of adequately similar property pairs.
Statistical Analysis	Evaluation of large sample sizes and a high number of variables using multiple regression analysis.	Better ability to account for numerous variables that affect sales. Provide the best information to date on the effects of power lines on property values.	Applicability of study results to specific properties and specific areas depends on the characteristics of the sample used.

For example, between 1978 and 1982, Jensen and Weber and the Jensen Management Company conducted three studies in west-central Minnesota. The studies in 1978 and 1982 are of particular interest since they consider effects to agricultural land. The 1978 study found that the landowners cited an inconvenience to the presence of the line, but had not paid less for their land (EPRI, 1978). The 1982 study, however, found there was a broad range of effect from no effect to a 20 percent reduction, which depended on the amount of disruption to farm operations (EPRI, 1982).

In the mid-1990s, Northern States Power hired a real estate appraisal group to collect market substantiated information on the impact attributable to the imposition of transmission line easements on residential property values in suburban and undeveloped areas near Eau Claire and La Crosse, Wisconsin. The Solum Group examined 200 residential property transactions adjacent to or in close proximity to high voltage electric transmission lines in urban, suburban, and rural areas of western Wisconsin. The selection process used in his study concentrated primarily on upper-price-level residences and vacant lots ready for construction on the assumption that these properties would be most sensitive to potential negative influences. In the report, Mr. Solum asserted that the very minor positive and negative impact results he observed indicate that there is virtually no impact present that is attributable to the presence of a transmission line encumbrance on residential properties (Solum, 1985).

Cowger Study

The 1996, a separate study of the impact of overhead high voltage transmission lines on residential property values in Seattle and Vancouver found little impact (Cowger, et. al., 1996). The literature review complete for that study also indicated the following:

1. Overhead transmission lines can reduce the

value of residential and agricultural property. The impact is usually small (zero through ten percent) for single family residential properties.

2. Other factors such as location, improvements, and lot size are more likely to be major determinants of sale price.
3. Impacts on sales are most likely to occur on property crossed or immediately adjacent to the lines.
4. In areas where the ROW has been landscaped or developed for recreational use, positive impacts have been measured.
5. Impacts may be greater on small properties than for larger properties.
6. Impacts are more pronounced immediately after construction of a new line and diminish over time.

Arrowhead to Weston EIS

In the final EIS on the Arrowhead-Weston Electric Transmission Line Project, the Wisconsin Public Service Commission (PSC) addressed the issue of property value changes associated with high voltage transmission lines. This document summarized the findings of approximately 30 papers, articles, and court cases covering the period of 1987 through 1999. The Arrowhead-Weston EIS provides six general observations:

1. The potential reduction in sale price for single family homes may range from zero to 14 percent.
2. Adverse effects on the sale price of smaller properties could be greater than effects on the sale price of larger properties.
3. Other amenities, such as proximity to schools or jobs, lot size, square footage of a house and neighborhood characteristics, tend to have a much greater effect on sale price than the presence of a power line.
4. The adverse effects appear to diminish over time.
5. Effects on sale price are most often observed for properties crossed by or immediately adjacent to a power line, but effects have also been observed for properties farther away from the line.
6. The value of agricultural property is likely to decrease if the power line poles are placed in an area that inhibits farm operations.

This EIS reported that in Midwest states such as Minnesota, Wisconsin and the Upper Peninsula of Michigan, the average decrease appears to be between four and seven percent. The authors succinctly summarize the dilemma in the closing paragraph which states, "It is very difficult to make predictions about how a specific transmission line would affect the value of specific properties." The primary mitigation method, as described in Section 6.1, is to avoid residences as much as possible during route selection.

6.6 Archaeological and Historic Resources

Like any large construction project, transmission line construction can impair or destroy archeological artifacts if not done carefully. Also, while unlikely to physically damage known historically important structures (houses, businesses, land forms, neighborhoods, or other historical resources), the lines can significantly change the view or character of the historic building, land form, or area.

Section 6.6.1 Archaeological and Historic Resources Reflect Historic Human Occupation

Archaeological and historic resources are those places that represent the visible or otherwise tangible record of human occupation. Archaeological resources are typically underground or at the surface and include things like structural ruins or artifacts. Historic resources include standing structures such as bridges and buildings and historic landscapes. Historic landscapes, also known as cultural landscapes, are geographic areas, including buildings, natural resources, and animals associated with a historic event, activity, or person. A historic landscape can range from thousands of acres of rural tracts to a small homestead with a front yard of less than one acre. Figure 6.6.1-1 shows an historic bridge located within one mile of several of the proposed routes.

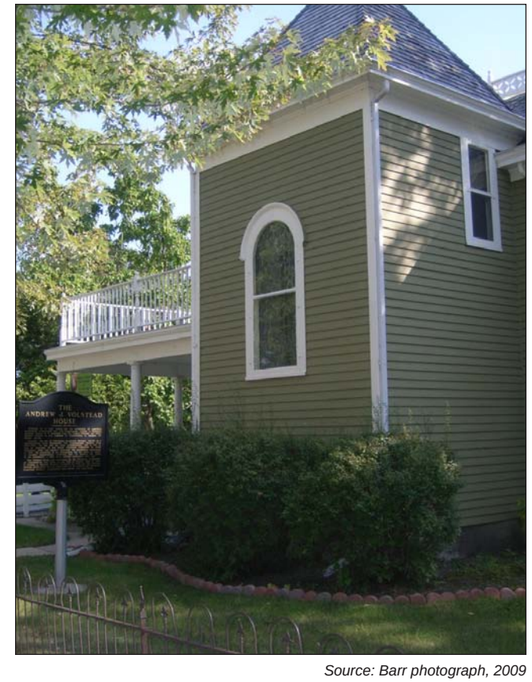
Section 6.6.2 Assessing the Presence of Cultural Resources

In July 2008, the applicants reviewed State Historic Preservation Office (SHPO) records to identify known archaeological resources, historical structures, and historic landscapes within one mile of the centerline of the Preferred and Alternate Routes. An updated records review of known cultural resources was completed in July, 2009 for both the applicants' proposed routes and routes added during the EIS scoping process. The literature review also included reports of previously surveyed areas relevant to the Project area. Records were reviewed for Lincoln, Lyon, Yellow Medicine, Redwood, Renville, Brown, Nicollet, Sibley, Le Sueur, Scott, and Dakota Counties. Discussions of archaeological sites within one-half mile of either side of the

Figure 6.6.1-1. Historic swayback bridge in Redwood Falls, Minnesota

Source: Barr photograph, 2009

Figure 6.6-2-1. Historic Andrew J. Volstead House in Granite Falls, Minnesota



Source: Barr photograph, 2009

centerline of the Preferred Route are provided in Section 7. Archaeological inventories of the Preferred Route and Alternate Route have not been conducted so it is not possible to quantify the entirety of the potential archaeological impacts and use that information. Figure 6.6.2-1 shows the historic Andrew J. Volstead House in Granite Falls, Minnesota, located within one mile of several of the proposed routes.

Section 6.6.3 Archaeological and Historic Resources within the Project Area

As shown in detail in Section 7, both the Preferred and Alternate Routes contain archaeological and historic resources within one mile of the centerline of each route. However, no historic landscapes have been identified within the Project area. Resources are typically categorized by type and whether or not they are significant. The standard of significance is one applied by federal agencies for compliance with federal regulations, typically Section 106 of the National Historic Preservation Act (NHPA) of 1966 (as amended), and is useful when determining sites to avoid. Significant resources are considered eligible for the National Register of Historic Places (NRHP). Physical avoidance of archaeological and historic resources was a consideration in locating route alternatives for the Project.

In addition to identifying specific resources, the acreage of aquatic environment near the routes was identified. Aquatic environments may indicate pre-contact archaeological sites as these sites are more common near permanent water sources. Therefore, in addition to evaluating the impact of various routes on known archeological sites, routes that impact or cross through areas with more lakes and streams have somewhat more potential to disturb as yet undiscovered sites.

6.6.4 Mitigation

As indicated in the route permit application, during the Project engineering phase the applicants would strive to avoid the resources or minimize impacts by utilizing best management practices developed in coordination with the SHPO. Prior to construction, if any of these resources cannot be avoided and would be physically impacted by the Project, the applicants would coordinate with SHPO to develop a plan to address the impacts. In addition, the applicants would devise a survey methodology to document the existing conditions within the Project area, identify the extent of resources within these areas, and, if applicable, provide recommendations regarding eligibility for the NRHP for potentially significant resources.

In addition, the applicants could integrate a training, monitoring, and discovery plan into construction bid documents to ensure that previously unknown cultural resources or human remains inadvertently encountered during construction along the route are handled properly. The plan would outline the framework for handling such discoveries efficiently and in compliance with all laws. The plan may include the following topics: construction contractor training, construction monitoring by a professional archaeologist in specific locations along the Project area, procedures for identification and protection of resources in the field, contact information for responsible individuals who would address a discovery, and procedures for avoidance and associated tasks in the event of work stoppage in a construction area. With regard to human remains, Project-specific procedures would be outlined to ensure that the appropriate authorities are activated in accordance with state statutes (Minn. Stat. § 307).

Because both the Preferred and Alternate Route would cross the Minnesota River, a Clean Water Act Rivers and Harbors Act permit (a Section 10 permit) would need to be issued prior to construction. In addition, a Section 404 wetlands permit from the U.S. Corps of Engineers, or USACE, would likely be required for the Project. The USACE would review the archaeological and historic resources that may be impacted in the area covered by the permit which does not include the entire Project area. Any adverse effects to NRHP-eligible or listed properties in the area potentially affected would be treated through a federal consultation process that could include SHPO and any potentially affected tribal governments.

As above, physical avoidance of these resources would be preferred but, should a resource be identified and not avoided, the applicants would work with state agencies and the SHPO to resolve questions of significance and mitigation if necessary. Mitigation may entail compensating for the losses of those properties that are eligible for listing on the NRHP. The applicants may also invite other parties (particularly Native American tribes and other state and federal permitting or land management agencies) to assist in the development of the avoidance, minimization, or treatment measures.

6.7 Land Use Compatibility

There are two primary general land use conflicts created by high-voltage transmission lines. First, in agricultural areas, the power poles may potentially interfere with farming operations. Because agricultural impacts are a prominent economic issue as well as a land use issue, agricultural impacts are also addressed in Section 6.8 (Land-Based Economies).

Second, in developing suburban areas, the lines can conflict with recreational, residential, and other potential future development planned for the area to be crossed by the power line. Specific potential conflicts with local land use plans are summarized in Section 7.

6.7.1 Project Area Land Use

Land cover data were was obtained for the counties and municipalities through which the proposed routes would travel. As described in detail in Section 7, the predominant land use in the western two-thirds of the Project area is rural agricultural, including planted row crops, open pasture and grazing areas. Rural residences and farmsteads are located along all of the roads that either route would follow. The rural areas include wildlife management areas (WMAs), Reinvest in Minnesota, and Conservation Reserve Program (CRP) lands, along with U.S. Fish and Wildlife Service (USFWS) habitat easement areas. Other land cover types include natural land features — forested areas, wetlands, streams, and standing water features.

Residential development is denser as the routes approach the Twin Cities metropolitan region in Scott and Dakota counties. Commercial and industrial land uses are typically concentrated around the urban centers of each county the transmission line would cross, while some industrial development has occurred outside of urban centers to support the growing renewable energy industry and for agricultural activities.

6.7.2 Impacts and Mitigation

The primary method used to reduce impacts on existing and future development, as well as farming, is to follow existing ROWs as much as possible. Throughout the route development process, the applicants indicate they have sought to identify areas to share ROW with existing infrastructure that includes transmission lines, highways, and railroads. The applicants would need to acquire necessary approvals from the ROW owner (e.g., the railroad) or the agency (e.g., the Minnesota Department of Transportation, or DOT, for state highways).

Although land use would be directly affected in some areas such as where new or expanded substation construction is required, in general land use along the selected route is not expected to change as a result of construction and operation of the proposed transmission line. The majority of land under or adjacent to the transmission line could still be used for agricultural practices following construction. In more developed areas, there are some specific potential conflicts that are described in Section 7. The proposed transmission line does not directly conflict with current county and city land use plans, zoning ordinances, and public policies.

Land-use impacts would result primarily from constuction. Additional land-use impacts would occur during occasional maintenance activities. All land-use impacts would be temporary. Temporary impacts to farmland during construction include soil compaction and likely some crop damage within the ROW. The route permit application indicates significant efforts have been made to avoid crossing or impacting center-pivot irrigation systems. The applicants would be required to work with landowners to minimize impacts to farming operations along the entire route. As described in Section 5, landowners would be compensated where the transmission line crosses property. Landowners would also be compensated in the event of any crop damage, soil compaction, or damage to drain tile, fences, structures, and landscaping during construction.

6.8 Land-Based Economies

The primary economic concern due to the Project (besides property values, addressed in Section 6.5) is on farming. This section summarizes the Project's potential impact on farming (including organic farms and beekeeping) as well as on other industries such as forestry and mining.

6.8.1 Agriculture

Agriculture is the primary land-based economic resource in the Project area. By sharing roadway with existing ROW, impacts to farmland can be minimized. Landowners commented at the public meetings that they would prefer structures as close to the field lines and roadways as possible. The specifics of how the proposed transmission line would be designed to share roadway ROW are provided in Section 4.0.

In addition, the applicants have developed an agricultural impacts mitigation plan (AIMP) in collaboration with the Minnesota Department of Agriculture (MDA). This agreement identifies measures that the applicants would take to avoid, mitigate, or provide compensation for, negative agricultural impacts that may result from the transmission line construction. For example, the AIMP addresses mitigation actions, where possible, restoration of damaged drain tiles, removal of construction debris, and restoration of soil to existing pre-construction conditions would be required. In the event that a drain tile line is located that the landowner did not discuss, the pole would be relocated and the drain tile line repaired, if damaged, according to the AIMP. Discussions with landowners would take place to reduce impacts to irrigation systems and restore temporary roads to pre-construction conditions. The applicants indicate that no impacts to center pivot irrigation systems are anticipated along the Preferred Route what about the Alternative Route. Before accessing private property, as much advance notice as is reasonable would be provided.

Prime Farmland

Much of the agricultural land is designated as "prime farmland," indicating land that is most desirable for agricultural production. Federal regulations define prime farmland 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" (7 CFR, 657.5 (a) (1)). There are also several livestock farms located along the Preferred Route and Alternate Route, including turkey, cattle, hogs, and sheep farms.

The Project would result in permanent and temporary impacts to farmland. Permanent impacts would occur as a result of structure placement along the route centerline. It is estimated that the permanent impacts in agricultural fields would be 1,000 square feet per pole (0.02 acres). During construction, temporary impacts, such as soil compaction and crop damage within the ROW, are likely to occur. Temporary impacts in agricultural fields are estimated to be one acre per pole for construction activities. In Section 7, impacts on prime farmland due to various route options are summarized.

Organic Farms

In addition to traditional farms, all available route options would have to run near or through organic farms (Figure 6.8.1-1). The MDA was consulted to identify known organic farms within the Project area. Because organic farms are not required to register with the MDA, organic farm registration does not give precise locations of organic fields, only the mailing address. Therefore, organic farms within one mile of route options have been identified for this EIS.

Figure 6.8.1-1. Organic "no spray" field within Project area

Source: Barr photograph, 2009

Additional organic farms have been included though public comments. Organic farms not addressed include farms not registered with the MDA, organic farms with less than $5,000 in organic product revenue, which are not required to be certified under United States Department of Agriculture (USDA) National Organic Program (NOP) requirements. Organic farms may also be transitional farms because the certification process takes three years and the farm, while using organic methods, may not have completed the process.

Under current USDA requirements, high-power transmission lines do not affect organic status. Organic certifying bodies are accredited through the USDA NOP. There is no expected impact from the high-voltage transmission lines itself to organic farm certification under these organic certification bodies. Similarly, there no direct impact to certified Biodynamic® farms under Demeter USA rules. The Demeter USA certification is not accredited through the USDA NOP program and therefore cannot be termed "organic," although the principles of the Biodynamic® farm are similar and more restrictive to the organic farm certification and the Biodynamic® farm certification is included in this section. Potential high-voltage transmission line impacts on organic farm certification are shown in Table 6.8.1-1.

While the presence of a high-voltage transmission line near an organic agricultural area does not directly impact organic status, special procedures must be followed during the construction and maintenance activities associated with high-voltage transmission lines to avoid impacts to organic farms. The applicant has worked with the MDA to develop an AIMP for this Project to identify measures the utilities would take to avoid, mitigate, repair, and/or provide compensation for impacts that may result from transmission line construction of the Project on agricultural land in Minnesota.

Table 6.8.1-1. Impacts of project on organic farm certification

Organic Farm Certification	Project Impact on Organic Status
USDA NOP	No Impact
COI	No Impact
OCIA	No Impact
ICS-FVO	No Impact
MOSA	No Impact
Demeter USA*	No Impact

USDA: United States Department of Agriculture
NOP: National Organic Program
COI: Certified Organic, Inc.
OCIA: Organic Crop Improvement Association, Inc.
ICS-FVO: International Certification Services, Inc. (Farm Verified Organic)
MOSA: Midwest Organic Services Association, Inc.
* Demeter USA certifies a farm is Biodynamic® and not organic.

Section 7 shows the general location of organic farms that could be affected by proposed routes in each segment of the transmission line. All mitigation requirements addressed in the AIMP apply to organic farms. The applicants have stated in their application that they would avoid the application of prohibited substances, including herbicides, pesticides, fertilizers or seeds unless requested and approved by the landowner. The applicants would follow the requirements outlined in the AIMP to control erosion, weeds, water from other fields, and manage soils to continue the organic status of the field.

6.8.1.2 Livestock

Livestock may be impacted temporarily during the construction phase of the Project. There is potential of livestock to have reduced access to pasture lands and may be subjected to construction noise. The applicants would try to avoid direct impacts to livestock farms and would work with individual landowners to minimize noise impacts near livestock farm facilities during construction. Impact of stray voltage on livestock due to transmission lines is not likely, and only would occur in limited circumstances. Stray voltage is addressed in more detail in Section 6.2.

6.8.1.3 Aerial Crop Spraying/Dusting

Crop dusting may occur within agricultural fields along the route. If this farming practice is utilized, and has the potential to become impacted by the Project, the applicants would work with the landowner to identify measures to avoid or reduce changes to farming practices caused by the Project.

6.8.1.4 Bee Keeping/Bee Colonies

Bee keeping for pollinating farm crops such as soybeans and alfalfa and for other reasons is also an important agricultural practice throughout the Project area (Figure 6.8.1.4-1).

In general, studies have demonstrated that bee colonies located directly underneath high voltage transmission lines could be impacted. One study (Greenberg 1981) examined impacts on bee colonies under a simulated 745kV transmission line. The authors found that there could be a negative impact to hive weight under 4.1kV/m ambient electric field strength. The maximum estimated electric field strength for the Project is 3.73kV/m. There was no impact on bee behavior, queen loss, or honey bee foraging rate below the 4.1kV/m ambient electric field strength.

Figure 6.8.1.4-1. Bee hive colony within the Project area

Source: Barr photograph, 2009

Another study (Bindokas, 1988) followed up on the earlier Greenberg study and examined the role of induced current in bee colonies. The authors found that even up to 100kV/m electric field strength in the bee colony entrances, there was no impact on hive weight if the tunnels were dry. By wetting the bee entrance either through condensation or rain, an induced current is able to flow and is focused in these tunnels. At elevated electric field intensity, which may not reflect realistic circumstances for the Project, the induced current can cause changes in bee foraging behavior and even bee death. Bee colonies not located directly underneath a high transmission power line are not expected to be impacted as the induced current and ambient electric field strength drops exponentially. Where it is not possible or reasonable to re-route the proposed transmission line to avoid existing bee colonies, the hives would have to be relocated.

A second concern of high voltage transmission lines is that electromagnetic fields have been proposed as one of many potential hypotheses for the cause of colony collapse disorder (CCD) in bees. Current research indicates that EMF is not contributing to collapse disorder. Instead, the cause seems to be a disease attacking bee ribosomal function, thereby weakening bee resistance to other diseases (Johnson 2009). There is no evidence that this disease is linked to EMF exposure.

6.8.2 Forestry

The potential routes are located primarily in grassland and cultivated land with some forested areas adjacent to farmsteads, waterways, and

within lands managed by the Department of Natural Resources (DNR). The forestry industry is located primarily in the northeastern section of the state. According to the DNR Forestry Division *Fiscal Year 2009 Harvest Plans* (DNR 2008b), no townships within the Preferred Route or Alternate Route have timber harvest plans. There are no economically important forestry resources within the Preferred Route or Alternate Route.

6.8.3 Mining

There are no active mineral-based mining operations within the Preferred Route or Alternate Route, although there are areas along the Preferred Route or Alternate Route that are not currently mined for natural resources that may be used in the future. An example is the Minnesota and Redwood River valleys, which provide significant areas of potential natural resource extraction, including aggregate and granite resources.

6.9 Transportation and Public Services

This section summarizes the Project's potential impacts on local roadways, highways, airports and railroads, and describes potential mitigation. Table 6.9-1 summarizes potential impacts to transportation infrastructure.

- **Roads:** Paralleling roadways helps reduce the need for new ROW. Under all route alternatives evaluated, the proposed line would run parallel to and would cross roads including township roads, county roads and highways, state highways and in one case, interstate highways. Roadways can potentially be impacted when the line crosses the road, or when the local or state government decides to expand the roadway. The utility poles must be moved.

- **Railroads:** Several routes segments under consideration run parallel to or cross railroad corridors. Construction has to be carefully coordinated and properly designed; the transmission line should not impact rail operations.

- **Airports:** There are both public and private airports and landing strips located at various locations in the Project area. Tall high-voltage transmission lines can conflict with the safe operation of public and private airports and air strips.

6.9.1 Roadways

The two primary impacts related to roadways involve compatibility with roadway expansion plans, and safety requirements.

Roadway Expansion Plans

When paralleling roadways, the applicants plan to install poles just outside public ROW—about five feet into fields or other private property when possible (*Application*, Section 3.1). This is partly for safety reasons, but also to avoid potential liability for the cost of moving the poles if the roadway is expanded in the future. That is, if a utility pole must be relocated to accommodate a roadway expansion and the pole is within the public ROW, the utility is liable for the relocation cost. But if the pole is outside of the public ROW, the local unit of government must pay for the relocation. Local governments have often expressed concern about the potential for having to pay the high cost of relocating the poles, should they need to be moved in the future.

Safety Requirements

Liability is not the only issue related to utility pole placement along highways and roadways. The poles must also be located such that they do not present a safety hazard. Requirements for clear zones and roadside obstructions vary based on traffic volume, design speed, roadside geometry, radius of horizontal curve, presence of a curb, and presence of urban or rural roads, collectors, arterials, or freeways. Thus, this review provides a basic summary of requirements from state and federal manuals.

For very low-volume local roads, such as township roads, the American Association of State and Highway and Transportation Officials state that, "at locations where a clear recovery area (an area free of hazards along the edge of a road) of two meters (six feet) or more in width can be provided at low cost and with minimum social/environmental impacts, provision of such a clear recovery area should be considered." However, they also state that where constraints make these impractical, clear recovery areas of less than two meters may be used. They also suggest consideration of other factors such as the presence of vehicles wider than 2.6 m (8.5 ft) such as farm equipment.

The *DOT Road Design Manual Part I and Part II*, Chapter 4 (4-6(6)-4-6(20)) provides charts to determine clear zone widths based on speeds and side slope type.

There are 11 different tables in the Minnesota manual for determining clear zone widths based on daily traffic, cut or fill slopes, and design speed. In addition, the State of Minnesota also provides a formula for adjusting the clear zone on the outside of horizontal curves and a table for increasing clear zone widths when there are curbs greater than four inches. Given the complexity of roadway design, it is not appropriate to generalize about what is considered "safe" in regard to placing transmission line poles adjacent to roadways. The safe zone would have to be determined case by case.

Mitigation

As part of their extensive route review for the Project, the applicants indicate that they have consulted with the DOT and county public works or planning departments regarding new roadways and future expansion plans. The applicants would be required to coordinate

Table 6.9-1. Potential impacts to transportation infrastructure

Transportation Infrastructure	Temporary Impacts due to Construction and Maintenance Activities	Permanent Impacts	Other
Roads	Yes	No	Potential conflicts with roadway expansion plans
Railroads	Yes	No	None
Airports	Yes	No	Must be compatible with FAA and DOT safety regulations
River Navigation	No	No	None

How can transmission lines impact airports?

Transmission line structures or the stringing of transmission lines between structures could severely impact the safe operation of an airport or hinder the maneuverability of aircraft. If close enough, the presence of a steel transmission line structure or wiring could interfere with the operation of air navigation or weather systems. Most importantly, transmission line wiring can also present a significant risk to pilots.

with these affected governmental units along the selected route during detailed design regarding the final placement of transmission line structures.

6.9.2 Airports

Transmission line construction is limited near public airports due to Federal Aviation Administration (FAA) height restrictions, which prohibit transmission line structures above a certain height depending on the distance from the specific airport. Regulatory obstruction standards only apply to those airports that are available for public use and are listed in the FAA airport directory. Private airports are those that are not available to the general public without prior request and approval.

The DOT has established separate zoning areas around airports that restrict use, the most restrictive of which prohibit structures such as high-voltage transmission lines. The most restrictive safety zones are A and B; Safety Zone A does not allow any buildings or

How can transmission lines impact private airports?

Landowners who operate a private airstrip on their property are not required to register with the FAA. Likewise, the DOT does not have any airspace protections or zoning for private non-public airports. Private non-public airports are not required to register with the state. However, if they do register with the state, and are available for public use, then they are subject to FAA and DOT obstruction regulations.

temporary structures, places of public assembly or transmission lines; Safety Zone B does not allow places of public or semipublic assembly (i.e., churches, hospitals, or schools). Permitted land uses in both zones include agricultural uses, cemeteries, and parking lots (Minnesota Rules, Chapter 8800).

Different classes of airports have different characteristics in terms of the physical dimensions of the airport runways, the class size of aircraft capable of landing at an airport and the clearance required allowing safe airplane landing and proper operation of navigation and communication systems. These factors determine the take-off and landing glide slopes necessary for safe flight operation, which in turn determine the setback distance of transmission line structures.

The majority of the airports within the Project area are classified as FAA non-primary commercial service, reliever, and general aviation airports. Guidelines around airports without precision instrument guidance systems for landing approach are generally less restrictive compared to airports with precision instrument guided landing capabilities. For example, airports without precision instrument guidance systems generally have smaller guide slope restrictions compared to larger airports with a high frequency of flight service.

Once the route is selected, the applicants would file all necessary notice requirements with FAA and work with both FAA and DOT to ensure compatibility between the transmission lines and air navigation stations and equipment along the selected route. Although FAA regulations governing obstructions to the airspace zones surrounding public-use airports do not apply to privately owned or operated airfields, the proximity of the proposed routes to existing privately owned or operated airfields has been evaluated where possible in Section 7.

Temporary Impacts to Transportation

There may be temporary traffic impacts associated with equipment and material delivery and worker transportation. In cities along the route, particularly in the constrained portions in downtown areas of certain cities, construction of the transmission line may temporarily impact use of streets. Impacts could result from construction vehicles and safety perimeters temporarily blocking public access to streets and businesses. Access to modify existing substations would be from existing roads and would only cause minor and temporary disruption to traffic. If the transmission line is buried beneath public roadways in certain areas, controlled lane closure would be used to allow continued use of the roadway.

Temporary Impacts to Emergency Services

Any required temporary lane closures would be coordinated with the local jurisdictions, and would provide for safe access of police, fire, and other rescue vehicles.

6.10 Recreation

The Project area contains many opportunities for outdoor recreation, including nature observation, hiking, canoeing, boating, fishing, and camping, swimming, biking, equestrian riding, hunting, and snowmobiling. Specifically, these areas include rivers, lakes and streams, public recreation areas, scenic byways, wildlife management areas (WMAs), andscientific natural areas (SNAs).

What is a Wildlife Management Area?

Minnesota's WMA system started in 1951, when the state began to buy habitats from willing sellers to address loss of wildlife habitat in the state. WMAs are the backbone to DNR's wildlife management efforts in Minnesota. WMAs protect areas with high potential for wildlife production, public hunting, trapping, fishing, and other recreational uses.

What is a Scientific Natural Area?

The SNA program, created by the 1969 Minnesota Legislature is aimed at preserving Minnesota's ecological diversity. To ensure that no single rare feature is lost from any region of the state, it is estimated that 500 natural areas are needed throughout the state. SNA lands are critical resources for scientific study, public edification, and as components of a healthy environment.

Table 6.10-1. Potential impacts to recreational resources

Recreational Resource	Potential Permanent Impacts from Pole Placement	Potential Temporary Impacts from Construction	Potential Visual Impacts for Recreators	Potential impacts on planned future expansion
WMA	Yes	Yes	Yes	No
SNA	No	No	Yes	No
Trails	No	Yes	Yes	No
Parks	No	Yes	Yes	Yes
River Crossings/ Scenic Byways	Yes	Yes	Yes	No
Golf Courses	No	No	Yes	Yes

Section 7 provides an overview of the specific recreation resources located along each of the route options. The data for the recreational impact analysis was done primarily using GIS data from local, state, and federal agencies. The DNR's Recreational Compass was used to locate federal and state recreation areas, lakes, water access points, and trails. Hunting area information was obtained from the DNR web site.

Impact types on recreational resources may vary depending on the proximity of the line, the placement of poles and the sensitivity of the recreational area. Table 6.10-1 summarizes the types of impacts that may occur due to transmission line construction for each of the listed recreational resources.

Key recreational resources that may be impacted by the Project are discussed below.

Wildlife Management Areas

WMAs play a large role in Minnesota's outdoor recreation system as they offer opportunities for hunting, which may include deer, small game, pheasants, waterfowl and doves and may provide wetland, prairie and forest wildlife viewing opportunities (Figure 6.10-1). WMAs within the project area may be impacted by the placement of poles where routes bisect or run immediately adjacent to these areas and where spanning the WMA area is not possible. In these cases, temporary impacts to 1 acre of land per pole are anticipated due to construction activities. For each pole placed within a WMA, permanent impacts of 55 feet are expected. The applicants would need to acquire an easement within an adjacent WMA if direct impacts are unavoidable.

Figure 6.10-1. Example of Wildlife Management Area

Source: Barr photograph, 2009

Other WMAs located outside the route may experience visual impacts in areas where the line is located near enough to the WMA to be seen by visitors. The applicants have stated that they avoided crossing WMAs when selecting their proposed routes, and would place poles adjacent to any parkland so as to avoid impacts to the extent feasible.

Scientific Natural Areas

Minnesota's SNAs provide an opportunity for public for nature observation and education. SNAs located near the Project area may experience visual impacts in areas where the transmission line is near enough to be seen by nature observers. The applicants have stated that they avoided crossing SNAs when selecting their proposed routes, and would place poles adjacent to any parkland so as to avoid impacts to the extent feasible.

Trails

Minnesota has a large network of state and county trails for hiking and cycling and a 20,000-mile snowmobile trail system across the state. At various points, routes may run parallel to and in some cases may cross trails used for recreation including snowmobiling, cycling, hiking and equestrian riding. The applicants would span trails that are crossed by the line. Project impacts to trail systems may range from temporary construction impacts on trails immediately adjacent to the line to visual impacts for visitors where the line is visible from the trail.

Parks (City, County, State, and Federal)

Minnesota's park system provides recreational opportunities including fishing, boating, swimming, and camping. No state or federal parks are located in the Project area. County and city parks located immediately adjacent to the proposed route may experience impacts ranging from temporary construction impacts on parks immediately adjacent to the line to visual impacts for visitors in areas where the line is visible from the parks. The applicants have stated that they avoided crossing parks when selecting their proposed routes, and would place poles adjacent to any parkland so as to avoid impacts to the extent feasible.

River Crossings/Scenic Byways

The Minnesota River is designated as a Wild and Scenic River between the Lac Qui Parle Dam and Franklin, Minnesota. Recreational opportunities within this stretch of the river include canoeing, hiking trails, camping, boating access and wildlife observation (Figure 6.10-2). The Minnesota River Valley National Scenic Byway runs from Browns Valley to Belle Plaine and is primarily used as a visual source of recreation to view the scenery of the River Valley. Project impacts to recreation in these areas are likely to be primarily visual. At the river crossing locations, the applicants have requested a Project route greater than 1,000 feet and less than the 1.25 miles to provide more

Figure 6.10-2. The Minnesota River near Franklin, Minnesota

Source: Barr photograph, 2009

flexibility during design to address engineering challenges as well as minimizing visual impacts in these areas.

Golf Courses

Golf courses located along the route may experience visual impacts in areas where the line is visible to golfers. The placement of the line may also impact planned expansions of golf course areas.

6.11 Water Resources

The proposed high-voltage transmission line may impact lakes, watercourses (rivers, streams, and ditches), and wetlands. All lakes and watercourses would be spanned; transmission structures would not be placed within these resources. However, required crossings of the Redwood and Minnesota Rivers may impact views, birds, and other ecological resources in those areas. In addition, some wetlands would be directly impacted by facility construction. The potential impacts of the various routes under consideration on these water resources are summarized in Section 7.

6.11.1 Area Hydrology

The proposed Project area crosses two major hydrologic units (HUs) within the Upper Mississippi Drainage Region (Seaber, et al., 1987). The western three-quarters of the Project area drain through the Minnesota HU to the Minnesota River. The eastern portion of the Project area drains through the Upper Mississippi –Black-Root HU to the Mississippi River. Annual precipitation tends to increase west to east across the Project area from about 25 inches in Lincoln County to about 31 inches in Dakota County (State Climatology Office, 2003).

Some watercourses, lakes, and wetlands located within the vicinity of the proposed Project area are designated as public waters by the State of Minnesota (Public Waters Inventory (PWI)) and are under the regulatory jurisdiction of the DNR. The statutory definition of public waters can be found in Minnesota Statutes Section 103G.005, subdivisions 15 and 15A. A license from the DNR is required to cross these watercourses and waterbodies. In addition, some watercourses and lakes are considered "impaired waters." Section 303(d) of the Federal Clean Water Act (CWA) requires states to publish, every two years, a list of streams and lakes that are not meeting their designated uses because of excess pollutants (impaired waters). The list, known as the 303(d) list, is based on violations of water quality standards. In Minnesota, the MPCA has jurisdiction over determining 303(d) waters. Section 401 of the federal CWA grants state agencies the authority to require certification of compliance with state and federal water quality regulations. In Minnesota, the MPCA implements Section 401 and approves Project certification. Construction activities near impaired waters would have to be addressed for any of the routes in the NPDES construction permit for the Project (see Section 5.0 for more details).

6.11.2 Lakes

Lakes are located throughout the proposed Project area but are more common in the eastern portion. Some of these lakes are designated as DNR Public Waters. Lake crossings would be avoided to the extent possible; however, some of the route alternatives evaluated for this Project may require spanning of lakes. For example, the applicant's Preferred Route would cross the southern end of Bucks Lake (Figure 6.11.2-1) in Sibley County. Bucks Lake is known by local residents as a premier location for bird watching.

6.11.3 Surface Flows

There are rivers, streams, and ditches located throughout the Project area. All routes would require crossing the Redwood River and the Minnesota River (Figure 6.11.3-1).

The Redwood River would be crossed by all route alternatives within the Brookings County to Lyon County Substation Segment and the Lyon County Substation to the Minnesota Valley Substation Segment.

The proposed Project would require crossing the Minnesota River at three locations, which occur within the following segments: Lyon County Substation to the Minnesota Valley Substation, Lyon County Substation to the Cedar Mountain Substation, and the Cedar Mountain Substation to the Helena Substation. The river crossings within each segment are briefly discussed below; see Section 7 of this document and Appendix I of the route permit application for more details on these Minnesota River crossings.

All route alternatives within the Lyon County Substation to the Minnesota Valley Substation Segment would cross the Minnesota River east of the City of Granite Falls (Granite Falls Crossing). The proposed transmission line route would replace an existing 115 kV transmission line that currently crosses the river at this location.

Within the Lyon County Substation to the Cedar Mountain Substation segment, the Preferred Route and associated route alternatives would cross the Minnesota River at Brown County Highway 8 and Renville County Highway 3 in

Figure 6.11.2-1 Bucks Lake

Source: Barr photograph, 2009

Figure 6.11.3-1. Minnesota River

Source: Barr photograph, 2009

Brown County (Brown County Crossing). At this crossing, large transmission structures would be required to cross an existing 115 kV transmission line on the eastern river bluff. The Alternate Route and associated route alternatives within this segment would cross the Minnesota River north of Redwood Falls (Redwood Crossing; Map 7.3-15). This crossing would follow an existing 115 kV transmission line and road that crosses the river at this location. The Minnesota River is designated as Wild and Scenic River at this crossing. Minnesota State Administrative Rules regulate special use areas including the Minnesota Wild, Scenic, and Recreational Rivers system (Minn. Rules Chapter 6105.0180).

Although transmission line crossings of these designations are permitted, the transmission line crossings must follow existing corridors wherever feasible. In addition, a Section 10 permit from the USACE (United States Army Corps of Engineers) would be required for the Minnesota River crossings.

Within the Cedar Mountain Substation to the Helena Substation segment, the Preferred Route and associated route alternatives would cross the Minnesota River at the Le Sueur treatment pond (Le Sueur Treatment Pond Crossing), which is about 0.8 miles north of Le Sueur. Although this crossing follows no existing infrastructure crossings of the river, the existing treatment pond is an area previously disturbed by industry and infrastructure (also known as a disturbance corridor). The Alternate Route and associated route alternatives within this segment would cross the Minnesota River about one mile west of Belle Plaine (West Belle Plaine Crossing). The West Belle Plaine Crossing would follow an existing 69 kV transmission line across the river.

The Federal Emergency Management Agency (FEMA) designates areas that are likely to experience flooding in a 100-year rainfall event. Permanent impacts to floodplains can reduce flood storage and may increase the flood elevation during a flood event. The small cross-section of transmission line structures are not expected to affect flood elevations over a large river floodplain. The proposed substation locations are also not located in a 100-year floodplain and and would not present a problem.

6.11.4 Wetlands

Wetlands are present at several points along the various route alternatives evaluated for the proposed Project. Wetlands serve as important resources in the landscape with regards to flood abatement, wildlife habitat, and water quality. In the State of Minnesota, wetlands are regulated under the Wetland Conservation Act (WCA) and therefore require coordination with the Minnesota Board of Water and Soil Resources (BWSR) and Section 404 of the CWA by the USACE. PWI wetlands are also regulated by the DNR.

What is a wetland?

Wetlands are areas in the landscape where water inundates the soil surface, or saturates the soil at some point within the top 12 inches, for varying periods of time during the growing season. Wetlands must possess specific hydrology, hydric soil features, and a dominance of wetland-adapted plant species in order to be classified as a wetland. There are several types of wetlands, some of these include: marshes, wet meadows and prairies, open and forested bogs, fens, and forested swamps.

The USFWS National Wetlands Inventory (NWI) was used to identify wetlands throughout the various transmission line routes evaluated for this Project. Starting in the 1970's, the USFWS produced maps of wetlands (NWIs) based on aerial photographs and Natural Resources Conservation Service soil survey maps. Because land use has changed since the 1970's, wetlands shown on the NWI maps are sometimes inconsistent with current wetland conditions; however, NWIs are the most accurate and readily available database of wetland resources within the proposed Project area.

Wetland impacts that would occur due to construction of the Project were estimated using NWIs. Along each of the route alternatives reviewed for this Project, the acres of wetland located within the 150-foot ROW and 1,000-foot route width were determined. This information is summarized for each route segment in Section 7.

6.11.5 Mitigation

Because all lakes and watercourses would be spanned, no structures would be placed within these features and no direct impacts to lakes and watercourses are anticipated. Placement of structures within 100-year floodplain zones would be avoided to the extent possible. Some counties and municipalities along the river have floodplain ordinances, which require that floodplain impacts be avoided when feasible, and permitted (usually through a floodplain permit) if unavoidable. Mitigation may be required as part of a floodplain permit. The number of structures in floodplains can be minimized by using taller (greater than 150 feet) and/or stronger (reinforced H-frame) structures that can span longer than-standard distances. Increased engineering and construction costs may be necessary in order to design and construct structures within the floodplain.

Construction activities may have the potential to indirectly impact lakes, watercourses, and wetlands by increasing the turbidity from sedimentation; however, BMPs would be used to minimize impacts during construction, as required in the State of Minnesota's National Pollutant Discharge Elimination Program (NPDES) construction permit for the proposed Project and as a condition of any route permit.

The construction stormwater general permit (MN R 100001) was re-issued by the MPCA on August 1, 2008. Under the re-issued permit an NPDES/State Disposal (SDS) permit is required for any construction activity disturbing:

- One or more acres of soil.
- Less than one acre of soil if that activity is part of a larger common plan of development or sale that is greater than one acre.
- Less than one acre of soil, but the MPCA determines that the activity poses a risk to water resources.

Based on these requirements and previous interpretation of disturbance, transmission line projects that meet these criteria would be required to comply with the requirements found in this general construction stormwater permit. The types of activities associated with the construction of power lines which trigger the need for a stormwater construction permit include ROW clearing, staging areas, access roads, landings for storage of equipment and timber, and other types of activities which disturb soil.

The construction stormwater permit requires the preparation of a project specific pollution prevention plan that identifies controls and practices that would be implemented during construction to prevent erosion and sediment from impacting surface waters. In addition, when construction projects are located near (within one mile) certain protected waters, such as trout streams or waters that have been designated as impaired, additional precautions, erosion controls and sediment removal practices would

be required.

Temporary impacts to wetlands may occur if they need to be crossed during construction of the transmission line. Best management practices (BMPs), such as scheduling construction when the ground is frozen and use of swamp mats, would be employed to minimize impacts to wetlands. Wetlands impacted during construction would be restored as required by the USACE and WCA.

The most effective means of minimizing impacts to wetlands is to span all wetlands with structures. However, when spanning wetlands is not possible, structures would be placed within wetland boundaries, causing permanent impacts to them. Wetland impacts due to permanent structure placement would result in approximately 55 square feet of permanent impacts per standard single-pole structure. Temporary impacts would total one acre per span of transmission line. Wetland vegetation would be restored following construction and all necessary Section 404 permits would be obtained from the USACE and would comply with the WCA.

Vegetation maintenance procedures under transmission lines prohibit trees from establishing. Existing trees must be removed throughout the entire 150-foot ROW, including forested wetlands. Because of this, forested wetlands within the 150-foot ROW may undergo a permanent vegetation type change to emergent or shrub/scrub vegetation. In addition, the USACE may require wetland mitigation for conversion of forested wetlands to nonforested wetlands. The required mitigation would be determined based on consultation with the USACE.

6.12 Flora and Fauna

6.12.1 Flora

6.12.1.1 Vegetation Communities

The Project area spans two Ecological Classification System (ECS) units: the Prairie Parkland ecoregion in the western half of the Project area and the Eastern Deciduous Forest in the eastern portion (ECOMAP 1993). The Prairie Parkland ecoregion was under tallgrass prairie preceding modern settlement. Natural vegetation in prairie remnants is dominated by big bluestem *(Andropogon gerardii)* and Indian grass *(Sorghastrum nutans)*, with prairie dropseed *(Sporobolus heterolepis*) also a prominent component.

In drier conditions, little bluestem *(Schizachyrium scoparium)*, porcupine grass *(Stipa spartea)*, and side-oats grama *(Bouteloua curtipendula)* occur more frequently. (DNR 2006) Forbs include purple coneflower (*Echinacea purpurea)*, lead plant *(Amorpha canescens)*, and pasque flower *(Anemone pulsatilla)* (Aaseng, et. al., 1993).

The Project area follows the transition between the eastern forests and central grasslands of North America. Tallgrass prairie, bur oak *(Quercus macrocarpa)* savanna, and oak *(Quercus sp.)* woodland were historically common in the transition from grassland to forest (DNR 2005). As the Project area continues eastward, it enters the Eastern Broadleaf Forest ecoregion, which is dominated primarily by hardwood species in southern Minnesota. The Big Woods Ecological Subsection in eastern Sibley, Scott, Le Sueur, and Rice counties typifies the forested portions of the Project area, and is dominated by maple *(Acer sp.)*, basswood (*Tilia americana)*, and oak *(Quercus sp.)* deciduous forest (DNR 2005).

Woodlands and forests dominated sites where fire was uncommon, including species such as sugar maple *(Acer saccarum)*, basswood, American elm *(Ulmus americana)*, and northern red oak *(Quercus rubra)*. Silver maple (*Acer saccarinum*) forests still occupy the active floodplains, while silver maple, cottonwood *(Populus deltoides)*, box-elder *(Acer negundo)*, green ash *(Fraxinus pensylvanica)*, and slippery elm *(Ulmus rubra)* grow near rivers where flooding is infrequent (DNR 2005). Wet depressions create conditions suitable for marshes, wet meadows, shrub/scrub wetlands, and wet prairies.

As a result of settlement and farming in the 1800s, most of the historic prairie has been converted to agriculture. The dominant plant species in the agriculture areas are corn (*Zea mays)* and soybeans (*Glycine max)*. In the grazed areas, dominant vegetation includes introduced grasses such as smooth brome *(Bromus inermis)* and sorghum *(Sorghum vulgare)*. Similarly, woodland trees were removed and land was converted to agriculture.

Wetlands are ecologically important and are typically found as isolated pothole wetlands or in association with rivers. Wet prairie and meadow/carr communities are typically encountered in southern Minnesota. Dominant plant species include slough sedge *(Carex atherodes)*, tussock sedge *(C. stricta)*, or aquatic sedge *(C. aquatilis)*. Prairie cordgrass (*Spartina pectinata)*, bluejoint (*Calamagrostis canadensis)*, and lake sedge *(C. lacustris)* are also common species.

Other common plants include forbs such as spotted Joe-Pye weed (*Eupatorium maculatum)*, great water dock *(Rumex orbiculatus)*, and water smartweed *(Polygonum amphibium)*, and shrubs such as red-osier dogwood *(Cornus sericea)* and willow *(Salix spp.)* (DNR 2008). Invasive species, particularly purple loosestrife *(Lythrum salicaria)* and reed canary grass *(Phalaris arundinacea)*, often degrade native wetland communities.

6.12.1.2 Native Vegetation

Throughout the Project area, there are several areas where native vegetation occurs naturally or is managed. Designated habitat or conservation areas include managed lands such as DNR WMAs and U.S. Fish and Wildlife Service wildlife protection areas (WPAs) and easements, and unmanaged areas include DNR-designated Minnesota County Biological Survey (MCBS) biodiversity significance and rare native habitats and communities. These resources provide habitat for native vegetation, wildlife, and rare and unique resources. Native prairie commonly occurs along railroads. These areas have been inventoried by the DNR and are listed as state-designated railroad prairie.

The DNR has identified areas with high-quality natural resources that would be suitable for metro parks. These areas are designated Metro Significant Natural Resource Areas (MSNRA). See Appendix B for maps showing locations of many of these features. WMAs are typically managed for wildlife resources including game species.

Two types of USFWS easement occur in the Project area. On habitat easements, the USFWS holds tillage, cropping, and disturbance rights

to the upland and protects the wetlands. These lands are often used for waterfowl production. Wetland and prairie restoration typically takes place on these easements. Farmers Home Administration (FmHA) easements are managed by the USFWS for wildlife resources. Management practices vary among easements depending on location and management goal.

The DNR Natural Heritage Information System (NHIS) database identifies 13 native plant community types at various locations along both the Preferred and Alternative Routes (see Section 6.13). See specific route segments in Section 7 for the locations of these native plant communities.

The Big Woods Heritage Forest is managed by the DNR through a program that relies largely on voluntary partnerships with private landowners. Landowners with more than 20 acres of deciduous woodland in counties in the Big Woods Ecological Subsection can enroll in this program to conserve old-growth deciduous forest. Transmission line easements across these lands would require agreement from the landowner.

6.12.1.3 Noxious Weeds and Invasive Vegetation

Noxious weeds are regulated under Minnesota Statutes, Chapter 18. Noxious weeds can rapidly overtake native vegetation and severely degrade habitat quality. Cropland suffers losses in productivity following noxious weed infestations. Noxious weeds can be introduced to new areas through propagating material like roots or seeds transported by contaminated construction equipment. Disturbed soil surfaces allow noxious weeds to establish and out-compete existing vegetation.

Eleven species of primary noxious weeds are recognized by Minnesota Rules 1505.0730. The Minnesota Noxious Weed Law also defines and lists 49 secondary noxious weeds. A county may select a weed or weeds from this secondary list to be placed on its noxious weeds list. If a secondary noxious weed is placed on a county noxious weed list, that weed must be controlled in that county.

6.12.1.4 Impacts and Mitigation

Flora throughout most of the proposed Project area is typical of that normally found in an agricultural setting. Approximately 93 percent of the route would occur along existing ROWs, including roads and agricultural field lines, most often adjacent to cultivated row crops. Impacts to native vegetation are not anticipated to substantially disrupt vegetative community quality or function. The applicants would span areas containing native communities wherever possible. The applicants would also avoid and minimize direct impacts to habitat and conservation areas as possible.

Temporary impacts to flora would take place most intensively at the structure locations where borings would take place and spoils would be stored. Permanent impacts are estimated at 55 square feet per pole. Temporary impacts are estimated at one acre per span. Staging areas and stringing areas would also temporarily impact flora across the route. Grading may be required at the staging areas if they are not located in previously disturbed sites. In forested areas, clearing for access roads and staging areas would be limited to only those trees necessary to permit the passage of equipment. Temporary access roads would be removed and the area restored to its original, preconstruction condition.

Permanent vegetative changes would take place in woodland areas within the ROW. Certain species of trees and shrubs that may interfere with maintenance and the safe operation of the transmission line cannot be allowed to establish within the ROW. Co-locating with existing corridors through wooded areas would reduce the impact to trees on the river valley bluffs. Typically, vegetation is controlled mechanically or with herbicides on a regular maintenance schedule. Vegetation that does not interfere with the safe operation of the transmission line typically is allowed to establish within the ROW.

The applicants have indicated they would continue to work with the DNR and USFWS to minimize and avoid impacts to sensitive flora along the route, and would avoid and minimize impacts to any areas known to support native vegetation, to the greatest extent possible. When native vegetation communities cannot feasibly be spanned, the number of structures could be minimized the within these lands. Areas disturbed due to construction activities would be restored to pre-construction conditions and could be reseeded with a seed mix recommended by the local DNR management and that is certified to be free of noxious weeds.

Construction equipment can spread noxious weed-propagating material to new locations. The applicants must comply with Minnesota noxious weed laws as described in Minnesota Rules Chapter 1505 and must observe county weed lists where they occur. Around substations and switches, the applicants would provide for weed control in a manner that does not allow for the spread of weeds onto adjacent agricultural land during operation of the transmission line. This would be a condition of the route permit.

Within the Preferred Route ROW, pole placement in Daubs Lake WMA and Lines WMA may be unavoidable. The applicants indicate a total of five poles would be placed in these WMAs. This would result in approximately 275 square feet of land permanently removed from the existing habitat and 2.2 acres temporarily impacted. One pole would be located in a USFWS easement creating 55 square feet of permanent impacts. Other resources would be spanned or avoided as much as possible.

Expansion at the Lyon County, Lake Marion, and Minnesota Valley substations is not expected to have significant effects on vegetation resources.

6.12.2 Fauna

6.12.2.1 Wildlife Overview

Habitat within the Project area includes areas used for forage, shelter, breeding, or as a stopover during migration by both resident and migratory wildlife. Wildlife throughout the Project area consists of birds, mammals, fish, reptiles, amphibians, mussels, and insects.

The diversity of habitat types—agricultural landscapes, prairie remnants, forested areas, pasture, grasslands, wetland, and riverine habitats—support a wide range of wildlife species. Portions of the Project dominated by agricultural fields, pasture, or urban and suburban areas tend to support a less diverse wildlife community. Conversely, portions of the Project with less-disturbed and/or diverse vegetation communities tend to support more wildlife species, and can act as refuges or corridors of movement for wildlife as well.

Throughout the Project area, there are several areas where high-quality wildlife habitat occurs

naturally or is being managed. While agricultural land uses are an important component of wildlife resources in the Project area, land managed to promote wildlife habitat can provide for higher species diversity and larger populations than surrounding intensively used landscapes.

Game species populations are managed by the DNR and are an important part of Minnesota recreation and rural economy. Pheasant populations have been increasing slightly over the past 10 years, while gray partridge (*Perdix perdix)* populations are below the 10-year average, as are the populations of mourning doves *(Zenaida macroura),* cottontail rabbits *(Sylvilagus floridanus),* and jackrabbits *(Lepus townsendii)* (Tranel and Haroldson, 2008). In the past decade, turkey populations have been increasing in the throughout the Project area. Deer populations have been steady in the western portion of the Project area and slightly decreasing in the Minnesota River area. Fishing takes place on many lakes and rivers in the Project area. Trout streams, designated and managed by the DNR, have very high water quality and are stocked with trout.

Designated habitat or conservation areas include managed areas:

- **Important Bird Areas (IBAs):** IBAs are developed by BirdLife International and the Audubon Society and designate high-quality bird habitat.
- **Grassland Bird Conservation Areas (GBCAs):** GBCAs are developed by the USFWS to identify areas of unbroken grassland where migratory bird species make summer homes.
- **Wildlife Management Areas (WMAs):** WMAs are managed by the DNR to promote wildlife and game species.
- **WPAs:** WPAs are managed to promote waterfowl populations and to conserve ecologically and recreationally valuable wetlands and lakes.
- **U.S. Fish and Wildlife Service easements (USFWS):** USFWS easements on private land protect the survival of wetlands and native grassland
- **National Wildlife Refuges (NWRs):** NWRs are managed to conserve important natural resources. No sections in this Project include NWR lands.
- **Aquatic Management Areas and Fish Management Areas (FMAs):** These areas protect aquatic wildlife and fish species by conserving lakes and rivers and the surrounding land areas.
- **CRP:** CRP converts marginal farmland to grassland in 10- to 15-year easements providing valuable habitat for bird and terrestrial species
- **Conservation Reserve Enhancement Program (CREP):** CREP easements are often permanent and are in coordination with state grassland reserve programs.

Common birds in Project area habitats include:

- Songbirds
- Waterfowl
- Raptors (hawks)
- Pheasant (*Phasianus colchinus*)
- Turkey (*Meleagus gallopavo*)

Designated habitat or conservation areas also include unmanaged areas:

- **DNR designated areas with Minnesota County Biological Survey (MCBS) biodiversity significance:** The MCBS biodiversity areas, identified by the DNR, are good indicators of wildlife species habitat and quality.
- **Rare native habitats and communities:** Organizations have identified other areas or habitats that are important for wildlife species.

The Minnesota River Valley is recognized as part of the North American Mississippi Migratory Flyway for migrating birds. Merging routes to the North American Atlantic Flyway also cross the Minnesota River Valley. More than 200 species of birds have been recorded in the valley (USFWS 2008). Birdlife International has designated much of the Minnesota River Valley as an IBA. The USFWS recognizes the value of the valley and is expanding the Minnesota Valley NWR to protect more of these resources. Bald eagles are frequently seen along the Minnesota River Valley.

Common mammals in Project area habitats include:

- Raccoon (*Procyon lotor*)
- Mink (*Neovison vison*)
- Skunk (*Mephitis* spp.)
- Weasel (*Mustela nivalis*)
- White-tailed deer (*Odocoileus virginianus*)
- Coyote (*Canis latrans*)
- Red fox (*Vulpes vulpes*)
- Badger (*Mustilidae* family)
- Porcupine (*Erethizon dorsatum*)
- Rabbit (*Sylvilagus* spp.)

6.12.2.2 Impacts to Wildlife

There is potential for the displacement of wildlife and loss of habitat from construction of the Project. Wildlife could be impacted in the short-term within the immediate area of construction.

The 1940 Bald and Golden Eagle Protection Act (16 USC 668-668C)

This act specifically prohibits the taking or possession of and commerce in bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*), either alive or dead, or any part, nest, or egg of these eagles, without a permit from the Secretary of the Interior.

The distance that animals would be displaced would depend on the species. Additionally, these animals would be typical of those found in agricultural and urban settings and should not incur population level effects due to construction. Potential Project impacts are expected to be limited to within one mile of the route centerline. Potential Project impacts to areas in permanent land conservation programs are anticipated to be limited to the 1,000 foot-route-width instead of within one mile of the intended centerline, because these areas are less intensively managed for wildlife resources.

Temporary impacts to fauna would likely take place most intensively at the structure locations (requiring one acre per span of transmission line) where foundation excavation would take place and spoils would be stored. Equipment

staging areas and conductor stringing areas may also temporarily impact fauna within the Project construction area. Grading could occur at the staging areas if they are not located in previously disturbed sites. Clearing for access roads would be limited as much as possible and would be at maximum 20 feet wide, unless safety concerns dictate wider sections. In forested areas, clearing for access roads would be limited to only those trees necessary to permit the safe passage of equipment and would temporarily fragment habitat. Temporary access roads would be removed and the area returned to original condition following construction and ROW restoration activities.

Permanent impacts to wildlife could take place at substation locations where two to five acres of land for each substation would be changed from existing land uses, most likely agricultural, to the developed substation area. Construction of these facilities would likely displace wildlife. Additional long-term impacts to wildlife in the surrounding area are not expected.

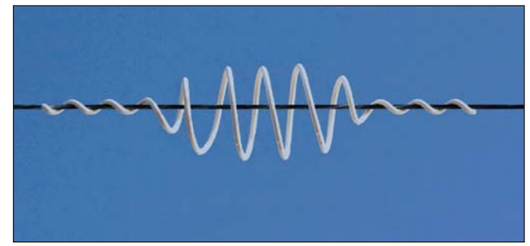
Raptors, waterfowl, and other bird species may be affected by the construction and placement of a new transmission line. Avian collisions are a recognized possibility. Transmission line impacts can be significant for some avian species, although they are negligible at distances greater than one mile from avian habitat (APLIC 1994). Waterfowl typically are more susceptible to transmission line collision. The species of birds more commonly involved in collisions are large-bodied and have long wing spans such as swans, geese, ducks, herons, pelicans, and cranes. Collision frequency may increase when a new transmission line is located between agricultural fields that serve as feeding areas, wetlands, or open water, which serve as resting areas. Also, the positioning of the line on the landscape can influence the potential of collision impacts. If the birds are flying into the sun, a line that runs north to south and divides feeding and resting areas can be difficult to see at sunrise and sunset. In these areas, it is likely that waterfowl and other birds would be traveling between different habitats, potentially increasing avian collision potential with the transmission line.

The Cedar Mountain–Helena and Helena–Lake Marion sections are both within one mile of colonial bird nesting sites. Because of the high density of birds in such nesting sites, disturbance to the site has the potential to impact individuals of the bird species. However the species' overall population reproductive success is not likely to be impacted. Construction impacts to these areas can be minimized during coordination with the DNR by employing construction timing and avoidance measures during the nesting season.

Migratory bird collisions are of particular concern in the Minnesota River Valley migratory corridor. High volumes and diversities of birds utilize this corridor. Both the USFWS and the DNR have expressed concerns over new transmission crossings of the Minnesota River and potential impacts to migratory birds. Wildlife resources, including potential bird impacts, were analyzed at several river crossing options in the river crossing analysis (Appendix I of the route permit application). The applicants would address avian collision issues at major river crossings and other high-risk areas of concern by collaborating with the DNR and USFWS to identify sites where marking the transmission line shield wires with bird flight diverters (see Figures 6.12.2-1 and 6.12.2-2) and/or utilizing alternate structure configurations (i.e., H-Frame structures instead of monopoles) could reduce the likelihood of collisions.

Electrocution of large birds, such as raptors, is a concern typically related to distribution lines versus transmission lines. Electrocution occurs when birds with large wingspans come in contact with either two conductors or a conductor and a grounding device. The applicants' transmission line design standards provide adequate spacing to eliminate the risk of raptor electrocution (APLIC, 2006). As such, electrocution is not a concern related to the Project.

Figure 6.12.2-1. Bird flight diverter.



Source: CapX Fact Sheet – Birds and Power Lines, *May 5, 2009*

Figure 6.12.2-2 Bird flight diverters on transmission line.

Source: Jon Keener

Habitat fragmentation could result from the transmission line bisecting wooded habitats. Because much of the proposed transmission line follows existing linear features such as roads or existing transmission lines, very few new corridors would be created as a result of this Project. Areas of sensitive habitat would be spanned as much as possible.

Impacts from habitat fragmentation can extend beyond the area disturbed by a new route. Fragmentation of wooded habitats has been shown to sometimes affect some wildlife species by creating barriers to daily movement. Predation may increase among animals that are forced out of cover as they search for food. The distance traveled by predators to penetrate large habitat areas may decrease. Some species depend on large areas of undisturbed wooded habitat and their survivability decreases as fragmentation increases. Another example of a detriment to forest interior nesting birds from clearing new ROWs through mature wooded areas is the potential for introduction of parasitic species of birds into new areas (e.g., cowbirds).

Mitigation of Wildlife Impacts

To mitigate possible impacts to wildlife, the applicants have indicated that they would span designated habitat or conservation areas wherever feasible. In areas where complete spanning is not possible, the applicants would

minimize the number of structures placed in high quality wildlife habitat and would work with the DNR and USFWS to determine appropriate mitigation. Vegetative buffers left adjacent to waterways can also provide some species with cover allowing secured movement across ROWs. Additionally, where appropriate, the applicants would use construction mats to avoid soil compaction. Areas disturbed due to construction activities would be restored to pre-construction contours and would be reseeded with a DNR-approved seed mix that is certified to be free of noxious weeds. Game species are not likely to be negatively affected by this Project. Because WMAs and native habitat and managed wildlife areas would be spanned wherever feasible, impacts to these species' habitat would be small. Similarly, because transmission line routing avoids direct impacts to lakes and rivers, potential impacts to fisheries are not expected. Any impacts, temporary or permanent, are unlikely to affect population levels of animal species along any of the proposed routes.

Mitigation of avian collisions would involve avian-safe design and siting practices, including marking shield wires with BFD and/or selecting suitable structures that can reduce opportunities for collisions and electrocutions. In addition, modern electrical transmission conductor is thicker and at a voltage of 345kV, consists of two spiral-wrapped units that add visual depth to the lines.

The overall east-west alignment of the route makes it impossible to avoid crossing migratory bird flyways. However, collision impacts to birds utilizing those flyways can be reduced by shielding lines with vegetation or topographic features. The applicant should work with DNR and USFWS to identify key avian-use areas where installation of BFD during stringing of shield wires would likely minimize future collision impacts.

Additional mitigation could include one or more new north-south transmission line route(s) that would connect the proposed Preferred and the Alternate Routes between the two Minnesota River crossing areas. A north-south connector route in this area would allow for greater flexibility when selecting between the four Minnesota River crossings, as proposed. It may also help further mitigate potential impacts to migratory bird flyways in the areas, as well as feeding and resting areas. Four examples of north-south connector routes in this area including one proposed by the Applicants' as filed in their direct testimony on October 13, 2009, are discussed in detail in Appendix G.

6.13 Rare and Unique Natural Resources

A variety of rare and unique resources are present in the proposed Project area. Without careful planning, the proposed Project may impact rare plants, animals, and habitats. A summary of the information used to evaluate rare and unique resources throughout the various routes evaluated for this Project is provided below. Section 7 summarizes rare resources identified within one mile of the Project area and compares the potential impacts presented by the various route alternatives.

Section 6.13.1 State and Federally Listed Threatened and Endangered Species

As summarized in the route permit application, the applicants queried the DNR Natural Heritage Information System (NHIS) to obtain the locations of rare and unique natural resources across the Project area. This NHIS database review was again queried in September, 2009, for this EIS.

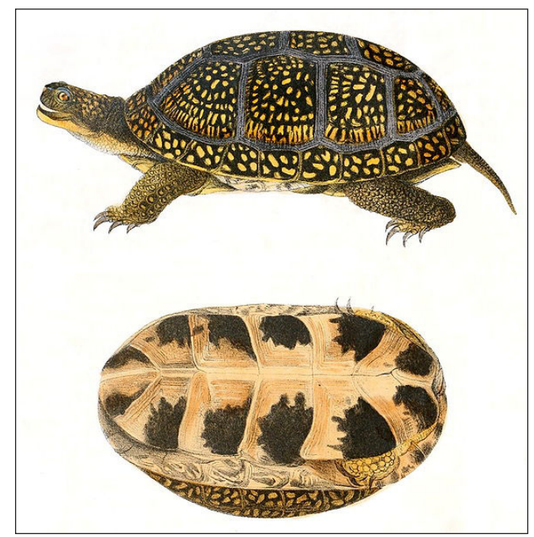
Rare and unique natural resources in the NHIS database have been listed on approved state and federally protected threatened and endangered species lists. The NHIS database also includes species that either do not have a status (referred to as "NON" in Appendix D tables) or are of special concern (referred to as "SPC" in Appendix D tables) status. Species or communities without a status or classified as special concern have no legal protection in Minnesota.

The rare species documented within the Project area include a variety of birds, such as the state-threatened loggerhead shrike *(Lanius ludovicianus)* (Figure 6.13.1-1) and the state-special concern bald eagle *(Haliaeetus leucocephalus);* reptiles, such as the state-threatened Blanding's turtle *(Emydoidea blandingii)* (Figure 6.13.1-2); fish, such as the state-threatened paddlefish *(Polyodon spathula);* mammals, such as the state-special concern prairie vole *(Microtus ochrogaster),* insects, such as the state-special concern regal fritillary butterfly *(Speyeria idalia);* mussels, such as the state-endangered wartyback *(Quadrula nodulata);* fungi, such as the state-endangered lichen species, *Buellia nigra;* and plants, such as the state and federally-threatened prairie bush clover *(Lezpedeza leptostachya)* (Figure 6.13.1-3).

Figure 6.13.1-1 Loggerhead shrike

Source: istockphoto.com

Figure 6.13.1-2 Blanding's turtle



Source: http://www.ci.bloomington.mn.us/cityhall/dept/pubworks/engineer/waterres/blandings_turtle/blandings_turtle.htm

Figure 6.13.1-3 Prairie bush clover

Photo by USFWS: Phil Delphey

6.13.2 Threatened and Endangered Species Habitat

Threatened and endangered species are often found within high quality rare and unique habitats. The NHIS database was used to identify rare habitats, such as native plant communities, within one mile of each route alternative. The following rare native plant communities were identified within one mile of the various route alternatives:

- Southern dry prairie
- Southern dry hill prairie
- Dry sand and gravel prairie
- Southern mesic prairie
- Southern wet prairie
- Calcareous fen
- Southern seepage meadow/carr
- Southern bedrock outcrop
- Sugar maple–basswood–(bitternut hickory) forest
- Elm– basswood–black ash–(hackberry) forest
- Red oak– sugar maple–basswood–(bitternut hickory) forest
- Silver maple–(Virginia creeper) floodplain forest
- Wouldow–dogwood shrub swamp

In addition, the DNR state-designated railroad prairie data were evaluated to determine whether there are locations of remnant native prairie along railroads within one mile of each route alternative. Prairies, once abundant in Minnesota, are often found on railroad ROWs because these areas may be devoid of cultivation and other disturbances.

The Minnesota County Biological Survey (MCBS) data were also reviewed to determine if there are areas with medium, high, or outstanding biodiversity significance within the Project area. Areas with medium biodiversity significance are those containing significant occurrences of rare species and/or moderately disturbed native plant communities and landscape that have a strong potential for recovery.

Areas with high biodiversity significance contain sites with very good quality occurrences of the rarest plant communities and/or important functional landscapes. Areas with outstanding biodiversity significance contain the best occurrence of the rarest species; the most outstanding example of the rarest native plant communities and/or the largest, most intact functional landscapes present in Minnesota.

The complete list of rare and unique resources obtained from the NHIS database query for each route alternative is available in Appendix D. In order to protect rare resources from exploitation or destruction, the maps shown in Section 7 do not indicate the names of species or communities identified within the NHIS database.

6.13.3 Mitigation

Several of the documented rare species within the Project area are associated with rivers, streams and wetlands. The applicants have stated that all rivers and streams can be spanned and structures would not be placed within them. Because of this, direct impacts to aquatic species are not anticipated. Wetlands would also be spanned to the extent feasible, which would minimize impacts to rare wetland species and habitats. In addition, appropriate BMPs would be used throughout construction in order to protect topsoil and adjacent water resources by minimizing soil erosion and sedimentation.

Because MCBS and DNR-listed natural communities and animal assemblages are areas known to be capable of supporting rare and unique species, the placement of structures within these areas should be avoided or minimized by spanning them to the extent possible. Where structure placement cannot be avoided within areas of documented rare resources, a biological survey should be conducted to determine the presence of rare species or suitability of habitat for such species and coordination would occur with appropriate agencies to avoid and minimize impacts. If the resource is unavoidable, a takings permit from the DNR may be required along with other conditions. See Section 6.12 for a discussion of potential impacts to birds from the proposed Project.

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