Appendix A
Visual Impact Assessment Report

Big Bend Wind, LLC
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Jacobs

Visual Impact Assessment Report

Big Bend Wind, LLC
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Acronyms

FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
GIS	geographic information system
KOP	key observation point
kV	kilovolt
O&M	operations and maintenance
proposed project	Big Bend Wind Project
TNC Prairie Reserve	The Nature Conservancy Prairie Reserve
ZVI	Zone of Visual Influence

1.0 Introduction and Background

1.1 Overview

Big Bend Wind, LLC is developing the proposed Big Bend Wind Project (proposed project) in Cottonwood and Watonwan Counties, Minnesota. The proposed project is located on private land and will consist of up to 55[1] wind turbine generators and associated facilities, including turbine access roads, underground electrical collector lines, a substation, an aboveground 161-kilovolt (kV) transmission line, up to two meteorological towers, an Operations and Maintenance (O&M) Building, and a temporary construction laydown yard. The proposed project will interconnect to the Blue Lake-Wilmarth-Interstate Junction 345 kilovolt (kV) transmission line approximately 10 miles south of the Project Area. (**Figure 1**).

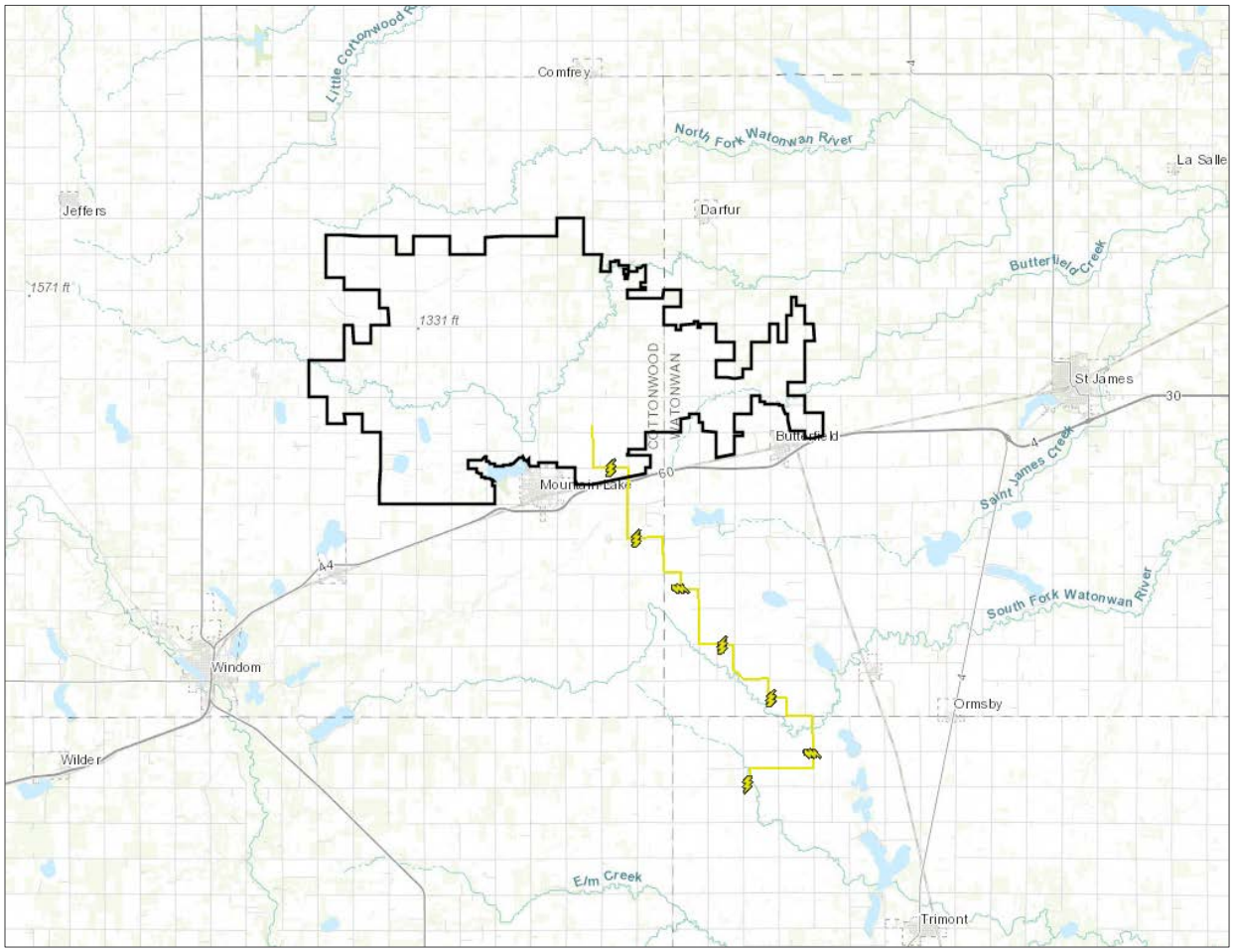

Figure 1: Big Bend Wind proposed project location.

[1] The Site Permit Application includes up to 55 turbine locations. This visual assessment analyzes a 56-turbine layout, including one turbine located in Watonwan County that has since been removed from the proposed layout.

This visual impact assessment has been developed to address stakeholder concerns regarding how visible the proposed project's turbines would be from culturally sensitive locations. An analysis area (**Section 2.1**) was developed to address these concerns and to:

1. Establish and describe the existing landscape character and visual quality of views towards the proposed project from within the analysis area.
2. Select representative key viewpoints, with stakeholder assistance, for describing existing landscape character and visual quality and identifying how the proposed project might change the landscape character and visual quality of views towards the proposed project.
3. Assess if the proposed project would be consistent with the existing landscape character of views towards it and if it would impact the visual quality of those views.
4. Describe avoidance, minimization, and mitigation measures that would prevent or reduce potential impacts.

1.2 Proposed Project Description

1.2.1 Project Features

The proposed project is a commercial-scale wind energy project that would build 50 wind energy turbines that would be visible to varying degrees from areas beyond the project boundary. **Table 1** describes the primary components that may be visible beyond the project boundary.

Table 1: Proposed Project Components Potentially Visible Beyond the Project Boundary

Proposed Aboveground Project Component and Maximum Heights and/or Dimensions	Temporary Ground Disturbance for Construction	Permanent Ground Disturbance
Turbines: Maximum distance from ground to hub: 410 feet Maximum distance from ground to tip of blade: 677 feet	300-foot diameter	38-foot diameter
Collection Substation	5 acres	5 acres
One Permanent Meteorological Tower: 295 feet	100-foot diameter (assumes one tower)	75 square-foot fenced gravel pad around tower (assumes one tower)
O&M Building	8 acres	5 acres
Transmission Line Monopole Structures: Range from approximately 75 to 90 feet tall	*None*	18-inch-diameter pole
Note: Post-construction reclamation would involve removal of turbines and all components described above and grading, seeding, and maintenance/monitoring of revegetation.		

1.2.2 Project Avoidance and Minimization Measures

This section identifies actions that would be implemented during construction and/or operation to reduce or avoid impacts from the proposed project on visual resources. The following measures would be incorporated to avoid and minimize visual impacts:

- Wind turbine towers, nacelles, and rotors would be consistent in size and type and would present a unified, trim, uncluttered appearance.

- The proposed turbines would not be used as structures for mounting commercial advertising, and conspicuous lettering or corporate logos identifying the facility owner or equipment manufacturer would not appear on the sides of the nacelles.
- The towers, nacelles, and rotors would be painted with low-reflectivity, neutral gray, white, or off-white finishes to be consistent with (Federal Aviation Administration) FAA daytime safety marking requirements while, at the same time, minimizing the reflectivity that can call attention to structures in the landscape, and minimizing contrast with the sky backdrop.
- The small cabinets containing pad-mounted equipment near or at the base of each turbine would be painted with neutral gray or earth tone finishes to help the cabinets blend into the surrounding ground plane.
- Exterior lighting on the turbines would be restricted to the aviation warning lights required by FAA, which would be kept to the minimum required number and intensity to meet FAA standards. With the implementation of ADLS, lights would only be seen when aircraft was present or to the minimum extent required by FAA for air traffic safety.
- As much of the facility's electrical collection system would be placed underground as practicable, minimizing the system's visual impacts.
- The exterior surfaces of the O&M Building would be painted with low-reflectivity finishes using an appropriate color scheme that would maximize the building's visual integration into the surrounding landscape.
- The O&M Building and its parking area would be appropriately landscaped to make these facilities look attractive and to visually integrate them into the landscape setting.
- Outdoor night lighting (other than lights associated with turbines) would be restricted to the O&M Building and the substation to the minimum required for safety and security. Sensors and switches would be used to keep lighting turned off when not required, and all lights would be hooded and directed to minimize backscatter and off-site light trespass.
- Site clearing and road widths would be kept to a minimum and, where possible, disturbed areas would be restored or put back into agricultural crop production.

1.3 Regulatory Setting

The Minnesota Public Utilities Commission site permit application requires an analysis of potential project impacts, proposed mitigation measures, and identification of any adverse environmental effects that cannot be avoided. Among the areas that are required to be analyzed are visual impacts. This visual impact assessment contains the analysis of potential visual impacts from the wind energy turbines associated with the proposed project. There are no applicable federal or additional state regulations related to aesthetic or visual resources that apply to the proposed project. In addition, neither Cottonwood or Watonwan Counties have adopted ordinances or regulations related to visual or aesthetic issues.

2.0 Methodology

The following describes the methods used to establish the extent of the analysis area, identifies areas within the analysis area from which the proposed project's components (turbines) would be visible, explains how representative key observation points (KOPs) used to evaluate impacts from the proposed

project were selected, and describes the protocols used to develop photo-simulations of the proposed project's components that would be seen from the KOPs.

2.1 Establishing the Analysis Area

The determination of the analysis area used for the visual impact assessment is based on recommendations made in the document produced for the National Park Service titled *Guide to Evaluating Visual Impact Assessments for Renewable Energy Proposed Projects* (Sullivan and Meyer, 2014). The National Park Service guide reports that the appropriate radius for wind energy analysis areas can range from 25 to 30 miles beyond a proposed project's boundary in the western United States to as little as 8 miles in the northeast. Based on site visits to the project area, existing wind turbines can be seen at distances that range as far as 11 to 15 miles. Topography, vegetation, climate (visibility is often more restricted in humid climates compared to dry climates), and air pollution play major roles in the potential visibility of proposed wind energy projects. Therefore, appropriate radii to use for analysis areas can vary greatly based on localized site conditions.

Based on site visits including reviewing the visibility of turbines from an existing wind farm in the vicinity of the proposed project, a 15-mile radius around the proposed project boundary was initially chosen as the analysis area. However, a more focused analysis area was used for the proposed project based on extensive stakeholder outreach and input. The more focused analysis area was developed after stakeholders expressed interest in how visible the proposed project's turbines might be from important cultural areas found along Red Rock Ridge, which is a discontinuous ridge of Sioux quartzite outcrops that includes Jeffers Petroglyphs State Historic Site (Jeffers Petroglyphs) and The Nature Conservancy's Red Rock Prairie Preserve (TNC Prairie Reserve). To determine potential turbine visibility in the Red Rock Ridge portion containing Jeffers Petroglyphs, the TNC Prairie Reserve, and potential cultural sites, a more focused area approximately 5 miles northwest, north, and east of the project site was established.

2.2 Determining Potential Proposed Project Visibility within the Analysis Area

To identify areas where proposed project turbines might be visible, a Zone of Visual Influence (ZVI) geographic information system (GIS) analysis was conducted (Figure 2). The ZVI analysis focused on the portion of the analysis area where stakeholders had expressed concerns related to the visibility of proposed project turbines. The ZVI analysis process determines the visibility or non-visibility of objects by employing computer software that uses a digital elevation dataset. The ZVI analysis used Environmental Systems Research Institute ArcGIS software to identify the areas within the analysis area from which proposed project turbines might be visible from eye level (5 feet aboveground). For the ZVI analysis, the maximum height of the tallest proposed project feature, which are turbines (677 feet from the ground to the tip of the extended blade) was used.

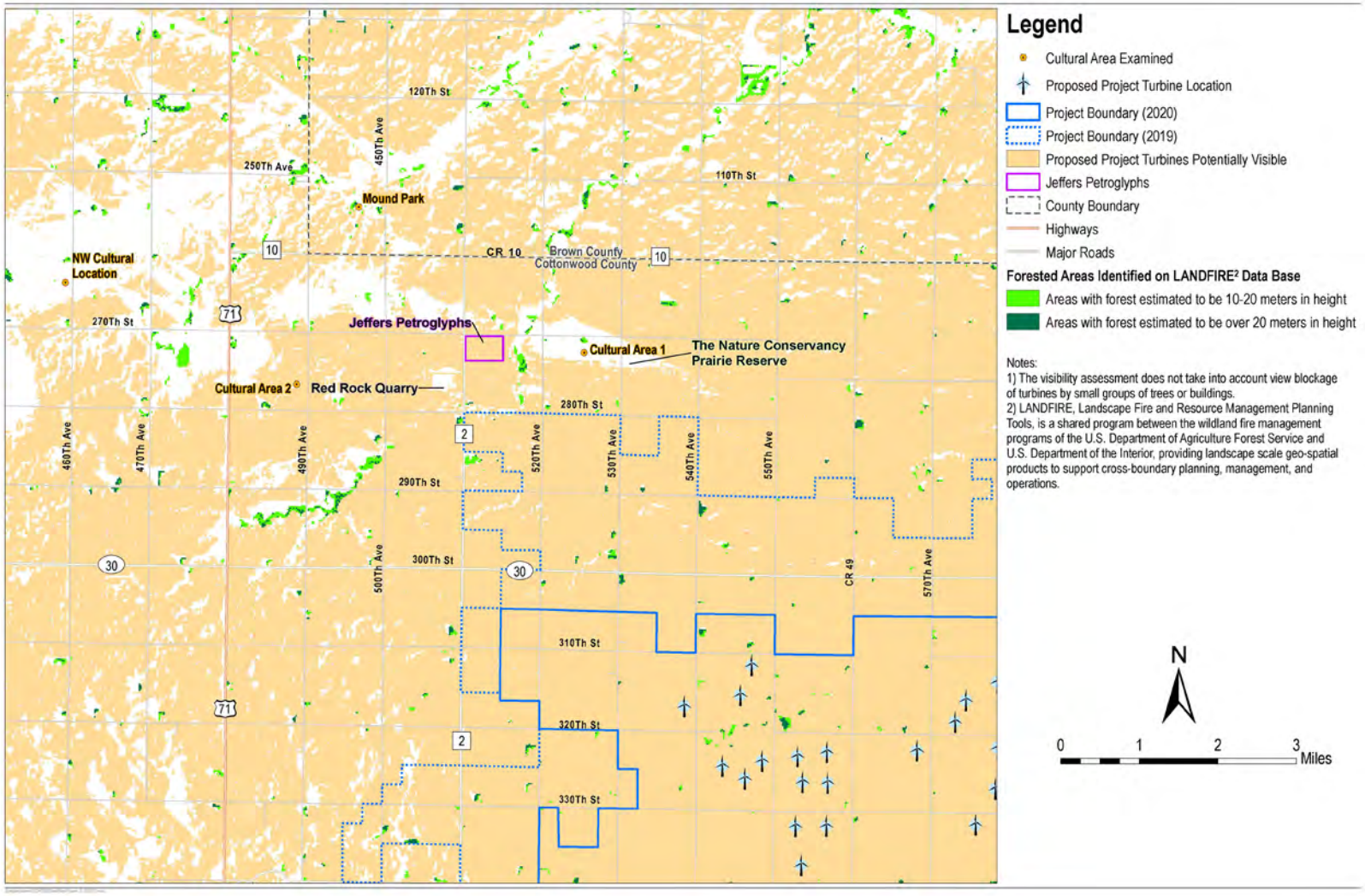

Figure 2: Potential Zone of Visual Influence Visibility Analysis.

2.3 Selecting Representative Key Observation Points

2.3.1 Selected Key Observation Points

The ZVI map was reviewed to identify important locations from which proposed project turbines would be potentially visible so that KOPs could be selected. Big Bend Wind, LLC, has consulted extensively with stakeholders potentially affected by or interested in the proposed project and knowledgeable of resource concerns in the analysis area and also with the cultural resources consultant to determine areas to assess. Based on these outreach efforts and consultation, seven KOPs were chosen to evaluate potential visual impacts. These representative or important locations were evaluated to provide an understanding of the existing landscape character within the analysis area, to represent how the proposed project would potentially affect landscape character, and to represent different types of views and viewer perspectives. It is important to note that several of the KOPs are located on private land in areas that the general public does not have access to but were deemed important to include in this analysis by stakeholders (**Figure 3)**.

Two site visits were conducted; the first was on June 18, 2019, and the second was on November 15, 2019. During the site visits, the results of the ZVI analysis were confirmed by field verifying areas where the ZVI map indicated the proposed project's turbines would be both visible and not visible. In addition, the seven KOPs used in this analysis were visited. The seven KOPs represent a variety of locations and types of viewers:

- KOP 1 – the entrance to Jeffers Petroglyphs visitors center
- KOP 2 – one of the boardwalks at Jeffers Petroglyphs
- KOP 3 – a rock outcropping at the TNC Prairie Reserve
- KOP 4 – the outdoor Jeffers Petroglyphs Astronomical Education Facility
- KOP 5 – the highest point (not accessible to the public) at Jeffers Petroglyphs
- KOP 6 – an area with cultural importance found on private land (not accessible to the general public) off 280th Street near the Red Rock Quarry
- KOP 7 – an area with cultural importance found on private land (not accessible to the general public) east of the project boundary

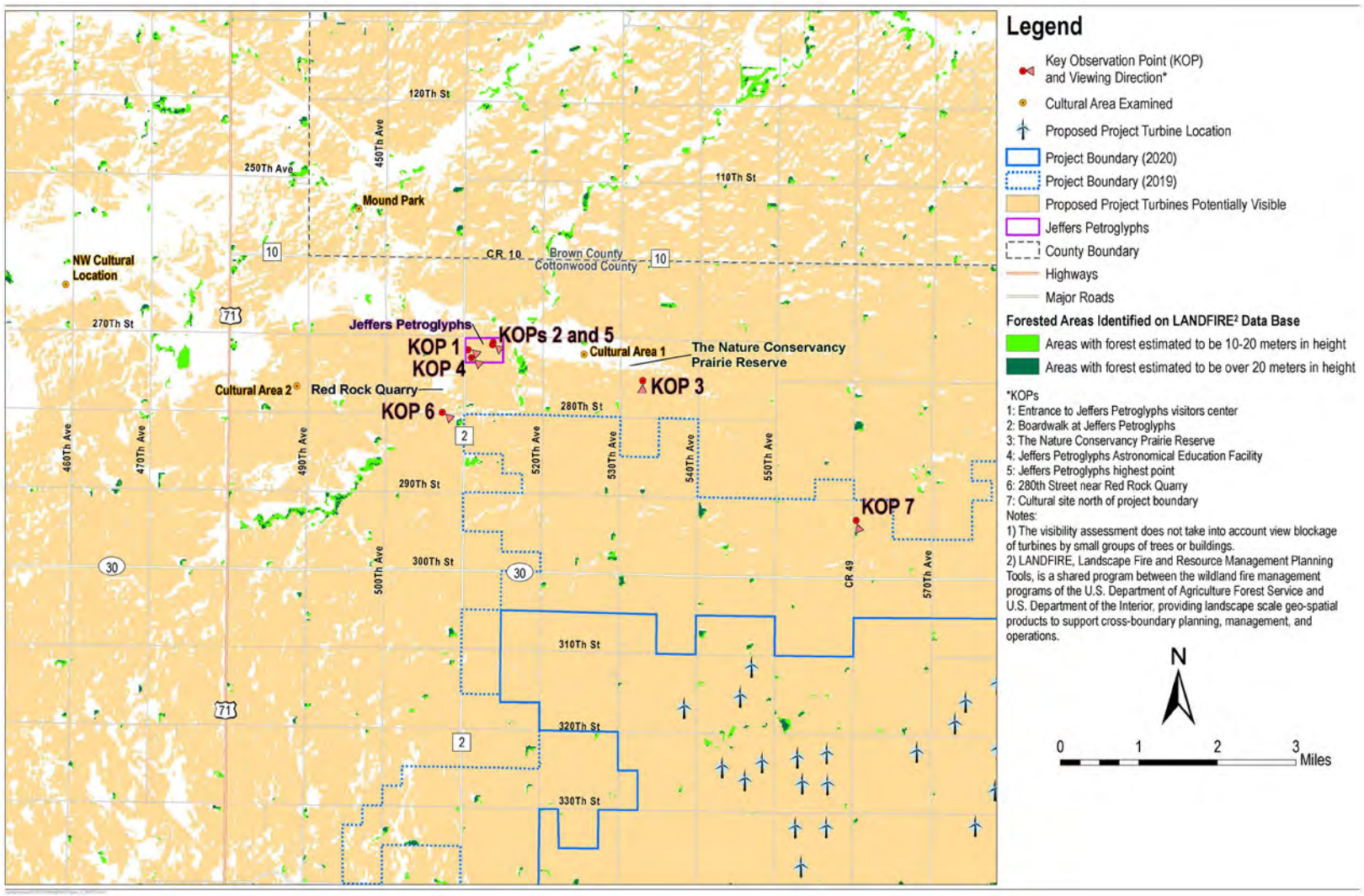

Figure 3: Key Observation Points

2.3.2 Additional Important Viewpoint Locations Considered but Not Selected

Meeting with stakeholders resulted in several additional potential locations being suggested due to cultural importance and that these locations be considered for use as KOPs. These locations are shown on Figures 2 and 3 as Cultural Area 1 and Cultural Area 2 and were identified for evaluation particularly because of their importance from a visual standpoint and the concern that the viewshed during solstice events from these areas should be preserved. These potential KOPS were reviewed by inputting the coordinates of the locations into the ZVI map (Figures 2 and 3) to determine whether they were located in areas from which proposed project turbines would be potentially visible. The ZVI map indicated that views of proposed project turbines would be blocked by terrain at Cultural Area 1 but potentially visible at Cultural Area 2. During the two site visits, all the additional potential locations, including Cultural Areas 1 and 2, were visited with the ZVI map to field check the map's conclusions. All locations had terrain and/or vegetation between them, and it was determined that there would not be views of proposed project turbines from Cultural Area 1 and views of turbines from Cultural Area 2 were highly unlikely. Therefore, none of these additional potential locations were selected for analysis.

2.4 Assessing Impacts

2.4.1 Developing Photo-Simulations to Assist in Assessing Impacts

Developing accurate photo-simulations is critical in assessing potential visual impacts. The photo-simulations included in Exhibits 1 through 7 in **Appendix A** were developed using the process described in **Appendix B.** Exhibits 1 through 7 present the existing view from each of the seven KOPs, along with photo-simulations that depict the views as they would appear with various layouts of the proposed project that were developed over time during and after consultation with stakeholders.

2.4.2 Impact Assessment Methodology

While we are unaware of any applicable visual assessment methodologies developed by Minnesota state agencies to assess the visual impacts of projects under state law, various visual assessment methodologies have been developed by Federal agencies to assess the visual impacts of proposed projects for National Environmental Policy Act (i.e., Federal nexus exists) evaluations. The methodology used for this impact assessment is based on the system developed by the Federal Highway Administration (FHWA). The FHWA Visual Impact Assessment methodology (FHWA, 2015) was developed on behalf of communities adjacent to proposed Federally funded transportation projects in order to adequately and objectively consider potential visual effects. Using this method ensures that the information gathered is adequate to contribute to the project decision-making process and that the assessment and descriptions are as objective as possible. This methodology is useful in a variety of settings, particularly in locations with private land ownership containing a mix of land uses of varying intensities. The impact assessment approach used in the FHWA methodology examines how consistent the proposed project would be with the landscape character seen from selected viewpoints and how, or if, the proposed project would change the visual quality of the landscape seen from each viewpoint.

The FHWA methodology used in this report bases its approach on a set of broad criteria that considers the following factors related to a proposed project:

- The overall landscape character and visual quality of views towards a proposed project and areas near it.

- The visual and aesthetic experience and expectations of viewers (including residents, users of parks and other public spaces, pedestrians, and motorists) looking at a proposed project site.
- The scale and contrast between objects seen in an existing view and the proposed project's components.
- How consistent a proposed project is with the existing landscape character of views towards it and how a proposed project would change the existing visual quality of views towards it.

Visual quality is an assessment of the composition of the character-defining features for selected views (viewpoints). Under the FHWA visual quality analysis system, visual quality is determined by evaluating the three characteristics that together establish visual quality. These characteristics are vividness, intactness, and unity which are defined below:

- Vividness is the degree of drama, memorability, or distinctiveness of the landscape components.
- Intactness is a measure of the visual integrity of the natural and human-built landscape and its freedom from encroaching elements. This factor can be present in well-kept urban and rural landscapes, as well as in natural settings. High intactness means that the landscape is free of unattractive features, and is not broken up by features and elements that are out of place. Low intactness means that visual elements can be seen in a view that are unattractive and/or detract from the quality of the view.
- Unity is the degree of visual coherence and compositional harmony of the landscape considered as a whole. High unity frequently attests to the careful design of individual components and their relationship in the landscape or an undisturbed natural landscape.

For this assessment, the characteristics discussed above are rated between 1 (very low) and 7 (very high). The visual quality ratings and their descriptors are as follows:

1 – Very Low

2 – Low

3 – Moderately Low

4 – Average

5 – Moderately High

6 – High

7 – Very High

To assist in this assessment, the photo-simulations described in **Section 4** and contained in **Appendix A** were examined and rated using the scoring system developed by the FHWA. The scoring system is described in the introduction of **Appendix C**. Scoring sheets for each of the viewpoints, both the existing view and the view with the June 2020 proposed project layout in place, are also provided in **Appendix C**.

3.0 Environmental Setting

The following provides an overview of the existing natural and human settings of the analysis area that currently influence the area's landscape character. Landscape character is defined as an impartial description of what the landscape consists of and is defined by the relationships between the existing visible natural and built landscape features. These relationships are considered and described in terms of dominance, scale, diversity, and continuity. Elements that influence landscape character can include landform, water bodies, vegetation, land use, open spaces, transportation facilities, utilities, and apparent upkeep and maintenance. Examples of types of landscape character found within the analysis area include agricultural, rural residential, residential, natural, industrial, etc.

3.1 Physical Setting

Much of the land within the analysis area is used for agriculture, most commonly crop production, pasture/hay production, and grazing. It has a rural/agricultural landscape character. The farms and small communities found across the analysis area contribute to its largely rural/agricultural landscape character. Agricultural features that influence the project area setting include grain silos, barns, buildings, roads, fencing, farming equipment, wood lots, and wind breaks.

Other large-scale human-made features that are visible within the analysis area include aggregate and rock quarries (the Red Rock Quarry is located between 0.25 and 0.5 mile southwest from the KOPs (1, 2, 4, and 5) within Jeffers Petroglyphs and 4.9 miles northwest of the closest proposed project turbine), wind energy projects, and electrical distribution lines. Turbines at the operational Bingham Lake Wind Farm would be adjacent to the boundary of the proposed project, turbines in the operational Odell Wind Farm are approximately 3 miles south of the boundary of the proposed project, and turbines in the operational Jeffers Wind Farm are approximately 9 miles west of the project boundary. Numerous electrical distribution lines parallel some unpaved and paved roads as they pass through the analysis area and where seen, are tall visual elements.

3.2 Viewer Types

Viewers are people who would have views of a proposed project. They are usually discussed in terms of their type (residents, workers, motorists, recreationists, etc.) and their sensitivity to changes in a viewed landscape is known as viewer sensitivity. Viewers are commonly categorized as having low, moderate, or high visual sensitivity to changes in the viewed landscape. People with low viewer sensitivity are not particularly concerned about the view or changes to it, and/or see a view for brief periods of time (such as when driving along a highway). These types of viewers might include people working or shopping in an area that are engaged in their activities and not concerned with the condition of the visual setting. Moderate viewer sensitivity indicates that viewers have some concern and/or familiarity with a viewed landscape to a degree that is greater than those with low sensitivity but less than viewers with high sensitivity. People with moderate viewer sensitivity might include those dining in an area where views are not part of the attraction, or those engaged in activities like sports and hunting that require concentration. People with high viewer sensitivity are very aware of the existing viewed landscape and are concerned about changes to it. These viewers typically include residents, recreationists, or others for whom the viewed landscape is important.

The analysis area contains a wide array of viewer types with varying viewer sensitivities. Viewers include visitors to Jeffers Petroglyphs and visitors to the TNC Prairie Reserve (although this area is not a publicly accessible resource), and local residents. These residents include people living in communities such as Butterfield, Mountain Lake, Bingham Lak, Windom, Jeffers, Comfrey, Darfur, and others, as well as residents living on farms and non-farm residences located away from developed communities.

3.3 Key Observation Point Locations

The following provides an overview of the areas selected for the KOPs, as well as a description of the views towards the proposed project from each of the KOPs.

3.3.1 KOP 1: Entrance to Jeffers Petroglyphs Visitor Center

This location was selected because it is near the Jeffers Petroglyphs visitor center entrance and provides a recognizable feature in the view (the visitor center building) in the direction of the proposed project. Jeffers Petroglyphs is managed by the Minnesota Historical Society, open seasonally, and allows restricted public access for a fee. This KOP represents views that visitors to Jeffers Petroglyphs would see as they enter the site to access the visitor center. The view direction is to the southeast and includes the facility parking area, visitor center, prairie, and agricultural lands beyond Jeffers Petroglyphs (**Figure 4**).

Figure 4: KOP 1 – Existing view to the southeast towards proposed project from parking lot and entrance of Jeffers Petroglyphs visitor center building and surroundings.

The landscape character of the view towards the proposed project represented by KOP 1 is a mixture of developed and rural. The existing visual quality of the view is between average and moderately low (**Appendix C**). Although not seen in the view from KOP 1 displayed in **Figure 4**, the industrial-scale Red Rock Quarry can be seen approximately 0.3 mile southwest of KOP 1 (**Figure 5**). The quarry's piles of materials, conveyor belts and other equipment, and lights produce an industrial landscape character for this portion of the overall view from this location.

Figure 5: View to southwest of the industrial-scale Red Rock Quarry from KOP 1*.

3.3.2 KOP 2: Boardwalk at Jeffers Petroglyphs

KOP 2 is situated on the boardwalk located along the edge of the main rock outcropping at Jeffers Petroglyphs. This is a view that people visiting the site have as they look south-southeast in the direction of the proposed project (**Figure 6**). The view includes the boardwalk, prairie, trees, and agricultural lands.

Figure 6: KOP 2 – Existing view looking southeast towards the proposed project from Jeffers Petroglyphs boardwalk.

*Note that the photographs in Figures 5 and 6 were taken with the same focal length lens used for the photo-simulations contained in Appendix A – they represent an accurate depiction of the viewing angle seen by the human eye.

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The landscape character of the view depicted in **Figure 6** is natural prairie, woodland, and agricultural. The visual quality of the view is moderately high (**Appendix C**). Existing turbines can be seen to the south in the background distance (approximately 9 miles away) from this location at a different viewing angle than the angle used for **Figure 6**. Their visibility depends on lighting and atmospheric conditions. The industrial-scale Red Rock Quarry can also be seen 0.5 mile to the southwest of this location and introduces an industrial element into the overall view. In addition, the top of a grain silo structure on a farm directly north of Jeffers Petroglyphs can be seen from this point "over" the top of the outcropping/ridge to the north.

3.3.3 KOP 3: TNC Prairie Reserve

This KOP at The TNC Prairie Reserve is located on private land at the edge of an outcropping surrounded by prairie approximately 0.25 mile from the closest road. The location offers relatively high and clear views of surrounding areas, including prairie and forested areas (**Figure 7**). The TNC Prairie Reserve is not open for general, unsupervised public use but does receive visitation by TNC personnel and invited guests. The landscape character of the view is natural prairie with farmsteads and woodlands scattered throughout the middle and background distance zones. The visual quality of the view is moderately high (**Appendix C**). Existing turbines can be seen to the south in the background distance (approximately 9 miles away) from this location. Their visibility depends on lighting and atmospheric conditions.

Figure 7: KOP 3 – Existing view looking south towards proposed project from an outcropping in TNC's Prairie Reserve.

3.3.4 KOP 4: Jeffers Petroglyphs Astronomical Education Facility

This outdoor facility is used for educational programs at Jeffers Petroglyphs. KOP 4 represents the views that visitors engaged in programs at the facility would see when looking to the southeast towards the proposed project. The view to the southeast includes prairie, woodlands, farmsteads, and grain silos (**Figure 8**). The landscape character of the view seen from KOP 3 to the southeast is natural prairie and agricultural, and the visual quality of the view is average (**Appendix C**).

Figure 8: KOP 4 – Existing view looking southeast towards proposed project area from Jeffers Petroglyphs Outdoor Astronomical Education Facility.

The industrial-scale Red Rock Quarry can be seen approximately 0.25 mile to the southwest of this facility. The quarry's piles of materials, conveyor belts and other equipment, and lights add an industrial element to a portion of the overall view seen from this facility **(Figure 9).**

Figure 9: View to southwest of Red Rock Quarry from KOP 4.

3.3.5 KOP 5: Jeffers Petroglyphs Highest Point

This KOP is located on the highest point of the main rock outcropping at Jeffers Petroglyphs. It is beyond the marked trail that passes over the rock outcropping and is not accessible to visitors who purchase tickets and tour the facility on their own. This location offers extensive views of the surrounding area. The view to the south/southeast that KOP 5 represents includes rock outcroppings, prairie, farmsteads, and agricultural lands (**Figure 10)**. The landscape character of this portion of the view from the top of Jeffers Petroglyphs is a combination of natural prairie and agricultural. The visual quality of this portion of the view is moderately high (**Appendix C**).

Figure 10: KOP 5 – Existing view looking south/southeast towards proposed project from Jeffers Petroglyphs high point.

Due to its elevation, additional features can be seen in other directions from KOP 5. Views to the south include existing turbines in the background distance (approximately 9 miles away) from this location. Their visibility depends on lighting and atmospheric conditions. The industrial-scale Red Rock Quarry is visible approximately 0.6 mile to the southwest of this location (**Figure 11**). The quarry's piles of materials, conveyor belts and other equipment, and lights produce an industrial landscape character for this portion of the overall view. This elevated location also has clear views of a farm 0.2 mile to the north (**Figure 12**). The farmstead and farm outbuildings and equipment and fields beyond establish an agricultural landscape character to the areas seen north of KOP 5.

Figure 11: View of the industrial-scale Red Rock Quarry (left side of photograph) and Jeffers Petroglyphs visitor center (right side of photograph) from Jeffers Petroglyphs highest point.

Figure 12: View of farmstead and agricultural outbuildings and equipment to the north of Jeffers Petroglyphs highest point.

3.3.6 KOP 6: 280th Street Near Red Rock Quarry

The view from this location is intended to represent a similar view towards the proposed project from a nearby cultural site located on private property that is not accessible to the general public. The view to the southeast towards the proposed project includes two roads, fields, forested areas, and a grain silo (**Figure 13**). Views towards the nearby Red Rock Quarry from this location are generally screened by

vegetation. The landscape character of the view to the southeast is agricultural and woodlands. The visual quality of the view is average (**Appendix C**).

Figure 13: KOP 6 – Existing view looking southeast from near a cultural resource location south of Red Rock Quarry. View is looking past 280th Street towards proposed project area.

3.3.7 KOP 7: Cultural Site East of the Proposed Project

This location on private property near a cultural resource site is the closest KOP to the proposed project. The view to the south towards the proposed project includes grasslands, agricultural fields, roads, and farmsteads and outbuildings (**Figure 14**). The landscape character of the view is agricultural and the visual quality of the view is average (**Appendix C**).

Figure 14: KOP 7 – Existing view looking south from a cultural resource location east of 560th Avenue between 290th Street to the north and 300th Street to the south. View is west past 560th Avenue towards proposed project area.

4.0 Impact Assessment

4.1 Changes to Project Layout

The visual impact assessment occurred over an approximately 24-month period during which three different project layouts were developed, assessed for impacts, presented to stakeholders, and further refined based on continued stakeholder input. Early in the project development life cycle, stakeholder concerns were anticipated and thus solicited to select KOPs for use in the development of photo-simulations to illustrate the proposed project layouts. **Table 2** contains turbine information related to the various layouts.

Table 2: Turbine Information Associated with Various Project Layouts

Turbine Information	July 2019 Layout	December 2019 Layout	June 2020 Layout
Number of Turbines	64	60	56
Height to rotor (or hub)	345 feet	345 feet	410 feet
Height to tip of blade	570 feet	591 feet	678 feet

4.1.1 July 2019 Layout

The first stakeholder meeting occurred in July 17, 2019, to address potential visual issues. The presentation detailed three KOPs (i.e., 1, 2, and 3) and provided photo-simulations of an early stage development project layout (July 2019). As a result of stakeholder input on the June 2019 project layout, additional KOPs were suggested to illustrate potential project impacts from other areas. These new locations (KOPs 4, 5, 6, and 7) were added to KOPs 1, 2, and 3 to develop photo-simulations of an updated project layout (i.e., now identified in this document as the December 2019 layout) that attempted to address stakeholder concerns expressed at the July 2019 meeting.

4.1.2 December 2019 Layout

Photo-simulations of the December 2019 project layout were developed for all seven KOPs. The December 2019 project layout would have used four fewer turbines than the July 2019 layout and the turbines would have been moved farther away from KOPs compared to the July 2019 layout. The closest December 2019 turbine to a KOP (KOP 3) would have been 2.7 miles and the closest to a KOP at Jeffers Petroglyphs would have been 3.3 miles **(Table 3)**.

4.1.3 June 2020 Layout

After sharing the December 2019 layout photo-simulations with stakeholders, additional refinements to the layout were made based on stakeholder input. The updated layout is referred to as the June 2020 layout. The refinements for the June 2020 layout included reducing the size of the 2019 project boundary, reconfiguring it, and moving it south (**Figure 3**). This resulted in moving turbines farther away from most KOPs compared to the December 2019 layout. The June 2020 project layout would require four fewer turbines than the December 2019 layout and eight less than the June 2019 layout. This layout would have taller turbines than the previous two layouts and the height to the tops of the blades of its turbines would be as much as 21 feet higher than the July 2019 and December 2019 layouts. The closest June 2020 turbine to a KOP (KOP 7) would be 2.2 miles and the closest to a KOP at Jeffers Petroglyphs would be 5.2 miles.

Table 3 summarizes the effects that these modifications to the project layout have had in moving the project farther away from the sensitive viewpoints represented by the KOPs. Under the current (June 2020) project layout, for five of the seven KOPs, the proposed project will be located more than 5 miles away from project turbines, placing them in the background distance zone, where visual impacts tend to be lower. Only two of the seven will be in the middle ground distance zone, where there is some potential for impact, depending on the specifics of the landscape conditions, and none of the viewpoints are in the foreground distance zone where the potential for visual impacts is the greatest.

Table 3: Closest Turbines to KOPs by Project Layout

KOP	July 2019	December 2019	June 2020
1: Entrance to Jeffers Petroglyphs visitors center	2.4 miles	3.4 miles	5.4 miles
2: Boardwalk at Jeffers Petroglyphs	2.3 miles	3.3 miles	5.2 miles
3: The Nature Conservancy Prairie Reserve ridgetop east of Jeffers Petroglyphs	1.6 miles	2.7 miles	3.9 miles
4: Jeffers Petroglyphs Astronomical Education Facility	NA	3.3 miles	5.4 miles
5: Jeffers Petroglyphs highest point	NA	3.4 miles	5.2 miles
6: 280th Street near Red Rock Quarry	NA	2.8 miles	5 miles
7: Cultural site east of project boundary	NA	2.8 miles	2.2 miles

Photo-simulations of the June 2020 layout are included in **Appendix A**, as are simulations of earlier layouts so that changes requested by stakeholders can be seen from various KOPs. The June 2020 layout is also the layout that was assessed in **Appendix C** , for which visual impacts are described below.

Appendix C contains rating sheets that assisted in the evaluation of the June 2020 layout.

4.2 Impacts by Distance Zone and Associated KOP

To assess the project's potential visual effects, the photographic simulations that have been prepared to depict how the views from each of the KOPs, as they would appear with the project in place, were compared with the existing condition photos taken from those locations. Comparison of the simulated with-project view with the existing view provided the basis identifying how the presence of the proposed project would change the character of the view and its visual quality as measured by the FHWA evaluation criteria. The section below summarizes the results of those analyses of the changes to the views from each of the KOPs. The summary is structured by distance zone, starting with assessment of the project's effects on the views in closest proximity to the project's proposed turbines and proceeding to the views that are more distant from them.

4.2.1 Foreground – Zero to 0.5 Mile

The proposed project has always been designed in a way that kept turbines out of the foreground for sensitive viewpoints as represented by the selected KOPs. However, if there were turbines located within the foreground distance zone surrounding the proposed project, they would likely dominate views towards the project site based on their scale, form, color, and movement. The turbines would likely

contrast with the existing character of views near them and could lower visual quality (depending on existing visual quality). In areas where views of the turbines would be blocked or partially blocked by topography, vegetation, or buildings (particularly at the far reaches of this distance zone), the turbines would not be as visually dominant as they would be in closer areas where there would be no blockage. In these conditions, the presence of the turbines would likely contrast with the landscape character (dependent on the type of landscape character) seen from the view. The visual quality of views with higher visual quality ratings are likely to be lowered to some degree in this distance zone if the turbines were to dominate the view. People in this distance zone would primarily be residents living on farms.

4.2.2 Middle Ground – 0.5 to 5 Miles

Because of topography and vegetation, the lower parts of some of the proposed project's turbines would be blocked in this distance zone from many areas surrounding the proposed project site. Where seen, the turbines would not dominate views but, with their form and color, would be visible. Depending on the existing landscape character of a view in this distance zone, the degree and number of turbines that would be visible, and the atmospheric and lighting conditions, project turbines could contrast with the existing landscape character of the view. The turbines could also lower the visual quality of views to some degree. People in the middle ground distance zone who would potentially see the proposed project's turbines would include residents living in Mountain Lake, Butterfield, Bingham Lake, Darfur, Comfrey, Jeffers, and on farms.

KOPs 3 and 7 have turbines in the middle ground distance zone, as described below.

KOP 3: The Nature Conservancy Prairie Reserve

Turbines would be quite noticeable in the middle ground of this view over the horizon formed by groups of trees. The closest project turbine would be 3.9 miles away. The turbines would add large-scale industrial-energy elements into the middle ground of the view that would differ with the existing visual elements of the view in terms of shape, scale, and color. Their presence would contrast with the natural visual character of this portion of the existing view and add industrial-scale energy elements to the view. These changes would be seen by relatively few people due to the remote location of this KOP and the necessity of obtaining permission from The Nature Conservancy to visit the Prairie Reserve. The existing moderately high visual quality of the view would be reduced to below average as a result of a small drop in vividness and larger drops in visual intactness and unity.

KOP 7: Cultural Site East of the Proposed Project

The turbines would be very noticeable in the middle ground and would dominate visual elements. The closest turbine would be 2.2 miles away. The turbines would add large-scale industrial-energy elements into the view that would contrast with the agricultural landscape character of this portion of the existing view. These changes would be seen by relatively few people because this location is on private land. The existing average visual quality of the view would be reduced to moderately low as a result of a small drop in vividness and moderate drops in visual intactness and unity.

4.2.3 Background – Beyond 5 Miles

Topography and vegetation would further impede views of the proposed project's turbines from this distance zone. In areas where the turbines could be seen on the horizon (particularly areas between about 6 and 10 miles of the turbines), in the right atmospheric and lighting conditions, their contrast and movement would likely be noticed. Compared to the other distance zones, the turbines viewed in the

background distance zone would be less likely to contrast with the existing landscape character of the view or change the visual quality of the view. Viewers who might see proposed project turbines in this distance zone primarily include people living in Windom, St. James, and on farms. In general, turbines within this distance zone would not contrast with the landscape character of views towards them or change the visual quality of the views.

KOPs 1, 2, 4, 5, and 6 have turbines in the background distance zone, as described below.

KOP 1: Entrance to Jeffers Petroglyphs Visitor Center

The proposed project's turbines would be seen in the background by people entering Jeffers Petroglyphs (the closest turbine would be 5.4 miles away). Turbines would be seen above and beyond the groupings of trees that define the horizon of this view. The landscape character of the view would remain a mixture of developed and rural, but the presence of the turbines would add additional human-made elements with an industrial-scale energy character into the background of this portion of the view. The presence of the turbines would slightly reduce the moderately low visual quality of the existing view as a result of a small drop in visual intactness and unity.

KOP 2: Boardwalk at Jeffers Petroglyphs

Turbines (particularly blades of turbines) would be noticeable in the background above distant trees from this location. The closest turbine would be 5.2 miles away. The strong foreground and middle ground visual presence of prairie grasses and trees tends to attract viewer attention, so the relatively small scale of the turbines at this distance would not greatly detract from the natural character of the view. The moderately high visual quality of the view would be somewhat lowered with the turbines as a result of a drop in visual intactness and unity, but the visual quality of the view would remain above average.

KOP 4: Jeffers Petroglyphs Astronomical Education Facility

The proposed project's turbines would be noticeable in the background against the horizon between two grain silos. The closest turbine would be 5.4 miles away. Even with the presence of the turbines, the prairie and agricultural landscape character of the view would still be the dominant character, but the turbines would add industrial-scale energy elements into the background of this portion of the view from KOP 4. These changes might be seen by people using the facility, but probably not during night activities (**Section 4.4,** Night Views of Turbines). The existing slightly average visual quality of the view would be reduced to slightly below average as a result of a moderate drop in visual intactness and unity but a slight increase in the vividness of the view from the presence of turbines.

KOP 5: Jeffers Petroglyphs Highest Point

From this location, proposed project turbines would be seen in the background against the horizon above and beyond groups of trees but would not be dominant visual elements. The closest turbine would be 5.2 miles away. The natural-rural landscape character of the view would still be the dominant character of the view even though the turbines would add industrial-scale energy elements into the background of this portion of the view. These changes would be seen by people with permission to leave the interpretive trail to visit this part of Jeffers Petroglyphs. The turbines would increase the vividness of the view but reduce visual intactness and unity, resulting in a reduction of the moderately high visual quality of the view to slightly below average.

KOP 6: 280th Street Near Red Rock Quarry

Proposed project turbines would be seen between groups of trees and beyond fields in the middle and background of this view. The closest turbine would be 5 miles away. The turbines would not be dominant visual elements and although they would add large-scale industrial energy elements to the view, the rural landscape character of this view would largely remain. Few people would view the proposed project from this location. The slightly lower-than-average visual quality of the existing view would be somewhat diminished due to a moderate drop in visual intactness and unity.

4.3 Key Observation Point Impact Assessment Summary

As described in **Section 3.1**, much of the land within the analysis area is used for agriculture, with a rural/agricultural landscape character. Agricultural features that influence the project area setting include grain silos, barns, buildings, roads, fencing, farming equipment, wood lots, and wind breaks. Other large-scale human-made features that are visible within the analysis area include aggregate and rock quarries, wind energy projects, and electrical distribution lines. Numerous electrical distribution lines parallel some unpaved and paved roads as they pass through the analysis area and where seen, are tall visual elements.

The visual impact assessment occurred over an approximately 24-month period during which three different project layouts were developed, assessed for visual impacts, presented to stakeholders, and further refined based on continued stakeholder input. During this time, the number of turbines was reduced from 64 to 56 and the location of the turbines was modified to place them farther away from sensitive views represented by the KOPs.

As described in **Section 4.2**, while turbines located within the foreground distance zone surrounding the proposed project would likely dominate views toward the project site and likely contrast with the existing character of views near them, resulting in lower visual quality, no proposed project turbines are located within the foreground view of any of the KOPs.

Turbines located within the middle ground distance zone are visible, but do not dominate views. Because of topography and distance, the lower parts of some of the proposed project's turbines would be blocked in this distance zone from many areas. KOPs 3 and 7 have turbines located within the middle ground. For KOP 3, the existing moderately high visual quality of the view would be reduced to below average, but these changes would be seen by relatively few people due to the remote location of this KOP and the necessity of obtaining permission from The Nature Conservancy to visit the Prairie Reserve. For KOP 7, the existing average visual quality of the view would be reduced to moderately low, but these changes would be seen by relatively few people because this location is on private land.

Turbines located in the background distance zone are less likely to contrast with the existing landscape character of the view or change the visual quality of the view, as topography and vegetation would further impede views of the proposed project's turbines from this distance zone. Five of seven KOPs have turbines located only in the background distance zone. For KOPs 1, 2, 4, 5, and 6, the visual quality of the existing view ranges from moderately low to moderately high. The presence of turbines in each of these views results in minor to moderate drops in visual intactness and unity, resulting from adding additional human-made, industrial-scale energy elements. However, for all of these KOPs, the dominant existing landscape character, whether a mixture of developed and rural, prairie and agricultural, or natural-rural, remains even with the addition of the turbines associated with the proposed project.

4.4 Night Views of Turbines

The proposed project's turbines would be illuminated as required by FAA regulations and would employ an Aircraft Detection Lighting System (ADLS), subject to availability and FAA approval. ADLS involves the installation of radar units around the perimeter of the proposed project. When the radar does not detect an aircraft, it sends a signal to the wind turbine lighting telling it to stay turned off. When the radar detects aircraft, it stops sending that signal, and the wind turbine lighting activates. This technology allows aviation obstruction lights to remain off until an aircraft is detected nearby. The lights that would be turned on when an aircraft is detected would be attached to the hubs of some turbines which, for the proposed project's turbines, would be at an elevation approximately 410 feet higher than the adjacent ground (note that the ZVI assessment is to the blade tip height of 678 feet), so when lights on the hubs of the turbines were turned on with the ADLS, the lights would not be visible from many of the locations indicated in **Figure 3**).

4.5 Transmission Line Visibility

The approximately 20-mile-long, 161-kV transmission line between the proposed project substation and the Lakefield Junction Field 345-kV line would consist of monopole support structures that would range from approximately 75 to 90 feet in height. The transmission span between support structures would be approximately 400 to 700 feet.

The transmission line would travel south approximately 20 miles from the project boundary through agricultural areas and near some farm structures and houses. Some residences would be within the foreground distance zone but most would be located within the middle ground. Views of the transmission line by most residents within the foreground distance zone would be somewhat interrupted due primarily to vegetation. Some residents living in residences within approximately 0.5 mile of the transmission line would likely see the transmission line from their residences depending on topography and tree presence. The transmission line would not be expected to be seen from residences beyond approximately 2 miles, given the height of the support structures, topography, and vegetation presence. The transmission line would cross over State Highway 60, but would only pass near one facility used by the general public, Mountain County Park. The transmission line would not be noticed by many people, especially people with high viewer sensitivity. If noticed, the transmission line would likely not be inconsistent with the rural character of areas near it, nor would it greatly change visual quality.

4.6 Site Improvement Visibility

The proposed project site is located in a remote rural area with little development and few places from which people with high viewer sensitivity would see it. The proposed project components within the project site (other than turbines) that would be most visible would include two 295-foot-high meteorological towers, an O&M Building, and a substation. None of these components would be inconsistent with the existing landscape character seen by people with high viewer sensitivity or lower the visual quality of views towards the project site by sensitive viewers.

5.0 Literature Cited

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LANDFIRE National Reference Database. 2010. https://www.landfire.gov/lfrdb.php

Sullivan, Robert, and Mark Meyer. 2014. *Guide to Evaluating Visual Impact Assessments for Renewable Energy Proposed Projects*. Natural Resource Report NPS/ARD/NRR—2014/836. National Park Service, Fort Collins, Colorado. August.

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Appendix A

Big Bend Wind Proposed Project Photo-Simulations

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Appendix A
Big Bend Photo-Simulations

Exhibit 1a: KOP 1 – Existing view to the southeast from parking lot of Jeffers Petroglyphs Visitor Center building and surroundings.

Exhibit 1b: KOP 1 – Photo-simulation of July 2019 project layout.

Exhibit 1c: KOP 1– Photo-simulation of December 2019 project layout.

Exhibit 1d: KOP 1 – Photo-simulation of June 2020 project layout (note that June 2020 project layout turbines are approximately 15 percent taller than turbines simulated for the December 2019 and July 2019 layouts).

Exhibit 2a: KOP 2 – Existing view looking southeast from Jeffers Petroglyphs boardwalk.

Exhibit 2b: KOP 2 – Photo-simulation of July 2019 layout.

Exhibit 2c: KOP 2 – Photo-simulation of December 2019 layout.

Exhibit 2d: KOP 2 – Photo-simulation of June 2020 layout.

Exhibit 3a: KOP 3 – Existing view looking south from an outcropping in The Nature Conservancy's Prairie Reserve.

Exhibit 3b: KOP 3 – Photo-simulation of July 2019 layout.

Exhibit 3c: KOP 3 – Photo-simulation of December 2019 layout.

Exhibit 3d: KOP 3 – Photo-simulation of June 2020 layout.

Exhibit 4a: KOP 4 – Existing view looking southeast from Jeffers Petroglyphs Outdoor Astronomical Education Facility.

Exhibit 4b: KOP – Photo–simulation of December 2019 project layout.

Exhibit 4c: KOP 4 – Photo–simulation of June 2020 project layout.

Exhibit 5a: KOP 5 – Existing view looking southeast from Jeffers Petroglyphs high point.

Exhibit 5b: KOP 5 – Photo-simulation of December 2019 layout.

Exhibit 5c: KOP 5 – Photo-simulation of June 2020 layout.

Exhibit 6a: KOP 6 – Existing view looking southeast from near a cultural resource location south of Red Rock Quarry. View is looking past 280th Street towards project site.

Exhibit 6b: KOP 6 – Photo-simulation of December 2019 layout.

Exhibit 6c: KOP 6 – Photo-simulation of June 2020 layout.

Exhibit 7a: KOP 7 – Existing view looking south from a cultural resource location east of 560th Avenue between 290th Street to the north and 300th Street to the south. View is west past 560th Avenue toward project site.

Exhibit 7b: KOP 7 – Photo-simulation of December 2019 layout.

Exhibit 7c: KOP 7 – Photo-simulation of June 2020 layout.

Appendix B

Developing Photo-Simulations

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Appendix B

The Process Used for Developing Photo-Simulations for the Proposed Project

Photo-simulations are produced to provide an indication of what a project will look like when built. The actual layout of turbines for this Proposed Action will be decided during the micrositing phase. Although the simulated turbine locations may change to some degree, the overall accuracy of the simulations must be high. The process described below was used to produce the simulations for this Proposed Project; Jacobs has used this process for numerous types of projects around the world including wind energy, transmission line, transportation (roads, freeway interchanges, ports, rail, light rail, airports), mining and other large-scale projects where visual issues are of concern. The following is the step by step process of how the simulations were developed (see Exhibits 1 through 6).

Step 1 (Exhibit 1)

A photograph is taken using a digital single-lens reflex 35-millimeter (mm) camera set to take photos with a focal length equivalent to a 50-mm lens. This setting is the generally accepted setting for visual assessment in that it captures views in a way that closely resembles the view cone (about 60 degrees) or field of view of the human eye (the width seen by the human eye).

Step 2 (Exhibit 2)

The location of the photograph (which is documented in the field using a global positioning system [GPS] unit) is located in geographic information system (GIS) data. Turbine location information and topographical contour data for the area of the Proposed Project are extracted from GIS. An aerial orthographic photo is used to help identify features at the Proposed Action site- landforms, structures, roads, transmission lines, etc. The viewcone displays a plan view of what will be visible in the simulation; it also identifies the camera location, the direction of view, the angle of view, and helps identify which turbines will be visible in the simulation.

Step 3 (Exhibit 3)

With the digital location of the photograph identified including correct elevation, the topographical features from the GIS data are used to align with the photograph following landforms of the data identical to what is visible in the photograph. The elevation of the view uses 5 feet as the assumed viewer eye level. In this example, the topographical features of the landforms are displayed as wireframe contour lines.

Step 4 (Exhibit 4)

3-D representations of the turbines are developed per model specifications and located in the turbine locations based on GIS data including the correct elevations for each model. Once they are placed in correct geographical position, they are referenced to the camera view.

Step 5 (Exhibit 5)

The turbines are rendered in shaded display, which includes the application of material characteristics for color and shadowing effects from solar light direction.

Step 6 (Exhibit 6)

The portions of turbines that would be screened by the ridgeline of landforms in the photograph are graphically edited resulting in a final image representation of an accurate photo-simulation.

Exhibit 1: Step 1 - Existing condition photograph.

Exhibit 2: Step 2 - Aerial orthographic photo view cone with photo location and turbines locations.

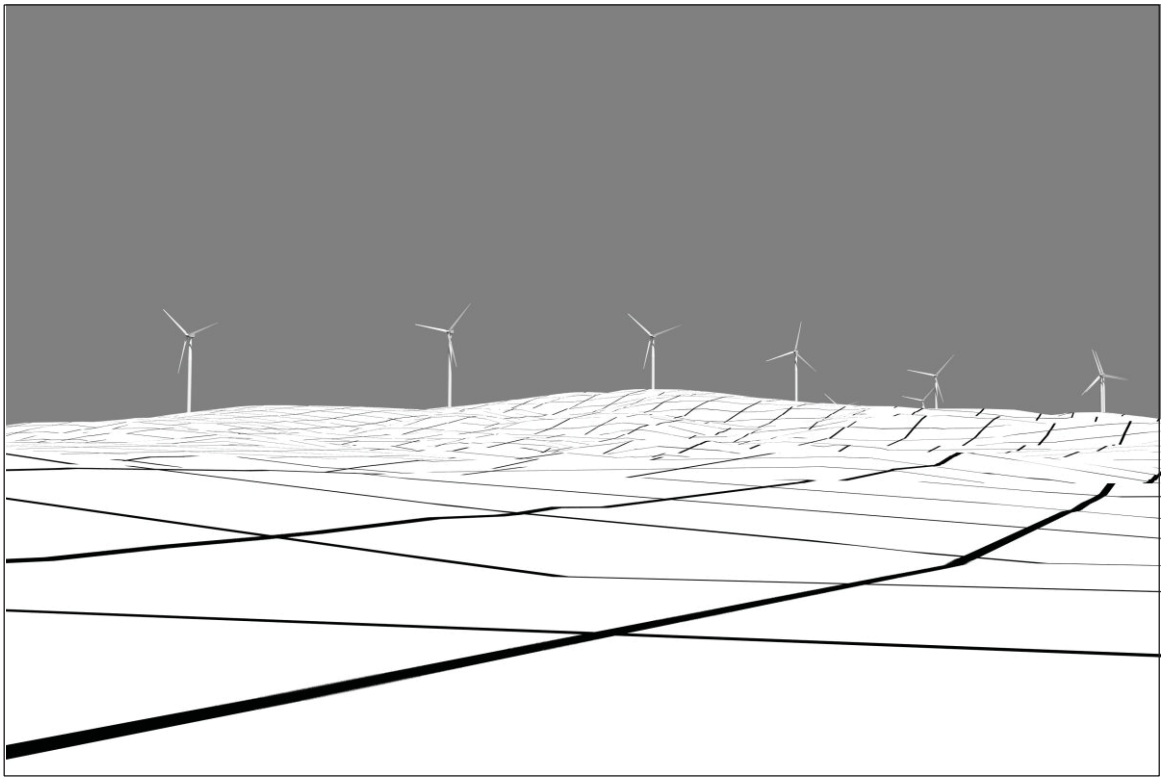

Exhibit 3: Step 3 - Digital overlay of terrain and turbines to allow alignment with photograph.

Exhibit 4: Step 4 - 3D representation of turbines and locations based on GIS.

Exhibit 5: Step 5 -Turbines rendered with shadowing to reflect light direction in photograph.

Exhibit 6: Step 6 - Portion of turbines that would be screened by ridgelines or landforms graphically edited out.

Appendix C

Visual Quality Rating Sheets

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Appendix C
Visual Assessment Methodologies

Visual assessment methodologies have been developed by several Federal agencies to assess the visual impacts of proposed projects for National Environmental Policy Act (NEPA) evaluations. For this assessment, the FHWA Visual Quality Assessment methodology was used. It is documented in the FHWA publication *Visual Impact Assessment for Highway Projects* (FHWA, 1988). This evaluative methodology has been successfully applied by the FHWA and state highway departments, as well as by other visual resource specialists, to evaluate countless transportation and other large-scale projects. The FHWA methodology used in this report based its approach on a set of broad criteria that considers the following factors related to a proposed project:

- The overall visual and aesthetic quality of views towards a proposed project and areas near it (analysis area).
- The visual and aesthetic experience and expectations of viewers (including residents, users of parks and other public spaces, pedestrians, and motorists) viewing a proposed project site.
- The scale and contrast between an existing proposed project, nearby areas, and the proposed project's components.

A visual quality and aesthetics assessment such as this report typically addresses three primary questions:

1. What are the visual qualities and characteristics of the existing landscape in a proposed project assessment area?
2. What are the potential effects of a proposed project's alternatives on the visual and aesthetic quality of the assessment area?
3. Who would see the project, and what is their likely level of concern about or reaction to how the project visually fits into the existing landscape?

The FHWA system uses a generally accepted set of tools and well-defined terminology. The following terminology was used in this report:

Viewers are people who have views of the project. Viewers are usually discussed in terms of general categories of activities (such as residents, workers, recreationists, visitors, pedestrians, and motorists who are referred to as "viewer groups."

Viewer sensitivity (or level of concern) is a combination of the following factors for a specific view:

- How many people have that view and what types of viewers are they?
- What is the likely level of concern of viewers about the appearance, aesthetics, and quality of the view? Level of concern is a subjective response that is affected by factors such as the visual character of the surrounding landscape, the activity a viewer is engaged in, and their values, expectations, and interests.
- How long can highly sensitive viewers see the view? Residents and recreationists generally have views of long duration while people travelling (pedestrians and motorists) through an area typically have views of shorter duration.

- Low viewer sensitivity results when there are few viewers who experience a defined view, or they are not particularly concerned about the view. High viewer sensitivity results when there are many viewers who have a view frequently or for a long duration, as well as viewers (many or few), such as those in a residential neighborhood, who are likely to be very aware of and concerned about the view, recreationists, or visitors of an attraction like a national or state park. Viewer sensitivity or level of concern does not imply support for or opposition to a proposed project; it is a neutral term that is an important parameter in assessing visual quality.

Viewing distance is distance between the viewed object and the viewer. The closer the viewer is to a viewed object, the more detail can be seen, and the greater the potential influence of the object on visual quality. For this report, the following viewing distances were used to better assist in evaluating impacts associated with large-scale objects such as wind turbines; they are foreground (between 0 and approximately 0.5 mile), middleground (between 2 and 5 miles), and background (more than 5 miles).

Viewpoints are specific locations chosen to represent typical views of a proposed project or special, sensitive views. These are the locations from which photographs documenting existing views of a proposed project site are taken and for which photographic-simulations depicting the proposed project will be developed.

Visual character is an impartial description of what the landscape consists of and is defined by the relationships between the existing visible natural and built landscape features. These relationships are considered in terms of dominance, scale, diversity, and continuity. Elements that influence visual character can include landform, water bodies, vegetation, land use, open spaces, transportation facilities, utilities, and apparent upkeep and maintenance.

Visual quality is an assessment of the composition of the character-defining features for selected views (viewpoints). Under the FHWA visual quality analysis system, visual quality is determined by evaluating the three characteristics that together establish visual quality. These characteristics are vividness, intactness, and unity which are defined below:

- **Vividness** is the degree of drama, memorability, or distinctiveness of the landscape components.
- **Intactness** is a measure of the visual integrity of the natural and human-built landscape and its freedom from encroaching elements. This factor can be present in well-kept urban and rural landscapes, as well as in natural settings. High intactness means that the landscape is free of unattractive features, and is not broken up by features and elements that are out of place. Low intactness means that visual elements can be seen in a view that are unattractive and/or detract from the quality of the view.
- **Unity** is the degree of visual coherence and compositional harmony of the landscape considered as a whole. High unity frequently attests to the careful design of individual components and their relationship in the landscape or an undisturbed natural landscape.

For this assessment, the characteristics discussed above are rated between 1 (very low) and 7 (very high). The visual quality ratings and their descriptors are as follows:

Using the rating sheets contained in this appendix, the three characteristics (vividness, intactness, and unity) of each viewpoint were added and then averaged to determine the total existing visual quality rating for the viewpoint. The visual quality ratings range from between 1 (very low) and 7 (very high). For example, if a view from a viewpoint has a vividness rating of 6, an intactness rating of 7, and a unity rating of 5, the ratings of the three characteristics would be added and divided by 3, which would produce an average total visual quality rating of 6. The existing visual quality of each of the viewpoints with views of the proposed project was rated using the criteria described above to establish existing visual quality.

To determine impacts, photographic-simulations of views towards the proposed project from each viewpoint were developed depicting the view as it would appear with the proposed project in place. Comparison of the simulated with-project view with the existing view provided the basis for identifying how the presence of the proposed project would change the character of the view and its visual quality as measured by the FHWA evaluative criteria.