Appendix J: Aesthetics/Visual Quality Resource Report

For Programmatic Environmental Impact Statement on Utility-Scale Onshore Wind Energy Facilities in Washington State

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For the

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DEPARTMENT OF ECOLOGY
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Acronyms and Abbreviations List

ADLS	aircraft detection lighting system
BESS	battery energy storage system
FAA	Federal Aviation Administration
GMA	Growth Management Act
KOP	key observation point
MW	megawatt
PEIS	Programmatic Environmental Impact Statement
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
UGP EIS	*Upper Great Plains Wind Energy Final Programmatic Environmental Impact Statement*
USFS	U.S. Forest Service

Executive Summary

This resource report describes the visual resource conditions in the study area. It also describes the regulatory context and potential impacts and actions that could avoid or reduce impacts.

The impact analysis addressed the following types of impacts relative to aesthetics and visual quality for each of the utility-scale onshore wind facility types (alternatives) evaluated in the Programmatic Environmental Impact Statement (PEIS):

- Long-term change or reduction in visual quality
- Creation of a new source of light or glare that would adversely affect day or nighttime views in the area

Findings for aesthetics and visual quality impacts described in this resource report are summarized as follows:

- Depending on the location and size of facility sites and visual characteristics of the activities, visual quality impacts from construction, operation, decommissioning, and repowering of all types of facilities considered could range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. In general, larger facilities and facilities located in high-value scenic landscapes would have a greater potential to impact visual quality.
- Construction, operation, and decommissioning for all facilities would result in **less than significant impacts** attributable to light or glare.

Impacts may be avoided and reduced through facility size, location, and design considerations. However, mitigation may not be possible for all impacts, and some utility-scale onshore wind energy facilities may result in **potentially significant and unavoidable adverse impacts** on visual quality, depending on location and design. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

Crosswalk with Aesthetics/Visual Quality Resource Report for Utility-Scale Solar Energy

Two PEISs are being released at the same time, one for utility-scale solar energy facilities and one for utility-scale onshore wind energy facilities. This crosswalk identifies the areas with substantial differences between the aesthetics/visual quality resource reports for each PEIS.

Utility-Scale Solar Energy PEIS	Utility-Scale Onshore Wind Energy PEIS (this document)
• Different specific visual quality, light, and glare conditions associated with facilities and resulting different ranges of potential impacts • Some differences in actions to avoid and reduce impacts	• Different specific visual quality, light, and glare conditions associated with facilities and resulting different ranges of potential impacts • Some differences in actions to avoid and reduce impacts

1 Introduction

This resource report describes aesthetics and visual quality within the study area and assesses probable impacts associated with the types of facilities (alternatives), including a No Action Alternative. Chapter 2 of the State Environmental Policy Act (SEPA) Programmatic Environmental Impact Statement (PEIS) provides a description of the types of facilities evaluated.

This section provides an overview of the aspects of aesthetics and visual quality evaluated and lists relevant regulations that contribute to the evaluation of potential impacts.

1.1 Resource description

Visual resources refer to all objects (built and natural, moving, and stationary) and features (e.g., landforms and waterbodies) that are visible on a landscape. These resources add to or detract from the aesthetic or scenic quality (or visual appeal) of the landscape. A visual impact is the creation of an intrusion or perceptible contrast that affects the scenic quality of a landscape. A visual impact can be perceived by an individual or group as either positive or negative, depending on a variety of factors or conditions (e.g., personal experience, time of day, and weather/season).

Visual resources considered in this analysis include the following:

- Designated scenic vistas
- Designated scenic corridors, including roadways, trails, rivers, and streams (including federally designated Wild and Scenic Rivers)
- Designated viewsheds
- Designated ridgelines and other elevated (i.e., visually prominent) natural features
- Areas with comprehensive plan, zoning, or other land controls that define an area as scenic or as designated/protected rural character
- Publicly accessible vantage points having moderate to high visual or rural character and quality and that are well traveled and populated
- Recreational resources
- Areas sensitive to light and/or glare, including designated night sky areas, as well as areas potentially affecting military and commercial aircraft

The following resources may have potentially overlapping impacts, or the impact analysis for these resources may be informed by the analysis of aesthetics and visual quality. Impacts on these resources are reported in their respective resource reports:

- **Tribal rights, interests, and resources and historic and cultural resources:** Tribal and cultural resources may be affected by visual changes in some areas, and sensitive viewers could include members of local Tribes. Information regarding potential visual changes inform the Tribal and cultural impact analyses in the *Tribal Rights, Interests, and*

Resources Report (Anchor QEA 2024a) and the *Historic and Cultural Resources Report* (ESA 2024a).

- **Recreation:** Recreation impacts are informed by the analysis of visual effects on the recreational experience. Recreational resource impacts are presented in the *Recreation Resource Report* (ESA 2024b).
- **Biological resources:** Potential effects of light/glare on terrestrial and aquatic species and habitats are analyzed in the *Biological Resources Report* (Anchor QEA 2024b).
- **Land use:** Potential effects to rural character are analyzed in the *Land Use Resource* Report (Anchor QEA 2024c).

1.2 Regulatory context

Table 1 provides an inventory of applicable laws, regulations, policies, and plans that contribute to the evaluation of aesthetics and visual quality. For local regulations and plans, it would be dependent on the specific location of a facility. The applicant would consult with the appropriate county or other local officials to determine local regulatory guidance that would be applied to project-level SEPA reviews.

Table 1. Applicable laws, plans, and policies

Regulation, statute, guideline	Description
Federal	
U.S. Department of Transportation Federal Highway Administration National Scenic Byways and All-American Roads Program	This program designates National Scenic Roads that meet the criteria for at least one of six “intrinsic qualities”: archeological, cultural, historic, natural, recreational, and scenic. The features contributing to the distinctive characteristics of the corridor’s intrinsic quality are recognized throughout the region and are considered regionally significant. Designated All-American Roads meet two of these “intrinsic qualities.” They are both considered in this analysis as designated scenic resources.
Federal Aviation Administration (FAA) Advisory Circular 70/7460-1M, Obstruction Marking and Lighting	The advisory circular describes FAA’s standards for marking and lighting structures to promote aviation safety. These standards are considered in this analysis relative to impacts attributable to light.
U.S. Forest Service (USFS) Forest Service Manual 2800 – Chapter 2380: Landscape Management and USFS Handbook 279 Landscape Aesthetics: A Handbook for Scenery Management	Chapter 2380 states that it is USFS policy to: 1. Inventory, evaluate, manage, and, where necessary, restore scenery as a fully integrated part of the ecosystems of National Forest System lands and of the land and resource management and planning process. 2. Employ a systematic, interdisciplinary approach to scenery management to ensure the integrated use of the natural and social sciences and environmental design. 3. Ensure scenery is treated equally with other resources.

Regulation, statute, guideline	Description
	4. Apply scenery management principles routinely in all National Forest System activities. USFS's Scenery Management System provides an overall framework for inventory, analysis, and management of scenery on National Forest lands.
Bureau of Land Management Manual 8400 – Visual Resource Management and associated handbooks and technical standards	The Visual Resource Management program provides a system for inventory of scenic values, protection of present and future values through land use planning, and management of visual impacts from proposed projects through project planning and visual design principles.
State	
Chapter 47.39 Revised Code of Washington (RCW), Scenic and Recreational Highway Act of 1967	This legislation establishes the State's Scenic Byway program and standards for eligibility and maintenance of scenic roadways and corridors. These roadways are considered in this analysis as designated scenic resources.
Chapter 70A.550 RCW, Aircraft Detection Lighting System	This legislation, effective in 2023, requires developers, owners, or operators of new utility-scale wind energy facilities of five or more turbines to comply with FAA lighting requirements and mitigations. This includes an aircraft detection lighting system. These standards are considered in this analysis relative to impacts attributable to light.
Local	
County and city comprehensive plans, zoning ordinances, municipal codes, including night sky ordinances	Many counties and cities in Washington have codes, plans, and ordinances that are relevant to an understanding of visual quality and potential impacts of facilities.

2 Methodology

This section provides an overview of the process for evaluating potential impacts and the criteria for determining the occurrence and degree of impact.

2.1 Study area

The study area for aesthetic and visual resources includes the overall onshore wind geographic study area (Figure 1), as well as surrounding viewsheds. The study area for the evaluation of aesthetic and visual resources associated with the construction and operation of the onshore wind energy facilities would be determined by the presence (or absence) of aesthetic and visual resources at a proposed facility site. Parameters could include sensitive visual resources such as visually sensitive vantage points, designated scenic resources (as listed previously), and receptors and facilities sensitive to light/glare (such as airports or residential neighborhoods).

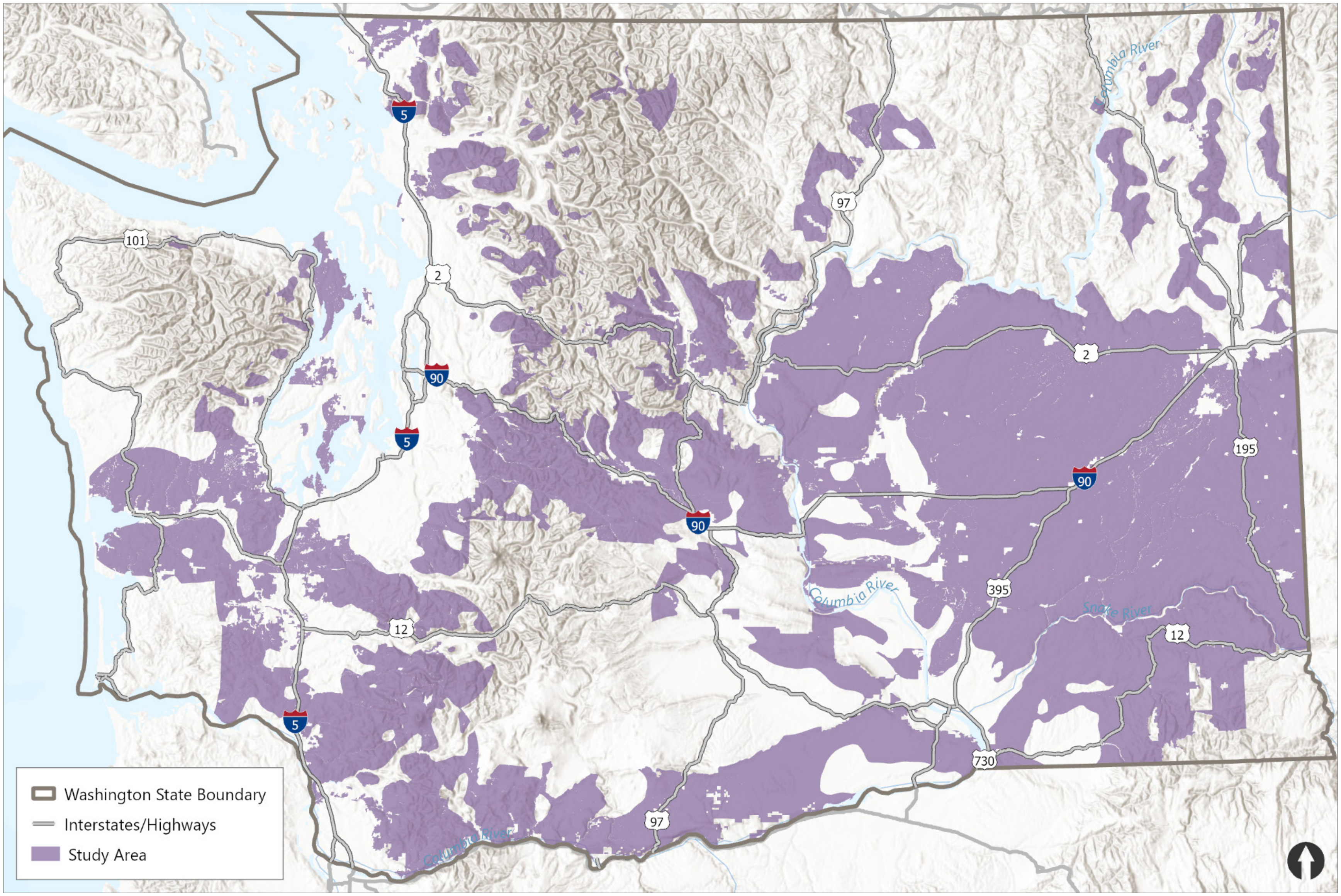

Figure 1. Onshore Wind Energy Facilities PEIS – geographic scope of study

2.2 Technical approach

The general technical approach for the following qualitative assessment of aesthetic and visual quality impacts included the following:

- Existing visual or rural character, land uses that may be sensitive to strong visual contrast (including light and glare), and sensitive viewer groups in the study area.
- Potential impacts of facilities on existing visual or rural character and sensitive viewer groups or land uses in the study area
- Effects of lighting and glare on sensitive receptors

2.3 Impact assessment approach

The magnitude of the aesthetics and visual quality impacts associated with a given wind energy facility would depend on site- and facility-specific factors, including the following:

- Distance of the facility from publicly accessible vantage points and their placement within the context of foreground, middleground, and background views[1]
- Size of the facility (number and spacing of turbines)
- Size of the wind turbines (including height and rotor span)
- Surface treatment of wind turbines, the buildings, and other structures (primarily color)
- The presence and arrangement of lights on the turbines and other structures
- The presence of workers and vehicles for maintenance activities
- Viewer characteristics, such as the number and type of viewers (e.g., landowners in the vicinity of wind energy facilities, residents, tourists, motorists, and workers) and their attitudes toward renewable energy and wind power
- The visual quality and sensitivity of the landscape, including the presence of sensitive visual, Tribal, and cultural resources including historic properties
- The existing level of development and activities in the wind energy facility area and nearby areas, and the landscape's capacity to withstand human alteration without loss of landscape character (i.e., scenic integrity and visual absorption capability)
- Weather and lighting conditions

These factors would be evaluated in detail during site-specific environmental analysis; a general discussion is provided in this resource report.

In 2015, the Western Area Power Administration and U.S. Fish and Wildlife Service published the *Upper Great Plains Wind Energy Final Programmatic Environmental Impact Statement* (UGP EIS; USDOE and USFWS 2015). The UGP EIS considered the impacts of utility-scale onshore wind energy facilities. The geographic area addressed in the UGP EIS included all or portions of

[1] The foreground, middleground, and background refer to areas in space. The foreground refers to the nearest area. The background refers to the area of space in the distance. The middleground occupies the space in between.

Iowa, Minnesota, Montana, Nebraska, North Dakota, and South Dakota. The variety of landscapes in this large region is similar to those found within the study area of the PEIS. These include large expanses of undeveloped or agricultural and rural lands dissected by waterways, small- to moderately sized population centers, foothills and mountains, and recreational areas. The analysis of visual resources in the UGP EIS relied on a large number of studies to provide a basis for determining impacts and their severity. Many of the mitigation measures presented in the UGP EIS are applicable to utility-scale wind energy facilities considered in the PEIS. This aesthetics and visual quality analysis incorporates much of the UGP EIS visual analysis methodology.

The UGP EIS consulted a number of studies that addressed the visibility of a wind turbine over distance, the visual effect of wind turbine movement, atmospheric haze and back- or frontlighting (i.e., whether illumination is from the back or front), color/finish of the apparatus, and public attitudes toward utility-scale wind energy facilities. These are incorporated by reference.

For purposes of this evaluation, a significant impact on aesthetics and visual quality was considered to occur if a utility-scale onshore wind energy facility would result in the following:

- Long-term changes in visual quality that would substantially contrast with the existing visual or rural character or with designated scenic resources, including:
    - Large-scale permanent clearing of vegetation
    - Construction of a large structure (i.e., wind turbines) in a previously undeveloped area
    - Construction of a structure that would block existing views
- Creation of a new source of light or glare that would adversely affect views in the area continuously or for most day or night hours and be visible to a substantial number of people

3 Technical Analysis and Results

3.1 Overview

This section provides an analysis of potential impacts on aesthetics and visual quality that might occur for utility-scale onshore wind energy facilities analyzed in the PEIS. The temporal scope of this analysis assumes that utility-scale onshore wind energy developments would be constructed between approximately June 2025 and January 2045, with construction of individual facilities taking 6 to 18 months. An approximate 50-year scope of analysis is assumed to encompass the period in which utility-scale onshore wind energy developments are likely to be constructed and operational. This section also evaluates actions that could avoid, minimize, or reduce the identified impacts and potential unavoidable significant adverse impacts.

3.2 Affected environment

The affected environment represents the conditions before any construction begins. The study area analyzed in this resource report encompasses a variety of landscape types determined by geology, topography, climate, soil type, hydrology, and land use. Included in this study area are diverse landscapes such as the Columbia River basin, the Cascade Range, the Palouse, the coastal ranges, the southern Olympic Peninsula, and the Puget Sound islands. Overall, the study area is relatively evenly divided between level terrain with long viewing distances and hilly/mountainous topography consisting of valleys and ridgelines.

Although much of the region is sparsely populated, human influences have altered much of the visual landscape, especially with respect to land use and land cover; in some places, intensive human activities, particularly agriculture, have seriously altered visual qualities. There are very few urban areas with populations of more than 50,000, and overall the region has a rural character, with many widely scattered small towns.

The term “rural character” has different definitions including a definition under the Washington State Growth Management Act (GMA). The GMA identifies rural character as patterns of land use and development that, among other things, allow open space, the natural landscape, and vegetation to predominate over the built environment, and provide visual landscapes that are traditionally found in rural areas and communities. For more information on rural character, refer to the *Land Use Resource Report*.

The undeveloped areas in the hilly and mountainous terrain are primarily forested up to the tree line elevation. In more level undeveloped areas, the non-agricultural landscape is dominated by sparsely vegetated plains and plateaus. In the central areas of the state, these give way to the Columbia River and its tributaries, which dissect an otherwise continuous landscape expanse. Large Tribal reservations and federal and state government holdings contribute to the undeveloped landscape, with the exception of clusters of structures within those holdings.

The air quality in many of these less developed areas is good, and the humidity is often low. Given this, and the general lack of vertical relief and the absence of trees and buildings, it is possible to see for great distances in many parts of the study area. In general, the undeveloped areas of the study area have dark night skies, with relatively few sources of light pollution.

The western portion of the onshore wind study area is higher in elevation and includes mountains such as the Cascade Range and the Olympic Mountains. Resource extraction activities (e.g., logging and mining) and recreation are land uses that may impact visual characteristics of the landscape. Because of the greater topographic relief and diversity of vegetation and the presence of mountains, buttes, rock outcroppings, and mountain streams, the visual diversity of the landscape is generally higher than in the central and eastern portion of the study area, and visual quality generally is also higher. In some areas within or near the study area, particularly in areas with national/state parks, waterbodies, forests, and other outdoor recreational opportunities, visual quality is very high, making these sites extremely attractive to tourists and other recreational users.

There are extensive scenic resources that occur within or near the study area, such as national and state parks, monuments, and recreation areas; historic sites, parks, memorials, and landmarks; National Wild and Scenic Rivers, national historic trails, scenic highways, and national wildlife refuges; and other designated scenic resources. In addition, many other scenic resources exist within or near the study area on federal, state, and other non-federal lands, including traditional cultural properties important to Tribes and state or locally designated scenic resources, such as state-designated scenic highways, state parks, and county parks. Many of these designated scenic resources provide views of broad scenic vistas.

The various scenic attractions within the study area draw tourists to the study area and surrounding lands each year and contribute to making tourism a component of many regional and local economies. For many individuals, however, their experience of the visual character of the study area is limited to the views from their vehicles from the interstate, U.S., and state highways that cross the region—for instance, I-5, I-82, I-90, US 12, US 97, and US 395—lending particular importance to the viewsheds of these roadways. There are five National Scenic Byways that traverse or are in close proximity to portions of the study area (USDOT 2024). These byways, designated by the Federal Highway Administration, are White Pass, Chinook, Mountains to Sound, Stevens Pass, and Coulee Corridor. There are also more than 100 state-designated Scenic Byways distributed across every region of the state, including the study area. Parts of the six waterways in the state designated as National Wild and Scenic Rivers also traverse portions of the study area (National Wild and Scenic Rivers System 2024). These include Illabot Creek, the Klickitat River, the Middle Fork Snoqualmie River, the Pratt River, the Skagit River, and the White Salmon River. They are all located in the Cascades portion of the study area.

Sensitive viewer groups are varied throughout the study area. These groups range from people in residential areas in less developed and agricultural areas to motorists and recreationalists/tourists. The viewing experience for each group would vary, depending on the length of time and distance the viewer would be exposed to a wind facility and the physical conditions of the vantage point and viewshed. For instance, passengers in a vehicle traveling at highway speeds, pedestrian/bike path users, and visitors to scenic lookouts located approximately the same distance from a facility would view that facility for different lengths of time and, as a result, would experience the effect of visual change resulting from the facility siting differently.

3.3 Potentially required permits

None of the federal or state laws, plans, and policies presented in Table 1 require permits related to aesthetics and visual quality. However, local land use development ordinances may require some form of design approval (i.e., in designated scenic corridors) or night sky exemption related to safety or obstruction lighting. Local land use permits may also require that projects demonstrate conformance with zoning and comp plan designations, which may include areas of rural character. Federally managed lands also have planning requirements for the protection of visual resources and would evaluate visual effects from proposed projects during right-of-way or leasing processes.

3.4 Small to medium utility-scale facilities of 10 MW to 250 MW (Alternative 1)

This section describes potential impacts on aesthetics and visual quality due to the site characterization, construction, operation, decommissioning, or repowering of small to medium utility-scale wind energy facilities.

3.4.1 Impacts from construction

3.4.1.1 Change or reduction in visual quality

Construction for a wind energy facility would involve a range of activities associated with potential visual impacts. Construction activities, including site characterization activities, are dependent on the site conditions and facility design details; however, they could include activities that result in contrasts in form, line, color, and texture; worker presence and activity; dust; and emissions. Construction of a wind energy facility would typically involve the following major actions with potential visual impacts:

- Erecting temporary meteorological towers
- Building/upgrading roads
- Grading certain parts of the site
- Constructing and using temporary staging and laydown areas
- Removing vegetation from construction and laydown areas
- Transporting towers, turbines, nacelles (housing), and other materials and equipment to the wind energy facility site
- Assembling and erecting the wind turbine generators

- Installing temporary meteorological towers for site characterization
- Installing permanent meteorological towers (as necessary)
- Constructing ancillary structures (e.g., control buildings, fences)
- Constructing electrical power conditioning facilities and substations
- Installing power-conducting cables and signal cables (typically buried)

Additional site characterization and construction activities may also be necessary at very remote locations or for the bigger range of wind energy facility sizes; they may include constructing temporary offices or sanitary facilities.

Construction visual impacts would vary in frequency and duration throughout the course of construction. There may be periods of intense activity followed by periods with less activity. Visual impacts would, to some degree, vary in accordance with construction activity levels. Construction schedules are also specific to each facility site and design. While construction of many facilities might be completed within 1 year, other facilities may take longer to construct and could involve phased development, with construction-related visual impacts therefore lasting longer.

Vegetative clearing, roads, and staging areas

Construction of a utility-scale wind energy facility would require clearing of vegetation, large rocks, and other objects for roads. The nature and extent of clearing are affected by the requirements of the facility, the types of vegetation, and other objects to be cleared. Vegetation clearing and topographic grading may be required for the construction of access roads, maintenance roads, and roads to support facilities (e.g., electric substations). Typically, vegetation-clearing activities would create visual impacts primarily by changing the color and texture of the cleared areas, with additional impacts occurring if refuse materials are not disposed of off site, mulched, or otherwise concealed.

Constructing new temporary and permanent access roads and/or upgrading existing roads would typically be required to support facility construction and maintenance activities. Roads are expected to be topped with aggregate. Road development may introduce strong visual contrasts to the landscape, depending on the elevation compared to the surrounding area, the relationship of the routes to surface contours, and the widths, lengths, and surface treatments of the roads. Construction of access roads would have some associated residual impacts (e.g., vegetation disturbance) that could be evident for some years afterward, with a gradual diminishing of impacts over time as vegetation is re-established. The length of time required for vegetation to re-establish varies greatly depending on location, weather patterns, soil fertility, surrounding land use, and the type of vegetation planted or recruited (e.g., grasses, forbs, shrubs, trees). Refer to the *Biological Resources Report* for more discussion of vegetation. These impacts could be lessened by application of mitigation measures, which are presented in Section 3.4.4.

The nature and extent of visual impacts associated with construction laydown areas and crane staging areas would depend in part on the size of the area and the nature of required clearing and grading, and on the types and amounts of materials stored at the laydown areas. The presence of materials and equipment in these areas would introduce temporary changes in the visible landscape, and additional visual contrasts could be introduced by any vegetation clearing or grading required. Most of these areas would be restored to pre-construction conditions immediately after completion of construction. However, as noted previously, some associated residual impacts (e.g., vegetation disturbance) could be evident for some years afterward, with a gradual diminishing of impacts over time. These impacts could be reduced by application of mitigation measures, which are presented in Section 3.4.4.

Constructing wind turbines and associated facilities

Because of the very large size of wind turbine towers, blades, and other components, the transport and installation of wind turbines on site are visually conspicuous activities. Large (and in some cases very unusual) vehicles are required to transport some components.

The installation of turbines at each facility typically involves excavating the tower foundation, pouring concrete, and performing a variety of other standard construction activities, but because of the height and size of the turbines and the cranes involved, tower erection and placement of the nacelle and rotor on the tower could be visible for long distances. For a large facility, installation of turbines and associated visual impacts could last for months, but at a given turbine location there would be brief periods of activity between periods of little or no activity.

The relative scale of typical onshore wind facility components and other buildings and potential elements of onshore wind facilities are compared in Figures 2 and 3. The various construction activities described previously require work crews, vehicles, and equipment that would add to the temporary visual impacts of construction.

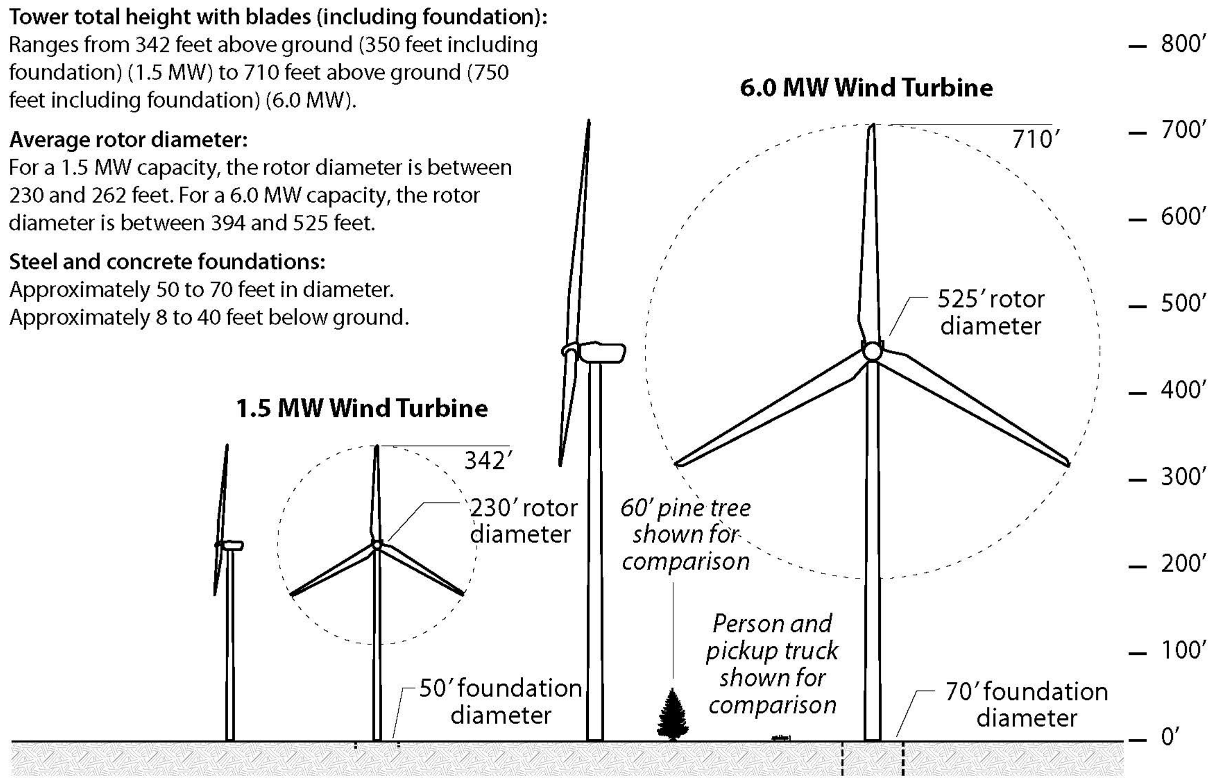

Figure 2. Relative scale of typical wind turbines

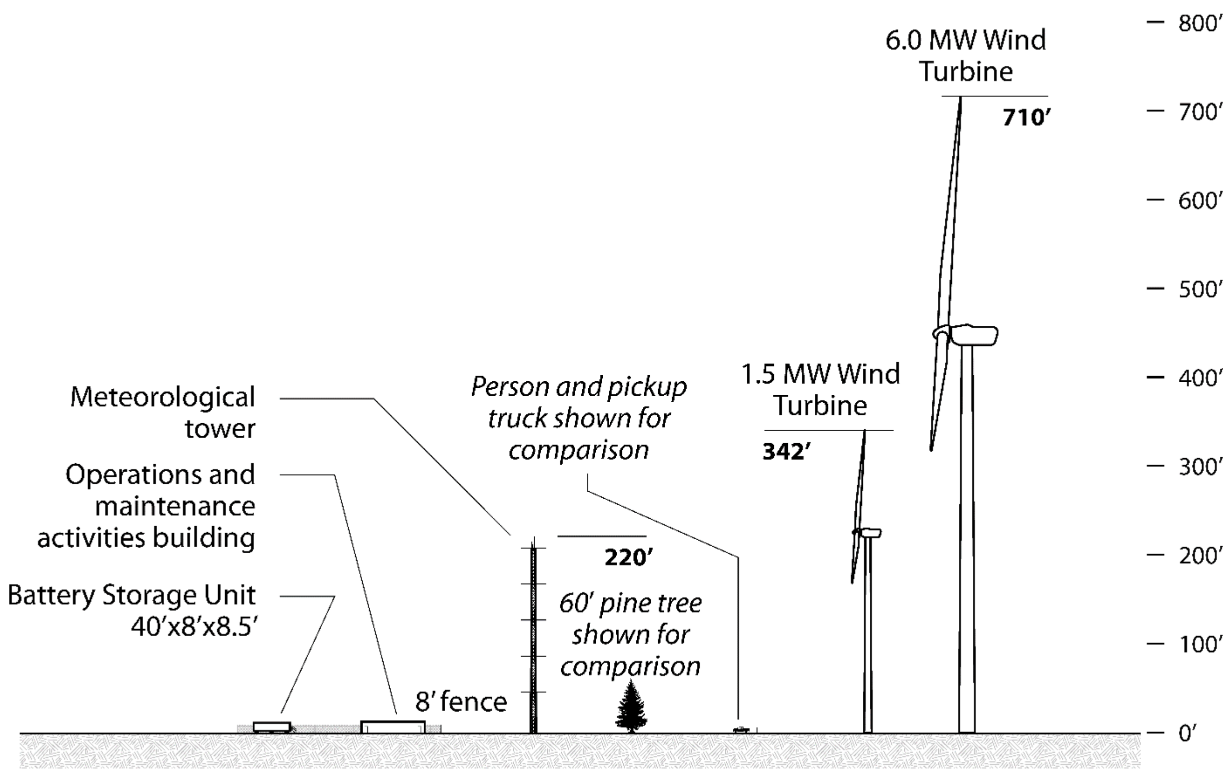

Figure 3. Relative scale of typical wind turbines with ancillary facilities

Dust and excavation

Traffic would produce visible activity and dust in dry soils. Suspension and visibility of dust would be influenced by vehicle speeds, road surface materials, and weather conditions. Temporary parking for vehicles would be needed at or near work locations. Unplanned and unmonitored parking could likely expand these areas, producing visual contrast due to suspended dust and loss of vegetation. Construction activities would proceed in phases, with several crews moving through a given area in succession, giving rise to brief periods of intense construction activity (and associated visual impacts) followed by periods of inactivity. Cranes and other construction equipment would produce emissions while in operation and may thus create visible exhaust plumes.

Excavation would damage or remove vegetation, expose bare soil, and suspend dust. Soil stockpiles (if not removed) could be visible for the duration of construction. Soil scars, exposed slope faces, eroded areas, and areas of compacted soil could result from excavation, leveling, and equipment/vehicle movement. Invasive species may colonize disturbed and stockpiled soils and compacted areas. These species may be introduced naturally in seeds, plants, or soils introduced for intermediate restoration or by vehicles. In some situations, the presence of invasive species may introduce contrasts with naturally occurring vegetation, primarily in color and texture. The presence of workers and construction activities could also result in litter and debris that could create negative visual impacts within and around work sites. Site monitoring, adherence to standard construction practices, and restoration activities discussed in Section 3.4.4 would reduce many of these impacts.

Other construction activities that could introduce visual contrast with existing landscape conditions include bracing and cutting existing fences; constructing new fences, gates, or cattle guards to contain livestock; and providing temporary walks, passageways, fences, or other structures to prevent interference with traffic. If a mobile or on-site concrete batch plant were required, it might temporarily create a visible steam plume under certain atmospheric conditions.

Summary of construction visual quality impacts

Depending on the facility location, there could be some situations where work areas would be blocked from view by intervening topography or screened by vegetation. There could also be facilities located in unpopulated or sparsely populated areas. However, some facilities would be in proximity to roadways, towns and cities, recreational areas, and other vantage points that would provide views of these developments. Impacts on residents are generally greater than those on more transient viewers, such as drivers or workers, in part because residents are likely to view the construction of onshore wind energy facilities more frequently and for longer durations.

A utility-scale onshore wind energy facility constructed in a high-value scenic landscape typically would be more conspicuous and therefore perceived as having greater visual impact than if that same facility were constructed in a setting of low scenic value or where similar facilities were already visible. Some landscapes have special meaning to some viewers because of unique scenic, Tribal, cultural, or ecological values and are therefore perceived as being more sensitive to visual disturbances. Depending on visibility factors, onshore wind energy facilities constructed within or near sensitive landscapes, such as state and national parks, historic sites, landscapes sacred to Tribes, scenic highways and trails, recreational attractions, and other valued cultural features, may be of particular concern. Depending on the facility location and topography, visual impacts could extend to viewers outside the study area of the PEIS.

Depending on the location and size of facilities and visual characteristics of the construction activities, visual quality impacts from construction would range from **less than significant impacts** to **potentially significant adverse impacts**.

Section 3.4.4 presents actions that could avoid or reduce construction impacts of utility-scale onshore wind energy facilities on the visual environment.

3.4.1.2 New source of light or glare

Lighting and glare

Site characterization and construction of a utility-scale onshore wind energy facility would be expected to occur during daylight hours. Some nighttime activities may occur, such as electrical connection, inspection, and testing activities. It is assumed that such activities would be performed with temporary lighting that would be directed downward to focus illumination on work areas and minimize impacts on neighboring properties in the vicinity of a facility. Any lighting used during construction activities would be occasional, temporary, and shielded downward. Cranes more than 200 feet (61 meters) tall used to install turbines may require Federal Aviation Administration (FAA)-compliant aircraft warning lights. FAA guidelines for marking and lighting facilities could require aircraft warning lights that flash during the day and at night. The presence of aircraft warning lights would greatly increase visibility of the cranes at night and could potentially cause visual impacts in predominantly rural settings within the study area, especially if few similar light sources were present in the area. However, only a limited numbers of turbines would be erected at any given time, and limited portions of the facility site would be actively under construction at a particular time. Obstruction lighting on cranes would not remain in any one fixed location for the entire duration of construction but would be present at different locations depending on the phase of construction activities throughout the site.

Onshore wind facilities would require substantial areas of undeveloped or minimally developed land (up to approximately 21,250 acres), which would likely place much of the construction activities away from receptors sensitive to light. The potential for nighttime lighting during construction to impact nighttime views would be minimal.

Construction would involve increased vehicle traffic and the presence, transport, and use of construction equipment and materials. These activities could temporarily increase glare conditions in and around a facility site if activities were associated with an increased presence of reflective materials, potentially including construction equipment, new materials (i.e., not yet subjected to weathering), and vehicle windows. However, an increase in glare that could result from the presence of construction equipment or materials would be minimal and temporary. Only portions of the facility site would be actively under construction at a particular time. Such new temporary sources of glare would not remain in any one fixed location for the entire duration of construction but would be present at different locations depending on the phase of construction activities throughout the site. Facility construction would not introduce new, substantial sources of glare that could affect daytime views in the vicinity.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, construction and decommissioning activities would likely result in **less than significant impacts** related to light or glare.

3.4.2 Impacts from operation

3.4.2.1 Change or reduction in visual quality

Visual impacts associated with the development of wind energy facilities in the study area include the presence of wind turbine structures; movement of the rotor blades; shadow flicker and blade glinting; turbine marker lights and other lighting on control buildings and other ancillary structures; roads; vehicles; and workers conducting maintenance activities. The effects of shadow flicker, blade glinting, and lighting are discussed in Section 3.4.2.2.

Wind turbines and other facility components

The primary visual impacts associated with wind energy facilities would result from the introduction of the numerous vertical lines of wind turbines into the generally strongly horizontal landscapes (e.g., plains, agricultural fields, high desert) found in most of the study area, or the placement of turbines on ridgelines where they would be visible against the skyline. The visible structures would potentially produce visual contrasts by virtue of form, color, and line of their design attributes.

The very large sizes and strong geometric lines of both the individual turbines themselves and the array of turbines could dominate views, and the large sweep of the moving rotors would tend to command visual attention depending on the proximity of the turbines to viewers, especially nearby communities and residences, and the intervening landform. Structural details, such as surface textures, could become apparent, and the control buildings and other structures could be visible as well, as well as strong reflections from the towers and moving rotor blades (blade glint). For viewers close enough to fall within the cast shadows of the turbines, shadow flicker might be observed. These effects are described in more detail in Section 3.4.2.2.

Based on the empirical studies consulted, the UGP EIS determined that a wind farm with wind turbines approximately 400 feet (122 meters) tall could be visible from approximately 25 miles (40 kilometers) away or farther assuming good visibility, and could potentially cause substantial visual contrasts at distances less than 7 to 8 miles (11−13 kilometers), and more moderate impacts up to approximately 15 miles (24 kilometers), with smaller visual impacts beyond approximately 15 miles (24 kilometers). These values are approximate, dependent on facility and turbine size and the number of turbines visible, and would be subject to lighting, atmospheric, and other effects. Further, taller turbines would increase the distances at which they can be seen.

Atmospheric haze could reduce turbine visibility. Backlighting or frontlighting can either decrease or increase contrast depending on the backdrop. Conditions of high contrast could substantially increase the perceived visual impact of turbines (e.g., when front-lit turbines are viewed against a dark sky or when backlit turbines are viewed against a bright sky). In cases in which turbines are viewed against a landform and vegetation ("backclothing"), the light gray or white color can produce strong visual contrasts with the background, but the contrast is reduced when the ground/vegetation is snow-covered. Strong visual contrasts can also occur when wind turbines are prominently placed along ridgelines and viewed against an open sky ("skylining").

A number of studies referenced in the UGP EIS noted that when the rotor blades on turbines were moving, the movement tends to attract viewers' attention to a greater extent than when the blades were not moving. A field-based study conducted in 2002 by the University of Newcastle involving wind turbine visibility at eight wind energy facilities in Scotland indicated that blade movement increased visual impact in all cases. The movement was discernible at distances of up to 9.3 miles (15 kilometers) in optimum viewing conditions and would be noticeable to casual viewers at distances of up to approximately 6.2 miles (10 kilometers).

The visibility and associated visual impacts of a wind energy facility and of individual wind turbines depend in part on the size of the facility, the arrangement of the turbines, and the size, height, surface treatment, and other characteristics of the turbines.

Greater numbers of wind turbines would have increased visibility, which would be expected to increase perceived visual impact, but the UGP EIS reported that the perceived impact is not necessarily directly proportional to the number of wind turbines in view. Regular spacing (grid layout) versus nonregular spacing (random layout) can strongly affect the appearance of the wind energy facility, with viewers generally finding regular turbine spacing to have less negative visual impact, but the apparent geometry can change substantially as viewer location and distance change.

Wind turbines are generally painted white or light gray to blend in with sky backgrounds, but other colors are sometimes used in particular settings, such as beige or tan in desert settings. When viewed against earth or vegetated backdrops, light-colored wind turbines may create strong color contrasts with these backdrops. Low-reflectance coatings are used for wind turbines and other structures to reduce specular reflections.

Support building structures would normally be constructed of sheet metal, concrete, or cinder blocks and would be of varying sizes. Support buildings may be fenced and may include landscaping plantings, possibly used for visual screening in certain situations. These built structures would also introduce complex rectilinear geometric forms and lines and artificiallooking textures and colors into the landscape that would likely contrast markedly with natural-appearing landscapes.

Operation and maintenance activities and traffic

As during other phases of development, occasional small-vehicle traffic can be expected for testing, commissioning, monitoring, maintenance, and repair, in addition to infrequent large-equipment traffic for turbine replacements and upgrades. Both would produce apparent activity and dust in dry soils. Suspension and visibility of dust would be influenced by vehicle speeds and road surface materials. These impacts would be infrequent and of short duration.

Summary of operations visual quality impacts

The degree of visual impact for a wind energy facility is determined in part by the facility location and existing visual landscape, number of viewers who experience the impact, and the type of activities viewers are engaged in when viewing a visual impact and the sensitivity to visual impacts. The degree of visual impact is also determined by the distances that facilities are sited from communities and residences and at which viewers would experience ongoing visual impacts over the life of the wind energy facility.

In areas of the study area with lower population density, wind energy facilities may be visible for long distances, but they would generally be viewed by few people. Impacts on residents are generally greater than those on more transient viewers, such as drivers or workers, in part because residents are likely to view wind energy facilities more frequently and for longer durations. Facilities located in or near a high-value scenic landscape or in proximity to viewers with unique scenic, Tribal, cultural, or ecological values typically would be more conspicuous and therefore would be perceived as having greater visual impact than if that same facility were present in a setting of low scenic value where similar facilities were already visible. Likewise, facilities located in or near rural areas would also be perceived to have more visual impact, which would be incompatible with elements of rural character such as a minimization of built structures in open spaces and natural areas and maintaining visual landscapes traditionally found in rural areas. Facility operations that change areas with rural character protections may also result in impacts on land use, which are evaluated in detail in the *Land Use Resource Report*.

Similarly, the level of perceived visual impact may be affected by any type of human alteration of the landscape, including industrial or agricultural. In these areas, the addition of facilities may not be perceived to be as conspicuous as in unaltered landscapes. Depending on the facility location and topography, visual impacts could extend to viewers outside the study area of the PEIS.

Depending on the facility size range and the nature of the facility structures, operation of utility-scale solar energy facilities could result in a range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality.

3.4.2.2 New source of light or glare

The primary light and glare impacts associated with wind energy facilities would result from the introduction of the numerous vertical lines of wind turbines into the generally strongly horizontal landscapes found in most of the study area, or the placement of turbines on ridgelines where they would be skylined in an area of greater topographic relief. The visible structures would potentially produce visual contrasts in light by virtue of their design attributes, the reflectivity of their surfaces and resulting glare, and their movement. In addition, marker lighting could cause substantial visual impacts at night.

Lighting

FAA guidelines for marking and lighting wind energy facilities require lights that flash white during the day and at twilight and red at night (FAA 2020). The white daytime lights may be omitted if the turbines are painted white or a light shade of off-white, as is frequently the case. White light strobes could be used optionally. All marker lights within a wind facility are also required to flash simultaneously (approximately 24 times/minute); however, only the perimeter turbines of a wind farm need such markings, provided that there is no unlighted gap greater than 0.5 mile (0.81 kilometer). Terrain, weather, and other location factors allow for adjustments to the manner in which FAA requirements are applied.

The presence of aircraft warning lights would greatly increase visibility of the turbines at night, because the synchronized flashing red warning lights or strobes could be visible for long distances. In the dark nighttime sky conditions typical of the predominantly rural setting within the study area, the warning lights could potentially cause significant visual impacts, especially if few similar light sources were present in the area. In nighttime observations in a rural setting in eastern Wyoming, Sullivan et al. (2012) observed plainly visible red aircraft warning lights on a wind farm containing 277 wind turbines at distances exceeding 36 miles (58 kilometers). At this distance, the amount of visible lighting from the wind turbines was small, but the lights were easily seen because of the synchronized flashing of the red lights against a featureless black background. White lights would likely be less obtrusive in daylight.

Revised Code of Washington 70A.550.020 requires developers, owners, or operators of new utility-scale wind energy facilities of five or more turbines to apply to the FAA for the installation of a light-mitigating technology system that complies with FAA lighting requirements and mitigations. This includes installing an aircraft detection lighting system (ADLS) with FAA approval. An ADLS utilizes sensors and radar to track aircraft operating in proximity to the wind facility and activates the obstruction lighting system when aircraft enter the ADLS coverage area, for safety purposes. The lights are turned off when aircraft are no longer present in the coverage area. Because of their intermittent operation, aircraft warning lights would likely not contribute to sky glow from artificial lighting. Security and other lighting on support structures (e.g., the control building) could contribute to skyglow. These impacts could be reduced by downward shielding or other measures and would be expected to have minimal effects in any event because typically only the maintenance facility and possibly the control building in the substation would have lighting capable of producing skyglow.

With regulatory requirements and implementation of mitigative actions provided in Section 3.4.4, security and other facility lights would not introduce new, substantial sources of light that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people. Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, operation of facilities would likely result in **less than significant impacts** attributable to light and glare.

Shadow flicker

As wind turbine blades spin under sunny conditions, they may cast moving shadows on the ground or nearby objects, resulting in alternating light intensity (flickering) as each blade shadow crosses a given point. If the duration and intensity of shadow flicker is sufficient, it can cause a nuisance to viewers, particularly if they are subjected to it frequently, as at their homes or places of work. Several factors determine the nature and extent of shadow flicker occurrence and the magnitude of potential associated visual impacts at a given wind energy facility, including the following:

- Distance and orientation of affected location with respect to turbines
- Rotor size and height of turbines
- Blade orientation, pitch, and speed (dependent on wind speed and direction)
- Geographic location and sun angle
- Local topography
- Presence of screening vegetation
- Weather/cloud cover
- Presence of airborne particles/haze
- Presence of sensitive viewers

Shadow flicker effects are more likely to cause visual impacts when the sun is low in the sky, as at sunrise or sunset, and in winter months when cast shadows are longest; however, at greater distances from the turbines, the loss of shadow intensity and sharpness would reduce the visual impacts associated with shadow flicker. Similarly, cloud cover or haze would reduce shadow intensity and sharpness, thus reducing shadow flicker effects. In general, because shadow flicker effects are dependent on precise geometric relationships between receptors (if any are present), the turbines, and the sun's direction and height above the horizon, with proper siting, shadow flicker effects are typically very limited in duration and area of effect. With implementation of mitigative actions related to turbine sighting and layouts provided in Section 3.4.2.3, shadow flicker would not introduce new, substantial sources of light or glare that could affect daytime or nighttime views visible to a substantial number of people in the vicinity and would result in a **less than significant impact** attributable to light and glare.

Glare

Blade glinting is the reflection of sunlight from moving wind turbine blades when viewed from certain angles under certain lighting conditions. The UGP EIS referenced an International Finance Corporation report (IFC 2007), which noted that glinting can also occur from wind turbine tower surfaces. The IFC report suggested that blade and tower glinting is a problem primarily for new turbines, that the problem is reduced as turbines become soiled in normal use, and that it can be mitigated through the use of low-reflectivity coatings, which are commonly specified for wind turbines and other structures to reduce specular reflections on blades and towers. With implementation of typical best management practices and mitigative actions provided in Section 3.4.2.3, blade glinting would not introduce new, substantial sources of glare that could affect daytime or nighttime views in the vicinity and would result in a **less than significant impact** attributable to glare.

3.4.3 Impacts from decommissioning

3.4.3.1 Change or reduction in visual quality

Decommissioning of a wind energy facility would involve the dismantling and removal of infrastructure associated with each wind turbine, the removal of aboveground and buried ancillary structures, road redevelopment, temporary fencing, and restoration of the decommissioned site to pre-facility conditions. Expected visual impacts of decommissioning activities would be similar to construction activities.

Similar to construction (Section 3.4.1.1), the various decommissioning activities would require work crews, vehicles, and equipment that would have visual impacts during decommissioning.

Restoration activities would typically include recontouring, grading, scarifying, seeding and planting, and stabilizing disturbed surfaces. Newly disturbed soils would create a visual contrast that could persist for several seasons before revegetation would begin to mature and restore the pre-facility visual landscape. Complete restoration of vegetation to pre-facility conditions may take much longer. As noted for construction, the time for vegetation to reestablish varies greatly depending on location, weather patterns, soil fertility, surrounding land use, and the type of vegetation planted or recruited. Invasive species may colonize newly and recently reclaimed areas. These species may be introduced naturally or in seeds, plants, or soils introduced for intermediate restoration, or by vehicles. Non-native plants that are not locally adapted would likely produce visual contrasts with existing conditions. Refer to the *Biological Resources Report* for more discussion of vegetation.

Depending on the location and size of facility sites and visual characteristics of the decommissioning activities, decommissioning of small to medium utility-scale onshore wind energy facilities would result in impacts ranging from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. Decommissioning impacts would last until restoration of the site is complete.

According to the U.S. Energy Administration, repowering older wind turbines—replacing aging turbines or components—is becoming more common. Fully repowering wind turbines involves decommissioning and removing existing turbines and replacing them with newer turbines at the same facility site. If a facility were repowered instead of decommissioned, repowering activities would require work crews, vehicles, and equipment similar to construction, but reduced in scope and duration. If a small to medium utility-scale wind energy facility was repowered, impacts attributable to facility repowering activities could range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality, and the long-term changes in visual quality and impacts described in Section 3.4.2.1 would persist.

3.4.3.2 New source of light or glare

The impacts of decommissioning and site restoration activities would be similar to those identified for construction. Decommissioning is not likely to include nighttime activities and would not create a source of lighting or introduce light pollution that would impact nighttime views. Although decommissioning activities would require the use of vehicles and equipment similar to those required for construction, any sources of glare would be minimal and temporary as equipment would be moved between active work locations on the facility site. Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, decommissioning activities would likely result in **less than significant impacts** related to light or glare.

If a facility were repowered instead of decommissioned, repowering activities would generate similar light and glare as construction activities. If a small to medium utility-scale wind energy facility was repowered, activities would not introduce new, substantial sources of light that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people and would result in a **less than significant impact** attributable to light and glare, and the long-term light, shadow flicker, and glare conditions described in Section 3.4.2.2 would persist.

3.4.4 Actions to avoid and reduce impacts

The preceding section identified potential aesthetic and visual impacts that could result during the construction, operation, and decommissioning of wind energy facilities. The nature, extent, and magnitude of these potential impacts would vary on a site-specific basis and depend on the specific phase of the facility's lifecycle (e.g., construction or operation). Similarly, aesthetic and visual quality impact mitigation measures appropriate for wind energy and transmission facilities would vary on a site-specific basis and would depend on the specific phase. Site-specific mitigation actions would be developed during project-specific reviews and permitting for each facility proposed in the future. The following types of actions are appropriate for facility proponents to consider to avoid, minimize, and mitigate potential impacts.

As noted in Section 2.3, the Western Area Power Administration and U.S. Fish and Wildlife Service published the UGP EIS in April 2015, and the PEIS aesthetics and visual quality analysis incorporates much of the UGP EIS visual analysis methods. Likewise, the UGP EIS also provides avoidance, minimization, and mitigation measures that would reduce the potential aesthetics and visual quality impacts. These are also incorporated into this analysis.

3.4.4.1 Siting and design considerations

Siting and design considerations are actions that could be taken by a developer in developing a facility design or considering a site. These are intended to result in the avoidance, minimization, and/or mitigation of potential resource impacts. The greatest potential for visual impacts associated with wind energy facilities and associated gen-tie lines would occur as a result of decisions made during the siting and design of the facilities. In many cases, visual impacts associated with these facilities could be avoided or substantially reduced by careful facility siting, as follows:

- Include a visual resource specialist in the planning team to evaluate visual impacts.
- Conduct a detailed visual resource analysis to identify and map landscape characteristics, key observation points (KOPs), and key viewsheds; prominent scenic, Tribal, and cultural landmarks; and other visually sensitive areas near the facility location.
- Consult with the appropriate land management agencies, planning entities, Tribes, and local public early to provide input on the identification of important visual resources near a facility site and on the siting and design process.
- Use GIS tools and visual impact simulations for conducting visual analyses (including mapping), analyzing the visual characteristics of landscapes, visualizing the potential impacts of facility siting and design, and fostering communication.
- Avoid locating facilities in places that would alter the visual setting and reduce the historic significance or function.
- Site facilities outside the viewsheds of KOPs, highly sensitive viewing locations, and/or areas with limited visual absorption capability and/or high scenic integrity. If they must be sited within view of KOPs, they should be as far away as possible, as visual impacts generally diminish as viewing distance increases.
- Site developments in already developed landscapes, with due consideration for visual absorption capacity and possible cumulative effects.
- Utilize siting near topography and vegetation as screening devices to restrict views of facilities from visually sensitive areas.
- Site wind turbines be sensitive to and respond to the surrounding landscape in a visually compatible way. In rolling landscapes, a configuration of turbines that follows local topography may be appropriate. In flatter agricultural landscapes, a more geometric or linear wind turbine configuration may be preferred.
- Avoid siting facilities and their elements next to prominent landscape features (e.g., peaks and waterfalls), where possible.
- Avoid siting linear facilities associated with a wind energy facility, such as gen-tie lines and roads, so that they bisect ridge tops or run down the center of valley bottoms.
- Site wind turbines to avoid skylining and make the structures less conspicuous by siting and designing them to harmonize with desirable or acceptable characteristics of the surrounding environment.
- Site wind turbines to eliminate shadow flicker effects on nearby residences or other highly sensitive viewing locations, or reduce them to the lowest achievable levels, as calculated using appropriate siting software and procedures.
- Site linear features (maintained rights-of-way and roads) associated with wind energy facilities to follow natural land contours and avoid fall-line cuts.
- Site facilities to take advantage of natural topographic breaks, and avoid siting on steep side slopes.

- In forested areas or shrublands, linear facilities should follow the edges of clearings rather than pass through their center.
- Choose locations for interconnection and gen-tie lines and right-of-way road crossings of other roads, streams, and other linear features within a corridor to avoid KOP viewsheds and other visually sensitive areas and to minimize disturbance to vegetation and landforms.
- Locate the rights-of-way to cross linear features (e.g., trails, roads, and rivers) at right angles whenever possible to minimize the viewing area and duration.
- Co-locate gen-tie lines and roads associated with wind energy facilities within a corridor to use existing/shared rights-of-way, existing/shared access and maintenance roads, and other infrastructure in order to reduce visual impacts.
- Locate facilities, structures, and roads in stable, fertile soils to reduce visual contrasts from erosion and to better support rapid and complete regrowth of affected vegetation.
- Site facilities in a manner that considers site hydrology to avoid visual contrasts from erosion.
- Strip, stockpile, and stabilize topsoil from the site before excavating earth for facility construction.
- When placed in large numbers, cluster or group wind turbines and separate otherwise overly long lines of turbines, and insert breaks or open zones to create distinct visual units or groups of turbines.
- Design facilities to provide visual order and unity among clusters of turbines and avoid visual disruptions and perceived disorder, disarray, or clutter.
- Exhibit wind turbines visual uniformity in the shape, color, and size of rotor blades, nacelles, and towers.
- Bury power collection cables or lines on the site in a manner that minimizes additional visual disturbance (e.g., co-locating them with access roads).
- Choose low-profile structures for ancillary buildings and other structures to reduce their visibility.
- Use natural-looking earthwork berms and vegetative or architectural screening where screening topography and vegetation are absent to minimize visual impacts associated with ancillary facilities.
- Minimize the number of structures through site design
- Design and locate structures and roads to minimize and balance cuts and fills.
- Set structures, roads, and other facility elements as far back from road, trail, and river crossings as possible, and use vegetation to screen views from crossings.

3.4.4.2 Permits, plans, and best management practices

As noted in Section 3.3, none of the federal or state laws, plans, and policies presented in Table 1 require permits related to aesthetics and visual quality.

Local land use development ordinances may require some form of design approval (e.g., in designated scenic corridors) or night sky exemption related to safety or obstruction lighting. Federally managed lands also have planning requirements for the protection of visual resources and would evaluate visual effects from proposed projects during right-of-way or leasing processes.

3.4.4.3 Additional mitigation measures

This section contains additional measures to reduce adverse impacts on aesthetics and visual quality, as follows:

- Consider the use of monopole turbine structures over truss- or lattice-style structures.
- Select colors for turbines to reduce visual impact and apply uniformly to tower, nacelle, and rotor, unless gradient or other patterned color schemes are used.
- Paint grouped structures the same color to reduce visual complexity and color contrast.
- Use materials and surface treatments that repeat and/or blend with the existing landscape.
- Paint turbines, visible ancillary structures, and other equipment before or immediately after installation.
- Use nonspecular conductors and nonreflective coatings on insulators for interconnector and gen-tie lines, as appropriate.
- Use full-cutoff designs that minimize upward light scattering.
- Consider using motion-activated security lights.
- Site staging and laydown areas outside the viewsheds of KOPs and not in visually sensitive areas.
- Restore disturbed surfaces to their original contours as closely as possible and revegetate immediately after, or contemporaneously with, construction.
- Preserve existing rocks, vegetation, and drainage patterns to the maximum extent possible.
- Slash from vegetation removal should be mulched and spread to cover fresh soil disturbances or, if that is not possible, buried. Topsoil from cut/fill activities should be segregated and spread on freshly disturbed areas to reduce color contrast and aid rapid revegetation. Topsoil piles should not be left in sensitive viewing areas.
- Round road-cut slopes and vary the cut/fill pitch to reduce contrasts in form and line.
- Excess fill material should not be disposed of downslope in order to avoid creating color contrast with existing vegetation/soils.
- Minimize visual contrasts from fill piles that do not blend in with the existing visual setting.
- Bury communication and other local utility cables, where feasible.
- Paint culvert ends to reduce color contrasts with the existing landscape.
- Minimize signage. Paint or coat reverse sides of signs and mounts to reduce color contrasts with the existing landscape.
- Implement dust abatement measures in arid environments to minimize the impacts of vehicular and pedestrian traffic, construction, and wind on exposed surface soils.

3.4.5 Unavoidable significant adverse impacts

Some small to medium utility-scale wind energy facilities may result in **potentially significant and unavoidable adverse impacts** on visual quality, depending on location and design. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

3.5 Large utility-scale facilities of 251 MW to 1,500 MW (Alternative 2)

This section describes potential impacts on aesthetics and visual quality due to the construction, operation, decommissioning, or repowering of large utility-scale wind energy facilities (Alternative 2).

3.5.1 Impacts from construction

3.5.1.1 Change or reduction in visual quality

The construction activities for large utility-scale onshore wind energy facilities would be the same as those considered for small to medium facilities. However, as can been seen in the description of Alternative 2, there would be substantially more wind turbines and ancillary structures and facilities over a much larger and broader land area.

Given the large area assumed for a large facility—8,250 to 127,500 acres—there could be some situations where work areas would be blocked from view by intervening topography or screened by vegetation. There could also be cases where a facility would be in an unpopulated or sparsely populated area. However, this would not be the case for most large facilities given the potential size and proximity to roadways, towns and cities, recreational areas, and other vantage points that would have views of these developments. As discussed in Section 3.4.1 for small to medium sized facilities, impacts on residents are generally greater than those on more transient viewers, such as drivers or workers. A large utility-scale onshore wind energy facility located in or near a high-value scenic landscape or in proximity to viewers with unique scenic, Tribal, cultural, or ecological values typically would be more conspicuous and therefore perceived as having greater visual impact than if that same facility were present in a setting of low scenic value or where similar facilities were already visible. Depending on the facility location and topography, visual impacts could extend to viewers outside the study area of the PEIS.

Depending on the location and size of facility sites and visual characteristics of the construction activities, impacts from facility construction would range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. In general, larger facilities and facilities located in high-value scenic landscapes have a greater potential to impact visual quality.

Section 3.5.4 presents actions that could avoid or reduce construction impacts of utility-scale onshore wind energy facilities on the visual environment.

3.5.1.2 New source of light or glare

As noted in Section 3.5.1.1, the facility construction activities occurring for large facilities would be the same as those occurring for small to medium facilities, but over a much larger area. Although there would be a greater area of construction activity and therefore a greater potential for night work requiring lighting, these activities would be performed with temporary lighting that would be directed downward as described in Section 3.4.

Similarly, for sources of glare, although there would be a greater area of construction activity when compared to small to medium facilities, an increase in glare that could result from the presence of construction equipment or materials would be minimal and temporary. Only portions of the facility site would be actively under construction at a particular time. Such new temporary sources of glare would not remain in any one fixed location for the entire duration of construction but would be present at different locations depending on the phase of construction activities throughout the site.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, construction activities would likely result in **less than significant impacts** related to light or glare.

3.5.2 Impacts from operation

3.5.2.1 Change or reduction in visual quality

Visual impacts associated with the operation of wind energy include the presence of wind turbine structures; movement of the rotor blades; shadow flicker and blade glinting; turbine marker lights and other lighting on control buildings and other ancillary structures; roads; vehicles; and workers conducting maintenance activities. The effects of shadow flicker, blade glinting, and lighting are discussed in Section 3.5.2.2.

A facility would be blocked from view by intervening topography or screened by vegetation or located in an unpopulated or sparsely populated area. However, this would not be the case for most large facilities given the vast size of larger facilities and proximity to roadways, towns and cities, recreational areas, and other vantage points that would provide views of these developments. Large facilities are generally more likely to be visible than small to medium facilities. As discussed for small to medium sized facilities, impacts would depend on the specific location of the facility and proximity to different types of sensitive viewers.

Depending on the facility size range and the nature of the facility structures, operation of utility-scale solar energy facilities could result in a range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. In general, larger facilities and facilities located in high-value scenic landscapes would have a greater potential for impacts.

3.5.2.2 New source of light or glare

The primary light and glare impacts associated with wind energy facilities would result from the introduction of the numerous vertical lines of wind turbines into the generally strongly horizontal landscapes found in most of the study area, or the placement of turbines on ridgelines where they would be skylined in an area of greater topographic relief. The visible structures would potentially produce visual contrasts in light by virtue of their design attributes, the reflectivity of their surfaces and resulting glare, and their movement. In addition, marker lighting could cause substantial visual impacts at night.

The types of light and glare impacts from the operation of a large wind energy facility would be the same as for a small to medium facilities described in Section 3.4; however, the impacts would occur over a much broader area. For the most part, similar to small to medium facilities, the lighting and glare impacts, including shadow flicker and blade glinting, would be limited by design considerations, limited operational use, distance from receptors, and other measures. The regulatorily required obstruction lighting, however, would be visually distributed over a much broader area and seen at greater distances. However, developers of large facilities would be required to apply to FAA for the installation of a light-mitigating technology system that complies with FAA lighting requirements and mitigations, including the installation of an ADLS that would result in obstruction lighting being activated only when aircraft come into the ADLS coverage area and deactivated at all other times. With the implementation of this regulatory requirement and other mitigative actions provided in Section 3.5.4, facilities would not introduce new substantial sources of light and glare that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, operation of facilities would likely result in **less than significant impacts** related to light or glare.

3.5.3 Impacts from decommissioning

3.5.3.1 Change or reduction in visual quality

Decommissioning activities for a large utility-scale onshore wind energy facility would be similar to construction activities (Section 3.5.1.1). The various decommissioning activities described previously require work crews, vehicles, and equipment that would add to visual impacts during decommissioning. Decommissioning of a large-scale wind energy facility would generally involve the same activities as described in Section 3.4.3 but on a larger scale.

Depending on the location and size of facility sites and visual characteristics of the decommissioning activities, impacts from facility decommissioning would range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. Decommissioning impacts would last until restoration of the site is complete. In general, larger facilities and facilities located in high-value scenic landscapes have a greater potential to impact visual quality.

If a large facility were repowered instead of decommissioned, repowering activities would require work crews, vehicles, and equipment similar to construction, but reduced in scope and duration. If a large utility-scale wind energy facility was repowered, impacts attributable to facility repowering activities could range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality, and the long-term changes in visual quality and impacts described in Section 3.5.2.1 would persist.

3.5.3.2 New source of light or glare

The impacts during decommissioning and site restoration activities would be similar to those identified for construction. Decommissioning of a large wind energy facility would involve the same activities as facilities described in Section 3.4.3 but on a larger scale.

Through compliance with laws, permits, and with implementation of actions that could avoid and reduce impacts, decommissioning activities would likely result in **less than significant impacts** related to light or glare.

If a facility were repowered instead of decommissioned, repowering activities would generate similar light and glare as construction activities. If a large utility-scale wind energy facility was repowered, activities would not introduce new, substantial sources of light that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people and would result in a **less than significant impact** attributable to light and glare, and the long-term light, shadow flicker, and glare conditions described in Section 3.5.2.2 would persist.

3.5.4 Actions to avoid and reduce impacts

The measures to minimize, reduce, and/or mitigate aesthetic and visual quality impacts for large facilities would be the same as those in Section 3.4.4. Specific measures appropriate for onshore wind energy facilities would vary on a site-specific basis and would depend on the specific phase of the facility construction, operations, and decommissioning.

3.5.5 Unavoidable significant adverse impacts

Some large utility-scale wind energy facilities may result in **potentially significant and unavoidable adverse impacts** on visual quality, depending on location and design. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

3.6 Wind energy facility and co-located battery energy storage systems (Alternative 3)

This section describes potential impacts on aesthetic and visual quality due to the construction, operation, and decommissioning/repowering of utility-scale wind energy facilities with battery energy storage systems (BESSs).

3.6.1 Impacts from construction

The construction activities occurring for onshore wind facilities with a co-located BESS would be the same as those for facilities without a BESS. Installation of the BESS would be similar to the construction of other support facilities and structures included in the facility construction. BESSs are usually installed in a graveled area where vegetation clearing and gravel surfacing would be required. For this analysis, it is assumed the BESS would be located within a wind energy facility site footprint and would require a small additional area of development.

3.6.1.1 Change or reduction in visual quality

BESSs are similar to other support facilities for a utility-scale wind energy facility and would not contribute to visual impacts from facility construction more than what was described for small to medium and large facilities.

Depending on the facility size range and the nature of the facility structures, operation of utility-scale wind energy facilities could result in a range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. Section 3.6.4 presents actions that could avoid or reduce impacts of utility-scale onshore wind energy facility on the visual environment.

3.6.1.2 New source of light or glare

Sources of light and glare during construction would be largely the same as those for facilities without a BESS. The additional BESS construction may require night work lighting; however, these activities would be occasional, temporary, and shielded downward as described for facilities without BESSs and would not otherwise change the visual nature of the construction of the onshore wind energy facility. Construction of a facility with a co-located BESS would not introduce new, substantial sources of glare that could affect daytime views in the vicinity.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, construction activities would likely result in **less than significant impacts** related to light or glare.

3.6.2 Impacts from operation

3.6.2.1 Change or reduction in visual quality

The addition of a BESS would not change or reduce the nature of visual quality impacts associated with the operation of facilities without a BESS. The BESS would not create a higher level of visual contrast when viewed together with other ancillary structures that would also be a part of the larger onshore wind facility and share an industrial appearance.

Depending on the location and size of facility sites and visual characteristics of the operations activities, impacts from facility operations would range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. Section 3.6.4 presents actions that could avoid or reduce impacts of a utility-scale onshore wind energy facility with BESSs on the visual environment.

3.6.2.2 New source of light or glare

The addition of a BESS would not change the sources of light and glare of an onshore wind energy facility. For the most part, similar to facilities without a BESS, the lighting and glare impacts, including shadow flicker and blade glinting, would be limited by design considerations, limited operational use, distance from receptors, and other measures. However, for larger facilities with a BESS, similar to larger facilities without a BESS, the regulatorily required obstruction lighting would be visually distributed over a much broader area and seen at greater distances. However, developers of facilities would be required to apply to FAA for the installation of a light-mitigating technology system that complies with FAA lighting requirements and mitigations, including the installation of an ADLS that would result in obstruction lighting being activated only when aircraft come into the ADLS coverage area and deactivated at all other times. With the implementation of this regulatory requirement and other mitigative actions provided in Section 3.6.4, facilities would not introduce new substantial sources of light and glare that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people. Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, operation of facilities would likely result in **less than significant impacts** related to light or glare.

3.6.3 Impacts from decommissioning

3.6.3.1 Change or reduction in visual quality

Decommissioning activities for a facility with a co-located BESS would be similar to construction activities (Section 3.6.1.1). The various decommissioning activities described previously require work crews, vehicles, and equipment that would add to visual impacts during decommissioning. Decommissioning of a wind energy facility with a BESS would generally involve the same activities as described in Sections 3.4 and 3.5. The addition of decommissioning the BESS would involve similar activities to the needs of removal of other support facilities and infrastructure.

Depending on the location and size of facility sites and visual characteristics of the decommissioning activities, impacts from facility decommissioning would range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. Decommissioning impacts would last until restoration of the site is complete.

If a facility with a BESS were repowered instead of decommissioned, repowering activities would require work crews, vehicles, and equipment similar to construction, but reduced in scope and duration. Impacts attributable to facility repowering activities could range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality, and the long-term changes in visual quality and impacts described in Section 3.6.2.1 would persist.

3.6.3.2 New source of light or glare

The impacts during decommissioning and site restoration activities would be similar to those identified for construction. Decommissioning of a wind energy facility with a co-located BESS would generally involve the same activities described in Sections 3.4 and 3.5. The addition of decommissioning the BESS would involve similar activities to the needs of removal of other support facilities and infrastructure.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, decommissioning activities would likely result in **less than significant impacts** related to light or glare.

If a facility with a BESS were repowered instead of decommissioned, repowering activities would generate similar light and glare as construction activities. If a facility was repowered, activities would not introduce new, substantial sources of light that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people and would result in a **less than significant impact** attributable to light and glare, and the long-term light, shadow flicker, and glare conditions described in Section 3.6.2.2 would persist.

3.6.4 Actions to avoid and reduce impacts

The measures to minimize, reduce, and/or mitigate aesthetic and visual quality impacts for facilities with a BESS would be the same as those in Section 3.4.4, including the measures relate to siting and design that could also be applied to the BESSs. Refer to Section 3.4.4 for a full discussion of those measures.

3.6.5 Unavoidable significant adverse impacts

Some utility-scale wind energy facilities with co-located BESSs may result in **potentially significant and unavoidable adverse impacts** on visual quality, depending on location and design. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

3.7 Onshore wind energy facility combined with agricultural land use (Alternative 4)

This section describes potential impacts on aesthetics and visual quality due to the construction, operation, and decommissioning of utility-scale wind energy facilities with agricultural use.

3.7.1 Impacts from construction

The construction activities for onshore wind facilities with co-located agricultural uses would be largely the same as those for facilities without agriculture. A facility may be located on lands where there is already existing agricultural activity, with or without changing the type of agricultural activity, or a facility could add a new agricultural use to a site.

3.7.1.1 Change or reduction in visual quality

Construction of facilities with co-located agriculture on existing agricultural land would be similar to the construction of onshore wind energy facilities without co-located agriculture.

Some construction activities, such as earthmoving, may appear similar to certain cultivating or other farming activities that also require use of large mechanical equipment. Construction of facilities with co-located agriculture in other areas would generally be the same as for facilities without agriculture. Considering the size of facility sites and the visual characteristics of the construction activities, impacts attributable to construction of facilities with co-located agriculture could range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. Section 3.7.4 presents actions that could avoid or reduce impacts of utility-scale onshore wind energy facility on the visual environment.

3.7.1.2 New source of light or glare

Sources of light and glare during construction would be largely the same as those for facilities without co-located agriculture. Development of agricultural areas are anticipated not to involve nighttime lighting, except for emergency or other episodic use.

Because construction activities for a facility with co-located agriculture would be largely the same as those for facilities without co-located agriculture, additional sources of glare are not anticipated. Agricultural activities that occur currently on a facility site could create sources of glare, much like construction activities; however, these sources would not remain in any one fixed location for the entire duration of construction but would be present at different locations depending on the phase of construction.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, construction activities would likely result in **less than significant impacts** related to light or glare.

3.7.2 Impacts from operation

3.7.2.1 Change or reduction in visual quality

The co-location of an onshore wind energy facility with agricultural land uses would still change or reduce the visual nature of a site to an onshore wind energy facility. For sites that are already in agricultural use, the presence of an onshore wind facility where none existed would change the visual character of the site. For sites not already in agricultural use, the conversion to agricultural use, in addition to the presence of an onshore wind facility, would also change the visual character of the site.

Depending on the location and size of facility sites and visual characteristics of the operations activities, impacts from facility operations would range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. Section 3.7.4 presents actions that could avoid or reduce impacts of utility-scale onshore wind energy facilities on the visual environment.

3.7.2.2 New source of light or glare

The types of light and glare during operation of a wind energy facility with agricultural land uses would largely be the same as facilities without agriculture. For the most part, the lighting and glare impacts would be limited by design considerations, limited operational use, or distance from receptors and would be limited to the wind energy portion of the facilities, with the potential for periodic night lighting for emergency or other episodic use related to agricultural uses. Similar to facilities without agriculture, the lighting and glare impacts, including shadow flicker and blade glinting, would be limited by design considerations, limited operational use, distance from receptors, and other measures. For larger facilities with agriculture, similar to larger facilities without agriculture, the regulatorily required obstruction lighting would be visually distributed over a much broader area and seen at greater distances. However, developers of facilities would be required to apply to FAA for the installation of a light-mitigating technology system that complies with FAA lighting requirements and mitigations, including the installation of an ADLS that would result in obstruction lighting being activated only when aircraft come into the ADLS coverage area and deactivated at all other times. With the implementation of this regulatory requirement and other mitigative actions provided in Section 3.7.4, facilities would not introduce new substantial sources of light and glare that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people. Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, operation of facilities would likely result in **less than significant impacts** related to light or glare.

3.7.3 Impacts from decommissioning

3.7.3.1 Change or reduction in visual quality

Decommissioning activities for a wind energy facility with co-located agricultural use would be similar to construction activities. If decommissioning activities would only apply to the wind facility components but agricultural activities would continue, extant agricultural activities would need to halt temporarily to allow the decommissioning work to commence. The presence of ongoing agricultural activities following decommissioning of energy facilities may reduce the visual contrast prior to maturation of revegetated areas as compared to facilities without agricultural uses.

Depending on the location and size of facility sites and visual characteristics of the decommissioning activities, impacts from facility decommissioning would range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality. Decommissioning impacts would last until restoration of the site is complete.

If a facility with co-located agricultural use were repowered instead of decommissioned, repowering activities would require work crews, vehicles, and equipment similar to construction, but reduced in scope and duration. Impacts attributable to facility repowering activities could range from **less than significant impacts** to **potentially significant adverse impacts** on visual quality, and the long-term changes in visual quality and impacts described in Section 3.7.2.1 would persist.

3.7.3.2 New source of light or glare

The impacts during decommissioning and site restoration activities would be similar to those identified for construction. Decommissioning of an onshore wind energy facility with co-located agricultural uses would generally involve the same activities described in Sections 3.4 and 3.5, is not likely to include nighttime activities, and would not create a source of lighting or introduce light pollution that would impact nighttime views. It is assumed that agricultural activities would be temporarily halted to allow decommissioning to occur but may continue after solar facility decommissioning. However, this would not be expected to add sources of light or glare that had not existed before.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, decommissioning activities would likely result in **less than significant impacts** related to light or glare.

If a facility with co-located agricultural uses were repowered instead of decommissioned, repowering activities would generate similar light and glare as construction activities. If a facility was repowered, activities would not introduce new, substantial sources of light that could affect daytime or nighttime views in the vicinity and be visible to a substantial number of people and would result in a **less than significant impact** attributable to light and glare, and the long-term light, shadow flicker, and glare conditions described in Section 3.7.2.2 would persist.

3.7.4 Actions to avoid and reduce impacts

The measures to minimize, reduce, and/or mitigate aesthetic and visual quality impacts for facilities with agricultural uses would be the same as those in Section 3.4.4, including the potential retaining or restoration of agricultural lands. Refer to Section 3.4.4 for a full discussion of those measures.

3.7.5 Unavoidable significant adverse impacts

Some utility-scale wind energy facilities with agricultural use may result in **potentially significant and unavoidable adverse impacts** on visual quality, depending on location and design. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site and local regulations and plans.

3.8 No Action Alternative

Under the No Action Alternative, city, county, and state agencies would continue to conduct environmental review and permitting for utility-scale wind energy facility under existing state and local laws on a project-by-project basis. The potential impacts from facilities developed under the No Action Alternative would be similar to the impacts for the types of facilities described above for construction, operations, and decommissioning, depending on facility size and design. Facilities could result in a **less than significant** to **potentially significant adverse impact** on aesthetic and visual resources.

Lighting and glare impacts, including shadow flicker and blade glinting, would be limited by design considerations, limited operational use, distance from receptors, and other measures. For larger facilities, the light resulting from regulatorily required obstruction lighting would be mitigated by the requirement to apply for FAA-compliant light-mitigating ADLS. Overall, new sources of light and glare would result in a **less than significant impact**.

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