State Environmental Policy Act Draft Programmatic Environmental Impact Statement

For Utility-Scale Onshore Wind Energy Facilities in Washington State

Shorelands and Environmental Assistance Program

Washington State Department of Ecology

Olympia, Washington

September 2024, Publication 24-06-012

DEPARTMENT OF ECOLOGY

State of Washington

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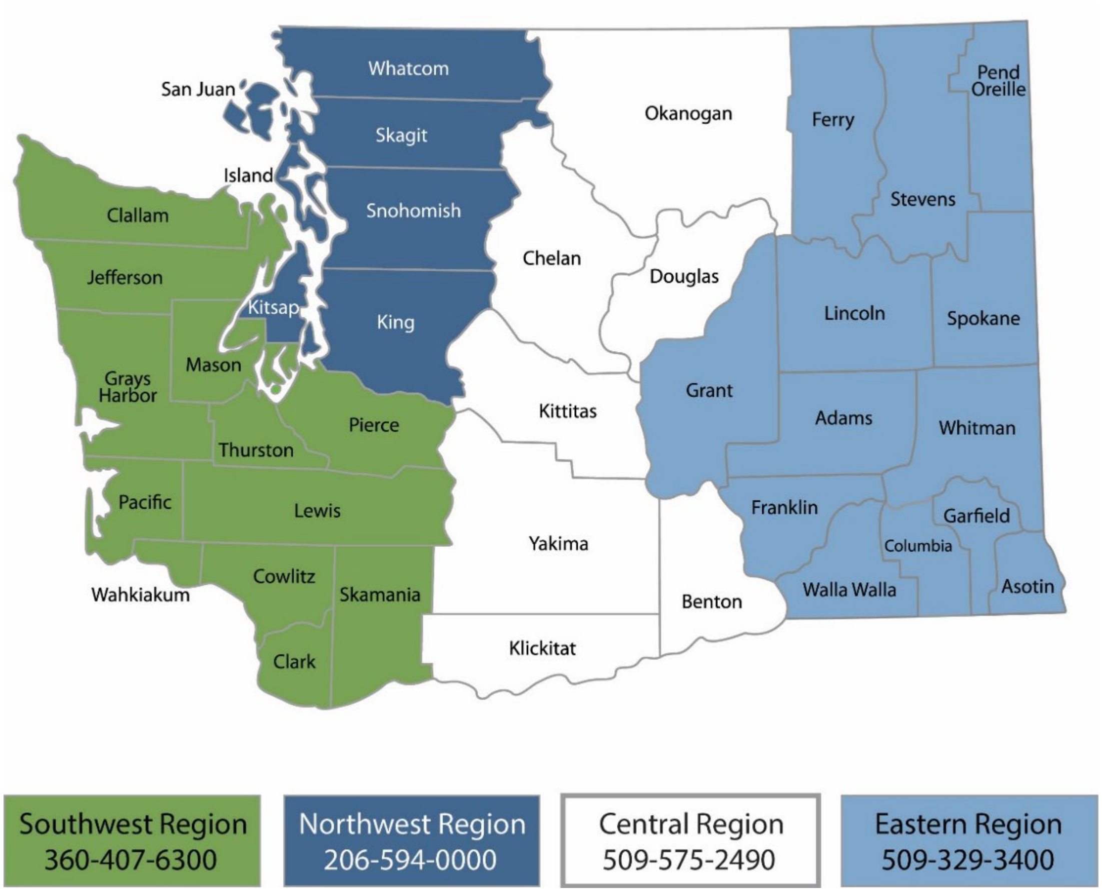
[1] https://climate.wa.gov/
[2] www.ecology.wa.gov/contact

Department of Ecology's Regional Offices

Map of Counties Served



Region	Counties served	Mailing Address	Phone
Southwest	Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Mason, Lewis, Pacific, Pierce, Skamania, Thurston, Wahkiakum	PO Box 47775 Olympia, WA 98504	360-407-6300
Northwest	Island, King, Kitsap, San Juan, Skagit, Snohomish, Whatcom	PO Box 330316 Shoreline, WA 98133	206-594-0000
Central	Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima	1250 W Alder St Union Gap, WA 98903	509-575-2490
Eastern	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman	4601 N Monroe Spokane, WA 99205	509-329-3400
Headquarters	Across Washington	PO Box 46700 Olympia, WA 98504	360-407-6000

Fact Sheet

Title

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

Brief description of proposal

The Washington State Legislature directed the Washington State Department of Ecology (Ecology) to prepare a non-project environmental review of utility-scale onshore wind energy facilities in Washington by June 30, 2025. Revised Code of Washington (RCW) 43.21C.535[3] requires Ecology to assess and disclose the probable significant adverse environmental impacts and related mitigation measures for onshore wind energy facilities. Ecology prepared this Draft Programmatic Environmental Impact Statement (PEIS) to evaluate potential impacts and mitigation at a broad level. This Draft PEIS was prepared in compliance with the Washington State Environmental Policy Act (SEPA).[4]

The PEIS is intended to:

- Support the state's transition to clean energy while protecting the environment, Tribal rights and resources, and local communities.
- Identify the range of probable significant adverse environmental impacts utility-scale onshore wind energy projects can pose.
- Provide information about facility siting and design that may be used to help avoid or minimize adverse environmental impacts for proposed projects.
- Identify general potential mitigation measures for impacts.
- Provide information for lead agencies to consider when conducting environmental reviews for utility-scale onshore wind energy projects.

The PEIS evaluated the following types of utility-scale onshore wind energy facilities as well as a No Action Alternative:

- **Utility-scale onshore wind facilities (Alternatives 1 and 2):** wind facilities capable of generating between 10 and 1,500 megawatts of energy on sites between 340 to 127,500 acres in size.
- **Utility-scale onshore wind facilities with battery energy storage systems (Alternative 3):** facilities that also include one or two battery energy storage systems, each capable of storing up to 500 megawatts of energy.

[3] https://app.leg.wa.gov/RCW/default.aspx?cite=43.21C.535
[4] https://apps.leg.wa.gov/wac/default.aspx?cite=197-11

- **Utility-scale onshore wind facilities that include agricultural uses (Alternative 4):** dual use facilities combined with agricultural land use.
- **No Action Alternative:** city, county, and state agencies would continue to conduct environmental review and permitting for utility-scale onshore wind facilities under existing state and local laws on a project-by-project basis without using this PEIS as a reference.

Location

The geographic scope for the wind PEIS includes areas throughout the State of Washington where utility-scale onshore wind facilities are likely to be developed based on available wind energy and proximity to transmission lines.

Proposed date of implementation

The Final PEIS will be issued by the legislatively mandated date of June 30, 2025.

Responsible official contact

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Required permits, licenses, and approvals

Numerous regulations, plans, and laws guided or influenced the development of this PEIS. Because this is a programmatic EIS for a nonproject action, and the specific nature of projects that would be proposed is not yet known, it is not possible to present a complete list of permits, licenses, and approvals that could be required for future facilities.

Implementation of the types of utility-scale energy facilities evaluated in the PEIS would require compliance with regulations, rules, and plans at federal, state, and local levels. Examples of those that could be associated with utility-scale wind energy facilities include:

Federal

- Bald and Golden Eagle Protection Act
- Clean Water Act Section 404 Permit

- Compensatory Mitigation for Losses of Aquatic Resources; Final Rule 33 (*Code of Federal Regulations* Parts 325 and 332 and 40 *Code of Federal Regulations* Part 230)
- Determination of No Hazard to Air Navigation Approval
- Endangered Species Act
- Fish and Wildlife Coordination Act
- Magnuson-Stevens Fishery Conservation and Management Act
- Migratory Bird Treaty Act
- National Environmental Policy Act
- National Forest Management Act
- National Historic Preservation Act, Section 106
- National Oceanic and Atmospheric Administration Radar Operations Center Approval
- U.S. Department of Defense Clearance for Radar Interference
- U.S. Department of Transportation Act of 1966 Section 4(f) Review

State

- Aquatic Use Authorization (Washington State Aquatic Lands Act)
- Archaeological Excavation and Removal Permit
- Clean Air Act Air Prevention of Significant Deterioration
- Clean Water Act National Pollutant Discharge Elimination System (NPDES) Permits
- Clean Water Act Section 401 Water Quality Certification
- Coastal Zone Management Act Consistency
- State Waste Discharge Permit
- State Environmental Policy Act
- Surface Mining Reclamation Permit
- Washington Forest Practices Act
- Washington State Department of Labor and Industries electrical permits
- Washington State Department of Transportation permits
- Washington State Growth Management Act
- Washington State Hydraulic Code
- Washington State Water Pollution Control Act
- Washington State Shoreline Management Act
- Water Right Permit

Local

- Air quality permits
- Blasting permits
- Construction permits (right-of-way, access, grading, building, mechanical, and electrical permits)
- Critical areas ordinances
- Floodplain development permits
- Shoreline permits
- Zoning ordinances and other land use requirements

Authors and principal contributors

This document has been prepared under the direction of Ecology. All chapters and appendices have been prepared for and approved by Ecology. Key authors and principal contributors to the PEIS analyses are listed below:

- Washington State Department of Ecology
- Washington Department of Fish and Wildlife
- Washington State Department of Natural Resources
- Washington State Department of Archaeology and Historic Preservation
- Washington State Department of Transportation
- State of Washington Energy Facility Site Evaluation Council
- Anchor QEA
- Environmental Science Associates
- Hammerschlag LLC

Date of Draft PEIS issuance

12:00 p.m., September 25, 2024

Date comments are due

11:59 p.m., October 28, 2024

Public comment and hearings on the Draft PEIS

A 33-day public comment period is being conducted from 12:00 p.m., September 25 through 11:59 p.m., October 28, 2024. Comments should focus on the substance of the Draft PEIS and be as specific as possible. Comments on the Draft PEIS received during the comment period will be addressed in the Final PEIS, which is planned to be issued by June 30, 2025. Comments may be submitted in the following ways:

By mail:

Clean Energy Coordination
Department of Ecology
PO Box 47709
Olympia, WA 98504-7709

Online:

Complete a comment form[5]

[5] https://ecology.wa.gov/regulations-permits/sepa/clean-energy/programmatic-eis

In person at a public hearing:

October 15, 2024, starting at 4:00 p.m.
Ecology Central Region Office
1250 West Alder Street
Union Gap, WA 98903

October 16, 2024, starting at 1:00 p.m.
Red Lion Hotel Pasco Airport & Conference Center
2525 North 20th Avenue
Pasco, WA 99301

Virtually at a public hearing:

October 22, 2024, starting at 10:00 a.m.
Information and links to register at https://ecology.wa.gov/regulations-permits/sepa/clean-energy/programmatic-eis

Timing of additional environmental review

A Final PEIS will be completed by June 30, 2025. The PEIS considers potential impacts from general types of onshore wind energy facilities; it is not site-specific or for a specific project. Implementation of the types of utility-scale energy facilities evaluated in the PEIS would require additional, more detailed, project-level environmental review prior to implementation.

RCW 43.21C.535 requires SEPA lead agencies to consider the onshore wind PEIS for any utility-scale onshore wind projects. Agencies must use the information in the PEIS, along with other publicly available information and site-specific details, to support their evaluation of proposed actions, alternatives, environmental impacts, or mitigation for a proposed project. Potential impacts not addressed in the PEIS will need to be evaluated in the project-level environmental review.

Document availability

The Draft PEIS is posted on the following websites:

- SEPA Register website[6]
- Ecology's programmatic EIS website[7]

[6] https://apps.ecology.wa.gov/separ/Main/SEPA
[7] https://ecology.wa.gov/regulations-permits/sepa/clean-energy/programmatic-eis

This document is also available at the following locations:

Ecology Headquarters
300 Desmond Drive SE
Lacey, WA 98503

Ecology Central Region Office
1250 West Alder Street
Union Gap, WA 98903

Location of background materials

The PEIS and associated resource reports developed specifically for this environmental review are available on Ecology's programmatic EIS website.[8]

Cost of copy of PEIS

To obtain a CD or printed copy of the Draft PEIS (for the cost of production), follow the instructions provided on the Ecology "Publications & Forms" webpage.[9]

[8] https://ecology.wa.gov/regulations-permits/sepa/clean-energy/programmatic-eis
[9] https://ecology.wa.gov/footer-pages/online-tools-publications/publications-forms

State Environmental Policy Act
Draft Programmatic Environmental Impact Statement

For Utility-Scale Onshore Wind Energy Facilities in Washington State

Shorelands and Environmental Assistance Program
Washington State Department of Ecology
Olympia, WA

September 2024 | Publication 24-06-012

DEPARTMENT OF
ECOLOGY
State of Washington

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Acronyms and Abbreviations List

AC	alternating current
ADLS	aircraft detection lighting system
BESS	battery energy storage system
BLM	Bureau of Land Management
BMP	best management practice
CCA	Climate Commitment Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	Compatible Energy Siting Assessment
CETA	Clean Energy Transformation Act
CO_2e	carbon dioxide equivalent
CSZ	Cascadia Subduction Zone
DAHP	Washington State Department of Archaeological and Historic Preservation
dBA	A-weighted decibel
DC	direct current
DNR	Washington State Department of Natural Resources
DOC	Washington Department of Commerce
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EDNA	Environmental Designation for Noise Abatement
EFSEC	State of Washington Energy Facility Site Evaluation Council
EHS	environmental health and safety
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FTA	Federal Transit Administration
GHG	greenhouse gas
GMA	Growth Management Act
HVAC	heating, ventilation, and air conditioning
kV	kilovolt
kWh	kilowatt-hour
LCA	life-cycle assessment
Leq	equivalent-continuous sound level
m/s	meter per second
mph	mile per hour
MW	megawatt
MWh	megawatt-hour
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association

NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration/Act
PEIS	Programmatic Environmental Impact Statement
RCW	Revised Code of Washington
RFFA	reasonably foreseeable future action
ROW	right-of-way
rpm	rotation per minute
SEPA	State Environmental Policy Act
SMP	Shoreline Management Plan
SPCC	Spill Prevention, Control, and Countermeasure
TCP	Traditional Cultural Property
UGA	urban growth area
UHV	ultra-high-voltage
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WSDOT	Washington State Department of Transportation

Crosswalk with PEIS for Utility-Scale Solar Energy

Two Programmatic Environmental Impact Statements (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 documents.

Section	Utility-Scale Solar Energy PEIS	Utility-Scale Onshore Wind Energy PEIS (this document)
1: Introduction and Background	• Different summary of types of facilities and geographic areas evaluated	• Different summary of types of facilities and geographic areas evaluated
2: Utility-Scale Onshore Wind/Solar Energy Facilities	• Descriptions of typical components and phases of utility-scale solar energy facilities • Some differences in alternatives considered but not carried forward	• Description of typical components and phases of utility-scale onshore wind energy facilities • Some differences in alternatives considered but not carried forward
3: Study Area	• Description and map depicting scope of study for utility-scale solar energy facilities	• Description and map depicting scope of study for utility-scale onshore wind energy facilities
4: Affected Environment, Potential Impacts, and Mitigation (Introduction)	• No substantial differences	• No substantial differences
4.1: Tribal rights, interests, and resources	• Differences in specific impact drivers associated with facilities	• Larger study area includes consideration of additional geographic regions and steeper sloped/more mountainous areas • Differences in specific impact drivers associated with facilities
4.2: Environmental justice and overburdened communities	• No substantial differences	• No substantial differences
4.3: Earth	• Some differences in actions to avoid and reduce impacts	• Larger study area includes consideration of different affected environment areas (e.g., overlap with tsunami inundation zones and additional faults) • Differences in landslide and erosion risks from potential for facilities to be on steeper slopes • Some differences in actions to avoid and reduce impacts

Section	Utility-Scale Solar Energy PEIS	Utility-Scale Onshore Wind Energy PEIS (this document)
4.4: Air quality and greenhouse gases	• Different specific air emission estimates • Differences in the estimates for greenhouse gas life-cycle assessments	• Different specific air emission estimates • Includes evaluation of air quality for repowering facilities instead of decommissioning • Differences in the estimates for greenhouse gas life-cycle assessments
4.5: Water resources	• Differences in which WRIAs and aquifers the study area overlaps • Different impacts related to impervious surfaces • Includes potential water use for washing solar panels	• Differences in which WRIAs and aquifers the study area overlaps • Different impacts related to impervious surfaces
4.6: Biological resources	• Differences in specific impact drivers associated with facilities • Some differences in actions to avoid and reduce impacts	• Larger study area includes consideration of additional ecoregions, marine and nearshore habitats and species, and estuarine wetlands • Differences in specific impact drivers associated with facilities • Some differences in actions to avoid and reduce impacts
4.7: Energy or natural resources	• Different specific energy and natural resource use estimates and resulting different ranges of potential impacts • Some differences in actions to avoid and reduce impacts	• Includes the potential for facilities to affect adjacent wind resource availability • Different specific energy and natural resource use estimates and resulting different ranges of potential impacts • Some differences in actions to avoid and reduce impacts
4.8: Environmental health and safety	• Some differences in specific hazardous materials, health and safety hazards, and wildfire risks • Some differences in actions to avoid and reduce impacts	• Some differences in specific hazardous materials, health and safety hazards, and wildfire risks • Some differences in actions to avoid and reduce impacts
4.9: Noise and vibration	• Differences in the types of facility noise-and vibration-generating activities • Some differences in actions to avoid and reduce impacts	• Differences in the types of facility noise-and vibration-generating activities • Larger distance at which potential impacts from facilities could occur • Some differences in actions to avoid and reduce impacts

Section	Utility-Scale Solar Energy PEIS	Utility-Scale Onshore Wind Energy PEIS (this document)
4.10: Land use	• Additional agricultural information in affected environment from Least-Conflict Solar Siting Study for the Columbia Plateau • Some differences in actions to avoid and reduce impacts	• Decommissioning considers potential impacts from repowering wind facilities • Some differences in actions to avoid and reduce impacts
4.11: Aesthetics/ visual quality	• 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
4.12: Recreation	• No substantial differences	• No substantial differences
4.13: Historic and cultural resources	• Differences in specific impact drivers associated with facilities	• Larger study area includes consideration of additional geographic regions • Differences in specific impact drivers associated with facilities
4.14: Transportation	• Differences in construction impacts from transportation of facility components • Some differences in actions to avoid and reduce impacts	• Differences in construction impacts from transportation of facility components • Some differences in actions to avoid and reduce impacts
4.15: Public services and utilities	• Differences in specific impacts on public service and utility providers • Some differences in actions to avoid and reduce impacts	• Potential for significant adverse impacts on fire response related to turbines • Potential for significant adverse impacts on solid waste and recycling during decommissioning or repowering • Some differences in actions to avoid and reduce impacts
5: Cumulative Impacts	• Some differences in cumulative impacts on biological resources, noise and vibration, aesthetics/visual quality, and public services and utilities	• Some differences in cumulative impacts on biological resources, noise and vibration, aesthetics/visual quality, and public services and utilities
6: Consultation and Coordination	• No substantial differences	• No substantial differences
7: Permits and Approvals	• No substantial differences	• No substantial differences
8: List of Preparers and Contributors	• No substantial differences	• No substantial differences
9: Distribution List	• No substantial differences	• No substantial differences

1 Introduction and Background

1.1 PEIS overview

This Washington State Environmental Policy Act (SEPA) Programmatic Environmental Impact Statement (PEIS) was prepared to evaluate utility-scale onshore wind energy facilities in Washington state. A PEIS is a type of nonproject environmental review used for planning; it is not an evaluation of a specific project. This PEIS considers potentially significant adverse environmental impacts at a broad level. It analyzes general types of facilities—but not individual projects—to identify probable significant adverse environmental impacts and possible ways to avoid, minimize, or mitigate those impacts.

The PEIS is intended to:

- Support the state's transition to clean energy while protecting the environment, Tribal rights and resources, and local communities.
- Identify the range of probable significant adverse environmental impacts utility-scale onshore wind energy projects can pose.
- Provide information about facility siting and design that may be used to help avoid or minimize adverse environmental impacts for proposed facilities.
- Identify general potential mitigation measures for impacts.
- Provide information for lead agencies to consider when conducting environmental reviews for utility-scale onshore wind energy facilities.

The PEIS does not approve, authorize, limit, or exclude facilities on a site-specific basis.

Environmental Review Terminology

Lead agency: Agency responsible for preparing the environmental review under state law. The Washington State Department of Ecology (Ecology) is the lead agency for this PEIS.

State Environmental Policy Act (SEPA): Washington State law intended to ensure that environmental values are considered early and during decision-making actions by state and local agencies.

Programmatic Environmental Impact Statement (PEIS): Fact-based nonproject environmental review used for planning. It is not an evaluation of a specific project. A PEIS considers potentially significant adverse environmental impacts at a broad level as well as possible ways to avoid, minimize, or mitigate those impacts. Local, state, and federal agencies may use PEISs in order to help evaluate proposed actions, alternatives, environmental impacts, or mitigation for proposed projects.

1.2 Background and history

The Washington State Legislature directed the Washington State Department of Ecology (Ecology) to prepare nonproject environmental reviews of utility-scale onshore wind energy facilities, utility-scale solar energy facilities, and green electrolytic and renewable hydrogen facilities in Washington by June 30, 2025. The reviews are being prepared pursuant to SEPA.

This Draft PEIS focuses on utility-scale onshore wind energy facilities. A separate Draft PEIS was prepared for utility-scale solar energy facilities. Solar and onshore wind environmental reviews are being developed at the same time, so this report includes a crosswalk for comparison purposes in the previous section. A PEIS that focuses on green electrolytic and renewable hydrogen facilities is being developed separately and is not discussed further in this document. Information on all three processes is available on Ecology's webpage for clean energy PEISs.[10]

Ecology developed this PEIS to analyze potential impacts and mitigation at a broad level. The agency issued a Determination of Significance and opened an extended comment period on the scope of the PEIS on utility-scale onshore wind energy facilities in Washington state on September 27, 2023. The PEIS was prepared under Revised Code of Washington (RCW) 43.21C.030(2)(c) per Chapter 197-11 Washington Administrative Code (WAC) procedures. The Determination of Significance and Scoping Notice for the PEIS initiated Ecology's environmental review process. Scoping helps determine the focus of the PEIS evaluation by seeking input from Tribes, agencies, members of the public, and interested parties on the contents of the PEIS. More information about the scoping process is available in Appendix A, Scoping Summary Report.

1.3 Types of wind facilities evaluated (alternatives)

The PEIS focuses on utility-scale onshore wind energy facilities as directed by the Washington State Legislature. As used in the PEIS, utility-scale means a facility capable of providing at least 10 megawatts (MW) of electricity directly to the state's electrical grid. Ecology published the Scoping Document[11] in September 2023 that included information on possible types of facilities that could be analyzed in the PEIS. To identify the types of facilities to be studied in this PEIS, Ecology considered the comments received during scoping.

Facility types that did not meet definitions of utility-scale onshore wind energy facilities to be analyzed in the legislative direction were eliminated from further consideration and are discussed in Section 2.5. For example, distributed onshore wind, community onshore wind, and home onshore wind systems are not utility-scale facilities and are not evaluated in the PEIS.

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[10] https://ecology.wa.gov/regulations-permits/sepa/clean-energy/programmatic-eis

[11] https://fortress.wa.gov/ecy/ezshare/sea/Clean Energy Coordination/OnshoreWind_ScopingDocument_PEIS_PublicFinal_092723.pdf

Fossil-fuel energy facilities and other clean energy facilities are considered in the cumulative impact analysis.

After consideration of comments and input received during scoping, Ecology identified four types of utility-scale onshore wind energy facilities and a No Action Alternative to be evaluated in this PEIS. The alternatives are as follows, and detailed descriptions are in Chapter 2:

- **Utility-scale onshore wind facilities:** onshore wind facilities capable of generating between 10 MW and 1,500 MW of energy on sites between 340 to 127,500 acres in size.
- **Onshore wind facilities with battery energy storage systems:** facilities that also include one or two battery energy storage systems (BESSs), each capable of storing up to 500 MW of energy.
- **Onshore wind energy facilities that include agricultural uses:** dual-use facilities where agriculture would occur during facility operations.

Because the analysis in the resource reports (Appendices B through Q) showed potential impacts from small to medium utility-scale facilities are similar in most cases to impacts from large utility-scale facilities, these types of facilities (alternatives) have been combined in the Draft PEIS. This is to improve readability of the document. The resource reports included in Appendices B through Q contain the full analysis of impacts, separated for each type of facility.

1.4 PEIS scope of analysis

Ecology considered the potential for impacts from these types of facilities, as well as comments received during scoping, to determine the scope of the Draft PEIS. The PEIS focuses on probable significant adverse impacts, with some information provided on other impacts. This is reflected in the level of detail provided for resources in the sections and appendices, with more information provided for potentially significant impacts. The introduction to Section 4 has more information on the types of impacts considered.

RCW 43.21C.535[12] states that "the scope of a nonproject environmental review shall be limited to the probable, significant adverse environmental impacts in geographic areas that are suitable for the applicable clean energy type." Based on this legislative direction, and considering comments received during scoping, the study area was developed.

Ecology identified the following assumptions in determining the geographic area for analysis. It is important to note that this map does not show where a facility may or may not be sited, it is for impact analysis only. Facilities may be proposed within or outside of the geographic scope of study.

- Areas with average annual wind speeds of 11 miles per hour (mph) (5 meters per second [m/s]) at 80 meters high or greater

[12] https://app.leg.wa.gov/RCW/default.aspx?cite=43.21C.535

- Areas within 25 miles of existing transmission lines that can handle the energy generation of utility-scale facilities (230 kilovolt [kV] or greater lines)
- An area in eastern Washington with existing utility-scale onshore wind energy facilities that does not meet the criteria above was included in the study area because the area has sufficient wind energy availability and other potentially favorable characteristics for utility-scale developments.

Figure 1-1 shows the onshore wind study area. More information on the study area is provided in Chapter 3.

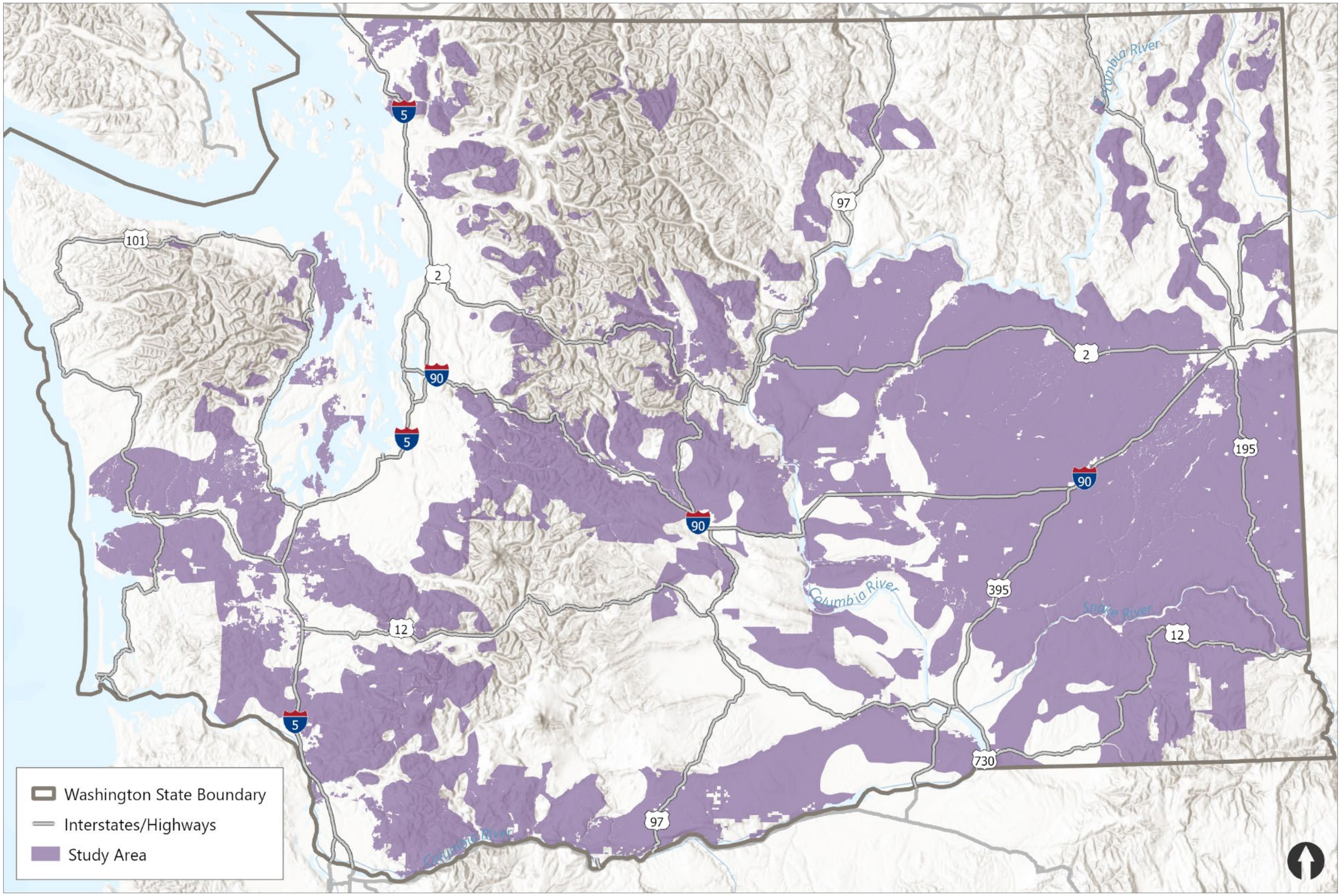


Figure 1-1. Onshore Wind Energy Facilities PEIS – geographic scope of study

1.5 State Environmental Policy Act process

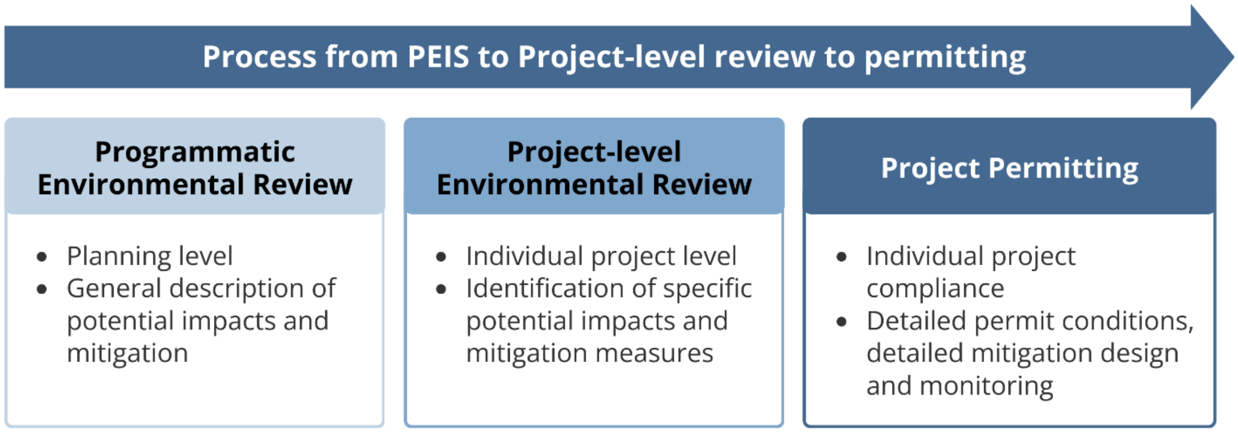
As the lead agency, Ecology prepared this PEIS in compliance with SEPA. The SEPA environmental review process provides a way to identify the possible environmental effects of a proposal and assess how they could be avoided or mitigated in advance. It helps decision-makers and the public understand how a proposed action could affect the natural and human environment.

The PEIS considers potential impacts from general types of onshore wind energy facilities; it is not site-specific or for a specific facility. It evaluates environmental impacts over a broad geographic area and time horizon, and the depth and detail of the impact analysis is general, focusing on major impacts in a qualitative manner. Mitigation is also identified at a high level.

SEPA analyses for specific onshore wind energy facility proposals would tier to this PEIS. Tiering means a broad nonproject evaluation is later used during the evaluation of a specific facility. Tiering can result in a more effective environmental analysis process for subsequent onshore wind energy development proposals.

This PEIS identifies probable significant adverse environmental impacts and relevant mitigation applicable to utility-scale onshore wind energy development in general. The PEIS does not assess site-specific issues associated with any individual energy development facility. Location-specific factors vary considerably from site to site. These include factors such as the soil type, groundwater availability, water types, habitat, vegetation, the presence of threatened or endangered species, and the presence of Tribal and cultural resources. The effects of location-specific and facility-specific factors cannot be fully anticipated or addressed in a programmatic analysis. The PEIS identifies potential impacts to be considered early and each onshore wind facility proposal would be required to have its own SEPA environmental review. During that process, site-specific information and facility-specific effects would be evaluated.

A PEIS does not approve or deny a proposed facility. Federal, state, and local agencies may—and in some cases must, as explained below—use the information in the PEIS, along with other publicly available information and site-specific details, to inform facility-level environmental reviews and permitting.



RCW 43.21C.538 requires SEPA lead agencies to consider the onshore wind PEIS for any onshore wind facilities. Each agency would be responsible for determining which elements of the PEIS analysis are applicable to their evaluation of a proposed facility and revising or supplementing the analysis to address facility-specific elements and circumstances that were not evaluated in the PEIS.

In summary, this PEIS can help:

- Developers avoid and minimize potential impacts as they work to site and develop their proposals and develop mitigation plans
- Local, state, and federal agencies conduct their environmental reviews and make permit decisions
- Provide information for the public and Tribes to use for future proposed facilities

1.6 PEIS organization

This PEIS is organized to provide information in three ways. The Summary provides brief, high-level information on key findings and probable significant adverse impacts. The PEIS chapters provide high-level information on the impact analysis and findings. The appendices contain the resource reports with detailed methods and technical information. For sections of this PEIS that have a related resource report, the report is the official technical documentation for this PEIS. If there is conflicting information between the Summary, PEIS chapters, or the resource report, the resource report is considered to be the controlling document. The Draft PEIS is organized as follows:

- **Publication and Contact Information, Cover Letter, and Fact Sheet**
- **Summary**
- **Draft PEIS:**
  - **Chapter 1: Introduction and Background** is contained in this chapter.
  - **Chapter 2: Utility-Scale Onshore Wind Energy Facilities** describes the purpose and objectives of the PEIS, typical components and phases of utility-scale onshore wind energy facilities, and the alternatives considered for the PEIS.

    - **Chapter 3: Study Area** describes the geographic and temporal scope of study that was used for the PEIS analysis.
    - **Chapter 4: Affected Environment, Potential Impacts, and Mitigation** summarizes the current conditions in the study area and probable significant adverse impacts for each element of the environment. This chapter also identifies potential mitigation measures that could be implemented to reduce potential effects. References are provided to appropriate appendices for more details.
    - **Chapter 5: Cumulative Impacts** summarizes the evaluation of potential cumulative effects of the alternatives. Additional detail is provided in Appendix Q.
    - **Chapter 6: Consultation and Coordination** summarizes the PEIS scoping process; the roles of Ecology, other agencies, and Tribal governments in the development of the PEIS; and Ecology's coordination with Tribes, other agencies, the public, and stakeholders.
    - **Chapter 7: Permits and Approvals** summarizes permits, licenses, and approvals that may be required for future proposed facilities.
    - **Chapter 8: List of Preparers and Contributors** identifies state agencies, Tribes, and consulting firms who participated in the evaluation.
    - **Chapter 9: Distribution List** identifies agencies, Tribes, organizations, and others who will receive this PEIS.
- **Appendices** include specific, detailed information relevant to the evaluation provided in this PEIS.

2 Utility-Scale Onshore Wind Energy Facilities

2.1 Purpose

As directed by the Legislature, this PEIS evaluates potential impacts and mitigation for utility-scale onshore wind energy facilities in Washington state. Four types of utility-scale onshore wind energy facilities (alternatives) and a No Action Alternative are assessed in this PEIS. The facility types include:

- **Utility-scale onshore wind facilities:** onshore wind facilities capable of generating between 10 MW to 1,500 MW of energy
- **Onshore wind facilities with BESSs:** facilities with the addition of one or two BESSs, each capable of storing up to 500 MWs of energy
- **Onshore wind energy facilities that include agricultural uses:** dual-use facilities where agriculture would occur during facility operations

This chapter describes typical types of equipment and actions for site characterization, construction, operation, and decommissioning of these types of facilities, which are used for analysis in the PEIS.

This PEIS is expected to be used by energy facility developers in developing specific facilities. Project-level state environmental review would need to be completed for specific facilities, but such review can use information from this PEIS.

2.2 Typical components of utility-scale onshore wind energy facilities

This PEIS evaluates utility-scale onshore wind energy facilities consisting of wind turbines and associated power and electrical equipment. This section describes typical types of equipment, and actions for site characterization, construction, operation, and decommissioning of these types of facilities, which are used for analysis in the PEIS. The typical components of utility-scale wind energy facilities are similar for the small to medium and large facility types analyzed, with larger facilities including proportionally more components.

Onshore wind energy facilities evaluated in this PEIS consist of two groups of equipment. The first group contains the wind turbines and meteorological towers. These structures may be arranged in clusters with several turbines and towers spread out across a wind farm, or they may be arranged in long lines like strings within a wind farm.

The second group of equipment is the power collection system. This includes transformers for each turbine, electrical collector lines, a collector substation, and a type of transmission line called a gen-tie line that connects the facility to the power grid.

One of the facility types analyzed in this PEIS includes a co-located BESS (refer to Section 2.4 for detailed discussion of this facility type). This type of facility would include the wind turbines, meteorological towers, and power collection system, along with batteries to store energy. This stored energy could be sent to the electrical grid at times other than when it is produced.

While the size of each facility would vary, for the purposes of this PEIS and based on examples of existing or permitted onshore wind facilities in Washington, 30 to 85 acres for 1 MW of energy is used for estimating site size, depending on the facility characteristics. The footprint for the turbines and other equipment would be within the facility site, and would typically occupy from a fraction of a percent to 5% of the total facility size because of the spacing required between turbines and to allow for necessary infrastructure including access roads, operations and maintenance facilities, BESSs (if applicable), and the power collection system. The rest of the site (95% or more) is typically not developed. Actual facility sizes would vary based on geography and design. The size of wind turbines varies greatly. Assumptions used for the PEIS analysis for wind turbines are described below. Figures 2-1 and 2-2 illustrate typical components of utility-scale onshore wind facilities, ranging in capacity from 1.5 MW to 6.0 MW, which is consistent with recent facilities in Washington.

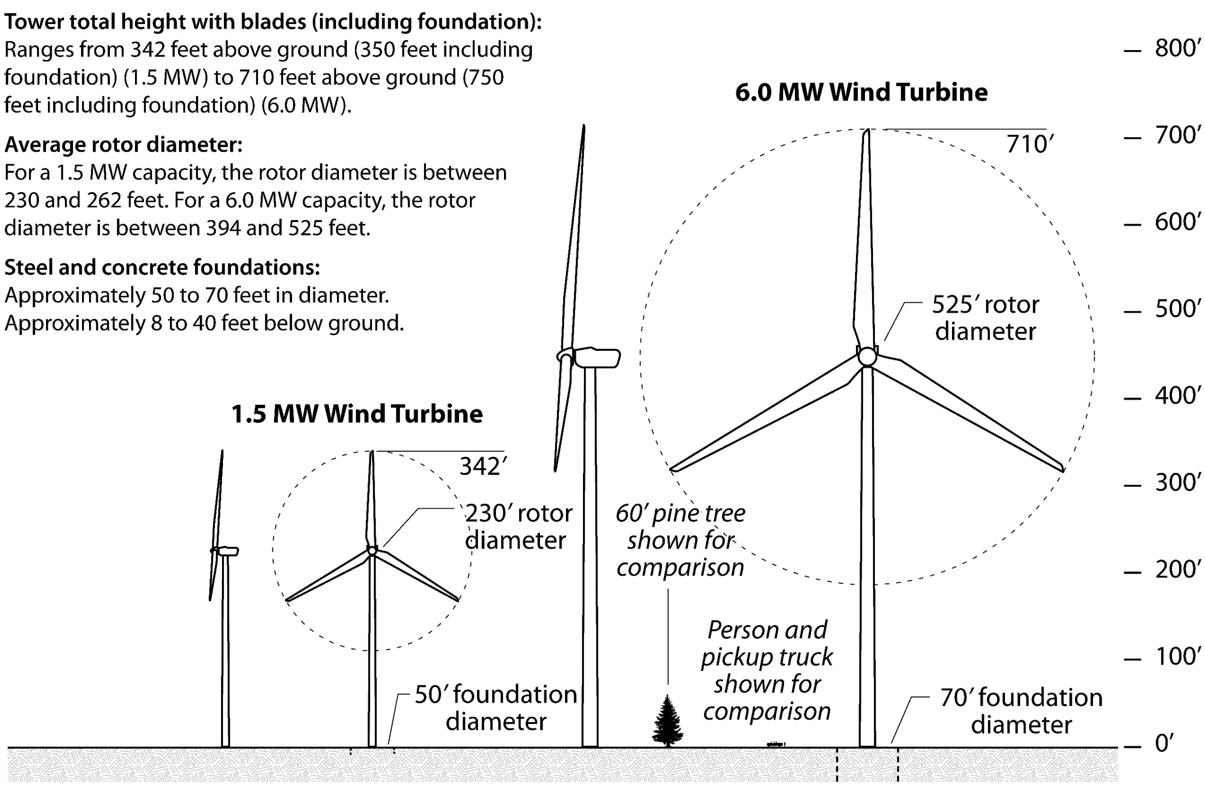


Figure 2-1. Relative scale of the typical components of a utility-scale onshore wind facility

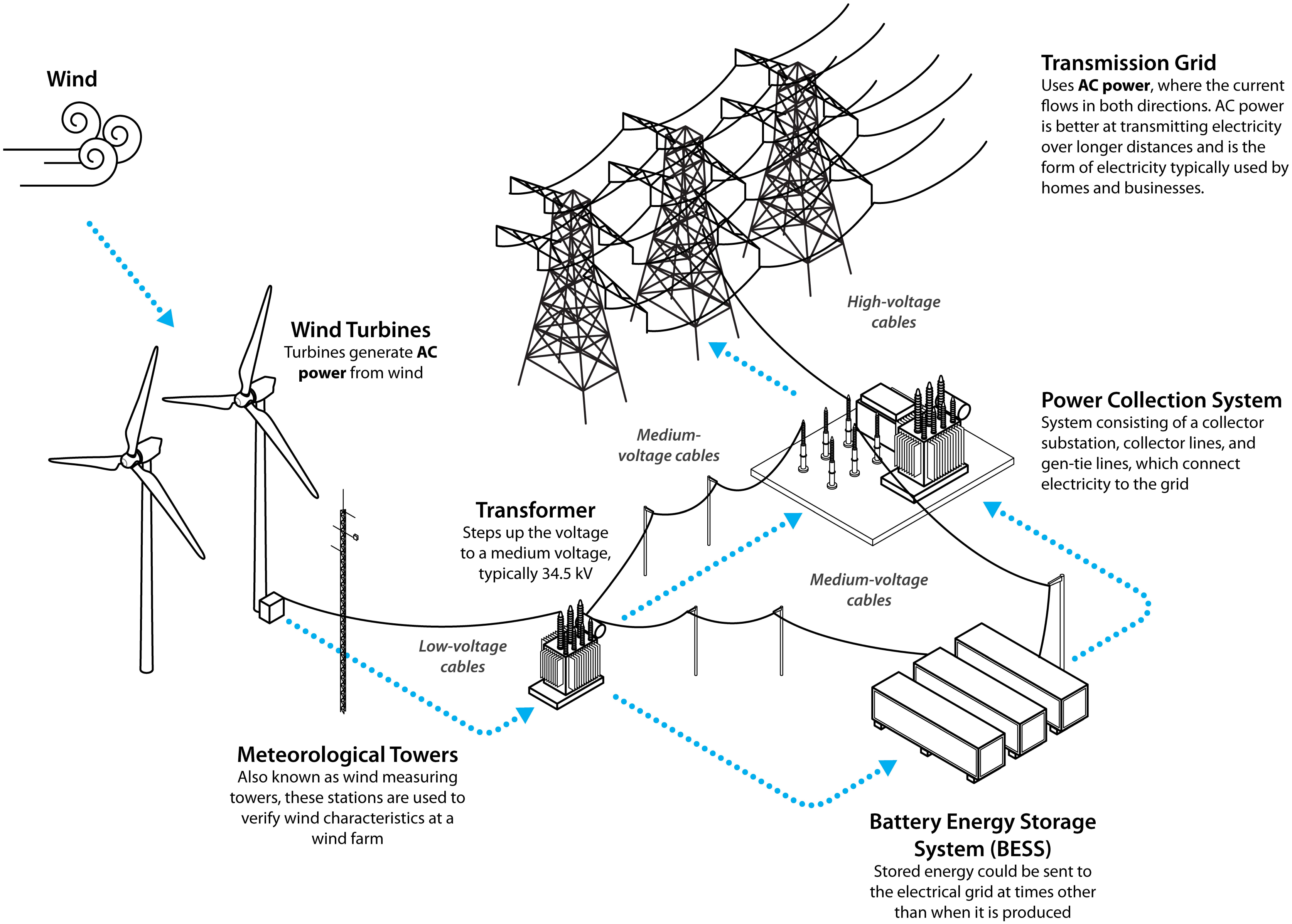


Figure 2-2. Typical components of utility-scale onshore wind energy facilities

2.2.1 Wind turbines

Wind turbines use wind to make electricity. When wind turns the blades of a turbine around a rotor, it spins a generator and creates electricity. A wind turbine consists of a tower with a nacelle (housing) attached to the rotor with the blades at the top (see Figure 2-3). Turbines may be arranged in clusters, with several turbines spread out across a wind farm, or they may be arranged in strings, with turbines placed in long lines within a wind farm.

A wind turbine's hub height is the distance from the ground to the middle of the turbine's rotor. Taller turbine towers capture more energy because winds generally increase as altitudes increase. At higher elevations above the ground, wind can flow more freely, with less friction from objects on the earth's surface such as trees and other vegetation, buildings, and mountains.

A turbine's rotor diameter is the width of the circle created by the rotating blades. The larger the rotor diameter, the more wind that can be captured and the more electricity produced. This means that even in areas with relatively less wind, a turbine with larger blades can capture more wind than one with shorter blades.

According to the U.S. Department of Energy (DOE),[13] the average hub height for onshore wind turbines was 308 feet in 2021, and the average rotor size was 418 feet in diameter, for an average of 517-foot-high towers including blades. Turbines are rated by their maximum power rating, or capacity. DOE found the average capacity for new wind turbines was 3.0 MW in 2021. Recent facilities and proposals in Washington range from 1.5 MW to 6.0 MW turbines with heights around 671 feet. A recent study[14] predicts that onshore wind turbines are likely to reach total heights of 750 feet tall. For the purposes of the PEIS analysis, it was assumed the wind turbines that would be installed at facilities would range from 350 feet to 750 feet in total height, measured from the ground surface to the tip of a blade pointing directly up. The height of turbines is directly related to their generating capacity, with taller heights found in higher capacity turbines.

Utility-scale onshore wind turbines are typically upwind turbines, meaning they face into the wind, as shown on Figure 2-4.

[13] https://www.energy.gov/eere/articles/wind-turbines-bigger-better
[14] https://onlinelibrary.wiley.com/doi/10.1002/we.2735

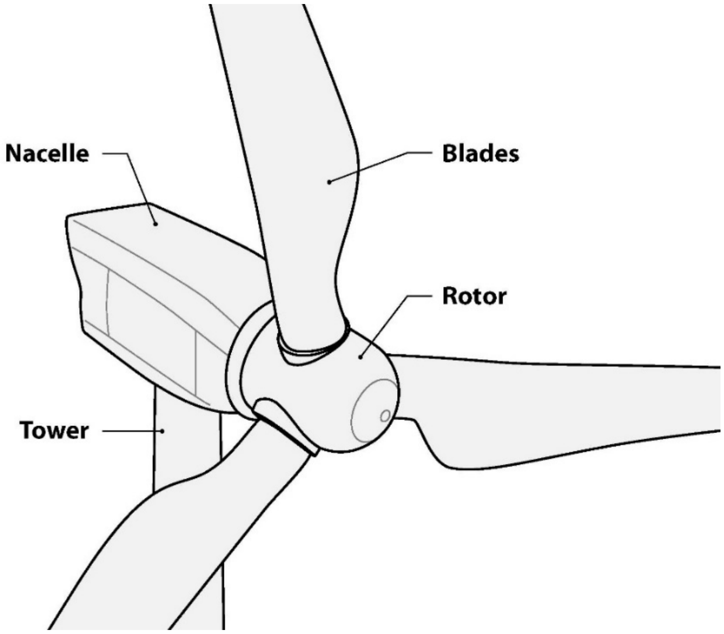


Figure 2-3. Onshore wind turbine components

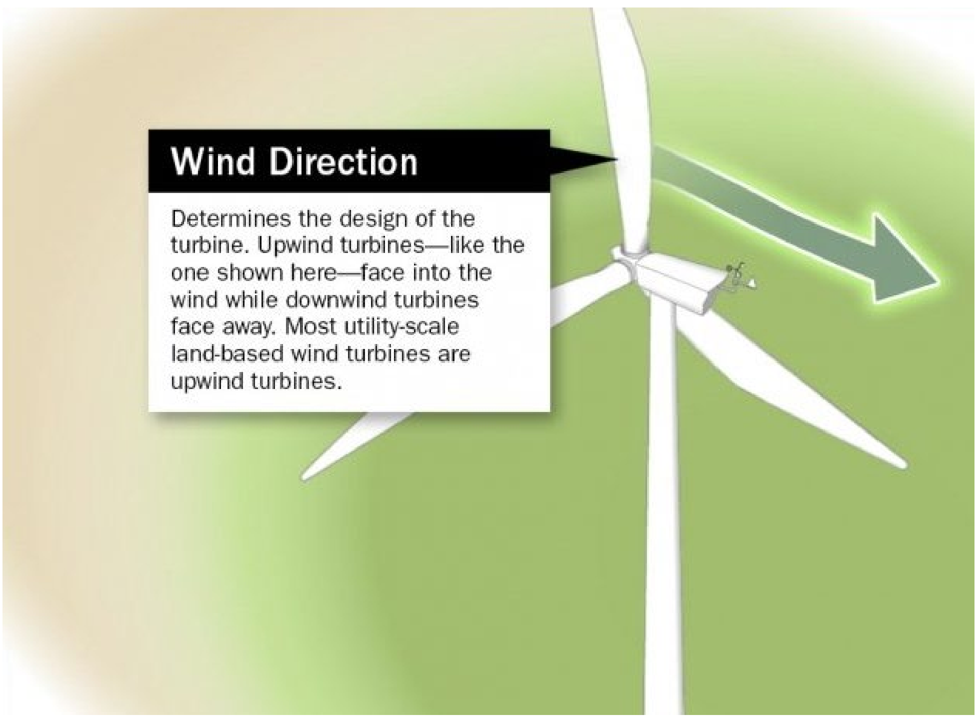


Figure 2-4. Wind turbine in upwind direction

Source: Image from DOE Wind Energy Technologies Office[15]

[15] https://www.energy.gov/eere/wind/how-wind-turbine-works-text-version

2.2.1.1 Tower

Wind turbines are freestanding, hollow, steel or steel composite towers with a nacelle at the top, which includes the generator and gear box.

Towers are mounted on concrete pads with foundations of concrete and steel going into the ground. Currently, the typical diameter of foundations can range from 50 to 70 feet and the distance belowground can range from 8 feet to more than 40 feet, depending on the foundation type, height of the tower, and anticipated wind speeds. Towers may be mounted on a spread foundation, which disperses the load coming from the tower to the soil. These foundations include a large plate, which provides the area for spreading the load, and a reinforced concrete footing in the shape of a cylindrical or square prism. Pier foundations may be used, where favorable soil conditions allow, for a deep foundation for taller turbines where spread foundations may not be able to support the tower. Foundation design will continue to evolve as wind turbine technology advances, and larger foundations may be required for larger turbines.

2.2.1.2 Wind turbine blades

Most turbines have three blades. Typically, these are made of fiberglass, and one side is curved while the other is flat. They vary in size depending on the facility. When wind flows across the blade, the air pressure on one side of the blade decreases. The difference in air pressure from the two sides creates lift and drag forces. The force of the lift is stronger, and this moves the blade and causes the rotor to spin. This same principle applies to how airplane wings work.

The rotor is made up of the three blades and the hub assembly. The blades fit into the hub, which is connected to the main shaft.

2.2.1.3 Nacelle

The nacelle is located at the top of the tower and connects to the rotor. It is a housing that contains a set of gears, control system, and a generator. It also includes the low- and high-speed shafts, drivetrain, and brake. This system converts the low-speed, high-torque rotation of the blades into electrical energy.

There are two types of turbines: direct-drive turbines and gearbox turbines. Direct-drive turbines do not use a gearbox; they connect the rotor directly to the generator and produce electricity using low rotation speeds. Gearbox turbines have a gearbox located in the nacelle. The purpose of the gearbox is to increase the rotational rotor speed before feeding it to the generator. The gearbox connects the low-speed shaft to the high-speed shaft. It increases the rotation speed of the low-speed shaft from 8 to 20 rotations per minute (rpm) to 1,000 to 1,800 rpm for the high-speed shaft. The generator uses copper windings turning through a magnetic field to create electricity.

The controller allows the turbine to start at wind speeds of about 7 to 11 mph. It shuts off when speeds are over 55 to 65 mph to prevent damage at higher wind speeds. Turbine brakes prevent the rotor from turning when the speeds are too high, or for maintenance.

2.2.1.4 Wind turbine measurement and orientation equipment

There are several pieces of equipment located in the turbine nacelle that are used to take wind speed and direction measurements. A wind vane measures wind direction. An anemometer most commonly measures wind speed but can also be useful for providing information about wind direction, turbulence, and wind shear when two anemometers are installed at different heights.

The yaw drive uses wind direction information to rotate the nacelle to keep the turbine facing the wind. The pitch system adjusts the angle of the wind turbine's blades with respect to the wind. This controls the rotor speed and how much energy is generated. The system can also adjust blades to ensure they do not produce enough force to spin the rotor for times when turbine rotation needs to be stopped.

2.2.1.5 Turbine lighting and marking

Turbines must be lighted and painted in accordance with Federal Aviation Administration (FAA) rules and advisory circulars. Lighting systems are placed on the nacelle to warn pilots at night of the presence of the turbines. This may include an aircraft detection lighting system (ADLS), which uses a sensor-based system to detect aircraft as they approach the wind turbines. An ADLS turns on the wind turbine lighting if an aircraft is detected or if there is a failure in the sensor. The lights then remain on until aircraft are clear of the ADLS coverage area. In non-ADLS lighting systems, the wind turbine lights would be turned on based on a predetermined schedule, regardless of the presence of aircraft in the area. New utility-scale wind energy facilities must install a light-mitigating technology that complies with FAA regulations under Chapter 70A.550 RCW.

2.2.2 Meteorological towers

Meteorological towers are used to collect weather data using various types of measuring equipment. This could include wind speed and direction, wind shear, temperature, and humidity. Data are typically collected for 1 to 2 years during the site characterization phase. Meteorological towers are placed strategically by engineers at locations that will provide the most useful data and may be temporary, installed only during site characterization. Some developers elect to include permanent meteorological towers in the wind facility design, and locations of permanent towers may differ from locations of temporary meteorological towers used during site characterization.

Meteorological towers can be as high as 200 feet, although this would vary based on the terrain. For most sites, up to 10 towers would allow for adequate meteorological measurements.

The meteorological towers include data collection equipment, which is usually in a central location inside a waterproof enclosure on or directly adjacent to the meteorological tower. Data may be sent using a radio transmitter or collected periodically by maintenance personnel.

Meteorological towers are typically galvanized or painted metal, lattice structures. Heavy-duty or medium-duty trucks are usually sufficient to transport the towers to their sites. It takes less than 1 day to erect each meteorological tower. Belowground foundations are not typically required, but if the towers are expected to remain throughout site operations, concrete foundations may be needed. Guy wires may be needed for larger meteorological towers in windy areas. Smaller meteorological towers may be permanently mounted to their own trailers, which act as the foundation. Signal cables that connect the sensors to power supplies and data processing equipment are not likely to be buried if the meteorological towers are only used for the site characterization phase.

Meteorological towers do not typically require signal lights, but if the height is subject to FAA lighting requirements, lights would be required.

2.2.3 Power collection system

A power collection system typically consists of transformers for each turbine, power collection cables, and a substation. This system connects the electricity generated by the turbines to the electrical grid transmission lines. The onshore wind energy facility would connect to the electrical grid via a substation through gen-tie lines.

2.2.3.1 Transformers

Transformers receive the alternating current (AC) from the turbine generators and increase the voltage. This type of transformer is called a step-up transformer, which is used to increase voltage, decrease the current, and decrease power losses. The voltage from the turbine generator is typically below 1 kV and the transformers increase the voltage to a medium voltage, typically around 34.5 kV. Voltage ranges are illustrated in Figure 2-5.

Transformers must comply with the applicable requirements of the National Electric Code and Institute of Electrical and Electronics Engineers standards. Transformers are filled with oil, up to 600 gallons depending on the size. These are located on concrete pads near the base of the tower and typically have a system to contain the oil in the case of a spill. In some cases, the transformer may be located in the nacelle. If a facility has an aggregate combined storage capacity of oil greater than 1,320 gallons or is located where a discharge could reach a navigable waterbody, either directly or indirectly, a Spill Prevention, Control, and Countermeasure (SPCC) Plan is required (*Code of Federal Regulations* Part 112).

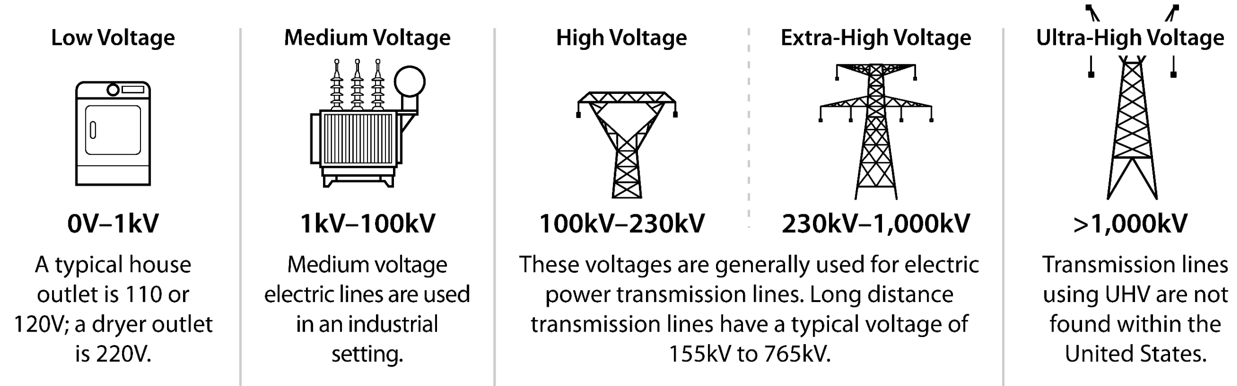


Figure 2-5. Voltage ranges

Note: Voltage measures the current strength or pressure that moves electricity from one point to another. Higher voltage means more electricity is flowing.

2.2.3.2 Electrical collection cables

Electrical collector lines (34.5 kV) link transformers throughout the facility to the substation. Collector lines are located within the facility area and are typically buried underground in trenches 3 to 4 feet deep. However, lines may be aboveground to avoid sensitive environmental or cultural areas, minimize ground disturbance, or avoid rocky or unstable areas, which could require blasting. Aboveground lines would be installed on steel or wooden pole structures approximately 60 to 150 feet tall.

Electrical collector lines are typically 34.5 kV. Higher voltage overhead lines of 100 kV or above may be used for larger wind energy facilities or if the distance to the electrical grid is long. In these cases, additional transformers would be required to increase the voltage from 34.5 kV to the required level.

2.2.3.3 Substation

A substation links the wind energy facility to the transmission lines for the electrical grid. A substation includes one or multiple transformers that increase the voltage for transmission to the grid. It is typically located close to the operations area and would be surrounded by a 7-foot chain-link security fence topped with barbed wire as required by the National Fire Protection Association (NFPA) and Occupational Safety and Health Administration (OSHA) standards to ensure public safety from exposure to electrical facilities.

Example of an electrical substation

Photograph from University of California, Davis

2.2.3.4 Interconnector lines and gen-tie lines

Interconnections are lines that carry electricity from the facility collector substation to a gen-tie line. The gen-tie lines then connect electricity to the power grid.

Lines must be constructed in compliance with codes and standards from the following: Washington regulations, National Electrical Safety Code (NESC), American National Standards Institute, National Electrical Manufacturers Association, American Society for Testing Materials International, Avian Power Line Interaction Committee, as well as other applicable laws and construction codes.

Lines are installed on wood or steel towers that may be up to 150 feet in height. Tower types may include monopole, H-frame, lattice structures, or turning structures and are installed on concrete foundation. Ground clearances for the suspended portion of the line would conform to the NESC standards. The minimum clearance between the line and the ground (including local roadways and land used for agriculture) must be designed consistent with applicable standards identified above and not preclude or inhibit transportation or agricultural uses under the line.

The strip of land where gen-tie lines are built and operated is called a right-of-way (ROW). Local regulations usually require a minimum clearance distance for gen-tie lines based on the voltage of the line.

2.2.3.5 Connection to grid transmission lines

Utility-scale onshore wind facilities typically connect to a main transmission line either through a substation or to a gen-tie line.

The length of these connections would depend on the distance from the site to existing transmission lines that have sufficient capacity to accept power from the facility. The distance to the grid would vary for each facility and would be determined by the facility applicant based on a selected site. The PEIS generally assumes the distance from a transmission line would be 25 miles or less for the analysis.

2.2.4 Buildings for operations and maintenance

Buildings or trailers may be utilized for operations and maintenance activities vary in size based on proposed uses. Buildings may be used for offices, restrooms, kitchens, material and equipment storage, or remote monitoring. There may also be an on-site area for parking and an open staging area. Buildings are expected to be fenced for security. Lighting would be needed for security and occasional work and maintenance. Service roads and the parking area must have sufficient space for emergency response vehicle access.

Local utilities would provide primary electrical and telephone connections. A facility may include aboveground fuel tanks for generators to serve as back-up power. Systems such as a site monitoring system, supervisory control and data acquisition system, and an onshore wind meteorological data system are expected to be installed to provide data for operations and security.

Buildings must be equipped with fire extinguishers, smoke detectors, and basic firefighting equipment for use on site. This includes shovels, beaters (consisting of a piece of rubber at the end of a pole used for extinguishing minor fires), portable water containers for hand sprayers, and personal protective equipment. The equipment used within the buildings must meet National Electrical Code and Institute of Electrical and Electronics Engineers standards.

2.2.5 Stormwater, wastewater, and water supply

Construction and operational stormwater management plans would be designed during the pre-construction engineering phase, and the developer would be required to obtain the appropriate National Pollutant Discharge Elimination System (NPDES) permits. Stormwater runoff would primarily be generated from rain that falls on turbine pads, buildings, access roads, and other cleared or developed areas within the facility footprint. Sanitary wastewater would be managed through municipal wastewater systems, a permitted on-site septic system, or a portable restroom.

Water used for operations and maintenance could be from on-site wells, commercially available wells, water brought to the site, or a municipal water system. Water cisterns may be used to store non-potable water for fire suppression needs.

2.2.6 Access roads and perimeter fencing

A facility site includes access roads, gates, and perimeter fencing. The road size and type would vary based on the facility location and expected use. Access roads leading to substations, parking areas, or operations and maintenance buildings are more likely to be paved two-lane roads, but interior roads are typically one-lane dirt or gravel roads. Access roads may be installed within the facility property to access certain areas and may also be needed outside of the facility to connect to the existing roadway system. Road widths would vary based on the type of road, use, and room for turning. Permanent dirt or gravel access roads would be constructed to access each turbine. Additional, temporary access roads including temporary pathways to accommodate large cranes may be necessary during construction. Temporary roads and crane walks would be decommissioned and restored as necessary after construction.

Fencing around the full perimeter of onshore wind energy facilities is not anticipated, nor is it assumed that there would be fencing around each individual wind turbine in the facility. Fencing is expected to be installed around the operations and maintenance buildings, substations, and other facility structures and include vehicle and pedestrian access gates. Depending on security needs and the potential presence of wildlife corridors in the area, fencing may consist of a 7- or 8-foot-high security fence. Fences around electrical installations would meet National Electric Code requirements. Temporary fencing may also be used during construction.

2.3 Battery energy storage system (BESS)

One of the facility types considered in this PEIS is a utility-scale onshore wind facility with a co-located BESS as part of the facility proposal. A BESS stores and deploys energy generated by a facility. For the purposes of this PEIS, the storage technologies evaluated are lithium-ion, flow, and zinc-hybrid batteries. These battery types would be stored in a series of self-contained enclosures located on a concrete pad within a fenced area, or within a warehouse-type enclosure.

Lithium-ion batteries are the most common type of utility-scale technology. They are a type of solid-state rechargeable battery in which lithium ions, suspended in an electrolyte, move from negative to positive electrodes and back when charging and recharging. Lithium-ion batteries have a typical lifespan of 5 to 10 years and would experience a gradual performance degradation over that time. Lithium-ion batteries have the potential to overheat due to damage or failure of battery management systems, which can cause fires and shocks if not safely handled and managed. State regulations require fire suppression and safety measures.

Flow batteries are an emerging technology for utility-scale storage. Flow batteries use two electrolyte solutions, one with positive ions and the other with negative ions, where the movement of electrons from one solution to the other creates electricity. Flow batteries typically have a maximum lifespan of 10 to 20 years, and do not degrade over time like conventional batteries. During normal operations, the electrolyte solutions are recovered and reused during the recharging process and are generally not reactive or toxic substances.

Zinc-hybrid batteries store energy by using electricity to split zinc into water and oxygen. This process charges the zinc particles in the battery, which can hold a charge for weeks at a time. When needed, the charged zinc is combined with oxygen to release stored electricity. Zinc batteries have a life of almost 20 years with periodic replacement of some components. Zinc batteries are generally not flammable.

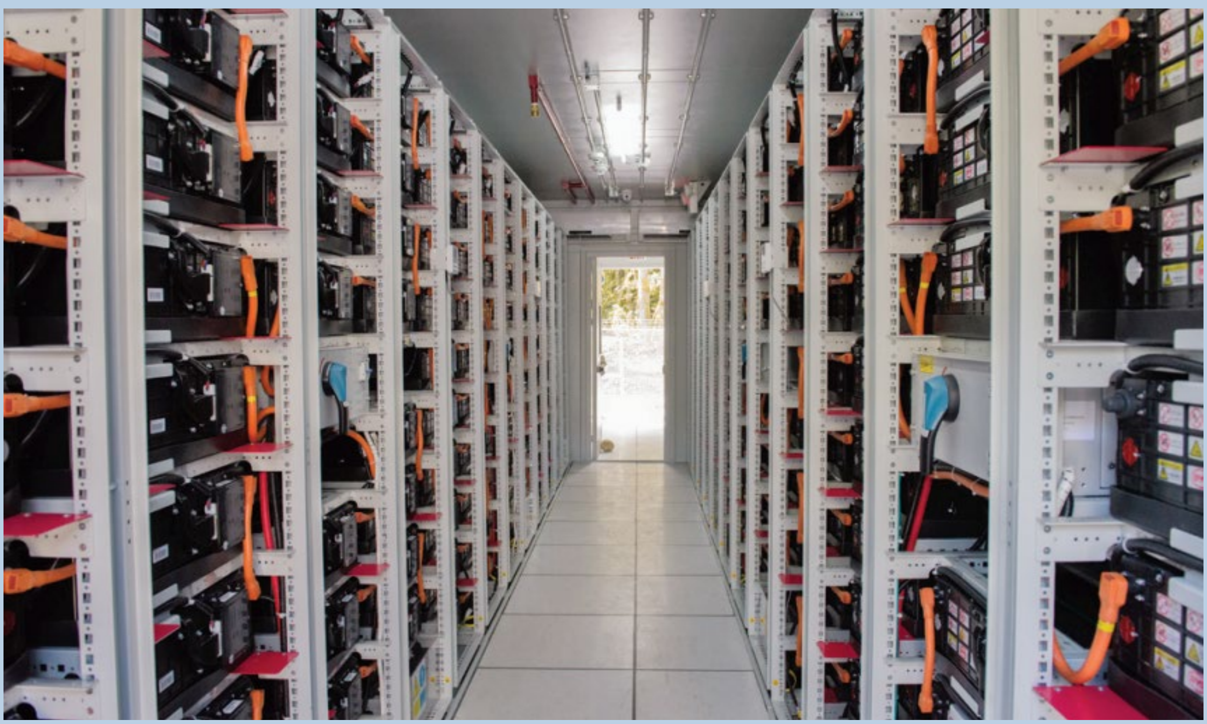
A BESS includes the following:

- Battery storage modules on racks or in containers with inverters, isolation transformers, and switchboards (which distribute power from one or more sources of supply to several smaller loads)
- Converters, which convert AC power to direct current (DC) power
- High-voltage, medium-voltage, and low-voltage electrical systems (voltage ranges are included in Figure 2-5; voltages have recently been advancing and may be as high has 1,500 volts)
- Heating, ventilation, and air conditioning (HVAC) units
- Building auxiliary electrical systems
- Fire suppression and prevention systems
- Control system, usually including data acquisition system

For this PEIS, it is assumed that BESSs would be installed within the onshore wind facility site footprint. The BESSs can be distributed or consolidated, but are assumed to typically be in a single location, most likely near the collector substation. BESSs are typically installed in a graveled area where vegetation clearing and gravel surfacing would be required. Battery storage containers are typically 40 by 8 by 8.5 feet and installed on concrete foundations designed to contain spills. A warehouse-type enclosure of a similar scale and size may also be used. A building must be constructed in compliance with state structural and electrical code requirements. BESSs must comply with the latest Washington State Building Code Council regulations for batteries.

Example of a BESS exterior

Example of a BESS interior



Photographs from Puget Sound Energy Glacier Battery Storage Innovation Pilot Project

2.4 Onshore wind energy facilities combined with agricultural land use

One of the facility types considered in this PEIS is a utility-scale onshore wind facility with co-located agricultural land uses. This could include facilities that maintain an existing agricultural use, change an agricultural type, or add new agricultural use developed with the onshore wind energy facility. This could include facilities that maintain an existing agricultural use, change an agricultural type, or add new agricultural use developed with the onshore wind facility. This could include rangeland or farmland. Many existing wind energy facilities in Washington have this type of coexisting land use. Generally, utility-scale onshore wind energy facilities result in permanent disturbance of a very small proportion of the land that the facility occupies and grazing and farming could happen simultaneously with onshore wind energy production.

Example of a wind facility that includes agricultural uses

Photograph from U.S. Fish and Wildlife Service Pacific Southwest Region

Example of a wind facility that includes agricultural uses

Photograph from Puget Sound Energy

2.5 Phases of utility-scale onshore wind energy facilities

Project design and site selection are often done before a developer submits an application and begins the SEPA environmental review process. It is during siting and design that developers can conduct pre-application discussions with agencies, Tribes, and communities to identify project and site-specific issues, and consider the PEIS findings and measures to avoid impacts.

Phases of utility-scale wind facilities analyzed in the PEIS include site characterization to construction, into operations, through decommissioning or repowering at the end of the facility lifespan (Figure 2-6).

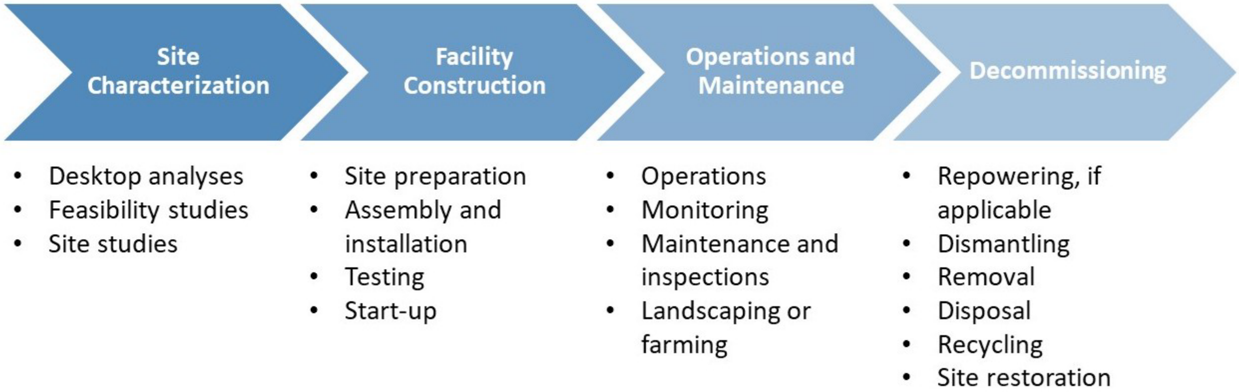


Figure 2-6. Phases of utility-scale wind facilities

2.5.1 Site characterization

It is assumed that developers would conduct desktop analyses and feasibility and site studies for site characterization of potential sites, with agreement from the landowner(s). During site characterization, generally very little modification of a site would occur. Work would include conducting field surveys to gather data on biological, cultural, Tribal, and historical resources. Surveys would need to follow appropriate regulatory requirements and procedures.

Siting considerations typically include wind conditions, physical characteristics of the area, and access to electrical transmission lines. Considerations also include zoning requirements and identification of critical areas. Additional siting considerations are included for each resource in Chapter 4.

The following site characterization activities would involve minimal or no site disturbance:

- Assessment of baseline wind energy available (availability of wind energy)
- Assessment of baseline climatic factors (e.g., wind speed and direction, precipitation type and amount, average snow or ice loads)
- Land survey
- Mapping surface hydrology assessment and floodplain
- Slope evaluation and soil stability studies
- Habitat mapping, including wetland identification
- Water type mapping, including identification of waters used by fish and fish passage barriers
- Species identification (plants and wildlife)
- Due diligence assessment for lands with previous industrial uses
- Evaluation of seismic stability and potential storm event runoff
- Baseline air quality assessment

The following site characterization activities could include ground disturbance:

- Construction of meteorological towers
- Soil sampling
- Cultural resource surveys

2.5.2 Facility construction

The time needed to construct a facility is expected to be between 6 and 24 months. Construction may be done in one phase or may be divided into two phases: a site preparation phase of relatively short duration (e.g., a few months) followed by a followed by a longer assembly, testing, and start-up phase.

Onshore wind turbines would be transported to the site in sections and assembled on site. Vehicles that transport components of a wind turbine, including tower sections and blades, are expected to be considered oversize/overweight by the Washington State Department of Transportation (WSDOT). Transporting these components requires specialized vehicles and carefully selected routes with appropriate turning room and roads and bridges that are constructed to accommodate such loads. Road improvements and associated permits may be required if public or private access roads cannot accommodate transportation of wind turbine components.

General construction activities include the following:

- Finalizing preconstruction surveys or conducting additional surveys
- Marking sensitive areas for avoidance, and installing best management practices (BMPs) and other preventative measures such as erosion and sedimentation control measures
- Establishing site access, constructing internal service roads, and modifying public roads, if needed
- Clearing, grading and constructing temporary staging and laydown areas
- Erecting security fencing and road access gates
- Constructing foundations and pads to support the turbines, including pile driving
- Assembling the towers, blades, and turbine components
- Grading and constructing foundations for buildings, substation, and BESSs
- Constructing building(s), substation, BESS, and other supporting components
- Constructing meteorological towers
- Constructing and connecting the electrical collector lines to the substation
- If BESSs are included in the facility, connecting the BESSs to the collector substation
- Conducting revegetation, including temporary staging and laydown areas

Typical construction equipment includes bulldozers, front-end loaders, graders, portable generators, mobile cranes, pumps, and trucks. Large-scale cranes with a maximum height taller than nacelle height are required to build wind turbines. Large cranes would be erected on the site on crane staging or laydown areas. Some crane components could require oversize/overweight transportation permits and specific routes to accommodate heavy loads. Once constructed, the cranes used on site would be transported along access roads wherever possible, and sometimes via temporary paths if needed to accommodate the required turning room.

Concrete would be used for tower foundations, transformer and substation pads, and buildings. Concrete would either be delivered to the facility via concrete trucks, or aggregate materials necessary to produce concrete would be delivered and concrete would be produced at on-site batch plants.

The number of people employed during the construction phase would vary but is expected to be between 100 and 400 workers for a 150 MW facility. Larger facilities could require up to 2,000 workers. The number of workers on site daily would vary.

2.5.3 Operations and maintenance

Onshore energy facilities would not typically have staff on site on a daily basis but would be monitored remotely 24 hours a day. The number of people needed to operate and maintain the facility would vary based on the facility type but is assumed for the PEIS to be about five to ten people. Activities include controlling turbine operations as needed to meet power deliveries and scheduled turbine maintenance.

There would be periodic maintenance, inspection, and routine testing of a facility. This could include mowing, landscape maintenance, and electrical maintenance, usually at scheduled intervals. Repairs would be done on site as needed for problems or scheduled maintenance. Mowing of vegetation at the site would likely occur a few times a year. Mowing would only occur in limited areas of the site, including around wind turbine foundations, access roads, electrical facilities, and other facility infrastructure. Herbicides may be applied. If the applicant has designed the facility for dual use with agriculture, then planting, harvesting, grazing, or other agricultural operations may occur.

2.5.4 Site decommissioning

An onshore wind energy facility has a useful lifespan, which is expected to be up to 30 years, although this could be longer if turbines are replaced over time. A developer may prepare a decommissioning plan as part of the proposal. Some cities and counties require financial security as part of a decommissioning plan.

Decommissioning activities would be similar to construction, including the equipment required and the number of people employed. Decommissioning actions include dismantling and removing the turbines and other aboveground components such as the collector substation, buildings, BESS, and overhead lines. Foundations may be removed to a level of 3 feet or more below the ground surface, while cables, lines, or conduit that are buried 3 feet below grade or more are not expected to be removed. However, the depth to which facilities and infrastructure would be removed would depend on agreements with landowners and would follow applicable regulatory requirements. Because transformers can include up to 600 gallons of oil, the removal of electrical substations would require inspection for contamination of the soil and decontamination if needed.

The facility site is assumed to be restored, which may include revegetation, to its pre-facility conditions unless the facility owners, permitting authority, and regulatory agencies agree on alternate actions. Service roads may be removed or may remain depending on agreements with the new or existing owner of the land.

When a wind energy facility reaches the end of its design life, repowering may be an option instead of decommissioning. Repowering consists of replacing (partially or totally) the old wind turbines with more powerful and more efficient models using the latest technologies. This may include replacing the turbine blades, rotor, nacelle, and tower or the tower may remain in place with a new nacelle, rotor, and blades added. Repowering is particularly effective on old wind farms, which are usually located where the best wind conditions occur.

2.6 Types of facilities (alternatives) considered for the PEIS

The types of facilities considered in this PEIS described in Table 2-1. After analysis for the small to medium facilities and large facilities was completed, many of the potential impacts were found to be very similar. To simplify the PEIS, Ecology has combined these in the PEIS chapters, but they remain separate in the technical resource reports.

Land requirements of utility-scale onshore wind energy facilities

The ranges of wind energy facility sizes (areas) include the total area inside a perimeter surrounding all the turbines and associated equipment for the facility. However, the spacing between turbines could be very large and the areas actually in use would typically be much smaller than the total area—likely 5% or less of the total site. The rest of the site (95% or more) is typically not developed. For example, some recent projects capable of generating around 150 MW are on sites ranging from 5,000 acres to 40,000 acres; however, the amount of land area in use by the turbines in those projects ranges from 100 to 200 acres.

Table 2-1. Types of facilities (alternatives) considered in the PEIS

Utility-scale onshore wind facilities	
Small to medium facilities	**Large facilities**
Facility size (power-generation capacity)	
10 to 250 MW	251 to 1,500 MW
Facility size (areas)	
340 to 21,250 acres	8,250 to 127,500 acres
5-acre collector substation area	
5,000-square-foot operations and maintenance buildings on up to 2-acre area	
Facility characteristics	
7 to 167 turbines (1.5 MW generation capacity) or 2 to 42 turbines (6.0 MW generation capacity)	168 to 1,000 turbines (1.5 MW generation capacity) or 42 to 250 turbines (6.0 MW generation capacity)
350- to 750-foot-high towers (including blades), with 50- to 70-foot-diameter foundations extending 8 to 40 feet below surface	
Transformers at base of each turbine on pads or in the nacelle	
Up to 10 meteorological towers up to 220 feet fall with 42-foot-square foundations	
Gen-tie lines to existing grid, suspended aboveground with monopole or wooden structures, up to 150 feet tall with typical 200-foot-wide ROW	
Utility-scale facilities with BESSs	
Small, medium, or large facilities	
Plus 1 or 2 BESSs, each capable of storing up to 500 MW	
Each BESS would include multiple containers arranged in geometric rows. Container dimensions and number of BESS units per container vary by manufacturer. Acreage for 200 MW BESSs proposed in Washington typically range from 10 to 20 acres. Acreage for a 500 MW BESS is assumed to range from 25 to almost 50 acres. The analysis in this PEIS assumes the upper end of the acreage range.	
Utility-scale facilities with agricultural uses	
Small, medium, or large facilities	
With agricultural uses such as crops, rangeland, or pollinator habitat	
Facilities could be located on lands with existing agricultural use that could continue, the type of agricultural use could change, or a site without prior agricultural use could add concurrent agriculture	

2.7 No Action Alternative

Under the No Action Alternative, it is assumed the city, county, and state agencies would continue to conduct environmental review and permitting for utility-scale wind energy development under existing state and local laws on a facility-by-facility basis but without the use of the PEIS for reference.

2.8 Alternatives considered but not evaluated in the PEIS

This PEIS focuses on utility-scale onshore wind energy facilities as directed by the Legislature. Ecology is preparing separate PEISs that evaluate utility-scale solar energy facilities and green electrolytic and renewable hydrogen facilities. The following alternatives were considered in screening, but for the reasons listed below were eliminated from further detailed study and are not carried forward in this PEIS:

- **Other types of energy facilities.** Other types of energy facilities, including geothermal facilities or stand-alone utility-scale battery facilities, were suggested in scoping comments. The Legislature, in RCW 43.21C.535,[16] directed that the scope of the PEIS review be limited to specific clean energy types of utility-scale solar, onshore wind, and green electrolytic or renewable hydrogen[17]; therefore, review of other types of clean energy facilities, standalone battery storage, or fossil-fuel energy facilities would not be appropriate as alternatives in this PEIS.
- **Distributed energy generation.** Distributed wind systems are another way that energy is generated in some communities, and scoping comments suggested consideration of smaller facilities with one or two turbines. This method typically generates energy for a specific local use and does not generate the amount of energy needed for utility use, and would not meet the intent of the PEIS to evaluate utility-scale facilities; therefore, they are not considered as an alternative.
- **Specific facility sizes.** Various sizes and ranges of onshore wind facilities were suggested in scoping comments, including different ranges of facility wattages and different areas or configurations for facilities. The types of facilities (alternatives) evaluated in this PEIS were modified to include a range of sizes.
- **Combined wind and solar facilities.** Scoping comments suggested evaluation of a facility type composed of wind and solar facility components on a single combined site. PEISs will provide information on solar and wind facilities separately but the impact analysis and potential mitigation can be used in various configurations by facility developers.
- **Analysis of build-out of all clean energy in Washington.** Scoping comments suggested analysis of all types of clean energy for the total amount of clean energy needed for Washington state to achieve its climate goals. The PEIS is evaluating a single type of energy facility and is not considering all energy types, so this is out of scope.

[16] https://app.leg.wa.gov/RCW/default.aspx?cite=43.21C.535
[17] https://ecology.wa.gov/regulations-permits/sepa/clean-energy/programmatic-eis

3 Scope of Study

The scope of study for utility-scale onshore wind energy development was defined considering areas where facilities could be built (geographic bounds) and the time period in which facilities may be constructed and operational (time scale or temporal bounds).

3.1 Assumptions for determining geographic scope of study

The following assumptions were used to identify areas that may have characteristics suitable for utility-scale onshore wind energy facilities (Figure 3-1). The area shown in Figure 3-1 is the geographic scope of study for this PEIS, where existing conditions and potential environmental impacts were analyzed.

For purposes of the PEIS, the study area for utility-scale onshore wind energy includes areas that meet the following criteria:

Wind speed: Areas with average annual wind speeds of 11 mph (5 m/s) at 80 meters high (Adequate wind speed at the appropriate height above the ground surface for a facility's turbines is required for turbines to generate electricity.)

Transmission line access: Areas within 25 miles of existing transmission lines that can handle the energy generation of utility-scale facilities (230 kV or greater lines)[18]

Existing utility-scale development areas: An area in eastern Washington with existing utility-scale onshore wind facilities that does not meet the criteria above was included in the study area because the area has sufficient wind energy availability and other potentially favorable characteristics for utility-scale developments.

The geographic study area is broader than where facilities are being built now. This is because new technologies could allow development of wind energy facilities in areas not considered before. The geographic study area identifies different levels of annual average wind speeds to provide context, but all shaded areas in Figure 3-1 are included in the study area.

The study area excluded the following areas:

- Tribal reservation and trust lands
- Military installations
- DOE Hanford Site[19]

[18] Restricting the study area to areas within 25 miles of a 230 kV or greater transmission line would exclude an area of Eastern Washington that already includes several substantial utility-scale facilities, sufficient wind energy availability, and other potentially favorable characteristics for utility-scale developments. Therefore, an exception to the 25-mile distance was made to include this area.

[19] DOE has identified a small area of land at the Hanford Site as available for lease to develop utility-scale carbon pollution-free electricity facilities. This area is included in the study area, but the rest of the Hanford Site is excluded.

- National parks, wilderness areas, and wildlife refuges
- Washington state parks
- Unincorporated areas zoned as urban or residential, areas inside city limits, and unincorporated urban growth areas (UGAs)[20]

The decision regarding where to site a utility-scale onshore wind energy facility would be determined by future facility developers based on their needs and could result in facilities being sited anywhere in Washington with agreement from the landowner or manager. Utility-scale wind energy facilities could be built on lands owned or managed by private, city, county, state, or federal entities. In all cases, developers would need to work directly with the landowner(s) or land manager(s) for individual facilities.

The PEIS does not approve, authorize, limit, or exclude facilities on a site-specific basis.

3.2 Assumptions for determining the time scale of study

The PEIS considers utility-scale onshore wind energy facilities that may be constructed after June 30, 2025, and before January 1, 2045. The Clean Energy Transformation Act (CETA) requires all Washington's electric utilities to meet 100% of their retail electric load using non-emitting and renewable resources by 2045. For the PEIS, a wind energy facility is expected to have an operational life of up to 30 years, at which time the developments are expected to be decommissioned. A facility may be repowered after decommissioning, which would consist of replacing the aging wind turbines or components and replacing them with newer turbines or components at the facility site.

An approximate 50-year time period (July 2025 through June 2075) is used for resource analyses. This includes when developments are likely to be constructed and operational.

[20] Under the Growth Management Act (GMA), counties identify UGAs where "urban growth shall be encouraged and outside of which growth can occur only if it is not urban in nature" (RCW 36.70A.110) in consultation with cities in the county. UGAs include both unincorporated areas and areas within existing city boundaries and are intended to accommodate the projected population growth of cities and counties over the subsequent 20-year period.

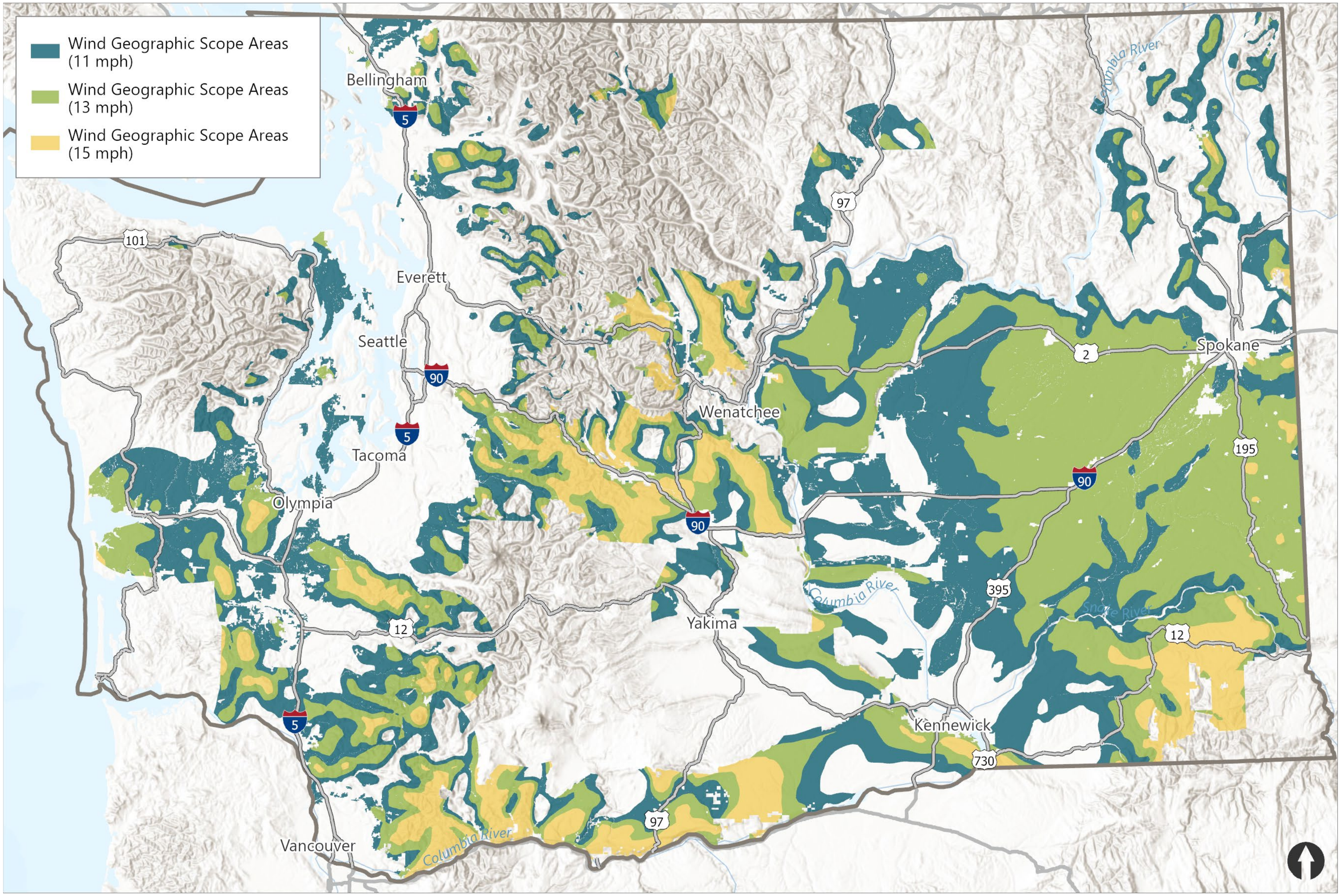


Figure 3-1. Geographic scope of study for utility-scale wind PEIS

Note: The geographic scope of study includes all areas with wind speeds depicted. Areas with annual average wind speed of 13 mph or greater and 15 mph or greater at 80 meters above the surface are also shown to provide additional context for consideration of wind energy availability.

4 Affected Environment, Potential Impacts, and Mitigation

This chapter summarizes the affected environment, impacts, and actions that could avoid or reduce impacts for each resource considered. The following paragraphs summarize the general approach that was used for the analysis in this chapter and the attached reports. Key terms are highlighted and explained below.

The **affected environment** is the existing condition within the study area for each resource. The **study area**—or the area of focused analysis—is defined in Chapter 3. For some resources, additional areas adjacent to the study area were also considered to determine the impacts on the resource within a larger community or landscape. Because this programmatic review considers a large study area, and because specific locations for facilities are not known, descriptions of the affected environment within the study area for this PEIS are broad and qualitative.

Impacts are the effects or consequences of actions. This chapter discusses potential impacts that site characterization, construction, operation, and decommissioning of utility-scale wind facilities may have on resources. The chapter also considers the potential impacts of the No Action Alternative.

The PEIS focuses on significant adverse environmental impacts, with some information provided on less severe impacts. "Adverse" means an impact would have a negative change in the condition of the resource. Determining if an impact is "significant" involves consideration of both the intensity of the impact (magnitude and duration) and the context of the impact, which can vary with the setting and existing conditions for a particular resource. This programmatic analysis considers potential environmental effects over a broad geographic and time horizon. As a result, it is fairly general and focuses on probable significant impacts in a qualitative manner, often characterizing a range of probable impacts. Where there is overlap between resource areas, the related section is noted.

This chapter also identifies **actions that could avoid or reduce impacts**, often called mitigation measures. **Mitigation** is the avoidance, minimization, rectification, compensation, reduction, or elimination of adverse impacts on built and natural elements of the environment. Mitigation may also involve monitoring and a contingency plan for correcting problems if they occur. The PEIS evaluates types of mitigation actions developers could use to address the probable impacts. Some mitigation measures would need more details specific to each facility design and site location. Developers can use the mitigation in this PEIS to develop mitigation plans for potential impacts.

To identify probable significant adverse environmental impacts, the potential adverse environmental impacts of the different types of facilities were first evaluated at a broad level. Mitigation measures required by existing environmental laws and rules were then considered. Next, mitigation measures typically provided by permit conditions, required plans (e.g., Temporary Erosion and Sediment Control Plans, SPCC Plans), and standard BMPs that would avoid and reduce impacts were considered. The latter types of mitigation measures are listed in the PEIS technical appendices for each resource under the category "permits, plans, and BMPs." If these actions were sufficient to reduce impacts to levels below significance, they were identified as **less than significant impacts**.

Where these mitigation measures are not sufficient to reduce impacts below a level of significance, those impacts were identified as **potentially significant adverse impacts**. Two categories of mitigation measures could potentially mitigate significant adverse impacts to a non-significant level. These are listed in the PEIS as:

- **Siting and design considerations:** Provided for all environmental resources to help all facilities avoid and reduce environmental impacts
- **Additional mitigation measures to address potentially significant impacts:** Provided specifically to address potential significant impacts only for environmental resources for which potential significant impacts have been identified

Even with these mitigation measures, in some cases, some significant impacts would still not be able to be mitigated to a non-significant level. These impacts are identified in this PEIS as potentially **unavoidable significant adverse impacts**.

Avoiding and reducing impacts

When developing proposals, developers should seek to avoid or minimize impacts through thoughtful siting and design. Each resource report includes a list of siting and design considerations which can help avoid impacts. **Refer to the technical appendices for detailed actions to avoid and reduce impacts.**

If significant impacts are likely, site-specific mitigation actions would be developed during project-specific reviews to be included in permit applications. These include plans and BMPs. BMPs are activities, maintenance procedures, managerial practices, or structural features that prevent or reduce pollutants or other adverse impacts. These may be required in permits or plans by a regulatory agency.

RCW 43.21C.538 says utility-scale wind energy project proposals following the recommendations developed in the PEIS must be considered to have mitigated the probable significant adverse project-specific environmental impacts for which recommendations were specifically developed, unless the project-level environmental review identifies project-level probable significant adverse environmental impacts not addressed in the PEIS.

The analysis of each resource was based on incorporation of the best available science and information, including:

- Studies, modeling, reports, and regulatory findings relevant to the study area
- Information received through the scoping process (see Appendix A)
- Information received from Tribes and interested parties (see Chapter 6)
- Expertise of state agency staff relevant to specific resources

Appendices B through P contain **technical resource reports** with more detailed information and specific analyses. The sections in this chapter are intended to be a summary and reference to the corresponding report(s). The resource reports are the official technical documentation for this PEIS.

Separate from the effects considered in the sections of this chapter, **cumulative impacts** are effects that would result from the incremental addition of effects of a facility to the impacts from past, present, and reasonably foreseeable future actions (RFFAs). These effects are summarized in Chapter 5 to determine whether cumulative impacts could result from incremental, but collectively significant, effects that occur over time with other actions. Full details can be found in the *Cumulative Impacts Report* (Appendix Q).

4.1 Tribal rights, interests, and resources

Key findings

The significance of impacts to Tribal rights, interests, and resources can only be understood from within the cultural context of an affected Tribe. This will depend on the project and the federally recognized Tribes potentially affected. Accordingly, the impact assessment and determinations of significance or non-significance would be done with engagement and in consultation with potentially affected Tribes at the project level.

Tribes are recognized as unique sovereign people that exercise self-government rights that are guaranteed under treaties and federal laws. Tribal rights, interests, and resources refer to the collective rights and access to traditional areas and times for gathering resources associated with an Indian Tribe's sovereignty since time immemorial. They include inherent rights or formal treaty rights associated with usual and accustomed territories. Tribal resources include Tribal cultural lands, archaeological sites, sacred sites, fisheries, and other rights and interests in Tribal lands and lands within which a Tribe or Tribes possess rights reserved or protected by federal treaty, statute, or executive order. Resources include plants, wildlife, or fish used for commercial, subsistence, and ceremonial purposes.

The analysis of impacts to Tribal rights, interests, and resources is different than for the impact analysis for environmental resources. Natural and built resources were analyzed in other resource reports to determine whether wind energy facilities could have significant impacts from a non-Tribal perspective and whether those impacts could be mitigated. For impacts to Tribal rights, interests, and resources, any determinations of significance or non-significance would be done with engagement and in consultation with each potentially affected Tribe at the project level. This would be done through the SEPA process or the federal Section 106 process.

The *Tribal Rights, Interests, and Resources Report* (Appendix O) includes the full analysis and technical details used to evaluate Tribal resources in this Programmatic Environmental Impact Statement (PEIS). This section contains a summary of the affected environment, how impacts were analyzed, and the key findings. This section uses information from the other resource sections later in this PEIS. Refer to other resource sections for additional information and impact analysis.

4.1.1 Affected environment

The range of resources considered for the affected environment includes biological resources, cultural and historic resources, water resources, recreation resources, environmental health and safety (EHS), noise and vibration, aesthetics and visual quality, transportation, air quality, and cumulative resources.

Historic and cultural resources are analyzed in Section 4.13 of this PEIS. This section focuses on cultural resources associated with Tribes. These include archaeological sites and objects and historic sites and structures, representing people, events, and trends significant to the history of affected Tribes. These include ceremonial sites, sacred sites, places of funerary activity, and Traditional Cultural Properties (TCPs).

Many archaeological and ethnographic studies have been conducted in the study area and have inventoried archaeological sites and TCPs. This information may be public, but it may be sensitive information protected under state law. The Washington State Department of Archaeological and Historic Preservation's (DAHP's) predictive model classifies areas with different levels of risk of containing archaeological sites. However, only about 5% of the state has actually been surveyed for cultural resources. Therefore, it should not be assumed that a site has been intensively surveyed. Existing surveys may not account for all cultural resources that may be present within a particular area. Projects will need their own surveys for a specific site.

Natural resources of interest to Tribes include but are not limited to plants, animals, water, and natural settings. Built resources include transportation, noise, and visual quality. Resources can be used for food, medicine, recreation, or spiritual purposes. Areas important to traditional cultural practices and the resources associated with those practices include waterways, trails, plants, wildlife, or fish used for commercial, subsistence, and ceremonial purposes. Natural resources may also include landforms that have an important role in oral histories or use of the landscape.

Culturally significant plants are often used for medicine, food, clothing, basketry, structures, and aesthetic or ritual purposes. Plants and animals within the study area provide important subsistence and medicinal resources. Water plays an important role in the histories and oral traditions of Tribes. Tribal rights include recreation and access to traditional hunting, fishing, or gathering areas, or to areas where other traditional practices occur.

4.1.2 How impacts were analyzed

The significance of resources only be understood from within the cultural context of an affected Tribe. The impact assessment considered comments provided by Tribes for early drafts of the *Tribal Rights, Interests, and Resources Report* (Appendix O) and the Final PEIS will consider comments provided on the Draft PEIS. Specific project impacts and determinations of significance or non-significance will be determined with engagement and in consultation with each potentially affected Tribe at the project level.

The analysis of impacts on Tribal resources considered the following:

- Impacts on plant and animal species used by Tribal members, including loss or modification of habitats, fragmentation of migration corridors, and loss of medicinal and traditional plants and foods
- Loss of access to traditional hunting, fishing, or gathering areas, to an area where other traditional practices occur, and recreation areas
- Impacts to TCPs, historical sites, areas of recreational use, and archaeological sites and objects
- Interruption of spiritual practices
- Changes in transportation routes that may interfere with access to culturally significant resources, health and safety, or economic activity
- Disruption and degradation of the health and mental wellbeing of Tribal members

4.1.3 Findings for all onshore wind facility types evaluated in the PEIS

4.1.3.1 Impacts

Impacts from construction and decommissioning

Most site characterization activities would involve little or no ground disturbance. However, some ground-disturbing activities, such as drilling deep soil cores and building access roads, could result in impacts on historic and cultural resources.

Activities that could impact Tribal resources during construction and decommissioning include ground disturbance, restricted access, and degradation of visual quality. Other activities could cause noise and interruption of the landscape, habitats, and species. Tribal spiritual practices could be interrupted by construction impacts to land areas and cultural or sacred sites. Access to traditional gathering areas for medicinal and traditional plants and foods could be restricted during construction or permanently lost. Impacts to archaeological sites, sacred sites, TCPs, burials, and specific habitats for culturally important species could result from clearing, grading, and excavation. These could also be affected from construction or decommissioning of facilities and associated infrastructure.

Potential impacts on habitats and species include alteration of species migration routes, loss of biodiversity, and habitat fragmentation. Construction and decommissioning could have impacts to plants and changes in water chemistry and soil compaction. Mortality of species and changes to habitats could impact wildlife and plants important to Tribes. These impacts could disrupt traditional subsistence practices. Access to treaty-reserved fishing areas and food harvesting areas may be limited during construction. Construction could impact terrestrial wildlife associated with Tribal use and could interrupt hunting and other cultural practices.

Noise, aesthetics, and air quality impacts from constructing facilities and associated land disturbances may degrade settings associated with cultural resources and sacred landscapes. Increases of human access and disturbance of resources important to Tribes could result from the establishment of corridors or facilities in otherwise intact and inaccessible areas.

Ground disturbance may emit dust and result in erosion with potential to impact cultural and natural resources. Vehicle and equipment traffic has the potential to introduce invasive species to the area, and removal of infrastructure and site restoration could lead to increases in noise and visual disturbance. Decommissioning activities could also disturb or cause the mortality of species.

Newly disturbed ground could create a visual contrast that could persist for several seasons before vegetation could begin to mature and restore the pre-facility visual landscape. For decommissioning, restoration of vegetation to pre-facility conditions may take much longer, along with the return of species and functioning habitats. Invasive species may colonize newly and recently reclaimed areas and could produce visual contrasts.

Impacts associated with onshore wind facility repowering may include some of those associated with facility construction, including redeveloping access routes and disturbance in areas of construction and staging, and would include a longer period of ongoing operations.

Impacts from operation
Ongoing operations and maintenance are not anticipated to include ground disturbance because the use of vehicles and equipment would generally be limited to access roads and facility areas developed during construction. Erosion, compaction, trampling, or exposure of Tribal resources could occur due to vehicles, equipment, workers, ongoing maintenance activities, and vegetation management or co-located agricultural activities, such as livestock grazing or farming. Ongoing ground disturbance could reveal previously unknown resources, such as archaeological sites.

Impacts that degrade fisheries, affect migration patterns of species, and reduce biodiversity and impacts to ecological communities from long-term vegetation management may impact Tribal resources. Air quality impacts from vehicle and dust emissions, ongoing noise and visual impacts, and facility fencing or other access restrictions may continue to impact Tribal rights and resources, including hunting. Facility security and fencing could restrict access to areas used for resource gathering, hunting, fishing, and cultural and spiritual practices.

4.1.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale wind facilities. See Appendix O, *Tribal Rights, Interests, and Resources Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Contact potentially affected Tribes early in the siting process, ideally before land is acquired for a project or before permit applications are developed and offer information relevant to Tribal technical staff to help identify potential impacts to Tribes.
- Include Tribal treaty-reserved rights, Tribal reservations, off-reservation rights, trust lands, other Tribal-owned land, and other areas of significance to Tribes in consideration of potential impacts and mitigation.
- Consider requiring a Tribal monitor for each potentially affected Tribe on archaeological survey crews to provide input on TCPs, sacred sites, and culturally significant sites.
- Design and site projects to avoid, to the maximum extent, impacts to Tribal interests, treaty rights, and resources.
- Tribal preferred aesthetic or visual quality mitigation practices may vary from those considered for other visual quality mitigation; consult with potentially affected Tribes on any aesthetic or visual quality mitigation practices.
- Consider maintaining open Tribal access routes and aligning construction, operations, and decommissioning to avoid disrupting Tribal access to sites and resources.
- Additional actions to be determined after engagement and consultation with Tribes.

4.1.4 Findings for the No Action Alternative

Facilities developed under the No Action Alternative would be subject to the same regulatory standards as those noted for the types of facilities considered in this PEIS. It is expected there would be similar types of impacts on Tribal rights, interest, and resources from site characterization, construction, operation, decommissioning, and repowering activities for onshore wind facilities under the No Action Alternative.

4.2 Environmental justice and overburdened communities

Key findings

Onshore wind energy development could have **disproportionate impacts** on historic and cultural resources and Tribes and Tribal communities. The impact assessment and determinations of significance or non-significance would be determined through engagement and consultation with potentially affected Tribes and DAHP at the project level.

If an onshore wind facility requires a conversion of natural resource lands of long-term commercial significance or conflicts with the rural character of an area containing a population of people of color or low-income population, this **would potentially result in a significant and unavoidable disproportionate impact**.

Depending on site location and facility design, long-term changes or reductions in visual quality **would also potentially result in a significant and unavoidable disproportionate impact** on people of color populations or low-income populations if located near the facilities.

Impacts associated with increased wildfire risk or impacts to fire response capacity **would also potentially result in a significant and unavoidable disproportionate impact** on people of color populations or low-income populations.

RCW 70A.02.010(8) defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, rules, and policies." The *Environmental Justice Resource Report* (Appendix G) includes the full analysis and technical details used to evaluate whether potential impacts in this PEIS disproportionately affect people of color populations and low-income populations. The report also identifies where overburdened community areas are located in the study area. This section contains a summary of the affected environment, how impacts were analyzed, and the key findings. This section uses information from the other resource sections in this PEIS. Refer to other resource sections for additional information and impact analysis.

4.2.1 Affected environment

Census Bureau 2018–2022 ACS data were used to determine census tracts containing people of color populations and low-income populations that overlap the study area. People of color were defined as all people who identify in the census as a race other than white alone and/or list their ethnicity as Hispanic or Latino. Of the 359 census tracts that overlap the study area, 47 (or 13%) contain a people of color population. Low-income populations were defined as those households with an income at or below twice the federal poverty level. Of the census tracts that overlap the study area, 191 (or 53%) contain a low-income population.

The census tracts overlapping the study area were also evaluated for whether or not they meet the criteria to be considered in an overburdened community area. An "overburdened community" is "a geographic area where vulnerable populations face combined, multiple environmental harms and health impacts, and includes, but is not limited to, highly impacted communities" (RCW 19.405.020). Of the census tracts that overlap the study area, 28% were identified as an overburdened community area. Overburdened community areas identified in the study area are primarily rural areas.

4.2.2 How impacts were analyzed

The determinations of potential impacts and potential mitigation measures were reviewed for each element of the environment analyzed in the PEIS for each type of facility. Only resource areas with impacts that could affect people are analyzed further. Potential impacts that are less than significant are not anticipated to result in disproportionately adverse effects on-people of color populations or low-income populations and are not discussed further in this section.

Potentially significant adverse environmental impacts were overlaid with census tracts containing people of color populations and low-income populations. This was used to determine the relative type and severity of effects and the potential for environmental impacts to disproportionately affect those populations.

4.2.3 Findings for utility-scale onshore wind facilities

Onshore wind energy development could have **disproportionate impacts** on historic and cultural resources and on Tribal rights, interests, and resources. The level of impact to these resources can only be understood from within the cultural context of an affected Tribe. Accordingly, the impact assessment and determinations of significance or non-significance would be done with engagement and in consultation with potentially affected Tribes and DAHP at the project level. For this reason, the impacts are not discussed further in this section. For more information on these resources, see the *Historic and Cultural Resources Report* (Appendix L) and the *Tribal Rights, Interests, and Resources Report* (Appendix O).

4.2.3.1 Impacts

Impacts from construction and decommissioning

Land use

Construction and decommissioning of facilities has the potential to result in impacts such as increased dust, noise, traffic, and visual changes that could affect nearby land uses and people. People most likely to be affected by these impacts are those living in nearby areas or those whose work requires them to be near the construction area for long periods. The impacts of converting property to a utility-scale onshore wind facility would depend on the existing use of the site. The siting of facilities could result in the long-term and permanent conversion of land uses, which would be a potentially significant adverse land use impact if natural resource lands of long-term commercial significance are converted.

Findings
If natural resource lands of long-term commercial significance are converted, this would be a potentially significant adverse impact on land use. If a facility is located near people of color populations or low-income populations, this **would potentially result in disproportionate impacts** on these populations

Aesthetics/visual quality
Construction and decommissioning of facilities would involve a range of activities associated with potential visual impacts. Depending on the location and size of facility sites and visual characteristics of the construction activities, visual quality impacts would range from less than significant to potentially significant adverse impacts.

Findings
If construction or decommissioning of a facility results in significant adverse impacts on visual quality and is located near people of color populations or low-income populations, this **would potentially result in disproportionate impacts** on these populations.

Public services and utilities and environmental health and safety
Depending on the specific location, severity, and fire response capacity, there is a potential that construction or decommissioning would have potentially significant adverse impacts due to an increased risk of a wildfire. A facility would result in potentially significant adverse impacts to fire response if activities required a large fire response in remote locations with limited response capabilities or if there are other unique aspects of a facility site.

Depending on turbine recycling facilities, recycling methods available at the time of decommissioning, and the volume of waste, there could be a range of less than significant to potentially significant adverse impacts on solid waste and recycling if there are large volumes of solid waste.

Findings
If construction or decommissioning of a facility results in significant adverse impacts of increased wildfire risk or impacts to fire response capacity and is located near people of color populations or low-income populations, this **would potentially result in disproportionate impacts** on these populations.

With the implementation of siting and design considerations, BMPs, and mitigation measures, impacts associated with solid waste and recycling are expected to be less than significant and would **not result in disproportionate impacts on people of color populations or low-income populations.**

Other resource areas
Potentially significant adverse environmental impacts that could affect people during

construction and decommissioning were identified for noise and vibration and recreation. These include increased noise and loss of recreational opportunities.

Findings
With the implementation of siting and design considerations, BMPs, and mitigation measures, construction and decommissioning impacts to other resources are expected to be less than significant and **would not result in disproportionate impacts** on people of color populations or low-income populations.

Impacts from operation

Land use

As described for construction, the operation of onshore wind facilities would result in the conversion of land uses to utility-related uses for the life of the facilities. Many of the census tracts overlapping the study area that have people of color populations and low-income populations identified are also rural communities. For facilities located in rural areas, there is also the potential to result in change to the rural character of the surrounding area and/or perceptions of the rural character.

Findings
Changes to rural character resulting from operation of a new utility-scale energy facility would range from less than significant impacts to potentially significant adverse impacts depending on whether plans and development regulations are in place to protect rural character and how they consider utility-scale onshore wind facilities. If a facility is located near people of color populations or low-income populations, this **would potentially result in disproportionate impacts on these populations**

Aesthetics/visual quality

The operation of onshore wind facilities and associated transmission lines, roads, and rights-of-way would have potentially significant long-term visual impacts. Depending on the facility size range and the nature of the facility structures, visual quality impacts would result in a range from less than significant impacts to potentially significant-adverse impacts.

Findings
If operation of a facility results in significant adverse impacts on visual quality and is sited near people of color populations or low-income populations, **operations would potentially result in disproportionate impacts** on these populations.

Public services and utilities and environmental health and safety

There is a potential that facility operation would have potentially significant adverse impacts related to wildfire risk. A facility would result in potentially significant adverse impacts to fire response if activities required a large fire response in remote locations with limited response capabilities or if there are other unique aspects of a facility site.

Findings
If operation of a facility results in significant adverse impacts of wildfire risk or impacts to fire response capacity and is located near people of color populations or low-income populations, this **would potentially result in disproportionate impacts** on these populations.

Other resource areas
Potentially significant adverse environmental impacts that could affect people were identified for noise and vibration and recreation. These include increased noise and loss of recreational opportunities.

Findings
With the implementation of siting and design considerations, BMPs, and mitigation measures, impacts from operation on noise and vibration and recreation are expected to be less than significant and **would not result in disproportionate impacts** on people of color populations or low-income populations.

4.2.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale onshore wind facilities.

Siting and design considerations
The following siting and design considerations could be used to reduce impacts on people of color populations and low-income populations:

- Design and site projects to avoid, to the extent practicable, adverse impacts on populations with environmental justice considerations and overburdened community areas.
    - Use available information and mapping tools.
    - Use the latest Washington State guidance to identify communities of color, low-income communities, and overburdened communities potentially affected by a proposed project.
- Engage potentially affected communities early in the process to understand their concerns and issues, identify potential impacts, and consider preferred mitigation options.

Additional mitigation measures
Additional mitigation measures developers may consider could include, but are not limited to, the following:

- Develop and implement public information sharing to provide technical and environmental health information directly to potentially affected populations, overburdened communities, local agencies, and representative groups.
    - Include information on potential impacts and mitigation proposed.

    - Engage with communities on how they prefer to receive information and tailor communications to provide this.
    - Use a variety of media tailored to affected communities, such as local print, online publications, and radio.
- Develop Community Benefit Agreements in coordination with potentially affected communities to address impacts through mutually agreed upon mitigation, if possible.
- Consider economic actions that communities may consider mitigation, such as the following:
    - Develop workforce development opportunities.
    - Provide opportunities for training, apprenticeships, and high-quality jobs.
    - Include labor standards, workforce agreements, and local hiring provisions.

4.2.4 Findings for facilities with co-located battery energy storage systems

4.2.4.1 Impacts

Impacts from construction, operation, and decommissioning

Land Use

Impacts from facilities with co-located battery energy storage systems (BESSs) would be generally the same as for facilities without a BESS. The addition of battery storage could generate a small amount of additional traffic during construction and decommissioning. The addition of battery storage could be perceived as added industrial-type facilities resulting in a greater change in rural character than for facilities without BESSs.

Findings

Impacts on land use would be similar to findings for utility-scale onshore wind facilities above. If a facility is sited near people of color or low-income populations, this **would potentially result in disproportionate impacts on these populations**

Aesthetics/visual quality

Impacts from facilities with co-located BESS would be generally the same as for facilities without a BESS.

Findings

Depending on facility size range and the nature of facility structures, visual quality impacts would be significant and adverse. If a facility is sited near people of color or low-income populations, this **would potentially result in disproportionate impacts** on these populations.

Public services and utilities and environmental health and safety

Impacts from facilities with co-located BESSs would be generally the same as for facilities without a BESS; however, the BESSs present additional risks to emergency responders.

Findings
Impacts on public services and utilities or EHS would be similar to findings for utility-scale onshore wind facilities above. If a facility is sited near people of color or low-income populations, this **would potentially result in disproportionate impacts** on these populations.

Other resource areas
Construction, operations, and decommissioning impacts on noise and vibration and recreation for facilities with co-located BESSs would be similar to facilities without a BESS, with additional BESS operation noise. Additionally, a thermal runaway event due to damage or battery management system failure at a facility with a co-located lithium-ion BESS would have additional risks to emergency responders related to hazardous air emission risks.

Findings
These effects would be potentially significant adverse impacts. With the implementation of siting and design considerations, BMPs, and mitigation measures, impacts to these other resources are expected to be less than significant and **would not result in disproportionate impacts** on people of color populations or low-income populations**.**

4.2.4.2 Actions to avoid and reduce impacts

The actions to minimize, reduce, and/or mitigate impacts for facilities with co-located BESS would be the same as those in Section 4.2.3.2.

4.2.5 Findings for facilities combined with agricultural land use

4.2.5.1 Impacts

Impacts from construction, operation, and decommissioning
Impacts for facilities co-located with agricultural uses would generally be the same as facilities without, but with some differences, including access limitations due to fencing.

Findings
If construction of a facility is near people of color or low-income populations, land use, aesthetics and visual quality, public services and utilities, and EHS would potentially result in **disproportionate impacts** on these populations.

Construction, operations, and decommissioning impacts on noise and vibration and recreation for facilities combined with agricultural land use would be similar to facilities without, but with some differences, including restrictions to recreation and seasonal noise.

Findings

With the implementation of siting and design considerations, BMPs, and mitigation measures, impacts to these other resources are expected to be less than significant and **would not result in disproportionate impacts** on people of color populations or low-income populations**.**

4.2.5.2 Actions to avoid and reduce impacts

The actions to minimize, reduce, and/or mitigate impacts for facilities with co-located BESS would be the same as those in Section 4.2.3.2.

4.2.6 Findings for the No Action Alternative

Under the No Action Alternative, local, state, and federal agencies would continue to conduct environmental review, land use review and approval, and permitting for onshore wind energy development under existing state and local laws on a project-by-project basis. Onshore wind energy development could have **disproportionate impacts** on historic and cultural resources and Tribes and Tribal communities. Some onshore wind energy facilities could have significant adverse impacts on land use, aesthetics and visual quality, public services and utilities, and EHS. Project-specific mitigation measures may not be sufficient to avoid or reduce impacts to less than significant. The No Action Alternative **would potentially result in disproportionate impacts** on people of color populations and low-income populations.

4.2.7 Unavoidable significant adverse impacts

4.2.7.1 Tribal rights, interests, and resources and historic and cultural resources

Onshore wind energy development could have **disproportionate impacts** on historic and cultural resources, Tribes, and Tribal communities. The impact assessment and determinations of significance or non-significance would be done with engagement and in consultation with potentially affected Tribes and DAHP at the project level.

4.2.7.2 Land use

The siting and operation of onshore wind facilities would result in the conversion of existing land uses and/or designated future land uses to utility-related uses at the onshore wind sites for the life of the facilities. The impacts of converting property to an onshore wind facility would depend on the existing use(s) of the site, particularly on lands currently zoned and used for rural residential or designated as natural resource lands (agriculture, forestry, or mining).

Substantial changes to rural character and land use may be unavoidable for facilities located in rural areas. The impact on people of color populations and low-income populations would be determined at the project level. If a facility required a conversion of natural resource lands of long-term commercial significance depending on local plans and development regulations, or if it resulted in changes to rural character in an area containing a population of people of color or low-income population, this **would potentially result in a significant and unavoidable disproportionate impact**.

4.2.7.3 Aesthetics/visual quality

Medium- or large-sized facilities may have a long-term change or reduction in visual quality, even with mitigation measures. If these impacts occur in an area with a population of people of color or low-income population, this **would potentially result in a significant and unavoidable disproportionate impact** on these populations.

4.2.7.4 Public services and utilities and environmental health and safety

Impacts associated with wildfire risk may be potentially significant and unavoidable. A facility would result in potentially significant adverse impacts to fire response if activities required a large fire response in remote locations with limited response capabilities or if there are other unique aspects of a facility site. Depending on the specific location, severity, and fire response capacity, there is a potential for potentially significant adverse impacts due an increased risk of a wildfire. If a facility is located near people of color populations or low-income populations, this **would potentially result in significant and unavoidable disproportionate impacts** on these populations.

4.3 Earth

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on earth resources (soil resources and geologic hazards).

No significant and unavoidable adverse impacts related to earth resources would occur.

This section evaluates geologic resources and geologic hazards, referred to as "earth" in the PEIS. The *Earth Resource Report* (Appendix B) includes the full analysis and technical details used to evaluate earth resources in this PEIS.

4.3.1 Affected environment

4.3.1.1 Geography and topography

The study area is within several varying regional environment types, each with unique ecological conditions. Western Washington includes the Olympic Peninsula, the Puget Sound lowlands and mountains to the north, and the Willapa Hills and Coast Range Mountains to the south. These areas receive heavy annual precipitation and generally moderate temperatures, except the Olympic Mountain Range, which rises in elevation to almost 8,000 feet and receives significant, frequent snowfall in the fall through spring months. Central Washington is composed of the Cascade Mountain range, which is characterized by higher levels of precipitation on the western side and decreasing amounts of precipitation and vegetation density on the eastern side. Eastern Washington includes the Columbia River basin and plateau, the Blue Mountains in the south, and the Okanogan region in the north, which are generally higher in elevation and more arid. The northern half of the state is also characterized by historic glacial activity.

4.3.1.2 Geology and seismicity

Geology is the study of the earth, the materials that make it up, their structure, and the processes that act upon them such as earthquakes, landslides, and erosion. Washington's geologic history is characterized by continental tectonic forces, volcanic activity, uplift, and glaciation. In central and eastern Washington, the Missoula floods caused massive flooding events that created geologic features in the Columbia River drainage basin such as scablands. The Palouse region is also notable for its undulating landscape made of windblown silt, which is rich in nutrients and important for agriculture in the region. The state's geology and effects of seismicity are highly variable between parts of the state and are largely affected by the Cascadia Subduction Zone (CSZ), the boundary of the Juan-de-Fuca plate and the North American Plate off the west coast.

There are several dense fault complexes throughout the state. The CSZ as well as several other fault systems in western Washington are capable of producing high-magnitude earthquakes and tsunamis. Central, southern, and southeastern parts of the state are also seismically active. Categories of surface geology in Washington and the study area are included in Figure 4-1.

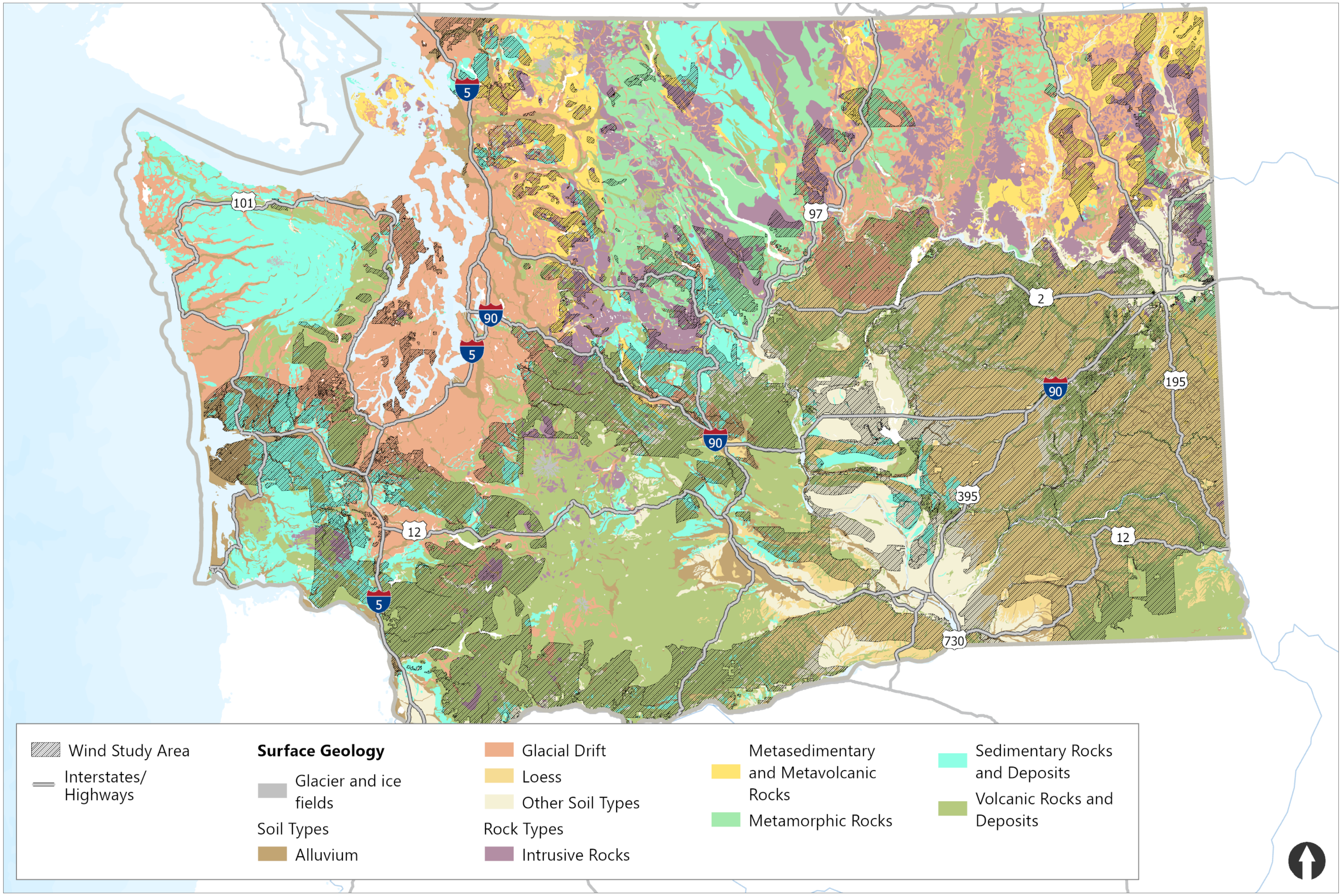


Figure 4-1. Surface geology categories

4.3.1.3 Surface soils

The formation of soil is a long-term, complex interaction between climate, topography, ecology, and other attributes of a given area. The study area encompasses several regions of the state that contain sensitive soil structures that play an important role in local ecology and if disturbed, can take long periods to recover. The onshore wind study area contains agricultural and forested land types with unique soil attributes that may be federally protected. Studies to identify soil types on a site are expected to be done in researching project sites and during site characterization.

Exposed soils in central and eastern Washington, where it is characteristically dry and windy, lead to loss of soil and impacts to air quality, including from large dust storms that occur generally from spring through fall (see Section 4.4 for additional information on air quality).

4.3.1.4 Geologic hazards

Many regions in the study area are at risk from the following geologic hazards:

- **Fault ruptures** are a physical separation of opposite sides of a fault, which can cause damage to infrastructure.
- **Tsunamis and seiches** are waves caused by rapid displacement of water, generally resulting from seismic events; tsunamis occur in the ocean and seiches occur in contained bodies of water. The study area does not contain any tsunami inundation zones, and there are few areas adjacent to waterbodies where seiches would have an effect.
- **Liquefaction** is an event where water-saturated sediment temporarily loses strength and acts like a fluid. Earthquake hazard maps from the Washington State Department of Natural Resources (DNR) can be used to identify geologically sensitive areas, though areas susceptible to liquefaction may not be sufficiently identified.
- **Volcanic areas** in Washington include Mt. Saint Helens, Glacier Peak, Mt. Rainier, Mt. Adams, and Mt. Baker. Though the onshore wind study area does not include all these areas, effects from an eruption could reach far beyond these areas. Effects could include airborne ash, flows and slides such as lahars, debris flows, lava, and pyroclastic flows.
- **Landslides** are the movement of a mass of rock, debris, or earth down a slope. Landslides can be natural or human-caused, and nature and various ecological factors contribute to an area’s susceptibility. Generally, landslides are associated with areas containing slopes greater than 20%. Mapped landslide features are numerous in the study area.

4.3.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

Impacts to soil resources

- The potential impacts caused by direct ground disturbance associated with soil or rock excavation or grading
- The potential impacts caused by construction materials (such as quarried rock, sand, and general fill)

- The potential for soil erosion to be affected by ground-disturbing activities, changes in drainage patterns, or addition of impervious surfaces
- The potential for slope instability from ground-disturbing activities, underground construction, or other activities that could increase local susceptibility to certain geologic hazards
- The potential for subsidence from activities related to tapping, withdrawal, or disturbance of groundwater reserves

Impacts from geologic hazards

- The potential for a site to be affected by naturally occurring geologic or seismic hazards
- The potential for a site to be affected by geologic hazards that are influenced or altered by human activity

4.3.3 Findings for utility-scale onshore wind energy facilities

4.3.3.1 Impacts

Impacts from construction and decommissioning

Soil resources

Site characterization activities done before construction would typically include activities that would result in soil compaction, creation of ruts, and erosion due to the passage of vehicles and equipment. These activities would include investigating the site, localized site clearing for investigations below-ground, and limited earthwork associated with test pit excavations. In steeper areas, site grading as well as removal of materials on the surface and belowground may be required if existing access routes are unavailable or unsuitable. Decommissioning may include repowering through the installation of new wind turbine generators at the facility site after the old turbines are removed.

Construction and decommissioning activities for onshore wind energy facilities would include grading, vegetation removal, installation of underground infrastructure (e.g., foundations, pilings, utility trenches), stockpiling of site soils, bringing soils to the site, removing soils from the site, placement and compaction of low-permeability materials. Activities could also include the development and decommissioning of an on-site concrete processing or batch plant, the use of aggregate resources and concrete from local suppliers, and demolition. Impacts associated with these activities would include potential soil compaction, mixing of different layers of soil, surface erosion and runoff, sedimentation of nearby waterways, soil contamination, potential slope stability, and change in local drainage patterns. The potential loss of vegetation during clearing would reduce the ability of the remaining plant root structures to resist the effects of wind and water, resulting in increased soil erosion. The degree of impact from ground-disturbing activities would depend on site-specific factors such as surface soil properties, vegetation density and type, slope angle and extent, distance to waterways or water collection infrastructure, and weather.

Construction activities would include the potential for fluid (fuel, oil, hydraulic fluid, etc.) releases or spills, and the potential application of herbicides and dust control stabilizers. These activities would introduce contaminants into local soils if not controlled with BMPs and other preventative measures. Spills to soil would likely be of small quantity and within containment areas or able to be cleaned up.

Construction of access roads, wind turbine bases, and subsurface utility installation would require excavation of soil and rock materials, depending on the site, and excavated materials may need to be hauled off site. Additionally, development of a wind energy facility could require importing aggregate and/or soil. Impacts on aggregate resources are described in Section 4.7, Energy and Natural Resources.

In general, impacts during construction would be larger for large facilities due to the increased disturbance area and potentially greater number of larger vehicles and equipment.

Decommissioning impacts would be similar to construction impacts but may be smaller due to the more limited duration of activities.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on soil resources.

Geologic hazards
The effects of geologic hazards during construction are associated with increasing slope instability and landslide risks. Construction activities that can potentially increase this risk include grading that results in steepening of slopes, cutting mid-slope or at the base of a slope (e.g., for an access road or building pad), and alteration of drainage patterns and infiltration rates. These activities are mainly related to roads and would increase the potential likelihood of landslides, which could affect surface waters through diversion or sedimentation. Landslides could also affect surrounding buildings, infrastructure, or people. Landslide risks would increase with facility size.

The potential that regional geologic hazards would occur (e.g., earthquake or volcanic hazards) or local geologic hazards would be triggered (e.g., landslide) during construction or decommissioning is low. A geologic event midway through construction or decommissioning may result in collapse of temporary support systems or toppling of unsecured equipment or materials. This would also increase the potential for limited fluid (fuel, oil, hydraulic fluid, etc.) releases or spills, including any herbicides and dust control stabilizers that are stored on site. These types of impacts are further discussed in the *Environmental Health and Safety Resource Report* (Appendix G).

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** from geological hazards.

Impacts from operation

Soil resources

Anticipated impacts on soil resources from operations and maintenance of onshore wind facilities are anticipated to be minimal. The use of maintenance vehicles and equipment would generally be limited to access roads and designated areas that were developed during construction, and little to no new ground disturbance is anticipated. Vehicles, equipment, and site management could include the potential for fluid releases or spills. Spills to soil would likely be of small quantity and within containment areas, or able to be cleaned up. Roads, parking areas, buildings, or other on-site developments, where runoff or wind may be channeled around impermeable elements, would result in increased soil erosion.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on soil resources.

Geologic hazards

While a utility-scale onshore wind facility is required to be designed to some level of seismic performance, if earthquake ground shaking intensity exceeds design standards, damage to facility infrastructure may occur. Additionally, ground shaking may dislodge or topple materials stored on site in support of operations and maintenance activities, which could result in a small-scale fluid releases or spills.

Volcanic hazards, such as pyroclastic flows (fast-moving gas and volcanic matter) or lahars (mudflow or debris flow from a volcano) are less likely to affect facilities within the study area because they are often confined to existing drainage features. Ashfall from an erupting volcano would affect facilities in the study area. An extensive seismic activity monitoring network has been installed at active volcano sites throughout the region to provide advance warning of a potential volcanic eruption, which may allow for safe relocation of select equipment and personnel. The impacts associated with ashfall on a facility are highly dependent on wind conditions. Impacts may include ash accumulation, potential corrosion of surfaces, damage to ventilation systems, damage to site equipment and electronics, and temporarily reduced or suspended operations.

While it is possible to avoid mapped landslide hazards during siting, the potential exists for sloughing of near-surface soils, on cut and fill slopes, during sustained or extreme rainfall events. Such instances would result in maintenance activity to clean up and repair slopes but are not expected to result in damage to a facility or impair general facility operation.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** from geologic hazards.

4.3.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale onshore wind facilities. See Appendix B, the *Earth Resource Report*, for a more detailed list of actions to avoid and reduce impacts, including typical BMPs and actions that may be included in plans or permit conditions and additional measures.

Siting and design considerations

- Conduct detailed geotechnical engineering, soil, and hydrologic studies to characterize site conditions.
- Avoid geologic hazards and hazard areas such as mapped landslide hazard areas, surface fault rupture hazard areas, and volcanic flow hazard areas.
- Select sites with minimal potential for impacts to soil health and stability to avoid soil erosion and compaction.
- Prioritize locations with suitable topography and soil characteristics to minimize the need for extensive grading and excavation, reducing soil disturbance. By focusing on sites with more gentle slopes, developers can mitigate erosion risks and preserve soil stability, because steep slopes are more prone to soil erosion and landslides.
- Select areas with favorable soil characteristics, such as well-drained soils with good permeability, to minimize soil disturbance during construction activities, by reducing the likelihood of soil compaction and waterlogging. These soil properties aid in efficient water infiltration and drainage, mitigating erosion risks and preserving soil structure and fertility throughout the facility's lifecycle.
- Design facilities to account for current seismic design parameters and building codes, including the latest version of the International Building Code and American Society of Civil Engineers Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- Limit construction of new roads and design new roads based on federal, state, and county requirements and based on local climate conditions, soil moisture, and erosion potential.
- Identify the level of seismic design, material types, and development strategies needed based on the potential risk of earthquakes.

4.3.4 Findings for facilities with co-located battery energy storage systems

4.3.4.1 Impacts

Environmental impacts for facilities with BESSs would be similar to the impacts considered for facilities without BESSs related to site characterization, construction, operation, and decommissioning. Specific differences related to all phases of work are discussed in the following sections.

Impacts from construction, operation, and decommissioning

Soil resources

A BESS requires storage facilities, spill containment, additional electrical infrastructure, and operational management systems. This means a larger overall footprint and more soil disturbance.

State regulations require fire and spill containment measures for lithium-ion, flow, and zinc-hybrid batteries (WAC 51-54A-0322 and 51-54A-1207). Potential failure of BESS components during construction, operation, or decommissioning could result in the release of chemicals or metals used in batteries. Although the likelihood is remote, in the event of a BESS failure, there is a risk of environmental contamination to soil. Emergency response would not typically use water for battery incidents so soil contamination would be limited to the BESS site. Clean-up actions include removal and proper disposal of contaminated soils.

Decommissioning of BESS components may necessitate soil testing to determine if failure or contamination has occurred. If contamination is identified, soil remediation efforts would be necessary. Section 4.8, Environmental Health and Safety, includes more information on impacts on human health from these types of facilities.

Geologic hazards

The risk of impacts from ashfall would increase for facilities with BESSs. Impacts would include equipment vulnerability due to ash particle infiltration, insulation challenges from ash accumulation, and air intake blockages affecting cooling systems.

Findings

Impacts from construction, operation, and decommissioning of a facility with BESS would be similar to those described for facilities without a BESS, with slight increase due to the increased total disturbed area and increased activities. Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on earth resources.

4.3.4.2 Actions to avoid and reduce impacts

Action for reducing impacts for facilities with a co-located BESS include those identified for facilities without a BESS. Additional mitigation measures to address potentially significant impacts caused by onshore wind energy facilities with a co-located BESSs include the following:

- Implement secondary effective spill and leak containment measures around BESS components for all battery types to prevent or minimize the spread of hazardous materials in the event of a failure. Examples include reinforced storage facilities and containment barriers to contain spills and leaks.
- Develop comprehensive training programs and safety protocols for personnel involved in BESS operations and maintenance. Proper training can help minimize the risk of accidents and ensure prompt and effective response in case of emergencies.
- Develop detailed emergency response plans specific to BESS operations to mitigate the consequences of potential failures. Robust plans include protocols for containment, cleanup, and remediation in the event of soil contamination or other environmental incidents.
- Implement regular maintenance schedules and inspections for BESS components to ensure optimal performance and early detection of potential issues. Routine maintenance can help prevent failures and minimize the risk of environmental contamination.

4.3.5 Findings for facilities combined with agricultural land use

4.3.5.1 Impacts

Environmental impacts from onshore wind energy facilities combined with agricultural land use would be similar to the impacts discussed for facilities without a combined agricultural use related to site characterizations, construction, operation, and decommissioning. Specific differences related to all phases of work are discussed in the following sections.

Impacts from construction, operation, and decommissioning

Soil resources

Impacts to soil for facilities combined with agricultural land use would be similar to the impacts considered for facilities without agriculture use related to site characterizations, construction, operation, and decommissioning. Additional activities could include maintenance of existing or addition of new infrastructure, roads, fences, and gates for agricultural use and the operation of agricultural machinery. During construction, the installation of turbines and associated infrastructure may disrupt soil structure and compaction, potentially affecting soil fertility and productivity by reducing nutrient availability, altering water drainage patterns, and disturbing beneficial microbial communities. Additionally, certain crops—particularly those with shallow root systems or sparse canopy cover—or grazing practices can increase soil erosion on sloped terrain by reducing soil stability and protection against runoff. Grazing can also result in soil compaction, which can decrease moisture absorption and increase runoff as well as limit germination.

Geologic hazards

Geologic hazards for facilities combined with agricultural land use would be similar to the impacts considered for facilities without agriculture use related to site characterizations, construction, operation, and decommissioning. No additional geologic hazard impact considerations are associated with the inclusion of co-located agricultural land use.

Findings

Impacts from construction, operation, and decommissioning would be similar to those described for facilities without agricultural land use. Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on earth resources.

4.3.5.2 Actions to avoid and reduce impacts

Actions for reducing impacts for facilities with combined agricultural land include those identified for facilities without combined agricultural use.

4.3.6 Findings for the No Action Alternative

The potential for 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, and would be **less than significant**.

4.3.7 Unavoidable significant adverse impacts

Through compliance with laws and permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale onshore wind energy facilities would have **no significant and unavoidable adverse impacts** related to earth resources from construction, operation, or decommissioning from these facilities.

4.4 Air quality and greenhouse gases

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on air quality and greenhouse gas (GHG) emissions.

No significant and unavoidable adverse impacts on air quality or GHG emissions would occur.

Air quality refers to the condition of the breathable air and the presence of pollutants or particles. The *Air Quality and Greenhouse Gases Resource Report* (Appendix C) includes the full analysis and technical details used to evaluate air quality and GHGs in this PEIS.

4.4.1 Affected environment

Pollutants can be local and affect a small area, or regional, such as ozone. Pollutants are regulated under state and federal laws. National Ambient Air Quality Standards and Washington Ambient Air Quality Standards are established for common "criteria pollutants." In general, if potential emissions from stationary sources exceed certain thresholds, they must get a Notice of Construction permit before beginning construction. The following common criteria pollutants have standards set by the U.S. Environmental Protection Agency (USEPA):

- Particulate matter smaller than 10 microns in diameter (PM_{10})
- Particulate matter smaller than 2.5 microns in diameter ($PM_{2.5}$)
- Ozone
- Sulfur dioxide (SO_2)
- Nitrogen dioxide (NO_2)
- Carbon monoxide (CO)
- Lead

Gases that trap heat in the atmosphere are referred to as GHGs because they capture heat radiated from the sun as it is reflected back into the atmosphere from the Earth, like a greenhouse does. Increasing amounts of GHGs trap more solar radiation and decrease the amount that is reflected back into the atmosphere, resulting in an increased global average temperature and climate change impacts to people and the environment. The Washington Legislature set new GHG emission limits (RCW 70A.45.020) to combat climate change. By 2050, the state must achieve net zero GHG emissions. CETA requires all electric utilities in Washington to be 100% carbon-free electricity by 2045.

Due to the large onshore wind study area, existing air pollutant concentrations can vary from site to site. Ambient air quality standards are met everywhere within the study area, though there are areas of concern for particulate matter and ozone. The Tri-Cities area (Kennewick, Pasco, and Richland) is an area of concern for ozone. Sunnyside, Toppenish, Yakima, Omak, and Colville are all areas of concern for particulate matter. Ecology monitors the air using Washington's Air Monitoring Network, and permitting regulations are in place to ensure air pollution levels do not increase to concentrations outside of ambient air quality standards. New sources of air pollution must obtain an air quality permit. New sources of air pollution must obtain an air quality permit.

Carbon dioxide equivalent, or CO_2e, is the number of metric tons of CO_2 emissions with the same global warming potential as 1 metric ton of another greenhouse gas. In 2019, Washington produced about 102.1 million metric tons of CO_2e. Transportation is the largest source, at 40% of the state's GHG emissions, followed by residential, commercial, and industrial energy use at 31%, and electricity consumption at 21%. The remaining 8% of emissions are from agriculture, waste management, and industrial processes.

4.4.2 How impacts were analyzed

This analysis evaluated how onshore wind facilities could affect air quality and contribute to GHG emissions. The primary emission sources include fuel combustion by equipment and vehicle traffic during construction and decommissioning. Disturbed soils from land clearing activities also result in airborne dust. Emissions and dust would be also generated by vehicles traveling on facility access roads to perform operations and maintenance functions.

Construction and operation emissions were estimated by reviewing emissions data from similar wind facilities in Washington and California and determining a scaled emissions rate in tons per MW to apply to this analysis.

Projected emissions from each facility phase were compared to state and federal laws, policies, guidance, and permitting thresholds for context and to evaluate impacts. Dust was considered qualitatively for how it may impact biological resources or water quality.

GHG life-cycle emissions were derived using GHG life-cycle assessments (LCAs) developed by the National Renewable Energy Laboratory. These assess the overall GHG impacts of the entire life cycle of wind facilities, from facility material production, to use, to disposal.

4.4.3 Findings for utility-scale onshore wind energy facilities

4.4.3.1 Impacts

Impacts from construction and decommissioning

Air emissions associated with site characterization, construction, and decommissioning activities would be generated by non-road construction equipment, haul-truck trips, worker trips, vehicle travel on paved and unpaved surfaces, and dust from material handling. Emission rates would be assumed to increase in relative proportion to the size of the facility. Estimated construction emissions for 250 MW and 1,500 MW facilities are provided in Table 4-1. Air emissions associated with decommissioning activities are expected to be similar to or less than the emissions generated from construction. If facilities were repowered after decommissioning, emissions would be similar to or less than the emissions generated from construction. Based on estimated emissions generated by facilities, emissions are not anticipated to exceed the significance thresholds for any criteria pollutant.

Table 4-1. Estimated construction emissions for types of facilities analyzed in this PEIS (tons)

Emission type	250 MW facility	1,500 MW facility	Threshold (tons per year)
Volatile organic compounds	0.7	4.4	100
Nitrogen oxides	9.1	54.7	100
Carbon monoxide	10.5	62.9	100
Particulate matter smaller than 10 microns in diameter	8.3	49.8	100
Particulate matter smaller than 2.5 microns in diameter	1.4	8.5	100
Sulfur dioxide	<0.01	0.2	100

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on air quality.

Impacts from operation
Operations would generate exhaust and dust emissions from on-road vehicles used for turbine maintenance. Emission rates are assumed to increase in relative proportion to the size of the facility, as larger facilities are assumed to require more maintenance. Estimated operations emissions for 250 MW and 1,500 MW facilities are provided in Table 4-2. Operations are not anticipated to produce emissions at a level that would exceed any criteria pollutant thresholds.

Table 4-2. Estimated operations emissions for types of facilities analyzed in this PEIS (tons)

Emission type	250 MW facility	1,500 MW facility	Threshold (tons per year)
Volatile organic compounds	0.2	1.1	100
Nitrogen oxides	0.9	5.5	100
Carbon monoxide	0.6	3.5	100
Particulate matter smaller than 10 microns in diameter	5.8	34.6	100
Particulate matter smaller than 2.5 microns in diameter	0.6	3.7	100
Sulfur dioxide	<0.01	<0.01	100

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on air quality.

GHG LCA
The operation of onshore wind energy facilities would reduce overall GHG emissions compared to a fossil fuel power plant that would otherwise be in operation to supply the same amount of electricity. Overall, GHG emissions would be reduced if onshore wind energy production replaces fossil fuel energy production over the next 20 years. Washington State law requires utilities to have net-zero GHG emissions by 2045.

Federal studies by the National Renewable Energy Laboratory evaluated the life-cycle GHG emissions for the full lifespan of a wind energy the facility, including upstream, downstream, and operational and processes. Upstream processes include the raw material extraction and construction of facility components, along with the construction of the facility. Operational processes include vehicle exhaust emissions from maintenance activities. Downstream processes include decommissioning and disposal of the turbines and other components.

The resulting operational facility GHG emissions for a 30-year life cycle are estimated to be up to 355,965 metric tons of CO_2e or up to 11,866 metric tons of CO_2e annually. For comparison, emissions for the same size of coal facility are estimated to be up to 11.49 million metric tons of CO_2e or up to 383,031 metric tons of CO_2e annually. Emissions for a natural gas facility of the same size are estimated to be up to 5.13 million metric tons of CO_2e or up to 171,063 metric tons of CO_2e annually.

Offsets could be used to reduce the amount of GHGs in the atmosphere.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on GHGs.

4.4.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale wind energy facilities. See Appendix C, *Air Quality and Greenhouse Gases Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Design facility to minimize use of fossil fuels to limit GHG and air emissions.
- Surface access roads, on-site roads, and parking lots with aggregate with hardness sufficient to prevent vehicles from crushing the aggregate and causing dust or compacted soil conditions. Paving could also be used on access roads and parking lots.

Additional mitigation measures:

- Use offsets to reduce the amount of GHGs in the atmosphere. Offset projects must result in GHG reductions that are real, permanent, quantifiable, verifiable, and enforceable.

4.4.4 Findings for facilities with co-located BESS

4.4.4.1 Impacts

Impacts from construction, operations, and decommissioning
Air emissions for facilities with BESSs would be slightly higher than the impacts considered for utility-scale facilities without a BESS related to site characterization, construction, operation, and decommissioning. This is due to more construction equipment and vehicles. The total construction and decommissioning emissions from a facility with a co-located BESS are not anticipated to exceed any criteria pollutant thresholds (Table 4-3). Operation of a facility and co-located BESSs would generate similar emissions as those analyzed for facilities without a BESS. If facilities are to be repowered after decommissioning, emissions would also be similar to or less than the emissions generated from construction.

Impacts related to fires and explosions are included in Section 4.8, Environmental Health and Safety, and Section 4.15, Public Services and Utilities.

Table 4-3. Estimated construction emissions for a 1,500 MW onshore wind energy facility and two 500 MW co-located battery energy storage systems

Emission type	Estimated emissions (tons)	Threshold (tons per year)
Volatile organic compounds	6.1	100
Nitrogen oxides	69.4	100
Carbon monoxide	70.2	100
Particulate matter smaller than 10 microns in diameter	50.2	100
Particulate matter smaller than 2.5 microns in diameter	9.0	100
Sulfur dioxide	0.2	100

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities with a co-located BESS would likely result in **less than significant impacts** on air quality.

GHG LCA

The GHG emissions for facilities with a co-located BESS would be greater than the range described above, with the addition of upstream and downstream LCA emissions from the BESS. Applying studied percentage increases in GHG life-cycle emissions for a case study in Texas where a 500 MW BESS was added to wind and solar applications, the GHG emissions for two 500 MW BESSs would range from 3,619 to 21,711 metric tons of CO_2e a year, depending on the size of the facility.

Offsets could be used to reduce the amount of GHGs in the atmosphere.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, facilities with a co-located BESS would likely result in **less than significant impacts** on GHGs.

4.4.4.2 Actions to avoid and reduce impacts

Actions for reducing air and GHG-related impacts for utility-scale onshore wind energy facilities and co-located BESSs are the same as those identified for facilities without a BESS.

4.4.5 Findings for facilities combined with agricultural land use

4.4.5.1 Impacts

Impacts from construction, operations, and decommissioning
Air emissions resulting from the site characterization, construction, and decommissioning of wind energy facilities combined with agricultural land use would be similar to the impacts considered for wind energy facilities without agricultural land uses. Emissions generated by the construction and decommissioning of wind energy facilities that include agricultural land use are not anticipated to exceed the significance thresholds for any criteria pollutant.

Operation of facilities with agricultural uses would generate similar emissions as facilities that do not include agricultural land use, with the addition of emissions from equipment for agricultural operations. The overall emissions footprint of an agricultural operation is highly variable, dependent on the types of crops or livestock, number of tilling operations per year, age of equipment being used, and many other variables. This may include emissions from operation of diesel-powered equipment, livestock operations, and fertilizer operations. However, it is not anticipated that the scale of agricultural operation that would be combined with onshore wind facilities would cause an emissions threshold to be exceeded.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities with co-located agricultural use would likely result in **less than significant impacts** on air quality.

GHG LCA
The GHG emissions for wind energy facilities with agricultural land use would likely be similar to the impacts described for wind energy facilities that do not include agricultural land use but would vary based on the type of land use and amount of land. An LCA would need to be conducted to estimate GHGs for each project based on its specific design.

Offsets could be used to reduce the amount of GHGs in the atmosphere.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, agrivoltaic facilities would likely result in **less than significant impacts** on GHGs.

4.4.5.2 Actions to avoid and reduce impacts

Actions for reducing air and GHG-related impacts for onshore wind energy facilities that include agricultural land use are the same as those identified for facilities that do not include agricultural land use. Additionally, agriculture-specific measures that can help to limit the emissions produced from agriculture operations include the following:

- Limit the amount of soil or unpaved surface disturbances during operations
- Optimize agricultural operations to reduce air emissions.

4.4.6 Findings for the No Action Alternative

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, and would be **less than significant**.

4.4.7 Unavoidable significant adverse impacts

Through compliance with laws and permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale onshore wind facilities with co-located agricultural use would have **no significant and unavoidable adverse impacts** related to air quality or GHGs from construction, operation, or decommissioning.

4.5 Water resources

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on water resources (surface water, groundwater, wetlands, and floodplains).

No significant and unavoidable adverse impacts related to water resources would occur.

This section evaluates surface water, groundwater, wetlands, and floodplains. This section evaluates the following features related to water resources: water quality, water quantity (flows and levels), and water availability and water rights.

The *Water Resources Report* (Appendix D) includes the full analysis and technical details used to evaluate water resources in this PEIS.

4.5.1 Affected environment

4.5.1.1 Surface water

The study area encompasses land along surface waters ranging in size from the Pacific Ocean to unnamed smaller creeks with only seasonal flow. All eight hydrologic sub-regions as identified by the U.S. Geological Survey (USGS) are found within the study area. The study area also falls within 56 of Washington's 62 Water Resource Inventory Areas (WRIAs; Figure 4-2). WRIAs provide a framework for water resources management in the state.

Water quality is a key element of surface water regulation and management in Washington. Water quality conditions across the study area vary by location. In general, surface water quality conditions are typically better higher in a watershed, upstream of intensive land uses. Common water quality issues that affect some waters within Washington and the study area include elevated temperature, low dissolved oxygen, high turbidity, bacteria, and toxics and other pollutants from industrial activities and stormwater runoff.

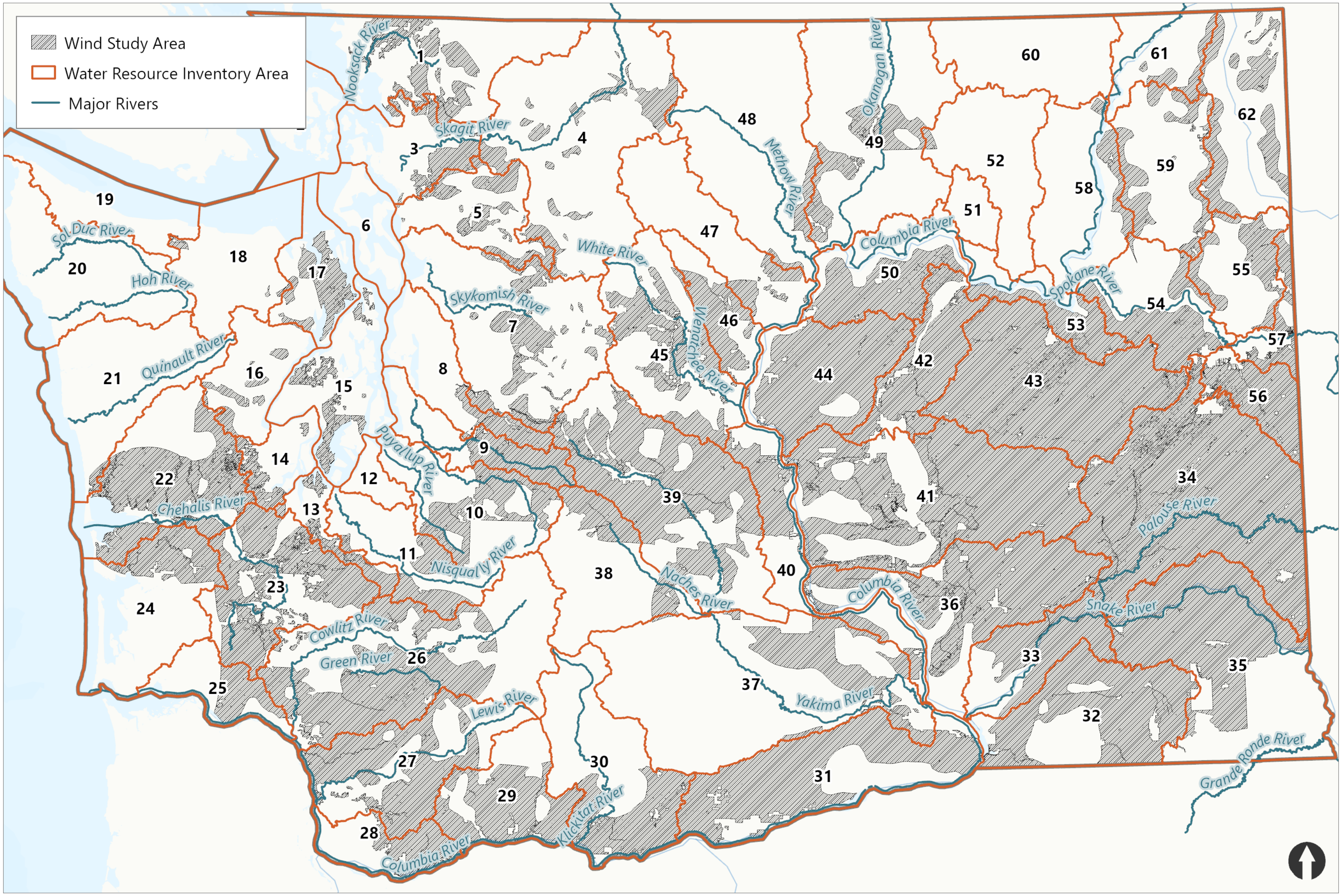


Figure 4-2. Water Resource Inventory Areas (WRIAs)

4.5.1.2 Groundwater

Groundwater is the water found underground in the spaces of saturated soil and rock. A saturated soil or rock layer with spaces that allow water to move through it is called an aquifer. There are seven main aquifers in Washington as identified by USGS. The PEIS study area includes land over portions of all of these aquifers.

Sole source aquifers are defined as aquifers that supply at least 50% of the drinking water for its service area and for which there are no reasonably available alternative drinking water sources if the aquifer becomes contaminated. USEPA has designated 13 sole source aquifers in Washington, and four of those overlap with the study area: the Troutdale Aquifer System Area, Lewiston Basin, Spokane Valley Rathdrum Prairie Aquifer, and the Cedar Valley Aquifer.

4.5.1.3 Water availability and water rights

Across the study area, water availability varies by location and is dependent on many factors such as local hydrology and climate conditions, land uses, and existing water rights. Ecology has responsibilities for managing waters of the state, including issuing rights to use water while protecting water resources for public benefit. Nearly 80% of the state's overall water use is for irrigation and public supply with more water used for public supply on the west side of the state, and more water used for irrigation on the east side of the state. In addition to water rights for withdrawal, water availability is also influenced by the requirement to maintain minimum instream flows. These requirements are in place to protect fish and wildlife, Tribal resources, water quality, recreation, aesthetics, and navigation. Ecology considers instream flow requirements and closed waterbodies when reviewing new water rights applications.

4.5.1.4 Wetlands

Wetlands are areas frequently saturated or inundated by surface or groundwater and supporting wetland vegetation and functions. They include areas that are commonly referred to as swamps, marshes, bogs, and fens. Wetlands can occur in and adjacent to stream and river channels, on floodplains, in low-lying areas and depressions, around the edges of ponds and lakes, on slopes, and in estuaries and coastal areas. Wetlands occur throughout the study area; however, there is no comprehensive source that identifies the presence of all wetlands. For this reason, utility-scale wind developers would be required to conduct wetland determinations or delineations to determine wetland presence. In Washington, wetlands are rated and categorized using Ecology's Washington State Wetland Rating System. Under this system, wetland categories range from Category I wetlands, which are a unique or rare wetland type, are more sensitive to disturbance, or are relatively undisturbed, to Category IV wetlands, which have the lowest levels of function and are often heavily disturbed. State law requires wetland mitigation plans to ensure no net loss of function.

4.5.1.5 Floodplains

Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps identify flood hazard areas regulated under the National Flood Insurance Program. Special flood hazard areas are areas that would be inundated by a flood event that has a 1% chance of occurring in any year (i.e., the "100-year" flood). These special flood hazard areas generally are the basis for floodplain management regulations. Flood risks vary across the study area based on location and setting. Information on flood risks for a given site should be evaluated using FEMA's Risk Mapping, Assessment, and Planning program tools available on the FEMA website.[21]

4.5.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

- Alterations to the course of surface water
- Changes in surface water quality
- Disruption of the groundwater flow regime (including groundwater recharge)
- Changes in groundwater quality
- Alterations to water availability or rights
- Wetland area alteration or loss
- Wetland buffer area alteration or loss
- Alterations to floodplain functions and/or any loss of floodplain storage

The assessment of impacts was qualitative, and potential impacts considered applicable laws and regulations (e.g., water quality standards, water rights laws, and wetland regulations).

4.5.3 Findings for utility-scale onshore wind energy facilities

4.5.3.1 Impacts

Impacts from construction and decommissioning

Construction of utility-scale onshore wind energy facilities would require a water supply during construction for drinking water, dust control, equipment cleaning, and potentially for concrete production. Facilities would require supplying drinking water to an estimated 100 to 400 construction workers. Water could also be needed to irrigate site restoration plantings for some period after structures are removed and grading is complete, until successful plant establishment.

Surface water

Site characterization, construction, and decommissioning activities could impact surface water flows for facilities that involve elements within or adjacent to streams, such as for a facility access road crossing of a stream. Streamflows could be temporarily re-routed from their natural channels by diversions needed to construct access road crossings. Permanent alterations to streams could occur if culvert installations are needed at access road crossings. Though these impacts would be minimized by following design guidelines and adhering to water crossing regulations, including the Washington Department of Fish and Wildlife's (WDFW's) Water Crossing Guidelines for fish-bearing streams.

[21] https://www.fema.gov/flood-maps/tools-resources/risk-map

Ground disturbance would impact flow rates and volumes of surface runoff reaching nearby streams. Vegetation clearing and soil compaction in site investigation and construction areas would reduce the potential for land to absorb and infiltrate precipitation, potentially leading to increases in stormwater peak flows. Construction of wind turbine towers, operations and maintenance buildings, and service roads would add impervious surface area. The addition of impervious surfaces would increase surface water runoff from those areas and, depending on how stormwater drainage is managed, could permanently change the amount and timing of surface flows reaching nearby streams. In addition to increased stormwater runoff from impervious surface additions, construction would alter drainage patterns due to grading, installation of access roads, and installation of utility trenches.

Site characterization, construction, and decommissioning activities would adversely affect surface water quality in several ways. In-water construction for elements such as new stream crossings for roads would temporarily elevate stream turbidity levels from sediment disturbance and temporary water management (e.g., bypassing and then re-introducing flows). Soil disturbance from establishing initial site access for geotechnical surveys, installing meteorological towers, structure and access road removal, and from site grading would temporarily increase erosion potential and sediment transport to receiving waters in runoff or by wind, contributing sediment and associated pollutants such as metals and organics. The erosion potential of the soils, the proximity of disturbance to surface waters, and the size and nature of construction activity would all influence the potential for water quality issues from ground disturbance. Revegetation of temporarily disturbed areas would limit the length of time soils are exposed. Structure removal during decommissioning would be expected to restore pre-facility drainage patterns. If facilities were repowered after decommissioning, surface water quality impacts would be similar to or less than the impacts anticipated during construction.

The presence of construction equipment and materials would increase the potential for associated pollutants to enter surface waters during in-water construction or through stormwater runoff from areas of upland construction or demolition. Potential pollutants from operating such equipment would include fuel (gasoline and diesel fuel), oil, grease, coolant, and hydraulic fluid. Hazardous material storage requirements and federal requirements for facilities storing more than 1,320 gallons of petroleum fuel would require secondary containment. For these types of quantities, spills would likely be to secondary containment or nearby soil and able to be cleaned up. EHS impacts are discussed in the Section 4.8. Developers would be required to be in compliance with applicable permits such as an NPDES construction permit and implement erosion control plans. Implementation of permit requirements would reduce impacts to surface water.

Construction would include on-site concrete pouring and could also include concrete production at on-site batch plants. Concrete production and pouring create the potential for introducing high-pH discharges to surface waters. Demolition of concrete pads and foundations could result in water coming into contact with freshly exposed concrete surfaces and debris/dust, which could lead to elevated water pH levels. Activities such as concrete production and pouring must meet water discharge requirements.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on surface water.

Groundwater
Site characterization includes groundwater or geotechnical drilling and testing to gather information. Construction of foundations for onshore wind energy facilities, including wind towers, buildings, and electrical substations, include subsurface excavation and fill and concrete pouring and potentially require dewatering during construction. Such activities would depend on the site, but could locally affect shallow groundwater flows, to approximately the depth of the drilling or excavation/fill.

The construction of new impervious surfaces in the form of facility and access roads would locally change surface-to-groundwater interactions and reduce groundwater recharge capability within those footprints. These make up a small portion of a facility site. This would result from impervious surfaces preventing infiltration of rainfall and snowmelt and directing runoff to locations nearby. Wells using groundwater may be used for construction of wind energy facilities and result in localized water table drawdown. These would require a water right.

During decommissioning, removal of structures and their foundations, access roads, and related project facility elements and restoration to more natural, pre-facility conditions would allow surface-groundwater interactions, including infiltration of rain and snowmelt and groundwater recharge. If facilities were repowered after decommissioning, groundwater quality would be similar to or less than the impacts anticipated during construction.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on groundwater.

Water availability and water rights
Depending on the site, water may be available from existing municipal sources, transported to the site by truck, or could require water from new surface water diversions or groundwater withdrawals.

Diversions of surface water for construction or decommissioning would require obtaining a water right prior to diversion. Groundwater pumping would also require a water right if withdrawals were to exceed groundwater permit exemption thresholds of 5,000 gallons per day for industrial uses. Water used to produce concrete and for other construction activities could likely exceed 5,000 gallons per day; this would require a water right.

Decommissioning may also require water to irrigate site restoration plantings for some period after structures are removed and grading is complete. If facilities were repowered after decommissioning, groundwater quality would be similar to or less than the impacts anticipated during construction.

Water availability and the likelihood of obtaining new water rights for construction vary by location. Water rights may not be granted in watersheds that are already over-appropriated and subject to closures or instream flow requirements that are often not met. If water is not available, a water right will not be issued.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on water availability or water rights.

Wetlands
Impacts to areas and functions of wetlands could occur during the site characterization, construction, and decommissioning phases. Because wind energy facilities are typically located on ridges and other elevated lands where wetlands and associated surface waters do not typically occur, site characterization, construction, and decommissioning of wind towers and supporting infrastructure are unlikely to result in wetland impacts. Wetlands may need to be cleared and/or filled to establish initial site access for geotechnical surveys or to install meteorological towers during the site characterization phase. Wetlands may also need to be cleared and/or filled for the construction of staging/laydown areas, permanent site access routes, gen-tie line corridors, and other supporting facilities. Roads and other infrastructure constructed near wetlands could introduce invasive species, change surface drainage patterns and/or introduce sediments or pollutants into adjacent wetlands via runoff.

During decommissioning, the removal of roads and culverted road crossings from wetlands (or areas adjacent to wetlands) could temporarily increase erosion potential and soil compaction in those areas. Removal of wind turbines and supporting infrastructure would disturb soils and increase the potential for runoff to carry sediments into wetlands and associated waterways. Such impacts could be minimized by the implementation of erosion control measures and BMPs and via prompt revegetation of disturbed soils. Repowering activities at facilities would require the use and potential re-establishment or development of access roads to facilitate turbine removal and replacement, which could temporarily increase erosion, potentially affecting water quality in adjacent wetlands.

Wetlands may be present on a facility site and the types of wetlands would be identified as part of the site characterization phase. The impacts would vary based on the type and amount of wetlands affected. If wetland impacts are likely, project developers would need to comply with a mitigation sequencing process in order to achieve the state goal of no net loss of wetland acreage and function. As part of the agency review process, a mitigation plan will need to be submitted that explains how wetland impacts will be compensated for ecologically and appropriately. The mitigation plan would need to be approved by regulatory agencies before permits would be issued.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on wetlands.

Floodplains
Site characterization, construction, and decommissioning activities could impact floodplains for wind energy facilities that involve elements within or adjacent to a stream, such as for a facility access road crossing of a stream. The majority of a facility would not include construction of impermeable areas and would not be likely to affect floodplain functions.

Permanent alterations to streams could occur with culvert installations at access road crossings, which could restrict natural stream and floodplain functions for flood storage, sediment transport, and large wood transport and could also restrict aquatic species movements. Projects would be required to meet state and local standards for culverts which would require they pass flows for a 100-year flood.

Temporary work activity and ground disturbance in the floodplain could result in temporary impacts on floodplain functions. During decommissioning, floodplain functions could be restored to pre-facility conditions following structure and road removal and restoration grading and planting. Repowering activities at facilities would require the use and potential re-establishment or development of access roads to facilitate turbine removal and replacement, which could impact floodplains to a similar level as during construction.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on floodplains.

Impacts from operation
Surface water
Operations and maintenance would involve the on-site storage and use of potential pollutants including oil for electrical transformers and fuel and oil for generators to provide backup power. Transformers typically contain 600 gallons of oil or less. Fuel is expected to be stored in aboveground storage tanks with containment. If more than 1,320 gallons is stored on site, a facility must have a plan to prevent, control, and respond to spills. For these types of quantities, spills would likely be to secondary containment or nearby soil and able to be cleaned up. EHS impacts are discussed in Section 4.8, Environmental Health and Safety.

Impervious surfaces for buildings and access roads, on-site oil and fuel storage, and the periodic presence of maintenance vehicles and equipment would create some potential for pollutants in stormwater discharges. Maintenance of facilities could also involve periodic use of herbicides to manage unwanted vegetation, which could impact water quality in receiving streams if not applied properly.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on surface water.

Groundwater
On-site storage and use of generator fuel and transformer oil present some risk of spills or releases of pollutants to the subsurface and could present a potential source of groundwater contamination. Buildings for operation of onshore wind energy facilities could include sanitary wastewater discharges (e.g., from restrooms) to the subsurface through on-site septic systems. Septic systems could present risks of bacterial contamination of groundwater if not designed and maintained in accordance with local codes.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on groundwater.

Water availability and water rights
Water would be needed for buildings (e.g., restrooms, fire suppression systems), for irrigation to re-establish vegetation in areas temporarily disturbed by construction, and for maintenance. Estimated water demand is expected to be relatively low and likely under the 5,000 gallons per day thresholds to qualify for a groundwater permit exemption in certain locations in Washington. Water from municipal sources may be used or water may be trucked to the site. If an on-site well is proposed, it would require a water right based on the expected amounts needed.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on water availability or water rights.

Wetlands
Potential water quality impacts on wetlands could occur during rain events, which could create runoff that carries sediment. Spills of pesticides, fuel, vehicle fluids, or other hazardous materials used or stored at the facility could impact nearby wetlands if outside of containment.

Runoff from parking areas, buildings, and other facility infrastructure or septic system discharges would also degrade water quality in adjacent wetland areas. Maintenance activities such as routine mowing, vegetation removal in gen-tie line corridors, and access road maintenance would also affect wetlands. Developers would be required to complete operational activities with standard BMPs and spill prevention measures and in compliance with applicable permits. Implementation of permit requirements would reduce impacts to wetlands.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on wetlands.

Floodplains
Potential operations and maintenance impacts on floodplains would be similar to those described above for surface waters. Maintenance of facility elements within floodplains could interfere with floodplain functions. For example, if vegetation maintenance at facilities and along access roads were to prevent natural vegetation from re-establishing, it could affect vegetation support for floodplain functions for water quality, habitat, and restricting the speed of moving floodwater. Overall, facility operation is not expected to lead to alterations to floodplain functions and/or any loss of floodplain storage that would cause a net rise in flood elevation during a 100-year flood.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on floodplains.

4.5.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale wind facilities. See Appendix D, *Water Resources Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Conduct a hydrologic study of the site. Identify site surface runoff and drainage patterns and groundwater levels and flow direction.
- Perform a wetland delineation on the site.
- Avoid siting structures and roads within critical areas.
- Avoid siting structures in areas of known soil or groundwater contamination, or in direct proximity to impaired receiving waters
- Avoid siting facility infrastructure in floodplains.

- Where gen-tie or utility line crossings of streams cannot be avoided, prevent impacts on surface waters by spanning the stream (aboveground lines) or using horizontal directional drilling to cross beneath the stream (underground lines).
- Where stream and wetland impacts cannot be avoided, minimize impacts on water quality by working below the ordinary high water mark or within the wetland boundary during the dry season when no rain is predicted, and/or within the WDFW-recommended in-water work window for minimizing impacts on aquatic species.
- Minimize impacts of stream and wetland crossings by following applicable design guidelines (e.g., WDFW *Water Crossing Design Guidelines*) and adhering to regulations, including WAC 220-660-190 (Water Crossing Structures).
- Avoid alteration of existing drainage patterns to the extent practicable, especially in sensitive areas such as erodible soils or steep slopes.
- Avoid siting facility infrastructure in floodplains. If floodplains cannot be avoided, design the structures located within them so as not to restrict or redirect flows from their natural flow path.

4.5.4 Findings for facilities with co-located BESS

4.5.4.1 Impacts

Impacts from construction, operation, and decommissioning

The potential impacts on water resources for wind energy facilities with co-located BESSs would closely resemble the impacts described for utility-scale wind energy facilities without co-located BESSs for site characterization, construction, operation, and decommissioning.

Co-locating BESSs with wind energy facility development would require additional construction-related ground disturbance and an increased building footprint relative to facilities with no BESS. A BESS at an onshore wind energy facility would add another stormwater consideration to a facility, from the container and concrete foundation, and potentially another regulated element to be included in an Industrial Stormwater Pollution Prevention Plan. Firefighters are not expected to use water for combatting a fire at a BESS. Emergency response actions are to allow the fire to burn to prevent water contaminated with pollutants to affect surface water and groundwater quality.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities with a co-located BESS would likely result in **less than significant impacts** on water resources.

4.5.4.2 Actions to avoid and reduce impacts

The actions for reducing impacts for facilities with co-located BESSs are also the same as those identified for facilities without a BESS, with the added recommendation:

- BESS facilities and associated infrastructure should be located away from surface waters and wetlands.

4.5.5 Findings for facilities combined with agricultural land use

4.5.5.1 Impacts

Impacts from construction, operation, and decommissioning

The potential impacts on water resources for wind energy facilities combined with agricultural land use would be similar to the impacts described for utility-scale wind energy facilities without agricultural land uses related to construction, operations, and decommissioning.

There are some ways the impacts for facilities with co-located agricultural use would differ from facilities without agricultural land use:

- A facility growing crops would have a higher demand for water than the same facility without agricultural use. For sites with existing agricultural use, the increase in water demand would only result from the addition of an onshore wind facility. For sites with changed agricultural types or the addition of an agricultural use where there was not one previously, the demand for water could be higher for a site with irrigated crop production, and lower for a site with livestock grazing. These changes increase the importance of considering water availability and water rights issues, depending on the specifics of the facility design and site considerations.
- Substances commonly associated with farm operations such as pesticides, fertilizers, and livestock waste could lead to increased pollutants in stormwater runoff.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities with a co-located agricultural use would likely result in less than significant impacts on water resources.

4.5.5.2 Actions to avoid and reduce impacts

The same regulatory triggers and permitting needs would apply to facilities combined with agricultural land use. The actions for reducing impacts for facilities with agricultural land use are also the same as those identified for facilities without agricultural use.

4.5.6 Findings for the No Action Alternative

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 the facility size and design, and would be **less than significant**.

4.5.7 Unavoidable significant adverse impacts

Through compliance with laws and permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale wind facilities would have **no significant and unavoidable adverse impacts** on water resources from construction, operation, or decommissioning.

4.6 Biological resources

Key findings

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, some construction, operation, and decommissioning activities of utility-scale onshore wind energy facilities would result in **less than significant impacts** on terrestrial habitats and vegetation, including special-status habitats and vegetation. Activities that cause the permanent degradation, loss, or conversion of suitable habitat that is critical to species viability or disrupt habitat continuity along migration routes would result in **potentially significant adverse impacts** on terrestrial habitats and vegetation.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, some construction, operation, and decommissioning activities of some utility-scale onshore wind energy facilities would result in **less than significant impacts** to terrestrial wildlife, including special-status species. Activities that affect species viability and the mortality of any individual species or disturbance that disrupts successful breeding and rearing behaviors would result in **potentially significant adverse impacts** on terrestrial wildlife.

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, construction, operations, and decommissioning activities would result in **less than significant impacts** on aquatic habitat and species and wetlands.

Construction, and operation, and decommissioning of utility-scale onshore wind facilities may result in **potentially significant and unavoidable adverse impacts** on terrestrial special-status habitats and species if activities cause the permanent degradation, loss, or conversion of suitable habitat that is critical to habitat or species viability; affect the mortality of any individual species or create a disturbance that disrupts successful breeding and rearing behaviors; or disrupt habitat continuity along migration routes. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site. Mitigation to reduce impacts below significance for terrestrial special-status habitats or species may not be feasible.

This section evaluates potential impacts and mitigation related to aquatic and terrestrial species and habitats. The *Biological Resources Report* (Appendix E) includes the full analysis and technical details used to evaluate biological resources in this PEIS. This section contains a summary of how impacts were analyzed and the key finding.

4.6.1 Affected environment

4.6.1.1 Terrestrial habitats and species

Terrestrial habitats refer to non-aquatic or upland areas of the landscape that support plants and wildlife. Examples include forests, shrubsteppe, grasslands, deserts, shorelines, and underground habitats like caves and burrow systems. Terrestrial species are plants or animals that live on or use these habitats for the majority of their life functions. Examples of terrestrial plants include trees, shrubs, and grasses that prefer upland or riparian habitats. Examples of terrestrial wildlife include mammals, birds, invertebrates, and reptiles.

Terrestrial habitats within the study area encompass diverse landscapes such as coastal areas, mountains, deserts, forests, and agricultural lands. These areas provide critical habitats for a wide range of species. There are many state and federal resources with maps and data on habitats and species. These are described in the *Biological Resources Report* (Appendix E) and *Cumulative Impacts Report* (Appendix Q). Figure 4-3 is an example of the type of information available about specific habitats that should be considered during siting and design to avoid impacts and for evaluation in project-level reviews. This map describes priorities for dry shrubsteppe habitat from the Washington Shrubsteppe Restoration and Resiliency Initiative.

The study area includes the following nine Level III Ecoregions (Figure 4-4), each with distinct environmental features:

- **Coast Range**: Features low mountains, temperate rainforests, and diverse surface water systems.
- **Puget Lowland**: Encompasses coniferous forests, floodplains, oak woodlands, and estuarine wetlands.
- **Willamette Valley**: Contains prairies, mixed forests, and extensive floodplains.
- **Cascades**: Dominated by steep mountain ranges, volcanoes, and diverse coniferous forests.
- **Eastern Cascades Slopes and Foothills**: Known for its dry climate, coniferous forests, and susceptibility to wildfires.
- **Columbia Plateau**: Characterized by arid sagebrush steppe, grasslands, and extensive agricultural use.
- **Blue Mountains**: Volcanic mountain ranges with coniferous forests and prairie ecosystems.
- **Northern Rockies**: Mountainous region with boreal forests, alpine meadows, and riparian woodlands.
- **North Cascades***:* High rugged mountains with active alpine glaciers and diverse forest types.

Wildlife migration corridors and landscape-scale habitat connectivity are critical for species movement. The study area is part of the Pacific Flyway, one of the four main north-south migratory routes in North America. Ungulate (small hooved mammals) migration corridors within the study area span broad landscapes, including the Northern Rockies, North Cascades, Eastern Cascades Slopes and Foothills, Cascades, and Columbia Plateau. Species include elk, moose, deer, bighorn sheep, mountain goats, pronghorn antelope, and woodland caribou. Seasonal migration between distinct summer and winter ranges is common among ungulate herds. The *Biological Resources Report* (Appendix E) and *Cumulative Impacts Report* (Appendix Q) include information on reports and websites with these data and maps.

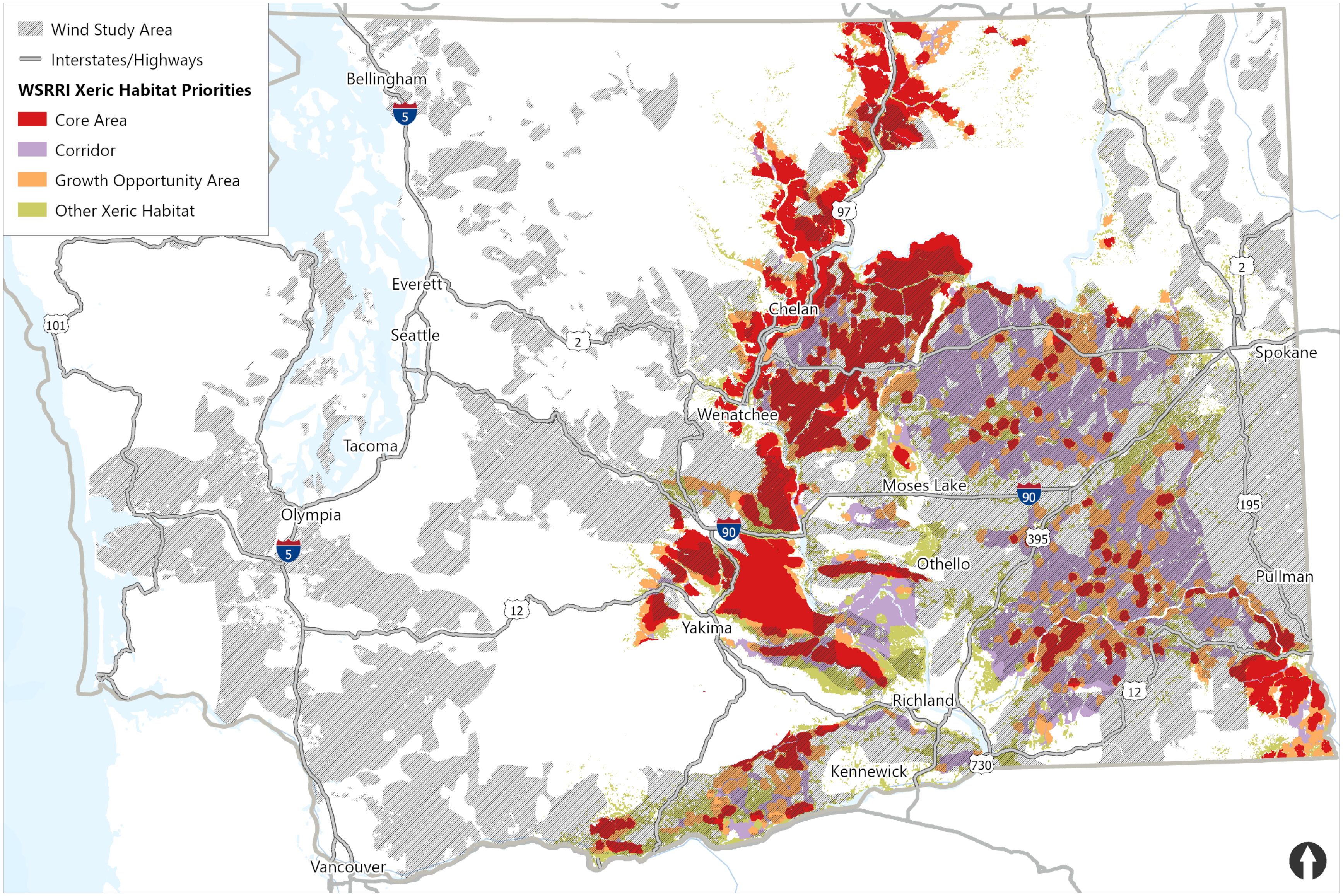


Figure 4-3. Example WSRRI priority map for a dry (xeric) ecosystem

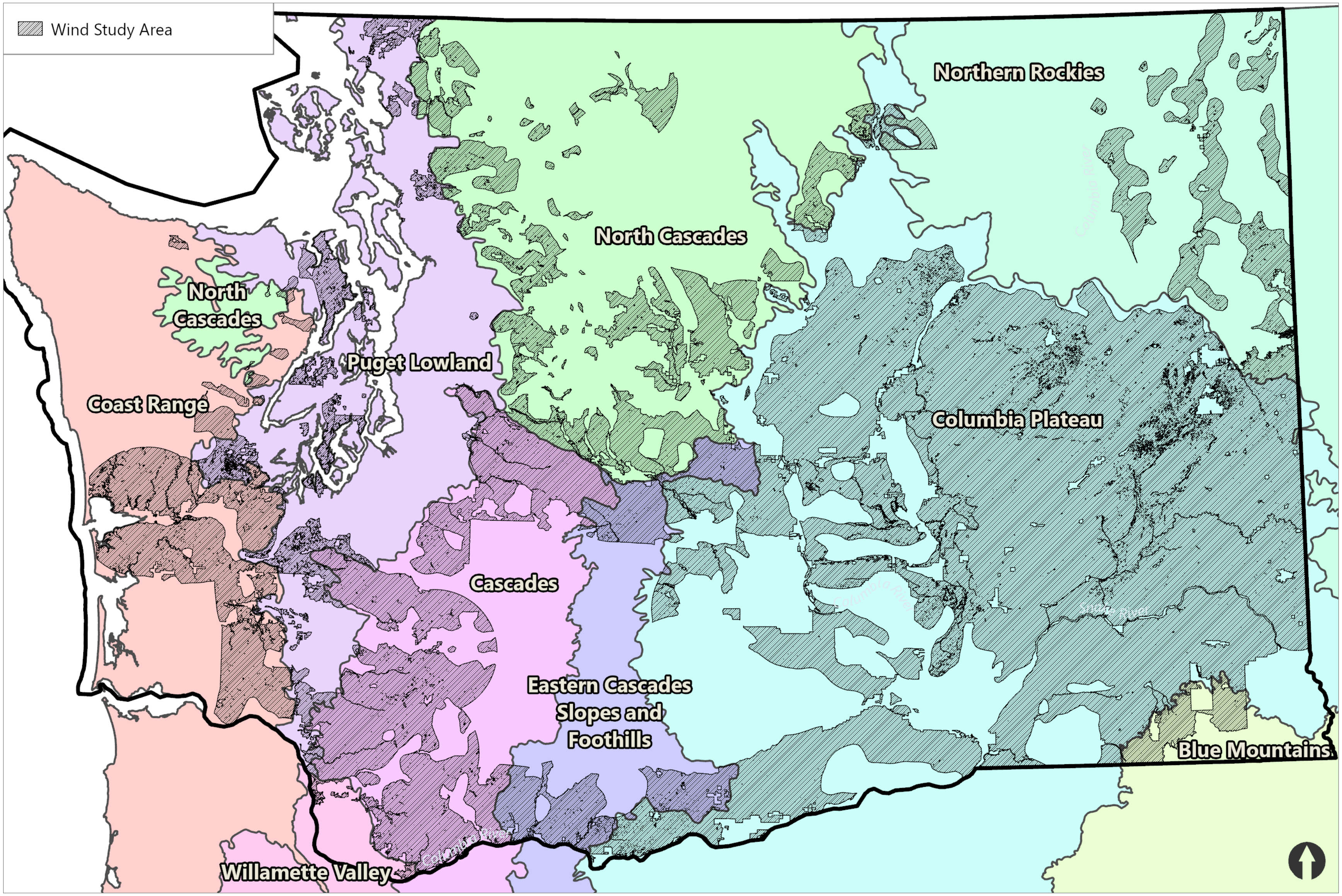


Figure 4-4. Level III Ecoregions

4.6.1.2 Aquatic habitats and species

Aquatic species are those that require water for some or all of their life cycles. Aquatic species that could be present in the study area include fish, amphibians, turtles, mollusks, and crustaceans. Aquatic habitat includes areas that have flowing or still surface water either year-round (perennial), seasonally (intermittent), or for short periods after rainfall or snowmelt events (ephemeral). Aquatic habitats commonly include rivers, streams, lakes, ponds, and wetlands. Human-created water system and storage features such as ditches, irrigation canals, or water retention ponds can provide habitat for aquatic species although they often lack important habitat elements and may be lower quality. Instream, fresh deepwater, and freshwater wetland habitats occur throughout all six ecoregions present in the study area. Persistent snowpack in the mountain regions creates snowmelt-dominated waterbodies, which provide cold aquatic habitat. In contrast, large portions of the eastern, semi-arid ecoregions that lack high-altitude water sources are characterized by low precipitation and higher water temperatures in summer and fall.

4.6.1.3 Wetlands

Wetlands are areas frequently inundated or saturated by surface or groundwater and supporting wetland vegetation and functions. They include areas that are commonly referred to as swamps, marshes, bogs, and fens. Wetlands can occur in and adjacent to stream and river channels, on floodplains, in low-lying areas and depressions, around the edges of ponds and lakes, on slopes, and in estuaries and coastal areas. Wetlands provide numerous ecological functions, including water filtration, flood control, and habitat for a wide range of species. Wetlands occur throughout the study area, but not all wetlands have been identified at a site level. For this reason, developers would be required to conduct wetland determinations or delineations to determine if wetlands are present. If wetlands are impacted, a mitigation plan will be required to ensure there is no net loss of wetland functions.

4.6.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

- Terrestrial species and habitats, including:
  - Terrestrial species (including waterfowl) listed under the Endangered Species Act (ESA), Washington State species of concern (listed and candidate species), and those listed by county-specific code ordinances identifying species of local importance
  - Unique, priority, and culturally important terrestrial species and habitats
  - Wildlife migration routes
- Aquatic and amphibious species and habitats, including:
  - Aquatic and amphibious species listed under the ESA, Washington State species of concern (listed and candidate species), and those listed by county-specific codes or ordinances identifying species of local importance
  - Unique, priority, and culturally important aquatic and amphibious species and habitats
  - Salmon, steelhead, trout, and other fish migration routes
  - Wetland habitats

- Special status species and habitats, including:
  - ESA-listed species
  - Washington State-listed species (including those on the Priority Habitats and Species List)
  - DNR heritage species
  - Species defined in county code or ordinance as sensitive species, species of local importance, and species of concern

The assessment of impacts in this PEIS was qualitative, and potential impacts considered applicable laws and regulations.

4.6.3 Findings for utility-scale onshore wind energy facilities

4.6.3.1 Impacts

Impacts from construction and decommissioning
Site characterization, construction, and decommissioning of onshore wind facilities would occur mainly in upland areas. Gen-tie lines, roads, and fencing may cross wetlands, streams, or rivers, and sites may include wetlands. Development could affect a wide variety of species in the areas where it occurs. In general, impacts would increase proportionally with the size of the facility because they are expected to occur over a larger area of habitat and affect a greater number of individual species as well as population levels.

Terrestrial habitats
Impacts to terrestrial habitats associated with the construction of onshore wind energy facilities include fragmentation, degradation, or loss of habitat associated with site characterization and site preparation. This includes access and service roads, and associated construction for power collection systems, operations and maintenance buildings, fencing, and meteorological towers. Land clearing and grading can alter existing habitats or habitat connectivity and may introduce invasive species. The reduction of habitat can also isolate communities, which could affect population sizes and movement. A facility could disrupt habitat continuity along migration routes for species such as birds, elk and deer.

Adjoining habitats may also be affected by habitat fragmentation, degradation, or loss. Disturbances from humans and construction-related noise, dust, and nighttime lighting could also affect nearby habitat. Development could also result in erosion, dust, changes in hydrologic regimes, increased human access, spills, soil compaction or removal, or sedimentation. Activities would reduce plant growth and reproduction and could cause plant loss. They could reduce opportunities for wildlife species to use the habitat for shelter, food, and breeding.

Impacts on special-status habitats would be similar to those for non-special-status habitats. However, because of the more sensitive nature of special-status habitats and the special-status species those habitats support, the impacts would be greater.

The magnitude of impacts would depend on the number, configuration, and overall size of wind turbines and associated infrastructure as well as the location and extent of access roads and

ROWs for gen-tie line corridors. Facility lighting, noise, and dust generation would also affect the level of impacts.

During decommissioning, it is assumed that habitat disturbance would primarily occur in the previously disturbed areas. The degree of impact would vary depending on how much the previously disturbed habitat had recovered during the operational phase.

If a facility is sited on forestlands subject to regulation under the Forest Practices Act (Chapter 76.09 RCW), the forestlands would likely be considered "converted" for the life of the facility. Upon decommissioning of a facility, converted lands could be reforested (reverted) so they would again be capable of supporting a merchantable timber stand. This would potentially make the lands again subject to the Forest Practices Act and Rules.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, some construction and decommissioning activities of utility-scale onshore wind energy facilities would result in **less than significant impacts** to terrestrial habitats, including special-status habitats. Activities that cause the permanent degradation, loss, or conversion of suitable habitat that is critical to species viability or disrupt habitat continuity along migration routes would result in **potentially significant adverse impacts** on terrestrial habitats.

Terrestrial species
Construction of facilities may adversely affect terrestrial wildlife species, depending on the types of wildlife and the stressors associated with specific site characterization and construction activities. Wildlife may be affected by site clearing and grading, turbine and tower construction, and access road and gen-tie line corridor construction. It may also be affected by construction noise, visual disturbance, and the movement of construction vehicles and equipment. Vehicle collisions could result in wildlife injury or mortality.

The magnitude of potential impacts on wildlife depends how long construction takes, if activities happen in the day or night, and the season of wildlife activity (e.g., nesting, wintering, migration). The type of impacts associated with construction activities are generally related to habitat disturbance or conversion and wildlife disturbance, injury, or mortality.

Species that are less capable of avoiding disturbance (e.g., non-winged invertebrates, reptiles, juvenile mammals, burrowing species, nesting birds) would be more severely affected by construction than more mobile wildlife species. Construction may require the total removal of most vegetation within the footprint of permanent structures, including turbine towers and access roads. All vegetation would be cleared in the footprint of permanent structures. It is assumed that, outside the footprint of permanent structures, construction areas, and access roads, most existing vegetation would be kept; however, mowing or trimming may be needed. Construction may also increase the risk of invasive species introduction and changes in species composition and distribution. It could also result in erosion, dust, altered drainage patterns, increased human access, spills from construction-related chemicals or fuel, soil compaction or removal, or sedimentation.

Impacts on special-status species would be greater than those described for non-special-status species because special-status species vitality and populations are more sensitive to impacts, and these populations are often geographically restricted.

Decommissioning activities would be similar to construction. Vegetation would be removed or damaged in areas of disturbed soil, and these areas would require the re-establishment of plant communities. The disturbance of vegetation would be expected to primarily occur in areas previously disturbed by construction. Wildlife could be affected by changes to existing habitats depending on the extent of infrastructure that would need to be removed, generation of waste materials and accidental spills, future land use, and the amount of required site restoration (e.g., regrading, revegetation). Restoring a site to pre-project conditions could take several years and for some habitat types, such as sagebrush-dominated shrubsteppe, restoration could take several decades.

If the wind energy facility were to be repowered after decommissioning, components could be replaced similar to construction activities, but with likely reduced impacts in previously disturbed areas.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, some construction and decommissioning activities of utility-scale onshore wind energy facilities would result in **less than significant impacts** to terrestrial vegetation, including special-status plants. Activities that cause the permanent degradation, loss, or conversion of suitable habitat that is critical to species viability would result in **potentially significant adverse impacts** on terrestrial vegetation.

Through compliance with laws, permits, and with implementation of actions that could avoid and reduce impacts, some construction and decommissioning activities of utility-scale onshore wind energy facilities would result in **less than significant impacts** to terrestrial wildlife, including special-status species. Activities that affect species viability, the mortality of any individual species, or disturbance that disrupts successful breeding and rearing behaviors would result in **potentially significant adverse impacts** on terrestrial wildlife, particularly birds and bats.

Aquatic habitats and species
Utility-scale onshore wind facilities are unlikely to be sited in aquatic areas and most aquatic impacts can be avoided or minimized. Construction may affect aquatic habitats and species through site clearing and grading, installing permanent meteorological towers, constructing access roads, excavating and installing turbine tower foundations, and installing power-conducting cables and signal cables. Both types of cables are typically buried underground.

During construction and decommissioning, aquatic habitats and species could be affected by a temporary increase in erosion during the removal of access roads and culverted road crossings. They can also be affected by soil compaction, vehicle and foot traffic through aquatic habitat, release of hazardous materials, and disturbance. Impacts could be minimized by implementing standard construction equipment and chemical and hazardous material use/storage BMPs. Removal of facility infrastructure and access roads could also alter drainage patterns on the site, potentially affecting aquatic habitat nearby. Installing and removing buried cables could introduce sediments into adjacent waterbodies through runoff and erosion. Impacts could be minimized by implementation of erosion control measures, BMPs, and safe equipment and hazardous material management.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of utility-scale onshore wind facilities would likely result in **less than significant impacts** on aquatic habitats and species.

Wetlands

Wetlands may need to be cleared and/or filled for the construction of staging/laydown areas, access roads, gen-tie line corridors, and other supporting facilities. Roads and other infrastructure constructed in the vicinity of wetlands could change surface drainage patterns and/or introduce sediments or pollutants into those areas via runoff. Building or removing access roads and culverted road crossings from wetlands could temporarily increase erosion potential. This would disturb species in the vicinity.

Removal of wind turbines and supporting infrastructure would disturb soils and increase the potential for runoff to carry sediments into wetlands and associated waterways, potentially affecting habitat in those areas.

State law requires a mitigation plan be developed and approved to ensure there is no net loss of wetland functions for wetlands and wetland buffers. A facility would require an approved wetland mitigation plan before permits are issued.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, construction activities of utility-scale onshore wind energy facilities would result in **less than significant impacts** to wetlands.

Impacts from operation

Operation of onshore wind energy facilities would likely occur mainly in upland areas. Gen-tie lines, roads, and fencing may cross wetlands, streams, or rivers, and sites may include wetlands. Operations could cause ongoing or repeated disturbance of terrestrial and aquatic habitats.

Terrestrial habitats
Impacts to terrestrial habitats associated with the operation of facilities include impacts from the long-term effects of habitat fragmentation, degradation, or loss associated with the facility ongoing operations and maintenance activities. Adjacent habitats may also be affected by the long-term effects of habitat fragmentation, degradation, or loss, as well as by disturbances from human activities and noise and movement from the wind turbines and maintenance vehicles.

The introduction and spread of invasive vegetation from vehicle and human disturbance could result in long-term impacts on terrestrial habitats. Vehicle movements and trampling by humans may lead to soil erosion.

Migration routes and wildlife corridors could be anywhere from 200 meters to several miles wide depending on the species. Migratory species that may be affected include birds, deer, pronghorn, and elk species. Wind energy development may affect the long-term persistence of existing wildlife migration corridors, particularly where herds use relatively narrow corridors.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, some operation activities of utility-scale onshore wind energy facilities would result in **less than significant impacts** to terrestrial habitats, including special-status habitat. Activities that cause the permanent degradation, loss, or conversion of suitable habitat that is critical to species viability or disrupt habitat continuity along migration routes would result in **potentially significant adverse impacts** on terrestrial habitats.

Terrestrial species
Operations could affect the viability of plant communities within and near facilities as a result of mowing and vegetation maintenance. Impacts could also occur from use of herbicides, trampling and soil compaction from humans and vehicles, and from fire suppression.

The introduction and spread of invasive vegetation could also result in long-term impacts on plant communities. The increase in edge habitats, vehicle movements, and trampling by humans can create gaps in vegetation and allow exotic, non-native plant species to become established and displace native species over time. In addition, changes to wildlife diversity could affect pollinators for plants. These factors could lead to loss of native plant species and vegetation communities.

Operations would result in adverse effects to wildlife, particularly birds and bats, depending on number, sizes, and locations of the turbines, meteorological towers, and powerlines. Birds and bats are at risk of collisions with wind turbines, and all wildlife may be potentially affected by noise, vehicle traffic, hydrologic changes, and runoff. Bird and bat collisions with towers and rotating turbine blades can result in severe injury or mortality. Most publicly available studies estimate[22] between three to five bird fatalities per MW per year. Bat fatality rates can be significantly higher than bird fatality rates, and bat fatality rates can be equally high across landscape types (e.g., agriculture, forests, mixed habitats). The risk of blade strikes depends on the relationship between bird and bat flight heights and patterns and turbine height and rotor sweep. Small songbirds account for more than half of the collisions at U.S. wind facilities. Raptor and pheasant collisions are also relatively frequent. Impacts on some bat species may be greater than impacts on birds because bats can have low reproduction rates, so any sizeable number of fatalities could affect their populations. During migration, bats tend to fly at lower altitudes than birds, which also increases the potential risk of collisions.

Specific impacts would depend on the types of habitats affected, the amount of habitat disturbance over time, the amount and type of infrastructure present, and the occurrence and use of those areas by special-status species. Impacts could be avoided through siting and design of a facility. Impacts on special-status species could result from the following:

- Long-term effects from reduced species use of habitat due to changes such as mowing or other types of vegetation management
- Collision with turbines, towers, gen-tie lines, and facility fences
- Noise from turbine operation, support machinery, motorized vehicles, and mowing equipment
- Periodic habitat disturbance within the gen-tie line ROWs and along the access roads from maintenance activities, including the risk of oil or other contaminant spills and the continued spread of invasive species
- Altered migration routes
- Disturbance to foraging, breeding, and nesting behaviors due to placement of facilities or increased human activities
- Altered fire regimes that negatively impact fire-adapted species

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, some operation activities of utility-scale onshore wind energy facilities would result in **less than significant impacts** to terrestrial wildlife. Activities that affect species viability would result in **potentially significant adverse impacts** on terrestrial wildlife, particularly birds and bats.

Aquatic habitats and species
During operations, potential impacts from the use of motorized equipment and runoff of surface soils would be minimized by limiting the amount of maintenance activities occurring near riparian and aquatic habitat. The risk of waterbody contamination from hazardous materials used in site maintenance would be minimized through restriction of machinery use and herbicide and pesticide application near waterways If water drainage patterns, sediment

[22] https://www.nwf.org/-/media/Documents/PDFs/NWF-Reports/2019/Responsible-Wind-Power-Wildlife.ashx

delivery to waterbodies, riparian area function, or water quality are changed during construction, those impacts could continue to affect aquatic habitat and species during the operational period.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of utility-scale onshore wind energy facilities would likely result in **less than significant impacts** on aquatic habitats and species.

Wetlands
Operations could affect wetland plant communities as a result of mowing and vegetation maintenance, application of herbicides, and soil compaction from humans and vehicles. Activities could affect native amphibian species dispersal into and out of wetland breeding habitats. Wetland impacts could be minimized through the proper management of wastewater systems and safe management of hazardous materials.

Findings
Through compliance with laws, permits, and with implementation of actions that could avoid and reduce impacts, the operation of utility-scale onshore wind energy facilities would likely result in **less than significant impacts** on wetlands.

4.6.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale wind facilities. See Appendix E, *Biological Resources Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

WDFW is developing mitigation guidelines for onshore wind facilities and expects to finalize them by the end of 2024. WDFW's mitigation guidelines will be incorporated into this section in the Final PEIS.

Siting and design considerations
Terrestrial habitats and species

- Contact appropriate agencies early to identify potentially sensitive ecological resources.
- Site and design the facility to avoid priority habitat, such as shrubsteppe habitat, to the maximum extent possible.
- Conduct surveys for special-status habitat and species. If special-status habitat or species are observed, site and design the facility to avoid individuals and populations to the extent possible.
- Screen potential facility sites through local, state, and federal mapping resources to identify sensitive habitat and wildlife areas and critical areas such as steep slopes, priority habitats, sensitive species occurrence locations, and other local critical area datasets

- Have all pre-construction biological surveys, such as special status plant surveys, conducted by qualified biologists following accepted protocols established by federal or state regulatory agencies.
- Conduct at least 1 full year of avian use surveys to estimate the use of a facility site by avian species/groups of interest during the major migratory seasons or season of most concern.
- Establish buffer zones around sensitive habitats and areas identified as critical to sensitive species (e.g., nests) and exclude or modify facilities and activities within those areas.
- Site and design facilities to minimize habitat loss, habitat fragmentation, and resulting edge habitat.
- Use existing roads. Limit new road construction. Design new roads to follow natural land contours and avoid or minimize hill cuts in and adjacent to a facility site.
- Configure turbines to avoid landscape features known to attract bats, such as cliffs, forest edge habitat, and water sources if bats are detected on site or if bat activity is expected to be high.
- Minimize overhead collector lines, unless underground collector lines are not appropriate or feasible due to environmental conditions or cultural or Tribal resource concerns.
- Avoid construction during bird nesting seasons to the maximum extent possible. If construction occurs during bird nesting seasons, conduct nest clearance surveys prior to site disturbance.
- Avoid surface water or groundwater withdrawals that affect sensitive habitats (e.g., riparian habitats) and any habitats occupied by special-status species.

Aquatic habitats and species

- Contact appropriate agencies early to identify potentially sensitive ecological resources, including but not limited to aquatic habitats, wetland habitats, and special-status species locations and habitats, as well as designated critical habitat, that might be present in the area proposed for a facility and associated access roads and ROWs.
- Site and design the facility to avoid all types of aquatic habitat to the maximum extent possible.
- Conduct an aquatic habitat survey of the site to identify surface waters, their drainage routes, and the potential habitat that they provide.
- Have all pre-construction biological surveys conducted by qualified biologists following accepted protocols established by federal or state regulatory agencies, to identify and delineate the boundaries of important, sensitive, or unique aquatic habitats and wildlife species within and adjacent to the facility including waters of the United States, wetlands, springs, seeps, ephemeral streams, intermittent streams, 100-year floodplains, ponds and other aquatic habitats, and habitats supporting special-status species populations.

- Avoid or minimize impacts on streams by designing the site and roads to avoid or minimize crossing streams. Design stream crossings to minimize permanent impacts as required in WAC 220-660-190 and local regulations.
- Avoid surface water or groundwater withdrawals that affect sensitive habitats (e.g., aquatic habitats) and any habitats occupied by special-status species.

Wetlands

- Perform a wetland reconnaissance or delineation study on the site to identify and map any potential wetlands that may be present.
- Avoid siting structures and roads within wetlands or wetland buffers.

Additional mitigation measures to address potentially significant impacts
Terrestrial habitats and species

- Designate a qualified biologist to be responsible for overseeing compliance with and implementation of all mitigation measures in the Wildlife Habitat Mitigation Plan.
- For impacts to shrubsteppe habitat, incorporate higher compensatory mitigation ratios because such a large percentage of the shrubsteppe landscape in Washington has already been lost.
- Develop mitigation measures using WDFW's recommendations for wind power mitigation for temporary and permanent impacts to wildlife and habitat.

4.6.4 Findings for facilities with co-located BESS

4.6.4.1 Impacts

Impacts from construction, operation, and decommissioning
The potential impacts on biological resources for facilities with co-located BESSs would closely resemble the impacts considered for facilities related to site characterization, construction, operations, and decommissioning.

Co-locating BESSs would require some additional construction-related ground disturbance and an increased building footprint. The presence and use of a BESS at an onshore wind energy facility would add another stormwater consideration to a facility due to the container and concrete foundation. BESSs require HVAC units, which could generate increased noise that may disturb wildlife.

Overall, BESSs are not expected to substantially add to the overall level of impact on terrestrial habitats and species if BMPs are implemented. In addition, during normal operations, BESSs are unlikely to release reactive or toxic substances, so it is unlikely the BESS would additionally impact terrestrial habitats and species.

Findings
Impacts on biological resources would be similar to findings for utility-scale wind facilities above.

4.6.4.2 Actions to avoid and reduce impacts

Actions for reducing impacts for facilities with a co-located BESS are the same as those identified for facilities without a co-located BESS with the following additional measure:

- Site all BESS facilities and associated infrastructure away from surface waters and wetlands.

4.6.5 Findings for facilities combined with agricultural land use

4.6.5.1 Impacts

Impacts from construction, operation, and decommissioning
The potential impacts on biological resources for onshore wind facilities combined with agricultural land use would closely resemble the impacts considered for facilities without agricultural land uses related to construction, operations, decommissioning, or repowering.

Impacts for facilities combined with agricultural use would differ from facilities without combined agricultural land use as follows:

- Human use at a site would increase due to continued or new agricultural use and would result in an increase in noise, herbicide and pesticide use, crop rotation, and livestock activities that would impact habitats and species.
- There would be a combined demand for water that is higher than for an onshore wind energy facility with no agricultural use. This demand would be higher for a site that maintained crop production and irrigation, and lower for a site that maintained livestock use with no crop production.

Findings
Impacts on biological resources would be similar to findings for utility-scale wind facilities above.

4.6.5.2 Actions to avoid and reduce impacts

Actions for reducing impacts for facilities with co-located agricultural land use are the same as those identified for facilities without agricultural land uses.

4.6.6 Findings for the No Action Alternative

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 site characterization, construction, operations, and decommissioning, depending on facility size and design, and would range from **less than significant adverse impacts** to **potentially significant adverse impacts** on terrestrial and aquatic habitats and species, including wetlands.

4.6.7 Unavoidable significant adverse impacts

Construction and operation of onshore wind facilities may result in **potentially significant and unavoidable adverse impacts** on terrestrial special-status habitats and species if activities cause the permanent degradation, loss, or conversion of suitable habitat that is critical to habitat or species viability, affect the mortality of any individual species, cause a disturbance that disrupts successful breeding and rearing behaviors, or disrupt habitat continuity along migration routes. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site. Mitigation to reduce impacts below significance for terrestrial special-status habitats or species may not be feasible.

4.7 Energy and natural resources

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on energy and natural resources.

No significant and unavoidable adverse impacts on energy and natural resources would occur.

This section describes sources and availability of energy and natural resources and the amount that would be required by the facilities considered in this PEIS. Impacts on public service or utility providers are described in the public services and utilities resource section. Emissions associated with use of energy and natural resources are described in the air quality and greenhouse gases section.

The *Energy and Natural Resources Report* (Appendix F) includes the full analysis and technical details used to evaluate energy and natural resources in the PEIS. This section contains a summary of how impacts were analyzed and the key findings.

4.7.1 Affected environment

The type and quantity of energy and natural resources used in construction and operation can affect overall availability of energy sources for other uses. The resources evaluated include wind, electricity, transportation fuel, and construction aggregate.

4.7.1.1 Wind

Wind availability in the study area is shown in Figure 3-1. A facility may have an impact on the wind energy resource available to adjacent areas if it produces a wake of reduced-velocity wind downstream. This could reduce the ability of neighboring wind facilities to produce electricity. This effect would be highly dependent on the local climate, the geometry of the facility, the distance and layout of any neighboring facility.

4.7.1.2 Electricity

In 2023, Washington state used 88,702 million kilowatt-hours (kWh) of electricity, while it produced 98,725 million kWh.

4.7.1.3 Transportation fuel

Transportation fuels include gasoline and diesel fuel. In 2019, Washington consumed 2.8 billion gallons of gasoline and 950 million gallons of diesel fuel. Washington has several refineries and imports crude oil from Alaska and other locations and exports refined products. The state has a processing capacity of 648,000 barrels of crude oil per day, which produces 4.2 billion gallons of gasoline and 2.5 billion gallons of diesel annually. Much of this is exported.

4.7.1.4 Construction aggregate

Construction aggregate is a collective term for sand, gravel, and crushed stone. State production is monitored by USGS and surface mine permitting is handled by DNR. Though it is a non-renewable resource, construction aggregate is readily available in Washington. In 2023 the state produced 30.9 million metric tons of sand and gravel, and 14.4 million metric tons of crushed stone.

4.7.2 How impacts were analyzed

The assessment of impacts was qualitative and considered if utility-scale wind facilities could result in reduction of wind resource sufficient to affect adjacent wind energy facilities or result in increased demand for electricity, transportation fuel, or construction aggregate that could require new mines or affect statewide annual production.

4.7.3 Findings for utility-scale onshore wind energy facilities

4.7.3.1 Impacts

Impacts from construction and decommissioning

Electricity

During site characterization, construction, and decommissioning activities, electricity would be needed to power tools, equipment, and lighting. This demand could either be met with diesel fuel from portable generators or with electricity provided by a utility.

Transportation fuel

Facilities would consume transportation fuels during construction and decommissioning for worker commuting, haul-truck trips, and site equipment. The combined transportation fuel consumed by worker commuting, delivery, and site equipment would range from 2,370 gallons to 339,000 gallons based on the facility size. If some of the wind turbine components are transported by marine or rail, then the fuel consumption per ton-mile would be lower than for truck transport.

In total, during the construction phase, facilities would consume 60,700 to 1.32 million gallons of transportation fuels, representing 0.0019% to 0.04% of the total transportation fuel resource produced in the state for the 6- to 24-month construction period. Decommissioning activities would have similar fuel usage. If a facility was repowered, it is anticipated to require less transportation fuel than construction as not all wind turbine components would be replaced and fewer materials would be transported to the facility site as compared to construction.

Construction aggregate
Construction of facilities would use construction aggregate for building roads, while sand and gravel are key components of the concrete used for turbine foundations, operations buildings, and crane pads.

Facilities using 1.5 MW turbines would require between 14,000 cubic yards to 500,000 cubic yards of aggregate based on the facility size. This is 0.03% to 1.1% of the total available resource produced annually in the state. Aggregate may need to be obtained from multiple mines, depending on the facility location. Because new foundations and infrastructure would not be created, decommissioning and repowering is not expected to require additional aggregate.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** on energy and natural resources.

Impacts from operation
Wind resource
A utility-scale onshore wind facility may have an adverse impact on a neighboring wind facility because it could create a downstream wake of reduced-velocity wind. This may reduce the ability of some neighboring lands to produce wind power, and should be considered in siting and design of facilities. The size of this loss would be highly dependent on site- and facility-specific details.

Electricity
A facility would consume electricity during operations and for maintenance. A facility may use energy either from its own generation or the local electric utility.

Transportation fuel
Facilities would consume gasoline and diesel fuels to power maintenance vehicles during operations. The quantity of fuel consumed would be approximately 102 gallons per turbine per year.

Construction aggregate
During operations and maintenance, only a small amount of construction aggregate would be needed to maintain maintenance roads leading to turbines and supporting facilities. Assuming a new surface gravel would be required every 5 years to a thickness of 4 inches, the average annual demand would range between 350 and 12,140 cubic yards, depending on the facility size and access points.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operations of facilities would likely result in **less than significant impacts** on energy and natural resources.

4.7.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale wind facilities. See Appendix F, *Energy and Natural Resources Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Site and design facilities to minimize wind wake on any adjacent wind development.
- Limit construction of new roads and design new roads based on regulatory requirements and based on local conditions.
- Minimize electricity demand by using facility power for operational needs whenever possible, and using high-efficiency fixtures, appliances, and security lighting.

4.7.4 Findings for facilities with co-located BESS

4.7.4.1 Impacts

Energy use for facilities with BESSs would be similar to the impacts considered for facilities without BESSs related to site characterization, construction, operation, and decommissioning. Specific differences are summarized in the following sections.

Impacts from construction, operation, and decommissioning
Wind resource
A BESS does not alter a wind energy facility's impact on the wind resource compared to facilities without BESSs.

Electricity
Electricity use may be more intensive for short periods during testing of the installed BESS. The demand for energy during construction and operation is not expected to require new or substantially modified production or energy transmission. Decommissioning and repowering of a facility with a co-located BESS would require similar electricity as anticipated during construction.

Transportation fuel
Adding BESSs to wind energy facilities would require additional hours for construction and installation, increasing demand for transportation fuels to support worker commuting. Delivery of BESS components to the work site would increase demand for transportation fuels to support materials and equipment delivery. The increase in fuel demand created by BESSs would be minimal compared to what is already demanded by the facility construction. Decommissioning would have approximately the same demand for transportation fuels as

construction. If a facility was repowered, it is anticipated to require less transportation fuel than construction because not all wind turbine components would be replaced and fewer materials would be transported to the facility site as compared to construction.

Construction aggregate
A BESS would typically be installed on a concrete slab. Such a slab is much thinner than a wind turbine foundation and thus would require far less aggregate, an additional approximately 1,000 cubic yards of aggregate per BESS. These additional aggregate needs for the BESS would not be a large increase relative to the amounts for facilities without BESSs. Because new foundations and infrastructure would not be created, decommissioning and repowering is not expected to require additional aggregate.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operations, and decommissioning of facilities with a co-located BESS would likely result in **less than significant impacts** on energy and natural resources.

4.7.4.2 Actions to avoid and reduce impacts

Actions for reducing impacts for facilities with a co-located BESS are the same as those identified for facilities without a co-located BESS.

4.7.5 Findings for facilities combined with agricultural land use

4.7.5.1 Impacts

Impacts from onshore wind energy facilities co-located with an agricultural land use would closely resemble the impacts discussed for facilities not co-located with an agricultural use related to site characterizations, construction, operation, and decommissioning. Specific differences are summarized below. Many wind facilities share their land with agricultural use.

Impacts from construction, operation, and decommissioning
Impacts for site characterization, construction, and decommissioning would be the same as those considered for wind energy facilities without combined agricultural land use. New agricultural uses could generate some additional seasonal and temporary resource use from discing, harvesting, or other activities involving agricultural equipment. During operations, the features of these facilities could require more maintenance-related truck trips, which would vary by facility. Agricultural land use will not alter a wind energy facility's impact to the wind resource.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operations, and decommissioning of facilities with a co-located agricultural use would likely result in **less than significant impacts** on energy and natural resources.

4.7.5.2 Actions to avoid and reduce impacts

Actions for reducing impacts for facilities with and without agriculture are the same.

4.7.6 Findings for the No Action Alternative

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, and would be **less than significant adverse impacts**.

4.7.7 Unavoidable significant adverse impacts

Through compliance with laws, permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale onshore wind facilities would have **no significant and unavoidable adverse impacts** on energy and natural resources from construction, operation, or decommissioning.

4.8 Environmental health and safety

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction, operations, and decommissioning activities would likely result in **less than significant impacts** related to hazardous materials, health and safety, and wildfire risk.

Depending on the specific location, severity, and fire response capacity (described in Section 4.15), there is potential that construction, operations, and decommissioning of a facility would have **less than significant** to **potentially significant adverse impacts** of wildfire due to risk of ignition.

A thermal runaway event due to damage or battery management system failure at a facility with a co-located lithium-ion BESS would have a **potentially significant adverse impact** related to hazardous air emission risks for emergency responders.

If there are new ignition sources in remote locations with limited response capabilities, this may result in **potentially significant and unavoidable adverse impacts**. 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.

EHS refers to the risks or hazards that threaten the well-being of people or other elements of the environment. Impacts related to emergency response are discussed in Section 4.15, Public Services and Utilities. The *Environmental Health and Safety Resource Report* (Appendix G) includes the full analysis and technical details used to evaluate EHS in the PEIS.

4.8.1 Affected environment

Workplace accidents or system failures can result in EHS hazards, such as fires, explosions, hazardous material spills, injury, or structural damage. In this section, EHS includes hazardous materials and toxic substances exposure, health and safety, and wildfire hazards.

4.8.1.1 Hazardous materials

Hazardous materials include petroleum products, heavy metals, pesticides, fertilizers, solvents, compressed gases, and batteries. Large concentrations of these materials are found at industrial sites, commercial properties, and agricultural lands. Small quantities of hazardous materials may also be present along roads due to vehicular activity or illegal dumping.

Ecology regulates and monitors the storage, use, and disposal of hazardous materials. Active land uses in the study area that handle hazardous materials must document their presence. A large portion of these hazardous materials are associated with agricultural land uses in rural areas. Toxic substance cleanup sites are recorded in Ecology's Contaminated Site Register.

4.8.1.2 Health and safety risks

Hazardous materials may affect workers and emergency responders at facilities. Turbines and electrical components and structures may pose risks of electrical hazards and accidents during maintenance activities.

4.8.1.3 Wildfire risk

Wildfires pose significant risks of injury, loss of life, and damage. Wildfires can occur from either human or natural causes. Washington has experienced extreme fire events, partly due to climate change and forest fire suppression practices, and this is expected to increase in the future. The combination of longer fire seasons, population growth, and declining forest health increases wildfire risks. The landscape, weather conditions, and vegetation present can influence the degree of fire risk and fire behavior in an area. The region west of the Cascade Mountains receives more rain, while eastern Washington (where more of the study area is located) is drier and more prone to wildfires.

Wildfire risk is increasing in Washington due to climate change. Climate change impacts variables related to fire risk, including temperature, precipitation, humidity, and forest health. The University of Washington's climate resilience mapping projects a significant increase in high fire danger days between 2040 and 2069. The region's most at risk areas include the eastern slope of the Cascades, Okanogan Big Bend, northeastern Washington, and the Blue Mountains of the southeastern Palouse.

4.8.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

- Potential for release of hazardous materials that increases the risk of environmental contamination (e.g., air or water) or increased threats to human health and safety
- Increase in physical safety risks resulting in a high likelihood of harm to facility workers or the public
- Increase in wildfire risk and associated hazard conditions

4.8.3 Findings for utility-scale onshore wind energy facilities

4.8.3.1 Impacts

Impacts from construction and decommissioning

Hazardous materials

Site characterization, construction, and decommissioning of utility-scale onshore wind energy facilities could increase the risks of hazardous material spills or contamination on a facility site. Hazardous materials are present in vehicles, construction equipment, transformers, and other materials used in facility construction and decommissioning. These include petroleum products, hydraulic fluids, batteries, solvents, corrosion control coatings, and spent hazardous material containers. Facilities store and use these hazardous materials in small quantities. If more than 1,320 gallons of petroleum fuel is stored on site, an SPCC Plan would be required. In the case of accidents, equipment failure, or damage to construction materials, spills of small amounts of hazardous materials are possible. The Washington State Model Toxics Control Act regulates the handling and cleanup of these types of hazardous materials. Spills would need to be contained, assessed, and remediated, with hazardous waste transported and disposed of in line with state and federal regulations.

Decommissioning could involve a higher risk of releasing hazardous materials due to degradation of facility components or dismantling facility components. This phase would include more processing and disposal of solid and hazardous waste. Large portions of the facility would be composed of recyclable metals, including structural components of the tower, transmission lines, transformers, and other components of the power collection system. Electrical substations would need to be inspected for contamination of the soil by hazardous materials and could require remediation. When a wind energy facility reaches the end of its design life, repowering may also be an option instead of decommissioning. The types of impacts related to hazardous materials that could occur during repowering would largely be comparable to those during construction.

Wind turbine blades could pose the largest challenge to waste disposal during decommissioning. Without mitigation, shredding the wind turbine blades at the facility site prior to disposal could generate particulates that irritate the skin, lungs, and eyes. The particulates can become airborne or enter soils or water in the area of disposal. This analysis assumes that a Decommissioning and Site Reclamation Plan would be required to be developed and implemented. Such a plan would include specific measures pertaining to potentially hazardous materials associated with wind energy facility components, fire prevention protocols, and would require specialized procedures for handling, transporting, management, and disposal.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** related to hazardous materials.

Health and safety
Construction activities in the study area would present similar health and safety risks to workers as those that are present on other industrial construction sites. Common occupational health and safety risks include falls from facility structures, collisions with construction vehicles, and exposure to electricity, hazardous materials, fire, the elements, or noise. The types of occupational health and safety impacts that could occur during decommissioning or repowering of utility-scale onshore wind energy facilities would largely be comparable to those that could occur during construction. Impacts on the public are unlikely. Decommissioning could involve a higher risk of exposure for workers to hazardous materials, electricity, or fire due to degraded or malfunctioning facility components. The types of impacts related to health and safety that could occur during repowering would largely be comparable to those during construction. Public access to the facility would be restricted by fences which would limit public exposure to potential hazards.

Facilities would follow Occupational Safety and Health Act (OSHA) regulations. Additional health and safety requirements would be established during site-specific, facility-level planning to address hazards specific to the facility.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction and decommissioning of facilities would likely result in **less than significant impacts** related to health and safety.

Wildfire risk
Construction and decommissioning of wind energy facilities could generate ignition risks from equipment or materials; however, the likelihood of an onshore wind energy facility or related gen-tie lines igniting a wildfire is low. These risks are similar to other industrial facilities and require careful management, especially in areas of high fire risk. Facilities could alter the behavior of fire due to structures, mowing, and land use changes. Equipment would need to meet state and international building and fire code standards. Proactive planning with federal, state, and local wildfire and emergency response agencies and compliance with OSHA requirements would reduce construction-related ignition risks. See Section 4.15 for an evaluation of fire response impacts.

Findings
Depending on the specific location, severity, and fire response capacity (described in Section 4.15), there is potential that construction and decommissioning of a facility would have **less than significant** to **potentially significant adverse impacts** of wildfire due to risk of ignition.

Impacts from operation

Hazardous materials

Accidents or failures that could result in the release of hazardous materials are rare, and are typically small quantities that would not likely result in risk of environmental contamination or threats to human health and safety.

Hazardous materials present would be consistent to those used during construction. Operations and maintenance would require fewer on-site personnel and less-intensive labor than construction, which would result in a lower use of vehicles and equipment that could accidentally release hazardous materials.

Maintenance of onshore wind energy facilities can require recurring changes to the oil or synthetic lubricant used in the wind turbines, which could increase the risk of accidents resulting in hazardous material spills. This maintenance activity would be unlikely to cause significant impacts and would be performed in accordance with applicable hazardous waste management regulations.

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

Health and safety

The types of occupational health and safety hazards during operation are similar to those during construction. However, the scale and intensity of on-site labor would be much less, reducing the risk of falls, vehicle collisions, and noise exposure. While accidents could occur, laws, regulations, and industry standards are in place to prevent health and safety hazards in the workplace.

Operations would increase potential exposure to health and safety risks from wind turbine failures or accidents, such as blades breaking, structural failures, or fires. While these incidents are extremely rare, they can pose significant impacts on the health and safety of workers but are unlikely to pose risks to public health and safety. Public access to the facility would be restricted.

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

Wildfire risk
Wind energy facilities would be maintained and monitored in compliance with all regulatory requirements pertaining to fire and safety. The potential for wind energy facilities to contribute to wildfire risk considers ignition risk associated with operations activities at a facility, along with the change to the landscape due to the presence of the facility. The presence and use of electrical equipment at the facilities, including gen-tie lines, would have risks of ignition. Most wildfires started by electrical power are caused by the contact of trees and surface fuels with power lines. All wind and electrical equipment would be required to conform to state and international building and fire code standards and these facilities would be regularly maintained and monitored to reduce ignition risks. Accidents and fires could still occur; however, there is a low likelihood of operations activities igniting a wildfire. Operations and maintenance activities would also include regular mowing and trimming of trees to control vegetation on the facility sites and associated electrical corridors. While these activities reduce a fuel source, they also involve ignition risks that could generate sparks and cause wildfires, which could spread into the surrounding landscape. However, these risks can be reduced through appropriate implementation of an Operational Site Safety Management Plan. See Section 4.15 for an evaluation of fire response impacts.

Findings
Depending on the specific location, severity, and fire response capacity, there is potential that operation of facilities would have **less than significant** to **potentially significant adverse impacts** of wildfire due to risk of ignition.

4.8.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale onshore wind facilities. See Appendix G, *Environmental Health and Safety Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- In areas susceptible to wildfires, coordinate with local fire organizations early in the facility planning process to determine measures that would be incorporated into the design of the facility to prevent an increase in wildland fire frequency.
- Design facilities to reduce risks to neighboring land uses from gen-tie lines or other wind energy facility components, including potential setbacks, to reduce the risk of ignitions in fire-prone environments.

- Determine appropriate setbacks in consultation with local, state, or federal land managers. Setback distances should consider proximity to residences, terrain, vegetation management clearance requirements for gen-tie lines, vegetation and natural communities on surrounding lands, and the need to maintain access for maintenance and emergency response, among other considerations.
- Install water cistern(s) on site to store water for wildfire and structure fire suppression needs, as determined by the local fire marshal.
- Implement lightning protection measures to protect generators and other associated ground equipment, as well as reduce the potential for wildfires or other damage to equipment.
- Establish roads before accessing the site to minimize vehicle contact with grass.
- Design gen-tie ROWs to be wide enough to ensure there is a sufficient firebreak inside the ROW.
- Consider underground gen-tie lines for areas with high-fire risk.
- Design a minimum 20-foot, noncombustible, defensible space clearance around the facility perimeter fencing and structure, particularly buildings, to serve as a fire break.
- Install fire protection equipment in accordance with Washington State fire code.
- Locate refueling areas on paved surfaces and away from surface water locations and drainages; features should be added to direct spilled materials to sumps or safe storage areas where they can be subsequently recovered.

Additional mitigation measures to address potentially significant impacts

- Develop and implement a site-specific Emergency Management Plan to address worker health and safety, standards concerning potential release of hazardous materials, and site-specific Construction/Operational Fire Prevention and Response Plans for fire prevention and control. These plans provide safety guidelines and procedures for potential emergency-related incidents during the facility's construction, operation, and decommissioning phases. The plan must meet applicable laws/codes, and should be developed in coordination with local fire and emergency service providers.
- In areas susceptible to wildfires, coordinate with local fire organizations and emergency management departments early in the facility planning process to determine measures to be incorporated into the design of the facility to prevent an increase in wildland fire frequency.
- The construction and facility manager would be responsible for contacting DNR and/or the U.S. Forest Service (USFS) for updates on wildfire conditions in the area and implementing any necessary wildfire precautions.
- Ensure that emergency service providers receive specialized training and are fully informed regarding the facility's fire and hazardous materials risks and how to safely respond to fires.
- Wildfire activity would be monitored during facility construction, decommissioning, and operation and, if necessary, activities would be modified, schedules changed, construction or operation ceased, or equipment removed.

- Staff who have 24-hour access to the site would be trained to prevent and control potential wildfires and structure fires inside the facility.
- It is recommended that a turbine blade procurement strategy and end-of-life stewardship plan be prepared as part of a developer's application to reduce the overall quantities of potentially hazardous solid waste associated with wind energy components.

4.8.4 Findings for facilities with co-located BESS

4.8.4.1 Impacts

Impacts from construction, operations, and decommissioning

Hazardous materials

Additional hazardous materials for site characterization, construction, and decommissioning of wind energy facilities with co-located BESSs include the following:

- Battery electrolytes, typically used in vehicle, equipment batteries, and BESSs
- Materials typically used in anti-conductive insulation for electric components, such as wires

This PEIS analyzes impacts from lithium-ion, iron-flow, and zinc-bromide batteries. Batteries from the BESS would contain toxic chemicals that could be hazardous in the event of a system failure, which could result in the battery leaking. If the batteries overheat or are damaged, they could leak toxic gases. This would be less likely during construction compared to operation because BESSs would not be storing energy generated on site, which would greatly reduce the likelihood of batteries failing due to overheating. There could be risk of hazardous materials leaks from batteries during operations due to the potential for batteries to leak or ignite when overheating from energy storage. BESS storage includes containment for spills. Similar to facilities without a BESS, the Model Toxics Control Act would dictate the handling and cleanup of these types of hazardous materials.

Flow batteries and zinc-bromide batteries are generally not flammable. Firefighting does not typically use water because it can increase exposure to toxic chemicals through smoke, vapor, or contaminated runoff. Once a fire has self-extinguished, there may be releases of flammable or toxic gases. Spraying water on smoke or vapor released from the battery, whether burning or not, may cause skin or lung irritation. This is one additional reason for allowing the battery to burn in a controlled manner. The site should be entered only by trained firefighters wearing full protective gear.

WAC 51-54A-0322 includes requirements for storage and fire prevention for lithium-ion and lithium metal batteries. A fire safety plan is required and must include emergency responses to be taken upon detection of a possible fire. Fire code officials may require a report to evaluate the fire and explosion risks associated with the storage area and to make recommendations for fire and explosion protection. The report must be approved by a fire code official.

During decommissioning, batteries would be stored, handled, and transported in accordance with either hazardous waste regulations or battery-specific disposal standards, which would reduce the risk of releases of hazardous material. Batteries can be recycled but are often disposed of as hazardous waste due to a lack of recycling service providers for batteries. Because of the growing use of lithium-ion batteries for energy storage and other purposes, the USEPA has proposed rules to establish waste management regulations specific to the batteries. The Washington State Legislature has directed Ecology to assess and recommend options for collection and end-of-life management of large batteries, such as those used in BESSs. Regardless of whether the batteries are recycled or disposed of as hazardous waste at their end of useful life, the batteries would be stored, handled, and transported in accordance with either hazardous waste regulations or battery-specific disposal standards, which would reduce the risk of releases of hazardous material.

Health and safety

Facilities with BESSs would largely include the same health and safety risks during construction, operations, and decommissioning as other utility-scale facilities without co-located BESSs, with higher operating risks due to the health and safety risks associated with BESSs. The addition of BESSs could create hazards with the possibility of explosions, flammable gases, toxic fumes, water-reactive materials, electrical shock, corrosives, and chemical burns that could affect human health and safety. Batteries in the BESS could impact worker health and safety if there was a release of hazardous materials or a fire. Exposure to toxic gases leaking from damaged batteries could cause irritation to the skin and lungs. Battery failures that could produce these health and safety impacts are rare. Compliance with requirements, regular maintenance, and proactive emergency plans would help mitigate risks.

Wildfire risk

Facilities with co-located BESSs would largely include the same wildfire risks during construction, operations, and decommissioning as those described for other utility-scale facilities without co-located BESSs. The BESSs present additional fire risk and risks to emergency responders, and utility-scale energy storage requires specialized and reliable equipment to perform firefighting operations; further details are available in the *Public Services and Utilities Resource Report* (Appendix N).

Battery overhearing events due to damage or failure of battery management systems are very rare for BESSs and, if properly installed and maintained, they are generally not flammable. Rooms and areas within buildings and walk-in units containing BESSs would be protected by an automatic fire protection system. Battery incidents require specialized response training for first responders due to risks with these hazardous materials. Battery incidents can be difficult to extinguish, and some battery types can reignite above certain temperatures after being put out. WAC 51-54A-0322 requires lithium battery storage containers to include a fire protection system. As described above, an Emergency Response Plan would include emergency responses to be taken upon detection of a possible fire and including setback distances in siting and design would reduce risks of a fire spreading.

BESSs generally come equipped with remote alarms for operations personnel and emergency response teams, including voltage, current, or temperature alarms from the battery management system. Other protective measures include ventilation, overcurrent protection, controls to operate the batteries within designated parameters, temperature and humidity controls, smoke detection, and maintenance in accordance with manufacturers' guidelines.

Findings
Most impacts on EHS would be similar to findings for utility-scale onshore wind facilities above. Facilities with lithium-ion BESSs would have **potentially significant adverse impacts** due to hazardous air emission risks to emergency responders associated with the BESS.

4.8.4.2 Actions to avoid and reduce impacts

Available actions for facilities with co-located BESSs would be the same as those proposed for facilities without BESSs. Additional actions relative to the BESS are detailed below.

Siting and design considerations

- BESSs should be designed and sited in a manner consistent with the current International Building Code and NFPA Standards to minimize overheating and enable clearing of hazardous gases in the event of battery leaks or thermal runaway events. They must also comply with the latest Washington State Building Code Council regulations for batteries.
- Setback distances allowing for emergency accesses and management or removal of dry vegetation would also reduce risks of explosion and potential release of hazardous materials. If there is a thermal runaway event, the required setback distances also prevent spread from one container to another.

Additional mitigation measures to address potentially significant impacts

- Develop and implement fire protection, prevention, and detection measures and design features in accordance with NFPA 855 Standards for Installation of Energy Storage Facilities and the current Washington Fire Code, including providing redundant separate methods of BESS failure detection. In addition, the proponent should develop an Emergency Response Plan in advance of construction.
- Develop and implement comprehensive training programs and safety protocols for personnel involved in BESS operations and maintenance.
- Develop and implement regular maintenance schedules and inspections for BESS components to ensure optimal performance and early detection of potential issues.
- Develop and implement detailed emergency response plans specific to BESS operations to mitigate the consequences of potential damage or failure of battery management systems.

4.8.5 Findings for facilities combined with agricultural land use

4.8.5.1 Impacts

Impacts from construction, operations, and decommissioning

Hazardous materials

Hazardous materials for site characterization, construction, operations, and decommissioning of wind energy facilities combined with agricultural land use would be similar to facilities without agricultural land uses, but would also include agricultural machinery and equipment that may require use of petroleum and the use of fertilizers, herbicides, and pesticides. The use of farm vehicles or equipment could increase the risk of accidents that could release hazardous materials. Decommissioning and repowering would also include disposal of solid and hazardous waste.

The presence of agricultural operations does not greatly increase the risk of adverse impacts. Accidents or failures that could result in the release of hazardous materials are rare, and if they do occur, they are unlikely to result in environmental contamination or an increase in threats to human health and safety.

Health and safety

The types of health and safety hazards that people could be exposed to would largely be the same as those considered for utility-scale facilities without agricultural land use. Agricultural activities on site could increase the presence or risk of exposure to certain occupational health and safety hazards, such as potential exposure to fertilizers, pesticides, herbicides, livestock, biohazards associated with livestock, or other hazards associated with agricultural operations. Agricultural operations would not occur in active construction and decommissioning areas, but agricultural activities nearby could increase the risk of exposure to certain occupational health and safety hazards. The risk of exposure to occupational hazards that were present during construction would decrease during operation in conjunction with a decrease in the scale and intensity of on-site labor compared to construction. Decommissioning could involve a higher risk of exposure to hazardous materials, electricity, or fire due to degraded or malfunctioning facility components.

Wildfire risk

Construction, operations, and decommissioning of facilities combined with agricultural use would involve the use of equipment and activities that could generate ignition risks. Facilities with agricultural land use would entail active management of the vegetative landscape (e.g., grazing, crop production, pollinator habitat) in conjunction with onshore wind energy facilities. Because there would be active management of the vegetative landscape and a beneficial cooling effect to the land, it is assumed that fire risk, and therefore demand for fire response, for the sites would generally be reduced compared to facilities without agriculture. However, coordination to reduce potential ignition risks at the facilities would still be required and emergency responders could face delays or obstacles to accessing the facility because of agricultural gated areas or areas with livestock.

Findings
Impacts on EHS would be similar to findings for utility-scale onshore wind facilities above.

4.8.5.2 Actions to avoid and reduce impacts

Available actions for wind energy facilities that include agricultural uses would be the same as those proposed for facilities without agricultural land uses. Additional siting and design considerations relative to the co-located agricultural land use detailed below.

- Engage in early consultation with agricultural operators to outline plans for acceptable compatible uses of the agricultural site.

4.8.6 Findings for the No Action Alternative

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, and would range from **less than significant** to **potentially significant adverse impacts**.

4.8.7 Unavoidable significant adverse impacts

Construction, operation, and decommissioning of utility-scale onshore wind facilities may result in **potentially significant and unavoidable adverse impacts** related to wildfires if there are new ignition sources in remote locations with limited response capabilities. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.

4.9 Noise and vibration

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction, operation, and decommissioning activities would likely result in **less than significant impacts** on noise and vibration.

Potentially significant adverse impacts related to noise would occur if:

- Construction or decommissioning activities occur within 2,500 feet of a noise-sensitive receptors in quiet rural areas
- Depending on the size of a facility, wind turbines are located closer than 1,000 to 2,400 feet from a noise-sensitive receptor or closer than 3,000 to 5,000 feet from noise-sensitive receptors within a quiet rural setting
- Depending on the size of a facility, substations are closer than 110 to 650 feet from a noise-sensitive receptor or closer than 350 to 2,000 feet from a noise-sensitive receptor in quiet rural areas
- Facilities with a BESS of certain design and consolidated configuration are closer than 1.5 miles from noise-sensitive receptors

Potentially significant adverse impacts related to vibration would occur if:

- Pile driving during construction and decommissioning activities occur closer than 350 feet from residential land uses or in close proximity to modern or historic structures
- Blasting is conducted within 2,000 feet of historic structures

No significant and unavoidable adverse impacts related to noise and vibration would occur.

Noise is unwanted sound that can affect people, fish, and wildlife. Vibration is motion through something solid, like the ground, which can affect living creatures or damage buildings. The information in this section summarizes the full analysis and technical details used to evaluate noise and vibration in the PEIS, which can be found in the *Noise and Vibration Resource Report* (Appendix H).

4.9.1 Affected environment

4.9.1.1 Ambient noise levels

Due to the large extent of the study area, ambient noise levels and their effect on the surrounding environment vary based on location. Generally, noise levels are higher around transportation corridors, airports, industrial facilities, and construction activities. Noise levels associated with general community activities throughout the study area can be estimated based on population density. More densely populated counties have background values between 45 and 55 A-weighted decibels (dBA); counties with sparser densities are less than 35 dBA.

Utility-scale onshore wind energy facilities would typically be located in rural areas with low population density, where ambient sound levels would be low. Noise may be sporadically elevated in localized areas due to roadway noise or periods of human activity.

The existing acoustic environment could include existing wind turbines, motor vehicle traffic, mobile farming equipment, farming activities such as plowing and irrigation, all-terrain vehicles, local roadways, periodic aircraft flyovers, as well as natural sounds such as bird calls and wind. Sound moving through the air is affected by air temperature, humidity, wind and temperature gradients, vicinity and type of ground surface, obstacles, and terrain features. Natural terrain features such as hills, and constructed features such as buildings and walls, can significantly affect noise levels.

4.9.1.2 Noise-sensitive receptors

Some land uses are considered more sensitive to noise than others due to the amount of noise exposure and the types of activities typically involved. Residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, and auditoriums generally are more sensitive to noise than are commercial and industrial land uses.

Sensitive wildlife and habitats, including the habitat of rare, threatened, or endangered species, can also be affected by noise. For noise impacts on wildlife including airborne noise effects on terrestrial wildlife and waterborne noise effects on fish and marine mammals, please refer to the *Biological Resources Report* (Appendix E). Recreational uses are also sensitive to noises, please refer to the *Recreation Resource Report* (Appendix K) for an analysis of noise impacts on recreationists.

4.9.1.3 Vibration-sensitive land uses and structures

Sensitive receptors for vibration include structures, such as older masonry structures or historic structures, and people, particularly in residential locations during nighttime hours. Information on impacts on historic properties is included in the *Historic and Cultural Resources Report* (Appendix L).

4.9.2 How impacts were analyzed

Construction-related noise impacts were evaluated using the General Assessment methodology of the Federal Transit Administration (FTA) Noise and Vibration Impact Assessment Manual. The Federal Highway Administration’s Roadway Construction Noise Model was also used to calculate noise levels at certain distances for comparison to FTA’s published construction noise criteria. A separate analysis was provided for conditions where blasting or pile driving would be a necessary method of construction. The approach for construction-related vibration impact assessment used an estimate of vibration generation at varying distances from specific construction equipment known to generate vibration.

For operational impacts from utility-scale wind energy facilities, reference noise levels from sources associated with these facilities were researched from existing facility-level analyses and a conservative estimate of noise generation with distance was developed for distances at which potential impacts of operational noise may occur from the extent of an onshore wind energy facility footprint.

Noise impacts were evaluated for likely conflicts with local ordinances or potential exposure of noise-sensitive land uses in excess of the FTA criteria, and potential to exceed the maximum permissible environmental noise levels specific to land use (Chapter 173-60 WAC). For residential uses, an Environmental Designation for Noise Abatement (EDNA) of 50 dBA would apply during nighttime hours. Note that most local jurisdictions and the noise standards in Chapter 173-60 WAC exempt sounds originating from temporary construction site activities between the hours of 7:00 a.m. and 10:00 p.m. In addition, WAC 173-60-050(2)(a) specifically exempts noise from electrical substations from its EDNA standards.

The extent of a noise impact would depend on the existing ambient noise level at any given receptor, and site-specific modeling would be needed for each future facility proposed. Existing noise levels are commonly low in rural areas where siting of energy facilities would likely occur. For facility operation, an increase of 5 dBA could result in a noise impact at noise-sensitive receptors.

Construction vibration impacts were evaluated for the potential to expose nearby land uses and structures to peak particle velocity levels that would meet or exceed FTA criteria.

4.9.3 Findings for utility-scale onshore wind energy facilities

4.9.3.1 Impacts

Noise impacts from construction and decommissioning

Potential construction or decommissioning noise impacts would depend on the activities, terrain, vegetation, and local weather conditions as well as distance to the nearest sensitive receptors. Most sensitive receptors are assumed not to be located close to potential utility-scale facility locations.

Site characterization, construction, and decommissioning of a utility-scale facility would generate noise from multiple sources, including:

- Off-road equipment used for site preparation and construction
- Blasting
- Truck trips to bring materials to work sites including sand, fly ash, and cement to a concrete batch plant
- Noise generated by rock processing at a concrete batch plant and by pile driving

Off-road equipment noise for site preparation and construction

Heavy equipment use would vary during the site preparation and construction activities. The construction phase would also include noise-generating site characterization activities, including soil coring and the construction of meteorological towers. Typically, noise levels are highest during site preparation when land clearing, grading, and road construction would occur.

All construction activities except pile driving, forklifts, and manlifts would be below 45 to 50 dBA when receptors are located 2,500 feet or further from work areas. FTA's daytime criterion of 90 dBA would be exceeded if pile-driving activities were conducted within 85 feet of noise-sensitive receptors. For an onshore wind facility located in a rural environment, this would be an unlikely scenario.

Noise-generating site characterization activities, such as soil coring and the construction of meteorological towers, would also occur at levels below 45 to 50 dBA.

If required for turbine foundations, pile driving may only exceed noise criterion during construction of a small number of turbine locations and may not constitute a prolonged noise increase at a distance of 2,500 feet. However, recognizing that existing ambient noise levels are commonly quiet (potentially 35 to 40 dBA or lower) in rural areas where siting of energy facilities would likely occur, a prolonged noise contribution of 45 to 50 dBA could also result in a noise impact at noise-sensitive receptors located closer than 2,500 feet, particularly during nighttime hours. The extent of a construction noise impact would depend on the existing ambient noise level at any given receptor.

Generators may be used for temporary power during the turbine commissioning period, which includes the testing and startup of the wind turbines after they are installed, but before they begin normal operations. Generators for construction are estimated to generate a noise level of 78 dBA equivalent-continuous sound level (Leq) at 50 feet, which could be reduced by using an acoustical enclosure.

However, most construction activities would be temporary and of short duration. Most local jurisdictions and the noise standards in Chapter 173-60 WAC exempt temporary construction site noise between the hours of 7:00 a.m. and 10:00 p.m. Outside of these times, construction and decommissioning activities would be required to meet noise limits.

Blasting noise

Blasting may be needed for construction of facilities (e.g., wind turbine foundations) and may occur as part of site preparation activities, depending on subsurface conditions. Blasting within 50 feet would affect noise-sensitive receptors, but this is not likely. Blasting would typically be a part of site preparation and, therefore, not occur simultaneously with pile driving or other construction building activities. Noise generated by blasting is similar in magnitude to that of other construction activities.

Noise from trucks

Noise from trucks moving materials to and from a facility construction site would potentially increase noise levels along roadways used to access the onshore wind facility. These truck trips would typically be made throughout the day and, except in cases where substantial volumes of material would be hauled, the increase in noise levels would not be enough to result in a noticeable increase in traffic noise.

Concrete batch plant noise
Concrete batch plants may be used to provide material for construction of foundations and would occur simultaneously with pile driving or other construction activities. Estimated noise from a concrete batch plant during facility construction is similar in magnitude to that of other construction activities.

Decommissioning
Facility decommissioning, site restoration, and repowering activities would result in similar noise levels as would occur during construction, except for pile driving and blasting activities, which are not expected during decommissioning or repowering.

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

If construction activities would occur within 2,500 feet of noise-sensitive receptors in quiet rural areas, this would result in a **potentially significant adverse impact**.

Vibration impacts from construction and decommissioning
Potential construction and decommissioning vibration impacts would depend on the equipment, methods, and distance to sensitive receptors or structures. Construction may involve blasting and the use of equipment such as impact pile drivers and vibratory rollers, which can generate substantial vibration. Vibration from pile driving during construction would exceed the applicable FTA criterion at distances closer than 350 feet, while vibration from vibratory rollers would exceed FTA criterion at distances closer than 50 feet. All other construction equipment could be 25 feet or closer without exceeding FTA criteria. Therefore, vibration from specific activities occurring at distances closer than 350 feet from residential land uses could be a potential impact to people.

Vibration has the potential to result in architectural damage to nearby structures. Cosmetic damage could result from pile driving closer than 30 feet to a modern building, or closer than 80 feet to a historic building. However, these are not likely to be that close to utility-scale facilities.

Blasting could cause cosmetic damage to sensitive structures because of vibration or acoustic overpressures. Some types of blasting would result in vibration impacts on historic structures located within 2,000 feet.

Facility decommissioning, site restoration, and repowering activities would result in similar vibration levels as would occur during construction, except for pile driving and blasting activities, which are not expected during decommissioning or repower.

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

Vibration from specific construction and decommissioning activities occurring at distances closer than 350 feet from residential land uses, or in close proximity to modern or historic structures, would be a **potentially significant adverse impact** with respect to human annoyance or building damage. If some types of blasting are conducted within 2,000 feet of historic structures, it would result in a **potentially significant adverse impact.**

Noise and vibration impacts from operation

Wind turbine noise

The major noise sources for facilities are wind turbines and substations. These sources may operate up to 24 hours a day and therefore could generate noise during the more noise-sensitive nighttime hours.

Facility-level noise assessments for two proxy facilities were used to estimate the noise generation potential. This included a proposed 216 MW wind facility with up to 72 turbines rated from 3 to 7.5 MW each (Fountain Wind in Shasta County, California) and a proposed 1,150 MW wind facility with 244 turbines rated from 2.8 to 5.5 MW each (Horse Heaven in Benton County, Washington).

Noise modeling developed for the proxy facilities shows that while turbines may be clumped into groups of three or more on a given facility footprint, the 50 dBA Leq noise contour consistently extends approximately 1,000 feet from each turbine for a 216 MW facility (based on a reference facility assessment from the Fountain Wind Energy Project) and the 55 dBA Leq noise contour consistently extends approximately 1,260 feet from each turbine for a 1,150 MW facility (based on a reference facility assessment from the Horse Haven Wind Farm). For larger facilities, it is estimated that the 50 dBA Leq noise contour would occur at approximately 2,400 feet.

For residential uses, an EDNA of 50 dBA would apply during nighttime hours.

In quiet rural areas, an increase of 5 dBA over ambient conditions could result in a noise impact at noise-sensitive receptors. In rural areas, an increase of 5 dBA over ambient noise could result when turbines generate a noise level of 40 dBA at a receptor. This noise increase would have the potential to occur within distances ranging between approximately 3,000 feet and 5,000 feet of the nearest turbine, depending on the size of the wind energy facility.

Substation noise

Based on a reference facility assessment, a typical substation transformer is estimated to generate a noise level of 72 dBA at a distance of 6 feet during full load with fans and pumps running. Any receptor more than 110 feet away from such a substation, or 350 feet away in quiet rural areas, would be unlikely to be affected by noise associated with that substation. Larger facilities would likely require a larger, and potentially louder, substation transformer. For larger substations, any receptor more than 650 feet away from such a substation in a noise-sensitive area or more than 2,000 feet away from such a substation in a quiet rural areas would be unlikely to be affected by noise associated with the substation. WAC 173-60-050(2)(a) specifically exempts noise from electrical substations from its EDNA standards.

Corona noise
The localized electric field near an energized conductor can be sufficiently concentrated to produce a small electric discharge, which can ionize air close by. This effect is called corona, and it is associated with all energized electric power lines. Corona can produce small amounts of sound. Corona noise is typically characterized as a hissing or crackling sound, which may be accompanied by a hum. Slight irregularities or water droplets on the conductor and/or insulator surface accentuate the electric field strength near the conductor surface, making corona discharge and the associated audible noise more likely.

Computer modeling software developed by the Bonneville Power Administration indicates that, during wet weather conditions, audible noise levels of up to 46 dBA can occur within the gen-tie ROW corridor for a 230 kV line. The study assumed a ROW 80 feet wide and the gen-tie ROW for onshore wind facilities is assumed to be wider than this. Outside the ROW, 34.5 kV lines would likely be inaudible. Noise from lower voltage lines and/or during dry conditions would be lower. This noise level would be below the 50 dBA EDNA applicable to residential uses.

Vibration
Operation activities would not be expected to generate vibration.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most operations activities would likely result in **less than significant impacts** related to noise and vibration.

Depending on the size of a facility and location to sensitive receptors, wind turbines located closer than 1,000 feet to 2,400 from a noise-sensitive land use, or closer than 3,000 to 5,000 feet from noise-sensitive land uses within a quiet rural setting, could have a **potentially significant adverse impact**.

Facility substations located closer than 110 feet from a noise-sensitive land use or closer than 350 feet from a noise-sensitive land use in a quiet rural area, or larger substations for large facilities closer than 650 feet away from a noise-sensitive receptor or 2,000 feet from a noise-sensitive receptor in a quiet rural area, would also have a **potentially significant adverse impact**.

4.9.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale onshore wind facilities. See Appendix H, *Noise and Vibration Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Complete a project-level noise and vibration analysis during siting.
- For facilities sited in quiet rural areas, depending on the facility size, site wind turbines at least 3,000 to 5,000 feet from noise-sensitive receptors.
- Depending on the facility size, site wind turbines at least 1,000 feet to 2,400 feet from the closest noise-sensitive land use.
- Site facilities such that the construction zone would be at least 80 feet from the closest structure.

Additional mitigation measures to address potentially significant impacts

- For construction of a facility closer than 2,500 feet from a noise-sensitive receptor, develop and implement a Construction Noise Management Plan.
- Select wind turbine equipment to reduce operational noise impacts, including selecting turbines designed to operate in noise-reduced operation mode.
- Develop and implement a Construction Vibration Management Plan for any construction areas closer than 80 feet from existing structures.

4.9.4 Findings for facilities with co-located BESS

4.9.4.1 Impacts

Impacts from construction and decommissioning
Site characterization, construction, and decommissioning of a utility-scale onshore wind facility with a co-located BESS would generate similar construction noise and vibration levels as those analyzed for facilities of the same size without a BESS.

Findings
Noise and vibration impacts during construction and decommissioning would be similar to findings for utility-scale onshore wind facilities above.

Impacts from operation
The BESS would not be expected to generate operational vibration.

Wind energy facility and corona noise
Operation of a utility-scale onshore wind energy facility with a co-located BESS would add BESS to the same equipment analyzed for utility-scale facilities evaluated in Section 4.9.3. Noise would be generated by battery storage liquid cooling units as well as inverters specific to the

BESS. In general, these sources would likely operate 24 hours a day and would generate noise during the more noise-sensitive nighttime hours.

Reference facility-level noise assessments were used to estimate the noise generation potential during operations. Noise modeling for these indicated that the cooling units do not meaningfully contribute to the noise generated by the substation transformers where they are typically co-located, but can generate higher noise levels when concentrated in a single area.

Review of proxy projects indicates that there is a wide range of variability in predicted noise levels based on BESS design and configuration, particularly when comparing distributed and consolidated BESSs. The potential exists for some BESS operations to exceed the Chapter 173-60 WAC EDNA of 50 dBA at distances of up to 1.5 miles from consolidated BESS equipment, depending on the design layout of the BESS.

Corona noise for overhead lines for utility-scale onshore wind energy facilities with BESS would be the same as identified for facilities without BESS.

Findings
The operations noise impact for co-located BESS would range from a **less than significant impact** to **potentially significant adverse impact** depending on the design and layout of the BESS and distance of sensitive receptors from the facility.

4.9.4.2 Actions to avoid and reduce impacts

Actions for reducing noise and vibration-related impacts are the same as those identified for facilities without a BESS. Additionally:

- Include acoustical enclosures or barriers for BESS containers to reduce potential operational noise impacts.
- Utilize a dispersed or distributed layout of BESSs.

4.9.5 Findings for facilities combined with agricultural land use

4.9.5.1 Impacts

Impacts from construction, operations, and decommissioning
Site characterization, construction, and decommissioning of a utility-scale onshore wind facility combined with agricultural use would generate the same construction noise and vibration levels as facilities without agricultural land uses.

Operational activities may include maintenance of existing or addition of new infrastructure (e.g., roads, fences, gates) and operation of farming machinery. If the agricultural uses exist prior to facility construction, any noise contribution from these existing activities would reduce the increase over ambient described for the other types of facilities. New agricultural uses could generate seasonal noise from discing, harvesting, or other activities involving agricultural equipment. Overall, the same operational noise impacts identified for facilities without agriculture could occur, depending on siting proximity to noise-sensitive receptors. While mobile agricultural equipment could represent a new additional noise source, the seasonality of such operations and temporary duration of any additional noise generation would not be considered a significant noise contribution.

Findings

Noise and vibration impacts would be similar to findings for utility-scale onshore wind facilities above.

4.9.5.2 Actions to avoid and reduce impacts

Actions for reducing noise and vibration-related impacts are the same as those identified for facilities without co-located agricultural use.

4.9.6 Findings for the No Action Alternative

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, and would range from **less than significant impacts** to **potentially significant adverse impacts**.

4.9.7 Unavoidable significant adverse impacts

Through compliance with laws and permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale onshore wind facilities would have **no significant and unavoidable adverse impacts** on noise from construction, operation, or decommissioning.

4.10 Land use

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction, operation, and decommissioning activities would result in **less than significant impacts** on land use.

Construction would have **potentially significant adverse impacts** if natural resource lands of long-term commercial significance are converted.

Changes to rural character resulting from operation of a new utility-scale energy facility would have **potentially significant adverse impacts** depending on whether plans and development regulations are in place to protect rural character and how they consider utility-scale wind facilities.

Some utility-scale wind energy facilities may result in **potentially significant and unavoidable adverse impacts** on natural resource lands of long-term commercial significance or rural character. 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.

Land use refers to how land is developed for various human uses or preserved for natural purposes. The *Land Use Resource Report* (Appendix I) includes the full analysis and technical details used to evaluate land use in the PEIS. This section contains a summary of how impacts were analyzed and the key findings.

4.10.1 Affected environment

Major land types and land uses in the study area include agricultural, rural residential, forestry, wildlife conservation, and undeveloped recreation areas. Major categories of land ownership include private, public, federal, state-managed, and state trust.

The Natural Resources Conservation Service classifies and maps farmland to identify the location and extent of prime farmland, farmland of unique importance, and farmland of statewide importance for Washington. Washington state has more than 1.4 million acres enrolled in the Conservation Reserve Program to re-establish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat.

The Growth Management Act (GMA) requires all counties and cities to designate agricultural resource lands. Criteria for designating agricultural resource lands include the following (WAC 365-190-050):

- The land is not already characterized by urban growth.
- The land is used or capable of being used for agricultural production.
- The land has long-term commercial significance for agriculture.

Land use planning designations considered in the PEIS analysis include GMA comprehensive plans, subarea plans, zoning, and Shoreline Master Programs. The analysis also considered GMA critical areas and resource lands designations, prime farmland, and farmland conservation reserves. In addition, it analyzed mapped flood hazard areas, and state-designated areas for agriculture, commerce, conservation, tourism, clean energy development, opportunity zones, and rural character. Military training, testing, and operation areas as well as commercial and aircraft routes are also considered.

Several, but not all, of the counties in the study area plan under the GMA. Counties planning under GMA must include a “rural element” in their comprehensive plans that addresses “lands that are not designated for urban growth, agriculture, forest, or mineral resources.” Counties not planning under GMA are not required to have this element in their comprehensive plans. A key requirement of a rural element are measures to protect rural character.

Rural character includes many considerations such as vegetation, views, housing, employment, fish and wildlife habitat, government services, and water. However, under GMA, individual counties are responsible for adopting a locally appropriate definition of local character that guides the development of the rural element and its implementing development regulations.

Under GMA, all cities and counties in Washington are required to adopt regulations for critical areas. Critical areas regulations include standards such as the types of activities allowed within each type of critical area as well as standard buffers and building setbacks. Critical areas include:

- Wetlands
- Critical aquifer recharge areas
- Fish and wildlife habitat conservation areas
- Frequently flooded areas
- Geologically hazardous areas

Also under GMA, all cities and counties in Washington must designate and protect natural resource lands of long-term commercial significance. These include agricultural, forest, and mineral lands that have long-term significance for the commercial production of food, agricultural products, timber, or for the extraction of minerals.

4.10.1.1 Population

The estimated population of Washington state was approximately 7.95 million in 2023. Population densities are generally highest on the west side of the Cascades. Between 2020 and 2023, the state's population increased by 244,840 people, driven largely by people moving into the state. In 2023, population growth remained concentrated in more metropolitan areas, consistent with trends over the past few decades. Washington's population is expected to continue growing in all counties to a total of almost 9.9 million in 2050.

4.10.1.2 Land ownership

The estimated total land area of Washington state is 45.7 million acres (including aquatic lands). In 2009, private ownership made up approximately 54% of the state's land area, with national forests covering approximately 21% (Figure 4-5). State, local, and other federal ownership made up the remainder. Federal agencies that own or manage large areas of land overlapping the study area include USFS and the Bureau of Land Management (BLM). State land ownership within the study area includes DNR and WDFW.

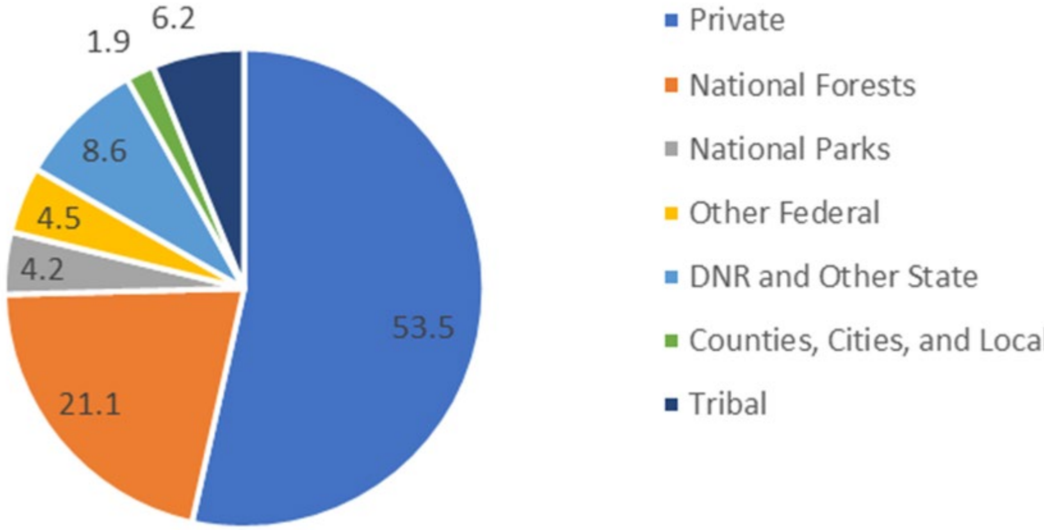


Figure 4-5. Land ownership percentages in Washington in 2009

4.10.1.3 Land uses

The study area encompasses various types of land uses, which each present unique considerations and potential for impacts associated with the development of utility-scale wind facilities. Washington's cities and unincorporated UGAs support much of the state's population and more intensive land uses, such as high-density residential, industrial, and concentrated commercial uses. Outside of cities and UGAs, which are excluded from the land use study area, common land uses include agricultural, rural residential, forestry, wildlife conservation, and undeveloped recreation areas.

Agricultural land use

Approximately 11.2 million acres in Washington are used for agriculture. Agriculture is a dominant land use in eastern Washington, encompassing millions of acres in the wind study area and including crop production, livestock grazing, and other farming activities. The study area also includes areas of prime farmland, which is land that has the best combination of characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses.

Forestry

Forestry is a significant land use in rural areas, covering approximately 22 million acres or half of the state. Timber harvest occurs on private lands as well as on public lands owned by USFS, BLM, and DNR.

Mining

Mineral resources include sand, gravel, and valuable metallic substances, as well as other minerals. There are dozens of active surface mines across Washington. DNR mapping indicates most of the active surface mine permits are for mining of sand, gravel, rock, and stone, which are important building materials.

Limited areas of more intensive development
Counties may designate “limited areas of more intensive development” in rural areas to allow for existing commercial, industrial, residential, or mixed-use areas; small-scale recreation and tourist use areas; and intensification of development on lots containing nonresidential uses. Washington has many small communities located in rural areas.

Military areas
Large areas of land, water, and air outside of military installations are used for military testing, operations, and training. The GMA prioritizes protecting lands around military installations from development that would reduce the ability of personnel to fulfill their mission requirements (RCW 36.70A.530). Development that is incompatible with this priority poses risks to operational efficiency and the safety of military personnel and the public. Energy developers and reviewers should consult with the U.S. Department of Defense (DoD) early during project planning to address these issues. Use the Compatible Energy Siting Assessment (CESA)[23] mapping tool to identify military utilized airspace and if applicable, submit plans to the DoD.

4.10.2 How impacts were analyzed

Impacts that utility-scale onshore wind facilities would have on land use were analyzed by considering how a proposed onshore wind energy facility could impact existing and planned land uses, the supply of land suitable for such uses, and the future viability of affected land uses. The analysis included the potential impacts associated with site characterization, construction, operation, and decommissioning of new utility-scale onshore wind facilities as related to the following:

- Conversion of land from an existing low-intensity use (rural, agricultural, or other resource uses) to a new utility-scale onshore wind use
- Potential for co-location of other land uses with utility-scale onshore wind facilities
- Potential conflicts with aviation or military operations
- Effects on existing or future land uses resulting from off-site changes in road networks, views, and increased noise, traffic, or water use
- Consistency with local, state, or federal land use plans, policies, or regulations

4.10.3 Findings for utility-scale onshore wind facilities

4.10.3.1 Impacts

Impacts from construction and decommissioning
Effects on existing adjacent land uses
Construction and decommissioning of utility-scale facilities have the potential to create impacts such as increased dust, noise, traffic, and visual changes that could affect adjacent existing land uses on properties near the facility. People most likely to notice these impacts are those living

[23] https://cesa-wacommerce.hub.arcgis.com/pages/tool

or working near the construction area. Agricultural land uses could be affected by increased dust settling on crops or by noise disturbance to livestock.

Potential disturbance impacts would depend on the activities, site conditions, adjacent land uses, and distance. Impacts would be less in uninhabited areas and greater in areas close to residences or communities, along important travel routes, or near view areas that are considered important to local communities.

Conversion of existing land use
The siting and development of facilities would result in the long-term (and potentially permanent) conversion of existing or designated future land uses to utility-related uses for the life of the facilities. The impacts of converting property to a utility-scale wind facility would depend on the existing use of the site. Changing the use of these lands to a renewable energy facility would make the land no longer available for these other uses for the life of the facility. Natural resource uses require certain site conditions, whether soil types, availability of irrigation, microclimate, slope, mineral resources, or other site-specific factors.

A facility would be decommissioned following the end of its useful life, which is expected to be up to 30 years. Land use impacts during facility decommissioning would be similar to those discussed for facility construction. If facility is not required to be restored to pre-facility conditions and uses, it is possible that a decommissioned site could be used for something other than its use prior to development of the wind facility. A new use of the site would require compliance with the same regulations described previously. Fully repowering wind turbines involves decommissioning and removing existing turbines and replacing them with newer turbines at the same facility site. If a facility was repowered after decommissioning, this may constitute a permanent land use change from the existing condition.

Findings
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** on existing adjacent land uses.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, construction of most facilities would result in less than significant impacts on land use. Construction would have **potentially significant adverse impacts** if natural resource lands of long-term commercial significance are converted.

Impacts from operation
Land use conflicts with rural character
Rural character encompasses many considerations such as vegetation, views, housing, employment, fish and wildlife habitat, government services, and water. A utility-scale onshore wind facility would likely affect vegetation, views, and habitat for species (see biological resources findings in Section 4.6). Installing facilities would result in increased development intensity at facility sites and a change to the visual landscape on and adjacent to those sites that

include a greater presence of built elements. The height of wind turbines (with blades) would range from 350 to 750 feet, potentially making the facility visible from long distances, depending on topography and other factors (see aesthetics/visual quality findings in Section 4.11). Operating wind turbines generates noise (see noise and vibration findings in Section 4.9). These changes could result in changes to and/or perceptions of the rural character of the surrounding area.

> *Findings*
> Changes to rural character resulting from a new utility-scale energy facility would range from **less than significant impacts** to **potentially significant adverse impacts** depending on whether plans and development regulations are in place to protect rural character and how they consider utility-scale onshore wind facilities.

Consistency with plans, policies, and regulations
The consistency of a proposed utility-scale onshore wind facility with federal, state, and local regulations and planning documents would depend on a number of factors such as:

- If on state or federal lands, if the facility is considered an allowed use
- If allowed by local Comprehensive Plan future land use designations, zoning, and Shoreline Management Plan (SMP) designations
- If the facility would impact areas with specific use restrictions and standards (such as SMP-regulated shorelines, critical areas, designated natural resource lands, or prime farmlands) and mitigate impacts
- If the facility can be sited and designed to avoid interfering with civil air navigation and military testing, operations, and training

Depending on the extent of critical areas on the site proposed for a facility, impacts on critical areas can often be avoided through facility design. Certain critical areas impacts must be addressed through compensatory mitigation. See the other PEIS resource sections for additional discussion of impacts to water (Section 4.5), wildlife (Section 4.6), and earth resources (Section 4.3).

> *Findings*
> A utility-scale onshore wind facility could be proposed that is inconsistent with federal, state, and/or local plans and regulations. Plans and regulations may be changed (e.g., through a rezone or comprehensive plan amendment) to resolve inconsistencies and allow a facility to proceed with **less than significant impacts.**

Military areas
Conflicts with potential physical or visual obstructions from facility towers and activities could interfere with military activities. However, early consultation with FAA and DoD should allow facilities to be sited and designed to avoid these issues.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of most facilities would likely result in **less than significant impacts** related to military areas.

4.10.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale onshore wind facilities. See Appendix I, *Land Use Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Consider existing uses, land ownership, and associated plans and regulations such as the following when siting and designing a facility:
  - Local Comprehensive Plans and zoning
  - Land leases (e.g., grazing, farmland, forestry)
  - Designated flood zones, shorelines, critical areas, natural resource lands, and other lands prioritized for resource protection
  - Military testing, training, and operation areas
- If siting on DNR-managed lands, contact the Clean Energy Program aligned with the DNR’s Product Sales and Leasing Division.
- Coordinate with federal, state, and county agencies; Tribes; property owners; and other interested parties as early as possible in the planning process to identify potentially significant land use conflicts and issues and state and local rules that govern onshore wind energy development.
- Contact the FAA early in the process to determine if there might be any potential impacts on aviation and if any mitigation might be required to protect military or civilian aviation use. Submit plans for proposed construction of any facility that is 200 feet or taller or that is located in proximity to airports to the FAA to evaluate potential safety hazards.
- Contact the DoD early in the siting process for any wind facility or transmission facilities near or within military training routes, military bases, or training areas in order to identify and mitigate potential impacts on military operations. Site design must consider military installations and air space needs. Use the CESA[24] mapping tool to determine if impacts are possible and submit plans to the DoD.
- Use existing roads and utility corridors when possible and minimize the number and length of new roads and lay-down areas.
- For roads in agricultural areas, include appropriate fencing, cattle guards, and signs.
- Site and design the facility to avoid critical areas, SMP-regulated shorelines, and designated agricultural lands, forestlands, and rangelands as much as possible.

[24] https://cesa-wacommerce.hub.arcgis.com/pages/tool

- Site and design facilities to minimize impacts on specially designated shrubsteppe areas (see the biological resources section).
- Consider wildland fire risk mapping when siting and designing and incorporate appropriate design criteria to achieve wildland fire resistance (see the environmental health and safety section).

Additional mitigation measures to address potentially significant impacts

- Evaluate opportunities to co-locate agricultural uses with projects, considering how wind facilities and agricultural activities may influence each other.

4.10.4 Findings for facilities with co-located BESS

4.10.4.1 Impacts

Impacts from construction, operations, and decommissioning
Construction, operations, and decommissioning impacts for wind energy facilities with co-located BESSs would be generally the same as for facilities without BESSs. The addition of battery storage could generate additional traffic for specialized equipment and construction workers. The addition of battery storage could be perceived as added industrial-type facility, resulting in a potential greater change in rural character than for facilities without BESS.

Findings
Impacts on land use would be similar to findings for utility-scale onshore wind facilities above.

4.10.4.2 Actions to avoid and reduce impacts

Actions for reducing land use-related impacts for wind facilities with BESSs are the same as those identified for facilities without a BESS.

4.10.5 Finding for facilities combined with agricultural land use

4.10.5.1 Impacts

Impacts from construction, operation, and decommissioning
Impacts during construction of a utility-scale onshore wind energy facility combined with agricultural use would be generally the same as for the other types of onshore wind facilities discussed above. Land use conversion impacts could be less than other alternatives because existing rural or agricultural lands may not need to be converted if agricultural uses would be co-located with energy facilities. Incorporating ongoing agricultural uses along with utility-scale onshore wind energy during operations may improve a facility's compatibility with local goals and policies related to preserving rural character.

Impacts from decommissioning an onshore wind energy facility combined with agricultural use would be similar to those for decommissioning wind energy facilities without agricultural land use. Land in agricultural use prior to facility construction would require less area to be restored following removal of facility equipment, and decommissioning would return the property to full agricultural use.

Findings
Impacts on land use would be similar to findings for utility-scale onshore wind facilities above.

4.10.5.2 Actions to avoid and reduce impacts

Actions that can be taken to avoid and reduce impacts would be the same as for the facilities without co-located agricultural use.

4.10.6 Findings for the No Action Alternative

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, and would range from **less than significant impacts** to **potentially significant adverse impacts.**

4.10.7 Unavoidable significant adverse impacts

There may be **potentially significant and unavoidable adverse impacts** on rural character or from conversion of resource lands of long-term commercial significance depending on local plans and development regulations. 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.

4.11 Aesthetics/visual quality

Key findings

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

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

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.

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).The information in this section summarizes the full analysis and technical details used to evaluate aesthetics and visual quality in the PEIS, which can be found in the *Aesthetics/Visual Quality Resource Report* (Appendix J).

4.11.1 Affected environment

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 plans, 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 aircraft

The study area includes physically diverse regions such as the Columbia River basin, the Cascade Range, prairies, the coastal ranges, and the southern Olympic Peninsula. Landscape types encompassed within the study area vary widely based on geology, topography, climate, soil type, hydrology, and land use. The study area is generally split between level terrain with long viewing distance and hilly topography. Human activity like agriculture has altered much of the landscape in the study area despite a generally sparse population density. Undeveloped areas in hilly terrain are forested up to tree-line elevation, while undeveloped flatter areas contain sparsely vegetated plains and plateaus. The central part of the state is dominated by the Columbia River and its tributaries, along with large parcels of government-owned land and Tribal reservations.

In many of the undeveloped portions of the study area, the land is generally flat and there are few obstructing structures. This, combined with generally high air quality and low humidity, means that it is possible to see for long distances. Minimal light pollution allows for dark night skies.

The western portion of the study area is higher in elevation. Visual characteristics may be impacted by recreation and resource extraction activities such as logging and mining. More hilly and mountainous terrain as well as the presence of vegetation and other ecological features contribute to a greater visual diversity and quality in this part of the study area. Areas of highest visual quality may attract tourists and other recreationists.

Extensive scenic resources occur within or near the study area, many on government- or Tribal-owned lands. Tourism in these areas is a major contributor to the regional economy.
Of particular importance is the viewshed from major roadways that pass through the area. There are numerous national and state-designated scenic byways that traverse or are near portions of the study area. Parts of the Klickitat River and White Salmon River that are designated as National Wild and Scenic Rivers also traverse portions 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 an onshore wind facility and the physical conditions of the view.

4.11.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered 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

The magnitude of the aesthetics and visual quality impacts associated with a given wind energy facility would depend on site- and project-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[25]
- Size of the facility (number and spacing of turbines)
- Size of the wind turbines (including height and rotor span)
- Surface treatment of wind turbines, 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

[25] 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 middle ground occupies the space in between.

- 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
- Weather and lighting conditions

4.11.3 Findings for utility-scale onshore wind facilities

4.11.3.1 Impacts

Impacts from construction and decommissioning

Change or reduction in visual quality

Construction for an onshore wind energy facility would involve a range of activities associated with potential visual impacts. Construction and site characterization activities are site and facility dependent; however, construction of a typical onshore wind energy facility in the study area would normally involve the following major actions with potential visual impacts: erecting temporary meteorological towers for site characterization, clearing and grading for construction laydown areas, access roads, and pad foundations; constructing supporting elements like internal service roads, fences, gates, and buildings; erecting wind turbine generators; and constructing facility components such as inverters/transformers, and electrical transmission lines. Construction vehicles, equipment, and worker presence and activity may also generate dust and emissions that can result in visual impacts.

Additional construction activities may be necessary at very remote locations or for very large wind facilities, such as the construction of 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; and associated visual impacts would, to some degree, vary in accordance with construction activity levels. Construction schedules are facility-specific, with some facilities taking longer and therefore extending the duration of construction-related visual impacts.

The relative scale of typical onshore wind facility components, buildings, and other potential elements of onshore wind facilities are illustrated in Figure 2-1 in Chapter 2. In general, larger facilities would require construction of more wind turbines and ancillary structures and facilities over a much larger and broader land area, which would lead to more 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 cases where a development site would be in an area where there are limited views of the facility. However, some facility development sites would be in proximity to roadways, towns and cities, recreational areas, and other vantage points that would have views of these facilities. In general, larger facilities would require much larger and broader land areas, which could lead to more impacts.

Visual impacts associated with vegetation clearing include the potential loss of vegetative screening, which would result in the opening of views, potentially substantial visual changes for viewers close to the facility, and potentially substantial changes for viewers with distant views of the facility.

Decommissioning activities would produce visual impacts similar to construction activities. Restoration activities would typically include recontouring, grading, scarifying, seeding and planting, and stabilizing disturbed surfaces. Newly disturbed soils would create a visual contrast that would persist for several seasons before vegetation would begin to mature and restore the pre-facility visual landscape. Complete restoration of vegetation to pre-facility conditions may take much longer. Invasive species may colonize newly and recently reclaimed areas and could produce visual contrasts. Vegetation restoration at some decommissioned facilities may be more challenging due to factors such as soil degradation, the extent of invasive species colonization, a change in seed dispersal patterns, or degradation of adjacent habitats. The length of time it takes for native vegetation to re-establish varies greatly depending on location, weather patterns, soil fertility, surrounding land use, and the type of vegetation planted or recruited. 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 was repowered after decommissioning, the visual impacts would be similar to those of construction of the facility, with construction activities limited to erecting new wind turbines and without the visual impacts associated with new access roads, buildings, fences, electrical infrastructure, or other associated facilities.

Findings
Depending on the location and size of facility sites and visual characteristics of the construction and decommissioning activities, impacts from facility construction and decommissioning 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.

New sources of light or glare
Site characterization, construction, decommissioning, and site restoration of onshore wind energy facilities would be expected to occur during daylight hours. Some nighttime activities may occur during construction, such as electrical connection, inspection, and testing activities. 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 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. This lighting, if required, would be temporary, would only occur in limited portions of the facility site that are actively under construction, and would not remain in any one fixed location for the duration of construction.

Onshore wind facilities would occur in big areas of undeveloped or minimally developed land, which would place much of the construction activities away from receptors sensitive to light. Decommissioning is not likely to include nighttime activities and, aside from the potential for temporary FAA-required obstruction lighting on cranes, would not create a source of lighting or introduce light pollution that would impact nighttime views.

Construction would involve increased vehicle traffic and the presence, transport, and use of construction equipment and materials. These activities would temporarily increase glare in and around a facility site if activities were associated with an increased presence of reflective materials, potentially including construction equipment, shiny materials, 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.

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. Because the facility site would be restored to pre-facility conditions following the operational life of the facility, there would be no remaining permanent sources of light or glare.

Findings
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.

Impacts from operation

Change or reduction in visual quality

Visual impacts associated with the development of facilities in the study area include the presence of wind turbine structures; movement of the rotor blades; shadow flicker[26] and blade glinting[27]; turbine marker lights and other lighting on control buildings and other ancillary structures; roads; vehicles; and workers conducting maintenance activities.

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 visible activity

[26] Shadow flicker occurs when rotating wind turbine blades pass between the sun and an object/person, casting a periodic shadow that may result in a flickering effect.
[27] Blade glinting occurs when the reflection of light from a turbine blade can be seen by an observer as a periodic flash of light.

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.

Cleared areas would include maintenance roads, facility access roads, and other support facilities. Visual contrasts associated with these cleared areas would include the potential loss of vegetative screening, which would result in the opening of views and potentially significant visual changes for viewers close to the cleared area.

Site entrances and main access roads leading to substations, parking areas, or operations and maintenance buildings are more likely to be paved two-lane roads, but interior roads are typically one-lane dirt or gravel roads. Roads may introduce strong visual contrasts to the landscape, depending on width, length, surface treatment, and route relative to surface contours. Improper road maintenance could lead to the growth of invasive species or erosion, both of which could introduce undesirable contrasts in line, color, and texture, primarily for foreground and near-middleground views.

The primary visual impacts associated with 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 silhouetted like a skyline.

For nearby viewers, 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. Structural details, such as surface textures, could become apparent, and the control buildings and other structures could be visible, as well as strong reflections from the towers and moving rotor blades (blade glint). Larger facilities would be more likely to occur in areas where nearby roadways, towns and cities, recreational areas, and other vantage points would provide views of these developments 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 below.

Based on the empirical studies consulted, the *Upper Great Plains Wind Energy Final Programmatic Environmental Impact Statement*[28] determined that a wind farm with wind turbines approximately 400 feet tall could be visible from approximately 25 miles away or farther assuming good visibility, could potentially cause large visual contrasts at distances less than 7 to 8 miles away, and could cause more moderate impacts up to approximately 15 miles away, with smaller visual impacts beyond approximately 15 miles. 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.

A number of studies referenced in the Upper Great Plains PEIS noted that when the rotor blades on turbines were moving, the movement tends to attract viewers' attention to a greater

[28] https://www.energy.gov/nepa/articles/doeeis-0408-final-programmatic-environmental-impact-statement

extent than when the blades were not moving. A field-based study found that movement was discernible at distances of up to 9.3 miles in optimum viewing conditions and would be noticeable to casual viewers at distances of up to approximately 6.2 miles.

The relatively low population density of most of the study area suggests that while wind energy facilities may be visible for long distances (potentially more than 25 miles away), they would generally be viewed by few people. Impacts on residents are generally greater than those on more transient viewers, such as drivers, workers, or recreationalists, in part because residents are likely to view wind energy facilities more frequently and for longer durations.

A wind energy facility located in a high-value scenic landscape 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. Some landscapes have special meaning to some viewers because of unique scenic, cultural, or ecological values and are therefore perceived as being more sensitive to visual disturbances. Depending on visibility factors, wind energy facilities located near sensitive landscapes, such as national parks, historic sites, landscapes sacred to Tribes, scenic highways and trails, recreational attractions, and other valued cultural features, may be of particular concern to the public.

Findings
Depending on the facility size range and the nature of the facility structures, operation of utility-scale onshore wind 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.

New sources of light or glare
The primary light and glare impacts associated with facilities would result from the introduction of 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 large visual impacts at night.

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 be a substantial visual change if few similar light sources were present in the area. In a study[29] of nighttime observations of wind turbines in a

[29] https://blmwyomingvisual.anl.gov/docs/WindVITD.pdf

rural setting in eastern Wyoming, plainly visible red aircraft warning lights were observed on a wind farm containing 277 wind turbines at distances exceeding 36 miles. 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 contrasting against a featureless black background. RCW 70A.550.020,[30] effective as of 2023, requires developers, owners, or operators of new utility-scale wind energy facilities of five or more turbines to apply to the FAA to install aircraft detection light-mitigating systems that complies with FAA lighting requirements, thereby reducing the amount of time that obstruction lighting on wind turbines would be activated and visible. For larger facilities, operation of aircraft warning lights would occur over a much broader 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.

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, such as at their homes or places of work. In general, with proper siting, shadow flicker effects are typically very limited in duration and area of effect.

Blade glinting is the reflection of sunlight from moving wind turbine blades when viewed from certain angles under certain lighting conditions. The Upper Great Plains PEIS referenced an International Finance Corporation report[31] that noted that glinting can also occur from wind turbine tower surfaces. The International Finance Corporation report suggested that blade and tower glinting is a problem primarily for new turbines, that the problem is reduced as turbines undergo 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.

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[30] https://app.leg.wa.gov/RCW/default.aspx?cite=70A.550.020

[31] http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_WindEnergy/$FILE/Final+-+Wind+Energy.pdf

Findings
Obstruction and marker lighting facilities for turbine towers and gen-tie lines would be visually distributed over a broad area and seen at great distances. However, developers would be required to apply for a FAA-compliant light-mitigating technology system, which would limit the activation of obstruction lighting only to times when aircraft are present. 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, including shadow flicker and blade glinting.

4.11.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale onshore wind facilities. See Appendix J, *Aesthetics/Visual Quality Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- To the extent practicable, site facilities to avoid or substantially reduce visual impacts.
- Incorporate assessment of visual resources as part of the facility's early pre-planning phases and continue the assessment throughout the life of the facility.
- Include a visual resource specialist as part of the planning team evaluating visual resource issues as facility siting options are considered.
- Consult with the appropriate land management agencies, planning entities, Tribes, and the local public to provide input on the identification of important visual resources and on the siting and design process.
- Avoid siting facilities where the landscape setting observed from national historic sites, national trails, and Tribal cultural resources may be a part of the historic context contributing to its historic significance.
- Locate facilities outside the viewsheds of key observation points, highly sensitive viewing locations, and/or areas with limited visual absorption capability[32] and/or high scenic integrity where possible. When wind energy facilities must be sited within view of key observation points, they should be sited as far away as possible to reduce the visual impacts.
- Site facilities in already developed landscapes, where possible.
- Use existing topography and vegetation, where possible, as screening devices to reduce views of facilities from visually sensitive areas.
- Avoid siting facilities next to prominent landscape features (e.g., knobs and waterfalls), where possible.

[32] Visual absorption capability is a tool to assess a landscape's susceptibility to visual change caused by human activities.

- Avoid siting linear facilities, such as gen-tie lines and roads, so that they bisect ridge tops or run down the center of valley bottoms.
- Avoid siting substations, gen-tie lines, communication towers, and other structures associated with wind energy facilities on ridgelines, summits, or other locations where they would be silhouetted against the sky from important viewing locations. Siting should take advantage of opportunities to use topography as a backdrop for views of facilities and structures.
- 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.
- Prepare spatially accurate and realistic photographic simulations of wind turbines in the proposed location as part of the siting process.
- Site linear features (e.g., roads, ROWs) following natural contours in the landscape where it can be accomplished without introducing unacceptable impacts on other resources.
- Siting of facilities, especially linear facilities, should take advantage of natural topographic breaks (i.e., pronounced changes in slope), and siting of facilities on steep side slopes should be avoided.
- Site linear features to follow the edges of clearings (where they would be less conspicuous) rather than pass through their center in forested areas or shrublands, where possible.
- In forested areas or shrublands, site facilities to take advantage of existing clearings to reduce vegetation clearing and ground disturbance where possible.
- Locate ROWs to cross linear features (e.g., trails, roads, and rivers) at right angles whenever possible.
- Co-locate interconnector and gen-tie lines and roads associated with onshore wind energy facilities within a corridor to use existing/shared ROWs, existing/shared access and maintenance roads, and other infrastructure to the extent possible.
- Design facilities, structures, roads, and other facility elements to match and repeat the form, line, color, and texture of the existing landscape where possible.
- Site wind turbines to be sensitive to and respond to the surrounding landscape where possible.
- To the extent possible, given the terrain of a site, cluster or group wind turbines when placed in large numbers, but avoid a cluttering effect by separating otherwise overly long lines of turbines. Breaks or open zones should be used to create distinct visual units or groups of turbines.
- Design facilities to provide visual order and unity among clusters of turbines (visual units) and avoid visual disruptions and perceived "disorder, disarray, or clutter" where possible.
- Design facilities such that wind turbines exhibit 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 surface disturbance (e.g., co-locating them with access roads).
- Chose low-profile structures for buildings and other structures, whenever possible, to reduce their visibility.

- Where screening topography and vegetation are absent, use natural-looking earthwork berms and vegetative or architectural screening where possible to minimize visual impacts associated with ancillary facilities.
- In forested areas and shrublands, openings in vegetation for facilities, structures, and roads should mimic the size, shape, and characteristics of naturally occurring openings to the extent possible.
- Minimize the number of structures required.
- Design and locate structures and roads to minimize and balance cuts and fills.
- 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 where possible.
- Include the feathering of cleared area edges (i.e., the progressive and selective thinning of trees from the edge of the clearing inward) combined with the mixing of tree heights from the edge in the vegetation-clearing design in forested areas.
- Set back structures, roads, and other facility elements as far from road, trail, and river crossings as possible to avoid a visual tunneling effect, and use vegetation to screen views from crossings, where feasible.

Additional mitigation measures to address potentially significant impacts
Building and structural materials

- 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 landscape.

Construction

- Where possible, site staging and laydown areas outside the viewsheds of KOPs and not in visually sensitive areas; they should be sited in low areas, around bends, and behind ridges and vegetative screens, where these screening opportunities exist.
- Implement a site restoration plan prior to construction with the goal of restoring the original site contours and vegetation as closely and quickly as possible after construction is complete.
- Preserve existing rocks, vegetation, and drainage patterns to the maximum extent possible.
- Protect valuable trees and other scenic elements.
- Avoid installation of gravel and pavement where possible to reduce color and texture contrasts with the existing landscape.
- For road construction, use excess fill to fill uphill-side swales to reduce slope interruption that would appear unnatural and to reduce fill piles.
- Round road-cut slopes and ditches, and vary the cut/fill pitch to reduce contrasts in form and line. Vary the slope to preserve trees and nonhazardous rock outcroppings.

- Leave planting pockets on slopes, where feasible.
- Sculpt and shape natural or previously excavated bedrock landforms into a final landform that repeats the natural shapes, forms, textures, and lines of the surrounding landscape when excavation of these landforms is required.
- Bury communication and other local utility cables, where feasible.
- Paint or coat culvert ends to reduce color contrasts with the existing landscape.
- Minimize and color or coat signage to reduce color contrasts with the existing landscape.
- Implement dust abatement measures in arid environments to minimize the impacts of vehicle and foot traffic, construction, and wind on exposed surface soils.

Operations and maintenance

- Implement interim restoration as soon as possible after conducting activities that causes disturbance.

Decommissioning

- A reclamation plan that includes visual impact mitigation measures should be in place prior to construction, and reclamation activities should be undertaken as soon as possible after disturbances occur and be maintained throughout the life of the facility.
- Consider combining seeding, planting of nursery stock, transplanting of local vegetation within the proposed disturbance areas, and staging of construction, enabling direct transplanting. Use native vegetation for revegetation. Coordinate with local authorities such as country extension services, weed boards, or land management agencies regarding seed mixes.

4.11.4 Findings for facilities with co-located BESS

4.11.4.1 Impacts

Impacts from construction, operations, and decommissioning

Change or reduction in visual quality and light or glare

The construction, operation, and decommissioning activities occurring for facilities with co-located BESSs would be similar to other support facilities and structures described for facilities without BESSs. BESSs are typically installed in a graveled area where vegetation clearing and gravel surfacing would be required.

The addition of BESSs would not change or reduce the visual nature of wind energy development because the racks, containers, buildings, control systems, and other elements associated with a BESS would look similar to other elements associated with an onshore wind facility. If a facility with a BESS was repowered, the visual impacts would be similar to those from repowering a facility without a BESS.

BESS construction and decommissioning may require night work lighting; however, these activities would be occasional, temporary, and shielded downward. The potential for nighttime lighting during construction or decommissioning to impact nighttime views would be minimal.

Lighting associated with a BESS would be the same type as for utility-scale facilities and the addition of BESSs would not change the sources of light and glare of an onshore wind energy facility.

Findings
Impacts to aesthetics and visual quality would be similar to findings for utility-scale onshore wind facilities above.

4.11.4.2 Actions to avoid and reduce impacts

Actions for reducing aesthetic and visual quality impacts of facilities with co-located BESSs would be the same as for facilities without a BESS.

4.11.5 Findings for facilities combined with agricultural land use

4.11.5.1 Impacts

Impacts from construction, operations, and decommissioning
Change or reduction in visual quality and light or glare
The construction and decommissioning activities for facilities combined with agricultural land use would be the same as for the other types of facilities evaluated in the PEIS. This could include construction of facilities on active agricultural land (or a new agricultural land use could be added), which would be similar to the construction of onshore wind energy facilities without co-located agriculture.

Long-term changes or reduction in visual quality from facilities with agricultural use would be the same as for facilities without agricultural land use. The co-location on agricultural land would not change or reduce the visual nature of an onshore wind energy development.

New sources of light or glare
Facility construction and decommissioning activities for facilities with agricultural use would be the same as those occurring for facilities without agricultural land use. Agricultural activities are not anticipated to involve nighttime lighting, except for emergency or other episodic use.

The types of light and glare impacts, as well as actions to avoid and mitigate light and glare, during operation would be the same as for facilities without agricultural land use. It is assumed that if current agricultural activities continue to occur, they would not result in additional sources of light and/or glare that are not present under existing conditions.

Because a facility site would be restored to pre-development conditions or continue as agricultural fields following the operational life of the facility, there would be no remaining permanent sources of light or glare.

Findings
Impacts to aesthetics and visual quality would be similar to findings for utility-scale onshore wind facilities above.

4.11.5.2 Actions to avoid and reduce impacts

Actions for reducing aesthetic and visual quality impacts of facilities combined with agricultural land use, including the restoration of agricultural land, would be the same as facilities without co-located agricultural use.

4.11.6 Findings for the No Action Alternative

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 visual quality and would result in a **less than significant impact** attributable to light and glare.

4.11.7 Unavoidable significant adverse impacts

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.

4.12 Recreation

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction, operations, and decommissioning activities would likely result in **less than significant impacts** on recreation.

Potentially significant adverse impacts would occur if:

- The facility results in the loss of recreation resources or crowding of alternative recreational opportunities
- Increased use of neighboring recreational opportunities were to result in overcrowding and overuse of those resources
- The facility results in segmentation of recreational facilities, such as severing trail connections, and recreationists no longer have access to the full activity

No significant and unavoidable adverse impacts related to recreation would occur.

Recreation provides people with the opportunity to engage with and enjoy both the natural and built environments. Washington has vast opportunities for outdoor recreation, from mountains to deserts, including both land- and water-based activities. Recreation opportunities include activities in parks, rivers, on state and federally managed lands, and on privately owned lands. Outdoor recreation is an important aspect of life and provides economic and health benefits to communities in the study area.

The *Recreation Resource Report* (Appendix K) includes the full analysis and technical details used to evaluate recreation in the PEIS. This section contains a summary of how impacts were analyzed and the key findings. Visual impacts can be found in the *Aesthetics/Visual Quality Resource Report* (Appendix J).

4.12.1 Affected environment

The study area includes various landscapes such as mountains, deserts, lakes, and rivers. Designated recreation areas within the PEIS geographic scope include local parks, national forests, wilderness areas, national monuments, state and local parks, and lands managed by DNR, WDFW, BLM, Bureau of Reclamation, and USFWS. Adjacent areas include similar types of recreational lands and trails, enhancing the diversity of available activities.

Recreational activities vary with terrain, season, and land use. Activities during the summer months typically include hiking, biking, camping, and water activities, while winter activities typically include more snow-based activities such as skiing, snowboarding, and snowshoeing. Agritourism activities like u-pick produce, farm tours, and seasonal events also occur across the study area. Other common recreational activities in the study area include the following:

- **Hunting and fishing** are significant recreational activities with varying seasons that occur throughout the state. Hunting and fishing seasons vary throughout the year by the species of animal. Tribal hunting and fishing take place throughout the state at various times during the year. More details are provided in the *Tribal Rights, Interests, and Resources Report* (Appendix O).
- **Informal recreation** on public or private lands includes dispersed camping, wildlife viewing, backcountry driving, off-trail hiking, and shooting.
- **Water-based recreation** is prevalent in coastal areas, rivers, reservoirs, and lakes. Wild and scenic rivers within the study area include the White Salmon River and Klickitat River, both located in the southern portion of the state.

4.12.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

- Potential loss or segmentation of existing recreational resources
- Potential for loss of existing recreational opportunities or areas to result in overuse and crowding of other recreational activities in the surrounding area

This analysis uses information and findings from visual impacts (see Section 4.11, Aesthetics/Visual Quality), noise impacts (see Section 4.9, Noise and Vibration), and air quality (see Section 4.4, Air Quality and Greenhouse Gases).

4.12.3 Findings for utility-scale onshore wind facilities

4.12.3.1 Impacts

Impacts from construction and decommissioning
Potential site characterization, construction, and decommissioning impacts on recreational areas on or adjacent to onshore wind facility sites could include short-term increased noise and dust, reduced visibility, traffic delays, and temporary changes in access. There could be a temporary increase in use at alternative recreation sites during construction. The decommissioning and removal of a facility could result in the restoration of recreational opportunities that were previously lost from construction of facilities. Repowering of facilities would result in impacts similar to construction as wind energy facility components are replaced.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction and decommissioning activities would likely result in **less than significant impacts** on recreation.

If construction or commissioning of the facility results in the loss of recreation resources or crowding of alternative recreational opportunities there would be **potentially significant adverse impacts**.

Impacts from operation
Some facilities may allow continued or new recreation on some or a majority of their facility site, whereas others may restrict recreational access to portions of the site for safety and security reasons. Elimination of recreational opportunities may also result in higher uses of neighboring recreation opportunities or segmentation of existing recreational areas (such as trails).

Recreationists near a facility during operations could experience changes that diminish their recreational experience, including changes in the noise and views created by a wind energy facility. For more discussion of these impacts, refer to the *Aesthetics/Visual Quality Resource Report* (Appendix J) and the *Noise and Vibration Resource Report* (Appendix H).

The increased facility size could increase the risk for significant adverse impacts from lost recreation opportunities. A larger facility would also have increased potential for impacts on nearby recreational opportunities. This could include a variety of recreational areas and opportunities. For example, perimeter fencing could exclude access to an area for mountain biking, hunting, or hiking. The presence of wind turbines or gen-tie lines could prevent activities like paragliding or hang gliding.

Operations of onshore wind energy facilities could impact plants, wildlife, and wildlife habitat, which could, in turn, impact hunting and wildlife viewing. For more information related to the impacts on wildlife and habitats, see the *Biological Resources Report* (Appendix E).

Findings
If operation of the facility results in the loss of recreation resources or crowding of alternative recreational opportunities, it would be a **potentially significant adverse impact**. If increased use of neighboring recreational opportunities throughout the operations phase were to result in overcrowding and overuse of those resources, such conditions would be **potentially significant adverse impacts**. Segmentation of recreational facilities, such as severing trail connections, could also result in **potentially significant adverse impacts** if recreationists no longer have access to the full activity.

4.12.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale onshore wind facilities. See Appendix K, *Recreation Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Consider local, state, and federal recreation areas and current uses when siting a facility.
- Avoid siting facilities in areas valued for recreational opportunities, areas with unique recreation resources, areas that would divide existing recreation areas, or cause overuse of neighboring recreational activities. This includes both informal recreational areas and recreation in designated local, state, and federal recreational areas.

Additional mitigation measures to address potentially significant impacts

- Mitigate for lost recreational opportunities by providing new opportunities for recreational activities. Wind energy facilities could be designed with biking or hiking trails, wildlife viewing areas, or be open to hunting during portions of the year. Avoid segmenting recreational areas or creating vast areas that are inaccessible to the public.
- Engage with statewide and local interest groups dedicated to conserving natural resources and recreation (for example, trail associations and environmental advocacy groups) regarding potential development of a recreation mitigation plan.

4.12.4 Findings for facilities with co-located BESS

4.12.4.1 Impacts

Impacts from construction, operation, and decommissioning
The construction and decommissioning activities for facilities with a co-located BESS would be the same as those for facilities without a BESS. For this analysis, it is assumed the BESS would be located within the overall onshore wind energy facility site footprint and would require a small additional area of development, but would not contribute other recreational impacts than described for facilities without a BESS.

Findings
Impacts to recreation would be similar to findings for utility-scale onshore wind facilities above.

4.12.4.2 Actions to avoid and reduce impacts

Actions for reducing the recreational impacts for facilities with a co-located BESS are the same as those identified for facilities without a BESS, with the addition of:

- Site the BESS away from any recreational uses to further avoid and minimize potential noise or visual impacts.

4.12.5 Findings for facilities combined with agricultural land use

4.12.5.1 Impacts

Impacts from construction, operation, and decommissioning
Recreational opportunities are generally less prevalent in agricultural landscapes because these areas have a primary purpose of raising livestock or crops, they are often located on private property, and they typically do not provide features like trails to support recreation. However, privately owned lands can still be used for recreation by the property owner or the public, including for hunting as part of WDFW's Private Land Program. Agricultural activities located on lands that are multi-use could also support recreational activities.

Impacts from construction, operation, and decommissioning of onshore wind energy facilities co-located with agricultural land uses would largely be the same as those discussed for facilities without agricultural land use.

Findings
Impacts to recreation resources would be similar to findings for utility-scale onshore wind facilities above.

4.12.5.2 Actions to avoid and reduce impacts

Actions for reducing the recreational impacts of facilities combined with agricultural land use would be the same as those for facilities without co-located agricultural use.

An additional mitigation measure to address potentially significant impacts for lost recreational uses could include:

- Offering agritourism activities where an onshore wind energy facility and agriculture use are co-located

4.12.6 Findings for the No Action Alternative

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, and would range from **less than significant impact** to **potentially significant adverse impact**.

4.12.7 Unavoidable significant adverse impacts

Through compliance with laws and permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale onshore wind facilities would have **no significant and unavoidable adverse impacts** on recreation resources from construction, operation, or decommissioning.

4.13 Historic and cultural resources

> **Key findings**
>
> Each historic or cultural resource's significance is unique to that resource; therefore, the impact analysis will also be unique and would need to be conducted during future project-level review for facilities. The significance of Tribal cultural resources can only be understood from within the cultural context of an affected Tribe. Accordingly, impact assessment and determinations of significance or non-significance would be done with engagement and in consultation with potentially affected Tribes and DAHP at the project level.

The land in Washington state has been utilized since before glaciers retreated at the end of the Pleistocene era. During the succeeding millennia, people have used a wide variety of strategies and approaches to interact with the landscape and its resources. As the environment has changed, so have those approaches. This has resulted in a history of human use and occupation that is reflected in historic and cultural resources. The *Historic and Cultural Resources Report* (Appendix L) includes the analysis and technical details used to evaluate historic and cultural resources in this PEIS. This section contains a summary of the affected environment, how impacts were analyzed, and the key findings.

4.13.1 Affected environment

The study area includes a diverse range of geological formations, animals, and plants. Each of these regions has a unique geological history that has formed the current landscape, and which plays an important role in archaeological site formation. The presence of an archaeological site means there was past human activity and physical objects or remains have been preserved there. Archaeological resources are typically identified through archaeological survey work.

Throughout the study area there are lands and shorelines where Tribes have lived for thousands of years and continue to live and use. Archaeological sites, historic properties, and Tribal place names exist throughout the study area. They include areas connected to Tribal cultural and spiritual practices and are represented within oral tradition stories and historic documents.

Historic architectural resources include buildings, sites, structures, objects, or districts that have reached a particular age threshold to be considered for eligible for listing in a historic register. Many of these resources are present in the study area.

A Traditional Cultural Property (TCP) is a property or a place that is inventoried or determined to be eligible for inclusion on the National Register of Historic Places or the Washington Heritage Register because of its association with cultural practices and beliefs. These are rooted in history and are important to maintaining the continuing cultural identity of the community's traditional beliefs and practices. DAHP maintains a database of TCPs, but very few are publicly disclosed. TCPs can be any location, landform, or object that has distinct association and importance to a group. The scale can be as large as an entire river or mountain or be confined to a single boulder. Many TCPs are present in the study area.

4.13.2 How impacts were analyzed

The PEIS evaluated how facilities could affect the following key features of historic and cultural resources:

- Archaeological resources, both recorded and unrecorded
- Historic architectural resources listed in a historic register or not listed but eligible for listing in a historic register
- Human remains and cemeteries
- Sacred sites
- Documented and undocumented TCPs

DAHP's databases identify the risk of potential historic and cultural resources at a broad level and identify known resources. Only a small portion of the state has been mapped in detail for historic and cultural resources. A future proposed facility would need to conduct site-specific cultural surveys to evaluate potential impacts in accordance with DAHP and federal requirements and guidance. General language about potential impacts to historic and cultural resources is identified in the PEIS.

The significance of Tribal cultural resources can only be understood from within the cultural context of an affected Tribe. Accordingly, the impact assessment and determinations of significance or non-significance of Tribal cultural resources would done with engagement and in consultation with Tribes. This would be done through the SEPA process or the federal Section 106 process.

4.13.3 Findings for all onshore wind facility types evaluated in the PEIS

4.13.3.1 Impacts

Impacts from construction and decommissioning

Most site characterization activities would involve little or no ground disturbance. However, some ground-disturbing activities, such as drilling deep soil cores and building access roads, could result in impacts on or inadvertent discoveries of historic and cultural resources. In mountainous terrain, additional site grading and clearing, may be required if existing access routes are unavailable or unsuitable for the planned investigation equipment.

Construction and decommissioning activities that could impact historic and cultural resources include ground disturbance, degradation of visual quality, noise, and interruption of the landscape and habitat. Tribal spiritual practices could be interrupted by construction impacts on land areas and cultural or sacred sites, including degradation of visual quality, noise, and interruption of access.

Construction could result in damage or destruction of historic and cultural resources from the clearing, grading, and excavation of the site and from building facilities and associated infrastructure. Construction will likely include subsurface infrastructure (e.g., foundations, pilings, utility trenches), and some onshore wind facilities may include deeper subsurface work for deep foundations required for large turbines. Ground disturbance during construction is likely to impact undiscovered archaeological resources because there are many such sites throughout the study area and because most of the study area has not been archaeologically surveyed.

Degradation and destruction of historic and cultural properties could result from changes to the landscape and water flow patterns. The removal of soils, erosion of soils, and runoff into adjacent areas could also affect resources. Oil or other contaminant spills could affect resources.

Increased human access and subsequent disturbance such as looting, vandalism, and trampling of cultural resources could result from creating corridors or facilities in otherwise intact and inaccessible areas. Visual changes, changes in light, dust, and human presence could affect cultural resources for which visual integrity is a component of sites' significance, such as Tribal sacred sites, historic structures, trails, and historic landscapes.

Construction noise would depend on the activities, terrain, vegetation, and local weather conditions but may involve blasting and the use of equipment such as impact pile drivers and vibratory rollers. These can generate substantial noise and vibration. Cultural resources that are susceptible to noise impacts include TCPs or sacred sites because the cultural uses or practices that occur at these locations could be interrupted or diminished. Construction vibration could adversely affect cultural resources by damaging rock features or archaeological sites.

Decommissioning would involve similar types of activities as for construction. Site restoration activities may include recontouring, grading, seeding, planting, and perhaps stabilizing disturbed surfaces. The types of impacts would be similar to those associated with facility construction. Impacts associated with onshore wind facility repowering would include some of those associated with facility construction and would include a longer period of ongoing operations.

Impacts from operation
Operational activities that could affect historic and cultural resources include changes in access to natural and cultural resources and increased human activity with associated noise, light, dust, and human presence. Ongoing operations and maintenance are anticipated to include little new ground disturbance because the use of maintenance vehicles and equipment would generally be limited to access roads and areas already developed during construction.

Archaeological sites could still be affected by the increase in activity during operation of a facility. This includes increased vehicle traffic, vegetation management, or other activities, as well as the presence of people who might disturb surface artifacts. Ongoing ground disturbance could reveal previously unrecorded archaeological sites that are associated with TCPs.

Visual degradation of settings associated with cultural resources could result from the presence of utility-scale onshore wind energy facilities and associated land disturbances. Visual changes could include the presence of wind turbine structures. These could also include the 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. These could affect cultural resources for which visual integrity is a component of sites' significance, such as Tribal sacred sites and landscapes, historic structures, trails, and historic landscapes.

Facility fencing and ongoing operations could impact access and travel paths traditionally utilized by Tribes for significant historic and cultural resources. This is most likely to impact TCPs, sacred sites, cemeteries, or precontact period archaeological sites where setting, feeling, and association are key aspects of the site.

4.13.3.2 Actions to avoid and reduce impacts

Mitigation would be done with engagement and in consultation with potentially affected Tribes and DAHP at the project level. Mitigation may be developed through consultation with affected Tribes as part of the SEPA process. Mitigation may also be developed under federal Section 106 of the National Historic Preservation Act. This is a separate, federal process.

The following are some actions to avoid and reduce impacts of utility-scale wind facilities. See Appendix L, *Historic and Cultural Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Design and site projects to avoid to the maximum extent impacts on cultural and historic resources. Begin with the use of the DAHP predictive model, then refine though the development of site-specific environmental and cultural context and Tribal coordination.
- Contact potentially affected Tribes early in the siting process, ideally before land is acquired for a project or before permit applications are developed, and offer information relevant to Tribal technical staff to help identify potential impacts on Tribes.

- Consider potential impacts on Tribal treaty-reserved rights, Tribal reservations, off-reservation rights, trust lands, other Tribal-owned land, and other areas of significance to Tribes during project design and in siting decisions.
- Conduct site-specific cultural survey to evaluate potential impacts in accordance with DAHP and federal requirements and guidance. Offer DAHP and cultural experts from potentially affected Tribes the option to help develop the survey strategy.
- Consider requiring a Tribal monitor for survey crews to provide input on TCPs, sacred sites, and culturally significant sites during site selection.
- Provide cultural resource survey results to potentially affected Tribes for early review.
- Use previously disturbed lands and lands determined by archaeological inventories to be devoid of historic properties to the maximum extent possible.
- In areas where homesteading was a prevalent historic activity, contact the local assessors and historic museums to determine if the area includes known homestead sites.

Additional mitigation measures

- Conduct a cultural resources survey of the entire project site.
- Use training/educational programs for workers to reduce occurrences of disturbances, vandalism, and harm to historic properties. Plans should incorporate adaptive management protocols for addressing changes over the life of the project, should they occur.
- Address impacts to historic and cultural resources that follow the best available guidance and strategies developed by the federal, Tribal, and state governments, including, but not limited to, compensatory mitigation, formalized ongoing consultation between Washington State and Tribes to address new concerns and monitor long-term mitigation, and the development and maintenance of new technologies and geospatial analysis that help identity and avoid historic and cultural resources.

4.13.4 Findings for the No Action Alternative

Facilities developed under the No Action Alternative would be subject to the same regulatory standards as those noted for the types of facilities considered in this PEIS. It is expected there would be the same ranges and types of impacts on historic and cultural resources, from site characterization, construction, operation, decommissioning, and repowering activities for onshore wind facilities under the No Action Alternative.

4.14 Transportation

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operation, and decommissioning of facilities would likely result in **less than significant impacts** on transportation.

No significant and unavoidable adverse impacts related to transportation resources would occur.

The term "transportation" refers to the system of roads, transit routes, railroads, waterways, and airport facilities that move people and goods. In this PEIS, transportation includes roadways and travel patterns, railroads, air travel, and navigable waterways.

The *Transportation Resource Report* (Appendix M) includes the full analysis and technical details used to evaluate transportation in the PEIS. This section contains a summary of how impacts were analyzed and the key findings.

4.14.1 Affected environment

4.14.1.1 Roadways and travel patterns

Washington's road network spans over 80,000 miles, including 764 miles of interstate highways and 1,602 miles of U.S. highways. Major roads in the study area include interstate highways I-5, I-90, and I-82, along with numerous state highways. These corridors serve as principal freight arterials, moving regional and international cargo, and providing commute and recreation routes. I-5 is the major north-south route, while I-90 serves as the primary east-west corridor in Washington state. I-82 connects Ellensburg to Oregon.

The road system supports commercial, commuter, and recreation traffic, providing access to cities, rural towns, and outdoor recreational areas. Eighty percent of communities in Washington rely solely on trucks for their goods. Major agricultural production areas, including Yakima, Whitman, and Grant counties, depend heavily on the road network for transporting agricultural products.

4.14.1.2 Railways

Washington's rail transportation system moves over 95 million tons of freight annually. The study area includes more than 3,200 miles of freight railroad tracks, with major operators being Burlington Northern-Santa Fe and Union Pacific. Rail freight is preferred for transporting high tonnage, oversize, and high-value cargo, such as wind facility components, due to its fuel efficiency and capacity for heavy loads. The study area contains ten intermodal facilities for transferring cargo between rail and other transportation methods.

4.14.1.3 Air travel

Currently, air transport is not typical, but may be used for smaller wind energy components. Commercial airports outside of the study area could be used to receive wind facility components that are then transported to facilities within the study area. Major air cargo hubs in Washington that could support shipping of energy components include Seattle-Tacoma International Airport, King County International Airport-Boeing Field, and Spokane International Airport. Seattle-Tacoma International Airport serves as a primary gateway for international air freight, particularly from Asia. The study area includes 89 general aviation airports, with additional airports nearby. These airports vary in size and uses but are primarily small airports serving local uses, including private aviation and agricultural operations.

4.14.1.4 Navigable waterways

Navigable waterways and ports are used to transport wind facility components. The Columbia River and the Snake River are key waterways located within the study area. Ports within or near the study area, such as Vancouver and Longview, receive wind energy components and transfer them to other modes of transport. Washington ranks fifth in the United States for maritime freight volumes, with 18 public ports and numerous marine terminals. Eight ports are located within the study area.

Using marine waterways can reduce road and rail congestion and system wear. The Columbia-Snake River System, part of the marine highway M-84, is a crucial route for transporting agricultural, energy, and manufacturing products. The study area's ports facilitate efficient and cost-effective freight transport, essential for regional and international trade.

4.14.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

- Traffic volumes and distances for construction and operation of facilities
- Potential water (barge), rail, and air traffic
- Potential new or redeveloped access roads or parking/staging areas for facility construction, operation, and maintenance activities

This programmatic analysis evaluated how the onshore wind facilities could result in the following:

- Impacts on traffic patterns, volumes, hazards, or risks to other users, including commercial and military aircraft
- Road closures or interruptions to traffic patterns or volumes, affecting the movement of people and goods
- Damage to roadways or related infrastructure (e.g., culverts or bridges)
- Damage or change to transit, rail, air, or water transportation

4.14.3 Findings for utility-scale onshore wind facilities

4.14.3.1 Impacts

Impacts from construction and decommissioning

Depending on location, onshore wind energy facilities could impact local roads. Construction and decommissioning would require transporting equipment, materials, and workers to a facility site, potentially utilizing road, rail, air, or water (barge) transport. This would cause a temporary increase in demand for transportation services and a temporary increase in traffic on roads during construction (6 and 24 months) and decommissioning.

Worker commute

Workers would likely commute using existing roads. The construction and decommissioning workforce would likely be between 100 to 400 workers for a small to medium facility and may be up to 2,000 workers for a large facility. The number of workers on site daily would vary. The location of the facility, workforce size, and commuting routes would determine whether construction or decommissioning would cause temporary traffic congestion. Major roads typically accommodate more traffic than local roads, so a site closer to major roads may generate less congestion.

Material and component transport
Wind turbine tower components (turbine sections and blades) would require oversize or overweight shipments, which would affect local traffic in the short term. The demand for freight transport would increase in proportion to the increased size of the facility. The number of daily truck trips would vary throughout the construction and decommissioning periods depending on the activity. These large loads would be expected to cause temporary disruptions on roads used to access a facility site. The heavy equipment and materials needed for construction and decommissioning would be similar to other road construction projects and would not pose unique transportation considerations.

Components of wind facilities are often transported by water or rail. Smaller wind facility components could be shipped by air. The choice of transportation method for large wind components, such as turbine blades, would depend on the quantity of turbine towers, the manufacturer's location, and the location of the wind facility. A shift from trucks to rail due to larger shipments would not substantially affect rail transportation due to the existing rail infrastructure and the capacity for rail freight transport throughout the study area. If rail is used, equipment could be transported on a flatbed or container. Longer turbine blades may require specially designed railcars, and heights after blades are loaded may be too high for overpasses or tunnels. Rail loads of greater size or weight differ from typical rail shipments in that they move as non-scheduled, special trains.

If trucks are used for transport between an intermodal facility and the site, flatbed trucks may be suitable for transporting large components such as turbine towers, rotors, and nacelles. A route between an intermodal station and a wind energy facility site may travel through small towns on roads with tighter turning radii, which may require road improvements.

One turbine blade can require a multi-axle trailer to accommodate the length and bulk of the blade. Seven flatbed trucks may be required to deliver one commercial wind turbine. Based on this, construction of 7 to 167 wind turbines for a small to medium wind energy facility would require 49 to 1,169 truckloads. Construction of 42 to 1,000 wind turbines for a large wind energy facility would require approximately 1,180 to 7,000 truck trips. The number of daily truck trips would vary depending on construction activities and the length of the construction period.

The oversize loads and carefully planned routes that would be needed for this facility type could result in temporary impacts on traffic patterns or hazards experienced by other road users such as drivers, bicyclists, and pedestrians due to temporary delays and construction hazards. Use of transportation modes for shipping components, supplies, and materials would be temporary. Due to the choices and availability of intermodal transportation within the study area, the highway, air, rail, and water transportation system in the study area could likely accommodate the additional demand associated with utility-scale facilities.

When compared to the existing volume of supplies, equipment, and materials that are shipped via truck, rail, air, and barge into, out of, and throughout the study area, the temporary increase in traffic volumes associated with construction or decommissioning would represent a small amount of the total traffic volumes in the area. Local transportation management plans and municipal regulations would address temporary traffic volume increases, detours, signage, and construction timing. No long-term road closures or interruptions to traffic patterns or volumes are expected during construction or decommissioning.

Road improvements

The construction of a facility could require new roads or improvement of existing roads. Road improvements could include adding driveways or turning lanes, widening roads to accommodate larger truck turns, or removal of obstructions to move oversize loads. Road building or improvement would require construction labor, supplies, and equipment. It would also result in temporary traffic disruptions. However, these activities are temporary and there are policies and regulations in place to reduce impacts on the public (such as Traffic Management Plans).

Although most conditions modified for construction activities, such as temporary access roads and turning or passing lanes, would be returned to existing conditions after construction, some may remain during operations and after decommissioning. These conditions would represent a permanent impact to the transportation and traffic system but are not likely to result in significant adverse impacts on users.

Developers may propose locating wind facilities in remote or higher altitude areas, which could require the construction or improvement of forest roads. These roads may also be required for operations, maintenance, and decommissioning of the facility.

No substantial damage to roadways or related infrastructure (e.g., culverts or bridges) or transit, rail, air, or water transportation would occur.

Findings

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** on transportation.

Impacts from operation

Traffic impacts

Operations would result in a small increase in vehicle trips caused by maintenance employees periodically traveling to the facility site. Periodic equipment repair or replacement would require the use of road, rail, water, or air shipping. Deliveries of materials during operations could include water or fuel for backup generators or maintenance vehicles. Fuels are routinely shipped for other applications and pose no unusual hazards. If on-site water is not available on-site during operations, water would need to be transported to the facility.

No long-term road closures or interruptions to traffic patterns or volumes are expected during operations. Air or marine transport would only be needed for periodic replacement of components. No substantial damage to roadways or related infrastructure (e.g., culverts or bridges) or transit, rail, air, or water transportation would occur.

Aviation impacts
Wind turbines are anticipated to be 750 feet or taller with blades extended. Given the height of the structures, wind energy facilities could introduce obstacles affecting air navigation for aerial firefighting capabilities and emergency response. Additional discussion on these hazards is discussed in the *Public Services and Utilities Resource Report* (Appendix M).

Authorization from the FAA is required for any structure over 200 feet tall. FAA advisory guidelines for obstruction lighting and marking would apply to wind turbine siting and design. In addition, FAA has requirements to provide notice to FAA of the following: 1) certain proposed construction or alteration of structures; 2) standards used to determine obstructions to air navigation and navigational and communication facilities; 3) a process for aeronautical studies of obstructions to air navigation or navigational facilities; and 4) the process to petition FAA for discretionary review of determinations, revisions, and extensions of determinations.

Electrical interference from control systems with aircraft operations is unlikely but should be evaluated for any new installation. Interactions with low-altitude aircraft avionics or communications could occur if corona discharges from the transmission lines are not minimized and if specific electric frequencies are not avoided. Additional consultations with FAA are required to ensure facilities comply with all FAA regulations.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the operation of facilities would likely result in **less than significant impacts** on transportation.

4.14.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale onshore wind facilities. See Appendix M, *Transportation Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Consider traffic routes and peak hour traffic volumes when designating and designing access roads.

- Consider using existing roads, parking and staging areas, and utility corridors when possible.
- Design any new access roads to the appropriate standard, no higher than necessary for the intended function.
- Assess potential transportation impacts in coordination with appropriate state and local agencies, and consult land use plans, transportation plans, and other local plans, as appropriate.
- Coordinate with interested agencies, Tribes, and interested parties if facility design proposes or requires a change in interstate access or a new interstate access. Proposed access changes should be considered in the context of statewide and local transportation and land use planning because they can affect local and regional traffic circulation.
- Design the facility to comply with applicable FAA regulations, including lighting requirements, to avoid or reduce potential safety issues.
- Coordinate with FAA early to identify and reduce impacts on military and civilian airport and airspace use.
- Contact DoD early in the process on siting of a wind facility and transmission facilities near or within military training routes, military bases, or training areas in order to identify and mitigate potential impacts on military operations. Site design must consider military installations and air space needs. Use the CESA mapping tool to determine if wind projects are under military utilized airspace. If so, submit plans to the DoD for review.

4.14.4 Findings for facilities with co-located BESS

4.14.4.1 Impacts

Impacts from construction, operations, and decommissioning

Impacts would be similar to facilities without BESSs, except that more truck trips would be required to transport the BESSs during construction and decommissioning. Some of those additional trips would be oversize or overweight loads, which could have localized temporary impacts. In addition, BESSs are typically constructed on gravel areas, so additional gravel may need to be transported to the site.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operations, and decommissioning of facilities with a co-located BESS would likely result in **less than significant impacts** on transportation.

4.14.4.2 Actions to avoid and reduce impacts

Actions to avoid and reduce impacts during construction, operation, and decommissioning of facilities with co-located BESSs would be the same as those identified for facilities without a BESS.

4.14.5 Findings for facilities combined with agricultural land use

4.14.5.1 Impacts

Impacts from construction, operation, and decommissioning

Impacts during construction, operation, and decommissioning would be similar to facilities without co-located agricultural uses. There would also be additional traffic associated with the agricultural use during operations. Traffic would be similar to that of existing agricultural areas and activities in the study area.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, the construction, operations, and decommissioning of facilities with agricultural use would likely result in **less than significant impacts** on transportation.

4.14.5.2 Actions to avoid and reduce impacts

Actions to avoid and reduce impacts from construction, operation, and decommissioning of facilities combined with agricultural land use would be the same as those identified for facilities without co-located agricultural use.

4.14.6 Findings for the No Action Alternative

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, and would be **less than significant**.

4.14.7 Unavoidable significant adverse impacts

Through compliance with laws and permits, and with implementation of actions to avoid and mitigate significant impacts, utility-scale onshore wind facilities would have **no significant and unavoidable adverse impacts** on transportation from construction, operation, or decommissioning.

4.15 Public services and utilities

Key findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction, operation, and decommissioning activities would likely result in **less than significant impacts** on public services and utilities.

Depending on turbine recycling facilities, methods available at the time of decommissioning, and the volume of waste, facility decommissioning would result in **potentially significant adverse impacts** on solid waste and recycling if there are large volumes of solid waste.

A facility would result in **potentially significant adverse impacts** to fire response if specialized emergency response is needed related to turbines, if activities required a large fire response in remote locations with limited response capabilities, or if there are other unique aspects of a facility site.

This may result in a **potentially significant and unavoidable adverse impact**. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.

Public services and utilities include basic services and facilities that support development and protect public health and safety.

The public services evaluated include the following:

- Fire and emergency response
- Law enforcement
- Hospitals
- Emergency management
- Public schools

The utilities evaluated include:

- Electrical power
- Water supply
- Wastewater
- Solid waste services
- Natural gas
- Communications

The *Public Services and Utilities Resource Report* (Appendix N) includes the full analysis and technical details used to evaluate public services and utilities in the PEIS. This section contains a summary of how impacts were analyzed and the key findings. Information on EHS can be found in the *Environmental Health and Safety Resource Report* (Appendix G).

4.15.1 Affected environment

4.15.1.1 Public services

The study area is served by a variety of public service providers. Depending on the local conditions, public services may be provided by federal, Tribal, state, county, or local governments as well as volunteer fire departments and other volunteer groups. Public services addressed in this section include fire protection, law enforcement, emergency or other medical services, and schools.

Emergency response
Emergency response services include the following:

- **Law enforcement** services are provided by various county, municipal, and state entities including local county sheriff's offices and the Washington State Patrol. Portions of the study area are outside of local law enforcement jurisdictions including areas in or near national forest lands, which are under USFS or BLM jurisdiction. DNR and federal agencies provide enforcement on their lands.
- **Fire prevention and response** are managed by local county fire departments, supported by volunteer units and other response teams.
- **Wildfire response** is provided by local fire departments as well as DNR, USFS, and BLM. DNR supports local responders and during high-risk conditions has helicopter and aircraft teams staged to respond to remote locations.
- **Emergency Medical Services** include paramedics to respond to medical emergencies.
- **Hospitals and medical facilities** provide public health preparedness and response services, with medevac services supported by public and private entities.

Public schools
A variety of public education school districts serve portions of the study area. These districts range in size from small, rural school districts to larger districts with numerous schools.

4.15.1.2 Utilities

The study area includes utility service areas and areas without services. Utilities described in this section include communications, gas and electrical, water, wastewater, and solid waste management. Depending on the area, utilities may be provided by county, city, Tribal, or private suppliers. In general, utility infrastructure often correlates to the size of the population it serves.

Communications
Communications services, including internet, broadband, and cell service, are generally available in populated areas, while rural parts may have limited or no service. Emergency alerts are communicated through radio, cell phones, and email.

Gas and electric
Four natural gas companies operate in Washington state. Electrical utilities are provided

through public utility districts and three main corporations. Wind energy facilities are unlikely to require gas service connections but must identify existing subsurface utilities before construction.

Water and wastewater
Water supply in the study area comes from groundwater wells, surface water, and other sources. Wind facilities typically do not use wastewater systems, relying instead on septic or portable sanitary systems.

Solid waste landfills and recycling
Solid waste is managed by cities, counties, and private entities, with nearly 1,000 facilities in Washington, including 14 municipal solid waste landfills. Municipal and commercial solid waste is the largest contributor to solid waste. The next largest is construction and demolition debris, industrial waste, and cured concrete. Wind energy components represent a substantial source of waste material during decommissioning and repowering. The issue of waste from wind energy components is emerging, with initiatives to make materials recyclable to limit landfill impacts. The disposal of hazardous materials from batteries is described in Section 4.8, Environmental Health and Safety.

4.15.2 How impacts were analyzed

The assessment of impacts was qualitative, and considered the following:

- Increased demand for public services that would exceed existing capacities of public service providers or such that unplanned new or physically altered governmental facilities would be needed to serve the facility
- Relocation or construction of new or modified utilities or service systems
- Potential to obstruct or otherwise impact aerial emergency response capabilities

4.15.3 Findings for utility-scale onshore wind facilities

4.15.3.1 Impacts

Impacts from construction and decommissioning
Impacts associated with site characterization, construction and decommissioning of wind energy facilities could consist of those related to exceeding emergency response capacity, conflicts with other existing utilities, and potential prolonged service interruptions that may occur over portions of the construction and decommissioning period.

Emergency response
Construction and decommissioning of utility-scale onshore wind energy facilities would employ a temporary workforce. This could result in an increased demand for public services including law enforcement, fire departments, and other emergency service response within and near the study area.

Materials and equipment on site may increase the potential for theft, vandalism, trespass, fire, safety issues, and/or accidents requiring law enforcement or other emergency response services. Facilities are expected to have site security including a combination of fencing, lighting, security patrols, security cameras, and other electronic security monitoring systems. It is anticipated that proactive planning, including a construction site security plan, would reduce potential law enforcement response demands.

Activities at wind energy facilities would introduce fire risks during construction and decommissioning. Wildfire risks are discussed in Section 4.8, Environmental Health and Safety. In rural areas, the fire response demand posed in the event of a construction-related fire could limit fire response resources needed elsewhere in the area. The presence of wind turbine towers can limit an aerial response to fire within a windfarm to the edges of the windfarm and can affect aerial access to other wildfires.

A probable increase in the demand for emergency response public services would occur in the study area as utility-scale wind energy facilities would introduce new risks and specialized response equipment needs to remote areas during construction, operation, and decommissioning. For example, a fire in a wind turbine nacelle or a maintenance worker's medical emergency (e.g., heart attack) at a height of 400 feet or greater above ground level requires a different kind of response than the demands for response at ground level. The presence of wind turbines and other tall structures can require indirect flight paths, which increases transport time for medevac flights.

Worker safety training and adherence to safety procedures during construction would reduce potential emergency medical response demands. Wind energy facilities are frequently sited in locations that are far from hospitals or other emergency facilities. Winter conditions could make medical response more difficult if weather conditions prevent a medevac landing or access roads are closed. Consultation or early coordination with emergency response providers to ensure access and other proactive safety planning would reduce such risks. Additional discussion regarding emergency response is included in the *Environmental Health and Safety Resource Report* (Appendix G).

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction and decommissioning activities would likely result in **less than significant impacts** on law enforcement, emergency medical response, and most fire response.

A facility would result in **potentially significant adverse impacts** to fire response if activities required a large fire response in remote locations with limited response capabilities or if there are other unique aspects of a facility site.

Public schools

> *Findings*
> The impact on local schools would be minor, because few out-of-area workers would likely permanently relocate their families to the community where the wind energy facility is being developed. For this reason, impacts on school enrollment would be **less than significant**.

Gas, electrical, and communications systems
Although new gas lines are not likely to be installed as part of a wind energy facility, existing gas and electrical lines would need to be located, marked, and avoided prior to ground-disturbing construction. During construction, there would also be the potential for temporary service interruptions as electrical systems are connected to the wind energy facility. Service providers require that line outages be scheduled during off-peak times, which would be coordinated to limit service disruptions. Notifications to residents and businesses for planned service interruptions would also likely be required.

While unlikely, wind facilities could require the relocation of electrical and communications facilities and/or the construction of new facilities to connect the facilities to the energy grid. Construction and decommissioning of utility-scale wind energy facilities have the potential to result in temporary service interruptions, which would require coordination and communication with local utility districts.

Additionally, due to the height and nature of wind turbines, interference with communications systems may occur after these structures are erected. For example, the specific location of wind turbine generators could affect existing electronic communications infrastructure. This could include emergency response-related communications capabilities associated with federally licensed (Federal Communications Commission [FCC]) microwave and fixed station radio frequency facilities and broadcast AM radio and television signals.

It is recommended that siting and design for wind energy facilities consider existing emergency response communications frequencies and locate turbines and other structures with the potential to generate signal interference outside the range of these signals to ensure minimal or no disruption of signals conveying emergency response information. In addition, FCC regulations regarding requirements for communications towers would be followed.

> *Findings*
> 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** on gas, electrical, and communication systems.

Water and wastewater
Information on impacts on water resources is included in Section 4.5. Water demand would consist of the supply needed for activities such as concrete mixing, dust control, fire control, or for initial revegetation efforts. Sanitation and wastewater could be managed through

contracted portable systems or septic systems. Water for non-potable uses may be accessed from reclaimed/recycled water supplies where available. Potable water would be needed for drinking water and could be supplied by a commercial supplier, on-site well, or a public or community water system.

Conflicts with existing subsurface water lines, wells, and wastewater lines could be addressed through utility mark and locate activities, which would be required prior to construction ground disturbances.

Findings
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** on water and wastewater utilities.

Solid waste and recycling
During construction, the primary solid waste generated would consist of solid construction debris and a negligible amount of waste associated with the construction workforce. A portion of this waste, such as scrap metal or cardboard, could be recycled; the remainder would be transported to a licensed transfer station or landfill.

Solid waste generated during decommissioning is assumed to consist of all aboveground components not capable of being reused. It is assumed that decommissioning of wind energy facilities would occur in a manner consistent with the state requirements, and that scrap metal and other materials of value would be recycled to the extent feasible, thereby reducing solid waste effects. Concrete foundations would be removed to the extent feasible and dismantled for recycling or disposal. Remediation of the substation and electrical sites would likely be necessary due to the use of mineral oils and other hazardous materials during wind energy facility operation.

Most turbine blades consist of glass fiber-reinforced polymers and may lack an established market for reuse and/or recycling. These components may be disposed of in landfills, disassembled, and repurposed, as permitted by law. Recycling wind turbine blades is not currently a viable option in Washington, with no industrial-scale recycling options available within cost-feasible transportation distances. However, based on the growing wind energy industry and lack of alternatives in the region, recycling options for wind turbine blades might be available by the time of decommissioning of facilities under this alternative.

There are recent developments in recycling or upcycling of turbine waste materials; however, with each of the methods, there are tradeoffs in terms of energy use and transportation challenges. Further, it is unclear whether such technologies would operate at a scale adequate to address the solid waste challenges posed during future decommissioning.

Findings
Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction and decommissioning activities would likely result in **less than significant impacts** on solid waste and recycling.

Depending on turbine recycling facilities, recycling methods available at the time of decommissioning, and the volume of waste, there could be a range of **less than significant** to **potentially significant adverse impacts** on solid waste and recycling if there are large volumes of solid waste.

Impacts from operation

Emergency response

As with construction, wind energy facility operations could increase the demand for law enforcement services due to potential theft, accidents, vandalism, or trespassing. However, various security measures would typically be in place as part of normal operations to protect the facilities. Such measures would reduce demand for law enforcement services.

Impacts related to fire protection and response services involve consideration of two main types of fire risks during facility operation: 1) fire risks caused by wind energy facility equipment or operational activities; and 2) fires started outside of facilities that are affected (i.e., spread, movement, or ability to suppress) by the presence of a wind energy facility. Fire risks associated with facility operations are described in Section 4.8, Environmental Health and Safety.

Wind energy facilities would involve the erection of structures and installation of electrical facilities that would be required to conform to International Building Code and fire code standards. Design measures and standard requirements would reduce risks of ignition. Turbine designs should include the following components: early fire detection and warning systems, automatic switch-off and complete disconnection from the power supply system, and automatic fire extinguishing systems in the nacelle of each wind turbine.

Turbines should also include lightning protection equipment, and a lightning measurement system. Statistics show that lightning is a primary cause of fire in wind energy facilities. Although facilities include elements to reduce the potential of ignition from lightning strikes, this does not eliminate all risk. Mechanical friction among the multiple moving parts of the turbine assembly, gears, shafts, and other moving or rotating metal components can provoke sparks that ignite the turbine or surrounding vegetation. Proper maintenance, including suitable vegetation clearance around turbine foundations, can manage this risk.

Local and/or volunteer fire departments and responders may not be adequately trained and equipped to respond to wildfires that may occur on utility-scale onshore wind energy facility sites. Challenges that can limit fire department intervention in a turbine fire include the height of the fire and the extremely limited vertical access inside the tower. Wind energy facility fire responses typically do not attempt to physically attack a fire inside the tower and generator assembly, but rather to establish an exterior defensive that protects exposed structures and vegetation near the affected area. Preparedness and training can result in better outcomes, including advance interaction of emergency responders with wind energy facility operators to create, implement, and maintain pre-emergency response planning; to familiarize responders with wind energy facilities in their jurisdiction; and to engage in simulation emergency exercises.

Given the height of wind turbines, wind energy facilities could also introduce obstacles affecting aerial firefighting capabilities. Aerial firefighting within the site would likely be limited for safety reasons, particularly on lands along ridgelines or near steep slopes. Depending on the site layout, turbine spacing, and topography, surrounding lands may also be affected. FAA advisory guidelines for obstruction lighting and marking would apply to wind turbine siting and design.

Development of a wind energy facility warrants site-specific fire prevention and response planning. It is not likely that wind facilities would include overall perimeter fencing, but other access and response challenges are likely, especially in mountainous regions of the study area.

Emergency medical services could be needed for employees. For example, periodic routine maintenance activities could involve a fire or entrapment in a confined space or a maintenance worker's medical emergency hundreds of feet above the ground surface. The challenges of an emergency medical response could be exacerbated by winter conditions, distance of the facility site from medical services, access to the site, and the height at which emergency response is needed. Further, equipment failure or an extreme event could lead to turbine failure or rotor failure.[33] Turbine siting and design guidelines could identify setback distances to protect facility workers, area residents, and travelers on public roadways from harm to reduce the need for emergency response.

However, the operational staffing for onshore wind energy facilities would likely be small and not regularly on site. Additionally, facility operators would be expected to use appropriately trained technicians to operate and maintain the equipment. These considerations should result in a minimal increase in emergency medical service needs.

Findings

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most operations of a facility would likely result in **less than significant impacts** on law enforcement, emergency medical response, and most fire response.

A facility would result in **potentially significant adverse impacts** to fire response if activities required a large fire response in remote locations with limited response capabilities or if there are other unique aspects of a facility site.

[33] "Rotor failure," also known as "blade throw," refers to the disconnection of a wind turbine blade or blade fragment from the tower, typically due to equipment failure or an extreme event such as a lightning strike.

Public schools

> *Findings*
> Facilities would not be expected to require full-time permanent staff for facility operations and maintenance. Facilities would not increase the population such that new or modified public schools would be needed. Impacts on local school enrollment during the operations phase would be **less than significant**.

Gas, electrical, and communications systems
Once operational, wind facilities would not be anticipated to increase demand for gas or electricity services.

Onshore wind energy facilities involve special communications siting and design considerations that could impact emergency response communications. As discussed for construction, the placement of turbines and other tall structures, and the operation of rotating turbines, may obstruct or interfere with existing electronic communications signals. Local emergency response cell phone notifications and FCC-licensed microwave and fixed station radio signals may be affected by wind energy facilities. An evaluation of specific potential communications conflicts would occur as part of the Federal Communications Commission review or during the conditional use permit/land use approval process.

> *Findings*
> Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, operations activities would likely result in **less than significant impacts** on gas, electrical, and communications systems.

Water and wastewater
During the operations and maintenance period, water may be needed for dust control, irrigation of on-site vegetation, fire water supply, and plumbed facilities such as sinks or toilets, if installed. If consistent with public health requirements and available supply, reclaimed water may supply some of these water demands. Potable water also may be needed for on-site drinking water, which could be supplied by a well or trucked to the site.

The small number of operational staffing would limit impacts associated with waste and wastewater. If wind energy facilities include on-site septic systems during operation, such systems would conform to state requirements for the protection of water resources and public health. Septic systems or portable units, if utilized, would typically be maintained by a licensed service provider.

Findings
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** on water and wastewater utilities.

Solid waste and recycling
A small amount of solid waste would be generated as part of normal operations and maintenance activities. Periodic replacement of wind components, which could include large items (such as damaged turbine blades) may occur over the 30-year operational time frame. Typical waste includes broken or rusted metal, defective or malfunctioning equipment, electrical materials, empty containers, miscellaneous solid waste, and typical refuse from operations and maintenance staff. Approximately 1 to 2 cubic yards of waste per week would be expected, which should be able to be collected by a commercial waste management service.

Findings
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** on solid waste and recycling.

4.15.3.2 Actions to avoid and reduce impacts

The following are some actions to avoid and reduce impacts of utility-scale onshore wind facilities. See Appendix N, *Public Services and Utilities Resource Report*, for typical mitigation measures that may be included in plans or permit conditions and additional measures that may apply for facilities.

Siting and design considerations

- Coordinate with the local fire district, emergency management departments, USFS, and/or DNR (if facility siting is proposed on or near forests or wildlands) prior to and during construction and throughout the life cycle of the facility.
- Coordinate with the local fire district and DNR (as applicable, if the facility would be located in or near forests or wildlands) to ensure that adequate water supply is available for fighting fires. The facility developer may also be able to demonstrate that adequate water supply is available for firefighting via an on-site well or other water storage.
- Design facilities to reduce risks to neighboring land uses from gen-tie lines or other facility components, including potential setbacks, to reduce the risk of ignitions in fire-prone environments.
- Follow all applicable building and fire code requirements pertaining to setback distances for public safety related to turbine failure or blade throw. Determine appropriate setbacks in consultation with local, state, or federal land managers. Setback distances should consider proximity to residences, terrain, vegetation management clearance requirements for gen-tie lines, vegetation and natural communities on surrounding

lands, and the need to maintain access for maintenance and emergency response, among other considerations.

- To allow for emergency ingress and egress once operational, it is recommended that fencing be limited to the perimeter of critical wind energy infrastructure (rather than the whole of a given site).
- Consult with applicable emergency management agencies to address potential communication signal conflicts.
- Prepare a communications interference report that evaluates the proposed wind energy facility site plans relative to the proposed locations for facility communication system infrastructure. Provide the information necessary to avoid interference and resulting impacts.

Additional mitigation measures to address potentially significant impacts

- Develop and implement a site-specific Fire Prevention and Response Plan. This plan would include specific measures for coordinating and training response personnel, such as guidelines for first responders to safely shut electrical systems down in the event of fire, management requirements to reduce ignition risks throughout the sites, site management fire safety and awareness protocols including tracking fire conditions in the surrounding region, among others.
- Develop and implement a Decommissioning and Site Reclamation Restoration Plan to include fire prevention measures.

4.15.4 Findings for facilities with co-located BESS

4.15.4.1 Impacts

Impacts from construction, operation, and decommissioning

The site characterization, construction, operation, and decommissioning of a facility co-located with a BESS is anticipated to include the same impacts on public services and utilities as those described for facilities without BESSs.

Co-location of BESSs introduces an additional fire risk management and emergency response consideration. The types of BESSs evaluated in this PEIS rarely start fires if properly installed and maintained. Flow batteries and zinc-bromide batteries are generally not flammable. BESSs come equipped with remote alarms for operations personnel and emergency response teams. Other protective measures include ventilation, overcurrent protection, battery controls to operate the batteries within designated parameters, temperature and humidity controls, smoke detection, and maintenance in accordance with manufacturers' guidelines. Some battery types may contain hazardous materials that pose potential risks for environmental release if not handled correctly and could introduce hazards for first responders. BESS facilities could create extreme hazards for firefighters and emergency responders with the possibility of explosions, flammable gases, toxic fumes, water-reactive materials, electrical shock, corrosives, and chemical burns. Utility-scale energy storage requires specialized and reliable equipment to perform firefighting operations safely and effectively to the Washington Fire Code, NFPA, OSHA, and Underwriters Laboratories codes and standards, as discussed in the environmental health and safety section, as well as the applicable county fire protection district codes and standards.

Specialized advanced planning and procedures for enhanced fire response training would be required to ensure that the wind energy facilities and co-located BESSs do not initiate or exacerbate wildfires during construction, operation, or decommissioning or otherwise generate hazards that could interfere with or exceed emergency response capabilities. The recommended approach from the American Clean Power Association is not to use water for firefighting but allow the battery to burn in a controlled manner. This would result in air emissions that could be hazardous to emergency responders and would require protective gear.

Findings
Impacts to public services and utilities would be similar to findings for utility-scale onshore wind facilities above, with additional fire response considerations for BESS.

4.15.4.2 Actions to avoid and reduce impacts

Available actions for facilities with BESSs would be the same as those proposed for utility-scale facilities without BESSs. Additional mitigation measures to address potentially significant impacts specific to BESS safety training and emergency response are below:

- Develop and implement the fire protection, prevention, and detection measures and design features in accordance with NFPA 855 Standards for Installation of Energy Storage Facilities and the current Washington Fire Code, including requirements for providing redundant separate methods of BESS failure detection.
- Develop and implement an Emergency Action Plan in advance of construction to train local emergency response personnel on hazards specific to BESSs during development and operation of the facility.
- Develop and implement regular maintenance schedules and inspections for BESS components to ensure optimal performance and early detection of potential issues.

4.15.5 Findings for facilities combined with agricultural land use

4.15.5.1 Impacts

Impacts from construction, operation, and decommissioning
Impacts on public services and utilities are anticipated to be similar to facilities without agricultural land use. However, because facilities would include active management of the vegetative landscape (e.g., grazing, irrigated crop production, pollinator habitat) and provide a beneficial cooling effect to the land, fire risk for the agricultural uses would generally be less compared to the other facilities analyzed. Emergency fire response demand may correspondingly decrease due to this type of land management. Agricultural land uses involve specific access considerations relevant to public services due to the shared land uses. Facilities

could include fencing to accommodate grazing or other agricultural activities, which could pose challenges for first responders.

Findings
Impacts to public services and utilities would be similar to findings for utility-scale onshore wind facilities above.

4.15.5.2 Actions to avoid and reduce impacts

The actions to avoid, reduce, and mitigate impacts for facilities would be the same as those identified for facilities without agricultural use.

4.15.6 Findings for the No Action Alternative

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, and would range from **less than significant** to **potentially significant adverse impacts**.

4.15.7 Unavoidable significant adverse impacts

Construction, operation, and decommissioning of utility-scale onshore wind facilities may result in a **potentially significant and unavoidable adverse impact** if activities required a large fire response in remote locations with limited response capabilities or if there are other unique aspects of a facility site that affect fire response. 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.

5 Cumulative Impacts

5.1 Cumulative impacts analysis

Cumulative impacts are effects that would result from the impacts of utility-scale onshore wind energy facilities added to the impacts from other past, present, and RFFAs. Cumulative impacts can result from incremental, but collectively significant, actions that occur over time. The cumulative impacts analysis was prepared in accordance with SEPA (WAC 197.11.060) and RCW 43.21C.535.

The purpose is to make sure that decision-makers consider the full range of consequences under anticipated future conditions. Future project-specific environmental reviews would need to consider the cumulative impact on the project with other local and regional actions.

The cumulative impact analysis considered the following:

- Effects of multiple actions in the geographic study area (see Figure 3-1)
- Effects on the same resource
- Long-term effects

The following steps were used:

- Identify the resources that could be adversely affected by the future utility-scale onshore wind energy facilities evaluated in the PEIS.
- Assess the current condition and historical context for each resource including trends affecting the resource.
- Consider RFFAs in the same time frame and affecting the geographic study area for each resource.
- Analyze cumulative impacts using the best available data.

Key Findings

Due to the large geographic study area and broad trends of RFFAs identified in Table 5-1 that are considered in this planning document, all resources in this section would have impacts that range from **less than significant** to **potentially significant**. Future projects would need to conduct cumulative analyses relative to their proposal.

For some resources, the study area for cumulative impacts may extend beyond the geographic scope of study in Figure 3-1 to evaluate the incremental impacts on the resource within a larger community or landscape, such as migration corridors. Appendix Q contains the *Cumulative Resource Report* with more detailed information and specific analyses.

5.2 Past, present, and reasonably foreseeable future actions

Current conditions are a result of past and present actions. The current conditions in the study area were used as the baseline existing environmental condition for the resource analyses in the PEIS and are described as part of the affected environment for those resources. Therefore, past actions were not considered again for most resources. Tribes have noted that resources in the study area are part of a much larger integrated cultural network and that impacts can extend far beyond the study area in space and time. To analyze the full range of consequences of potential cumulative impacts to Tribal rights, interests, as well as resources and cultural resources, some additional past and present actions are considered in this analysis (see Sections 5.3.1 and 5.3.13).

RFFAs, including the onshore wind energy facilities evaluated in this PEIS, are activities that could affect the geographic study area over the 50-year study period (July 2025 through June 2075). These include trends that could affect humans and the environment within the study area during the study period. This trend analysis is appropriate for this planning document.

Table 5-1 outlines the types of future actions identified as reasonably foreseeable in the relevant geographic study area and time frame. These were used to identify trends that were used for the cumulative analysis

Table 5-1. Summary of reasonably foreseeable future actions affecting the study area

RFFA	Associated activities	Trends identified
Energy Projects including Clean Energy Developments and Changes to Existing Energy Systems	• Development of new energy-generating facilities, including the onshore wind energy facilities evaluated in this PEIS; transmission systems; and distribution networks • Modification of existing energy generation, transmission, and distribution infrastructure including those for electricity, natural gas, and petroleum products (e.g., gasoline and oil) • Decommissioning, decontamination, and demolition of former coal-fired power plants and associated facilities	• State committed to reducing GHG emission by 95% below 1990 levels by 2050 • Increased development of clean energy sources to meet state goals
Urban, Commercial, and Industrial Activities and Development	• Local residential developments • Urban redevelopment projects • Utility infrastructure (e.g., water/sewer, electrical distribution, and communications) rehabilitation and expansion • Industrial development • Industrial facility decommissioning	• 28% increase in population by 2050 • 1.04% to 1.27% increase in workforce growth for nonfarm occupations over next 10 years • Increased development to support population and workforce growth

RFFA	Associated activities	Trends identified
Rural and Agricultural Activities and Development	• Changes in the types of crops farmed • Conversion of non-designated agricultural land • Irrigation system maintenance and upgrades • Livestock grazing development and expansion	• Overall decline in agricultural land use from 1997 to 2022 (1.9 million acres of farm converted to other uses) • Future conversion of higher valued agricultural land less likely due to Goal 8 of the GMA • Increased changes in farming practices and improvements to rural and agricultural-based infrastructure • Changes in agricultural activities to adapt to climate change
Federal, State, Tribal, and Local Wildlife and Habitat Projects	• Growth management programs • Stream and riparian habitat projects • Watershed planning and implementation	• Ongoing long-term strategies and activities that improve habitat and ecosystem functions, habitat connectivity, and species-specific conservation projects • Statewide 30-year program in place to restore and improve resiliency of shrubsteppe habitat
Transportation Infrastructure Development and Modification	• Highway and road expansion and maintenance • Rail transportation expansion and maintenance • Port and navigation channel expansion and maintenance • Airport and aviation support infrastructure expansion and maintenance • Mass transit projects	• Ongoing activities that maintain, expand, and improve state road and rail transportation systems and increase air and watercraft cargo shipping • Increased development and enhancement of multimodal (e.g., road, rail, waterway, bicycle, pedestrian) connections and choices
Timber and Forestry Management	• Expansion/reduction in forest management areas • Updates to the state's Forest Practices Rules • Timber harvests • Fire/fuel management projects • Fire suppression/firefighting activities	• Ongoing programs and activities to reduce fire risk in timber and forestry areas considering the effects of climate change
Contaminated Site Cleanup and Remediation	• Initial and remedial site investigations • Site cleanup activities • Monitoring and maintenance activities	• Ongoing cleanup and remediation activities at known contaminated sites

RFFA	Associated activities	Trends identified
Mining Operations	• Expansion of existing mining and processing facilities • Development of new mines and processing facilities • Changes in mining processes and procedures • Performance of reclamation activities	• Ongoing development expansion, operation, and reclamation of existing and newly permitted mining sites
Recreation Activities on Public Lands	• Management plans to continue and increase access to and use of hiking, biking, and equestrian trail systems; winter recreation areas; camping and RV sites; and areas for hunting, fishing, and off-road motor vehicle use	• Increased recreational use of public lands • Increased development and maintenance of public access points, trail systems, and other recreational use areas
Military Use	• Development or modification at military facilities • Runway resurfacing, construction, rehabilitation, and maintenance projects, and expansion of exclusion areas • Changes to surface and air training, operations, and testing	• Ongoing assessments of civilian-military compatibility needs to ensure military use and safety of military personnel
Water Supply Development and Withdrawals for Municipal, Agricultural, Industrial, and Conservation Uses	• Development and use of reservoirs, well fields, water distribution systems, water treatment plants, and pump stations for municipal, agricultural, and industrial uses • Implementation of projects designed to improve water conservation and encourage water storage and flood risk reduction • Implementation of projects that support streamflow for aquatic species • Changes in water rights policy and water availability • Dam removals	• Increased risk of drought and subsequent water shortages considering the effects of climate change • Ongoing activities related to the development, improvement, and use of water supply systems to address future water supply issues

5.3 Cumulative impacts by resource

This section provides a summary of potential adverse cumulative effects from the types of facilities considered in the PEIS and other RFFAs on resources. In general, the larger the facility the greater the potential for cumulative impacts because of the larger footprint, the increased need for construction materials, and the increased scale of the supporting infrastructure. It is assumed that energy projects included in RFFA 1 are likely to be located relatively near each other to take advantage of the same energy source conditions and infrastructure.

5.3.1 Tribal rights, interests, and resources

Tribes are recognized as unique sovereign people that exercise self-government rights that are guaranteed under treaties and federal laws. Tribal rights, interests, and resources refer to the collective rights and access to traditional areas and times for gathering resources associated with an Indian Tribe's sovereignty since time immemorial. They include inherent rights or formal treaty rights associated with usual and accustomed territories.

Tribal resources include areas important to traditional cultural practices and the natural and cultural resources associated with those practices, including plants, wildlife, or fish used for commercial, subsistence, and ceremonial purposes. Tribal resources may also include archaeological or historic sites or TCPs associated with Tribal use and sites considered sacred by Tribes. Tribal resources, archaeological sites, historical and cultural sites, TCPs, and natural resources can often be interconnected and overlapping as Tribal resources. Additional details can be found in the *Tribal Rights, Interests, and Resources Resource Report* (Appendix O).

Tribal rights, interests, and resources have been repeatedly affected by past and present actions. Construction of past and present projects has included a range of ground disturbance and alterations to the landscape, some of which persist and contribute to the cumulative impacts that may result from wind energy facilities. The assessment of cumulative impacts on Tribal rights, interests, and resources includes these considerations.

All RFFAs identified in Table 5-1 have the potential to contribute to cumulative impacts on Tribal rights, interests, and resources. These could be from ground disturbance; restrictions to access; noise impacts; degradation of visual quality; or by affecting landscape, habitats, and species. The development of new energy, industrial, commercial, and agricultural facilities and transportation, mining, or forestry activities could impact Tribal resources. This could be from erosion, water quality impacts and water consumption, biological resource impacts, and disruption of access to resources. Federal, state, Tribal, and local wildlife and lands management and habitat projects would be expected to maintain, restore, or create habitats, including wetlands. Contaminated site cleanup and remediation projects would also be expected to improve habitats in the long term, but there would be short-term risks from leaks or spills during cleanup and remediation. Increased human access from recreational activities could potentially disrupt, alter, or degrade habitats and species. Water supply development and withdrawals for municipal, agricultural, industrial, and conservation uses could result in improvements to water resources but could also potentially disrupt, alter, or degrade habitats and species.

Construction and decommissioning activities of utility-scale wind energy facilities could result in cumulative impacts when combined with the impacts of these activities. Cumulative impacts on plants, animals, and ecological communities used by Tribal members could occur if multiple facilities and other activities are in the same area. These could result in changes to vegetation, fragmentation of habitats, degradation of fisheries, or restricted movement of animals and impacts to migration paths due to increased fencing, roads, and other structures. Tribal spiritual practices could be interrupted by construction impacts, and access to land areas and cultural or sacred sites could be limited. Sensitive viewers or sensitive receptors of noise impacts could include members of Tribes, and some landscapes can have special meaning because of Tribal connections or values. Multiple wind energy facilities and other activities developed in close proximity to each other could intensify disruption to sacred religious and ceremonial practices. As such, projects that are being constructed at the same time and near each other could intensify impacts from degradation of visual quality, noise, and interruption of culturally significant landscapes and habitats.

Potential cumulative impacts on Tribal rights, interests, and resources during operation of wind energy facilities include disturbance of previously unrecorded archaeological sites and visual degradation of settings associated with Tribal resources. Impacts could also include limitation of access and travel paths traditionally utilized for hunting, fishing, and other ritual and cultural activities. Impacts from limiting access and travel and from visual degradation are likely to be more significant cumulatively than on an individual project basis.

5.3.2 Environmental justice and overburdened communities

RCW 43.21C.535 requires this PEIS to consider environmental justice and overburdened communities. This PEIS considers whether potential environmental impacts disproportionately affect people of color populations and low-income populations. Of the 359 census tracts that overlap the study area, 47 (or 13%) contain a people of color population and 191 (or 53%) contain a low-income population. This PEIS also identifies where overburdened communities are located in the study area. An overburdened community is defined as a geographic area where highly impacted communities and vulnerable populations face multiple combined environmental harms and health impacts. Of the census tracts that overlap the study area, 28% were identified as overburdened community areas. Additional details regarding environmental justice and overburdened communities can be found in the *Environmental Justice Resource Report* (Appendix P).

All RFFAs identified in Table 5-1 have the potential to contribute to cumulative impacts on people of color populations and low-income populations. This is mostly because if projects are sited in or near these communities, residents could be disproportionately affected by project activities. These include increased traffic, noise, air emissions, hazards, visual impacts, and land use changes. The development of new energy, industrial, commercial, and agricultural facilities and transportation and forestry activities would have a greater risk of visual changes and conversion of land uses that affect the rural character of surrounding areas. These impacts could occur disproportionately in areas containing low-income populations and people of color populations. Mining is also likely to result in EHS risks and adverse environmental impacts from the use of hazardous materials that could disproportionately impact low-income populations and people of color populations.

Construction, operation, and decommissioning of the types of onshore wind energy facilities evaluated in this PEIS are most likely to have cumulatively considerable impacts on people of color populations or low-income populations from visual changes, conversion of land uses, and impacts on fire response. The siting and operation of these facilities could result in the conversion of existing land uses. The specific impacts from these would depend on the existing use of the site where the facility would be located. Wind facilities and activities could have visual impacts from long distances, depending on topography and other factors. These changes could result in changes to perceptions of the rural character of the surrounding area. Facility activities could result in an impact on fire response if activities required a large fire response in remote locations with limited response capabilities or if there are other unique aspects of a facility site. If a facility is located near people of color populations or low-income populations, this would potentially result in disproportionate impacts on these populations.

Wind energy facilities and other activities near each other could also result in cumulative impacts on other resource areas, which could result in further cumulative impacts on people of color populations or low-income populations. Potentially significant impacts on resource areas that may disproportionately affect people of color or low-income populations, if cumulatively considered with similar effects from other RFFAs, include the following:

- Land use
- Aesthetics and visual quality
- Historic and cultural resources
- Tribal rights, interests, and resources
- Public services and utilities
- EHS
- Noise and vibration
- Recreation

5.3.3 Earth

Earth resources include geology, like soils and topography, and geologic and seismic hazards. Details can be found in the *Earth Resource Report* (Appendix B).

All RFFAs identified in Table 5-1 have the potential to result in impacts on earth resources. The cumulative impacts would depend on the location and number of activities and how near they are to each other. Ground-disturbing activities would impact soils. These may include grading for roads and development, clearing a site, and installing infrastructure. They could also include stockpiling, importing and removing soils, changing the flow of water, and construction of access roads and facilities. These impacts may increase the potential for soil compaction, surface erosion and runoff, sedimentation of nearby waterways, soil contamination, slope instability, landslide risks, and changes in local drainage patterns. Grading and fill activities of multiple developments in the same area could result in an increased risk of large-scale landslides.

Cumulative impacts to earth resources from wind facilities and other RFFAs would be expected to increase but would vary depending on the size, type, and number of activities within a given area.

5.3.4 Air quality and greenhouse gases

All of the study area meets all ambient air quality standards. There are some areas of concern for particulate matter and ozone within the study area. Washington has requirements for reducing GHG emissions to achieve net zero emissions by 2050. Additional details regarding air quality and GHGs can be found in the *Air Quality and Greenhouse Gases Resource Report* (Appendix C).

Most RFFAs in Table 5-1 could contribute to cumulative impacts on air quality and GHGs. These RFFAs would use equipment and burn fossil fuels that would result in air pollutant and GHG emissions. These activities could create dust emissions from land-clearing activities and vehicle travel on paved and unpaved roadways.

State GHG emissions are expected to decrease over time to meet regulatory requirements like CETA, the Climate Commitment Act (CCA), and the Clean Fuels Standard. Clean energy sources would add to the state energy system, coal-fired power plants would be retired, and the use of electric cars would increase.

However, population growth would lead to increases in urban, commercial, transportation, and industrial developments. These would emit GHGs but would need to meet regulatory requirements. More frequent and intense wildfires due to climate change could become an increasing source of particulate matter emissions and GHGs.

Cumulative impacts to air resources from wind facilities and other RFFAs may increase or decrease, depending on the size, type, and number of activities within a given area.

5.3.5 Water resources

Water resources include surface water and groundwater quantity and quality, water availability and water rights, streams and stream buffers, wetlands and wetland buffers, and floodplains. Further details on water resources can be found in the *Water Resources Report* (Appendix D).

All RFFAs identified in Table 5-1 have the potential to result in impacts on water resources. Cumulative impacts would occur when activities are within or adjacent to streams, wetlands, and floodplains. Ground disturbance, vegetation clearing, soil compaction, and increased impervious surface area would impact surface runoff. Sedimentation and spills of hazardous materials would adversely impact water quality in wetlands and other shared waters. Multiple developments within floodplains would result in cumulative impacts on floodplain functions. New development would increase the need for water use and obtaining water rights. Some activities, such as wildlife and habitat projects, could decrease impacts on water.

Cumulative impacts to water resources from wind facilities and other RFFAs may increase or decrease, depending on the size, type, and number of activities within a given area.

5.3.6 Biological resources

Biological resources considered in this cumulative analysis include terrestrial, aquatic, and wetland wildlife species including birds and bats, plant species, and habitats. These resources are described in detail in the *Biological Resources Report* (Appendix E).

All RFFAs identified in Table 5-1 have the potential to contribute to cumulative impacts on biological resources. Construction activities like land clearing, excavation, fill, and grading could affect species and habitat. Building and using roads, transmission lines, and facilities would also affect them.

Terrestrial, aquatic, and wetland habitats, including special-status habitats, would be affected by development of activities. Impacts include habitat fragmentation, degradation, and loss, which could also affect landscape-scale habitat connectivity and wildlife migration corridors. Impacts may also include creating edge habitat.

Cumulative impacts would primarily be related to the disturbance, injury, and mortality of species. Wildlife would be affected by the movement of vehicles and equipment. Habitat changes across the landscape would adversely affect these species by limiting suitable habitats for cover, foraging, nesting, breeding, rearing, and migration activities. It would also result in the increased potential for invasive species to displace native species. Mobile species, like birds or larger animals, may be able to move into unaffected habitats. Special-status species may be particularly vulnerable to decreases in habitat connectivity due to their already declining populations and sensitivity to changes in their preferred habitats.

Wildlife may be affected by the movement of vehicles and equipment for onshore wind energy facilities and nearby RFFAs.

Cumulative impacts on landscape-scale habitat and migration and wildlife corridors would occur if multiple RFFAs are developed in the same area, resulting in habitat degradation, fragmentation, and loss affecting landscape-scale habitat connectivity and wildlife migration corridors and the creation of edge habitat. This would restrict of the movement of animals and migration paths due to increased fencing, roads, and other structures.

Migration routes and wildlife corridors provide important habitats for migrating species like birds and large animals. Cumulative impacts on landscape-scale habitat and migration and wildlife corridors would occur if multiple activities occur in the same area. Some animals and birds could be affected by activities that restrict their movements. This could be from construction, operation, or increased fencing, roads, and other structures. Many ungulates, or large hooved animals, migrate on a seasonal basis. The viability of these animals could be affected if summer and winter migration patterns are disrupted. USGS reports provide detailed mapping of migration routes (see Figure 5-1 for an example of this mapping).

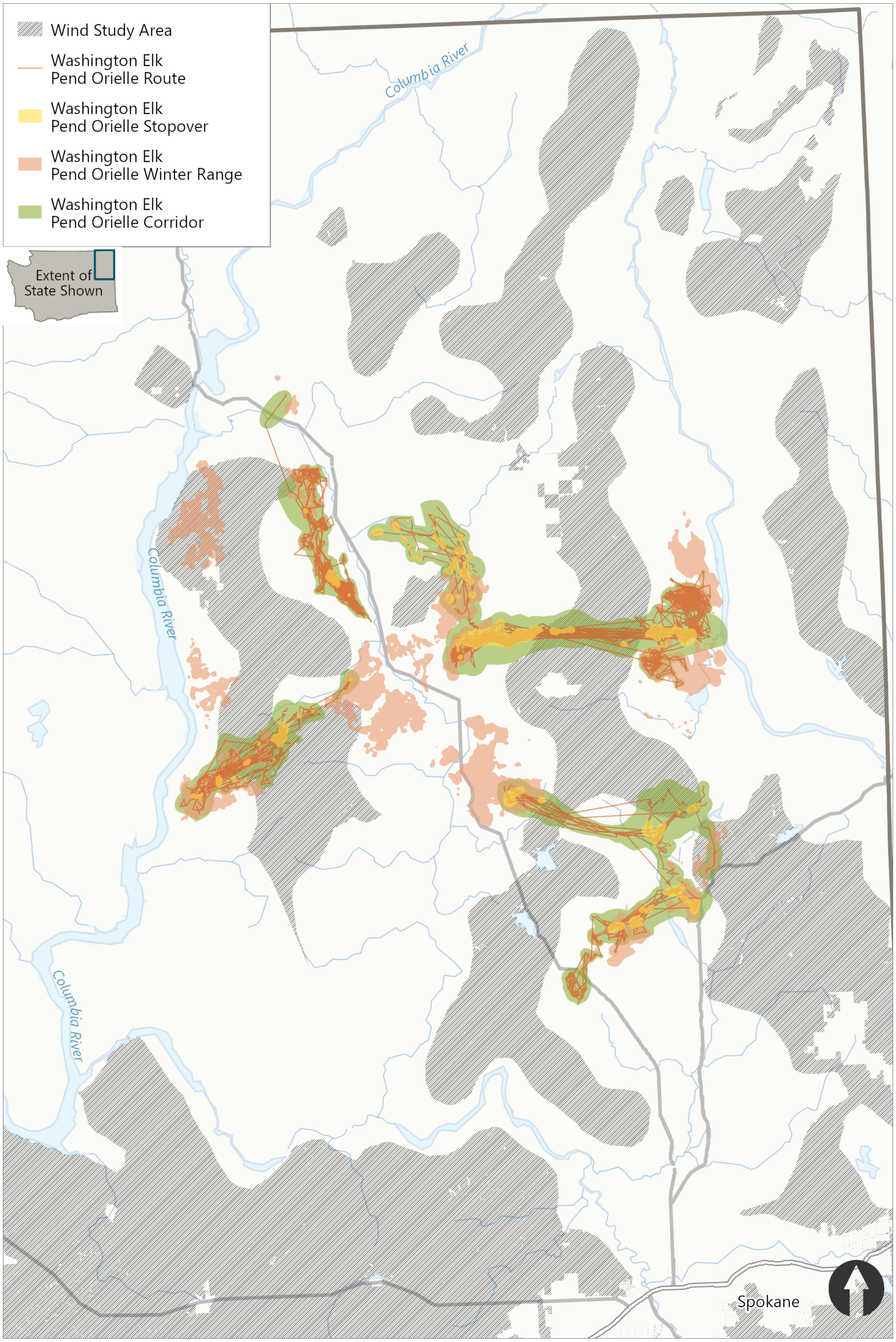

Figure 5-1. Example ungulate migration map for Pend Oreille elk winter range

Bird or bat species that have a wide distribution or migrate long distances would be at greater risk of collisions with moving rotors if multiple wind facilities are sited in the same area. The rotor-swept area poses a risk to birds and bats that move through the area, depending on their flight behaviors. Turbines are usually arrayed across the landscape, and depending on the topography of a site, there would be variable spaces between the turbines. Migratory bird species that have narrow flyways may need to pass through multiple wind facilities during their migration cycle, and all or part of the species population may encounter the wind facility.

Cumulative impacts on migratory bird patterns may also occur if multiple wind facilities are in the same area as other RFFAs affecting air space such as wind turbines, utility lines, and military operations.

Cumulative impacts to biological resources from wind facilities and other RFFAs would be expected to increase but would vary depending on the size, type, and number of activities within a given area and the magnitude and extent of disturbance to terrestrial, aquatic, and wetland habitats and species.

5.3.7 Energy and natural resources

The study area contains substantial energy sources, including wind, sunlight, electricity, and fuels. Mines and quarries throughout the area produce sand, gravel, and crushed stone. These resources are described in detail in the *Energy and Natural Resources Report* (Appendix F).

Most RFFAs have the potential to contribute to cumulative impacts on energy. Clean energy projects would add electricity resources while other energy projects could use electricity. New development would use resources to grow. Changes in land designations would make a site suitable or unsuitable for development. Improved transportation infrastructure would be expected to lead to improved energy distribution. Conservation efforts could reduce the need for energy-intensive water treatment systems. Activities could increase the need for electricity and fuels for new development. There may be an increased need for aggregate to construct infrastructure, urban developments, transportation projects, and water supply projects.

Cumulative impacts to energy from wind facilities and other RFFAs may increase or decrease, depending on the size, type, and number of activities within a given area. Cumulative impacts to natural resources from wind facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

5.3.8 Environmental health and safety

EHS includes hazardous materials exposure, wildfire hazards, and worker health and safety. For more information, refer to the *Environmental Health and Safety Resource Report* (Appendix G).

All RFFAs identified in Table 5-1 have the potential to result in impacts on EHS. Many activities are permitted to store, use, or dispose of hazardous materials. The study area contains cleanup sites on the National Priorities List under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund sites. These sites have hazardous material contamination present in the soil, surface water, or groundwater. Decommissioning for wind energy facilities and other energy facilities and cleanup and mining sites could involve a higher risk of releasing hazardous materials. This could be from degradation of facility components or from increased movement of hazardous materials.

Washington has experienced many extreme fire events in recent years due to climate change. Due to the relatively dry conditions, wildfires in eastern Washington occur more often than in other parts of the state and this trend is expected to continue in the future. Based on research conducted by the University of Washington, all counties in Washington show a significant increase in the projected number of high fire days between the years 2040 and 2069. Development or land use changes could lead to increased ignition risks or create areas with elevated fire risk. Some activities, such as land management and habitat projects, could potentially reduce wildfire risk by improving the health of ecosystems and communities.

Cumulative impacts to wildfire risk and hazardous materials from wind facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

5.3.9 Noise and vibration

Impacts from noise and vibration are based on distance to potential sensitive human receptors. In general, noise levels are high around major transportation corridors, airports, and industrial facilities and low in rural or non-industrial areas. For more information, refer to the *Noise and Vibration Resource Report* (Appendix H).

With the exception of RFFAs associated with timber and forestry management; contaminated site cleanup; and recreation activities on public land, all RFFAs identified in Table 5-1 have the potential to result in noise and vibration impacts.

Noise levels for activities are highest during construction when land clearing, grading, and road construction would occur. These could include heavy equipment operation, pile driving, and blasting. These would typically be temporary and of short duration.

The major noise sources for onshore wind energy facilities are wind turbines and substations, which would generally operate 24 hours a day and hence would generate noise during the more noise-sensitive nighttime hours. Noise impacts from turbines would vary based on the type of model, the configuration towers, wind environment, distance to nearest sensitive receptors, and the presence of intervening structures or geographic features.

Noise impacts during operations of activities would depend on the type, terrain, vegetation, and local weather conditions as well as distance to the nearest sensitive receptors. Sources of noise and vibration from operations of onshore wind facilities would contribute to cumulative impact. Urban, rural, agricultural, commercial, mining, and transportation development and use are expected to add to noise and vibration.

Cumulative impacts from noise and vibration from wind facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

5.3.10 Land use

Most of the study area is agricultural, rural residential, forestry, wildlife conservation, and undeveloped recreation areas. GMA counties must develop Comprehensive Plans to manage their land use. Non-GMA counties must still plan for critical areas and natural resource lands. For more information, refer to the *Land Use Resource Report* (Appendix I).

Most RFFAs identified in Table 5-1 have the potential to result in land use impacts. Cumulative impacts on land use would occur as a result of the construction and operation energy, urban, industrial, and transportation activities. The general trend towards conversion of land uses to urban developments and onshore wind energy facilities in rural areas would lead to a cumulative loss in other land uses such as agricultural or undeveloped lands. Activities could result in increased dust, noise, traffic, and visual changes that could affect other properties.

The operation of wind facilities would also result in changes to the visual landscape from the presence of turbines and infrastructure. These would be visible from long distances depending on topography and other factors. Other development activities would also result in change to the visual landscape. These changes would result in changes to and/or perceptions of the rural character of the surrounding area.

The nature and extent of cumulative effects on land use in the study area would depend on whether the RFFAs resulted in changes or conversions to the same types of land uses and designations.

5.3.11 Aesthetics/visual quality

The study area for aesthetic and visual resources includes the overall onshore wind energy geographic study area, as well as surrounding viewsheds. Visual resources include all objects and features that are visible on a landscape and that add or detract from its aesthetic or scenic quality. Additional details can be found in the *Aesthetics/Visual Quality Resource Report* (Appendix J).

With the exception of RFFAs associated with federal, state, Tribal, and local wildlife and lands management and habitat programs; contaminated site cleanup; and recreation activities on public land, all RFFAs identified in Table 5-1 have the potential to result in impacts on aesthetics and visual quality.

Development and operation would involve a range of activities with potential visual impacts. These include the removal of vegetation; dust generation; new roads; and modifying or building residential, industrial, commercial facilities. Multiple utility-scale onshore wind energy facilities in the same area would introduce 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 "skylined" in an area of greater topographic relief. This could occur at long distances. A larger number of wind turbines in close proximity would have increased perceived visual impacts from the introduction of more geometrical shapes to the visual landscape, the movement of rotor blades, shadow flicker and blade glinting, and lighting from turbine markers or other ancillary structures in a concentrated area.

Typically, vegetation-clearing activities for facilities, forestry management, and roads would create visual impacts primarily by changing the color and texture of the cleared areas. Other RFFAs, such as other energy facilities, land use changes, and the development of water reservoirs or major transportation infrastructure projects would also introduce visual contrasts and glare from artificial light sources. The visible structures from RFFAs in the vicinity, such as urban, commercial, and industrial development, would potentially produce visual contrasts based on their design attributes.

Cumulative impacts to visual resources from wind facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

5.3.12 Recreation

Recreation resources include parks, recreational opportunities, public lands, and public amenities such as trails. Designated recreation areas include local parks, federal lands, and state lands. Hunting and fishing seasons vary throughout the year by the species of animal. For more detailed information, see the *Recreation Resource Report* (Appendix K).

Tribal hunting and fishing also occur throughout the state at various times during the year. For more detailed information, see the *Tribal Rights, Interests, and Resources Report* (Appendix O).

Some RFFAs identified in Table 5-1 have the potential to result in impacts on recreational resources. Construction of utility-scale onshore wind energy facilities, other energy facilities, new commercial and industrial development, mining operations, transportation projects, and water supply projects would increase temporary noise, dust and visibility, and traffic, and result in temporary changes in access to recreation resources. Larger transportation networks would also involve more vehicle traffic, resulting in more sources of noise and vibration and air pollution near recreation areas. Construction and operations could restrict access to existing recreational sites on a site or affect access to nearby areas. Increased fencing could also result in loss of recreational opportunities.

As described in Section 5.3.6, activities are expected to have cumulative impacts on habitat and species, reducing opportunities for hunting and wildlife viewing. Some activities, such as wildlife and habitat projects, could improve recreational opportunities.

Cumulative impacts to recreation resources from onshore wind facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

5.3.13 Historic and cultural resources

Archaeological sites, historic properties, and Tribal place names exist throughout the study area. They include areas connected to spiritual practices and named places and are represented within oral tradition stories and historic documents. Historic and cultural resources include recorded and unrecorded archaeological resources, historic architectural resources listed or eligible for listing in a historic register, human remains and cemeteries, sacred sites, and documented and undocumented TCPs. Historic and cultural resources have been repeatedly affected by past and present impacts. Additional details regarding historic and cultural resources can be found in the *Historic and Cultural Resource Report* (Appendix L).

All RFFAs identified in Table 5-1 have the potential to result in impacts on historic and cultural resources. Construction of past and present projects has included a range of ground disturbance and alterations to the landscape, some of which persist and contribute to the cumulative impacts that may result from onshore wind energy facilities. The assessment of cumulative impacts on historic and cultural resources includes these considerations.

Construction and decommissioning of all utility-scale onshore wind energy facilities considered in this PEIS along with other activities could result in cumulative impacts on, or inadvertent discoveries of, historic and cultural resources. Construction and decommissioning activities that could impact historic and cultural resources include ground disturbance, degradation of visual quality, noise, and interruption of the landscape. Ground disturbance is likely to impact undiscovered archaeological resources due to the prevalence of such sites throughout the study area and the fact that the majority of the study area has not been archaeologically surveyed. If wind energy facilities are repowered at the end of their useful life, the cumulative impacts would include some of those associated with facility construction and would also result in a longer period of facility operation. Other cumulative impacts that may result from wind energy facilities along with other activities could include degradation and interruption of culturally significant landscapes and habitats. Increased human access exposes archaeological sites and historic structures and features to greater probability of impact from a variety of stressors.

Potential cumulative impacts on historic and cultural resources during operation include disturbance of previously unrecorded archaeological sites. They also include visual degradation of settings associated with historic and cultural resources, and limitation of access and travel paths traditionally utilized for cultural resources. These impacts are likely to be more significant cumulatively than on an individual project basis.

Visual changes associated with wind energy facilities could 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. These could affect cultural resources for which visual integrity is a component of sites' significance, such as Tribal sacred sites and landscapes, historic structures, trails, and historic landscapes.

Together, past and present projects, the future activities identified here, and potential wind facilities represent changes to culturally important landscapes. Archaeological sites and TCPs are non-renewable resources; impacts on these resources could contribute to cumulative impacts from past, present, and future projects.

5.3.14 Transportation

Transportation includes roadways, railroads, airports, ports, transportation systems, traffic, parking, and movement of people and goods. For more information, refer to the *Transportation Resource Report* (Appendix M).

Most RFFAs identified in Table 5-1 have the potential to result in impacts on transportation. Transporting resources and workers during construction, operation, and decommissioning of contribute to cumulative impacts on transportation and traffic. Construction and decommissioning activities for different RFFAs also have the potential to contribute to a temporary increase in demand for shipping services if they occur at the same time and location.

Activities may also include road modifications or new road construction. Transportation activities would directly affect transportation resources and would be likely to result in improvements to traffic or movement. Increases in traffic from transportation infrastructure projects and urban, rural, industrial, agricultural, and commercial facilities would result in impacts.

Cumulative impacts to transportation resources from wind facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

5.3.15 Public services and utilities

Public services in the study area include public schools, fire departments, emergency medical services, and law enforcement. Public services may be provided by federal, Tribal, state, county, or local governments as well as volunteer fire departments and other volunteer groups. Utilities include telecommunications, gas and electrical, water, wastewater, and solid waste management. Depending on the area, utilities may be provided by county, city, Tribal, or private suppliers. These resources and activities are described in detail in the *Public Services and Utilities Resource Report* (Appendix N)

With the exceptions of RFFAs associated with federal, state, Tribal, and local wildlife and habitat projects; contaminated site cleanup and remediation; mining operations; recreation activities on public lands; and military operation, all other RFFAs identified in Table 5-1 have the potential to contribute to cumulative impacts on public services and utilities.

New urban, commercial, and industrial activities and development would be expected to increase both the demand and availability of public services and utilities, as would activities associated with changes in rural and agricultural activities. Increased demand from activities could exceed existing capacities of public service providers and result in the need for new or modified utilities or service systems.

Firefighting and emergency response needs would increase from land management and the development and operation of energy facilities, water supply projects, and rural and urban developments. These activities would introduce ignition sources that would increase the risk of fire.

Additionally, interference with communications systems may occur due to the height and nature of wind turbines affecting existing electronic and microwave communications infrastructure, including emergency response-related communications capabilities, AM broadcast stations, and television receiver locations. This is because rotating electrical machines generate a certain amount of electrical noise as a combination of various frequencies, resulting in potential interferences to existing signals from each wind energy generator and its associated system.

Cumulative impacts related to fire protection and response services involve consideration of fire risks during facility operation caused by wind energy facility equipment or operational activities, and fires started outside of facilities that have altered behavior (i.e., spread or moved) due to the presence of a wind energy facility. Depending on location, the presence of wind turbine towers also has the potential to limit an aerial response to fire within a windfarm to the edges of the windfarm and can affect aerial access to other wildfires. These impacts would be expected to be additive to those of RFFAs being developed and operating nearby.

Urban, commercial, industrial, rural, and agricultural development may also increase demand for potable water and wastewater treatment. If waste associated with urban, rural, commercial, agricultural, and industrial activities is not managed appropriately, it would exceed capacities for utility providers such as landfills and transfer stations.

Cumulative impacts to public services and utilities from wind facilities and other RFFAs would likely increase depending on the size, type, and number of activities within a given area.

6 Consultation and Coordination

This chapter describes how information was shared during the development of the Draft PEIS. Ecology used several methods to reach out to Tribes, local and state agencies, wind energy developers, environmental organizations, and other interested parties. These groups were provided opportunities to share information, comments, and perspectives and to engage in the development of the Draft PEIS.

6.1 PEIS scoping process

Scoping for the PEIS began on September 27, 2023. The Determination of Significance and Scoping Notice for the PEIS initiated Ecology's environmental review process. The public scoping comment period was held from September 27 to October 27, 2023. Two online public scoping meetings were held for the public to provide verbal comments on October 5 and October 10, 2023. Spanish interpreters were available at meetings, and materials were translated into Spanish. A separate Tribal scoping meeting was held on October 17, 2023. Tribes were provided an additional 30 days to submit comments. Ecology accepted written scoping comments online and by mail, and verbally during online public scoping meetings.

A variety of scoping materials were available on Ecology's PEIS website for public review throughout the scoping period. The website provided information on scoping, including how to comment and a link to an online comment form. The *Scoping Summary Report* can be found in Appendix A.

Scoping outreach summary

- **Legal notices** published on the SEPA Register on September 27, 2023, and published in *The Seattle Times*, *The Spokesman-Review*, *Columbia Basin Herald*, *TriCity Herald*, and *Tú Decides*
- **Notifications** sent to Tribal Chairs, Natural and Cultural Resources Directors, and Executive Directors of Tribal Organizations
- **Public, agency, and media notifications** through social media post on Twitter, email and listserv distributions, and news releases
- **PEIS website** developed and provided information and links
- **Information** published on Ecology's Public Input and Events Listing website

6.2 Additional outreach and coordination with interested parties

A series of meetings were held with interested parties during development of the Draft PEIS. These meetings were designed to engage environmental organizations, the wind industry, utilities, federal and local governments, and ports. Invited parties included those that have been active in discussions about onshore wind energy development in the state, expressed an interest in contributing information for the PEIS process, or are located in areas where future facilities considered in this PEIS may be proposed.

Meetings were designed to share Ecology's clean energy legislative directive, updates on the purpose of the PEIS and how it can be used, as well as the PEIS timeline. Meetings were also used to gather general input and specific information and feedback from participants.

Ecology will host three public hearings, two in person and one virtual, to collect comments on the Draft PEIS. Ecology will respond to comments in the Final PEIS. Materials for the public hearings will be available in English and Spanish. Public hearings will take place within 30 days of the date of publication of the Draft PEIS.

6.3 Tribal engagement and consultation

Ecology provided notification of the scoping period to Tribal Chairs and Natural and Cultural Resources Directors of all federally recognized Tribes with lands and territories in Washington state, and Executive Directors of Tribal organizations. Government-to-government consultation was offered to federally recognized Tribes in Washington as an option at any time during the PEIS process. After scoping, Ecology repeated this invitation for consultation at Tribal forums in spring 2024 where the scoping report was discussed.

Ecology provided opportunities where Tribes could choose to share information, comments, and perspectives on clean energy planning as well as facility environmental review and permitting processes. A Tribal scoping meeting was held on October 17, 2023.

Tribal forums were held during development of the Draft PEIS on March 12 and April 30, 2024, with representatives of interested Tribes and Tribal associations attending. At Tribal forums during development of this Draft PEIS, Ecology presented the geographic scope of study. The study area excludes Tribal reservation and trust lands, and Ecology asked if Tribes wanted to include their lands in the scope of study. Ecology offered Tribes an opportunity to review draft sections of the *Tribal Rights, Interests, and Resources Report* (Appendix O) and *Historic and Cultural Resources Report* (Appendix L). The Columbia River Inter-Tribal Fish Commission and Suquamish Tribe provided comments, which Ecology considered in developing this Draft PEIS.

Ecology will continue to offer Tribal forums once per quarter to provide information and discuss ideas and issues related to clean energy coordination. These forums are opportunities for Ecology to request early and continued feedback from and involvement by Tribes potentially affected by planning actions or facilities and ensure Tribes are informed of opportunities to comment on the PEIS.

6.4 Agency coordination

Ecology worked with state agencies that have expertise in the areas evaluated in the Draft PEIS. These included the State of Washington Energy Facility Site Evaluation Council (EFSEC), WDFW, DNR, WSDOT, and DAHP. State agency coordination included a series of meetings in early 2024 on how impacts on specific resources would be technically evaluated in the PEIS. Ecology met with EFSEC, DAHP, WDFW, and DNR staff on several occasions to discuss sources of information, potential impacts, and measures to avoid and reduce impacts. State agency staff reviewed draft technical reports and chapters of the Draft PEIS. Ecology also provided regular updates to the interagency Clean Energy Siting Council.

7 Permits and Approvals

7.1 Federal

- **Bald and Golden Eagle Protection Act (USFWS):** This permit is required for any facility activities that may disturb or harm bald or golden eagles or their habitats, especially during construction near nesting sites.
- **Determination of No Hazard to Air Navigation Approval (FAA):** Submission of FAA Form 7460-1 is required for any structure that exceeds certain height limits or is near airports to ensure it does not pose a hazard to air navigation.
- **Endangered Species Act (USFWS/National Oceanic and Atmospheric Administration [NOAA] Fisheries):** This consultation is required for any facility that may affect endangered or threatened species or their habitats, ensuring no jeopardy to their existence or destruction of critical habitats.
- **Magnuson-Stevens Fishery Conservation and Management Act (NOAA Fisheries):** This consultation is required to protect essential fish habitats affected by the facility, particularly those near significant waterbodies.
- **Migratory Bird Treaty Act (USFWS):** This permit is required for any facility activities that may disturb or harm migratory birds, their nests, or eggs.
- **National Environmental Policy Act (federal agency):** This environmental review is required for all federal actions including federal projects or any project requiring a federal permit, federal funding, or located on federal land.
- **National Historic Preservation Act (Advisory Council on Historic Preservation):** A Section 106 consultation is required for facilities that may affect historic properties and is typically completed as part of the federal permitting or other approval process. The process includes consultation with interested and affected Tribes, the State Historic Preservation Officer with DAHP, and other interested parties.
- **National Oceanic and Atmospheric Administration Radar Operations Center Approval (NOAA):** This approval is required to ensure the facility does not interfere with NOAA radar operations.
- **Section 4(f) Review (U.S. Department of Transportation):** This review is required to ensure the protection of publicly owned parks, recreation areas, wildlife refuges, and historic sites.
- **Section 401 Water Quality Certification (USEPA, Ecology, or Tribes):** This certification is required for any facility needing a federal permit or license that may result in discharges to waters of the United States, ensuring compliance with state water quality standards.
- **Section 404 Permit (U.S. Army Corps of Engineers):** This permit is required for facilities involving the discharge of dredged or fill material into U.S. waters, including wetlands.
- **U.S. Department of Defense Clearance for Radar Interference (DoD):** This clearance is required for facilities that may interfere with military radar operations, particularly for tall structures near military installations.

- **Determination of No Hazard to Air Navigation Approval (FAA):** This approval ensures that the facility does not pose a hazard to air navigation, which is critical for tall structures.
- **Federal Aviation Administration Form 7460-1 (Notice of Proposed Construction or Alteration) (FAA):** This form is submitted for structures affecting navigable airspace, and is necessary for wind turbines.

7.2 Washington State

- **Aquatic Use Authorization (DNR):** This authorization is required for any facility activities involving the use of state-owned aquatic lands.
- **Archaeological Excavation and Removal Permit (Washington Department of Archaeology and Historic Preservation):** This permit is required for excavating or removing archaeological resources within the facility area.
- **Air Prevention of Significant Deterioration Permit (EFSEC, Ecology):** This permit ensures that air discharges from the facility meet state standards.
- **NPDES Permit (Ecology):** This permit may be required for construction or for industrial uses that include discharges from the facility site.
- **Sand and Gravel General Permit (Ecology):** This permit is required for operations involving sand, gravel, concrete, or asphalt production.
- **Surface Mining Reclamation Permit (DNR):** This permit is required for each surface mine that results in more than 3 acres of disturbed ground, or has a high-wall or disturbance area that meets certain criteria.
- **State Environmental Policy Act (state or local agency):** This environmental review helps state and local agencies identify environmental impacts that may result from projects and decisions.
- **Coastal Zone Management Act (Ecology):** A notice of consistency with the state Coastal Zone Management Program is a condition of federal activities, federal license, and permit approval.
- **Washington Forest Practices Act (DNR):** A permit is not required for every forest practice, but the forest practices rules must be followed when conducting all forest practices activities. A permit may be required for logging or forest road construction activities.
- **Electrical Permit (Washington State Department of Labor and Industries):** This permit ensures all electrical installations meet state safety standards.
- **Washington State Hydraulic Project Approval (WDFW):** This permit is required for any work that uses, diverts, obstructs, or changes the natural flow or bed of any fresh water or saltwater of the state.
- **Washington State Shoreline Management Act (Ecology):** The Shoreline Management Act requires all counties and most towns and cities with shorelines to develop and implement Shoreline Master Programs. Local governments issue shoreline substantial development, conditional use, and variance permits, as well as shoreline exemptions pursuant to the policies and use regulations in their Shoreline Master Programs.

- **Water Pollution Control Act (Ecology):** This is used to authorize projects that will result in the alteration or loss of non-federally regulated wetlands and other waters of the state that are not within federal jurisdiction certifications.
- **Water Right Permit (Ecology):** This permit is necessary for new water diversions, withdrawals, or changes to existing water rights.
- **Utility Lines – Franchises and Permits (WSDOT):** This permit is required for utility installations crossing state highway ROWs.
- **Overweight/Oversize Permits (WSDOT):** These permits are required for overweight/oversize loads.

7.3 Local

- **Air Quality Permits (local air quality management authority or Ecology):** These permits are required to control and manage emissions from construction and operation activities.
- **Blasting Permits (local fire department or building authority):** These permits are necessary for any blasting activities during construction.
- **Construction Permits (local building authority):** Various permits are required for construction activities, including ROW, access, clearing, grading, building, mechanical, and electrical permits.
- **Floodplain Development Permits (local planning department):** These permits are required for construction activities within designated floodplain areas.
- **Critical Areas Codes, Shoreline, Zoning Ordinances, and Other Land Use Requirements (local planning department):** Compliance with these local regulations ensures the facility meets land use, zoning, and environmental protection standards.

8 List of Preparers and Contributors

Name	Subject matter
Agencies	
Washington State Department of Ecology	Tribal rights, interests, and resources, environmental justice and overburdened communities, earth, air quality and GHGs, water resources, biological resources, energy and natural resources, EHS, noise and vibration, land use, aesthetics/visual quality, recreation, historic and cultural resources, transportation, public services and utilities, cumulative impacts
State of Washington Energy Facility Site Evaluation Council	SEPA process, energy facility considerations
Washington Department of Fish and Wildlife	Earth, water resources, biological resources, recreation
Washington State Department of Natural Resources	Earth, water resources, biological resources, EHS, land use, recreation, transportation
Washington State Department of Transportation	Transportation
Washington State Department of Archaeological and Historic Preservation	Historic and cultural resources
Department of Defense	Military areas
Consultant team	
Anchor QEA	Tribal rights, interests, and resources, environmental justice and overburdened communities, earth, water resources (wetlands), biological resources, land use, cumulative impacts
Environmental Science Associates	Air quality and GHGs, water resources, EHS, noise and vibration, aesthetics/visual quality, recreation, historic and cultural resources, transportation, public services and utilities
Hammerschlag	Energy and natural resources, climate change assumptions
Dynamic Language	Document accessibility and language translation
Ross Strategic	Stakeholder and public engagement
Triangle Associates	Tribal engagement

9 Distribution List

Governments, agencies, and regional councils

- Association of Washington Cities
- Bonneville Power Administration
- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Reclamation
- Clean Air Agencies
- Clean Energy Siting Coordination Council
- State of Washington Energy Facility Site Evaluation Council
- Environmental Justice Council
- Federal Aviation Administration
- Federal Emergency Management Agency
- Federal Energy Regulatory Commission
- General Services Administration
- Governor Jay Inslee and executive and policy staff
- Governor's Office of Indian Affairs
- Governor's Office for Regulatory Innovation and Assistance
- National Marine Fisheries Service
- National Park Service
- Northwest Power and Conservation Council
- Puget Sound Partnership
- Puget Sound Regional Council
- U.S. Army Corps of Engineers
- U.S. Department of Defense
- U.S. Department of Energy
- U.S. Department of the Interior
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- Washington city and county planning agencies and SEPA lead agencies
- Washington State Department of Fish and Wildlife
- Washington State Department of Natural Resources
- Washington Emergency Management Division
- Washington State Association of Counties
- Washington State Conservation Commission
- Washington State Department of Agriculture
- Washington State Department of Archaeological and Historic Preservation
- Washington State Department of Commerce
- Washington State Department of Health
- Washington State Department of Social and Health Services
- Washington State Department of Transportation
- Washington State Legislators and Legislative Committees
- Washington State Parks and Recreation Commission
- Washington State Utilities and Transportation Commission

Tribes and Tribal representation

- Affiliated Tribes of Northwest Indians
- Columbia River Inter-Tribal Fish Commission
- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Chehalis Reservation
- Confederated Tribes of the Colville Reservation
- Confederated Tribes of the Umatilla Indian Reservation
- Confederated Tribes of Warm Springs
- Cowlitz Indian Tribe
- Hoh Indian Tribe
- Jamestown S'Klallam Tribe
- Kalispel Tribe of Indians
- Lower Elwha Klallam Tribe
- Lummi Nation
- Makah Tribe
- Muckleshoot Indian Tribe
- Nez Perce Tribe
- Nisqually Indian Tribe
- Nooksack Indian Tribe
- Port Gamble S'Klallam Tribe
- Puyallup Tribe
- Quileute Tribe
- Quinault Indian Nation
- Samish Indian Nation
- Sauk-Suiattle Indian Tribe
- Shoalwater Bay Indian Tribe
- Skokomish Indian Tribe
- Snoqualmie Indian Tribe
- Spokane Tribe of Indians
- Squaxin Island Tribe
- Stillaguamish Tribe of Indians
- Suquamish Tribe
- Swinomish Indian Tribal Community
- Tulalip Tribes
- Upper Skagit Indian Tribe

Utilities and industry

- Wind energy developers
- Association of Washington Business
- NW Energy Coalition
- Public Power Council
- Renewable Northwest
- Utilities
- Washington Public Utility District Association
- Washington Rural Electric Cooperative Association
- Washington Public Ports Association

Environmental, labor, and other organizations

- Agricultural and farmland organizations
- Environmental justice organizations
- Environmental organizations
- Washington State Building and Construction Trades Council
- Washington State Labor Council

Other distribution

- Ecology's SEPA Register
- Ecology's clean energy and SEPA email distribution lists
- Published legal notices and public and media notifications
- Ecology's PEIS website

Appendix A. Scoping Summary Report

Appendix B. Earth Resource Report

Appendix C. Air Quality and Greenhouse Gases Resource Report

Appendix D. Water Resources Report

Appendix E. Biological Resources Report

Appendix F. Energy and Natural Resources Report

Appendix G. Environmental Health and Safety Resource Report

Appendix H. Noise and Vibration Resource Report

Appendix I. Land Use Resource Report

Appendix J. Aesthetics/Visual Quality Resource Report

Appendix K. Recreation Resource Report

Appendix L. Historic and Cultural Resources Report

Appendix M. Transportation Resource Report

Appendix N. Public Services and Utilities Resource Report

Appendix O. Tribal Rights, Interests, and Resources Report

Appendix P. Environmental Justice Resource Report

Appendix Q. Cumulative Impacts Report