Appendix G: Biological Resources Technical Appendix

For Programmatic Environmental Impact Statement on Green Hydrogen Energy Facilities in Washington State

By

HDR

For the

Shorelands and Environmental Assistance Program

Washington State Department of Ecology

Olympia, Washington

January 2025

DEPARTMENT OF ECOLOGY
State of Washington

Table of Contents

List of Figures and Tables

Figures

Tables

Acronyms and Abbreviations List

BESS	battery energy storage system
BMP	best management practice
CFR	Code of Federal Regulations
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DNR	Washington Department of Natural Resources
DPS	Distinct Population Segment
Ecology	Washington State Department of Ecology
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESCP	Erosion and Sediment Control Plan
ESU	evolutionarily significant unit
GMA	Washington Growth Management Act
NHD	National Hydrography Dataset
NHP	National Heritage Program
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NWI	National Wetlands Inventory
OHWM	ordinary high-water mark
PEIS	Programmatic Environmental Impact Statement
PHS	Priority Species and Habitats
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
SGCN	species of greatest conservation need
SMA	Washington Shoreline Management Act
SMR	steam-methane reforming
SRKW	Southern Resident killer whale
SWAP	State Wildlife Action Plan
SWPPP	Stormwater Pollution Prevention Plan
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WNHP	Washington Natural Heritage Program
WSRRI	Washington Shrubsteppe Restoration and Resiliency Initiative

Summary

This technical appendix describes biological resources conditions in the study area. It also describes the regulatory context and potential impacts and actions that could avoid or reduce impacts. The following are key features of biological resources in the discussions of the affected environment, potential impacts, and actions to avoid and reduce impacts:

- Terrestrial species and habitat, including:
  - Terrestrial species (including avian species and 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 habitat, 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
  - Salmonid and other fish migration routes
- Wetland habitats

Findings are summarized as follows:

- Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction, operation, and decommissioning activities of green hydrogen facilities would result in **less than significant** impacts to terrestrial and aquatic habitats, including special status habitats. Activities that cause the permanent degradation, loss, or conversion of suitable habitat that is crucial to species viability or disrupt habitat continuity along migration routes would result in **potentially significant adverse** impacts on terrestrial habitats.
- Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction, operation, and decommissioning activities of green hydrogen production facilities would result in **less than significant** impacts on terrestrial and aquatic species, 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 and aquatic species.
- Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, construction, operation, and decommission of green hydrogen production facilities would result in **less than significant impacts** on wetlands.
- Construction and operation of green hydrogen facilities may result in **significant and unavoidable adverse impacts** on terrestrial and aquatic 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 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 and aquatic special-status habitats or species may not be feasible.

1 Introduction

This report describes biological resources within the study areaFigure 1 and assesses probable impacts associated with the types of green hydrogen facilities evaluated, and a No Action Alternative. Chapter 2 of the State Environmental Policy Act (SEPA) Programmatic Environmental Impact Statement (PEIS) provides a description of the types of facilities evaluated.

This section provides an overview of the biological resources evaluated and lists relevant regulations that contribute to the evaluation of potential impacts.

1.1 Resource description

Biological resources include both terrestrial and aquatic habitats and species. Each of these is described in the following sections. Wetlands are also discussed as a separate category due to the habitats they provide to terrestrial and aquatic species.

In the study area, the following resources could have impacts that overlap with impacts to biological resources. Impacts on these resources are reported in their respective technical appendices:

- **Noise and vibration:** Potential impacts of noise and vibration on terrestrial and aquatic species and habitats use information presented in the *Noise and Vibration Technical Appendix*.
- **Tribal interests, treaty rights, and resources:** Tribal rights, interests, and resources may include terrestrial and aquatic plants, animals, and habitats. The importance of those biological resources to Tribes is assessed in the *Tribal Rights, Interests, and Resources Technical Appendix*.
- **Water resources:** The hydrologic and hydraulic characteristics of surface waters, groundwater, and wetlands, and their federal, state, and local regulatory considerations are primarily addressed in the *Water Resources Technical Appendix*, whereas the species-specific habitat features provided by those waters are discussed in this technical appendix.

1.1.1 Terrestrial habitats and species

Terrestrial habitats are places where animals and plants live that are found on land, including forests, grasslands, deserts, shorelines, and underground habitats like caves and burrow systems. Terrestrial species are the animals and plants that live in those habitats. Terrestrial animals typically include mammals, birds (including waterfowl), reptiles, insects, spiders, and other invertebrates. Terrestrial plants typically include various species of trees, shrubs, herbs, and mosses.

The following key features are analyzed in the affected environment, potential impacts, and actions to avoid and reduce impacts discussions:

- Terrestrial species (including avian species and 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

1.1.2 Aquatic habitats and species

Aquatic habitats are areas that have surface water that may be rain or snowmelt dependent (ephemeral), seasonally intermittent (flowing during certain times of the year), or year-round (perennial) that provide spawning, rearing, foraging, and migration areas for aquatic and amphibious species. They include wetlands, which are often generally described as transitional areas that occur between aquatic and terrestrial habitats.

Aquatic species include fish, marine mammals, mollusks, aquatic invertebrates, and other organisms that live in water for the duration of their life cycle. Amphibious species (i.e., amphibians) are those that use both aquatic and terrestrial habitats in their life cycles and include frogs, toads, newts, and salamanders.

The following key features are analyzed in the affected environment, potential impacts, and actions to avoid and reduce impacts discussions:

- 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 freshwater and marine habitat for aquatic and amphibious species, including migration routes for salmonids and other highly migratory species
- Wetlands that provide habitat for aquatic and amphibious species

1.1.2.1 Wetlands

Wetlands are a specific type of habitat that often occur in transitional areas between terrestrial and aquatic systems. They are typically characterized as areas where the underlying water table is at or near the soil surface or where the ground is covered by shallow water for an extended duration during the growing season. Such conditions result in the development of anaerobic (i.e., low oxygen) conditions in the upper part of the soil column.[1] Soils formed under such conditions are known as hydric soils. Wetlands also typically support vegetation that is specifically adapted to growing in saturated or flooded soil conditions. Such vegetation is

[1] The upper part of the soil column is typically defined as the upper 12 inches.

known as hydrophytic, or "water-loving" vegetation, and can include various species of herbs, shrubs, vines, and trees.

Wetlands can occur in 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. They are typically distinguished from streams and rivers by the presence of rooted hydrophytic vegetation and the lack of a defined channel that conveys flowing water, although some wetlands can include channel-like features such as vegetated swales or drainages. Wetlands are primarily distinguished from deepwater aquatic habitats like lakes and ponds by water depth and the presence of vegetation. Deepwater aquatic habitats are typically permanently inundated with greater than 6.6 feet (2 meters) of water and do not support rooted-emergent or woody vegetation (Cowardin et al. 1979; Environmental Laboratory 1987). In the marine environment, wetlands can occur in estuarine areas where freshwater enters the ocean or along coastlines where they are supported by tidal action, waves, or ocean spray with minimal influence from freshwater (Cowardin et al. 1979).

Wetlands provide a number of important ecosystem functions, including habitat for terrestrial, aquatic, and amphibious species; water quality improvement; flood protection; shoreline stabilization; groundwater recharge; and stream flow maintenance (Ecology 2023). This technical appendix focuses on those wetland functions associated with the provision of habitat for aquatic and terrestrial species. The regulation and jurisdictional boundaries of wetlands and the potential effects of green hydrogen facilities on hydrological (e.g., water storage and delay) and water quality functions are addressed in the *Water Resources Technical Appendix*.

1.2 Regulatory context

Table 1 provides the federal, state, and local regulations, statutes, and guidelines that potentially apply to the analysis for biological resources.

Table 1. Applicable laws, plans, and policies

Regulation, statute, guideline	Description
Federal	
U.S. Code (USC) 16.1531 et seq., Endangered Species Act	Provides for the conservation of species listed as threatened or endangered and the habitat upon which they depend. Section 7: Requires consultation with the U.S. Fish and Wildlife Service (USFWS) and/or National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) when undertaking a federal action to ensure the conservation of any listed animal species and critical habitat so as not to jeopardize the continued existence of any listed species. NOAA Fisheries manages listed marine species while USFWS manages listed terrestrial and freshwater species.
16 USC 661, Fish and Wildlife Coordination Act	Requires equal consideration and coordination of wildlife conservation with other water resources development programs and provides authority to USFWS and NOAA

Regulation, statute, guideline	Description
	Fisheries to evaluate impacts on fish and wildlife from federal actions that result in modifications to waterbodies.
USC 16.1361–16.1423h, Marine Mammal Protection Act of 1972	National policy to prevent marine mammal species and population stocks from declining beyond the point where they cease to be significant functioning elements of the ecosystems of which they are a part. Establishes a moratorium on taking and importing marine mammals, including parts and products. Defines the federal responsibility for conservation of marine mammals. Recognizes the importance of marine mammals to the oceans and seeks to restore or maintain populations at healthy and productive levels.
USC 16.668–16.668c, Bald and Golden Eagle Protection Act of 1940, as amended	Prohibits the taking of bald eagles, including their parts, nests, or eggs, without a permit issued by USFWS, and provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle... [or any golden eagle], alive or dead, or any part, nest, or egg thereof."
USC 16.703–16.713, Migratory Bird Treaty Act of 1918, as amended	Makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations. Under the regulatory authority of USFWS.
67 Code of Federal Regulations 2343, Magnuson-Stevens Fishery Conservation and Management Act Provisions; Essential Fish Habitat (EFH)	Governs marine fisheries management in U.S. federal waters; federal agencies are required to consult with NOAA Fisheries on activities that may affect EFH.
Clean Water Act (CWA) (33 USC 1251 et seq.)	The Federal Water Pollution Control Act of 1948 was the first major U.S. federal law to address water pollution. The law was amended in 1972 and became commonly known as the Clean Water Act. The CWA establishes the basic structure for regulating pollutant discharges into waters of the United States and makes it unlawful to discharge any pollutant from a point source into those waters without a permit.
16 USC 2901 et seq., Fish and Wildlife Conservation Act	The Federal Fish and Wildlife Conservation Act of 1980 recognized that previous conservation acts focused on game fish and wildlife for commercial and recreational purposes. This act establishes a precedent for federal agencies to provide states with technical and financial assistance to create conservation plans for nongame fish and wildlife, as well as those that are not listed species or marine mammals protected by the Marine Mammal Protection Act of 1972.
Coastal Zone Management Act (CZMA) Federal Consistency	Provides for the management of coastal resources. CZMA Federal Consistency is a tool that state programs use to manage coastal activities and resources and to facilitate cooperation and coordination with federal agencies. Under Washington's federally approved Coastal Zone Management Program, activities that could affect the coastal zone must comply with Washington's Shoreline Management Act, Water Pollution Control Act, Clean Air Act, and Ocean Resources Management Act.

Regulation, statute, guideline	Description
Wild and Scenic Rivers Act, 1968 (16 USC 1271–1287)	This act establishes a National Wild and Scenic Rivers System for the protection of rivers that have important scenic, recreational, fish and wildlife, and other resources. The system protects the designated river and an adjacent corridor of land. Wild and scenic river corridors contain both private and public lands. Restrictions associated with the Wild and Scenic Rivers Act apply only to federal lands and the federal government does not have the authority to regulate private lands.
Executive Order 11990, Protection of Wetlands	Provides the overall wetlands policy applicable to all agencies managing federal lands, sponsoring federal projects, or providing federal funds to state or local projects. Requires federal agencies to follow avoidance, mitigation, and preservation procedures and to obtain public input before new construction in wetlands. Consistency with the overall wetlands policy contained in Executive Order 11990 is achieved through CWA Section 404 compliance requirements.
State	
Chapter 220.610 Washington Administrative Code (WAC), Washington Department of Fish and Wildlife (WDFW) State and Protected Species; WDFW Priority Habitats and Species	Grants WDFW the responsibility to oversee the listing and recovery of state endangered, threatened, or sensitive species to ensure their survival as free-ranging populations in the state.
Washington State Wildlife Action Plan	Provides a comprehensive plan for conserving the state's fish and wildlife and its natural habitats as part of the State and Tribal Wildlife Grants Program. Identifies the Species of Greatest Conservation Need. Many species of uncertain conservation need are listed in the Washington State Wildlife Action Plan. Currently updating to identify Habitats of Greatest Conservation Need.
Chapter 90.58 Revised Code of Washington (RCW), Washington State Shoreline Management Act	Requires all local jurisdictions with Shorelines of the State to adopt Shoreline Master Programs consistent with the Shoreline Management Act, which emphasizes appropriate shoreline land use, protection of shoreline environmental resources, and protection of the public's right to access and use state shorelines.
Chapter 36.70A RCW, Washington State Growth Management Act	Requires all cities and counties in Washington to adopt development regulations, according to the best available science, that protect critical areas as defined in RCW 36.70A.030(5), including fish and wildlife habitat conservation areas.

Regulation, statute, guideline	Description
Title 77 RCW, Fish and Wildlife	Authorizes WDFW to regulate fish, shellfish, and wildlife species in the State of Washington. Includes the following chapters that are relevant to impacts on fish species and habitats: • Chapter 77.44 RCW: Warmwater game fish enhancement program • Chapter 77.55 RCW: Construction projects in state waters • Chapter 77.57 RCW: Fishways, flow, and screening • Chapter 77.85 RCW: Salmon recovery • Chapter 77.95 RCW: Salmon enhancement program • Chapter 77.105 RCW: Recreational salmon and marine fish enhancement program • Chapter 77.110 RCW: Salmon and steelhead trout – Management of resources • Chapter 77.135 RCW: Invasive species
Chapter 220.640 WAC, Invasive/Non-Native Species	Classifies prohibited and regulated species and regulates the introduction or possession of non-native and invasive aquatic species.
Chapter 17.10 RCW, Noxious Weeds	Requires owners to control and prevent the spread of noxious weeds within and from their property. Includes the state Noxious Weed List (Class A, B, and C), definitions and descriptions of region boundaries for Class B weeds, and the schedule of monetary penalties.
Washington Department of Natural Resources (DNR) Natural Heritage Program (advisory)	Assigns conservation status to species and habitats to support federal, state, and local land management policies and listing decisions; has no direct regulatory authority and is advisory only.
DNR 2006 Policy for Sustainable Forests and 1997 Habitat Conservation Plan	Guides DNR's long-term sustainable management of forested state trust lands.
Chapter 77.55 RCW; Chapter 220.660 WAC, Washington State Hydraulic Code	Implements Chapter 77.55 RCW (Construction Projects in State Waters), regulating projects that use, divert, obstruct, or change the natural flow or bed of any water of the state. Requires entities who are planning such projects to obtain a Hydraulic Project Approval from WDFW.
Chapter 90.48 RCW, Water Pollution Control Act	The Water Pollution Control Act sets standards to ensure the purity of all waters of the state and to work cooperatively with the federal government where interest overlaps in a joint effort to extinguish the sources of water quality degradation. Grants the Washington State Department of Ecology (Ecology) the jurisdiction to control and prevent the pollution of streams, lakes, rivers, ponds, inland waters, salt waters, water courses, and other surface and groundwater in the state, including wetlands. Tool Ecology uses to regulate certain activities in wetlands and waters that are non-jurisdictional under Section 404 of the CWA through the issuance of Administrative Orders.

Regulation, statute, guideline	Description
Chapter RCW 90.74 RCW, Aquatic Resource Mitigation	Requires state regulatory agencies to consider mitigation proposals for projects that are designed in a manner to provide equal or better biological functions compared to traditional onsite mitigation proposals.
Chapter RCW 90.54 RCW, Water Resources Act of 1971	Provides fundamentals of water resource policy for the state to ensure that waters of the state are protected and fully utilized for the greatest benefit to the people of the state of Washington; provides direction to state and local governments in carrying out water and related resources programs.
Title 173 WAC, Department of Ecology	• Chapter 173-201A WAC: Water Quality Standard for Surface Waters of the State of Washington • Chapter 173-204 WAC: Sediment Management Standards • Chapter 173-22 WAC: Adoption of Designations of Shorelands and Wetlands Associated with Shorelines of the State • Chapter 173-226 WAC: Waste Discharge General Permit Program • Chapter 173-500 WAC: Water Resources Management Program Established Pursuant to the Water Resources Act of 1971
Washington Forest Practices Act (Chapter 76.09 RCW)	Forest practices in Washington are regulated by means of the Forest Practices Act. This includes all non-federal and non-Tribal lands within the state. The industry is governed by the Washington Forest Practices Board to protect the state's natural resources, including fisheries and wildlife, but also to maintain a viable timber industry. The Washington Department of Natural Resources enforces the rules that are adopted by the Board.
Washington State Executive Order 89-10, Protection of Wetlands	Establishes statewide goals to achieve no net loss in function and acreage of wetlands and to increase the quality and quantity of Washington's wetlands.
Local	
County and municipal critical areas ordinances	As required under Washington's Growth Management Act, cities and counties have development regulations to protect critical areas. Critical areas can be related to public health and safety or public welfare (e.g., habitat protection).
County and municipal shoreline master programs	Local codes regulate development within shorelines of the state in accordance with Shoreline Master Programs and state Shoreline Management Act requirements.

2 Methodology

The purpose of this section is to provide an overview of the process for evaluating potential impacts to biological resources and the criteria for determining the occurrence and degree of impact.

2.1 Study area

The study area for biological resources includes the PEIS geographic scope of study (Figure 1) and surrounding areas relevant to biological resources. The study area for the evaluation of biological resources associated with the construction and operation of green hydrogen facilities would be determined by the presence (or absence) of biological resources during project-specific reviews. Parameters could include terrestrial species and habitats, and aquatic species and habitats. Study areas specific to sub-elements of biological resources are described below. Figure 1, which shows the PEIS geographic scope of study, does not include federal lands, national parks, wilderness areas, wildlife refuges and sanctuaries, state parks, or Tribal reservation lands, but information related to these areas is provided as context for the affected environment.

2.1.1 Terrestrial

The study area for the analysis of terrestrial species and habitats includes the following:

- Terrestrial habitat, including U.S. Fish and Wildlife Service (USFWS) critical habitats and Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species (PHS) priority habitats (e.g., aspen stands, riparian, biodiversity areas and corridors, shrubsteppe), and habitat features such as caves, cliffs, snags and logs, and taluses; and other terrestrial habitats that support priority species such as disturbed areas
- Non-wetland terrestrial and riparian habitat regulatory buffers required by cities and counties for the protection of critical areas as required by the Washington Growth Management Act (GMA)
- Vertical air space above ground that is typically used by bird, bat, and other flying species, and vertical depths below ground that may be used by burrowing species

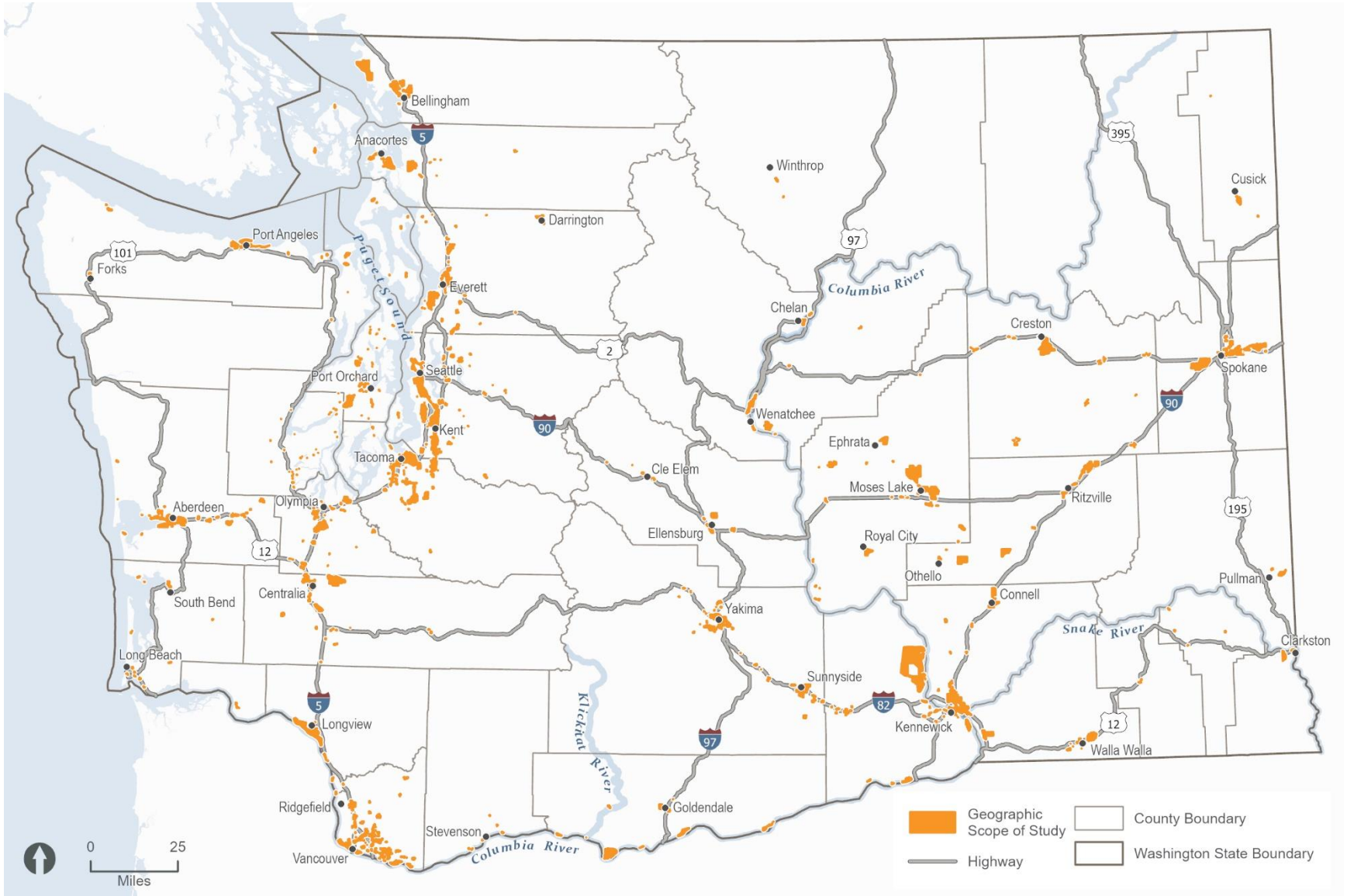

Figure 1. Green Hydrogen Facilities PEIS geographic scope of study

2.1.2 Aquatic and wetlands

The study area for the analysis of aquatic species and habitats includes the following:

- Aquatic habitat, including National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) and USFWS critical habitats, and the following WDFW PHS priority habitats: Instream, Freshwater Wetlands and Fresh Deepwater, and Puget Sound Nearshore habitat types
- Waters of the state or the United States and their associated regulatory buffers required by cities and counties for the protection of critical areas under the Washington Shoreline Management Act (SMA) and the GMA
- Wetlands and their associated regulatory buffers required by cities and counties for the protection of critical areas under the SMA and the GMA

2.2 Technical approach

The general approach for analyzing biological resources includes the following steps:

- Use existing data and information from publicly available sources to generally characterize key species and habitat conditions in the study area.
- Qualitatively evaluate biological resource impacts of the types and sizes of facilities and range of activities that could be expected from construction, operation, and decommissioning of green hydrogen production and storage facilities relative to baseline and predicted future conditions.
- Evaluate the impacts relative to applicable laws and regulations (e.g., "special-status species and habitats," which include ESA-listed species, Washington state-listed species [including those on the PHS list], Washington Department of Natural Resources [DNR] heritage species, and those defined in county code or ordinance as species of local importance).

Impacts to biological resources would have a duration. Permanent impacts would result when terrestrial, aquatic, and amphibious species or habitats are removed or impaired to such a degree that they would not return to their pre-construction state. In addition, if wildlife species are excluded from the site for an extended period of time, it is uncertain if those species would re-occupy the site after decommissioning, resulting in a permanent impact.

Temporary impacts would result when short-term disturbance of terrestrial, aquatic, or amphibious species or habitats would occur but would not prevent the re-establishment of conditions similar to those before a facility was constructed in the affected area. For example, temporary impacts typically occur during construction activities and include impacts such as noise and turbidity, or disturbed areas that are replanted. When construction is complete, affected areas return to baseline conditions and species and habitats resume their function or use of the area. The Washington State Department of Ecology (Ecology) defines short-term temporary wetland impacts as impacts that last for a limited time, and wetland functions return

to pre-impact performance within about 1 year or within one growing season of the impact. Long-term temporary wetland impacts are defined by Ecology as impacts that affect wetland functions that would eventually be restored or recover over time, but not within a year or so (Ecology et al. 2021).

The magnitude of impacts was evaluated in the context of the health and uniqueness of species populations relative to proper habitat functions.

Sources analyzed included publicly available habitat and species occurrence mapping; species-specific studies and information; and lists of federal and state threatened, endangered, and other special-status species. Existing literature was used to characterize the affected habitats relative to natural processes, properly functioning habitat, and prevalence of invasive species.

The following sources were used to evaluate biological resources in the study area:

- Geographic information system layers including National Wetlands Inventory (NWI) wetlands, Ecology modeled wetlands, WDFW mapped wetlands, county wetland inventories, and other local datasets
- NOAA Fisheries ESA Protected Pacific Salmon and Steelhead Species ESA Listings and Critical Habitat maps (NOAA 2024e)
- Ecology Wetland Guidance for Critical Areas Ordinance Updates, Western and Eastern Washington (Ecology 2022)
- Washington Natural Heritage Program (WNHP) Data Explorer for Rare Plant and Ecosystem Locations (WNHP 2024)
- Washington State Wetland Rating System for Eastern Washington: 2014 Update, Publication no. 14-06-030 (Hruby 2014)
- Washington State Wetland Rating System for Western Washington: 2014 Update, Version 2.0, July 2023, Publication #23-06-009 (Hruby and Yanke 2023)
- WDFW PHS List (WDFW 2023) and online PHS mapper (WDFW 2024a)
- WDFW online species information (WDFW 2024l)
- WDFW State Wildlife Action Plan (SWAP) 2015 (WDFW 2015), to be updated 2025
- USFWS online listed species information (Information for Planning and Consultation; USFWS 2024d)

The PEIS analyzes a timeframe of up to 25 years of potential facility construction and up to 50 years of potential facility operations (totaling up to 75 years into the future). A project-level environmental review of impacts on terrestrial and aquatic habitats and species (including wetland habitats and regulatory buffers), would consider regional and local guidelines and regulations, and site-specific assessments.

2.2.1 Terrestrial

This section describes the methods that were used to analyze the potential impacts on terrestrial species and habitats.

The analysis of impacts on terrestrial species and habitats addresses (1) impacts on terrestrial animals, including mortality due to construction or facility activities; (2) impacts on their habitat; and (3) impacts to adjoining habitats or migration routes and wildlife corridors that may occur because of construction, operation, and decommissioning. Habitat impacts may include changes to habitat quantity or habitat function including changes to the natural processes that support that habitat. Impacts from construction and decommissioning were evaluated for their relatively short-term effects as well as any longer-term effects that persist after the construction or decommissioning period. Impacts from operations were evaluated for the presence of infrastructure and activities for the duration of the assumed operating period (up to 50 years).

Impacts on terrestrial wildlife species consider construction and decommissioning effects such as noise and vehicle traffic. Impacts on terrestrial plant species consider construction effects such as removal and erosion. Impacts from operations consider the removal, reduction, or alteration of resources (e.g., cover, foraging opportunities, prey). Impacts also consider effects on terrestrial plants and wildlife species in terms of potential long-term habitat changes from operations.

Publicly available information on existing terrestrial species and habitats from local, state, and federal agencies was used to make assumptions about the importance of the affected species and habitats in context of their uniqueness across Washington and the viability of their populations. Impacts to terrestrial species and habitats considered are those that have geographic overlap with the study areas.

2.2.2 Aquatic and wetlands

This section describes the methods that were used to analyze the potential impacts on aquatic habitats and species.

The analysis of impacts on aquatic species and habitats addresses (1) impacts on aquatic animals, including mortality due to facility activities; and (2) impacts on their habitat. Habitat impacts may include changes to habitat quantity or habitat function (i.e., changes to the natural processes that support that habitat). Impacts from construction and decommissioning were evaluated for their relatively short-term effects, as well as any longer-term effects that persist after the construction or decommissioning activities end. Impacts from construction and decommissioning were evaluated for their relatively short-term effects, as well as any longer-term effects that persist after the construction or decommissioning period. Impacts from operations were evaluated for the presence of the infrastructure and activities for the duration of the assumed operating period (up to 50 years).

Publicly available information on existing aquatic species and habitats from local, state, and federal agencies was used to make assumptions about the importance of the affected species and habitats in context of their uniqueness across Washington and the viability of their populations. Species that were considered are those that have geographic overlap between the study areas and these species' known habitats or their associated riparian areas.

2.2.2.1 Wetlands

Information from the following sources on the potential occurrence and condition of wetlands in the study area was reviewed:

- USFWS's NWI (USFWS 2024d)
- Ecology's 2016 Modeled Wetland Inventory (Ecology 2016)[2]
- U.S. Geological Survey (USGS) National Hydrography Dataset (NHD) (USGS 2024c)
- Aerial photography and Light Detection and Ranging (LiDAR) imagery
- USGS topographic maps

Although these sources can offer general information on the likelihood of a site to support wetlands, they do not provide a definitive indication of the presence or absence of wetlands. The definitive presence of wetlands and a demarcation of their boundaries can be determined only through a wetland delineation performed in accordance with the 1987 *Corps of Engineers Wetlands Delineation Manual* (1987 Manual; Environmental Laboratory 1987) and the appropriate regional supplement produced by the U.S. Army Corps of Engineers (USACE).[3]

2.3 Impact assessment approach

For the purposes of this assessment, potentially significant impacts would occur if a facility resulted in the following:

- Construction actions would cause permanent degradation, loss, or conversion of terrestrial habitat function due to changes in habitat quantity, habitat quality, habitat connectivity, prey abundance, interactions with non-native species, or other key functional elements that are critical to species viability.
- Operations would cause ongoing or repeated disturbance of terrestrial habitat function due to changes in habitat quantity, habitat quality, habitat connectivity, prey abundance, interactions with non-native species, or other key functional elements that are critical to species viability.
- Actions like earthwork, or noise and vibration would produce disturbance, stranding, entanglement, permanent injury, or mortality to any species that occurs frequently, or single events affecting any special-status species, or events that increase the need for federal or state listing of a species or increases risk to species viability.

[2] The Ecology (2016) Modeled Wetland Inventory covers only the western portion of the state.

[3] Two regional supplements to the 1987 Manual are applicable to Washington: (1) *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (Version 2.0) (USACE 2010); and (2) *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (Version 2.0) (USACE 2008). The western mountains, valleys, and coast region supplement generally covers the majority of western Washington and the Cascade and Rocky Mountain regions in the site; the arid west supplement generally covers the central portion of the site where drier climate is predominant. Users should check the Wetland Delineation Regions of the USACE map provided at https://www.arcgis.com/apps/mapviewer/index.html?layers=624f9a9dfec24471b3fa5b393c96120b, to determine which regional supplement is appropriate for their site.

- Construction actions would cause permanent degradation, loss, or conversion of aquatic habitat function or reduction in aquatic habitat, including wetland habitat function, due to changes in surface water quantity or quality, riparian area condition, prey abundance, interactions with non-native species, or other key functional elements that are critical to species viability or are rare or unique in Washington.
- Operations would cause ongoing or repeated disturbance of aquatic habitat, including wetland habitat function, due to changes in surface water quantity or quality, riparian area condition, prey abundance, interactions with non-native species, or other key functional elements that are critical to species viability.

2.3.1 Terrestrial

Impacts include any activities that result in the loss of terrestrial habitat or reduction in terrestrial habitat due to changes in habitat quantity, habitat quality, habitat connectivity, prey abundance, interactions with non-native species, or other key functional elements. Activities that disturb, strand, entangle, injure, or kill terrestrial species resulting from actions like earthwork or noise and vibration are considered to be impacts. Frequent mortality or injury to any species; single events affecting any special-status species; or events that increase the need for federal or state listing of a species or increase risk to species viability are all considered to be significant impacts.

Impacts to terrestrial habitats or their regulatory buffers have a duration, affected area, and significance level. Activities that result in significant adverse impacts to terrestrial habitats and regulatory buffers may include:

- Excavation
- Erosion
- Soil compaction
- Grading
- Establishment of temporary staging and laydown areas
- Installation of foundations for buildings and equipment
- Vegetation removal and revegetation
- Road and utility corridor construction
- Road improvements
- Installation of security fencing and road access gates
- Placement of lighting and noise-generating structures/activities
- Hydrogen fires or explosions
- Battery fires

Impacts related to excavation, erosion, vegetation removal, or grading can be identified by overlaying the footprint of the proposed facilities on the resource mapping using geospatial software. Impacts would be further determined using field surveys to gather data and assess the potential effects.

2.3.2 Aquatic and wetlands

Impacts include any activities that result in the loss of aquatic habitat or reduction in aquatic habitat, including wetland habitat function due to changes in surface water quantity, surface water quality, riparian area condition, prey abundance, interactions with non-native species, or other key functional elements. Activities that disturb wetlands or their regulatory buffers, or that affect the continued existence of such a resource in its current form (e.g., hydrologic alteration) are considered impacts.

Impacts to aquatic habitats, wetlands, or their regulatory buffers have a duration, affected area, and significance level. Activities that result in significant adverse impacts to aquatic habitats, wetlands, and regulatory buffers may include:

- Excavation
- Erosion
- Soil compaction
- Grading
- Establishment of temporary staging and laydown areas
- Installation of foundations for buildings and equipment
- Vegetation removal and revegetation
- Road and utility corridor construction
- Road improvements
- Installation of security fencing and road access gates
- Placement of lighting and noise-generating structures/activities
- Hydrogen tank leaks
- Battery fires
- Draining or dewatering
- Discharging water or redirecting runoff
- Discharge of material to or removal from wetlands or their regulatory buffers
- Discharge of potential pollutants including sediments
- Road crossing, culvert installation, or bridge construction

Impacts related to excavation, grading, or fill placement in wetlands can be determined by overlaying the footprint of the proposed facilities and limits of grading/construction on the delineated boundary of wetlands using geospatial software. Any delineated wetlands or regulatory buffers that occur within a facility footprint or impact area are considered impacts. Wetland impacts determined through these analyses are quantified by their Cowardin and hydrogeomorphic classifications and their state wetland ratings, which are determined using either the Washington State Wetland Rating System for Eastern Washington (Hruby 2014) or the Washington State Wetland Rating System for Western Washington: 2014 Update (Version 2) (Hruby and Yahnke 2023), depending on site location.

Impacts to other types of aquatic habitat can be determined by characterizing waterbody types within the study area (marine, deep freshwater, or freshwater instream habitat with ephemeral, intermittent, or perennial flow) and whether those waters are fish-bearing. Fish-

bearing waters may be further characterized as spawning and rearing habitat, foraging habitat, or migratory corridors for the species that are present. Essential fish habitat and critical habitat for special-status species can be identified using geospatial analysis.

If green hydrogen facilities are located in wetland areas or adjacent to other waterbodies, their placement would be subject to all applicable statutory requirements and associated regulations, such as Section 404 of the Clean Water Act (CWA), Chapter 90.48 Revised Code of Washington (RCW) Water Pollution Control Act, and local critical areas ordinances and shoreline master programs.

3 Technical Analysis and Results

3.1 Overview

This section describes the affected environment within the study area (Section 3.2) and discusses the probable impacts on terrestrial, aquatic, and wetland wildlife species, plant species, and habitats from the proposed types of facilities (Sections 3.4 to 3.6) and the No Action Alternative (Section 3.7). This section also evaluates actions that could avoid or reduce the identified impacts, along with potential unavoidable significant adverse impacts. Potentially required permits for the proposed facility types are addressed in Section 3.3.

3.2 Affected environment

The affected environment represents existing conditions at the time this study was prepared and provides the baseline for evaluating how a specific natural or built-environment resource could be affected by proposed green hydrogen facilities. Depending on the resource, and because the temporal scope of analysis includes 1–3 years within which potential facilities could be constructed and up to 50 years of potential facility operations, the potential for the affected environment to change in that time must also be considered.

The green hydrogen facilities study area includes several distinct areas scattered throughout Washington State. Due to the size of the study area, the characterization of the affected environment provided in this technical appendix is relatively general and based on the Level III Ecoregions identified for the state by the U.S. Environmental Protection Agency (EPA) and habitat types (Table 2 and Table 3).

Ecoregions are geographic areas where ecosystems, and the type, quality, and quantity of environmental resources that compose them, are generally similar (EPA 2023). They are based on a framework derived from Omernik (1987) and were developed by grouping areas using patterns of similarity in the various biotic, abiotic, terrestrial, and aquatic ecosystem components of a landscape. Ecoregions typically include combinations of geology, landforms, soils, vegetation, wildlife, climate, and hydrology. Ecoregions are described in various hierarchy where Level I and Level II Ecoregions are broad and more applicable to a nationwide scale. The study area for this analysis includes portions within eight ecoregions, as shown in Figure 2. Additional information of the typical landforms, climate, and water resources for each ecoregion in Washington were obtained from multiple sources including Omernik (1987, 2010), Bryce and Woods (2000), EPA (2023), and LandScope America (2024).

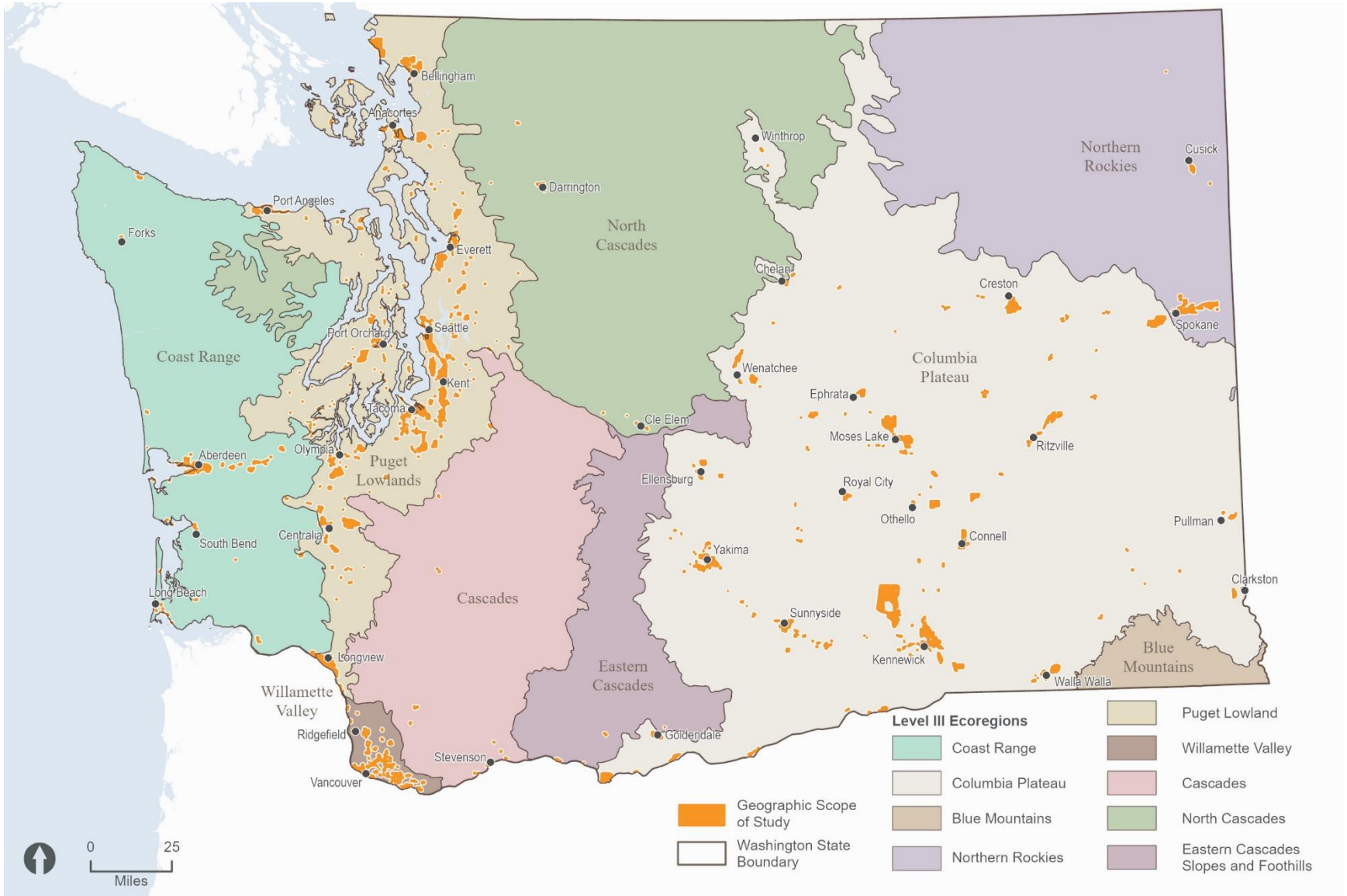

Figure 2. Level III Ecoregions within Washington State and the PEIS geographic scope of study

Table 2. Level III Ecoregions within the PEIS geographic scope of study

Level III Ecoregion	Major habitat type	Description
Coast Range	Olympic mountain range, coastal plain, temperate rainforest, alpine meadows	Low mountains covered by rain-drenched coniferous forests. Sitka spruce originally dominated the coastal region while mosaics of Douglas fir, western red cedar, and western hemlock cover the inland region. The maritime climate brings mild temperatures and overcast days. Surface water systems are highly variable and characterized by marine estuaries, low gradient black-water meandering streams and rivers, and shallow coastal lakes in coastal lowlands; medium to high gradient black-water streams in coastal uplands; high gradient, cascading streams and rivers in volcanic landscapes; medium gradient streams and rivers that have low summer flows in glacial outwash areas; and medium gradient sinuous streams and rivers at relatively low drainage densities in areas characterized by low rolling hills/mountains. Major river systems include the lower Columbia, Chehalis, Newaukum, Skookumchuck, Black, Soleduck, Bogachiel, Hoh, Queets, Quinault, Humptulips, and Wynoochee rivers, which all drain to the Ocean; and the Elochoman, Grays, and Deep rivers, which drain to the lower Columbia River. Three major estuaries are also present: Columbia River, Willapa Bay, and Grays Harbor.
Puget Lowland	Coniferous forest, floodplains, oak woodlands, prairies	Broad rolling lowland that occupies a continental glacial trough. Composed of islands, bays, and peninsulas in the Puget Sound area that are characterized by a mild maritime climate. The native forest is predominantly Douglas fir, western hemlock, and western red cedar. Bigleaf maple and red alder grow in riparian areas. Vegetation distribution is affected by the rain shadow of the Olympic mountains. Surface water systems are highly variable and characterized by low gradient, meandering streams and rivers, oxbow lakes, meander scar wetlands, and both estuarine and freshwater wetlands in riverine lowland areas that enter Puget Sound; small intermittent streams with limited surface water in the San Juan islands; small, low to medium gradient streams with limited water in the rain shadow of the Olympic Mountains; lakes and sinuous streams and rivers in the eastern Puget uplands and central Puget lowlands with multiple bays occurring along coastline areas; low gradient streams and lakes in prairie areas; medium to high gradient streams in the upper portions of the Chehalis and Cowlitz river basins; and meandering streams with oxbow lakes in the lower Cowlitz and Newaukum river floodplains. Major river systems include the Skagit, Stillaguamish, Snohomish, and Nisqually rivers, which all drain to Puget Sound; and the Cowlitz, Coweeman, and Toutle rivers, which drain to the lower Columbia River.

Level III Ecoregion	Major habitat type	Description
Willamette Valley	Prairies, deciduous/ coniferous forests, wetlands	Broad, lowland valley that consists of terraces and floodplains surrounded by rolling hills. The temperate climate is characterized by lower precipitation than the adjacent Coast Range and Cascades regions. Surface water systems in the portion of this ecoregion that occur in the study area are characterized by low gradient, meandering streams, numerous wetlands, oxbow lakes, and ponds. Major river systems in this ecoregion include a portion of the lower Columbia River, the Washougal River, and the lower portions of the East Fork Lewis and Lewis rivers, all of which drain to the Columbia River.
North Cascades	Cascade mountain range, subalpine parklands, coniferous forests, deciduous forests	High rugged mountains with active alpine glaciers. Dry continental climate in the east and mild, maritime rainforest conditions in the west. Coniferous forests of western red cedar, Douglas fir, and western hemlock intermix with riparian areas that support broadleaf trees such as bigleaf maple and red alder. Surface water systems are highly variable and include perennial medium gradient, glacial-fed rivers and streams, reservoirs, and glacial lakes common in lowland forested areas; cascading glacial streams and glacial rock basin lakes in highland forests; high gradient, sediment laden, glacial meltwater streams and glacial rock-basin lakes in alpine and subalpine areas; small glacial rock-basin lakes and both permanent and intermittent high gradient streams in the highlands around the Pasayten River and Sawtooth Mountain range; medium to high gradient, permanent and intermittent streams and rivers, with some alpine glacial rock-basin lakes and irrigation storage reservoirs in the Okanogan hills; medium to high gradient rivers and streams and glacial rock- basin lakes in the Chelan tephra hills; high gradient streams and rivers, with some glacial rock-basin lakes in the Wenatchee/Chelan highlands; steep gradient perennial and intermittent streams with high sediment loads and a general trellis-shaped drainage pattern in the Chiwaukum Hills and Lowlands region; and cascading glacier-fed streams and glacial rock-basin lakes in the high Olympic Mountain region. Major river systems in this ecoregion include the Skagit, Stillaguamish, Snohomish, and Nooksack rivers. Some drainages have been dammed for hydroelectric power, creating large reservoirs such as Ross and Baker lakes.
Cascades	Cascade mountain range, volcanoes, glaciers, coniferous forests, subalpine meadows	Steep ridges and river valleys to the west and high plateau to the east. Mountainous region with active and dormant volcanoes. Rocky alpine zones and subalpine meadows occur at high elevations. Maritime weather brings mild conditions that support coniferous forests of Douglas fir, western hemlock, and western red cedar. Surface water systems typically include reservoirs and medium gradient rivers and streams occurring in u-shaped, glaciated valleys in the lowlands; high to medium gradient streams and glacial rock-basin lakes occurring in montane

Level III Ecoregion	Major habitat type	Description
		highlands; sinuous, medium gradient streams, glacial rock basin lakes, small lakes on collapsed lava flows and wetlands in montane forested areas; and cascading streams and glacial tarns in subalpine/alpine areas. Major river systems in this ecoregion include the upper portions of the Cowlitz, Lewis, East Fork Lewis, Kalama, North Fork Toutle, and Cispus rivers, which flow to the Columbia River; and the Puyallup, Carbon, Green, White, Duwamish, and West Fork White rivers, which all flow toward Puget Sound.
Eastern Cascades Slopes and Foothills	Coniferous forest, sagebrush steppe, grassland	The region is in the rain shadow of the Cascade Range. The dry continental climate creates greater temperature extremes. Vegetation is highly susceptible to wildfire. This region is one of Washington's most heavily forested areas with open ponderosa and lodgepole pine forests. Surface water systems typically include medium- to high-gradient, permanent and intermittent streams and rivers running through canyons, with springs commonly occurring in the Yakima Plateau and associated slopes; high-gradient, permanent streams and rivers with scattered glacial rock-basin lakes in areas dominated by grand fir mixed forests; and permanent and intermittent, mostly medium-gradient streams and rivers in the eastern Cascades and Columbia foothills. Major river systems in this ecoregion include the Little White Salmon, White Salmon, and Klickitat rivers, and a small section of the Yakima River, which all flow to the Columbia River.
Columbia Plateau	Shrubsteppe, fertile agricultural lands, Palouse Hills	The Columbia Plateau is dominated by arid sagebrush steppe and grassland. The region is located within the rain shadow of the Cascade mountains. Summers are hot and dry with precipitation occurring mainly between late fall and early spring. Surface water systems typically include perennial, intermittent, and ephemeral streams, some of the larger of which flow through steep river canyons and coulees, that are tributary to the Columbia River. Multiple human-created reservoirs are present and primarily used to supply hydroelectric power and irrigation water for the extensive agricultural uses that occur throughout this ecoregion. Extensive emergent wetlands supported by irrigation runoff are present as are riparian wetlands. Major river systems in this ecoregion include a portion of the middle Columbia River, as well as portions of the Yakima, Snake, Clearwater, Spokane, Walla Walla, and Okanogan rivers, all of which flow to the Columbia River. Large human-created reservoirs are also present including multiple impoundments on both the Columbia River (Priest Rapids Lake, Lake Wanapum, Lake Entiat Rock Island Pool, Lake Pateros, Rufus Woods Lake, and part of Franklin Delano Roosevelt Lake) and the Snake River (Lake Sacajawea, Lake Herbert G. West, Lake Bryan). Other reservoirs such as Potholes Reservoir, Banks Lake, and Billy Clapp Lake have been created by flooding

Level III Ecoregion	Major habitat type	Description
		potholes and coulees that were originally carved out by multiple cataclysmic floods from Glacial Lake Missoula during the Pleistocene epoch.
Northern Rockies	Boreal forest, alpine meadows, riparian woodlands, grasslands	Mountainous region with thick volcanic ash deposits. Alpine characteristics are found at the highest elevations. Boreal weather patterns influence the north while inland maritime patterns influence the south. Marine-influenced vegetation such as Douglas fir, ponderosa pine, and subalpine fir dominate. Major river systems in this ecoregion include the south-southeast flowing Columbia River, north-flowing Pend Oreille River, south-flowing Kettle River, and the west-northwest flowing Spokane River. Multiple glacial kettle lakes are also present, and a portion of the impounded Columbia River known as Franklin Delano Roosevelt Lake also extends into this ecoregion from the adjacent Columbia Plateau ecoregion.

Sources: Omernik 1987, 2010; Bryce and Woods 2000; EPA 2023; LandScope America 2024

3.2.1 Terrestrial habitats

The study area for terrestrial habitats occurs within eight Level III Ecoregions of Washington State (Table 2, Figure 2). These Level III Ecoregions are delineated based on a general similarity in ecosystems, and throughout the state they are further characterized by a number of ecological systems or habitat types and vegetation communities (Level IV Ecoregions; LandScope America 2024). Table 2 also provides an overview of typical climatic conditions for each Level III Ecoregion. The industrially zoned areas or areas zoned to support industrial uses in the study area may already be developed or cleared, and therefore habitats of interest may not be present within those zones. However, even if not present on industrial lands, special status habitats may be adjacent and warrant consideration. Furthermore, climate change is anticipated to cause changes in both species and habitat ranges (Thomas 2010). Range boundaries that are currently outside of the study may alter over time as the climate regime shifts.

The most prevalent Level III Ecoregions that make up the study area include the Columbia Plateau and Puget Lowland. The Columbia Plateau Ecoregion is located within the rain shadow of the Cascade Mountains and is dominated by arid sagebrush steppe and grasslands, fertile agricultural land, and Palouse Hills habitat types. Surface waters within the ecoregion typically include perennial, intermittent, and ephemeral streams that flow through steep river canyons and coulees and ultimately drain into the Columbia River. The Puget Lowland Ecoregion is a broad, rolling lowland that occupies a continental glacial trough and is comprised of islands, bays, and peninsulas in the Puget Sound. This ecoregion is characterized by a mild maritime climate where vegetation distribution is affected by the rain shadow of the Olympic Mountains. Douglas fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and western red cedar (*Thuja plicata*) primarily make up the native forest vegetation. Surface waters are highly

variable and characterized by low gradient, meandering streams and rivers, oxbow lakes, meandering scar wetlands, and both estuarine and freshwater wetlands in riverine lowland areas that enter the Puget Sound. The dominant habitat types in this ecoregion include coniferous forest, floodplains, oak woodlands, and prairies.

The following sections describe specific critical, priority, and unique terrestrial habitats currently within the affected environment.

3.2.1.1 Critical habitat

Critical habitat includes geographic areas containing physical and biological features that are essential to the recovery of ESA-listed species. ESA-listed species that also have designated critical habitat in Washington state are summarized in Table 3. The USFWS Critical Habitat for Threatened & Endangered Species online mapper can also be used to view designated -critical habitat for ESA-listed species in Washington (USFWS 2017).

3.2.1.2 Priority habitat

WDFW's PHS on the Web online mapping tool identifies priority habitat types and features for conservation within the state (WDFW 2024a; Figure 3 and Figure 4). Not all priority habitats are PHS mapped and may include some more specific habitats such as riparian, nearshore, instream, and snags and logs. In addition, there may be non-priority designated habitats that support priority species such as agricultural lands and disturbed areas. The PHS list also includes Priority Areas for species that are within known limiting habitats (e.g., breeding areas, foraging areas, haul-outs) or within areas that support a relatively high number of individuals (e.g., migration corridors, regular concentrations) (WDFW 2023). WDFW defines priority habitat as habitat types or elements with unique or significant value to a large number of species, and has one or more of the following attributes:

- Comparatively high fish and wildlife density or species diversity
- Important fish and wildlife breeding habitat, seasonal ranges, or movement corridors
- Limited availability or high vulnerability to habitat alteration
- Unique or dependent species

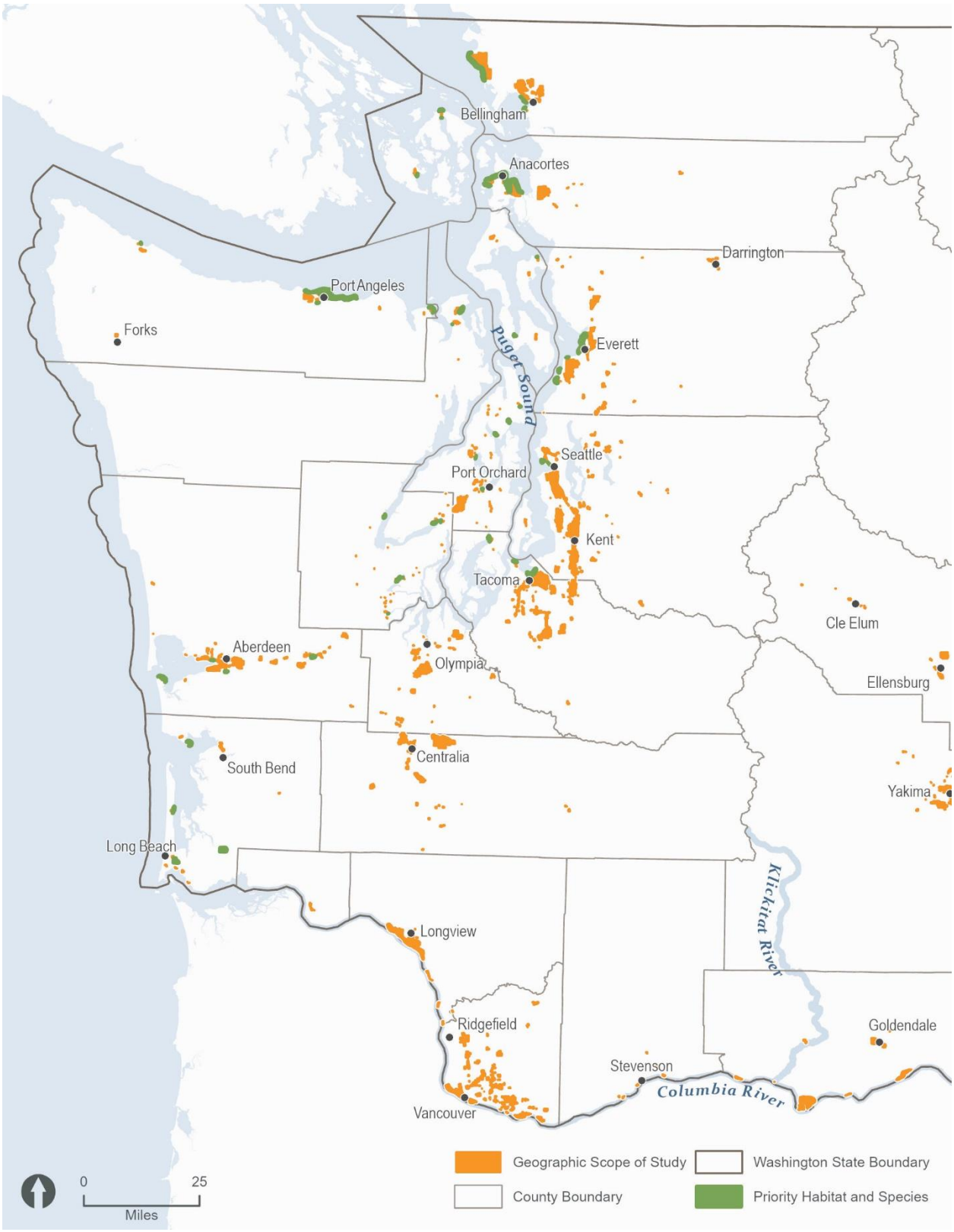

Figure 3. Western Washington State Priority Habitat and Species areas within the PEIS geographic scope of study

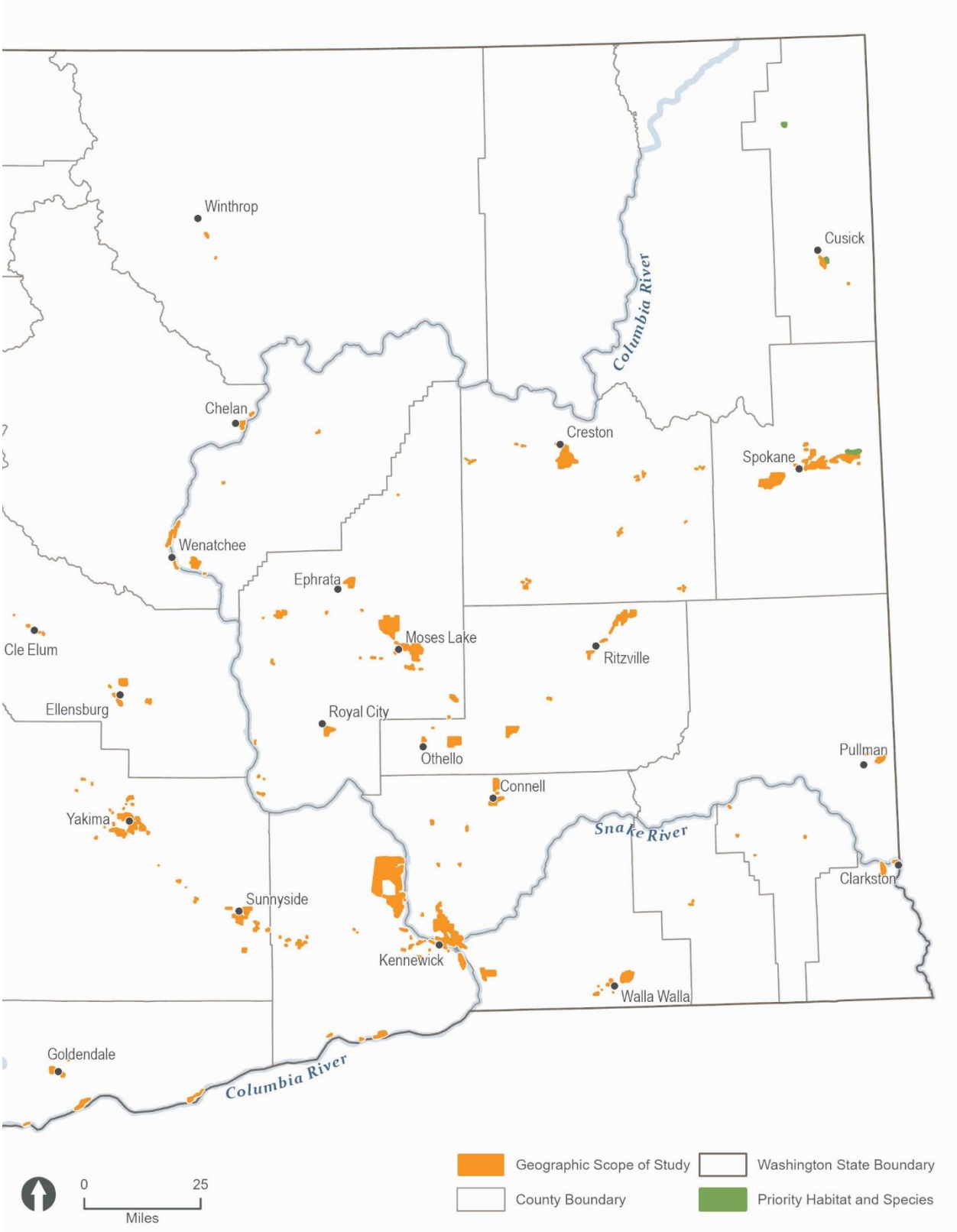

Figure 4. Eastern Washington State Priority Habitat and Species areas within the PEIS geographic scope of study

Throughout Washington state, there are 193 species, 10 species groups, and 20 habitat types currently on the PHS list, including about 17% of the state's vertebrate species. The distribution of these species and habitats can be found online at the WDFW's PHS website (WDFW 2024a). The following are 14 types of terrestrial priority habitats and features in the study area:

- Aspen stands
- Biodiversity areas and corridors
- Eastside steppe
- Herbaceous balds
- Inland dunes
- Old growth – mature forest
- Oregon white oak woodlands
- Riparian
- Shrubsteppe
- Westside prairie
- Caves
- Cliffs
- Snags and logs
- Talus

While many priority habitats and features are recorded within the ecoregions and counties where the study area is located, few are expected to occur in or adjacent to industrial lands. Habitats that are most likely to occur in the study area were determined by assessing PHS data, current and historic observations of species of concern, and their preferred habitats. Habitat features such as caves, cliffs, and talus are excluded from further analysis, as they would not occur on industrial lands where facilities are most likely to be built and operated. Similarly, Biodiversity Areas and Corridors (Azerrad et al. 2023) are unlikely to be affected by construction and operation of green hydrogen facilities, as projects would be sited outside of those boundaries.

The priority habitats at highest risk of potential impacts from green hydrogen facilities are shrubsteppe habitat, westside prairie, and riparian areas. While site characterization efforts would prioritize the utilization of industrial lands that have been previously disturbed, there is still potential for these habitats to exist adjacent to these industrial lands. Additionally, it is possible that the industrial land has not yet been developed, and these habitats exist undisturbed. While shrubsteppe habitat is mapped along the eastern side of the Cascade Range, there is a lower concentration of priority habitats in this area, reducing the potential for this habitat to be greatly affected by green hydrogen facilities. Additional at-risk habitats include forest habitat and marine shorelines as they are mapped on the western side of the study area, predominantly along the Coast Range and Puget Sound. Marine shorelines are discussed in the aquatic habitat section, although many terrestrial species use these aquatic habitats for habitat and forage (Section 3.2.3).

Shrubsteppe habitat

Washington's shrubsteppe landscape is within the Columbia Plateau Ecoregion and supports unique biological diversity and provides habitat for a wide range of species, including birds, mammals, reptiles, amphibians, insects, and plants (WDFW 2024b). ESA-Listed species such as the pygmy rabbit (*Brachylogies idahoensis*) and state-listed species including greater sage-grouse (*Centrocercus urophasianus*) may be found in shrubsteppe habitats, and priority species such as burrowing owl (*Athene cunicularia*) and Washington ground squirrel (*Urocitellus washingtoni*) can also be found (WDFW 2024c). Shrubsteppe is non-forested, typically dominated by shrubs such as big sagebrush (*Artemesia tridentata*) and antelope bitterbrush (*Purshia tridentata*) and bunchgrasses, including Idaho fescue (*Festuca idahoensis*) and Sandberg bluegrass (*Poa secunda*). In disturbed shrubsteppe sites, non-native species such as cheatgrass (*Bromus tectorum*) are common (WDFW 2023).

Approximately 60% of the original shrub-steppe habitat in Washington has been converted to other landcover (Dobler et al. 1996). WDFW (2024b) recently released new conservation guidance for Washington's shrubsteppe habitat. The Washington Shrubsteppe Restoration and Resiliency Initiative (WSRRI) is a collaborative effort between WDFW, DNR, and Washington State Conservation Commission that was formed to help enhance the health and resiliency of shrubsteppe habitat in Washington to benefit shrubsteppe wildlife (WDFW 2024b). To facilitate a strategic approach for targeting investment, WSRRI mapped core areas, growth opportunity areas, corridors, and other habitat across the shrubsteppe landscape. WSRRI's spatial priority map portal provides a view of core areas and areas where cores can be expanded within Washington (WDFW 2024b). Figure 5 through Figure 8 show the WSRRI objective areas in Washington's xeric (dry) and mesic (wet) shrubsteppe habitats. The type of spatial priority identifies locations where mitigation may be required, or may not be an option, in the study area.

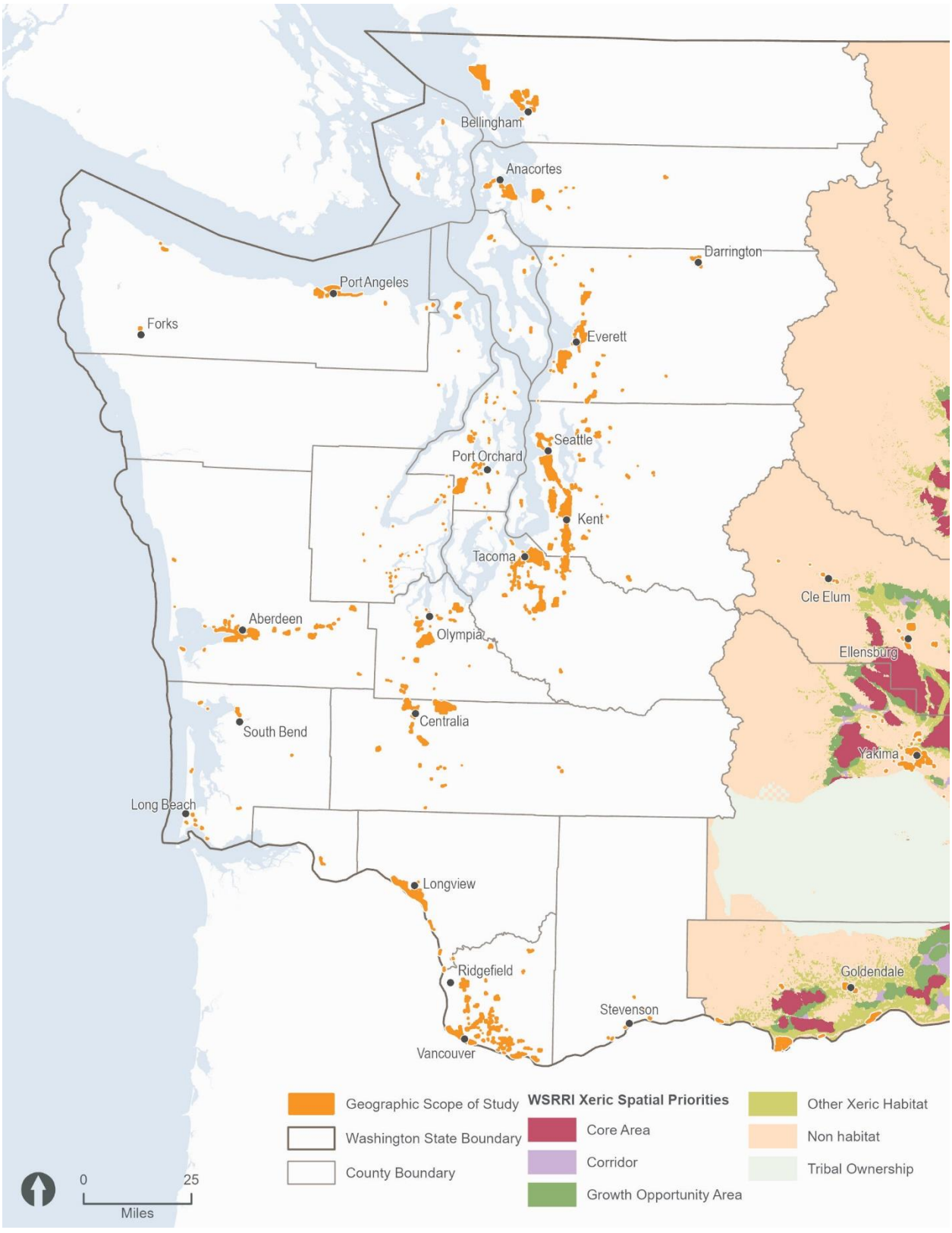

Figure 5. WSRRI objective areas in western Washington's xeric shrubsteppe habitats

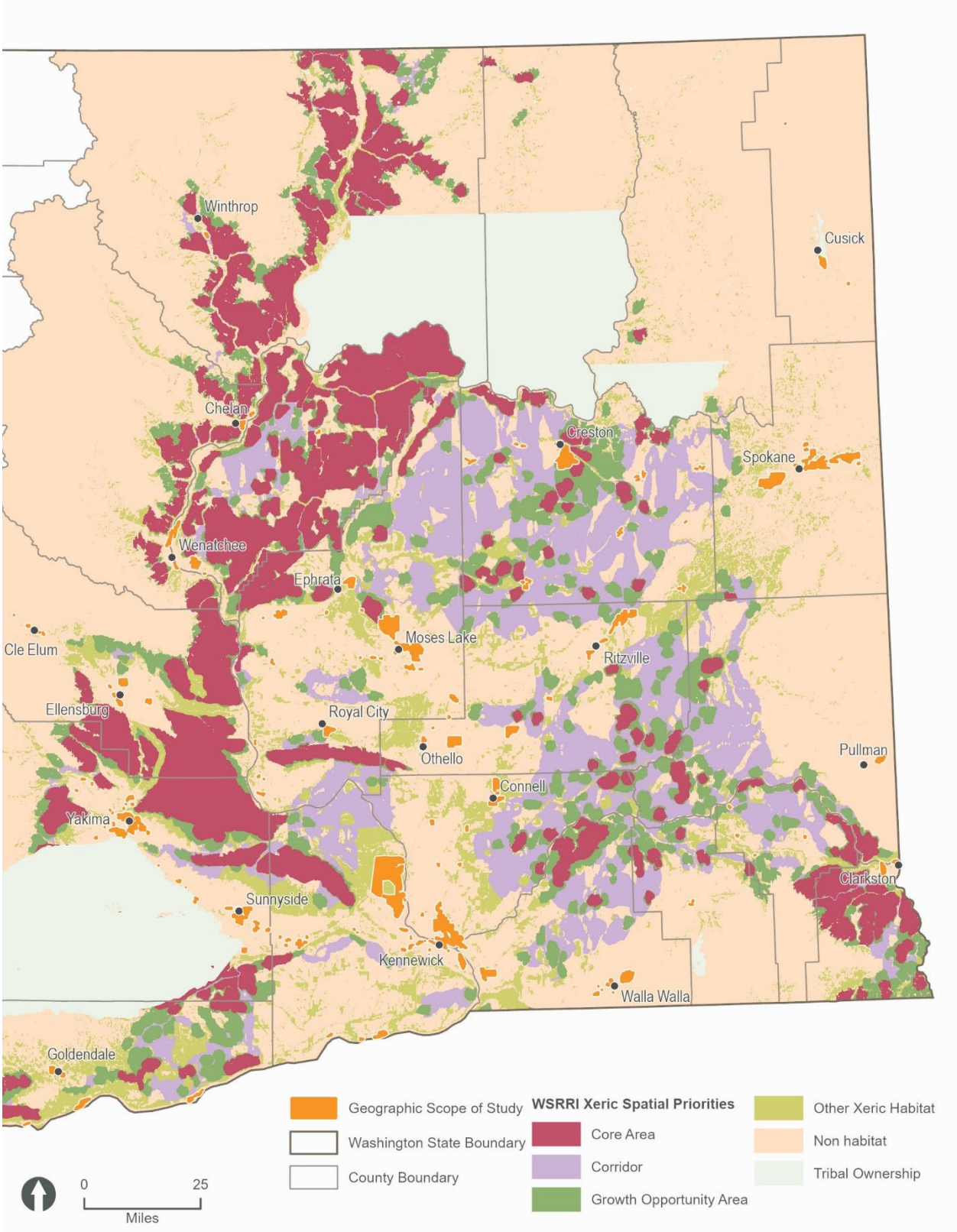

Figure 6. WSRRI objective areas in eastern Washington's xeric shrubsteppe habitats

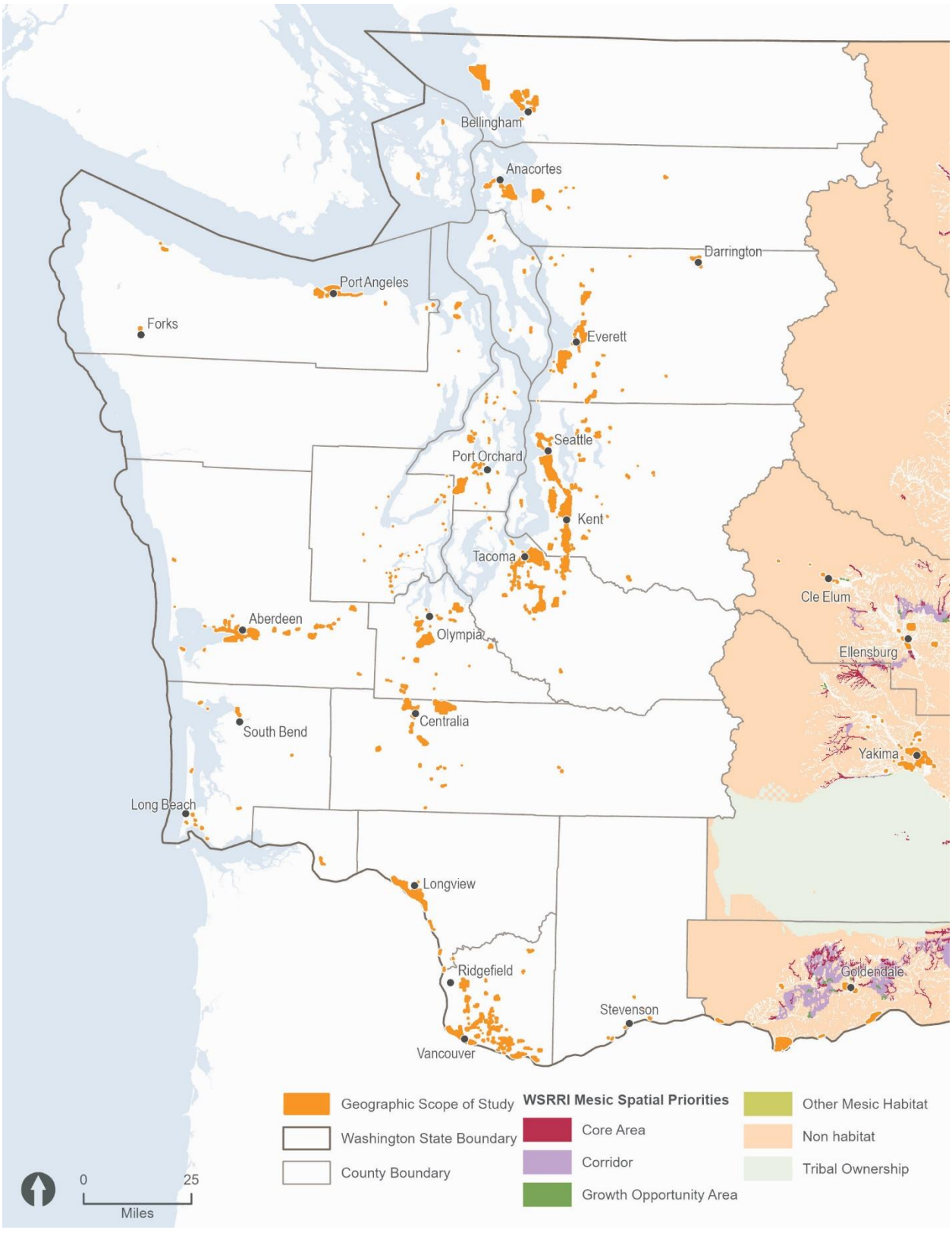

Figure 7. WSRRI objective areas in western Washington's mesic shrubsteppe habitats

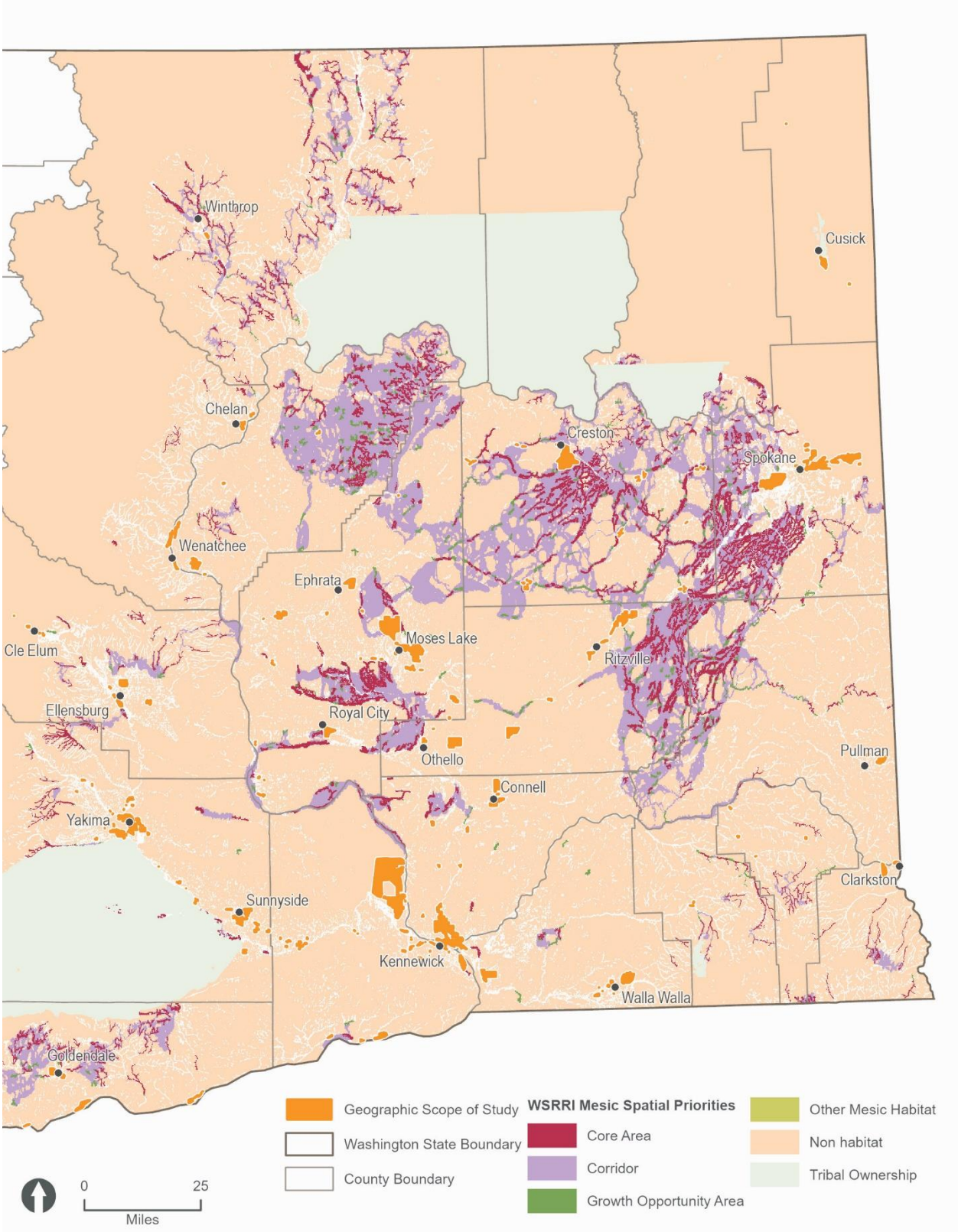

Figure 8. WSRRI objective areas in eastern Washington's mesic shrubsteppe habitats

Forest habitat

Washington state has a wide variety of forests, including boreal forests in the northern portion of the state, temperate rainforests in the west, mixed coniferous-deciduous forests in the Cascades, deciduous forests in riparian areas, and coniferous dominant forests in the Puget Lowlands, East Cascades, and Cascades (Table 2). The forests of Washington provide abundant nesting, breeding, and forage habitat for numerous species, as well as support ecosystem functions including water filtration, soil stability, and temperature regulation.

One of the most important forest habitat types for listed species is old growth. Old-growth forests are characterized by stand size, density, age, tree diameter, and height, as well as the abundance and sizes of snags and downed logs. The threshold for what is considered an old-growth forest differs depending on whether the forest is on the west or east side of the Cascade crest. In general, old-growth forests west of the Cascade crest are older and have larger tree diameters, as well as having both larger and higher volumes of snags and logs than old-growth forests east of the Cascade crest (WDFW 2023). Old-growth forests are essential for the ESA-listed northern spotted owl (*Strix occidentalis caurina*), as the owls require complex, multi-storied forests with high canopy closure, trees of multiple sizes and ages, a high volume of downed wood, and a high amount of large, decaying trees or snags for nesting, roosting, foraging, and dispersal (WDFW 2024d). These features are typically only found in old-growth and mature forests. ESA-listed marbled murrelets (*Brachyramphus marmoratus*) are also dependent on coastal old-growth conifer forests for nesting (WDFW 2024e).

While old-growth forests are an exceptionally important forest habitat type for listed species in the state of Washington, these forests are generally not found within industrial lands. If old-growth forests are mapped within or adjacent to industrial lands, there are forest practice rules and regulations which prevent the removal of old-growth habitat unless a tree is considered a danger risk. Site characterization would occur on industrially zoned areas or areas zoned to support industrial uses. Because of this effort, any impacts to forests, including old growth, would be minor and would likely be concentrated in riparian areas.

Westside prairie

Westside prairie habitat occurs in 10 counties in the west and southwest portions of the state. It is an herbaceous habitat dominated by grasses and wildflowers, with minimal canopy cover, and can be either dry or wet prairies. Dry prairies are characterized by deep, well-drained soils with upland vegetation such California oatgrass (*Danthonia californica*), common wooly sunflower (*Eriophyllum lantanum*), sticky goldenrod (*Solidago simplex ssp. simplex*), and prairie lupine (*Lupinus lepidus*). Some shrubs, like black hawthorn (*Crataegus douglassii*) and kinnikinnick (*Arctostaphylos uvaursi*), and non-native vegetation including scot's broom (*Cytisus scoparius*) and Kentucky bluegrass (*Poa pratensis*), may also be found. Wet prairies are characterized by clay soils that are water-saturated to the surface early in the growing season and slowly dry out throughout the summer. Common vegetation in wet prairies includes tufted hairgrass (*Deschampsia cespitosa*), large leaf lupine (*Lupinus polyphyllus*), bog birds-foot trefoil (*Lotus pinnatus*), and plantain leaf buttercup (*Ranunculus alismifolius*). Both prairie types provide habitat for listed species and species of concern, including the Mazama pocket gopher

(*Thomomys mazama*), streaked horned lark (*Eremophila alpestris strigata*), Taylor's checkerspot butterfly (*Euphydryas editha taylori*), and western pond turtle (*Actinemys marmorata*). It is estimated that prior to colonization, there were about 180,000 acres of prairie in western Washington, and only 3% (5,400 acres) now remain (WDFW 2023, 2024f).

Riparian areas

A riparian area is the transition zone between a terrestrial and aquatic system, extending from the ordinary high-water mark (OHWM) to the edge of the terrestrial area where it is no longer influenced by the aquatic system. They generally occur along rivers, streams, and lakes; within floodplains; adjacent to wetlands; and near other flowing or standing freshwater aquatic ecosystems. Riparian areas provide essential habitat for both terrestrial and aquatic species, with an estimated 75% or more of terrestrial species using riparian areas. Riparian areas can have different characteristics depending on where in the state they occur. For example, lowland western riparian areas can range from deciduous woodlands to marshes, whereas high elevation riparian areas are more commonly dominated by conifers. Several listed species and those of concern depend on riparian areas for habitat, including the Columbia white-tailed deer (*Odocoileus virginianus*), cascade torrent salamander (*Phyacoriton cascadae*), and Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) (WDFW 2023, 2024g).

3.2.1.3 Wildlife migration routes

Migration routes and wildlife corridors could be anywhere from 200 meters (656 feet) to a few thousand meters (several thousand feet) wide, depending on the species. WDFW designates large, connected areas as Biodiversity Areas and Corridors and recognizes these areas as an agency-wide conservation priority. Further information and maps on Biodiversity Areas and Corridors can be found in *PHS Local Government User Guide: Biodiversity Areas and Corridors Map* published by WDFW (Azerrad et al. 2023).

All of Washington state, including the study area is located in the Pacific Flyway, one of the four main north-south migratory routes in North America used by a variety of migratory bird species. Flyway management plans are developed by the Pacific Flyway Council with an approximately 5-year planning horizon and are adopted to help state and federal agencies cooperatively manage migratory birds under common goals (Pacific Flyway Council 2024).

Management plans typically focus on migratory bird species populations and habitat conditions that support those populations. The Pacific Flyway spans approximately 21,301,891 square kilometers (8,224,706 square miles) and extends from the arctic regions of Alaska and Canada to South America and is bounded on the west by the Pacific Ocean and on the east by the Rocky Mountains. Many bird species use the Pacific Flyway to migrate between breeding habitat in North America and wintering habitat in the tropics (BirdLife International 2024).

While green hydrogen facilities would not be directly sited within Biodiversity Areas and Corridors, they may be adjacent to them. These areas may include wildlife migration routes, including the broad landscapes that are used by ungulates including deer and elk for winter range and migration routes. These areas are becoming increasingly fragmented due to human

encroachment from agriculture, fencing, residential and urban development, roadway expansion, and natural resource extraction (WAFWA 2018).

USGS collaborates with state, Tribal, and federal wildlife management agencies to map ungulate migration corridors across the western United States. Maps and acreage of migration corridors as well as links to the latest and past *Ungulate Migrations of the Western United States* reports can be found on the USGS webpage "Mapping Ungulate Migrations Across the Western U.S." (USGS 2024a). Many ungulate herds migrate on a seasonal basis between distinct summer and winter ranges within their corridor footprints to make the best use of various food sources and to avoid predation risks and adverse habitat conditions such as deep snow (USGS 2024b). Ungulate migration corridors can be found within the Northern Rockies, North Cascades, Eastern Cascades Slopes and Foothills, Cascades, and Columbia Plateau ecoregions, in which the study area also occurs (USGS 2022a, 2022b, 2024b).

In the study area, the herds most likely to be encountered are the Columbia Hills, Wenatchee, Chelan, and Colockum herds, although due to human activity and development, it is unlikely that mule deer would migrate through the study area.

The Columbia Hills mule deer herd occupies private and public lands in the Columbia Plateau in central Washington south of the Wenatchee Mountains. The Wenatchee Mountains mule deer herd inhabits private and public lands along the eastern slope of the Cascade Range. The Chelan mule deer herd occupies private and public lands from the Columbia River to the crest of the Cascade Range in central Washington. The Colockum elk herd inhabits public and private lands northeast of Ellensburg, between Blewett Pass of the Cascade Range and west of the Columbia River.

3.2.2 Terrestrial species

The eight ecoregions in which the study area occurs support a variety of terrestrial native and non-native vegetation, birds, mammals, reptiles, amphibians, and invertebrates. The sections below describe the special-status terrestrial species that could be affected by green hydrogen facilities.

3.2.2.1 Special-status terrestrial species

ESA and state-listed endangered, threatened, and sensitive species

The state of Washington provides a variety of habitats that support many plant and animal species that are listed as threatened, endangered, proposed and candidates for listing, or otherwise deemed as species of special concern at the federal, state, and local levels (Table 3). Special status species include the following:

- Plants and animals listed as endangered, threatened, or proposed for listing under the ESA
- Priority plant and animal species deemed sensitive by WDFW
- Plants and animals identified as rare species under the DNR Natural Heritage Program (NHP; DNR 2024)

- Plants and animals identified in county or city codes or associated ordinances as species of local importance

Table 3. Federal and state listed terrestrial species, their preferred habitats, and critical habitat status in the PEIS study area.

Species name	State status	Federal status	Preferred habitat	Preferred habitat in study area	Critical habitat
Mammals					
Columbian white-tailed deer (*Odocoileus virginianus*)	Threatened	Threatened	Riparian areas along the Columbia River	Yes	Not designated
Fisher (*Pekania pennanti*)	Endangered	None	Coniferous, mixed coniferous-deciduous forests	Yes	Not designated
Gray wolf (*Canis lupis*)	Endangered	Endangered	Wide range of habitats	Yes	Designated/ Does not occur within study area
Olympia pocket gopher (*Thomomys mazama pugetensis*)	Threatened	Threatened	Westside prairie	Yes	Designated/ Occurs within study area
Pygmy rabbit (*Brachylogies idahoensis*)	Endangered	Endangered	Shrubsteppe	Yes	Not designated
Roy prairie pocket gopher (*Thomomys mazama glacialis*)	Threatened	Threatened	Westside prairie	Yes	Not designated
Tenino pocket gopher (*Thomomys mazama tumuli*)	Threatened	Threatened	Westside prairie	Yes	Designated/ Does not occur within study area
Western gray squirrel (*Sciurus griseus*)	Endangered	None	Oak woodlands and coniferous forests in six counties	Yes	Not designated
Yelm pocket gopher (*Thomomys mazama yelmensis*)	Threatened	Threatened	Westside prairie	Yes	Designated/ Does not occur within study area
Birds					
American white pelican (*Pelecanus erythrorhynchos*)	Sensitive	None	Marine shorelines	Yes	Not designated
Columbia sharp-tailed grouse (*Tympanuchus phasianellus columbianus*)	Endangered	None	Shrubsteppe, riparian areas	Yes	Not designated

Species name	State status	Federal status	Preferred habitat	Preferred habitat in study area	Critical habitat
Common loon (*Gavia immer*)	Sensitive	None	Marine shorelines	Yes	Not designated
Ferruginous hawk (*Buteo regalis*)	Endangered	None	Shrubsteppe	Yes	Not designated
Greater sage-grouse (*Centrocercus urophasianus*)	Endangered	None	Shrubsteppe	Yes	Not designated
Hawaiian petrel (*Pterodroma sandwichensis*)	None	Endangered	Marine shorelines	Yes	Not designated
Marbled murrelet (*Brachyramphus marmoratus*)	Endangered	Threatened	Marine shorelines	Yes	Designated/ Does not occur within study area
Northern spotted owl (*Strix occidentalis caurina*)	Endangered	Threatened	Old-growth coniferous forests	Yes	Designated/ Occurs within study area
Oregon vesper sparrow (*Pooecetes gramineus affinis*)	Endangered	Under review	Westside prairie	Yes	Not designated
Sandhill crane (*Grus canadensis*)	Endangered	None	Wetland meadows, grasslands	Yes	Not designated
Short-tailed albatross (*Phoebastria albatrus*)	Candidate	Endangered	Marine shorelines	Yes	Not designated
Streaked horned lark (*Eremophila alpestris strigata*)	Endangered	Threatened	Westside prairies, marine shorelines	Yes	Designated/ Does not occur within study area
Tufted puffin (*Fratercula cirrhata*)	Endangered	None	Marine shorelines	Yes	Not designated
Upland sandpiper (*Bartramia longicauda*)	Possibly extirpated, endangered	None	Open habitats, wetland meadows	Yes	Not designated
Western snowy plover (*Charadrius nivosus nivosus*)	Endangered	Threatened	Marine shorelines	Yes	Designated/ Does not occur within study area
Yellow-billed cuckoo (*Coccyzus americanus*)	Endangered	Threatened	Riparian areas	Yes	Designated/ Does not occur within study area

Species name	State status	Federal status	Preferred habitat	Preferred habitat in study area	Critical habitat
Reptiles					
Green sea turtle (*Chelonia mydas*)	Threatened	Threatened	Marine shorelines	Yes	Designated/ Does not occur within study area
Northwestern pond turtle (*Actinemys marmorata*)	Endangered	Proposed Threatened	Westside prairie	Yes	Not designated
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	Endangered	Marine shorelines	Yes	Designated/ Does not occur within study area
Loggerhead sea turtle (*Caretta caretta*)	Endangered	Endangered	Marine shorelines	Yes	Designated/ Does not occur within study area
Insects					
Island marble butterfly (*Euchloe ausonides insulanus*)	Candidate	Endangered	Westside prairie, marine shorelines on San Juan Islands	Yes	Designated/ Does not occur within study area
Mardon skipper (*Polites mardon*)	Endangered	None	Westside prairie	Yes	Not designated
Monarch butterfly (*Danaus plexippus*)	Candidate	Candidate	Milkweed patches, typically in weedy or sparsely vegetated fields, wetlands, and riparian areas	Yes	Not designated
Oregon silverspot butterfly (*Argynnis zerene hippolyta*)	Endangered	Threatened	Westside prairie, marine shorelines	Yes	Designated/ Does not occur within study area
Taylor's checkerspot (*Euphydryas editha taylori*)	Endangered	Endangered	Westside prairie, marine shorelines	Yes	Designated/ Does not occur within study area
Western bumblebee (*Bombus occidentalis*)	Candidate	Under review	Areas with high floral abundance	Yes	Not designated
Flowering Plants					
Kincaid's lupine (*Lupinus sulphureus* ssp. kincaidii)	Endangered	Threatened	Oak woodland prairies	Yes	Designated/ Does not occur within study area

Species name	State status	Federal status	Preferred habitat	Preferred habitat in study area	Critical habitat
Marsh sandwort (*Arenaria paludicola*)	Possibly Extirpated	Endangered	Coastal swamps	Yes	Not designated
Spalding's catchfly (*Silene spaldingii*)	Threatened	Threatened	Shrubsteppe, scabland, ponderosa pine forests	Yes	Not designated
Ute ladies'-tresses (*Spiranthes diluvialis*)	Endangered	Threatened	Wetlands, wet meadows, riparian areas	Yes	Not designated
Nelson's checkermallow (*Sidalcea nelsoniana*)	Endangered	Threatened	Wet meadows, prairies, and grasslands	Yes	Not designated

Sources: USFWS 2024a, 2024b; University of Washington 2024; WDFW 2024h.

Washington state has approximately 40 terrestrial candidate and species proposed for listing as endangered, threatened, or sensitive. Listing status for candidate and proposed species, as well as those listed above, may change over time. Required regulations and conservation regarding these species may also change, and individual developers will need to conduct the appropriate consultation and protections required at the time of planning and permitting.

State rare and species of concern

The SWAP was first developed in 2005 and is updated every 10 years per USFWS requirements to stay eligible for State Wildlife Grant Funding. It was updated in 2015 and will be updated again in 2025. The purpose of the SWAP is to develop conservation plans for Washington's fish, wildlife, and habitats. It does this through designating species of greatest conservation need (SGCN), which are determined through evaluation of species that are:

- Federally or state listed endangered, threatened, or candidate species
- Federal species of concern or state sensitive
- Were ranked as "high" threat/vulnerability in the 2005 SWAP
- Are critically imperiled or imperiled at the state level or globally according to NatureServe (are rated S1, S2, G1, or G2)

Evaluation of species in 2015 resulted in 268 species being designated as SGCN. Guidance for conservation of these species and their habitats is provided in the SWAP (WDFW 2015). If a green hydrogen facility would affect one of these species or their habitats, additional studies and conservation plans may be required. As the SWAP is to be updated in 2025, it is recommended that developers check the list for subsequent changes.

There are around 150 plants that are state threatened or endangered but not federally listed, around 230 state sensitive plants, and 400 rare plant species designated by the DNR NHP that occur within Washington state. These plant species occur in a variety of habitats throughout

the state and may occur in the study area, and may require additional surveys, consultation, or conservation plans.

City and county sensitive species
Critical areas ordinances may designate additional species of local importance at the city and county levels that may warrant further avoidance, mitigation, conservation, or consultation plans. Developers would be required to determine the appropriate requirements for species and habitats plans at the local scale.

3.2.3 Aquatic habitats

The following sections describe the types of critical, unique, and priority aquatic habitats that are potentially present in the study area, including habitats for aquatic and amphibious federally and state listed species, sensitive species, species of concern, and wetlands that could be affected by green hydrogen facilities.

Human-created water storage features such as ditches, irrigation canals, or water retention ponds can provide opportunistic habitat for aquatic species although they often lack important habitat elements and may be lower quality habitat compared to natural ponds, wetlands, and streams. These features would not be protected by the regulatory framework in place to protect natural aquatic habitat.

3.2.3.1 Critical habitat

Aquatic critical habitat is extensive throughout the state of Washington. Many waterbodies within the state are critical habitats for listed species such as salmon, Bull Trout, steelhead, and Oregon spotted frog. The extent of critical habitat for each ESA-listed aquatic species is determined and mapped by USFWS or NOAA Fisheries, where those analyses have been completed (87 *Federal Register* 37757, 2022) (USFWS 2024c).

3.2.3.2 Priority habitat

In addition to the terrestrial priority habitat described in Section 3.2.1.2, WDFW's PHS on the Web online mapping tool also identifies aquatic PHS types for conservation within the state (WDFW 2024a) (Figure 3). While aquatic priority habitats are recorded within the ecoregions and counties where the study area is located, green hydrogen facilities would not be sited directly in aquatic habitats. However, aquatic priority habitats may be adjacent to a green hydrogen facility site. Habitats that are most likely to occur near industrial land where green hydrogen facilities may be constructed were determined by assessing PHS data, current and historic observations of species of concern, and their preferred habitats. Analysis found that the aquatic priority habitats most likely to be affected by green hydrogen facilities include:

- Fresh deepwater
- Instream habitat
- Freshwater wetlands
- Marine shorelines (coastal nearshore, open coast nearshore, and Puget sound nearshore)

Fresh deepwater habitat

Freshwater aquatic habitat conditions are influenced by climatic conditions including precipitation and temperature, and whether the source of the waterbody is glacial meltwater, snowmelt, or rain dominated. In addition, the connectedness of surface water with groundwater is determined by local geology and soil conditions. Fresh deepwater habitat is defined as permanently flooded areas lying below the deepwater boundary of wetlands (WDFW 2023). Surface water is permanent and often deep and includes all underwater structures and features such as rock piles, woody debris, and caverns. The principal medium in which the dominant organisms live is water, and the dominant plants are hydrophytes (WDFW 2023). Fresh deepwater habitat is found in all ecoregions of the state of Washington. Because of the potential for fresh deepwater habitat to exist adjacent to industrial lands, such as at ports, there is a possibility that construction of green hydrogen facilities could impact this habitat and the associated species (see the *Water Resources Technical Appendix*). Construction activities could increase potential for runoff and increased sedimentation, which could briefly but negatively impact aquatic species. Leaks or hazardous material spills during construction could also negatively impact fresh deepwater habitat.

Instream habitat and freshwater wetlands

Instream habitat is defined as the combination of physical, biological, and chemical processes and conditions that interact to provide functional life-history requirements for instream fish and wildlife resources. Freshwater wetlands are defined as transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface or covered by shallow water during the growing season each year. Ponds containing emergent vegetation may also be classified as freshwater wetlands. In western Washington, wetlands can be dominated by tidal influences and develop in the outwash plains left by glaciers (Hruby and Yahnke 2023). In the semi-arid regions of eastern Washington, aquatic habitats and associated riparian vegetation develop along elevation contours and gradients determined by geomorphic, erosional, and depositional formations (Hruby 2014). In comparison to wetter environments, water is present on the land for shorter durations and low levels of precipitation support lower vegetation biomass in riparian areas.

Instream habitat and freshwater wetlands can be further subdivided by the predominant hydrologic conditions in different areas and accessibility of the habitat to aquatic animals.

Surface waters that provide aquatic habitat can be categorized based on how long water is present and flowing on land throughout the year:

- Ephemeral streams are rain and snowmelt dependent. They have flowing water during brief periods of precipitation, typically during fall and early spring rain events.
- Intermittent streams are seasonal, with flowing water only during certain times of the year based on precipitation patterns or groundwater levels.
- Perennial streams have flowing water year-round.

Unique ecological functions are provided by low-order ephemeral and intermittent surface waters with intact riparian corridors:

- Provision of fish and wildlife habitat, oftentimes temporary, especially for reproduction or early rearing life stages in the spring
- Regulation of water temperature when shaded by reed-beds or riparian shrubs and trees
- Provision of organic inputs (e.g., leaves, pollen, and terrestrial insects) as a source of nutrients that support aquatic food webs close to, or distant downstream areas when seasonally connected

Instream, fresh deepwater, and freshwater wetland habitats occur throughout all eight ecoregions where the study area occurs. Persistent snowpack in the Cascades, Eastern Cascades Slopes and Foothills, North Cascades, and Northern Rockies Ecoregions creates snowmelt-dominated waterbodies. In the uplands of the Coast Range, Cascades, Eastern Cascades Slopes and Foothills, North Cascades, and Northern Rockies Ecoregions, waterbodies are also glacially fed. Snowmelt originating from high altitude watersheds with large snowpack and glacial meltwater can sustain abundant, cold aquatic habitat throughout the dry season (approximately July through September), even in more arid Eastern Cascades Slopes and Foothills that experience greater air temperature extremes. In contrast, large portions of the eastern, semi-arid ecoregions that lack high-altitude water sources, including the Columbia Plateau and parts of the Eastern Cascades Slopes and Foothills, are characterized by low precipitation and higher water temperatures in summer and fall. In comparison to wetter environments, snow and runoff is present on the land for shorter durations and lower vegetation biomass is present in riparian areas.

Instream habitat and freshwater wetlands have the potential to exist adjacent to, and within, industrial lands. Depending on the existing land use and level of disturbance, green hydrogen facility construction could potentially impact instream habitat and freshwater wetlands. Stormwater runoff during construction activities could result in increased sedimentation and impact water quality. If fill and removal activities are needed for construction, there is potential to reduce the function of nearby wetlands and degrade aquatic habitat. Additionally, this habitat fragmentation could limit the habitat quality for species of concern and reduce water conveyance ability. Impacts to instream habitat from increased sedimentation and changes in water temperature could negatively affect salmonid species and their ability to utilize spawning and rearing habitat. Hazardous material leaks or spills during construction could directly impact instream habitat and freshwater wetlands and could also impact groundwater.

Shoreline and nearshore habitats

Several shoreline and nearshore habitats occur within the study area. Marine shorelines are the interface between terrestrial and ocean ecosystems. The aquatic portion of this habitat is divided into intertidal, subtidal, and photic zones. Coastal nearshore habitat, which encompasses the estuaries of Washington's coastline, occurs in the Coast Range and Puget Lowland regions. The coastal nearshore includes shorelines, intertidal, and subtidal zones near Gray's Harbor, Willapa Bay, and the mouth of the Columbia River. Open coast nearshore habitat

occurs along the same stretch as the coastal nearshore but includes the non-estuarine nearshore (WDFW 2023). The Puget Sound nearshore occurs in the Coast Range and Puget Lowlands, Ecoregions. It includes the marine environment in the Puget Sound, including the Strait of Juan de Fuca, the Strait of Georgia, the San Juan Islands, and Hood Canal (WDFW 2023).

Green hydrogen facility construction could impact shoreline and nearshore habitats. Industrial lands exist along waterways, and construction activities could result in stormwater discharge and sedimentation runoff into shoreline and nearshore habitats. Increased sedimentation could negatively impact habitat quality as well as individual species. Salmon species could be affected by reduced water quality and habitat, which could also negatively impact predator species which rely on salmonids thus impacting species beyond the geographic scope of industrial lands.

3.2.3.3 Essential Fish Habitat

Essential Fish Habitat (EFH) is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" and is designated for groundfish, Pacific salmon, and coastal pelagic composites (50 Code of Federal Regulations [CFR] 600.10, 2024). For the purposes of this PEIS, EFH includes wetlands, lakes, rivers, and nearshore marine areas with bays, coral reefs, and kelp forests that are necessary for fish reproduction, growth, feeding, and shelter (NOAA 2024a). EFH is mapped throughout most of the state and potentially occurs in some sites in the study area (NOAA 2024b) (Figure 9).

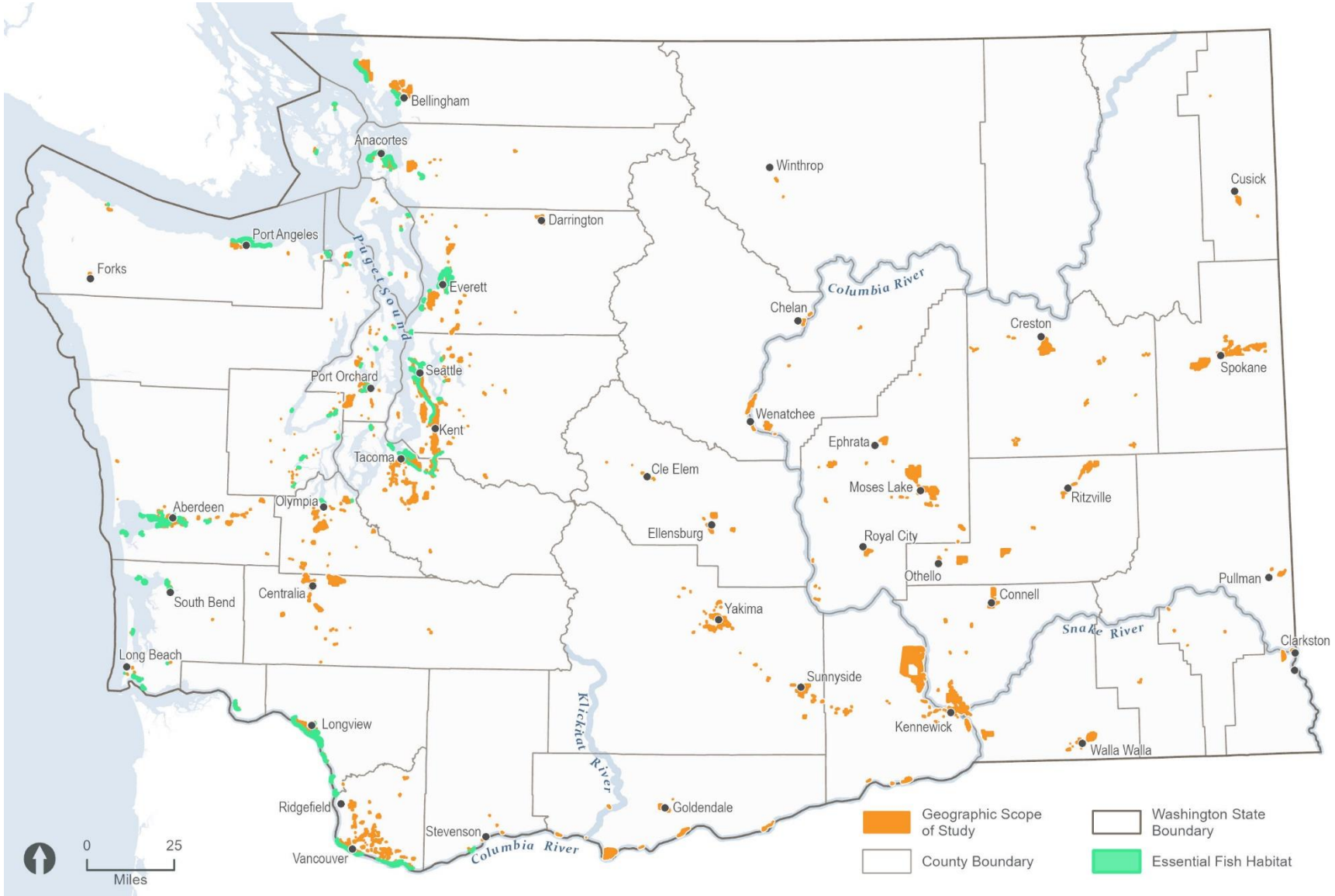

Figure 9. Washington State Essential Fish Habitat within the PEIS geographic scope of study

3.2.3.4 Salmonid and other fish migration routes

Salmonids are fish species including salmon, steelhead, and trout. Many of these species, in particular salmon and steelhead, exhibit anadromous life-histories where they hatch and rear in freshwater, migrate to the Pacific Ocean to feed, and return to their natal waters to spawn. Salmonids and other fish species of concern need specific aquatic habitat features to complete their life cycles, including cool, clean water with adequate in-stream habitat complexity to rest, spawn, and hide from predators (WDFW 2011). Adequate freshwater ecosystems for salmonid and other fish migration occur throughout all ecoregions in the study area. While green hydrogen facilities would not be located directly on these aquatic habitats, they may be sited adjacent to them.

3.2.3.5 Wetlands

Wetlands occur throughout the study area where green hydrogen facilities are considered. However, unlike many streams, rivers, lakes, and marine waters whose locations and boundaries are often evident and relatively well mapped, there are no comprehensive sources that identify and map the presence, extent, and condition of wetlands. As such, future developers of green hydrogen facilities would be required to conduct additional quantitative analyses and site surveys (e.g., wetland determination or delineations, wetland rating and functions and values assessments, critical area assessments) to determine the amount, type, and category of wetlands, and the width and condition of their associated buffers, that exist on and adjacent to proposed development sites as part of project-specific planning.

Because of their ecological importance and value to humans, wetlands are regulated under various federal, state, and local laws including Sections 401 and 404 of the CWA, the Washington State Water Pollution Control Act, and county and city critical areas ordinances and shoreline master programs within designated shorelines. Although the definition of the jurisdictional limits of wetlands are similar under these various laws, there are differences in whether or not a wetland is subject to federal or state regulation. In particular, federal regulations typically only apply to those wetlands that are directly connected to certain surface waters that are considered to be waters of the U.S. Those wetlands determined to be non-jurisdictional by the federal government are generally regulated under state and local laws. Because of this overlapping coverage in regulation, all wetlands are considered to be subject to regulation in this study.

As part of state and local regulation of wetlands in Washington, wetlands are rated and categorized using Ecology's Washington State Wetland Rating System. The rating system includes specific regional methods for the western (Hruby and Yahnke 2023) and eastern (Hruby 2014) portions of the state.[4] These methods are designed to consider regional

[4] Western Washington is typically considered to mean "the geographic area in Washington west of the crest of the Cascade Mountains from the international border to the top of Mt. Adams, then west of the ridge line dividing the White Salmon River drainage from the Lewis River drainage and west of the ridge line dividing the Little White Salmon River drainage from the Wind River drainage to the Washington-Oregon state line" (Hruby and Yahnke 2023). Areas to the east of this boundary are considered eastern Washington.

differences in climate, landforms, hydrology, and wetland types that are characteristic of those areas. Ecology's wetland rating system is used to differentiate wetlands based on their sensitivity to disturbance, significance in the watershed, rarity, ability to be replaced, and the beneficial functions they provide to society. The rating system evaluates wetlands on their ability to provide water quality improvement, hydrologic, and wildlife habitat functions based on the wetland's physical characteristics (site potential), the surrounding environment (landscape potential), and the importance of those functions to humans (value) in the vicinity. The categories derived using the rating system include the following:

- **Category I wetlands** represent a unique or rare wetland type, are more sensitive to disturbance, or are relatively undisturbed and contain ecological attributes that provide a high level of functions. These types and functions are very difficult to replace.
- **Category II wetlands** provide high levels of some functions. These types and functions are very difficult to replace.
- **Category III wetlands** have moderate levels of functions. They have been disturbed in some ways and are often less diverse or more isolated from other natural resources in the landscape than Category II wetlands.
- **Category IV wetlands** have the lowest levels of functions and are often heavily disturbed.

Wetland categories are used by local entities to assign protective buffers to wetlands under their critical areas' regulations and shoreline master programs within shoreline jurisdiction. For this study, wetland rating categories were used to define the threshold for significant impacts.

Because Category I and II wetlands typically represent relatively unique or rare wetland types or wetlands of high conservation value that are difficult to replace and that provide high levels of function, any impacts to those wetland types would be difficult to mitigate for and would be determined on a case-by-case basis. Many types of wetlands occur throughout the state, with different types on the eastern and western sides. Green hydrogen facilities are most likely to encounter wetlands in the western side of the state. There are fewer wetlands in the southeast portion, particularly in the Columbia Plateau Ecoregion. While the density of wetlands is lower in this ecoregion, green hydrogen facilities could still overlap or be sited adjacent to wetlands, particularly near larger waterbodies such as the Columbia River, Snake River, and Moses Lake (USFWS 2024c).

Category III and IV wetlands are the most common types of wetlands in the state. As a result, most wetlands that would be encountered on proposed development sites for green hydrogen facilities are likely to be those types. Category III and IV wetlands typically provide moderate to low levels of functions and support relatively common plant and animal species. While such wetlands are still important (and regulated), they have likely experienced some level of disturbance and are easier to replace through compensatory mitigation. Permits that may be required for impacts on such areas are described in Section 3.3.

3.2.4 Aquatic species

This analysis focuses on aquatic and amphibious plants and animals that are listed or species of concern that are likely to occur in areas that could be affected by new green hydrogen facilities. The types of green hydrogen facilities being considered are likely to be sited to avoid aquatic habitat; however, potential impacts such as changes to drainage patterns or water quality could extend to adjacent freshwater streams and lakes, wetlands and ponds, and nearshore marine areas. Groups of aquatic animals that could be affected include fish, shellfish, aquatic macroinvertebrates, amphibians, and turtles. In marine nearshore areas, some mammals such as seals and sea lions use shorelines as haul-out areas. Green hydrogen facilities may occur adjacent to waterbodies where aquatic habitats and species could experience indirect effects from project activities or direct effects from operation activities, spills, and accidents.

In addition to the list in Table 4, there are 13 aquatic species Washington has designated as candidate species for state listing as endangered, threatened, or sensitive. The "Preferred habitat near study area" column in Table 4 indicates species with potential to occur in the study area or within a 0.5-mile buffer of the study area.

Table 4. Non-salmonid aquatic federal and state listed species with potential to occur in or near the PEIS study area

Species name	State status	Federal status	Preferred habitat	Preferred habitat near study area
Mammals				
Humpback whale (*Megaptera novaeangliae*)	Endangered	Endangered	Oceans, coastal water, bays	Yes
Southern resident killer whale (*Orcinus orca*)	Endangered	Endangered	Pelagic and coastal waters, inland marine waters	Yes
Sea otter (*Enhydra lutris kenyoni*)	Threatened	None	Rocky marine shorelines, kelp beds	Yes
Fish				
Lake chub (*Couesius plumbeus*)	Candidate	None	Instream, fresh deepwater	Yes
Leopard dace (*Rhinicthys falcatus*)	Candidate	None	Instream, fresh deepwater	Yes
Margined sculpin (*Cottus marginatus*)	Sensitive	None	Instream, fresh deepwater	Yes
Mountain sucker (*Catostomus platyrhynchus*)	Candidate	None	Instream, fresh deepwater	Yes
Olympic mudminnow (*Novumbra hubbsi*)	Sensitive	None	Instream, wetlands	Yes
Pygmy whitefish (*Prosopium coulteri*)	Sensitive	None	Instream, fresh deepwater	Yes
River lamprey (*Lampetra ayresii*)	Candidate	None	Instream, fresh deepwater	Yes

Species name	State status	Federal status	Preferred habitat	Preferred habitat near study area
Umatilla dace (*Rhinichthys umatilla*)	Candidate	None	Instream, fresh deepwater	Yes
Amphibians				
Oregon spotted frog (*Rana pretiosa*)	Endangered	Threatened	Instream, wetlands	Yes
Cascade torrent salamander (*Phyacoriton cascadae*)	Candidate	Listing may be warranted	Instream, wetlands	Yes
Columbia spotted frog (*Rana luteiventris*)	Candidate	None	Instream, wetlands	Yes
Larch mountain salamander (*Plethodon larselli*)	Sensitive	None	Rocky areas, both forested and non-forested	Yes
Northern leopard frog (*Lithobates [Rana] pipiens*)	Endangered	None	Wetlands	Yes
Mollusks				
California floater mussel (*Anodonta californiensis*)	Candidate	None	Instream, fresh deepwater	Yes
Pinto abalone (*Haliotis kamtschatkana*)	Endangered	None	Marine shorelines	Yes

Sources: WDFW 2023, 2024a, 2024h.
Note: Salmonids are addressed in Table 5.

3.2.4.1 Migratory species

Several highly migratory aquatic species use Washington's major river basins and tributaries, sometimes traveling hundreds of miles between spawning, rearing, and foraging habitats. These include native anadromous species of salmon, steelhead, lamprey, and sturgeon, which migrate from freshwater spawning and rearing areas to the ocean to grow, then back to freshwater to complete their unique life cycles. Marine mammals such as seals, sea lions, and whales are also migratory aquatic species that use Washington's major river basins, nearshore habitats, and coastal water habitats. Several of these species are either federally or state listed, protected by the Marine Mammal Protection Act, Magnuson-Stevens Fisheries Conservation Management Act, PHS species of concern, or other state and county ordinances that may require consultation, mitigation, or conservation plans.

Salmon, steelhead, and Bull Trout

There are nine anadromous salmonid species found in Washington state. Some fish travel hundreds of miles upstream to reach their spawning grounds and rely heavily on the connectivity of waterbodies to complete their migration. The duration of freshwater rearing stages depends on the species, and migration rates depend on seasonal flows and fish age and size. Salmonids rely on riverine conditions with cold, well-oxygenated water with clean gravels;

low levels of fine sediments to complete spawning and embryo incubation; and intact riparian zones with complex channel features that include woody material for rearing.

An evolutionarily significant unit, or ESU, of Pacific salmon is considered a “distinct population segment” (DPS) and is thus considered a protected species under the ESA. Table 5 lists the ESU and DPS salmon populations in Washington State. Figure 10 shows the watersheds within Washington State where ESU populations occur. Figure 11 and Figure 12 show the areas within Washington State where salmon populations occur.

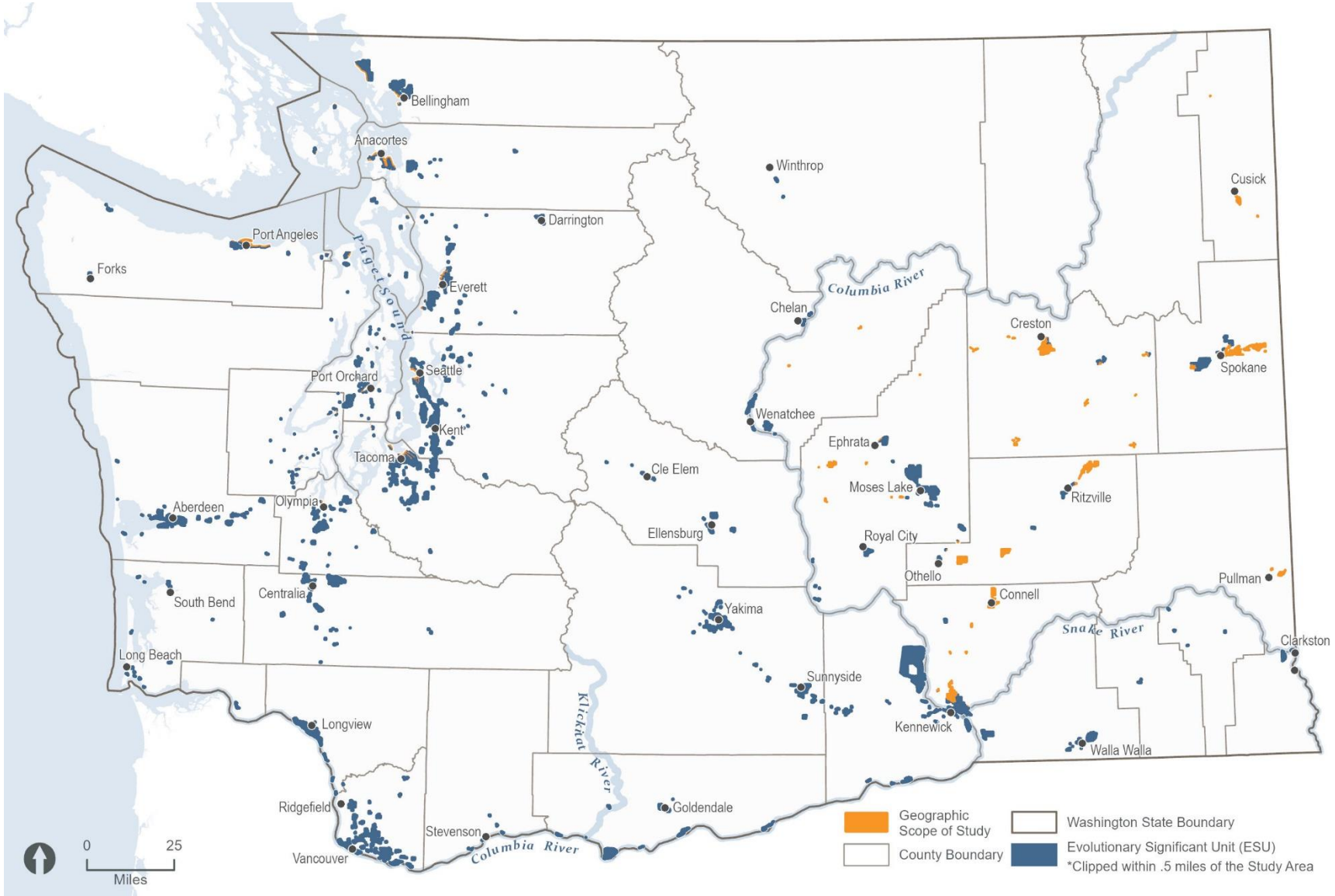

Figure 10. Washington State Evolutionary Significant Unit watersheds containing salmon within the PEIS geographic scope of study

Table 5. Evolutionarily Significant Unit and Distinct Population Segment salmonid populations in Washington State

Species	Population (ESU/DPS)	State Status	Federal ESA status	Preferred Habitat
Chinook Salmon (*Oncorhynchus tshawytscha*)	Lower Columbia River ESU	None	Threatened	Instream, fresh deepwater
	Snake River Fall ESU	None	Threatened	Instream, fresh deepwater
	Snake River Spring/Summer ESU	None	Threatened	Instream, fresh deepwater
	Upper Columbia River Spring DPS	None	Endangered	Instream, fresh deepwater
	Puget Sound ESU	None	Threatened	Instream, fresh deepwater
Coho Salmon (*O. kisutch*)	Lower Columbia River ESU	None	Threatened	Instream, fresh deepwater
Chum Salmon (*O. keta*)	Columbia River ESU	None	Threatened	Instream, fresh deepwater
	Hood Canal Summer ESU	None	Threatened	Instream, fresh deepwater
Sockeye Salmon (*O. nerka*)	Snake River ESU	None	Endangered	Instream, fresh deepwater
	Ozette Lake ESU	None	Threatened	Instream, fresh deepwater
Steelhead (*O. mykiss*)	Middle Columbia River DPS	Candidate	Threatened	Instream, fresh deepwater
	Snake River DPS	Candidate	Threatened	Instream, fresh deepwater
	Upper Columbia River DPS	Candidate	Threatened	Instream, fresh deepwater
	Puget Sound DPS	None	Threatened	Instream, fresh deepwater
Bull Trout (*Salvelinus confluentus*)	Coastal Recovery Unit	Candidate	Threatened	Instream, fresh deepwater
	Mid-Columbia Recovery Unit	Candidate	Threatened	Instream, fresh deepwater

Sources: WDFW 2023, 2024a, 2024h.

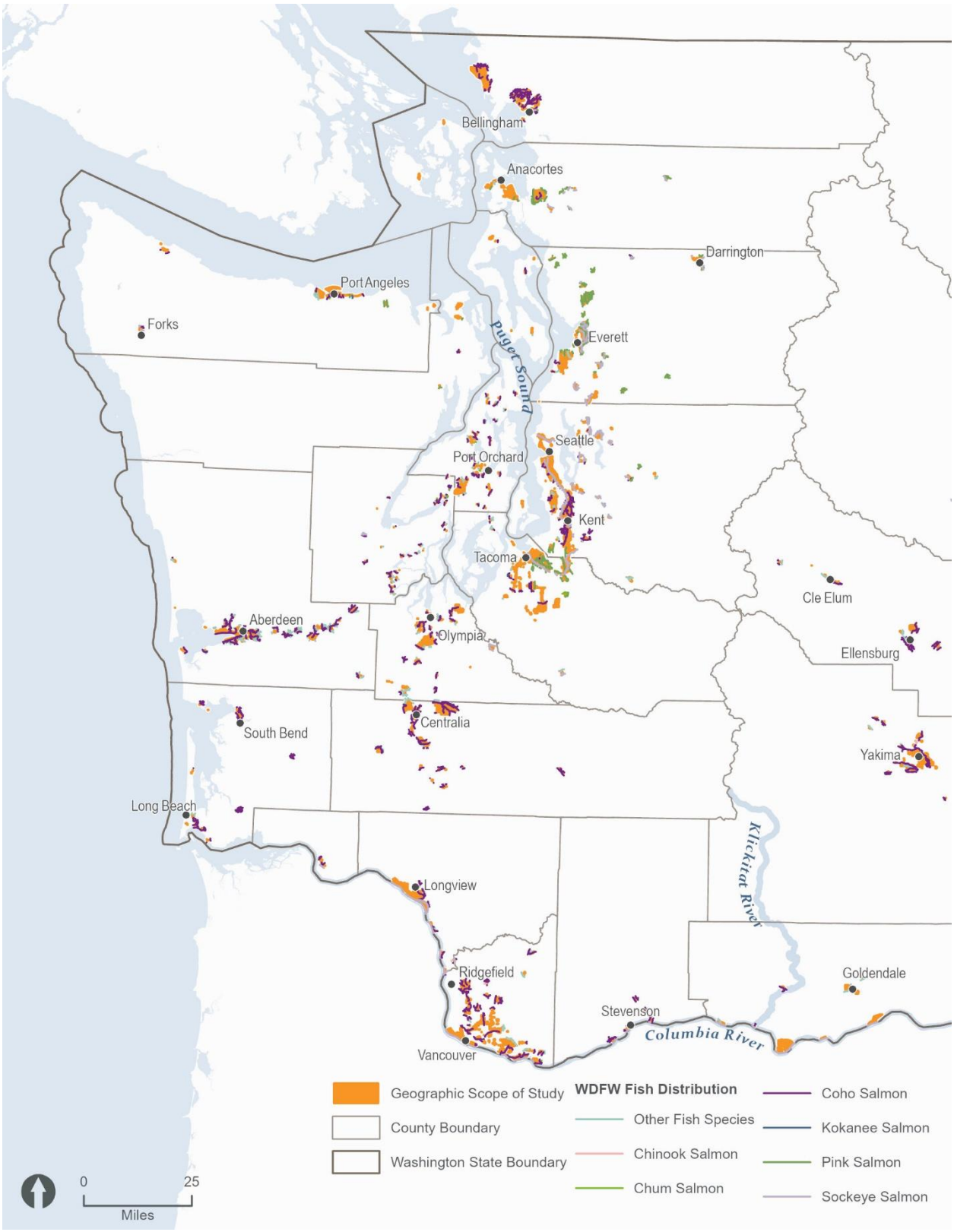

Figure 11. Western Washington State salmon distribution areas within the PEIS geographic scope of study

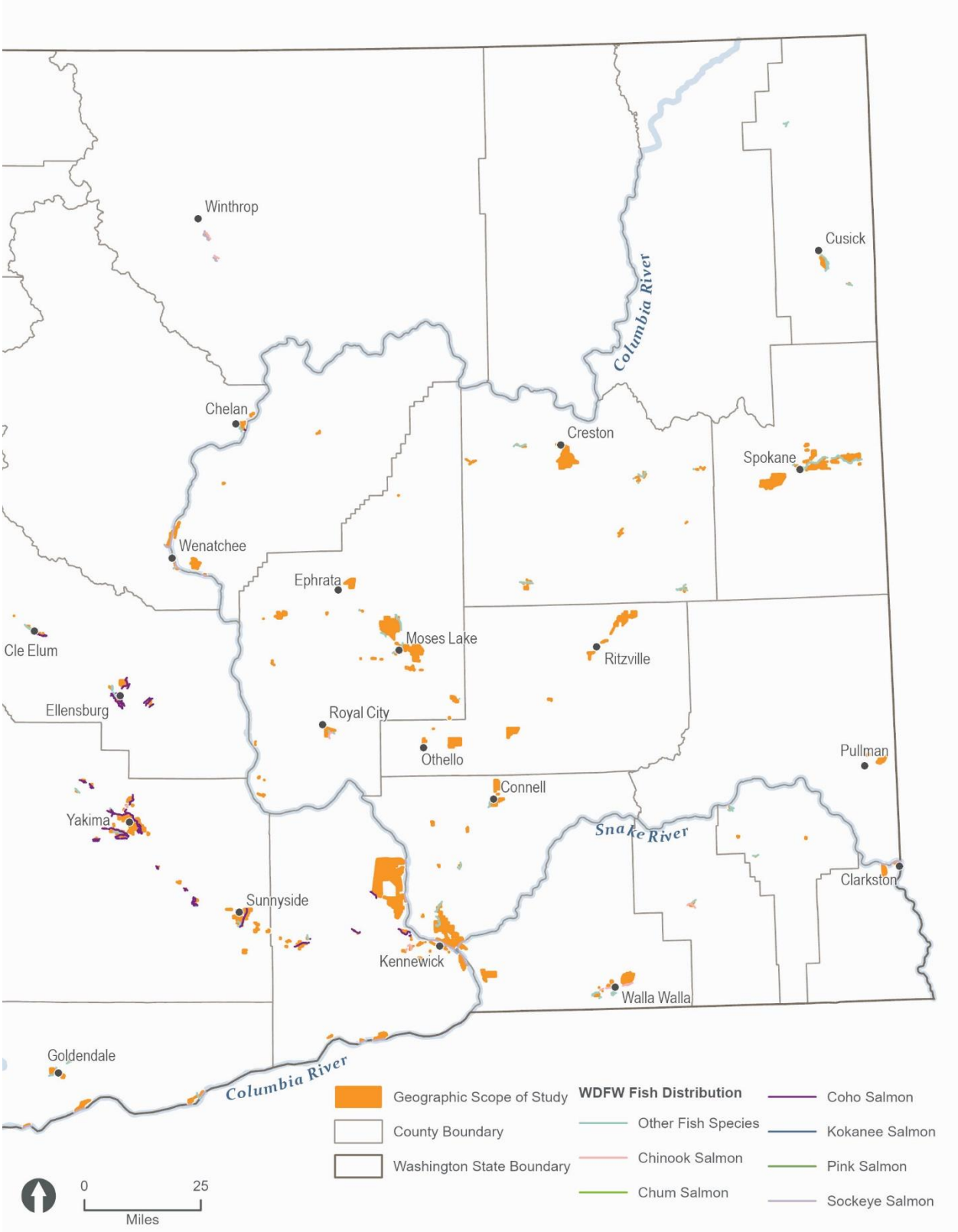

Figure 12. Eastern Washington State salmon distribution areas within the PEIS geographic scope of study

Lamprey

The Pacific lamprey (*Entosphenus tridentatus*) and river lamprey (*Lampetra ayresii*) are anadromous species that can migrate upstream hundreds of miles to complete the freshwater phase of its life cycle. Lamprey heavily rely on the connectivity of waterbodies to complete their migration. Larvae burrow in the soft substrate of low gradient, cold-water streams to filter feed and rear for up to 8 years. Adults spend several years in the ocean and migrate back to freshwater to spawn. They are largely nocturnal and migrate through the lower part of the water column, stopping frequently to attach to substrate. Anadromous lamprey can be found in all eight ecoregions within the study area.

Sturgeon

The white sturgeon (*Acipenser transmontanus*) is an anadromous species that spawns in large rivers and migrates to estuarine and marine environments to feed and develop from juveniles to adults. Sturgeon are able to spawn multiple times during their extended lifespan, which can be around 60 to 70 years (NOAA 2024c). During spawning, eggs are broadcast into the water column in relatively swift portions of the river and may be dispersed downstream before settling into river substrate. White sturgeon exhibit physiological sensitivity to water temperature, and increasing water temperatures may reduce spawning success while increasing the risk of disease (WDFW 2024a). White sturgeon can be found within or adjacent to the study area in the mainstem Columbia and Snake rivers, which extend through the Cascades, Eastern Cascades Slopes and Foothills, Columbia Plateau, Northern Rockies, and North Cascades Ecoregions.

Pinnipeds, otters, and whales

Pinnipeds, a group of aquatic, carnivorous mammals that includes seals and sea lions, otters, and whales, are protected under the Marine Mammal Protection Act and are known to inhibit or migrate through portions of the study area along the Coast Range and Puget Sound Ecoregions as well as the Columbia River. Marine mammals forage in the Columbia River and Puget Sound and could be potentially affected by impacts to salmon and other prey species.

Pinnipeds and otters are known to inhibit colder waters and need both terrestrial and aquatic habitats to survive. They are most typically found in coastal waters but have been known to migrate into the Columbia River Gorge. Primary prey species include Coho and Chinook Salmon as well as various mussel species.

The Southern Resident killer whales (*Orcinus orca*) (SRKW) DPS is composed of a single population that includes three pods, identified as J, K, and L pods. SRKW, also known as orca whales, are the only endangered population of orca whales in the United States and receive additional federal protections. Orcas are highly social and tend to stay in their natal pods, which consist of a few to 20 or more individuals. SRKW feed primarily on fish, with salmonid species as the primary prey species. Chinook Salmon make up the majority of SRKW diet from late spring to fall (approximately 78 to 80% of total diet) (Ford and Ellis 2006; Hanson et al. 2010; Ford et al. 2016). Chum Salmon are an important prey species in fall and winter, along with Coho Salmon and steelhead (Ford et al. 2017). Limiting factors that have contributed to SRKW

population decline include declining quantity and quality of prey, high levels of contaminants from pollution, and disturbance from vessel traffic and other anthropogenic sounds.

Humpback whales (*Megaptera novaeangliae*) live throughout the world's major oceans and can migrate up to 5,000 miles between high-latitude summer feeding grounds and winter mating and calving areas. Their primary diet is shrimp-like crustaceans (krill) and small fish. Females produce a single calf every 2–3 years on average, and calves stay near their mothers for up to 1 year before weaning. Limiting factors that impact populations include vessel strikes, climate change, entanglement in fishing gear, and vessel-based harassment.

3.2.4.2 Resident freshwater fish species

Rainbow Trout, Cutthroat, and whitefish

Similar to anadromous salmon and steelhead, resident Rainbow and Cutthroat Trout prefer clean, cold-water habitat, which is especially key for spawning. Adults require enough water depth and flow to provide unimpeded access to spawning areas. Spawning adults require specific flow conditions, cover, and access to spawning gravel to deposit eggs. Rainbow and Cutthroat Trout can be found throughout all eight ecoregions within the study area.

In summer, whitefish species occur in groups in pools in locations of upstream tributaries that exhibit cooler temperatures. Whitefish species can be found in the North Cascades, Northern Rockies, Columbia Plateau, and Eastern Cascades Slopes and Foothills Ecoregions.

Freshwater sculpins, minnows, and suckers

Sculpins are benthic species that are widely distributed throughout Washington rivers. They are highly mobile, with a range of a few hundred meters (several hundred feet) or less, and may occupy the river environment year-round. Adult sculpins prefer rivers with gravel or cobble substrate and tolerate warm or cool water. Sculpin species can be found in the North Cascades and Columbia Plateau regions.

Minnow species are small-bodied fishes. Juveniles and most adult minnows prefer shallow nearshore and shoreline environments, with low velocities during the warmer months, while retreating to deeper water from October through April. Minnow species can be found in the Cascades, Columbia Plateau, North Cascades, and Northern Rockies Ecoregions.

Sucker species tolerate high water velocities and prefer deeper water habitats during the day, moving to shallower habitat at night. Juveniles prefer shallower water, pools, and backwaters. Suckers prefer gravel substrate and riffle habitat for spawning, which occurs in the spring. Sucker species can be found in the North Cascades, Columbia Plateau, Northern Rockies, and Eastern Cascades Slopes and Foothills Ecoregions.

3.2.4.3 Freshwater shellfish and aquatic macroinvertebrates

There are five species of freshwater mussels found in Washington. Freshwater mussels are found in shallow habitats in permanent bodies of water, concentrating in areas with consistent flows and stable substrate conditions. Freshwater mussels rely on the movements of host fish

to reproduce and disperse. Their association with fish allows them to populate new areas. Highly migratory species such as Chinook Salmon (*Oncorhynchus tshawytscha*), Cutthroat Trout, and steelhead have been documented as host fish for freshwater mussels (WDFW 2024a). They are considered an excellent indicator of water quality (WDFW 2024a). Two of these species, quagga mussels (*Dreissena bugensis*) and zebra mussels (*D. polymorpha*), are highly invasive. Freshwater mussel species can be found throughout all nine ecoregions in Washington. There are 15 species of crayfish found in all freshwaters across Washington State, with signal crayfish (*Pacifastacus leniusculus*) being the only native species. Juveniles prefer shallow, weedy areas that provide protection from predators, while adults favor areas of deeper water (WDFW 2024j). Crayfish species can be found in waterbodies in all eight ecoregions within the study area.

There are eight species of freshwater aquatic snails in Washington. They occur in cold, shallow, slow-flowing streams, springs, and permanent seeps with high dissolved oxygen content. Egg masses can be found under rocks or in loose, stable cobble substrate away from the flowing current. *Juga* species exhibit seasonal upstream and downstream migrations (WDFW 2024a).

Benthic macroinvertebrates in freshwater are excellent indicators of the biological health and water quality of stream systems. Species include insects, crustaceans, mollusks, and worms that live in or near the streambed. Due to their limited mobility, they cannot escape exposure to pollutants and can integrate the effects of the stressors they are exposed to in freshwater drainages (EPA 2023).

3.2.4.4 Amphibians and turtles

Amphibians include frogs, toads, and salamanders. There are 25 native species of amphibians and five native species of turtles in the freshwaters of Washington (WDFW 2024k). Amphibians and turtles rely on still water such as ponds, wetlands, ephemeral pools, or slow-moving areas of rivers and creeks for breeding, egg laying, and juvenile rearing. Amphibians and freshwater turtles may migrate along waterbodies during wetter seasons. Within more arid regions, they may become residents in isolated waterbodies. Amphibian and freshwater turtle species are found throughout the eight ecoregions within the study area.

3.2.4.5 Aquatic invasive species

Changes in water conditions and habitat connectivity can alter the distribution and competitive advantage of invasive species. Invasive species can negatively impact native species through direct interactions like predation and competition and indirect actions like disease spread (NOAA 2024d). Invasive and or noxious weed species can also negatively affect native plant species through the introduction of invasive species that grow quickly and overtake native populations.

The American bullfrog (*Rana [Lithobates] catesbeiana*) is an invasive species that is approximately two times larger than Washington's native frogs. They are found in lowland permanent waterbodies such as wetlands, ponds, creeks, rivers, and lakes. Bullfrogs have been reported in lowland areas of all ecoregions in Washington except the Blue Mountains region.

The Columbia Plateau and Canadian Rockies Ecoregions have the most documented sightings (WDFW 2024a).

A major group of resident freshwater fish species that have been introduced to Washington freshwater habitats as game fish are centrarchids, or fish from the sunfish family including Smallmouth Bass (*Micropterus dolomieu*). Bass are opportunistic predators, and large individuals can prey heavily on juvenile salmon where their distributions overlap (Wydoski and Whitney 2003). Other abundant invasive fish species include Walleye (*Sander vitreus*), crappie (*Pomoxis* spp.), yellow perch (*Perca flavescens*), and members of the carp or bullhead family.

3.2.4.6 Aquatic state rare and species of concern

The Washington SWAP evaluation of species in 2015 resulted in 268 species being designated as SGCN, many of which are aquatic. Guidance for conservation of these species and their habitats is provided in the SWAP. If a green hydrogen facility would affect one of these species or their habitats, additional studies and conservation plans may be required. As the SWAP is to be updated in 2025, it is recommended that developers check the list for subsequent changes.

Furthermore, of the approximate 150 plants that are state threatened or endangered but not federally listed, the 230 state sensitive plants, and the 400 rare plant species designated by the DNR NHP that occur within Washington State, many are aquatic species. These aquatic rare species may occur in wetlands, marine shorelines, and floodplains, and adjacent to rivers, streams, and lakes. There are 27 rare marine algae species in Washington State, including species of red algae, seaweed and brown algae, and green algae (DNR 2012).

3.2.4.7 County aquatic sensitive species

Critical areas ordinances may designate additional aquatic species of local importance at the county and city levels that may warrant further mitigation, conservation, or consultation plans. Individual green hydrogen project developers will be required to determine the appropriate requirements for species and habitats plans at the local scale.

3.3 Potentially required permits

The following permits related to biological resources would be required for construction, operation, or decommissioning of green hydrogen facilities, if applicable.

3.3.1 Federal

- **CWA Section 404 Permit (USACE):** Required for activities that involve the discharge of dredged or fill materials in waters of the United States, including wetlands.
- **ESA Section 7 consultation (USFWS):** Issuance of a Department of the Army permit under CWA Section 404 is a federal action that requires interagency consultation with USFWS regarding terrestrial species under Section 7 of the ESA. Interagency consultation is performed to ensure that a proposed project would not jeopardize the existence of any listed species.

- **ESA Section 10 review (USFWS):** If take is determined likely to occur for ESA-listed species, Section 10 review would be required for the issuance of an incidental take permit.
- **Bald and Golden Eagle Protection Act compliance (USFWS):** If a project is likely to directly affect bald or golden eagle nesting sites, then an incidental take permit would be required as part of a project.
- **National Pollutant Discharge Elimination System Permit:** As part of a National Pollutant Discharge Elimination System (NPDES) permit, development and implementation of an erosion and sediment control plan (ESCP) and construction and operations stormwater pollution prevention plan (SWPPP) would be required. Best management practices (BMPs) in these plans would help reduce erosion and impacts to vegetation.

3.3.2 State

- **Coastal Zone Management Act Federal Consistency:** If the project is in one of 15 coastal counties with marine shorelines, this might be required.
- **CWA Section 401 Water Quality Certification (Ecology/EPA/Tribes):** Required for activities affecting a water of the United States, including wetlands, and needing a federal permit or license (e.g., USACE Section 404 permit). Verifies whether projects meet state water quality standards.
- **Hydraulic Project Approval (WDFW):** Required for projects in, near, or over state waters that use, divert, obstruct, or change the natural flow or bed of any of the salt or fresh waters of the state. Intended to ensure that construction is done in a way that protects fish and aquatic habitats.
- **Forest Practices Act application/notification (DNR):** If a proposed project involves conversion of forestland to non-forestry use, an application under the Forest Practices Act would be required. This application would be required in forested areas that have not been previously developed.
- **Chapter 90.48 RCW authorization (Ecology):** Impacts to non-federally regulated waters, including wetlands, may require authorization from Ecology pursuant to Chapter 90.48 RCW (Water Pollution Control Act).

3.3.3 Local

- **Critical Areas Permit:** Must be obtained for construction and development activities within designated critical areas regulated by local jurisdictions, including vegetated buffers adjacent to streams and wetlands, critical aquifer recharge areas, fish and wildlife conservation areas, and frequently flooded areas.
- **Shoreline Substantial Development Permit:** If a proposed project involves new development in a shoreline area that is regulated by the Washington SMA and the local Shoreline Master Programs, the action would require a Shoreline Substantial Development Permit.
- **Land Use Permit:** This permit may be required for land development actions or changes in land use regulated by local jurisdictions. The permit would require compliance with the local agency's critical areas ordinance.

- **Fill and Grade Permit:** This permit is required for construction projects that require movement of earth regulated by local jurisdictions. The permit requires consideration of erosion and sedimentation to surface waters in the vicinity of a proposed project.
- **Floodplain Development Permit:** Local agencies may require this permit for development within the 100-year floodplain. The developer must evaluate whether a proposed project would affect the flood elevation associated with the 100-year floodplain.
- **Noxious Weed List:** Owners are required to control and prevent the spread of noxious weeds within and from their property. A county-level noxious weed list will need to be consulted, and a vegetation survey must be conducted pre-construction. All BMPs must be followed.

3.4 Green hydrogen production facility

This section describes potential impacts of green hydrogen production facilities. For the purposes of the PEIS, the estimated footprint of a green hydrogen production facility, based on existing facilities in other areas, ranges from 1 acre to 10 acres, depending on the production method, type of storage facilities, and layout of external pipes and tanks, a parking area, and security fencing. The estimated height of structures is up to 100 feet.

A green hydrogen production facility would typically include a connection to the electricity grid to power all, or a portion of, the facility's equipment needs and buildings. Facilities typically connect to the main transmission line through distribution lines that can be up to 100 feet and between 1 and 8 miles in length, which would be determined by the project developer based on the distance between a selected site and existing electricity grid infrastructure. This technical appendix includes evaluation of impacts associated with distribution line connections to main transmission lines.

Off-site access roads may be needed to connect a facility to the existing state routes. Most of study area is less than 10 miles from a state route (63% within 1 mile and 99% within 10 miles). If needed, the project developer would determine the length of off-site access road needed, based on the distance between a selected site, existing road infrastructure, and coordination with state and local departments of transportation.

3.4.1 Impacts from construction and decommissioning

During site characterization, project-level evaluations may require baseline surveys of vegetation, habitat, and potential wildlife presence; water typing; and wetland delineation surveys for a site. These would map and characterize species and habitats for a specific area for impact analysis. Generally, there would be little to no modification of a site. It would involve minimal to no site disturbance except for potential ground disturbance from soil coring and geotechnical investigations. Site characterization activities would likely result in **less than significant** impacts to terrestrial habitats, terrestrial species, aquatic habitats, wetlands, and aquatic species.

Construction of green hydrogen facilities would occur in floodplains, upland areas, and near shorelines and would be similar to other industrial facilities. Impacts would range from 1 to 3 years. The footprint of the green hydrogen production facility would vary depending on the technology used and the capacity. The construction activities would also vary depending on the facility type, size, and site characteristics. These activities could affect a wide variety of aquatic and terrestrial species in the areas where they occur. Impacts from construction of a green hydrogen production facility would generally be greater, the less-developed the land. For lands with existing industrial or high-intensity uses, the impacts from construction of a green hydrogen production facility at the same site may be limited.

Green hydrogen production facilities would be decommissioned after their useful life, which could be up to 50 years, depending on the type of facility. A developer may prepare a decommissioning plan as part of a proposal. Some cities and counties require financial security as part of a decommissioning plan.

3.4.1.1 Terrestrial habitats

Some facilities may be built on previously disturbed areas or replace existing facilities. Some industrial lands may not have been previously developed and may have intact terrestrial habitat. Impacts may occur from the fragmentation, degradation, or loss of habitat associated with ground disturbance from construction activities associated with site preparation (excavation; blasting; vegetation removal; grading; installation of secure fencing and road access gates, temporary work buildings, and storage facilities for materials and tools and equipment) and facility construction (building the foundation, framework including internal components and structural support, roofing, and siding). Land clearing, excavation, grading, and fill placement activities could alter existing habitats or habitat connectivity and may introduce invasive or noxious weed species. Green hydrogen facility development could result in erosion from stormwater runoff, fugitive dust from construction vehicles, increased human access, spills, soil compaction or removal, or sedimentation that may degrade or alter terrestrial habitats. Adjoining habitats may also be affected by habitat fragmentation and degradation, as well as by disturbances from humans and construction-related noise, dust, and nighttime lighting.

The effects of habitat fragmentation, degradation, and loss are more readily observed in vegetation communities and wildlife but can also impact ecological processes. The construction of roads, staging areas, new structures, buildings, and other infrastructure disrupts the connectivity between formerly contiguous habitats resulting in a reduction in habitat interspersion and complexity. This can result in changes to energy flow and water and nutrient cycles. The reduction of total intact habitat area can also isolate communities, which could affect population sizes and dispersal rates (Wilcox and Murphy 1985; Wilcove et al. 1986).

Terrestrial habitat-related functions (e.g., biotic and abiotic functions) would also be adversely affected by construction. Impacts on biotic functions would include reduced plant growth and reproduction and reduced opportunities for wildlife species to use the habitat for shelter, foraging, and breeding. Abiotic functions would be affected because of vegetation loss.

Adjoining habitats may also be affected by habitat fragmentation, degradation, or loss, as well as by disturbances from humans and construction-related noise, dust, and nighttime lighting. Construction activities have been found to decrease the quality of habitat for forest interior bird species for distances up to 300 feet from the edge of the right-of-way, for roads or electrical distribution lines, for example (Anderson et al. 1977).

Generally, the significance of habitat fragmentation, degradation, or loss associated with construction of green hydrogen production facilities depends on the amount of area disturbed, the types of habitats that would be affected, and the capacity or opportunity for the disturbed habitat to recover. Some habitat types may take a much longer time to recover than others, may never recover, or may change to a different, potentially less valuable habitat type. The facility size and configuration, the number and types of equipment required, the locations and extents of access roads, and the amount of lighting, noise, and dust generation also contribute to the magnitude of impacts. These factors determine whether the construction impacts to terrestrial habitat would be short or long term.

Wildlife migration routes are unlikely to be affected by the development of green hydrogen production facilities, as the facilities would be sited in industrial lands outside of these corridors. However, depending on the proximity of the facility to the migration route, indirect effects from fugitive dust, noise, and traffic could be experienced by wildlife using those corridors.

Most designated critical habitat for listed terrestrial species is not on industrial land. A very small amount of critical habitat for the northern spotted owl intersects the study area in Skamania County but it is expected that this could be avoided with siting and design considerations.

The special status habitats of concern analyzed (shrubsteppe, forest, westside prairie, and riparian areas) could be adversely affected by construction. Potential impacts could include habitat disturbance, degradation, alteration, or loss, depending on siting, longevity of activities, facility footprint, and type of construction activities required. The degradation, alteration, or loss of these areas could reduce the quantity and quality of available shelter and foraging opportunities for species of concern and diminish the system's ability to return to the pre-construction state, potentially causing increased loss of special status species. However, with siting considerations, minimization measures, and mitigation measures, impacts to special status habitats could be reduced.

Projects that potentially occur within shrubsteppe core areas or growth opportunities identified in WSRRI (WDFW 2024b) areas may result in a higher likelihood of adverse impacts on shrubsteppe habitats and species. Therefore, they may require additional siting considerations and mitigation measures to reduce and minimize impacts on these special status habitats and the species they support.

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction and decommissioning activities of green hydrogen

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 impacts** on terrestrial habitats. The facility site would not be restored to pre-existing conditions only if the facility owner, permitting authority, and regulatory agencies agree on alternate actions. Similar to construction impacts, the duration and magnitude of impacts from decommissioning would depend on the facility type, size, and location.

3.4.1.2 Terrestrial species

Special status terrestrial species may be adversely affected by construction activities, depending on facility size, siting, construction activities, timing, and longevity. Plants that are federally or state listed, rare, and species of greatest conservation need could be impacted by construction of green hydrogen production facilities through grading and removal of vegetation for site preparation, changes in soil characteristics, erosion, deposition of fugitive dust, and spills from construction-related chemical pollutants.

Removal of non-special status vegetation can increase surface runoff, resulting in increased erosion and transport of sediment into adjacent vegetation communities. This could lead to long-term adverse effects such as altered soil characteristics, changes in hydrology, and the establishment of non-native or invasive plants. Impacted plant communities could undergo short- or long-term changes in species abundance, composition, and distribution. Mortality of vegetation could cause loss of habitat for other species and increase the establishment of invasive plants, further altering the landscape. The re-establishment of vegetation around the green hydrogen production facilities and associated infrastructure would also depend on the climate, soils, and plant community types at a facility location. Some vegetation communities in more arid locations, such as shrubsteppe habitat, may be more challenged to recover over time. This could be of particular concern for listed plant species that could occur in those habitats, such as Umtanum desert buckwheat (*Eriogonum codium*), Spalding's catchfly (*Silene spaldingii*) and White bluff's bladderpod (*Physaria douglasii ssp. tuplashensis*) (Table 3).

Special status terrestrial wildlife species may be affected by site clearing and grading, building construction, access road construction, and the movement of construction vehicles and equipment. The magnitude of potential impacts on wildlife also depends on the length of time the construction effect would persist, the time of day or night, and the season of the wildlife activity (e.g., nesting, wintering, migration). The types of impacts associated with construction activities are generally related to habitat disturbance (see Section 3.4.1.1) and wildlife disturbance, injury, or mortality. Changes in habitat may lead to the introduction of invasive or more opportunistic non-native wildlife species, which could lead to further habitat and species loss.

In general, terrestrial wildlife species that are less capable of avoiding disturbance (e.g., non-winged invertebrates, reptiles, juvenile mammals, burrowing species, ground-nesting birds) would be more severely impacted than more mobile wildlife species (e.g., winged

invertebrates, most birds, adult mammals). Special status species that are less capable of avoiding disturbance may include the Mazama pocket gopher (*Thomomys mazama*) and the Washington ground squirrel (*Urocitellus washingtoni*). Less-mobile species are at higher risk of injury or mortality from construction vehicles or equipment, although these aspects of construction are a threat to all wildlife in the construction area. Furthermore, there are known populations of Kincaid's lupine (*Lupinus sulphureus ssp. kincaidii*) within and adjacent to the study area in Lewis County. These populations should be avoided through siting and design considerations.

Removal of vegetation during the breeding season could result in destruction of nests and injury or death to birds or eggs. Construction activities resulting in noise, nighttime lighting, erosion, fugitive dust, vibration, and altered terrestrial habitat may also cause temporary disruption in foraging, nesting, breeding, rearing, and migration activities for some terrestrial wildlife species. Spills during equipment refueling and release of stored fuel or hazardous materials could also adversely affect wildlife if present in the area.

Construction of green hydrogen facilities, distribution lines, and associated access roads could result in new edge habitats. Adverse effects may include increasing predation of animals in the vicinity of edges, altering wildlife distribution and movement patterns, and reducing contiguous habitat size, resulting in possible modification of foraging, nesting, breeding, rearing, and migration activities.

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction and decommissioning activities of green hydrogen production facilities would result **less than significant impacts** to terrestrial species, including special status species. Activities that affect species viability or the mortality of any individual species, or disturbance that disrupts successful breeding and rearing behaviors would result in **potentially significant adverse impacts** on terrestrial species. Similar to construction impacts, the duration and magnitude of impacts from decommissioning would depend on the facility type, size, and location.

3.4.1.3 Aquatic habitats and wetlands

Aquatic habitats

Green hydrogen production facility construction activities that may affect aquatic habitats and wetlands include site clearing and grading, constructing access roads, excavating, and building infrastructure. The impacts to aquatic habitats and wetlands would likely be less than those to terrestrial habitats, as the facilities would generally not be sited directly on aquatic habitats. However, they may be near shorelines.

Water would be needed for various activities during site characterization and construction, including concrete preparation, water for crews (potable and wastewater), vehicle washing, and dust control. Depending on the amount of water used and where it is sourced, these activities could reduce the quality and quantity of water available in nearby aquatic systems.

Surface water flow rates and volumes of water runoff reaching surface waters could be altered during facility construction. Increases in impervious and hardened surfaces could limit infiltration, resulting in increases in stormwater flows, either temporarily or permanently, into nearby aquatic ecosystems, as discussed in the *Water Resources Technical Appendix*.

Facility construction could impact stream buffers or permanently alter local drainages and drainage patterns, which could alter the quantity of surface waters in nearby water bodies. Additionally, groundwater withdrawals, if necessary for construction, could interface with surface waters and reduce water quantity. Groundwater extraction for construction uses could result in changes in drainage patterns and the alteration of intermittent streams. Improperly designed wells could create conduits for poor-quality groundwater. The removal of riparian vegetation during site clearing could affect aquatic habitats by reducing the area of shading over the water, leading to higher water temperatures. Other benefits of riparian vegetation for aquatic habitat that could be lost include moderation of water chemistry and addition of leaf litter, wood, and insects that fall into the water, which provide habitat structure and food for aquatic animals. Furthermore, if pesticides or herbicides are used for vegetation removal, these chemicals could be transported into aquatic ecosystems, degrading water quality. Removal of native riparian vegetation could also facilitate colonization of the area by noxious weeds.

Hazardous or regulated chemicals used during construction could also affect aquatic habitats and species if released into adjacent waterbodies. The level of impact would depend on the type and volume of chemical entering the waterway, waterbody characteristics, and the location of the release. Hazardous or regulated chemicals would generally not be expected to enter waterbodies if equipment and fueling locations are not used near aquatic habitat.

Waterborne noise is primarily generated when a vibrating component is submerged in a body of water. The PEIS assumes that there is no dock construction. No such components are expected be used in the construction of green hydrogen production facilities. Transmission of airborne noise to water is very limited due to the difference in density between the two mediums, especially for sound sources that are not located directly over a body of water. Predicted airborne noise levels from the facility are expected to result in negligible waterborne noise at any distance.

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction and decommissioning activities of green hydrogen production facilities would result in **less than significant impacts** to aquatic 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 range from **less than significant to potentially significant adverse impacts** on aquatic habitats. The facility site would not be restored to pre-existing conditions only if the facility owner, permitting authority, and regulatory agencies agree on alternate actions. Similar to construction impacts, the duration and magnitude of impacts from decommissioning would depend on the facility type, size, and location.

Wetlands

Impacts to hydrological functions of wetlands and their ability to provide habitat for terrestrial and aquatic species could occur during site characterization and construction of green hydrogen production facilities. Wetlands may need to be cleared and filled to establish initial site access for geotechnical surveys during site characterization. Wetlands may also need to be cleared and filled for the construction of staging and laydown areas, permanent site access routes, and other supporting infrastructure.

Some facilities may be built on undisturbed land that may not have been previously developed and may have intact aquatic habitat such as wetlands. Impacts may occur from the fragmentation, degradation, or loss of habitat associated with ground disturbance from construction activities associated with facility development (grading and constructing for staging areas and building equipment, installing electrical power facilities and buildings, erecting fencing and road access gates, constructing or modifying roads). These activities could impact wetland ecosystems and amphibious species such as frogs, toads, newts, salamanders, and beavers. Land clearing, excavation, grading, and fill placement activities could alter existing habitats or habitat connectivity and may introduce invasive species. Green hydrogen facility development could result in erosion from stormwater runoff, fugitive dust from construction vehicles, increased human access, fossil fuel spills, soil compaction or removal, or sedimentation that may degrade or alter wetland habitats.

Soil disturbance from earthwork to establish site access, develop the facility footprint, create laydown areas, construct or improve road and site access, install fencing, construct buildings, install powerlines, and revegetate the site could affect wetlands and wetland buffers and their ability to provide habitat for terrestrial and aquatic species. Wetland functions (e.g., absorb floodwaters, filter contaminants, reduce erosion, and support groundwater and surface water) may be reduced from these activities. Degradation from sedimentation and reductions in water quality and quantity of surface and groundwater sources feeding wetlands could occur (see the *Water Resources Technical Appendix*). The reduction of wetland function could degrade, alter, or cause the loss of wetland habitat and adversely affect the species that depend on wetlands.

Alteration of drainage patterns during construction could alter surface or groundwater connections and could directly introduce pollutants and sediments or alter the depth, timing, and frequency of surface waters flowing into wetlands. Increases in impervious and hardened surfaces may limit surface water infiltration, resulting in a decrease of groundwater availability for nearby wetlands. Additionally, groundwater withdrawals necessary for construction could interface with surface waters and reduce water availability for wetlands (see the *Water Resources Technical Appendix*). This could potentially reduce available wetland habitat and wetland habitat quality.

Roads, distribution lines, and other infrastructure constructed in the vicinity of wetlands could change surface drainage patterns and introduce sediments, pollutants, or noxious weed seed or propagules into adjacent wetlands via runoff. Most impacts to wetlands could be avoided or minimized by siting these outside of wetlands. Through compliance with laws and permits, and

with implementation of actions that could avoid and reduce impacts, construction and decommissioning of green hydrogen production facilities would result in **less than significant impacts** to wetlands. The facility site would not be restored to pre-existing conditions only if the facility owner, permitting authority, and regulatory agencies agree on alternate actions. Similar to construction impacts, the duration and magnitude of impacts from decommissioning would depend on the facility type, size, and location.

3.4.1.4 Aquatic species

Green hydrogen production facility construction activities that may affect aquatic habitats and wetlands include site clearing and grading, constructing access roads, excavating, and building infrastructure. The types of impacts associated with construction activities are generally related to habitat disturbance (see Section 3.4.2.3) and wildlife disturbance, injury, or mortality.

Similar to aquatic habitats and wetlands, impacts on aquatic species are likely to be less than those for terrestrial species. For example, if removal of vegetation leads to increased water temperatures, dissolved oxygen levels may decrease, which could alter the preferred ecological conditions for many aquatic species. Surface water temperature can affect embryonic development, juvenile growth, migration of adults, susceptibility to disease, and interspecies competition. Salmonids such as Bull Trout (*Salvelinus confluentus*), Dolly Varden (*S. malma*), and char (*Salvelinus* spp.) have narrow windows of temperature tolerance, while species such as suckers and dace have less-stringent temperature criteria (Ecology 2024).

Construction of access roads through aquatic habitat, resulting in vehicle and foot traffic, could injure or kill aquatic organisms, introduce invasive or noxious weeds, and disturb aquatic habitats adjacent to a facility site. Access roads that cross streams would obstruct fish passage if culverts or low-water crossings are not properly installed. Vehicle traffic could result in the accumulation of cobbles in fish passages that prevents fish from moving freely throughout the stream. This would result in the disturbance of migration, foraging, and rearing behavior. Species most likely to be affected include migratory fish species such as salmon, steelhead, and lamprey, and species that prey upon these, such as SRKW.

If spills occur, pollutants could enter waterbodies and cause injury or mortality to aquatic species. Special status species could be impacted from the degradation or loss of aquatic habitats (Table 4).

As mentioned above, waterborne noise is anticipated to be negligible during construction and would not cause adverse impacts to aquatic species.

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most construction and decommissioning activities of green hydrogen production facilities would result in **less than significant impacts** to aquatic species, including special-status species. Activities that affect species viability or the mortality of any individual species, or disturbance that disrupts successful breeding and rearing behaviors would range from **less than significant to potentially significant adverse impacts** on aquatic species. Similar

to construction impacts, the duration and magnitude of impacts from decommissioning would depend on the facility type, size, and location.

3.4.2 Impacts from operation

3.4.2.1 Terrestrial habitats

Impacts from the operation of green hydrogen production facilities and ongoing maintenance activities include probable adverse impacts to terrestrial habitats from the long-term effects of habitat fragmentation, degradation, or loss. Adjacent habitats could also be affected by the long-term effects of habitat fragmentation, degradation, or loss, as well as by disturbances from humans and noise generated from the facility.

The loss of habitat or division of habitat into smaller and more isolated fragments could result in long-term changes in species composition or structure and reductions in terrestrial biodiversity that may lead to the degradation of ecosystems. The higher the quality of habitat affected, the greater the impact from operations and maintenance. Tree or shrub removal results in increased light levels and reduced soil moisture, and favors shade-intolerant species, causing further changes to habitat dynamics. Additional adverse impacts could result from alteration of natural fire patterns from fire suppression in and adjacent to facility sites.

The introduction and spread of invasive vegetation from vehicle and human disturbance could also result in long-term impacts on terrestrial habitats. Vehicle movements and trampling by humans could lead to soil erosion and affect the rate of rainfall interception and evapotranspiration, as well as alter water penetration, which affects soil moisture and surface and subsurface flows. Oil or contaminant spills from maintenance activities could also adversely affect special terrestrial habitats. This could adversely affect the four special habitats at highest risk of potential impacts from green hydrogen facilities identified in Section 3.2.1, potentially degrading and causing the loss of these important habitats and the special status species they support.

While there is potential for the development of these facilities to impact migratory species by collisions and impacts from nighttime light pollution, green hydrogen production facilities generally would be unlikely to affect the long-term persistence of existing wildlife migration corridors if constructed in a previously disturbed location. The operation of these facilities would not result in such a disturbance that it would cause migratory birds to change their flight trajectories and would therefore be unlikely to have adverse impacts on the Pacific Flyway. However, if green hydrogen facilities are constructed in a previously undisturbed environment, it has the potential to affect migratory species beyond the up to 50 years of operation. Wildlife may use these areas less frequently due to the increased presence of human and related disturbance from increased noise, light, and vehicular traffic that would occur during operation and maintenance of the facility. As a result of habitat disturbance from facility development, the introduction of non-native, invasive animal species could impact native species through resource competition and changes in food web dynamics and biodiversity. Ungulate migration corridors would be adversely affected, particularly if a facility is sited where physiographic

constrictions (e.g., geologic formations, topography, development) force herds through relatively narrow corridors (Berger 2004). These impacts are not likely for facilities on developed industrial lands, but impacts may occur for facilities on previously undeveloped lands.

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most operation activities of green hydrogen 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.

3.4.2.2 Terrestrial species

Operations could affect the viability of plant communities re-establishing within and adjacent to green hydrogen production facilities as a result of mowing and vegetation maintenance, application of herbicides, trampling and soil compaction from humans and vehicles, and fire suppression. Increased human activity also increases the risk for damage to adjacent vegetation communities.

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 could 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 of, or seed dispersal agents for, plants within vegetation communities. These factors could lead to extirpation of native plant species and vegetation communities, including those that are special status.

Even if adjacent habitats remain unaffected, wildlife may use these areas less frequently due to the increased presence of human and related disturbance from increased noise, light, and vehicular traffic that would occur during operation and maintenance of the facility. As a result of habitat disturbance from facility development, the introduction of non-native, invasive animal species could impact native species through resource competition and changes in food web dynamics and biodiversity.

Wildlife injury or mortality due to vehicle collisions would likely decrease during operation because vehicle activity would likely be less frequent compared to construction. However, species could still experience collisions with vehicles and facility fences. Depending on the size and siting of the facility, special status species could experience disturbances to foraging, breeding, and nesting habitats. Spills of oil and contaminants, and the spray of herbicides or pesticides could cause injury or mortality of special status species as well as increase the spread of invasive species, further degrading habitat for wildlife.

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most operation activities of green hydrogen production facilities

would result in **less than significant impacts** to terrestrial species, including special status species. Activities that affect species viability or the mortality of any individual species, or disturbance that disrupts successful breeding and rearing behaviors would result in **potentially significant adverse impacts** on terrestrial species.

3.4.2.3 Aquatic habitats and wetlands

Aquatic habitats

Resulting levels of turbidity and sedimentation, and changes to temperature and oxygen regimes altered by facility construction activities could continue to affect aquatic habitat and species during the operational period.

During operations, potential impacts from the use of motorized equipment and runoff of surface soils would be minimized through limiting the amount of maintenance activities that occur near riparian and aquatic habitat. The risk of waterbody contamination from hazardous materials used in site maintenance could be minimized through restriction of machinery use and herbicide and pesticide application near waterways.

Electrolysis, steam-methane reforming (SMR), and bio-gasification processes create contaminants that could degrade water quality. Bio-gasification from certain gasification feedstocks may contain sulfur, electrolysis requires demineralized water, and SMR creates wastewater that could include biocides. Bio-gasification storage and treatment would create the potential for pollutants to inadvertently enter surfaces waters and degrade water quality. Storage and treatment of fossil fuels such as gasoline and other petroleum products, chemical constituents, and byproducts would create the potential for pollutants to enter surface waters and degrade water quality. The degradation of water quality could adversely affect aquatic habitats and wetlands and, in turn, the species that depend on them.

Production of green hydrogen and operation of associated facilities could result in certain emissions as byproducts, which could be transported to receiving waters through atmospheric deposition (see the *Air Quality and Greenhouse Gases Technical Appendix*). Green hydrogen production that is dependent upon surface water diversions could affect the temperature of surface waters because of potential reductions in flows and volumes. Electrolytic green hydrogen facilities use large amounts of water. Potential annual ranges of water requirements for electrolysis and SMR production range from slightly over 2 acre-feet to nearly 900 acre-feet per year, depending on the size of the facility (see the *Water Resources Technical Appendix*). Furthermore, green hydrogen production facilities require water for potable and sanitary water supply needs as well as for irrigation of vegetation and other miscellaneous facility maintenance actions. If surface or groundwater is diverted for green hydrogen production facility operation and maintenance activities, that would reduce streamflow from water intake areas, potentially causing the loss of aquatic habitats, which could lead to adverse effects on the species that depend on them (see the *Water Resources Technical Appendix*). The extent of the impacts on aquatic ecosystems depends on the facility size, type, and surrounding hydrologic conditions.

The PEIS does not evaluate the transportation, distribution, or end uses of green hydrogen, or associated improvements to in-water facilities such as docks or port infrastructure. This evaluation would be done during future project-level environmental review (see the *Transportation Technical Appendix*).

Impacts could be minimized through the proper management of stormwater and sanitary wastewater systems and the implementation of BMPs for the use and storage of chemical and potentially hazardous materials.

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most operation activities of green hydrogen production facilities would result in **less than significant impacts** to aquatic 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 range from **less than significant to potentially significant adverse impacts** on aquatic habitats.

Wetlands

Similar to the impacts described above, potential hydrological and water quality impacts to wetlands could occur during routine operations and maintenance including washing and cleaning, which would mobilize potential pollutants into nearby wetlands. Potential for pollutants to enter wetlands during stormwater discharges and degrade their function could occur due to utilization of impervious surfaces for buildings and access roads, combined with on-site chemical storage and the presence of maintenance vehicles and equipment on the site.

Water quality impacts on wetlands adjacent to facility infrastructure could occur from spills of pesticides, fuel, or vehicle fluids; from stormwater discharge; or from other hazardous materials used or stored at the facility. Such impacts could affect a wetland's ability to provide habitat for terrestrial and aquatic species. Similarly, if not managed property, runoff from parking areas, buildings, and other facility infrastructure could also degrade water quality in adjacent wetland areas, as could discharges from undersized or poorly maintained septic systems if such systems are used to manage sanitary wastewater at the facility. Maintenance activities, such as mowing and vegetation removal, could also impact water quality and quantity through discharge of chemicals and alteration of wetland boundaries. If wetlands are located along access roads or on other portions of the facility where landscape maintenance is required, activities such as routine mowing, woody vegetation removal, and access road maintenance could alter the existing habitat (e.g., convert forested or scrub-shrub wetlands to herbaceous wetlands). Such activities could also affect wetlands through the introduction of invasive species or alteration of drainage patterns and modification of the wetland water regime.

Employee and fleet vehicles and other maintenance equipment utilized during operation and maintenance would increase the likelihood that pollutants would be discharged and enter wetlands. Pesticide and herbicide use could result in the transport of undegraded chemicals into nearby wetlands and buffers.

Potential sediment transport to nearby wetlands, resulting in decreased water quality and function, could occur as a result of periodic ground disturbance. Surface and groundwater water withdrawal to support green hydrogen production and facility operations could reduce the amount of water available to support wetlands, which could result in the loss and degradation of wetland habitat and the species they support.

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, operation and decommissioning activities of green hydrogen production facilities would result in **less than significant impacts** to wetlands.

3.4.2.4 Aquatic species

Impacts to aquatic species would depend on facility location, type, and size. The type of impacts associated with operation activities are generally related to continued habitat disturbance (see Section 3.4.2.3). Alterations to flow regimes, water quality, and water quantity could cause disturbance, injury, or mortality to aquatic species. For facilities with high water demand in dry areas, the likelihood of potential adverse impacts to both aquatic habitats and species would increase.

Erosion, runoff, fossil fuel spills such as gasoline and other petroleum products, and pollutants could adversely affect water quality. Regularly used maintenance roads and sites of foot traffic could affect aquatic habitat and species by continuing to fragment fish passage corridors. Activities such as routine mowing, woody vegetation removal, and access road maintenance adjacent to aquatic habitats and wetlands could also directly impact aquatic species using those ecosystems and alter the existing habitat through fossil fuel spills and habitat degradation. Facility lighting during operations also has the potential to affect aquatic species.

Through compliance with laws and permits, and with implementation of actions that could avoid and reduce impacts, most operation and decommissioning activities of green hydrogen production facilities would result in **less than significant impacts** to aquatic species, 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 range from **less than significant to potentially significant adverse impacts** on aquatic species.

3.4.3 Actions to avoid and reduce impacts

Because this is a programmatic environmental review of green hydrogen facilities, site-specific mitigation actions would be developed during project-specific reviews and permitting for each facility proposed in the future. The following sections describe relevant actions that could avoid or reduce impacts from construction, operation, or decommissioning of facilities and whether significant impacts are likely to be mitigated to less-than-significant levels.

3.4.3.1 Siting and design considerations

This section details siting and design considerations. Siting and design considerations are actions that should be taken by a developer in developing a facility design or considering a site. Early coordination with agencies is intended to result in the avoidance, minimization, and/or

mitigation of potential resource impacts. The siting and design considerations described under the section below may also apply to aquatic habitats and species and wetlands.

Terrestrial habitats and species

- Site projects on disturbed lands (e.g., those that are developed, cultivated, or otherwise disturbed by roads or other corridors), except where such lands host significant aggregations of wildlife or are used by state or federally listed species.
- If existing information suggests the probable occurrence of state or federal threatened, endangered, or sensitive-status species on the project site, recommend focused surveys during the appropriate season to determine the presence or likelihood of presence of the species. If special-status species are observed during surveys, avoid inhabited areas such as nests, denning sites, or critical habitat
- Site and design the facility to avoid priority habitats.
- Conduct surveys for special-status plant species prior to clearing activities in areas of increased potential presence, including all priority habitat. If special-status plant species are observed during preconstruction surveys, avoid individuals and populations.
- Place linear facilities (such as access roads) in or adjacent to existing disturbed corridors in order to minimize project footprint, habitat fragmentation, and habitat degradation.
- Contact appropriate agencies early to identify potentially sensitive ecological resources, including but not limited to aquatic habitats, wetland habitats, unique biological communities, crucial wildlife 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.
- Screen potential project sites through local, state, and federal mapping resources to identify sensitive habitat and wildlife areas and critical areas such as wetlands and steep slopes, priority habitats, and sensitive species occurrence locations.
- Design the project to avoid and minimize impacts to surrounding landscape and landscape connectivity. Use mapping data to design and site the project to avoid impacts on important, sensitive, or unique habitats identified in predisturbance surveys.
- Establish buffer zones around sensitive habitats and exclude or modify project facilities and activities in those areas.
- Complete preconstruction surveys if native habitat is present on site.
- Minimize habitat loss, habitat fragmentation, and resulting edge habitat due to project development. Habitat fragmentation could be reduced by consolidating facilities (e.g., access roads and utilities could share common rights-of-way), reducing the number of access roads to the minimum amount required, minimizing the number of stream crossings, and locating facilities in areas where habitat disturbance has already occurred.
- Locate staging and parking areas within the facility site to minimize habitat disturbance in areas adjacent to the site.
- Cap or otherwise modify vertical pipes and piles to prevent cavity-dwelling and nesting birds from entering and entrapment of other small species.

Aquatic habitats, aquatic species, and wetlands

- Conduct an aquatic habitat survey of the site to identify surface waters, their drainage routes, and the potential habitat that they provide.
- 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 rights-of-way.
- Conduct all pre-construction surveys 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 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 surface water or groundwater withdrawals that affect sensitive habitats (e.g., aquatic, wetland, and riparian habitats) and any habitats occupied by special-status species.
- Minimize the impacts of stream crossings through design as required in Washington Administrative Code (WAC) 220-660-190 and local regulations.
- Use design and construction methods to avoid impacts to waters of the state. If impacts are unavoidable, reduce impacts when working below the OHWM by working during the dry season when no substantial rain is forecast.
- Avoid siting access roads and facilities near open water or other areas known to attract a large number of birds.
- Avoid siting and/or minimize disturbance in areas of known soil or groundwater contamination.
- Perform a wetland delineation on the site to identify and map any potential wetlands that may be present. Assess wetland functions and rate all on-site wetlands using the appropriate Washington Wetland Ratings System method (Ecology 2014) to determine their categories and local buffer requirements. Examine adjacent properties for the presence of off-site wetlands that could be affected by facility construction and operation, map their locations, and identify any off-site connections to surface waters.
- Avoid siting structures and roads within streams, wetlands, and their buffers; mapped floodplains and other frequently flooded areas; and critical aquifer recharge areas to the greatest extent practicable.
- Where stream and wetland impacts cannot be avoided, minimize impacts on water quality by working below the OHWM 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 [WDFW 2013]) and adhering to regulations, including WAC 220-660-190 (Water Crossing Structures).

3.4.3.2 Permits, plans, and best management practices

This section details potential permits, 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. The potential permits, plans, and BMPs described below may also apply to aquatic habitats and species and wetlands.

Terrestrial habitats and species

- Develop and implement a wildlife habitat management plan to avoid, minimize, or reduce/eliminate impacts in compliance with WAC 463-62-040 to achieve "no net loss of habitat functions and values." The plan should include but is not limited to the following:
  - Demonstrate compliance of the facility with the regulatory requirements of the Bald and Golden Eagle Protection Act.
  - Implement measures to protect birds (including migratory species protected under the Migratory Bird Treaty Act) developed in coordination with the appropriate federal and state agencies.
  - Implement measures to protect ground-nesting birds.
  - Implement measures to protect bats.
  - Implement measures to protect raptors.
- As part of an NPDES permit, develop and implement an ESCP and construction and operations SWPPP. BMPs in these plans would help reduce erosion and impacts to vegetation.
- For projects that require a federal permit or license, a habitat conservation plan might be required if the project needs an incidental take permit.
- Develop and implement a vegetation and weed management plan with input from the county or city prior to construction.
- Develop and implement a trash abatement plan that focuses on containing trash and food in closed and secured containers and removing them periodically to reduce their attractiveness to opportunistic species that could serve as predators on native wildlife and special-status animals.
- Cut trees and leave existing root systems intact where possible to help prevent erosion.
- Use down-shield lighting for permanent lighting at the buildings. Outdoor lighting would be sited, limited in intensity, shielded, and hooded in a manner that prevents the lighting from projecting onto adjacent properties, roads, and waterways.
- Turn off unnecessary lighting at night to limit attraction of migratory birds and bats. This includes using lights with timed shutoff, using downward-directed lighting to minimize horizontal or skyward illumination, and avoiding steady burning, high-intensity lights.
- Avoid evening and nighttime construction activities to the extent practicable to limit the impacts of construction noise to wildlife.
- Manage for low-maintenance vegetation (e.g., native shrubs, grasses, and forbs) and invasive species control, minimizing the use of herbicides near sensitive habitats (e.g.,

aquatic and wetland habitats), and using only approved herbicides consistent with state and local regulations and safe application guidelines.

- If cattle guards are identified for the design for new roads, ensure that they would be wildlife-friendly. Make improvements to existing ways and trails that require cattle to pass through existing fences, fence-line gates, new gates, and standard wire gates alongside them.
- Use noise-reduction devices to minimize the impacts on wildlife and special-status species populations.
- Instruct personnel on wildlife resource protection measures including (1) applicable federal and state laws (e.g., those that prohibit animal collection or removal) and (2) the importance of these resources and the purpose and necessity of protecting the resources.
- Limit vehicle speeds to 25 miles per hour on internal access roads to avoid wildlife collisions. Limit speeds in areas occupied by special-status animal species.
- Prepare a project-specific spill prevention and response plan (40 CFR 112).
- Time activities to avoid, minimize, or mitigate impacts on wildlife. The timing of activities should be coordinated with the authorizing federal and state agencies.
- Conduct seasonally appropriate walkthroughs prior to any ground-disturbing activity to ensure that important or sensitive species or habitats are not present in or near facility sites. Walkthroughs should be conducted by a qualified biologist or team of biologists and should include federal agency representatives, state natural resource agencies, and Tribal staff, as appropriate.
- Replant the facility site with native vegetation at spaced intervals to the extent possible to break up areas of exposed soil and reduce soil loss by wind erosion and use native seed mixes for revegetation and erosion control.
- Design perimeter fencing to minimize collision risk for wildlife. Chain-link fencing allows some small mammals through.
- Develop and implement an emergency management plan with input from with the local Fire Marshal.
- Develop a revegetation plan for decommissioning that describes methods, success criteria, monitoring, and reporting for revegetation of areas.
- Recontour the ground surface in areas where the foundations are removed following decommissioning to be similar to the pre-construction condition.
- For projects in shrubsteppe habitat, reference WDFW's WSRRI Long Term Strategy 2024–2054 document and online mapper (WDFW 2024b, 2024i) to identify potential mitigation sites and actions.
- Based on survey results, include mitigation measures to subgrade over excavation and fill, compaction, moisture conditioning, and minimizing disturbed areas.
- Minimize removal of native vegetation to reduce erosion and minimize invasion of non-native plants.
- Replant project areas with native vegetation to the extent possible to break up areas of exposed soil and reduce soil loss by wind erosion.

- Return temporarily disturbed areas to their original, preconstruction contours and conduct site restoration and revegetation measures before or at the beginning of the first growing season following construction.
- Conduct tree removal in a manner that minimizes disruption to remaining plants and shrubs.
- Implement measures to minimize noxious weed spread, including inspection of vehicles before entering construction areas, remaining on established roads as much as possible, and installation and use of weed wash stations or use of other appropriate equipment cleaning measures.

Aquatic habitats, aquatic species, and wetlands

- For projects that require a federal permit or license:
  - Section 404 Discharge of Dredge or Fill Material permit and 401 Water Quality Certification might be required.
  - Coastal Zone Management Act Federal Consistency might be required if the project is within one of the 15 coastal counties.
- Construction on a floodplain may require a Floodplain Development Permit. As needed, a developer would consult with the local government's floodplain administrator and obtain a Floodplain Development Permit.
- Constructing a facility near a wild and scenic river could require Section 7 consultation with the river-administering agency. As needed, a developer would consult with the river-administering agency under the Wild and Scenic Rivers Act.
- Constructing structures in or over navigable waters of the United States could require consultation with USACE under Section 10 of the Rivers and Harbors Act. As needed, a developer would obtain authorization from USACE.
- As needed, a developer would obtain shoreline permits.
- Obtain hydraulic project approval permits as needed and as informed by discussions with WDFW in accordance with WAC 220-660-050.
- Design and install culverts in accordance with WDFW fish passage requirements and NOAA Fisheries.
- Reduce water quality impacts by minimizing removal of native vegetation.
- Reduce erosion by revegetating disturbed areas using an appropriate mix of native vegetation.
- Store fuel and maintain all vehicles and other heavy equipment (when not in use) in a designated upland staging area located a minimum of 150 feet away from any stream, water body, or wetland or where any spilled material cannot enter natural or human-made drainage conveyances.
- Confirm that any vehicle or mechanized equipment to be operated within 150 feet of wetlands is clean (e.g., power-washed) and does not have fluid leaks before the contractor mobilizes heavy equipment to the site. Inspect equipment and tanks for drips or leaks daily and make necessary repairs within 24 hours.

- In gentle terrain or where more than 150 feet from water bodies or wetlands, dispose of excess material generated from access road work in a stable upland site approved by the environmental lead. Smooth to match adjacent grades and seed for stability.
- In steep terrain or where less than 150 feet from water bodies or wetlands, haul excess material off site.
- To the extent practicable, avoid creating excessive slopes during construction of green hydrogen facilities.
- As feasible, avoid altering existing drainage systems, especially in sensitive areas such as erodible soils or steep slopes.
- Avoid creating hydrologic conduits between two aquifers.
- If construction occurs near or within groundwater recharge areas, monitor activities to reduce the potential for contamination.
- Implement water conservation during all construction activities, to the extent practicable (e.g., use less water-intensive methods of dust suppression, reuse site water):
    - Avoid use of polyacrylamide dust-control methods near surface water features.
- Ensure that wash-water does not contain additives and is not discharged into surface waters or groundwater.
- If a stream crossing(s) is proposed, develop final construction details in consultation with WDFW and Ecology.
- If green hydrogen facilities are sited in a floodplain, design structures to not restrict or redirect flows from their natural flow paths.
- If impervious surfaces such as roads are placed in the floodplain, develop measures to mitigate for the change in floodplain storage.
- If the facility has an aggregate 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 plan is required to prevent spills during construction and operation and to identify measures to expedite the response to a release if one were to occur. The plan would be prepared in consultation with Ecology and pursuant to the requirements of 40 CFR 112, Sections 311 and 402 of the CWA, Section 402 (a)(1) of the Federal Water Pollution Control Act, and RCW 90.48.080.
- Impacts to non-federally regulated waters and wetlands may require authorization from Ecology pursuant to Chapter 90.48 RCW.
- Impacts on federally regulated wetlands would require authorization under CWA Section 404 through USACE and a CWA Section 401 Water Quality Certification from Ecology.
- Impacts on wetlands and their associated buffers may require authorization under local critical areas ordinances.
- Development and implementation of wetland restoration and compensatory mitigation plans (using the Wetland Mitigation in Washington State guidance [Ecology et al. 2021]) may be required if unavoidable impacts to wetlands are proposed.

Additional mitigation measures to address potentially significant impacts

Terrestrial habitats and species

- Develop and implement a wildlife habitat mitigation plan to mitigate for unavoidable adverse impacts on important ecological resources. Request input from WDFW to determine appropriate mitigation. The plan should include measures that mitigate for the following unavoidable impacts:
  - Temporary impacts: revegetation, soil stabilization, and erosion reduction measures
  - Permanent impacts: mitigation and monitoring to address any significant impacts on the permanent loss of priority habitats that may be habitat for special-status plant and animal species

3.5 Green hydrogen production facility with co-located battery energy storage system (BESS)

This section describes potential impacts of green hydrogen production facilities with up to two co-located BESS containers. The BESSs would be used to balance loads or to provide up to 15% of power in case of an outage or power quality deviation. One BESS would provide 2.85 megawatts of electricity for 4 hours (a capacity of 11.4 megawatt hours or 11,400 kilowatt hours). Each container would be approximately 60 by 12 feet wide and 10 feet tall.

3.5.1 Impacts from construction, operation, and decommissioning

The potential construction, operation, and decommissioning impacts to biological resources described for green hydrogen production facilities would also apply to green hydrogen production facilities co-located with up to two battery energy storage systems (BESS). For example, a large-scale electrolytic green hydrogen facility is expected to have one container, typically 40 feet by 8 feet by 8.5 feet. It would be installed on concrete foundations within a fenced area or within warehouse-type enclosure with secondary containment. The footprint of a facility would slightly increase with the addition of BESSs, but the potential impacts would remain similar to those described in Section 3.4.

The presence and use of a BESS at a green hydrogen production facility would add another stormwater consideration and potentially another regulated element to be included in an industrial SWPPP. BESSs would require heating, ventilation, and air conditioning units, which could generate increased noise that could affect species.

The potential impacts from construction, operation, and decommissioning of a facility with BESSs on terrestrial habitats and species, aquatic habitats and species, and wetlands would be the same as those described in Section 3.4.

3.5.2 Actions to avoid and reduce impacts

The same actions to avoid and reduce impacts (Section 3.4.3) would also apply to this facility type, with the additional measure to site the BESS away from streams, wetlands, and other water resources.

3.6 Green hydrogen storage facility (gas or liquid form)

This section describes potential impacts of green hydrogen storage facilities. A green hydrogen storage facility could store hydrogen in gas or liquid form. Gaseous hydrogen would be stored in stationary, aboveground, cylindrical storage systems, each of which employs different construction materials to achieve maximum working pressure ratings. Liquid hydrogen would be stored in double-walled, vacuum-insulated cryogenic storage tanks. The footprint of storage facilities would depend on the amount of hydrogen needed to store but would be less than 1 acre. This includes the storage tanks, separation space between tanks (if more than one), on-site access roads, and ancillary equipment.

A green hydrogen storage facility may be co-located with a green hydrogen production facility, as a stand-alone facility, transport terminal, or an end-use location such as an industrial facility or fueling facility. For purposes of the PEIS, green hydrogen storage facilities are expected to be located in areas with similar biological resources as the production facility.

3.6.1 Impacts from construction, operation, and decommissioning

The potential construction, operation, and decommissioning impacts to biological resources described for green hydrogen production facilities would largely apply to green hydrogen storage facilities. However, a green hydrogen storage facility would have less than the 1-acre requirement for a green hydrogen production facility, which would reduce the need for water resources, site disturbance, and the presence of production-specific materials, such as hazardous materials, on the site.

The reduced water demands on operations and maintenance of storage facilities would decrease the likelihood of adverse impacts on aquatic biological resources. The construction and decommissioning impacts are anticipated to be the same as those described in Section 3.4. Potential impacts from green hydrogen storage facilities on terrestrial habitats and species are anticipated to be the same as those described for green hydrogen production facilities.

3.6.2 Actions to avoid and reduce impacts

The same actions to avoid and reduce impacts described previously (Section 3.4.3) also apply to this facility type.

3.7 No Action Alternative

Under the No Action Alternative, agencies would continue to conduct environmental review and permitting for green hydrogen facilities under existing laws on a project-by-project basis. The potential impacts would be similar to the impacts for the types of facilities described above for construction, operation, and decommissioning, depending on facility size and design, and there would be **less than significant to potentially significant adverse impacts**.

3.8 Unavoidable significant adverse impacts

Construction and operation of green hydrogen facilities may result in **significant and unavoidable adverse impacts** on terrestrial and aquatic 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 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 and aquatic special-status habitats or species may not be feasible.

4 References

Azerrad, J.M., J.L. Michalak, and T.P. Johnson, 2023. *PHS Local Government User Guide: Biodiversity Areas and Corridors Map.* Habitat Program, Washington Department of Fish and Wildlife: Olympia, Washington. Available at: https://wdfw.wa.gov/publications/02426

BirdLife International, 2024. Pacific Americas Flyway Factsheet. Accessed July 1, 2024. Available at: https://datazone.birdlife.org/userfiles/file/sowb/flyways/1_Pacific_Americas_Factsheet.pdf

Bryce, S.A., and A.J. Woods, 2000. Level III and IV Ecoregion Descriptions for Washington. December 14, 2000; revised by G. Griffith on October 5, 2010.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe, 1979. *Classification of Wetlands and Deepwater Habitats of the United States.* Washington, D.C.: Government Printing Office.

DNR (Washington Department of Natural Resources), 2012. Washington Natural Heritage Program Working List of Marine Algae. Accessed July 3, 2024. Available at: https://www.dnr.wa.gov/publications/amp_nh_algae.pdf

DNR, 2024. National Heritage Program. Available at: https://www.dnr.wa.gov/natural-heritage-program

Ecology (Washington State Department of Ecology), 2014. Wetland rating system. Available at: https://ecology.wa.gov/water-shorelines/wetlands/tools-resources/rating-systems

Ecology, 2016. Washington Department of Ecology 2016 Modeled Wetlands Inventory. Accessed July 1, 2024. Available at: https://apps.ecology.wa.gov/coastalatlasmap

Ecology, 2022. Wetland Guidance for Critical Areas Ordinance (CAO) Updates: Western and Eastern Washington. Available at: https://apps.ecology.wa.gov/publications/documents/2206014.pdf

Ecology, 2023. *Functions & Values of Wetlands.* Accessed July 1, 2024. Available at: https://ecology.wa.gov/water-shorelines/wetlands/education-training/functions-values-of-wetlands

Ecology, 2024. Surface water quality criteria. Accessed July 5, 2024. Available at: https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-quality-standards/Criteria#:~:text=The%20surface%20water%20quality%20standards%20include%20narrative%20criteria,other%20substances%20that%20can%20harm%20people%20and%20fish.

Ecology, USACE (U.S. Army Corps of Engineers Seattle District), and EPA (U.S. Environmental Protection Agency) Region 10, 2021. Wetland Mitigation in Washington State–Part 1: Agency Policies and Guidance (Version 2). Washington State Department of Ecology, Publication 21-06-003.

Environmental Laboratory, 1987. *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station. January 1987.

EPA (U.S. Environmental Protection Agency), 2023. Ecoregions. Accessed March 4, 2024. Available at: https://www.epa.gov/eco-research/ecoregions.

Ford, J.K.B., and G.M. Ellis, 2006. Selective foraging by fish-eating killer whales Orcinus orca in British Columbia. Marine Ecology Progress Series 316: 185–199.

Ford, M.J., J. Hempelmann, M.B. Hanson, K.L. Ayres, R.W. Baird, C.K. Emmons, J.I. Lundin, G.S. Schorr, S.K. Wasser, and L.K. Park, 2016. Estimation of a Killer Whale (*Orcinus orca*) Population's Diet Using Sequencing Analysis of DNA from Feces. *PLoS One 11*: e0144956.

Ford, J.K.B., J.F. Pilkington, A. Reira, M. Otsuki, B. Gisborne, R.M. Abernethy, E.H. Stredulinsky, J.R. Towers, and G.M. Ellis, 2017. Habitats of Special Importance to Resident Killer Whales (Orcinus orca) off the West Coast of Canada. Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, *Research Document 2017/035*. 57 pp. Available at: http://publications.gc.ca/site/eng/9.839838/publication.html.

Hanson, M.B., R.W. Baird, J.K.B. Ford, J. Hempelmann-Halos, D.M. Van Doornik, C.R. Candy, C.K. Emmons, G.S. Schorr, B. Gisborne, K.L. Ayres, S.K. Wasser, K.C. Balcomb, K. Balcomb-Bartok, J.G. Sneva, and M.J. Ford, 2010. Species and stock identification of prey consumed by endangered southern resident killer whales in their summer range. *Endangered Species Research* 11: 69–82.

Hruby, T., 2014. *Washington State Wetland Rating System for Eastern Washington: 2014 Update*. (Publication #14-06-030). Washington Department of Ecology: Olympia, Washington.

Hruby, T., and A. Yahnke, 2023. *Washington State Wetland Rating System for Western Washington: 2014 Update (Version 2)*. Publication #23-06-009. Washington Department of Ecology: Olympia, Washington.

LandScope America, 2024. LandScope Washington: Ecoregions in Washington.

NOAA (National Oceanic and Atmospheric Administration), 2024a. Understanding Essential Fish Habitat. Accessed July 1, 2024. Available at: https://www.fisheries.noaa.gov/insight/understanding-essential-fish-habitat

NOAA, 2024b. Essential Fish Habitat Mapper. Accessed July 2, 2024. Available at: https://www.habitat.noaa.gov/apps/efhmapper/?page=page_4

NOAA, 2024c. "Green Sturgeon." Accessed August 29, 2024. Available at: https://www.fisheries.noaa.gov/species/green-sturgeon.

NOAA, 2024d. "Invasive and Exotic Marine Species." Accessed August 29, 2024. Available at: https://www.fisheries.noaa.gov/insight/invasive-and-exotic-marine-species#:~:text=Invasives%20may%20negatively%20affect%20native,light%2C%20prey%2C%20and%20habitat

NOAA, 2024e. "Pacific Salmon and Steelhead." Available at: EPA (U.S. Environmental Protection Agency), 2023. Ecoregions. Accessed March 4, 2024. Available at: https://www.fisheries.noaa.gov/species/pacific-salmon-and-steelhead

Omernik, J.M., 1987. Ecoregions of the conterminous United States. Map (scale 1:7,500,000). *Annals of the Association of American Geographers* 77(1):118-125.

Omernik, J.M., 2010. Level III and IV Ecoregions of Washington. Map (scale 1:250,000). Accessed July 1, 2024. Available at: https://gaftp.epa.gov/epadatacommons/ORD/Ecoregions/wa/wa_eco.pdf

Pacific Flyway Council, 2024. Pacific Flyway Council Migratory Bird Management. Available at: https://www.pacificflyway.gov/Index.asp

Thomas, C.D., 2010. Climate, climate change and range boundaries. *Diversity and Distributions* 16:488–495. Available at: https://doi.org/10.1111/j.1472-4642.2010.00642.x

USACE (U.S. Army Corps of Engineers), 2008. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)*, ed. J. S. Wakeley, R.W. Lichvar, and C.V. Noble. ERDC/EL TR-08-28. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

USACE, 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)*, edited by J.S. Wakeley, R.W. Lichvar, and C.V. Noble. ERDC/EL TR-10-3. Final Report. U.S. Army Engineer Research and Development Center. May 2010.

USFWS (U.S. Fish and Wildlife Service), 2017. Listing and Critical Habitat Frequently Asked Questions. Available at: https://www.fws.gov/sites/default/files/documents/critical-habitat-fact-sheet.pdf

USFWS, 2024a. Environmental Conservation Online System. Accessed July 2, 2024. Available at: https://ecos.fws.gov/ecp/

USFWS, 2024b. Wenatchee Mountains Checkermallow. Accessed July 2, 2024. Available at: https://www.fws.gov/species/wenatchee-mountains-checker-mallow-sidalcea-oregana-var-calva

USFWS, 2024c. National Wetlands Inventory Wetlands Mapper. Available at: https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/

USFWS, 2024d. IPAC: Information for Planning and Consultation. Available at: https://ipac.ecosphere.fws.gov/

USGS (U.S. Geological Survey), 2022a. *Ungulate Migrations of the Western United States, Volume 2*. Scientific Investigations Report 2022-5008. Available at: https://www.usgs.gov/data/ungulate-migrations-western-united-states-volume-2.

USGS, 2022b. *Ungulate Migrations of the Western United States, Volume 3*. Scientific investigations Report 2022-5088. Available at: https://www.usgs.gov/publications/ungulate-migrations-western-united-states-volume-3

USGS, 2024a. "Mapping Ungulate Migrations Across the Western U.S." Accessed April 16, 2024. Available at: https://www.usgs.gov/index.php/special-topics/year-of-open-science/news/mapping-ungulate-migrations-across-western-us

USGS, 2024b. *Ungulate Migrations of the Western United States, Volume 4*. Scientific Investigations Report 2024-5006. Available at: https://pubs.usgs.gov/sir/2024/5006/sir20245006.pdf

USGS, 2024c. National Hydrography Dataset. Accessed July 1, 2024. Available at: https://www.usgs.gov/national-hydrography/national-hydrography-dataset

University of Washington, 2024. Burke Museum Herbarium. Accessed July 2, 2024. Available at: https://burkeherbarium.org/imagecollection/

WAFWA (Western Association of Fish and Wildlife Agencies), 2018. Washington Action Plan For Implementation of Department of the Interior Secretarial Order 3362: "Improving Habitat Quality in Western Big-Game Winter Range and Migration Corridors." https://wafwa.org/wp-content/uploads/2021/04/2018-FINAL-Washington-State-Action-Plan.pdf

WDFW (Washington Department of Fish and Wildlife), 2011. Habitat Restoration and Protection in Washington. Available at: https://fortress.wa.gov/dfw/score/score/habitat/habitat.jsp

WDFW, 2013. Water Crossing Design Guidelines. Available at: https://wdfw.wa.gov/sites/default/files/publications/01501/wdfw01501.pdf

WDFW, 2015. State Wildlife Action Plan, 2015 Update. Accessed July 2, 2024. Available at: https://wdfw.wa.gov/species-habitats/at-risk/swap

WDFW, 2023. Priority Habitats and Species List. Olympia, Washington: Washington Department of Fish and Wildlife. August 2008; updated June 2023. Accessed February 20, 2024. Available at: http://wdfw.wa.gov/publications/00165/wdfw00165.pdf.

WDFW, 2024a. Priority Habitats and Species (PHS): PHS on the Web. Accessed February 15, 2024. Available at: https://geodataservices.wdfw.wa.gov/hp/phs/.

WDFW, 2024b. Washington Shrubsteppe Restoration and Resiliency Initiative. Long-Term Strategy 2024 – 2054. Fostering resilient wildlife and human communities in the face of wildfire in the shrubsteppe landscape. March 1, 2024. Available at: https://wdfw.wa.gov/publications/02489

WDFW, 2024c. Shrubsteppe. Accessed July 2, 2024. https://wdfw.wa.gov/species-habitats/ecosystems/shrubsteppe

WDFW, 2024d. Northern spotted owl (*Strick occidentalis caurina*). Accessed July 2, 2024. Available at: https://wdfw.wa.gov/species-habitats/species/strix-occidentalis-caurina#desc-range

WDFW, 2024e. Marbled murrelet (*Brachyramphus marmoratus*). Accessed July 2, 2024. Available at: https://wdfw.wa.gov/species-habitats/species/brachyramphus-marmoratus#desc-range

WDFW, 2024f. Westside prairie. Accessed July 2, 2024. Available at: https://wdfw.wa.gov/species-habitats/ecosystems/westside-prairie#species

WDFW, 2024g. Riparian areas. Accessed July 2, 2024. Available at: https://wdfw.wa.gov/species-habitats/ecosystems/riparian#species

WDFW, 2024h. State Listed Species, Revised 2024. Accessed July 2, 2024. Available at: wa-state-listed-and-candidate-species-list.pdf.

WDFW, 2024i. WSRRI Spatial Priorities Map. Accessed July 5, 2024. Available at: terradapt.org/regions/WSRRI/visualisations-embed/map?view=map&state_version=1&init_time=1720462372151&scope=monitor&theme=null&layer=null&sub_layer=null&overlay=null&config-url=https%3A%2F%2Fstorage.googleapis.com%2Fterradapt_cascadia_public%2Fconfig%2FWSRRI_config_043024.json&baseLayer=Terrain&map_opacity=0.7&map_speed=500&map_primary_layer=null&map_secondary_layer=null&dashboard_region=null&dashboard_region_id=null&dashboard_region_id_friendly=null&dashboard_start_year=null&dashboard_end_year=null&start_year=null&end_year=null.

WDFW, 2024j. “Fishing for Crayfish.” Accessed August 29, 2024. Available at: https://wdfw.wa.gov/fishing/basics/crayfish.

WDFW, 2024k. “Amphibians and Reptiles of Washington.” Accessed August 29, 2024. Available at: https://wdfw.wa.gov/species-habitats/amphibians-reptiles#lizards.

WDFW, 2024l. Species in Washington. Available at: https://wdfw.wa.gov/species-habitats/species

WNHP (Washington Natural Heritage Program), 2024. WNHP Data Explorer Rare Plant and Ecosystem Locations. Accessed July 3, 2024. Available at: https://experience.arcgis.com/experience/174566100f2a47bebe56db3f0f78b5d9/page/Rare-Plant-and-Ecosystem-Locations/

Wilcove, D.S., C.H. McLellan, and A.P. Dobson, 1986. “Habitat Fragmentation in the Temperate Zone.” In *Conservation Biology: The Science of Scarcity and Diversity*, edited by M.E. Soulé, 237–256. Sunderland, Massachusetts: Sinauer Associates Inc.

Wilcox, B.A., and D.D. Murphy, 1985. “Conservation Strategy: The Effects of Fragmentation on Extinction.” *American Naturalist* 125(6): 879–887.

Wydoski, R.S., and R.R. Whitney, 2003. *Inland Fishes of Washington*. Second Edition. Seattle, WA: American Fisheries Society and University of Washington Press.