Summary

Programmatic Environmental Impact Statement for Green Hydrogen Energy Facilities in Washington State

Shorelands and Environmental Assistance Program

Washington State Department of Ecology

Olympia, Washington

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DEPARTMENT OF ECOLOGY
State of Washington

Summary

Introduction

In 2023, the Washington State Legislature directed the state Department of Ecology (Ecology) to prepare a nonproject or programmatic environmental impact statement (PEIS) for green hydrogen energy facilities. The PEIS is a broad environmental review that assesses and discloses the probable significant adverse environmental impacts that green hydrogen facilities may pose in Washington. Ecology also evaluated related measures to avoid and reduce likely impacts. State law, Revised Code of Washington (RCW) 43.21C.535,[1] requires that the final PEIS be completed by June 30, 2025.

Green hydrogen facilities can help support the state's transition to clean energy. When green hydrogen replaces fossil fuels for uses such as transportation fuels, industrial heating, and power transmission, it helps to reduce overall greenhouse gas emissions in Washington. However, green hydrogen facilities may have adverse environmental impacts. This PEIS evaluates, at a broad level, different types of green hydrogen facilities to identify probable environmental impacts and ways to avoid and reduce those impacts.

Ecology developed this Draft PEIS to provide consistent and useful information that the public, local and state agencies, Tribes, and developers can use to help review and plan for potential green hydrogen facilities. This statewide planning document is not specific to any single green hydrogen project. Each green hydrogen energy project will still need an individual environmental review as determined by the lead agency.

The Draft PEIS evaluates both natural and built resources. While some resources are unlikely to be adversely impacted by green hydrogen projects, the PEIS found other resources have the potential to be significantly affected. While there may be mitigation options that can reduce or eliminate those impacts, these approaches will depend on the specific project and site.

Purpose

The PEIS is intended to:

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

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

- Provide information for lead agencies to consider when conducting environmental reviews for green hydrogen projects.

Environmental review process

Under state law, Ecology is the lead agency for the Draft PEIS and developed the study in compliance with the State Environmental Policy Act (SEPA).[2] To gather feedback, Ecology held an extended scoping period in March and April 2024, including two online public meetings and a Tribal scoping meeting. Tribes were also provided additional time to comment. An overview of the SEPA review process is shown in Figure S-1.

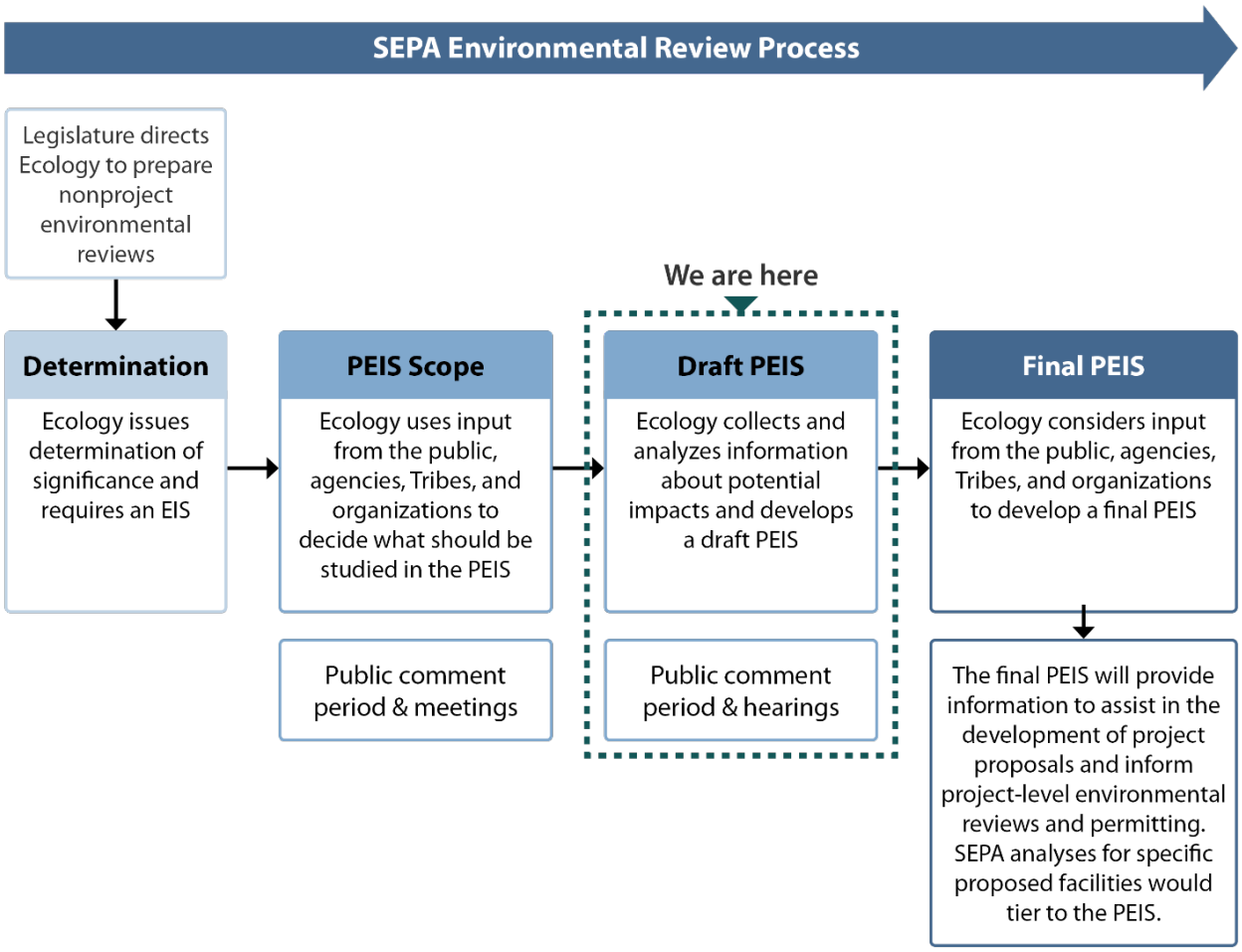

Figure S-1. SEPA environmental review process

A PEIS is a type of environmental review used for planning; it is not an evaluation of a specific project. This PEIS considers potentially significant adverse environmental impacts at a high level. It analyzes general types of green hydrogen facilities—but not individual projects—to

[2] https://ecology.wa.gov/regulations-permits/sepa/environmental-review/sepa-guidance

identify likely environmental impacts and possible ways to avoid and reduce those impacts. The PEIS does not approve, authorize, limit, or exclude any projects.

Using the PEIS for projects

Under SEPA, each individual green hydrogen project will need to have its own separate environmental review. During that review process, site-specific information and project-specific effects will be evaluated.

Developers can use the PEIS to:

- Consider if a site or design could result in potential environmental impacts.
- Make siting and design decisions that avoid or reduce impacts.
- Help identify if impacts could be potentially significant and the type of information reviewing agencies will need for their evaluations.
- Propose measures to mitigate potential significant impacts that can be incorporated into a mitigation plan.
    - If a lead agency finds the plan reduces environmental impacts below levels deemed to be significant, they can issue a mitigated determination of non-significance.
    - However, if significant impacts are probable, a lead agency will require an environmental impact statement for a proposed project.

State and local agencies reviewing a green hydrogen project must use the information in the PEIS, as well as other publicly available information and site-specific details, to inform their environmental reviews and permitting decisions (Figure S-2).

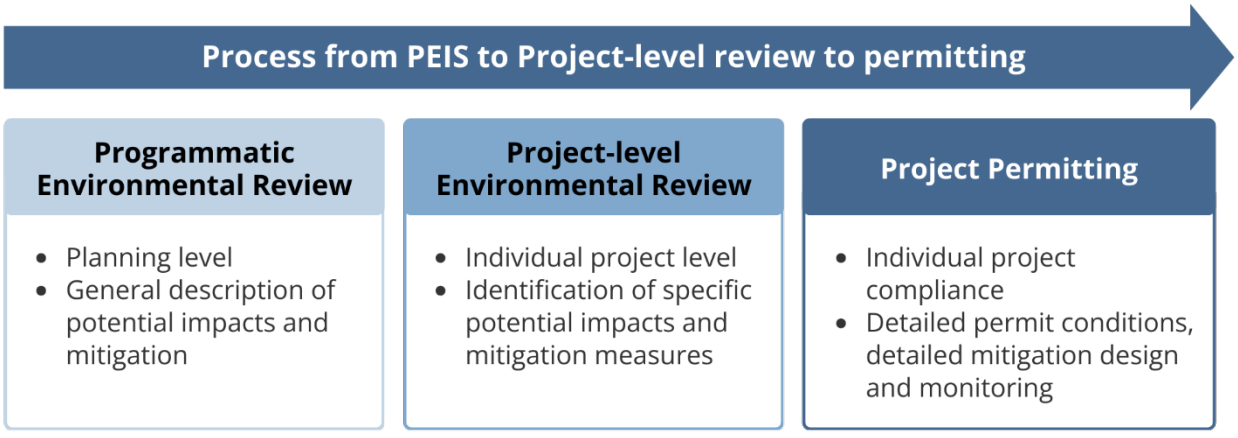

Figure S-2. Process from PEIS to project-level review to permitting

Overview of green hydrogen

Hydrogen is abundant on earth as an element but is almost always found as part of another compound, such as water or methane. It must be separated into pure hydrogen for use as energy. It can be stored and transported as a gas or liquid. Hydrogen as a fuel contains a high level of energy per unit mass, more than natural gas or gasoline.

Hydrogen gas is nontoxic, colorless, and odorless. Hydrogen has similar risks of fire and explosion to other flammable fuels, such as natural gas and gasoline. There are federal, state, and local requirements for processes, materials, and operations of industrial facilities. Since hydrogen is a combustible fuel, this includes requirements for minimum setback distances when siting a facility. However, some hydrogen specific standards may not be adopted into local codes.

Currently, hydrogen is mainly used for petroleum refining and production of bulk chemicals, such as ammonia. The United States produces approximately 10 million metric tons of hydrogen annually. Most hydrogen comes from a process called steam-methane reforming using fossil fuels as the feedstock. This hydrogen is often called gray hydrogen.

For the PEIS, the term green hydrogen includes the following two types.

- **Green electrolytic hydrogen**[3] is hydrogen produced through electrolysis using electricity to break apart water and create hydrogen and oxygen. This definition allows for renewables and fossil fuels to be used as a source of electricity with the amount of fossil fuels decreasing over time to meet state greenhouse gas (GHG) limits.
- **Renewable hydrogen**[4] is hydrogen produced using renewable resources both as the source for the hydrogen and the source for the energy input into the production process. This is produced using steam-methane reforming, pyrolysis, or bio-gasification processes.

Types of facilities evaluated

The PEIS evaluates the following:

- **Green hydrogen production facilities:** green hydrogen production facilities using electrolysis, steam-methane reforming, pyrolysis, or bio-gasification processes. Production facilities would be in an area that is zoned for industrial land uses.
    - **Electrolysis**: process that uses electricity to split water into hydrogen and oxygen.
    - **Steam-methane reforming**: process using renewable natural gas to react with steam at high temperatures to produce hydrogen.

[3] https://app.leg.wa.gov/RCW/default.aspx?cite=43.158.010
[4] https://app.leg.wa.gov/RCW/default.aspx?cite=43.158.010

    - **Pyrolysis:** process using methane from renewable natural gas or biomass heated to a high temperature and decomposed, creating hydrogen and solid carbon.
    - **Bio-gasification:** process involving heat, steam, and oxygen to convert biomass into hydrogen and other products.
- **Green hydrogen production facilities with battery energy storage systems:** facilities that also include up to two battery energy storage systems used for back-up power.
- **Green hydrogen storage facilities (in gas or liquid form):** storage facilities could be co-located at green hydrogen production facilities, a standalone facility, located at transport terminals, or at an end-use location such as an industrial facility or fueling facility.
- **No Action Alternative:** city, county, and state agencies would continue to conduct environmental review and permitting for green hydrogen facilities under existing state and local laws on a project-by-project basis without using the PEIS as a reference.

The size and scale of a facility would vary. The PEIS uses a range from 1 acre to 10 acres, based on the size of similar industrial facilities. All green hydrogen facilities would require some amount of electricity for construction, operation, and decommissioning. It is expected that the facility would connect to the main electric grid using distribution lines. These are analyzed in the PEIS as part of a facility. This PEIS does not analyze the many end uses (such as in industries or as fuel for different types of transportation) of green hydrogen. These would be evaluated during project-level analysis.

Figure S-3. Electrolysis facility – Plug Power – Woodbine, GA
Source: Lutz 2024

Figure S-4. Electrolysis facility – H2B2 SoHyCal – Fresno, CA
Source: H2B2 Electrolysis Technologies 2023

Figure S-5. Steam methane reforming and liquid storage facility – Air Liquide – Apex, NV
Source: Air Liquide 2022

Study area

The geographic scope of study for the PEIS (Figure S-6) includes areas throughout the state where green hydrogen facilities are likely to be developed based on available transmission lines, proximity to freight highway routes, and industrial or industrial-use supporting zoning. These lands include city and county industrially zoned areas or areas zoned to support industrial uses, such as areas with major port facilities that handle freight shipments, intermodal facilities, and airports.

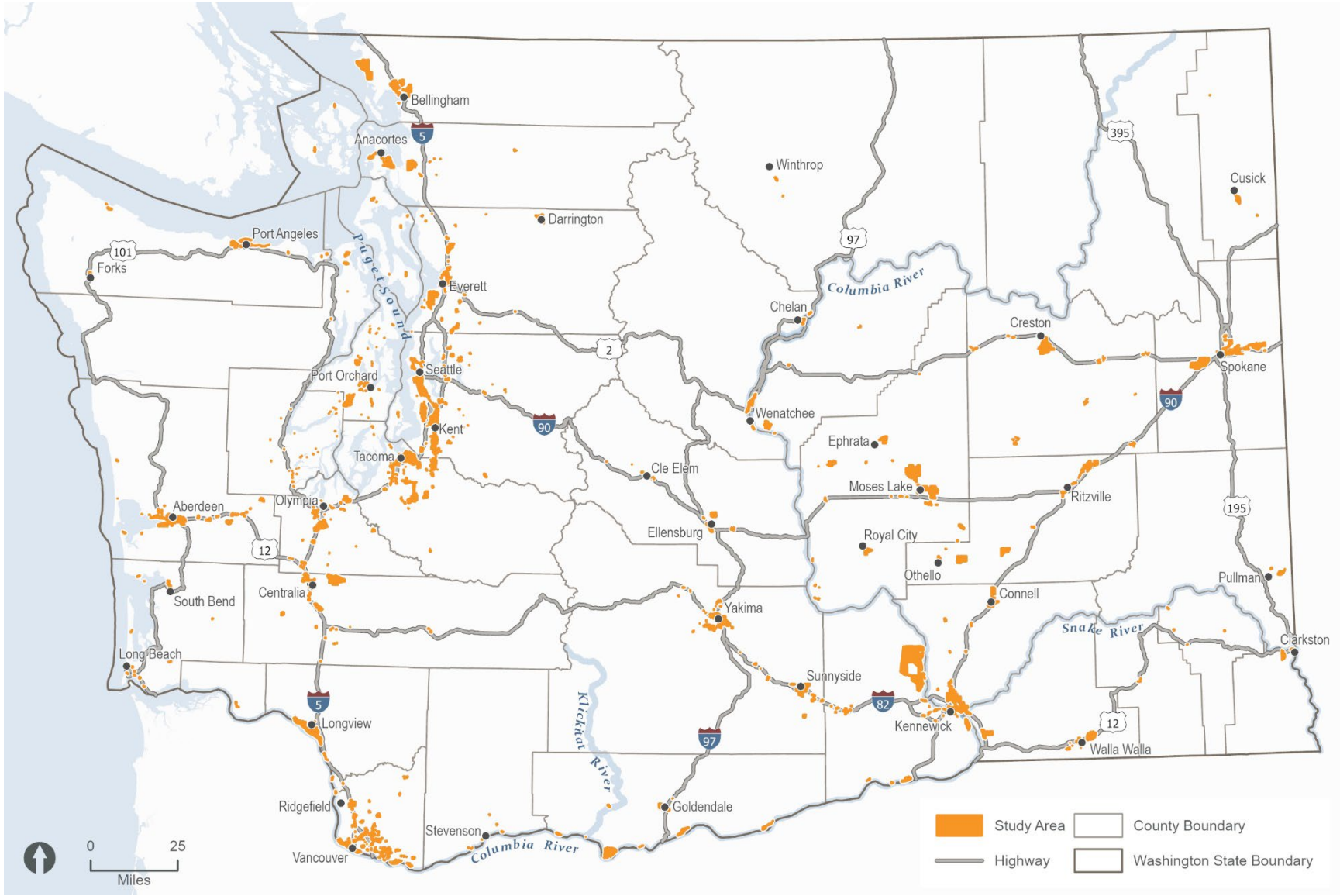

Figure S-6. Green Hydrogen Energy Facilities PEIS geographic scope of study

Project Siting and Design Considerations

As with any proposal, when choosing a site, developers will consider if resources needed for their project are available. For green hydrogen production facilities, based on the type of process used, key resources include water, electricity, renewable natural gas, and biomass. Availability of these will vary based on a project's location and this study does not evaluate the availability of these resources for specific sites. If the resources needed for a project to be built and operated are not available, the project would not be feasible.

Developers should seek to avoid impacts when making siting decisions and determining the design of their project. The PEIS includes "siting and design considerations" identifying agencies and Tribes to contact early in the process, data to gather, and actions to take. To avoid and reduce potentially significant impacts, we recommend developers closely review these considerations and the PEIS analysis.

Analysis and impact findings

The PEIS analyzes the potential impacts on environmental resources associated with constructing, operating, and decommissioning green hydrogen facilities. These include resources where significant impacts are not likely as well as resources that could be significantly impacted. The PEIS also considers cumulative impacts. For more detailed information and analysis, see the resource technical appendices.

The PEIS identifies measures to avoid and reduce the potential environmental impacts that a green hydrogen project might pose. Developers can select mitigation approaches that will help offset the potential impacts specific to their facility, including design and site location. In some cases, mitigation actions can reduce probable adverse impacts to a less-than-significant level. In other cases, while there may be mitigation options that can reduce or eliminate significant impacts, these approaches will depend on the specific project and site.

Resources with probable significant adverse environmental impacts

Table S-1 provides a summary of the environmental resources with probable significant adverse impacts.

Table S-1. Summary of potential significant impacts in the PEIS

Section	Topic	Description of potential significant impact from facility types	Can it be mitigated below significance?
Tribal rights, interests, and resources	Tribal rights, interests, and resources	Constructing, operating, and decommissioning facilities could impact Tribal rights, interests, and resources. The significance of these impacts would be determined through consultation with potentially affected Tribes.	Impacts and mitigation would be determined in consultation with Tribes.
Environmental justice	Disproportionate impacts	Disproportionate impacts on historic and cultural resources, Tribes and Tribal communities, biological resources, public services and utilities, vibration, and environmental health and safety.	Impacts and mitigation would be determined in consultation with Tribes. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.
Air quality and greenhouse gases	Greenhouse gases	Impacts from electrolysis, steam-methane reforming, pyrolysis, bio-gasification production and storage would range from less than significant impacts to potentially significant adverse impacts on life-cycle greenhouse gas emissions. In general, electrolysis using all renewable energy sources for electricity would have the lowest amount of life-cycle greenhouse gas emissions.	Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.
Biological resources	Terrestrial and aquatic habitat and species (including special status species)	Impacts affecting species viability, the mortality of any individual species, or disturbance that disrupts successful breeding and rearing behaviors. Permanent degradation, loss, or conversion of suitable habitat that is critical to species viability or disrupts 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 special-status habitats or species may not be feasible.
Environmental health and safety	Fire and explosions	Risk of fire or explosion during operations from flammable substances, including hydrogen and methane gas. The severity of risks would need to be assessed for each facility based on the project location, production method, and quantities of flammable materials produced or stored on-site.	Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.

Section	Topic	Description of potential significant impact from facility types	Can it be mitigated below significance?
	Wildfire risk	New ignition sources from operations that may pose fire risk in remote locations with limited response capabilities.	Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.
	Battery overheating	If a facility has a co-located battery energy storage system, potential hazardous air emissions from damage or failure of the battery management system.	Yes
Noise and vibration	Vibration	Construction or decommissioning could affect people within 350 feet of the facility or in close proximity to conventional or historic structures. Some types of blasting within 2,000 feet of historic structures may have adverse effects.	Yes
Historic and cultural resources	Historic and cultural resources	Construction, operations, and decommissioning of all types of facilities could impact historic and cultural resources. The significance of these impacts would be determined through consultation with potentially affected Tribes, and for cultural and historic resources in consultation with DAHP.	Impacts and mitigation would be determined in consultation with Tribes and DAHP.
Public services and utilities	Fire response	If new ignition sources are in remote locations with limited response capabilities, or if a fire or explosion during operations spreads rapidly or impacts large areas.	Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.

Resources with findings of less than significant impacts

These resources had findings of less than significant when plans, permits, and best management practices were considered. For any project, a site-specific environmental review would still be done to evaluate these resources.

- Earth
- Air quality
- Water
- Energy and natural resources
- Noise
- Environmental health and safety, including hazardous materials and worker safety
- Land use, including military areas
- Aesthetics and visual quality
- Recreation
- Transportation
- Public services and utilities, including law enforcement, schools, and water, waste, and electrical infrastructure

Cumulative impacts

The broad geographic study area includes many reasonably foreseeable actions in the past, present, and future that taken together could result in impacts. These were evaluated as trends. They include:

- Energy projects, including clean energy development and changes to energy systems
- Urban, commercial, and industrial development and activities
- Rural and agricultural development and activities
- Federal, state, Tribal, and local wildlife and related habitat projects
- Transportation infrastructure development and modification
- Contaminated site cleanup and remediation
- Mining operations
- Recreation activities on public lands
- Military use
- Water supply development

Due to the diverse regions of the state covered by the geographic study area that the PEIS addresses, as well as the broad trends of reasonably foreseeable actions the study identifies and considers, cumulative impacts on natural and built resources would range from **less than significant** to **potentially significant**. The cumulative impacts analysis is designed to ensure decision-makers consider the full range of potential consequences under anticipated future conditions. An analysis of individual green hydrogen facilities would also consider cumulative impacts as part of a project-specific environmental review.

Areas of controversy and uncertainty

- **Resource use**: People have raised concerns about availability of resources, such as water and electricity, for green hydrogen production facilities. This is evaluated in Sections 4.5, 4.7, and 4.15.
- **Fire and explosion risks and emergency response:** There is concern about increased fire and explosion risks and adequacy of available response resources related to green hydrogen energy projects and battery energy storage systems. This is evaluated in Sections 4.8 and 4.15.
- **Cumulative impacts:** Communities, Tribes, and interested parties have raised concerns about cumulative impacts related to developing multiple energy projects in the same area. Chapter 5 describes trends and potential cumulative impacts.

Next steps

Ecology will review and consider all comments received during the public comment period for the draft PEIS and may revise the study as a result. The final PEIS will be completed by the legislatively mandated date of June 30, 2025, and made available to the public.