State Environmental Policy Act
Draft Environmental Impact Statement

Proposed Chehalis River Basin
Flood Damage Reduction Project

DEPARTMENT OF ECOLOGY
State of Washington

Publication No.: 20-06-002
February 27, 2020

DEPARTMENT OF ECOLOGY
State of Washington

STATE ENVIRONMENTAL POLICY ACT
DRAFT
ENVIRONMENTAL IMPACT STATEMENT

Proposed Chehalis River Basin Flood Damage Reduction Project

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Publication and Contact Information

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Draft Environmental Impact Statement

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Proposed Chehalis River Basin
Flood Damage Reduction Project

Shorelines and Environmental Assistance Program

Washington Department of Ecology

Olympia, Washington

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DEPARTMENT OF ECOLOGY
State of Washington

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
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February 27, 2020

Dear Interested Parties, Jurisdictions, and Agencies,

The Washington Department of Ecology (Ecology) is issuing this Draft Environmental Impact Statement (EIS) for the Proposed Chehalis River Basin Flood Damage Reduction Project (the Proposed Project). The Chehalis River Basin Flood Control Zone District (the Applicant) is proposing to construct a flood retention facility and associated temporary reservoir near Pe Ell, Washington, on the Chehalis River and make changes to the Chehalis-Centralia Airport levee to reduce flood damage in the Chehalis-Centralia area.

The Draft EIS has been prepared to satisfy the requirements of the Washington State Environmental Policy Act (SEPA). The purpose of the Draft EIS is to evaluate the probable significant environmental impacts from the construction and operation of the Proposed Project and its contribution to cumulative environmental impacts. In addition to the Proposed Project, the Draft EIS evaluates a No Action Alternative and a Local Actions Alternative.

The following resource areas are evaluated in the Draft EIS.

- Air Quality and Greenhouse Gases
- Cultural Resources
- Earth (Geology and Geomorphology)
- Environmental Health and Safety
- Environmental Justice
- Fish Species and Habitats
- Land Use
- Noise and Vibration
- Public Services and Utilities
- Recreation
- Transportation
- Tribal Resources
- Visual Quality
- Water
- Wetlands
- Wildlife Species and Habitats

The Draft EIS proposes mitigation to address adverse environmental impacts of the Proposed Project identified in the review. In some cases, implementation of mitigation measures would reduce but not completely eliminate the significant adverse impacts or the feasibility of mitigation is uncertain. These are identified in the Draft EIS as significant and unavoidable adverse environmental impacts for the following resource areas: Earth, Environmental Health and Safety, Fish Species and Habitat, Recreation, Wildlife Species and Habitat, Wetlands, and Water.

Comments on this Draft EIS will be accepted during the extended 61-day comment period (February 27 through April 27, 2020). Comments should focus on the substance of the Draft EIS and be as specific as

possible. This could include comments on the adequacy of the EIS, alternatives, methodology used, mitigation measures proposed, or additional information that should be considered. Comments may be submitted in the following ways:

By mail to:

SEPA Draft EIS for the Chehalis Flood Damage Reduction Project
c/o Anchor QEA
1201 3rd Avenue, Suite 2600
Seattle, WA 98101

Online:

Complete a comment form at http://chehalisbasinstrategy.com/eis/comment-form

In person at a public hearing, verbally or in writing:

Tuesday, March 31, 5:00 p.m. to 8:30 p.m.
Centralia College – TransAlta Commons
600 Centralia College Boulevard
Centralia, WA 98531

Thursday, April 2, 5:00 p.m. to 8:30 p.m.
Montesano Jr. Sr. High School – Commons Room
303 Church Street North
Montesano, WA 98563

Comments received on the Draft EIS during the comment period will be compiled and reviewed. Substantive comments will be considered by Ecology in the preparation of a Final EIS. Ecology anticipates the Final EIS will be published in late 2020 or early 2021. The Final EIS may be used by agencies to inform permit decisions for the Proposed Project.

Questions about the Draft EIS may be directed to: Diane Butorac at diane.butorac@ecy.wa.gov or (360) 407-6573.

Sincerely,

Gordon White

Gordon White, Program Manager
Shorelands and Environmental Assistance Program

FACT SHEET

Proposed Project Title

Chehalis River Basin Flood Damage Reduction Project

Description of Proposed Project and Alternatives

The Applicant's Proposed Project is to:

- **Construct a flood retention facility and associated temporary reservoir** near Pe Ell on the Chehalis River to reduce peak flood levels during a major flood or larger from floods originating in the Willapa Hills. A major flood is determined to occur when the flow of water in the Chehalis River reaches 38,800 cubic feet per second (cfs) at the Grand Mound stream gage. The Flood Retention Expandable (FRE) facility would store up to 65,000 acres of floodwater in a temporary reservoir during major or larger floods, then slowly release it over a period of time. In normal conditions or for smaller floods, the Chehalis River would flow through the structure at its normal rate. The proposed FRE facility is considered expandable because it would be built with a foundation and hydraulic structure extents capable of supporting the future construction of a larger facility that could expand the water storage from 65,000 acre-feet to up to 130,000 acre-feet. This expansion may or may not occur and, if pursued in the future, it would be subject to a separate environmental review and permitting process.
- **Make changes to the Chehalis-Centralia Airport levee** by raising the levee 4 to 7 feet, widening the levee, and raising a portion of NW Louisiana Avenue to reduce flood damage from a catastrophic flood. A catastrophic flood is determined to occur when the flow of water in the Chehalis River reaches 75,100 cfs at the Grand Mound stream gage.

The Local Actions Alternative consists of local and non-structural approaches to reduce flood damage in the study area. The Local Actions Alternative considers a variety of local-scale actions that approximate the Applicant's objective through improving floodplain function, land use management actions, buying out at-risk properties or structures, floodproofing buildings, channel migration protection, improving early flood warning systems, and increasing water storage from Pe Ell to Centralia through floodplain storage improvement.

The No Action Alternative is intended to represent the most likely future conditions if the Proposed Project is not constructed. Basin-wide large- and small-scale efforts would continue as part of the Chehalis Basin Strategy work. Local flood damage reduction efforts would continue based on local planning and regulatory actions. Implementation of existing state and local floodplain regulations, existing land use regulations, planned updates to Comprehensive Plans, and planned or ongoing updates to Shoreline Master Programs are considered part of the No Action Alternative. Expected changes from

local authorities in land use and development, based on these planning documents and census projections, are also included in the No Action Alternative.

Location

The Applicant's Proposed Project, described in Chapter 2 of the EIS, includes an FRE facility—located on the mainstem Chehalis River about 1 mile south (upstream) of the Town of Pe Ell, Washington—and Airport Levee Changes along the northern, western, and southern boundaries of the Chehalis-Centralia Airport in Chehalis, Washington.

The FRE facility would be located on property currently owned by Weyerhaeuser and Panesko Tree Farm, south of State Route 6 in Lewis County, on the mainstem Chehalis River at about river mile 108. The property is located in Section 3, Township 12N, Range 5W; on Government Lot 13 and a portion of Government Lot 14 (the west half of the southwest quarter and the southeast quarter of the southwest quarter, excluding roads).

The Applicant is also proposing to raise the existing Chehalis-Centralia Airport levee and part of NW Louisiana Avenue. The property associated with the levee changes is located in Section 30, Township 14N, Range 2W; on a portion of Sections 19 and 30 between the highway, St. Helens Avenue, and Lawrence Road; and on a portion of NW Louisiana Avenue.

Applicant (Proponent)

Chehalis River Basin Flood Control Zone District

Proposed Date of Implementation

The Applicant plans to begin construction in 2025 and operations in 2030, if permitted.

Lead Agency

Washington Department of Ecology (Ecology)

Responsible Official

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Lead Agency Contact Person

Diane Butorac, Project Manager
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(360) 407-6573
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Required Permits, Licenses, and Approvals

Federal

- Endangered Species Act Consultation (U.S. Fish and Wildlife Service)
- Federal Explosives License/Permit (Federal Bureau of Alcohol, Tobacco, and Firearms)
- Letter of Map Revision, Conditional Letter of Map Revision, or Physical Map Revision (Federal Emergency Management Agency)
- National Historic Preservation Act Section 106 Consultation (U.S. Army Corps of Engineers)
- Clean Water Act Section 404 Permit (U.S. Army Corps of Engineers)

Tribal

Federal consultations under Section 106 of the National Historic Preservation Act, and Section 7 of the Endangered Species Act

Washington State

- Application for Exploration Reclamation Permit (Washington State Department of Natural Resources)
- Aquatic Lands Lease and Use Authorization (Washington State Department of Natural Resources)
- Coastal Zone Management Program Consistency (Ecology)
- Dam Safety Construction Permit (Ecology)
- Fish Transport Permits (Washington Department of Fish and Wildlife)
- Forest Practices Applications (Washington State Department of Natural Resources)
- Hydraulic Project Approval (Washington Department of Fish and Wildlife)
- National Pollutant Discharge Elimination System Construction Stormwater Permits (Ecology)
- National Pollutant Discharge Elimination System Industrial Stormwater Permit (Ecology)
- National Pollutant Discharge Elimination System Sand and Gravel Permit (Ecology)
- Scientific Collection Permit (Washington Department of Fish and Wildlife)
- Section 401 Clean Water Act Water Quality Certification (Ecology)
- Shoreline Conditional Use Permit (Ecology)

- Surface Mining Reclamation Permit (Washington State Department of Natural Resources)
- Washington State Explosives License (Department of Labor and Industries)
- Water Rights Permits (Ecology)

Local

- Air Discharge Permit (Southwest Clean Air Agency)
- Airport Obstruction Zone Application (City of Chehalis)
- Building permit (Lewis County)
- Comprehensive Plan Update and Rezone (Lewis County)
- Critical areas review (Lewis County, Pacific County, and City of Chehalis)
- Earth-moving permit (City of Chehalis)
- Fill and Grade Permit (Lewis County)
- Flood Hazard Zone Permit (Lewis County)
- Local Land Use and Development Permits (Lewis County and City of Chehalis)
- Open Burning Permit (Southwest Clean Air Agency)
- Permit for Nonroad Engines (Southwest Clean Air Agency)
- Right-of-Way Use Permit (City of Chehalis)
- Shoreline Substantial Development Permit, including shoreline critical areas review (Lewis County)
- Shoreline Conditional Use Permit (Lewis County)
- Storm Drainage Approval (Lewis County)

Authors and Principal Contributors

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

KEY AUTHORS AND PRINCIPAL CONTRIBUTORS	TOPIC(S)
Anchor QEA, LLC 1201 3rd Avenue, Suite 2600 Seattle, WA 98101	Environmental Justice; Fish Species and Habitat; Land Use; Tribal Resources; Wetlands; Wildlife Species and Habitat
Climate Impacts Group University of Washington Box 355674 Seattle, WA 98195-5672	Climate change modeling
Environmental Science Associates 5309 Shilshole Avenue NW, Suite 200 Seattle, WA 98107	Air Quality; Cultural Resources; Environmental Health and Safety; Noise; Public Services and Utilities; Recreation; Transportation; Visual Quality; Water

KEY AUTHORS AND PRINCIPAL CONTRIBUTORS	TOPIC(S)
ICF Consultants 615 SW Alder Street, Suite 200 Portland, OR 97205	Ecosystem Diagnosis and Treatment salmonid habitat model for the Chehalis Basin
National Oceanic and Atmospheric Administration (NOAA) Fisheries Northwest Fisheries Science Center 2725 Montlake Boulevard East Seattle, WA 98112	Salmonid lifecycle model for the Chehalis Basin
Shannon and Wilson 400 N 34th Street, Suite 100 Seattle, WA 98103	Earth (Geology)
Washington Department of Ecology	Air Quality; Cumulative; Cultural Resources; Earth; Environmental Health and Safety; Environmental Justice; Fish Species and Habitat; Land Use; Noise; Public Services and Utilities; Recreation; Transportation; Tribal Resources; Water; Wetlands; Wildlife Species and Habitat
Washington Department of Fish and Wildlife	Earth; Fish Species and Habitat; Recreation; Tribal Resources; Water; Wetlands; Wildlife Species and Habitat
Washington State Department of Archaeology and Historic Preservation	Cultural Resources
Washington State Department of Natural Resources	Earth; Environmental Health and Safety; Fish Species and Habitat; Land Use; Recreation; Transportation; Water; Wildlife Species and Habitat
Washington State Department of Transportation	Transportation
Watershed Geodynamics 52542 Canna Court Homer, AK 99603	Earth (Geomorphology)
Watershed Science and Engineering 506 2nd Avenue, Suite 2700 Seattle, WA 98104	Hydrologic and Hydraulic modeling

Date of Draft EIS Issuance

February 27, 2020

Date Comments are Due

April 27, 2020

Public Comment and Hearings on the Draft Environmental Impact Statement (EIS)

Comments on this Draft EIS will be accepted during a 61-day comment period (February 27 through April 27, 2020). Comments should focus on the substance of the Draft EIS and be as specific as possible. This could include comments on the adequacy of the EIS, alternatives, methodology used, mitigation measures proposed, or additional information that should be considered. Comments may be submitted in the following ways:

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Thursday, April 2, 5:00 p.m. to 8:30 p.m.
Montesano Jr. Sr. High School – Commons Room
303 Church Street North
Montesano, WA 98563

Date Final Action is Planned by Lead Agency

A Final EIS is estimated to be completed in late 2020 or early 2021.

Document Availability

The Draft EIS is posted on the following websites:

- **SEPA Register at** https://apps.ecology.wa.gov/separ/Main/SEPA
- **Ecology website at** https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Office-of-Chehalis-Basin/EIS
- **Chehalis Basin Strategy website at** http://chehalisbasinstrategy.com/eis/sepa-process

The document is also available as a reference at the following locations:

Washington Department of Ecology
300 Desmond Drive SE
Lacey, WA 98503

Local Libraries

Centralia Timberland Library
110 South Silver Street
Centralia, WA 98531

Chehalis Timberland Library
400 North Market Boulevard
Chehalis, WA 98532

Oakville Library
204 Main Street
Oakville, WA 98568

Location of Background Materials

2017 Chehalis Basin Strategy Programmatic EIS is available at:
http://chehalisbasinstrategy.com/programmatic-eis/

Reports and background data for the Chehalis Basin Strategy used for the EIS are available at:
http://chehalisbasinstrategy.com/publications/

Cost of Copy of EIS

To obtain a CD or printed copy of the Draft EIS (for the cost of production), follow the instructions provided at https://fortress.wa.gov/ecy/publications/UIPages/ProgramOrder.aspx?pubno=20-06-002

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ACRONYMS AND ABBREVIATIONS

Applicant	Chehalis River Basin Flood Control Zone District
cfs	cubic feet per second
CHTR	collect, handle, transfer, and release
Corps	U.S. Army Corps of Engineers
DAHP	Department of Archaeology and Historic Preservation
DNR	Washington State Department of Natural Resources
Ecology	Washington Department of Ecology
EDT	Ecosystem Diagnosis and Treatment
EIS	Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FR	Forest Road
FRE facility	Flood Retention Expandable facility
GHG	greenhouse gas
GIS	Geographic Information Systems
I-5	Interstate 5
LCM	Life-Cycle Model
LiDAR	Light Detection and Ranging
LLO	low-level outlet
LOS	level of service
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity unit
PCB	polychlorinated biphenyl
PUD	Public Utility District

RM	river mile
SEPA	State Environmental Policy Act
SMP	Shoreline Master Program
SR	State Route
UGA	Urban Growth Area
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation

SUMMARY

Floods are getting worse and salmon runs are in serious decline in the Chehalis Basin. Climate change will be driving more frequent and higher flood levels, and steeper declines in fish runs in the future. Communities in the basin are working with the Chehalis Basin Board on a long-term strategy to address these two catastrophes with a wide variety of programs and actions. To address flooding, one part of this strategy is to consider large-scale flood damage reduction actions. The project evaluated in this Draft Environmental Impact Statement (EIS) is one of the proposed actions for consideration.

The Washington Department of Ecology (Ecology) has prepared a Draft EIS for the proposed Chehalis River Basin Flood Damage Reduction project. The Applicant, the Chehalis River Basin Flood Control Zone District, proposes to construct a flood retention facility and associated temporary reservoir near Pe Ell, Washington, on the Chehalis River and make changes to the Chehalis-Centralia Airport levee to reduce flood damage in the Chehalis-Centralia area. The Proposed Project is evaluated in this Draft EIS under the State Environmental Policy Act (SEPA) requirements.

What is in the Draft SEPA EIS?

The Draft EIS:

- Describes the Proposed Project and alternatives
- Describes methods, data, and scenarios used for analysis
- Identifies probable significant adverse environmental impacts from the Proposed Project and alternatives
- Proposes mitigation measures for the Applicant to develop and implement

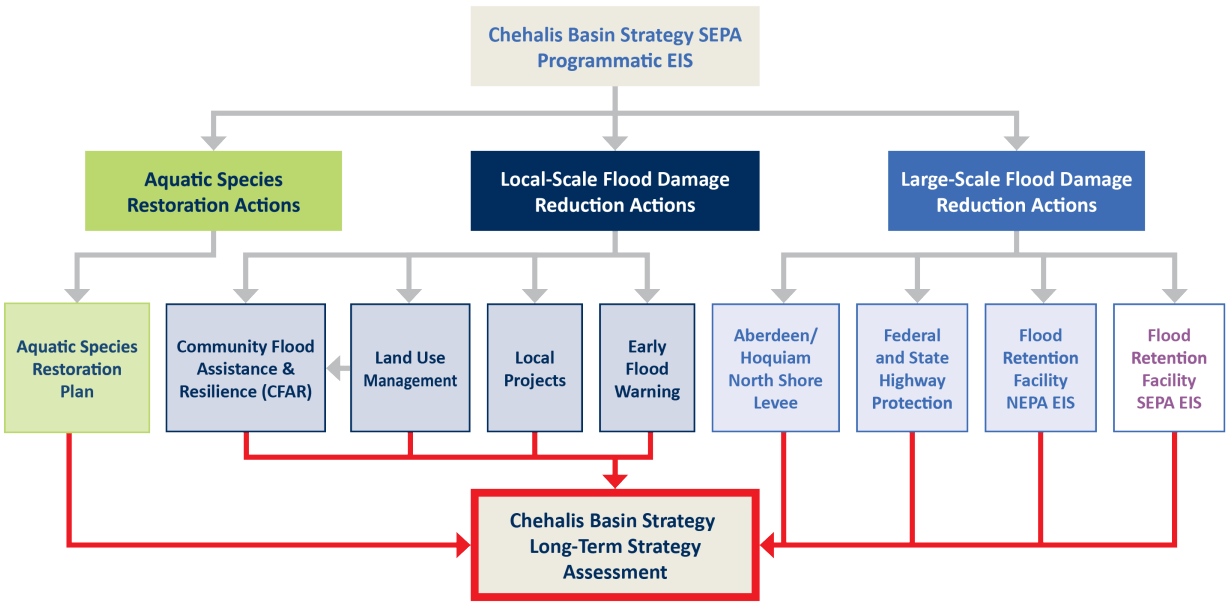
How Does the SEPA EIS Fit in the Chehalis Basin Strategy?

In 2017, a Chehalis Basin Strategy Programmatic EIS evaluated large projects that might be used for the Chehalis Basin Strategy to reduce damages from floods and restore degraded aquatic species habitat. It considered several concepts to reduce flood damage and restore aquatic habitat. The Governor's Work Group, the predecessor to the Chehalis Basin Board, recommended a project-level EIS be completed to further identify the probable significant impacts of a flood retention facility. In October 2017, the Chehalis River Basin Flood Control Zone District's Board of Supervisors decided to become the project sponsor for a proposed flood retention facility.

The Chehalis Basin Board is expected to use the information in the SEPA EIS, along with other information, to inform their recommendations for the long-term Chehalis Basin Strategy to address the social, environmental, economic, and other public health and safety considerations related to both flood

damage reduction and aquatic species habitat restoration objectives. Exhibit S-1 shows how the SEPA EIS fits within the Chehalis Basin Strategy.

Exhibit S-1
Chehalis Basin Strategy Long-Term Strategy



What is the Purpose of the SEPA EIS?

Ecology has prepared this Draft EIS using the SEPA requirements in the Washington Administrative Code (WAC) 197-11. Ecology determined the Proposed Project would likely have significant adverse impacts on the environment so an EIS was required. An EIS evaluates the probable significant adverse impacts on the environment from a proposed project and alternatives. It considers the future conditions when the project is proposed to be constructed and operated.

Scoping was held from September 28 to October 29, 2018. Scoping comments were used by Ecology to identify what to study in the EIS.

An EIS does not approve or deny a proposed project. It provides information about the probable significant environmental adverse impacts of a proposal. Local and state agencies will use the SEPA EIS as part of any future permitting decisions related to the project.

How was Climate Change Included in the EIS?

The EIS incorporates climate change projections for precipitation, temperature, flood peak flows, streamflow, and sea level rise throughout the analyses and modeling as part of the future conditions for all scenarios and for all resource areas. Climate change predictions are included in the baseline conditions for the Proposed Project, No Action Alternative, and Local Actions Alternative and are consistent between those. No separate impact findings for climate change or quantitative comparisons between the Proposed Project and alternatives related to climate change are made in this EIS.

Flood Terminology Used in the EIS

Major Flood: Water flow rate of 38,800 cfs or greater at the Grand Mound gage. This would be similar to the 2009 flood. In late-century, this type of flood has a 1 in 4 (25%) chance of occurring in any given year.

Catastrophic Flood: Water flow rate of 75,100 cfs or greater at the Grand Mound gage. This would be similar to the 1996 flood. In late-century, this type of flood has a 1 in 27 (4%) chance of occurring in any given year.

What is the Applicant's Proposed Project?

The Proposed Project includes a flood retention facility and temporary reservoir, referred to as the Flood Retention Expandable (FRE) facility, and changes to the Chehalis-Centralia airport levee (Exhibit S-2).

The Applicant intends for the flood retention facility to reduce the severity and duration of major floods or larger from storms from the Willapa Hills. The Airport Levee Changes are intended to improve the levee protection level at the Chehalis-Centralia Airport during catastrophic floods. The purpose of the Proposed Project is to reduce flood damage in the Centralia and Chehalis area. It would not protect all basin communities from all flooding, and it is not designed to stop regular annual flooding from the Chehalis River or smaller floods.

Applicant's Purpose and Objective

Purpose: To reduce flood damage in the Chehalis-Centralia area by constructing a flood retention facility and temporary reservoir near Pe Ell and making changes to the Chehalis-Centralia Airport levee.

Objectives: To reduce flooding coming from the Willapa Hills and improve the levee protection level at the Chehalis-Centralia Airport.

The flood retention facility would store floodwaters in a temporary reservoir during major or larger floods (Exhibit S-3). For analysis in this EIS, based on future conditions for a catastrophic flood, the temporary reservoir would hold 65,810 acre-feet of water and extend 6.4 miles. For normal conditions and for smaller floods, the river and fish would pass through the outlets at the base of the flood retention structure. When a major flood or larger is predicted, the outlet gates would close, and water would be stored in a temporary reservoir. For this EIS, a storage period of up to 35 days was evaluated for a catastrophic flood scenario.

Exhibit S-2
Vicinity Map and EIS Study Area

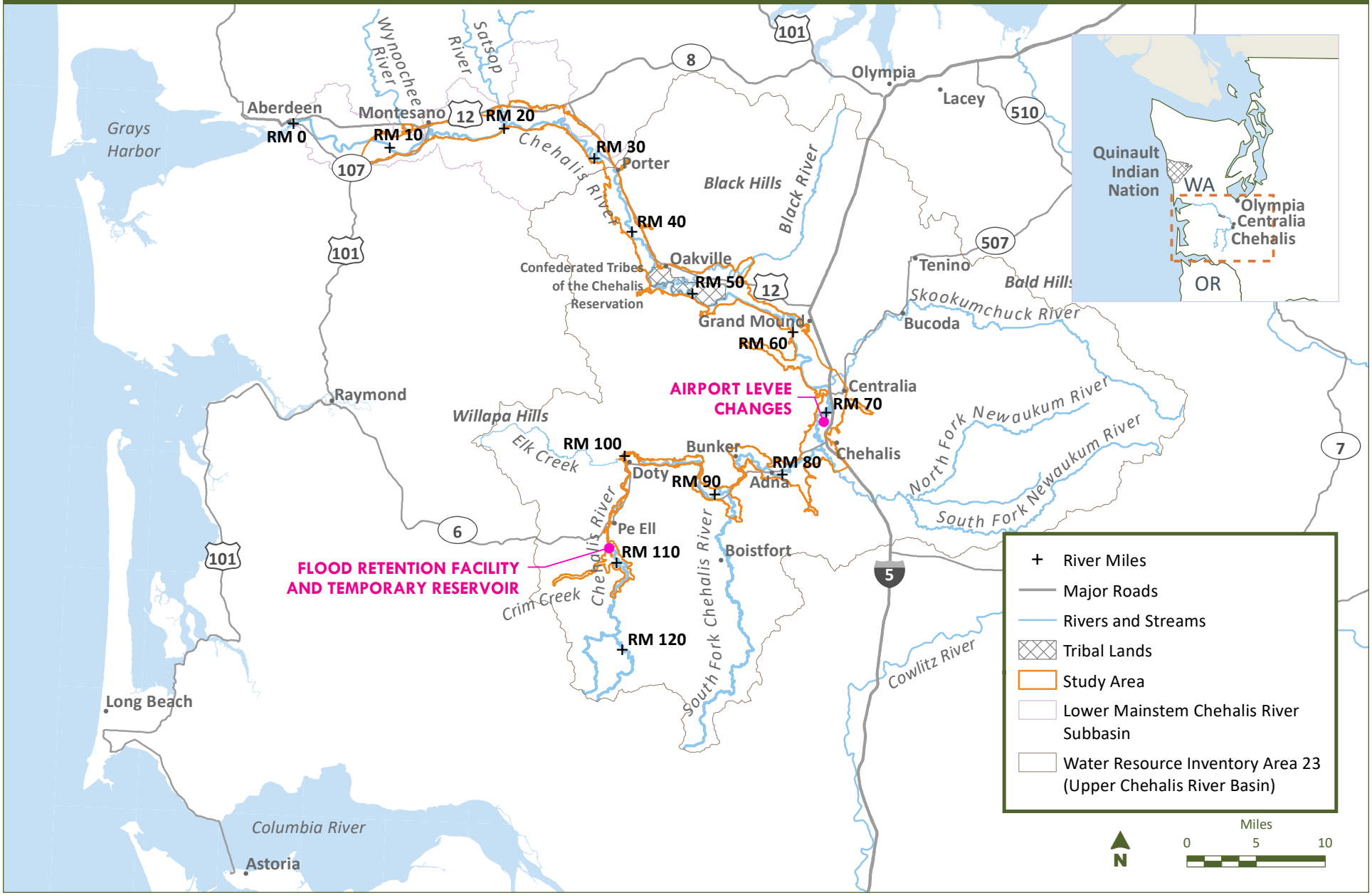
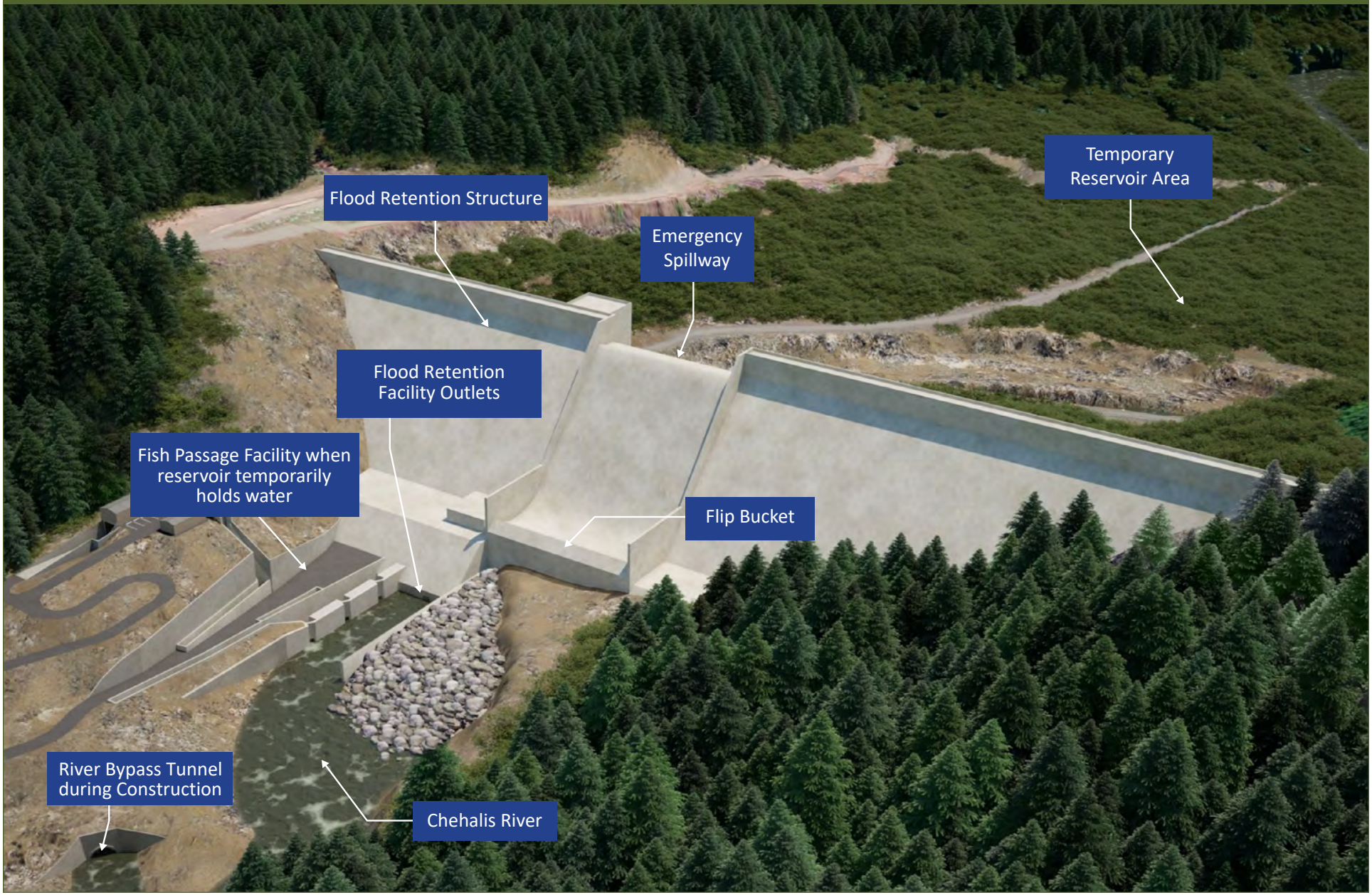


Exhibit S-3
Flood Retention Facility Illustration

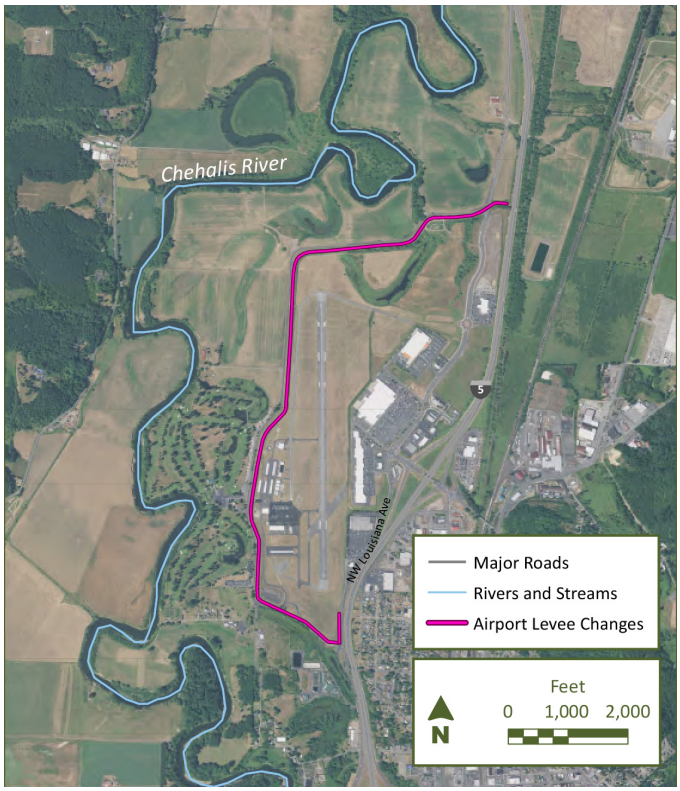


Source: HDR 2018

When the reservoir is holding water, fish would have to move upstream using a fish ladder and a trap-and-transport process. During construction, a temporary trap-and-transport process would be used. The Proposed Project also includes constructing quarries to provide rock for building the flood retention structure and roads for access to the quarries and flood retention facility areas.

The Airport Levee Changes include raising the existing airport levee and part of NW Louisiana Avenue (Exhibit S-4). The existing temporary retaining walls and the rock on top of the levee would be removed and 4 to 7 feet would be added to the height of the existing levee. The project would also raise a portion of NW Louisiana Avenue along the southern extent of the airport and replace utility infrastructure.

Exhibit S-4
Airport Levee Changes



What Other Alternatives are Evaluated in the EIS?

In addition to the Proposed Project, a Local Actions Alternative and a No Action Alternative were evaluated in the EIS. SEPA regulations require that an EIS analyze reasonable alternatives. In general, this means alternatives that could achieve the project objectives and have lower environmental costs. Over the past decades, many flood hazard projects and concepts have been studied. Ideas such as re-routing or raising I-5, other levees, floodwalls, flood retention facilities, and restoration actions have all been assessed for effectiveness in controlling floods. These alternatives were considered but not further analyzed in this EIS because they had higher environmental costs, were not economically feasible, or did not meet the Proposed Project objectives.

Local Actions Alternative

The Local Actions Alternative represents a local and non-structural approach to reduce flood damage in the study area. It considers a variety of local-scale options that local governments and agencies could choose to do in the future. These actions could potentially achieve the Applicant's objective through improving floodplain function, land use management actions, buying out or relocating at-risk properties or structures, improving flood emergency response, and increasing water storage from Pe Ell to

Centralia. The Local Action Alternative does not identify specific projects because those decisions would be made by local governments. Therefore, the EIS does not analyze the feasibility or economic practicability of these potential actions.

No Action Alternative

The No Action Alternative represents the most likely future, including the effects of climate change, if the Proposed Project is not constructed. Some large- and small-scale efforts would continue basin-wide as part of the Chehalis Basin Strategy work. Local flood damage reduction efforts would continue based on local planning and regulatory actions.

The No Action Alternative includes projects to reduce flood damage that are in progress, funded, or permitted as of June 2019. These projects include local floodproofing efforts, Chehalis River Basin Flood Authority projects, and some early Chehalis Basin Strategy and Aquatic Species Restoration Plan projects. The No Action Alternative does not include other possible future restoration, mitigation, or adaption action that may be taken. The EIS shows that substantial flood damage risks will continue to affect people, the environment, transportation, and structures. The EIS also shows that reductions in the number of salmon and steelhead from climate change will bring population abundances below 70% of historical abundance in the study area (a target in other Washington State salmon recovery plans), but to a lesser degree than the reductions from the Proposed Project.

What Geographic Area is Analyzed in the EIS?

The Chehalis Basin is primarily in Lewis County and Grays Harbor County and includes portions of Thurston, Pacific, Cowlitz, Mason, and Wahkiakum counties. The mainstem Chehalis River starts in the central Willapa Hills above Pe Ell in Lewis County and flows approximately 120 miles north-northwesterly to the Grays Harbor estuary and the Pacific Ocean. The flood retention facility would be located on property currently owned by Weyerhaeuser and the Panesko Tree Farm and used for commercial forest. The site is south of State Route 6 in Lewis County, on the mainstem Chehalis River at approximately river mile (RM) 108, about 1 mile south of Pe Ell. The Applicant is also proposing to raise the existing Chehalis-Centralia Airport levee and part of NW Louisiana Avenue. The locations of the Proposed Project are shown in Exhibit S-2.

What Resources Would Be Impacted by the Proposed Project?

Construction and operation of the Proposed Project would have significant impacts on fish, wildlife, aquatic and terrestrial habitat, recreation, earth, water, air, and wetlands. These impacts would occur in the flood retention facility and temporary reservoir area and downstream of the facility to the confluence with the South Fork Chehalis River. This includes significant impacts on spring-run and fall-run Chinook salmon, coho salmon, steelhead, lamprey, mountain whitefish, freshwater mussels, amphibians, and macroinvertebrates. Some of the amphibians are listed or candidates for listing in Washington State as endangered, threatened, or sensitive.

Modeling was done to identify impacts on salmon and steelhead in two areas of the Chehalis Basin near the proposed flood retention facility. The modeling predicts declining numbers of salmon and steelhead into the future with the Proposed Project. The subbasin upstream of Crim Creek supports populations of salmon and steelhead that are genetically unique from salmon and steelhead in other subbasins of the Chehalis River Basin. The modeling predicts that the Proposed Project would reduce the genetic diversity within and among salmon populations of each species across the Chehalis Basin. Spring-run Chinook spawn in three primary areas within the Chehalis Basin. The Proposed Project would significantly affect one of these three important spawning areas. Reductions in the number of salmon and steelhead in the late-century from the Proposed Project are significant because they bring population abundances even further below 70% of historical abundance than the reductions predicted from climate change alone. The Proposed Project could reduce future restoration options in the subbasins above and below Crim Creek and within the larger basin for the fish species and habitats they rely on.

Significant downstream impacts of the flood retention facility include possible impacts on the Town of Pe Ell's water supply, environmental health and safety, environmental justice populations, and wetlands from the Airport Levee Changes. In addition, the Proposed Project would eliminate peak channel-forming flows downstream, reduce input of large woody material, and significantly affect habitat.

These significant impacts are considered unavoidable impacts unless mitigation is technically feasible and economically practicable. The next page discusses the proposed mitigation in more detail. Significant adverse environmental impacts and proposed mitigation are described in Exhibits S-5 and S-6.

Tribal resources and cultural resources would also be impacted by the Proposed Project. Determinations of impacts and mitigation for these resources are made in government-to-government consultation and through the federal National Historic Preservation Act Section 106 process, which is currently in progress.

Impact Analysis Considerations

Timeframes

The Applicant proposes to construct the Proposed Project from 2025 to 2030, if permitted. The operational period analyzed was from 2030 to 2080. It was divided into two timeframes for impact analysis:

- **Mid-century** = 2030 to 2060
- **Late-century** = 2060 to 2080

Scenarios

- **Major flood:** A flood when water flow is 38,800 cfs or more at the Grand Mound gage, similar to the 2009 flood
- **Catastrophic flood:** A flood when water flow is 75,100 cfs at the Grand Mound gage, similar to the 1996 flood
- **Recurring flood:** A major flood or greater that occurs in 3 consecutive years

Environmental impacts from the Proposed Project downstream past Centralia and Chehalis would be moderate to minor.

How does the Proposed Project Affect Flooding?

Analysis shows the Proposed Project reduces flood duration and extents for many locations downstream of the facility. The amount of change varies based on the scenario and location and is shown in a mapbook available in Chapter 10 of the EIS. For the catastrophic flood scenario in the late-century, much of the land in the study area from Pe Ell to just upstream of the confluence of the South Fork Chehalis River would be no longer inundated, with flood depths being reduced by 1 inch to more than 8 feet lower than without the Proposed Project. This area mainly consists of rural and agricultural lands. In the City of Centralia, some residential areas would be protected. In the City of Chehalis, flood levels for much of the study area would be reduced by 3 to 5 feet. The Chehalis area would still experience flooding, and some areas would still have more than 10 feet of inundation during catastrophic flood events in the late-century. Downstream of Centralia, the modeled reduction in inundation during a late-century catastrophic flood scenario would be less than 3 feet with most of the area still inundated.

The EIS found that in the late-century, 2,955 existing structures could be inundated during a catastrophic flood in late-century. The Proposed Project would eliminate flooding for 1,280 of these structures. In the late-century, the Proposed Project reduces the flood levels at the Chehalis-Centralia airport by 50% for a catastrophic flood and reduces the duration of flooding from 60 hours to 40 hours. For I-5, six of seven interchanges that were analyzed would be inundated for less than 24 hours under the late-century catastrophic flood scenario. One would remain flooded for 48 hours. Actual freeway closure times would vary based on the Washington State Department of Transportation's need to prioritize the safety of the traveling public, which requires additional preparation and recovery time and involves closing approximately 20 miles of I-5 whenever any portion within that stretch is underwater.

What Mitigation is Proposed for the Applicant to Implement?

The SEPA EIS identifies proposed mitigation measures for the Applicant to develop and implement. Mitigation is intended to reduce and compensate for impacts on the environment from construction and operation of the Proposed Project. These mitigation measures would be implemented with, or as part of, the required permits, plans, and approvals.

WAC 197-11-440 states the EIS may discuss the technical feasibility and economic practicability of mitigation if there is a concern that the measure is capable of being accomplished. The decision if mitigation is feasible and meets the regulatory requirements would be determined during the permitting processes by the permitting agencies. In some cases, additional information on the project design would be required which is not available at this early stage of design.

Proposed mitigation includes developing and implementing mitigation and management plans for various resources, including vegetation, wetlands and wetland buffers, streams and stream buffers, fish and aquatic species and habitat, wildlife species and habitat, riparian habitat, surface water quality, recreation, greenhouse gas emissions, and large woody material. These plans would need to be approved by agencies and would be developed in conjunction with each other.

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Significant Impacts from the Proposed Project

The Proposed Project would have probable significant adverse environmental impacts from both construction and operations. These significant impacts would occur in the upstream areas of the Chehalis Basin. The environmental impacts downstream of Chehalis and Centralia would be moderate to minor. A summary of key impacts is presented in this map.

Impacts in Flood Retention Facility and Temporary Reservoir Area:

FISH AND WILDLIFE HABITAT

Construction and operation of the flood retention facility would significantly degrade habitat. Water temperatures would increase by up to 9ºF and habitat would be removed to build the retention structure. 90% of the trees in the 600-acre temporary reservoir area would be removed during construction. 847 acres would be temporarily flooded when the reservoir holds water, killing trees and vegetation.

FISH SPECIES

Construction and operation of the flood retention facility would degrade habitat, increase water temperatures, eliminate spawning areas, and reduce fish passage survivability. This would have significant impacts on spring-run and fall-run Chinook salmon, coho salmon, steelhead, other native fish like lamprey, and freshwater mussels.

WILDLIFE SPECIES

Habitat for wildlife would be degraded as described above. This, along with noise and reduced nesting and breeding areas, would significantly affect wildlife like amphibians and marbled murrelets.

WATER

Temperature increases of up to 9oF and decreased dissolved oxygen would affect Chehalis River water quality from construction and operation of the flood retention facility.

WETLANDS

11 acres of wetlands, 333 acres of wetland buffers, 17 miles of streams, 441 acres of stream buffers, and 0.3 acre of the Chehalis River would be permanently eliminated from the construction of the flood retention facility, road development, and removal of large trees and inundation in the reservoir area.

RECREATION

There would be a permanent loss of access to 14 miles of kayaking and 13 miles of recreational riverbank fishing.

LAND USE

Land use changes would be inconsistent with current land use and zoning designations.

AIR QUALITY AND GREENHOUSE GASES

Construction and operation would cause over 123,000 metric tons of greenhouse gas emissions.

Impacts Between the Flood Retention Facility and the South Fork Chehalis River:

ENVIRONMENTAL HEALTH AND SAFETY

While extremely unlikely, if ground shaking from an earthquake causes a breach of the flood retention structure at the same time the reservoir is holding water, it would cause significant impacts on people, infrastructure, and the environment downstream.

WATER

Temperature increases of up to 5.4oF and decreased dissolved oxygen would affect Chehalis River water quality for about 20 miles downstream of the facility. Turbidity would increase when water is released from the temporary reservoir and after storms.

FISH HABITAT

Changes in the movement of sediment and removal of part of the river channel for construction and during reservoir inundation would significantly affect fish habitat. Operation of the flood retention facility would eliminate peak channel-forming flows and remove large woody material, reducing the habitat downstream.

FISH SPECIES

Construction and operation of the flood retention facility would degrade habitat, increase water temperatures, eliminate spawning areas, and reduce fish passage survivability. This would have significant impacts on spring-run and fall-run Chinook salmon, coho salmon, steelhead, and other native fish like lamprey.

Impacts Near Pe Ell:

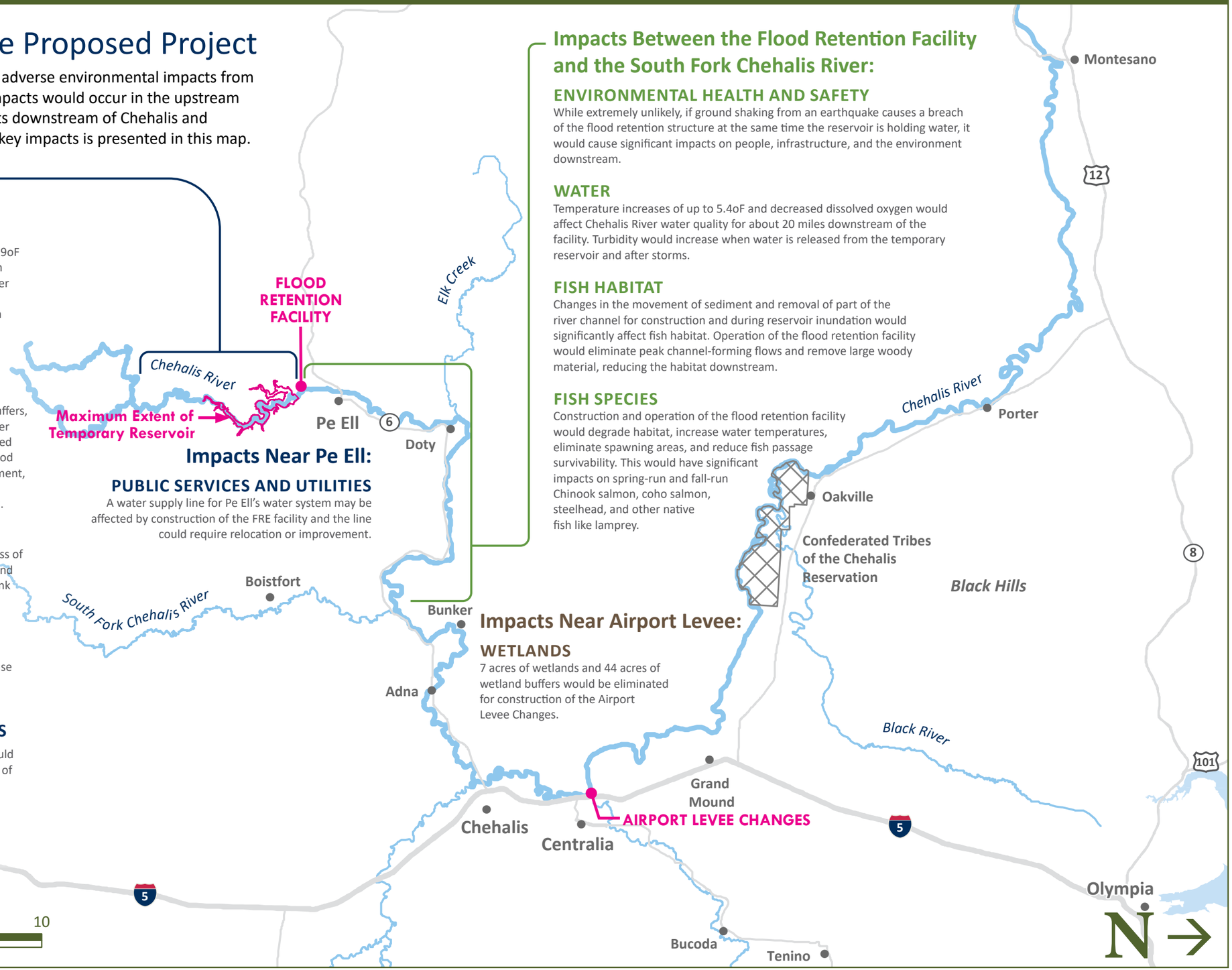
PUBLIC SERVICES AND UTILITIES

A water supply line for Pe Ell's water system may be affected by construction of the FRE facility and the line could require relocation or improvement.

Impacts Near Airport Levee:

WETLANDS

7 acres of wetlands and 44 acres of wetland buffers would be eliminated for construction of the Airport Levee Changes.



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Significant Adverse Environmental Impacts and Proposed Mitigation Summary

Exhibit S-6 provides a summary of probable significant impacts from construction and operation of the Proposed Project for each environmental resource that was analyzed. No significant impacts were identified for Noise and Vibration, Transportation, or Visual Resources and these are not included in the summary.

Exhibit S-6

Summary of Significant Impacts and Proposed Mitigation for the Proposed Project (in alphabetical order by resource)

ELEMENT OF THE ENVIRONMENT	IMPACT FINDING	DESCRIPTION	PROPOSED MITIGATION MEASURES
Air Quality and Greenhouse Gases	**Significant**	Combined greenhouse gas (GHG) emissions from construction and operation would be 123,439 metric tons.	• Prepare a GHG Mitigation Plan to reduce 100% of emissions from construction and operation. • Ensure timber removed from the temporary reservoir area will not be burned.
Cultural Resources	**Findings of eligibility and adverse effects are determined during the ongoing federal Section 106 process**	Flood retention facility construction could affect four archaeological sites and reservoir inundation could affect nine sites. Airport Levee Changes could affect eight archaeological sites. Traditional and Cultural Properties may also be affected.	• Mitigation and treatment requirements would be determined through the current federal consultation under the National Historic Preservation Act Section 106 process and documented in a Memorandum of Agreement among the Section 106 parties.
Earth **(also Wetlands)**	**Significant and unavoidable, unless mitigation is feasible**	Permanent alteration of 0.32 acre of river channel at the flood retention facility site. Changes to sediment transport and substrate in the river channel within the temporary reservoir.	Develop and implement: • Fish and Aquatic Species and Habitat Mitigation Plan • Riparian Habitat Mitigation Plan • Stream and Stream Buffer Mitigation Plan • Surface Water Quality Mitigation Plan • Vegetation Management Plan
Environmental Health and Safety **(also Earth)**	**Significant and unavoidable**	The likelihood of a flood retention facility failure from ground shaking during a large earthquake at the same time the reservoir is storing water is extremely low, but consequences to people, buildings, infrastructure, and the environment would be significant.	• Develop and implement a breach flood warning system for Pe Ell, Centralia, and Chehalis. • Provide training to local emergency response officials for dam breach scenarios.

ELEMENT OF THE ENVIRONMENT	IMPACT FINDING	DESCRIPTION	PROPOSED MITIGATION MEASURES
Environmental Justice	**Significant and disproportionate**	There would be disproportionate impacts on environmental justice populations in the event of a flood retention facility failure from groundshaking during a large earthquake while the reservoir is holding water.	• Develop an inclusive public involvement strategy tailored to the communities who may be affected.
Fish, Aquatic Species and Habitat in the: Headwaters and Upper Chehalis River (including the flood retention facility and temporary reservoir areas) and Upper to Middle Chehalis River (downstream of flood retention facility) **(also Recreation, Earth, Wildlife Species and Habitat)**	**Significant and unavoidable, unless mitigation is feasible for:** • Aquatic habitat in the reservoir area and from the facility site to the confluence with the South Fork Chehalis River • Spring-run and fall-run Chinook salmon, coho salmon, and steelhead in the Above Crim Creek and Rainbow Falls to Crim Creek subbasins • Non-salmon native fish, including lamprey • Migratory non-salmon native fish, including minnows and sculpin • Freshwater mussels • Macroinvertebrates	Impacts on fish, aquatic species, and aquatic habitat function from: • Temporary dewatering of the river and in-water work during construction, • Reduced fish passage survival • Permanent elimination of 0.32 acre of aquatic habitat • Degraded riparian function • Reduced nutrient availability • Removal of non-flood tolerant trees in 600 acres of the temporary reservoir area during construction • Recurring inundation events affecting up to 847 acres of vegetation during operations • Reduction in channel-forming flows and large woody material downstream of the facility site • Water temperature increases and decreases in dissolved oxygen from loss of vegetation in the temporary reservoir • Increased turbidity downstream from reservoir releases	Develop and implement: • Fish and Aquatic Species and Habitat Plan • Large Woody Material Management Plan • Riparian Habitat Mitigation Plan • Stream and Stream Buffer Mitigation Plan • Surface Water Quality Mitigation Plan • Vegetation Management Plan • Wetland and Wetland Buffer Mitigation Plan • Wildlife Species and Habitat Management Plan
Land Use	**Significant and unavoidable, unless mitigation is feasible**	Impacts on shoreline ecological functions at the flood retention facility and temporary reservoir area from vegetation removal and inundation events. This would be inconsistent with land use plans, policies, and regulations to maintain no net loss of ecological	Rezone or convert land use under conditional use permit. Develop and implement: • Fish and Aquatic Species and Habitat Plan • Riparian Habitat Mitigation Plan

ELEMENT OF THE ENVIRONMENT	IMPACT FINDING	DESCRIPTION	PROPOSED MITIGATION MEASURES
		function. Change from commercial forestry would be inconsistent with the current Forest Resource land use and zoning designations.	• Stream and Stream Buffer Mitigation Plan • Surface Water Quality Mitigation Plan • Vegetation Management Plan • Wetland and Wetland Buffer Mitigation Plan • Wildlife Species and Habitat Management Plan
Public Services and Utilities **(also Water)**	**Significant**	A water supply line for the Town of Pe Ell's water system would be affected by the flood retention facility construction and temporary reservoir inundation, and the line could require relocation or improvement.	• Conduct a study with the Town of Pe Ell to determine if the water supply line needs to be redesigned to ensure that it can withstand inundation or needs to be relocated, and, if so, develop a cost estimate and provide funding.
Recreation	**Significant and unavoidable, unless mitigation is feasible**	Permanent loss of use of 13.8 miles of the Chehalis River for kayaking and whitewater boating and 12.8 miles of riverbank for recreational fishing. The reduction of fish from the Chehalis River headwaters to Rainbow Falls would impact recreational fishing by reducing the number of fish available to be caught.	Develop and implement: • Fish and Aquatic Species and Habitat Plan • Recreation Mitigation Plan
Tribal Resources	**Determined during government-to-government consultations**	Significant impacts on fish and aquatic species, wildlife species, and aquatic and wildlife habitat during construction and operation of the flood retention facility or the Airport Levee Changes could affect tribal resources.	• Determined during government-to-government consultations
Water **(also Earth, Fish, Aquatic Species and Habitat)**	**Significant and unavoidable, unless mitigation is feasible**	• Increased water temperatures of 2°C to 3°C (3.6°F to 5.4°F) in the Chehalis River and in Crim Creek by 2°C to 5°C (3.6°F to 9°F) • Decreased dissolved oxygen in the temporary reservoir area and downstream about 20 miles from loss of riparian shading • Exceedances of turbidity when the temporary reservoir is inundated and water released, and during subsequent storms when sediment may be resuspended	Develop and implement: • Surface Water Quality Mitigation Plan

ELEMENT OF THE ENVIRONMENT	IMPACT FINDING	DESCRIPTION	PROPOSED MITIGATION MEASURES
Wetlands	**Significant and unavoidable, unless mitigation is feasible**	• Flood retention facility construction and operation would eliminate 11 acres of wetlands, 333 acres of wetland buffer habitats, 17 miles of streams, and 441 acres of stream buffers due to removal of trees and inundation of the reservoir • Airport levee changes would eliminate 7 acres of wetlands and 44 acres of wetland buffers	Develop and implement: • Fish and Aquatic Species and Habitat Plan • Riparian Habitat Mitigation Plan • Stream and Stream Buffer Mitigation Plan • Surface Water Quality Mitigation Plan • Vegetation Management Plan • Wetland and Wetland Buffer Mitigation Plan
Wildlife Species and Habitats	**Significant and unavoidable, unless mitigation is feasible**	Elimination of upland, wetland, and riparian habitat and impacts on wildlife species from: • Removal of 90% of tree cover in the 600-acre temporary reservoir area during construction of the flood retention facility • Tree removal on 847 acres from inundation of the reservoir and periodic tree removal • Inundation of up to 847 acres in the temporary reservoir area • Decreased habitat functions • Increased water temperatures • Invasive species colonization • Noise during construction • Mortality of species unable to move during inundation of the reservoir, like amphibians or nesting birds • Mortality of species due to loss of habitat • Decreased distribution of native species and increased habitat for non-native species	Develop and implement: • Fish and Aquatic Species and Habitat Plan • Large Woody Material Management Plan • Riparian Habitat Mitigation Plan • Stream and Stream Buffer Mitigation Plan • Surface Water Quality Mitigation Plan • Vegetation Management Plan • Wetland and Wetland Buffer Mitigation Plan • Wildlife Species and Habitat Management Plan

What are the Areas of Uncertainty and Controversy?

There is uncertainty if the proposed mitigation is technically feasible or economically practicable; therefore, the Proposed Action would have **significant and unavoidable** adverse environmental impacts on the environment as shown in Exhibit S-6. The Applicant may provide mitigation plans. If the agencies determine the plans meet regulatory requirements and the implementation is feasible, then the impacts would be addressed as part of the permitting processes.

How Do I Provide Comments on the Draft EIS?

Comments on this Draft EIS will be accepted during a 61-day comment period (February 27 through April 27, 2020). Comments may be submitted the following ways:

By mail:

SEPA Draft EIS for the Proposed Chehalis Flood Damage Reduction Project
c/o Anchor QEA, LLC
1201 3rd Avenue, Suite 2600
Seattle, WA 98101

Online: using the comment form on the website at chehalisbasinstrategy.com/eis/comment-form

In person at a public hearing, verbally or in writing:

- Tuesday, March 31, from 5:00 p.m. to 8:30 p.m.
  Centralia College – TransAlta Commons
  600 Centralia College Boulevard
  Centralia, WA 98531

- Thursday, April 2, from 5:00 p.m. to 8:30 p.m.
  Montesano Jr. Sr. High School – Commons Room
  303 Church Street North
  Montesano, WA 98563

Comments received on the Draft EIS during the comment period will be compiled and considered by Ecology and substantive comments will be reviewed for preparation of a Final EIS. Ecology anticipates the Final EIS will be published within a year from the release of the Draft EIS, depending on the number and substance of comments and any need for additional work. The Final EIS may be used by local and state agencies to inform permit decisions for the Proposed Project. Seven days following publication of the Final EIS, permits for the Proposed Project may be issued based on the regulatory requirements for each permit process. If permitted, construction of the Proposed Project could begin in 2025.

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1 INTRODUCTION

1.1 EIS Overview

The Chehalis River Basin Flood Control Zone District (the Applicant) proposes to build a new flood retention facility and temporary reservoir near Pe Ell, Washington, and to make changes to the Chehalis-Centralia Airport levee in Chehalis, Washington. These are called the "Proposed Project" in the EIS.

The Washington Department of Ecology (Ecology) determined the Proposed Project is likely to have a significant adverse impact on the environment and requires an Environmental Impact Statement (EIS). An EIS evaluates the probable significant adverse impacts on the environment from the Proposed Project. It analyzes the future conditions when the project is proposed to be constructed and operated. This EIS also evaluates two alternatives, a Local Actions Alternative and a No Action Alternative.

Ecology has prepared this Draft EIS to meet the State Environmental Policy Act (SEPA) requirements in the Washington Administrative Code (WAC). The EIS does not approve or deny a proposed project. It provides information about the probable, significant, environmental, adverse impacts of a proposal. Local and state agencies will use the information in this EIS, along with other information, for making decisions on permits. The Chehalis Basin Board is expected to use this EIS to inform its recommendations for the long-term Chehalis Basin Strategy.

The Proposed Project

The Applicant: The Chehalis River Basin Flood Control Zone District

The Proposed Project: To build a flood retention facility and associated temporary reservoir on the Chehalis River, and make changes to the Chehalis-Centralia Airport levee

Environmental Review Terminology

Lead Agency: The agency responsible for preparing the EIS (Ecology)

Environmental Impact Statement or EIS: A fact-based document that evaluates the probable significant adverse environmental impacts of the Proposed Project. It also looks at alternatives and mitigation to avoid or minimize impacts.

EIS Alternatives: An action that meets the Applicant's objectives but at a lower environmental cost. This EIS has two alternatives, the Local Actions Alternative and the No Action Alternative.

State Environmental Policy Act or SEPA: State law that requires analysis of the probable environmental impacts of a proposed project before any decisions to approve or issue permits are made by government agencies.

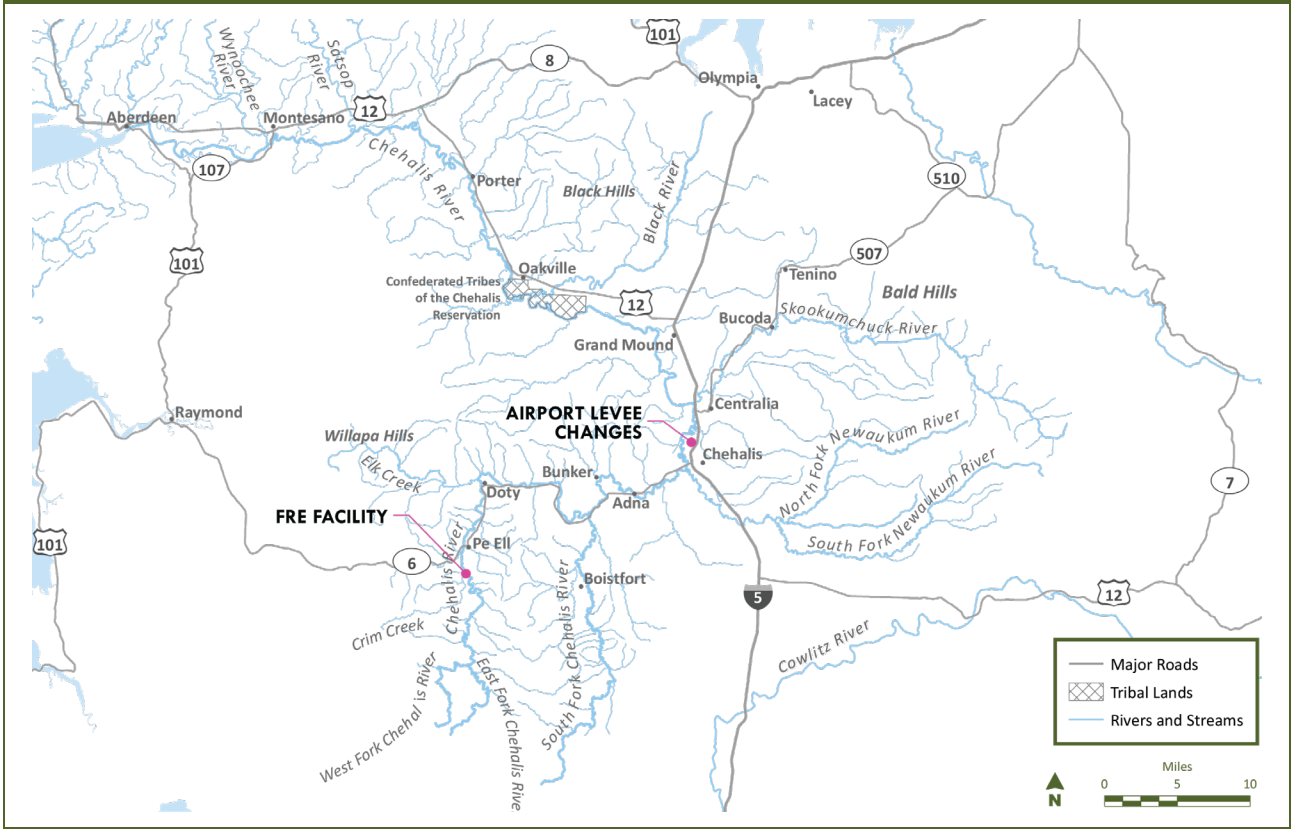
1.2 Proposed Project and Alternatives

The Applicant proposes to:

- **Construct a flood retention facility and associated temporary reservoir** near Pe Ell on the Chehalis River to reduce peak flood levels during a major flood or larger, from floods originating in the Willapa Hills. A major flood is measured as 38,800 cubic feet per second (cfs) at the Grand Mound stream gage.
- **Make changes to the Chehalis-Centralia Airport levee** by raising the levee 4 to 7 feet, widening the levee, and raising a portion of NW Louisiana Avenue to reduce flood damage from a catastrophic flood. A catastrophic flood is measured as 75,100 cfs at the Grand Mound stream gage.

The locations of the Proposed Project are shown in Exhibit 1-1. In addition to the Proposed Project, this EIS evaluates two alternatives, the Local Actions Alternative and the No Action Alternative. The Local Actions Alternative looks at local and nonstructural approaches to reduce flood damage without the flood retention facility or levee changes. The No Action Alternative represents the most likely future scenario if the Proposed Project is not built. More detail on the Applicant's Proposed Project and the alternatives are in Chapter 2.

Exhibit 1-1
Vicinity Map



1.3 Background and History

The Chehalis River Basin in Southwestern Washington has a history of chronic flooding and damage from large floods from the Chehalis River and its major tributaries. The Chehalis River Basin Flood Authority was formed as a cooperative organization of local governments and the Confederated Tribes of the Chehalis Reservation that came together in response to the 2007 Chehalis Basin flood. The Chehalis River Basin Flood Control Zone District was created in 2011 to take on and maintain flood control projects in the Chehalis Basin. Its jurisdiction covers areas of Lewis County located within the Chehalis River Basin watershed. It is authorized to take action necessary to protect property and life from flood damage, acquire property, accept and provide funds, and control and remove floodwater.

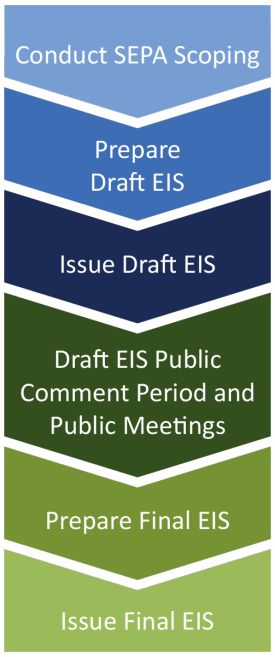
In 2012, the Governor's Chehalis Basin Work Group was created to look at how to reduce flood damage and improve aquatic species habitat in the Chehalis Basin. The Work Group was made up of six representatives, including local elected officials, tribal leaders, and citizens. They evaluated a variety of options, including both big and small projects. Following the efforts of the Work Group, the Chehalis Basin Strategy was created in 2014 to coordinate projects and efforts to reduce flood damage and improve aquatic habitat. In 2016 (effective July 1, 2017), the Washington Legislature created the Office of Chehalis Basin within Ecology to administer funding to implement the Chehalis Basin Strategy. The Chehalis Basin Board was created to provide long-term oversight of the strategy. The board is also responsible for developing budget recommendations to the Governor's office to implement the strategy. The Chehalis Basin Board has seven members who represent the Chehalis River Basin Flood Authority, the Confederated Tribes of the Chehalis Reservation, the Quinault Indian Nation, as well as agricultural, environmental, and economic interests in the basin. There are also five non-voting board members representing state agencies.

In 2017, a Programmatic EIS was finalized which evaluated large projects that might be used for the Chehalis Basin Strategy to reduce damages from floods and restore degraded aquatic species habitat. It considered several concepts to reduce flood damage and restore aquatic habitat, including water retention facilities and levee improvements. The Programmatic EIS evaluated these ideas at a high level to identify potential significant impacts. The flood retention facilities evaluated in the Programmatic EIS included a Flood Retention Flow Augmentation facility with a permanent reservoir and a Flood Retention Only facility with a temporary reservoir. After review of the Draft Programmatic EIS in the fall of 2016, the Governor's Work Group recommended a project-level EIS be completed to further identify the probable significant impacts of a flood retention facility.

On October 13, 2017, the Chehalis River Basin Flood Control Zone District's Board of Supervisors decided to become the project sponsor for a proposed flood retention facility. As the Applicant, the Chehalis River Basin Flood Control Zone District proposes to build a flood retention facility and make changes to the Chehalis-Centralia Airport levee. The operator for the proposed flood retention facility has not yet been identified. The Proposed Project is described in Chapter 2.

1.4 State Environmental Policy Act Process

The SEPA process identifies and analyzes environmental impacts from a proposed project. The process helps agency decision-makers, applicants, and the public understand how the entire proposal will affect the environment. The environmental review process in SEPA is intended to work with other regulations and documents to provide a comprehensive review of a proposal. Ecology has prepared this Draft EIS under SEPA requirements described in Washington Revised Code Chapter 43.21C and Washington Administrative Code Chapter 197-11. Ecology issued a Determination of Significance on September 24, 2018, starting the EIS process.



The U.S. Army Corps of Engineers (Corps) is developing a federal EIS to evaluate the Proposed Project under the National Environmental Policy Act (NEPA) requirements. The federal EIS is separate from this state EIS and is expected to be released in September 2020.

1.5 EIS Organization

This EIS is organized to provide information in three ways. The Summary provides quick, high-level information on key findings and significant impacts. The Draft EIS chapters provide details on the EIS technical methods, impact analysis, and findings. Each EIS chapter for a resource has a related technical Discipline Report in the Appendices. The Discipline Reports include detailed and technical information. The Discipline Report is the official technical documentation for this EIS and if there is conflicting information between the Summary, EIS sections, or the Discipline Report, the Discipline Report is considered to be the controlling document.

- Summary
- Draft EIS
  - Chapter 1: Introduction
  - Chapter 2: Proposed Project Description and Alternatives
  - Chapter 3: EIS Analysis Terminology and Approach
  - Chapter 4: Required Permits and Approvals
  - Chapter 5: Impact Analysis, Findings, and Potential Mitigation
  - Chapter 6: Cumulative Impacts
  - Chapter 7: Consultation and Coordination
  - Chapter 8: List of Preparers and Contributors
  - Chapter 9: Distribution List
  - Chapter 10: EIS Mapbook

- Appendices
  - Appendix 1: Proposed Project Description and Alternatives
  - Appendix 2: Cumulative Impacts Analysis
  - Appendix 3: Scoping Summary Report
  - Appendix 4: Bibliography
- Discipline Reports
  - Appendix A: Air Quality and Greenhouse Gas Discipline Report
  - Appendix B: Cultural Resources Discipline Report
  - Appendix C: Environmental Health and Safety Discipline Report
  - Appendix D: Environmental Justice Discipline Report
  - Appendix E: Fish Species and Habitats Discipline Report
  - Appendix F: Earth Discipline Report
  - Appendix G: Land Use Discipline Report
  - Appendix H: Noise and Vibration Discipline Report
  - Appendix I: Public Services and Utilities Discipline Report
  - Appendix J: Recreation Discipline Report
  - Appendix K: Transportation Discipline Report
  - Appendix L: Tribal Resources Discipline Report
  - Appendix M: Visual Quality Discipline Report
  - Appendix N: Water Discipline Report
  - Appendix O: Wetlands Discipline Report
  - Appendix P: Wildlife Species and Habitats Discipline Report

2 PROPOSED PROJECT DESCRIPTION AND ALTERNATIVES

This section summarizes information provided by the Applicant about their Proposed Project, also called the Proposed Action. It also describes the two alternatives that were developed for the EIS (the Local Actions Alternative and No Action Alternative). *Appendix 2, Proposed Project Description and Alternatives*, contains the detailed information used for this section.

2.1 Applicant Purpose and Objectives

The Applicant's purpose for the Proposed Project is to reduce flood damage in the Chehalis-Centralia area by constructing a flood retention facility and temporary reservoir near Pe Ell and making changes to the Chehalis-Centralia Airport levee.

The Applicant's objective for the Proposed Project is to reduce flooding coming from the Willapa Hills and improve the levee protection level at the Chehalis-Centralia Airport.

2.2 Location and Regional Setting

The Chehalis Basin is primarily in Lewis County and Grays Harbor and includes smaller portions of Thurston, Pacific, Cowlitz, and Wahkiakum counties. The Chehalis Basin includes managed forestlands, agricultural lands, and the cities of Chehalis, Centralia, Montesano, and many smaller cities. The Confederated Tribes of the Chehalis Reservation is also located in the Chehalis Basin, near the City of Oakville. The mainstem Chehalis River starts in the central Willapa Hills above Pe Ell in Lewis County where the East Fork Chehalis River and West Fork Chehalis River meet. The Chehalis River flows about 125 miles north where it reaches the Grays Harbor estuary and the Pacific Ocean.

The Applicant's Proposed Project includes two sites located in Lewis County: 1) a flood retention facility and temporary reservoir area located on the mainstem Chehalis River about 1 mile south (upstream) of Pe Ell; and 2) changes to the levee along the northern, western, and southern boundaries of the Chehalis-Centralia Airport in Chehalis. Exhibit 1-1 shows the location of the Applicant's Proposed Project.

The flood retention facility would be located on property currently owned by Weyerhaeuser and the Panesko Tree Farm. The site is south of State Route (SR) 6 in Lewis County, on the mainstem Chehalis River at about river mile (RM) 108, about 1 mile south of Pe Ell. The Applicant would need to acquire the property for the flood retention facility and reservoir footprint. The Applicant has stated the land would no longer be managed as commercial forestland. The Applicant is also proposing to raise the existing Chehalis-Centralia Airport levee and part of NW Louisiana Avenue (Exhibit 1-1).

2.3 Proposed Project

2.3.1 Flood Retention Facility and Temporary Reservoir

The proposed flood retention facility, also called the Flood Retention Expandable (FRE) facility, would store floodwater during major or larger floods. For this EIS, a major flood is when the Chehalis River flow is equal to or greater than 38,800 cfs but less than 75,100 cfs of water at the Grand Mound stream gage and a catastrophic flood is when the river flow is equal to or greater than 75,100 cfs. This gage also measures water coming from the Newaukum River and Skookumchuck River. When river forecasts show the river flow could be 38,800 cfs at the Grand Mound gage, the gates on the FRE outlets would be activated. Water would then be stored in the temporary reservoir behind the FRE structure.

The Applicant's intent for the FRE facility is to reduce the severity and duration of major floods or larger caused by rain falling in the Willapa Hills and reduce flood damage in Centralia and Chehalis. The FRE facility would not protect communities from all flooding, and it is not designed to reduce regular annual flooding from the Chehalis River or smaller floods.

Commonly Used Terms

Acre-foot or acre-feet: This is the volume of water that would cover 1 acre of land to a depth of 1 foot. 1 acre-foot = 43,560 cubic feet.

Catastrophic Flood: Size of a flood when the water flow is 75,100 cfs at the Grand Mound stream gage. This is similar in size to the 1996 flood.

Cubic feet per second or cfs: This is a measurement of the rate of water flow of a stream or river. 1 cfs = 7.48 gallons of water flowing each second.

FRE or FRE Facility: The Flood Retention Expandable Facility, which is part of the Proposed Project.

Major Flood: Size of a flood when the water flow is 38,800 cfs at the Grand Mound stream gage. This is similar in size to the 2009 flood.

Outside of these events, the river would flow through the FRE facility. Fish would move through the openings in the structure most of the time, and when the reservoir holds water, they would move using a fish ladder and be moved upstream using a trap-and-transport process. The Applicant intends the flood retention structure to hold up to 65,000 acre-feet of water in the temporary reservoir. The Applicant calls the proposed facility expandable because it would be built so it could support the future construction of a larger structure. The larger structure could hold up to 130,000 acre-feet of water in the reservoir. This expansion may or may not occur, and, if pursued in the future, it would be subject to a separate environmental review and permitting process.

The Applicant has identified the following metrics for the reduction in flood damage:

- Protect approximately 635 structures of value from flooding risk during a catastrophic flood.
- Reduce disruption of access via main transportation routes, specifically ensuring access along SR 6 and Interstate 5 (I-5) is open within 24 hours of a catastrophic flood.
- Minimize flood-related impacts (e.g., closure) at the Chehalis-Centralia Airport.

2.3.2 FRE Facility Design

The FRE facility would be a roller-compacted concrete gravity structure (Exhibit 2-1). The top of the FRE facility would be 1,550 feet long and up to 270 feet high. It would be located at RM 108 on the Chehalis River, about 1 mile upstream of Pe Ell.

There would be five 310-foot-long openings (outlets) along the base of the structure that would allow the Chehalis River to flow through the FRE facility unimpeded outside of major (or greater) flood events. One of the outlets would be 12 feet wide by 20 feet high and four would be 10 feet wide by 16 feet high. Under normal conditions, the outlet gates would typically be open, and the river would pass through the outlets to a 230-foot-long stilling basin (Exhibit 2-2). This concrete basin is designed to slow the water and minimize downstream channel erosion. Water would re-enter the natural river channel downstream of the FRE facility.

Parts of the FRE Facility

Emergency Spillway: If the flood is larger than catastrophic and more than the reservoir can contain, water would flow over the top of the FRE structure here.

Fish Passage: A trap-and-transport facility that captures fish and transports by truck around the dam above the reservoir to allow fish to move upstream when the FRE gates are closed.

Flip Bucket: Part of the base of the FRE structure that directs the water coming from the emergency spillway a safe distance downstream. It reduces the force of the water entering the river channel.

Low-Level Outlets: Five openings in the FRE structure to allow the Chehalis River to pass through the FRE structure. These can be closed using gates during floods.

River Bypass Tunnel: A tunnel that will redirect water around the construction site while the FRE facility is being built.

Stilling Basin: An area at the base of the FRE structure where the channel widens temporarily to reduce the speed and energy of the water coming out of the outlets and to reduce erosion.

Temporary Reservoir: The area used to store water upstream of the FRE facility. The EIS analyzed the reservoir storing 65,810 acre-feet of water.

Temporary Reservoir Inundation area: The maximum area of the temporary reservoir that would be temporarily covered by water during a catastrophic flood. The EIS analyzed an area of 847 acres.

Temporary Reservoir Inundation extent: The maximum length where the reservoir would cover the river. The EIS analyzed an extent of 6.4 miles.

Exhibit 2-1
Flood Retention Facility Illustration

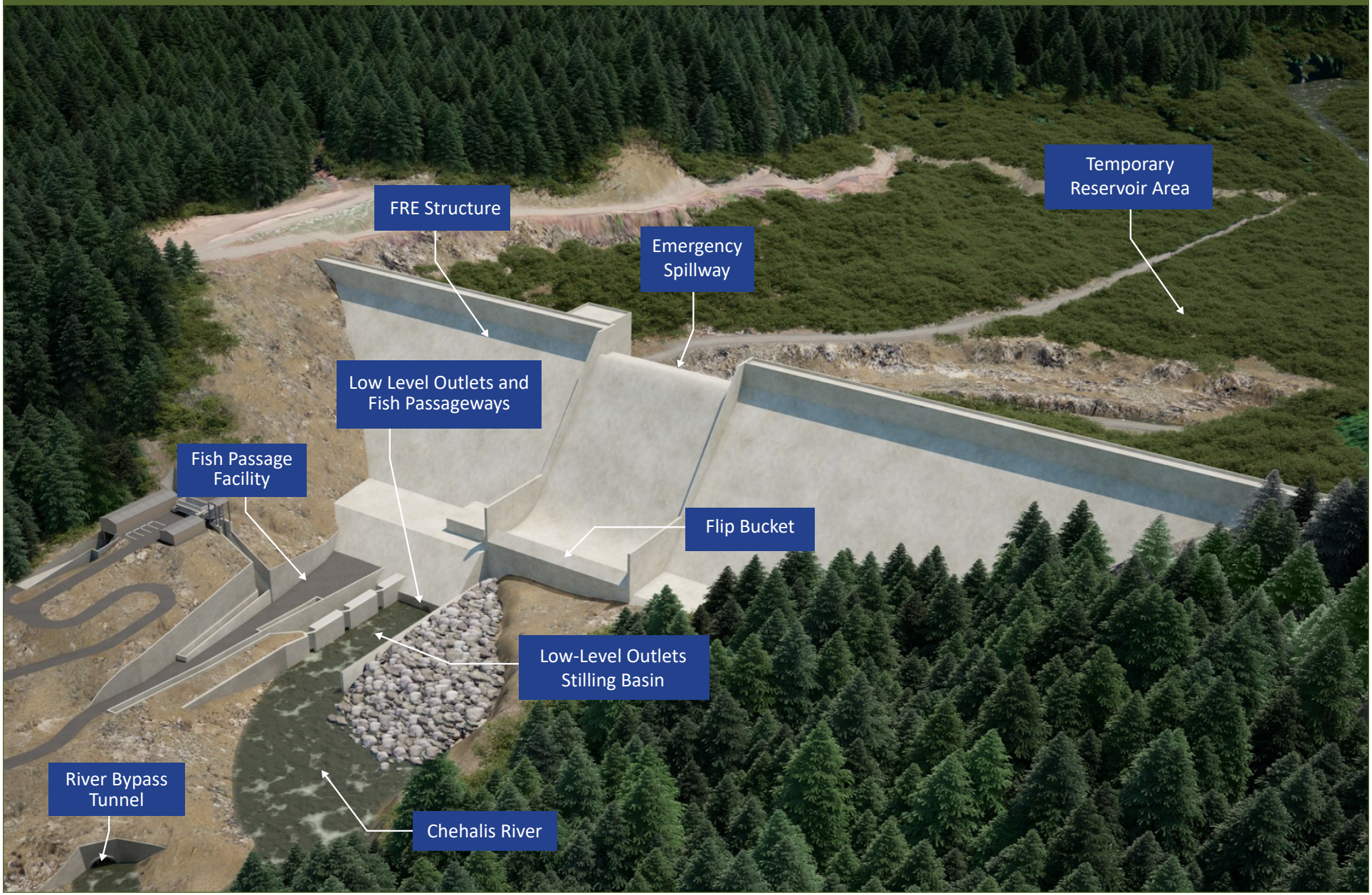
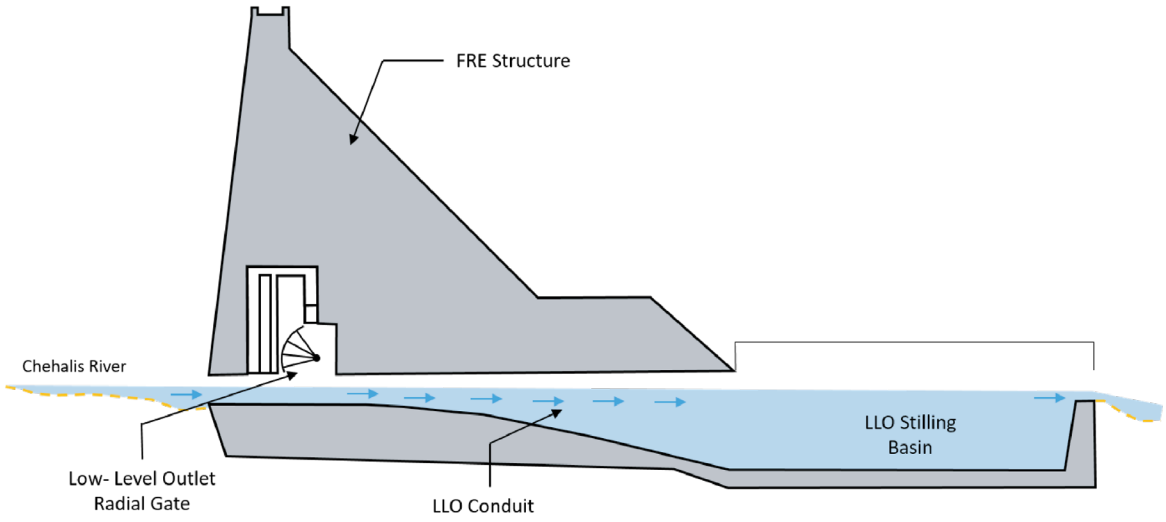


Exhibit 2-2
Side View of FRE Facility Showing River Flow During Normal Conditions



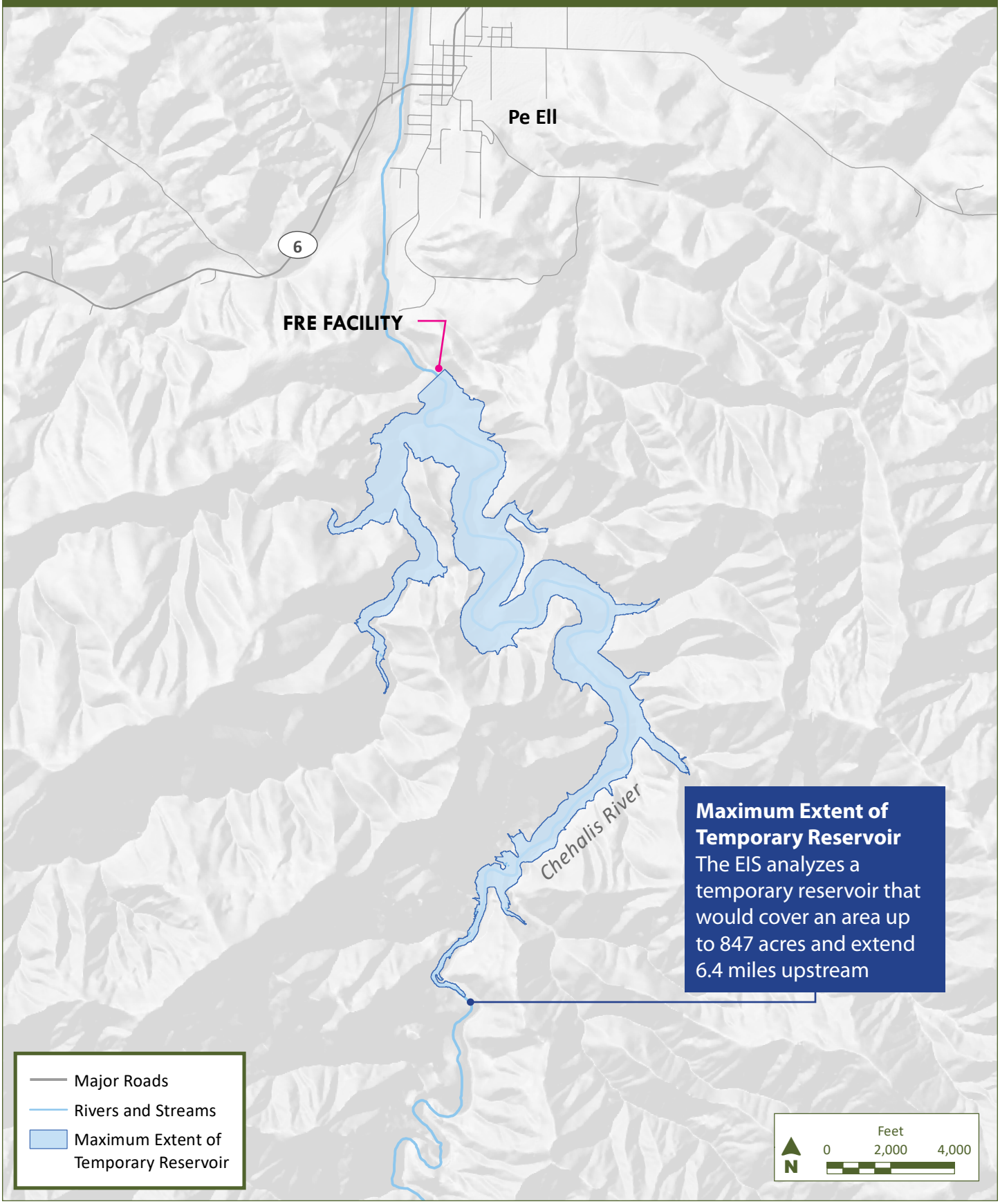
Source: HDR 2020

During major floods or larger, the outlet gates would be closed and water would fill the temporary reservoir (Exhibit 2-3). After flooding has subsided, for a major or catastrophic flood, the water in the reservoir would be released slowly back to the river. The release of water could last up to 35 days.

The FRE facility site would be accessed from Muller Road and Forest Road (FR) 1000. Existing forest roads will need to be improved to access the FRE facility area. The Applicant plans to access the site using existing roads. These would provide permanent access around the temporary reservoir area and temporary access to and around the construction site. The Applicant would construct some smaller, temporary roads within the active construction site for construction access. Temporary roads within the active construction site would be removed and restored after construction is complete.

A new power line would be constructed for the FRE facility's pumps, gates, instruments, and other controls. The new power lines for the fish passage facility and gate operations would connect to existing local transmission lines. The new power lines could be above or below ground and would be located along existing roads and areas cleared for FRE facility construction.

Exhibit 2-3
Temporary Reservoir Extent



The Applicant's proposal used current climate conditions to determine the maximum extents of the temporary reservoir for a catastrophic flood. Under these conditions, the reservoir would store 65,000 acre-feet of water, extend 6.2 miles, have a depth of 195 feet, and would cover 778 acres (Exhibit 2-4).

Because the EIS analyzes the future conditions, it includes climate change projections. With climate change, a catastrophic flood (when the stream gage at Grand Mound reads above 75,100 cfs) is larger. So, the EIS analyzes the probable impacts for a temporary reservoir storing 65,810 acre-feet. The reservoir area analyzed in this EIS would cover 6.4 miles along the Chehalis River with a depth of 202 feet, and would cover 847 acres (Exhibit 2-4). The maximum design capacity of the temporary reservoir is slightly greater than the late-century conditions analyzed in the EIS with an inundation extent of 6.5 miles, inundated area of 856 acres, reservoir elevation of 628 feet, reservoir depth of 203 feet, and water capacity of 66,360 acre-feet.

Exhibit 2-4

Temporary Reservoir Characteristics Under Current Climate and Climate Change Conditions

	MAJOR FLOOD		CATASTROPHIC FLOOD	
ELEMENT	**CONDITIONS UNDER CURRENT CLIMATE (APPLICANT'S CONDITIONS)**	**CONDITIONS WITH CLIMATE CHANGE AT LATE-CENTURY (EIS CONDITIONS)**	**CONDITIONS UNDER CURRENT CLIMATE (APPLICANT'S CONDITIONS)**	**CONDITIONS WITH CLIMATE CHANGE AT LATE-CENTURY (EIS CONDITIONS)**
Duration of temporary reservoir inundation upstream of the FRE facility	Up to 32 days	**Up to 35 days**	Up to 32 days	**Up to 35 days**
Inundation extent	5.3 miles	**5.5 miles**	6.2 miles	**6.4 miles**
Inundated area	188 acres	**604 acres**	778 acres	**847 acres**
Reservoir elevation	513 feet	**590 feet**	620 feet	**627 feet**
Reservoir depth	88 feet	**165 feet**	195 feet	**202 feet**
Capacity	65,000 acre-feet	**65,810 acre-feet**	65,000 acre-feet	**65,810 acre-feet**
Probability of a flood occurring in a given year	14%	**25%**	1%	**4%**

2.3.2.1 FRE Facility Construction

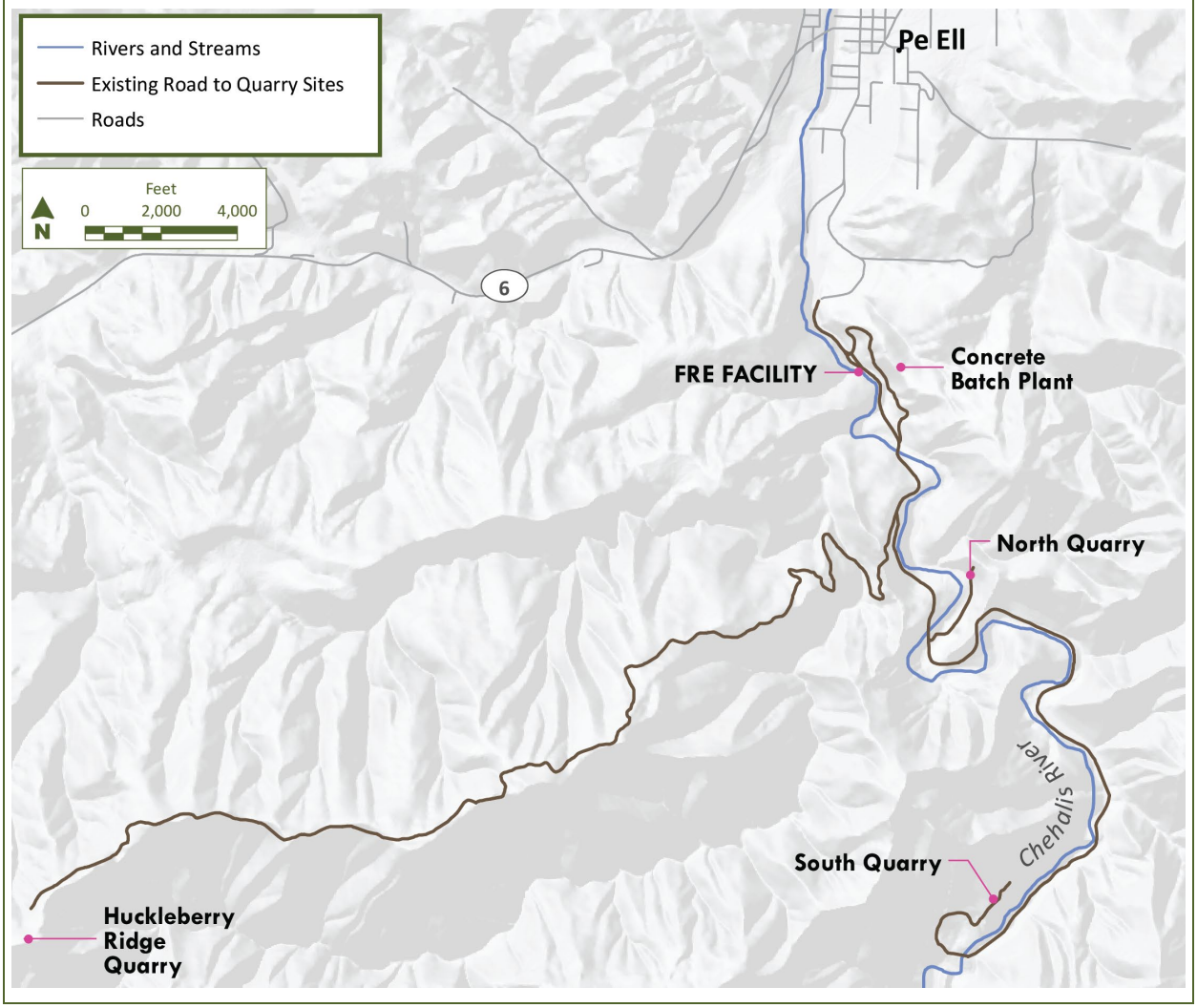
If permitted, the Applicant expects construction of the FRE facility would occur between 2025 and 2030 and would last about 5 years. Work in the river channel would take place over three separate in-water work windows, which are the time periods approved by regulatory agencies that avoid fish migration periods. The Washington Department of Fish and Wildlife (WDFW) approved in-water work window for the upper Chehalis River includes the month of August and the Corps window is from July to August. To meet the 5-year schedule, the Applicant stated they would request extensions to these work windows to September 30.

Construction equipment would include a range of mid- to large-size bulldozers, track excavators, front-end loaders, off-road fixed-wheel and articulated haul trucks, integrated tool carriers, and rollers. Equipment would also include cranes up to 250 tons or larger, quarry and material processing equipment, and concrete production and delivery equipment. Trucks and equipment for construction would access the site using Muller Road and FR 1000. Staging and construction laydown areas will be used for equipment, vehicles, and materials. These areas will be located near the construction site.

One or more quarries would be developed to provide rock for construction of the FRE facility. This would also include upgrading roads to the quarries, identifying material storage and processing sites, and constructing areas for offices and equipment storage. The proposed quarry sites include the North Quarry, South Quarry, and Huckleberry Ridge (Exhibit 2-5). A concrete production facility would also be located near the FRE facility and would include both roller-compacted and conventional concrete production. The site would include a roller-compacted concrete batch plant, conventional concrete batch plant, rock crushing and screening, rock storage, fly ash storage, and cement storage.

During construction, the Chehalis River would be diverted through a bypass tunnel while the FRE structure is built. The tunnel would be 20 feet in diameter, 1,630 feet long, unlit, and U-shaped. It would connect upstream and downstream of the FRE facility site (Exhibit 2-1). The tunnel would be built through bedrock using blasting and excavation. Cofferdams, or enclosures, would be built across the river channel above and below the site of the FRE structure. These would be used to provide a dry area for construction in the riverbed. Once the tunnel is ready, water from the Chehalis River would be diverted and flow through the tunnel. After construction ends, the process would be reversed and the river would flow through the FRE facility outlets in the river channel.

Exhibit 2-5
Potential Quarry Site Locations



2.3.2.2 FRE Facility Operations

Operation of the FRE facility is proposed to begin in 2030, if permitted.

During Normal or Smaller Flood Conditions

During normal, non-flood conditions or for floods smaller than a major flood, the Chehalis River would flow through the FRE facility outlets. Water would flow freely through the outlets up to a rate of 8,500 cfs. For flows over 8,500 cfs, the water would start to pond at the outlet entrances and rise into the reservoir area, but water would continue to flow through the outlets. The FRE outlet design would allow debris up to 3 feet in diameter and 15 feet in length to pass though. Steel bar racks would protect the river opening entrances from material that is too large to pass through the outlets. An anchored log boom upstream of the FRE facility would also help contain large woody material.

Decision to Close the FRE Facility Outlets

The FRE facility operators would use flood forecasts from the National Oceanic and Atmospheric Administration (NOAA) Northwest River Forecast Center to identify when the water flow at the Grand Mound gage is expected to exceed 38,800 cfs. This gage would be used because it provides the most consistent and accurate measurement of water for the area. FRE facility operations would begin within 48 hours of the forecasted flood peak. Because the Grand Mound gage measures flow from the Chehalis River, the Newaukum River, and the Skookumchuck River, the reading of 38,800 cfs would include water from all three rivers. Based on the historical record, when the Grand Mound gage reads 38,800 cfs, the flow at the FRE site has ranged from 10,000 to 15,000 cfs.

Outflow from the FRE Outlets

Operation of the FRE facility would change sediment transport and channel forming processes by eliminating large peak flows at the FRE location during major or greater flood events. For example, the estimated peak flow at the FRE facility site during the 2007 flood event was 34,700 cfs and if the FRE had been in place the outlet gates would have been closed. Flows of this magnitude would be reduced to the levels described below for the closed and drawdown periods.

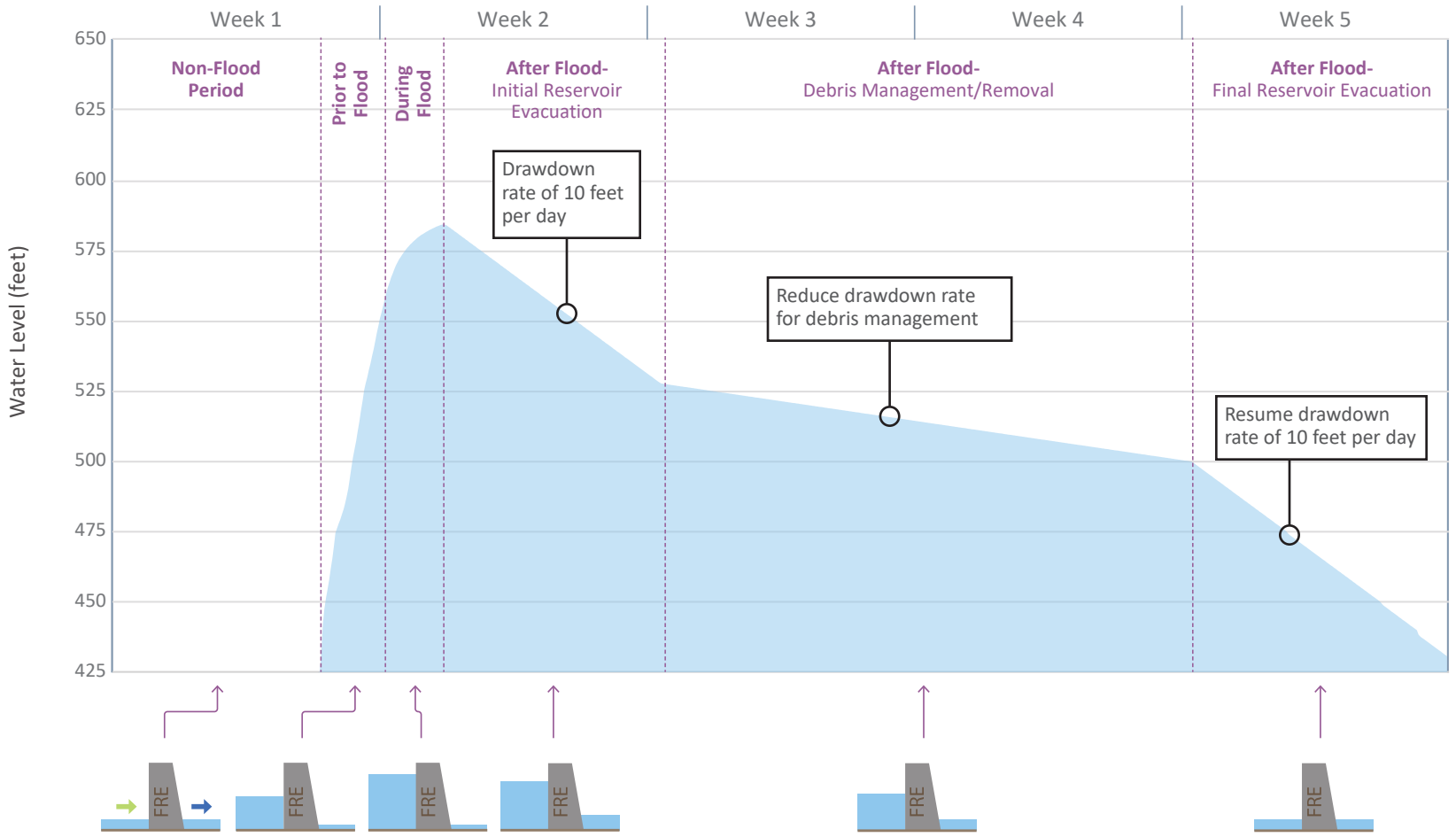
Estimates of the maximum flow through the FRE outlets would vary under different conditions. These are based on the historical record and are estimates for the late-century catastrophic flood scenario.

- When FRE gates are open: up to 18,520 cfs. The FRE gates would be closed when the water level at the Grand Mound gage is predicted to be 38,800 cfs. However, if the prediction is less than 38,800 cfs, the flow through the outlets could be up to 18,520 cfs, based on the historical record.
- When FRE gates are being closed: 300 to 6,000 cfs
- When FRE gates are closed: 300 cfs
- During FRE drawdown periods: 4,320 to 10,600 cfs

Operations Prior to and During Major or Larger Floods

Once flood operations are triggered, the outlet gates would begin to close. For the 2 days before major or larger flooding is predicted to occur, the water outflow would be reduced at a rate of 200 cfs per hour. During flood operations, water would fill up the temporary reservoir. While the gates are being closed, the water flow would be from 6,000 cfs to 300 cfs. Some water would continue to flow through the main outlet at a rate of 300 cfs even when the gates are closed. The peak of the flood would be expected to pass within 48 to 72 hours and would be monitored using the Grand Mound gage. The temporary reservoir would hold up to 65,810 acre-feet of water. Exhibit 2-6 illustrates the changes in the reservoir water level during a representative major flood before, during, and after a flood event.

Exhibit 2-6
Temporary Reservoir Changes During FRE Operations



Initial Drawdown

To release water from the temporary reservoir, the FRE outlet gates would be opened and the outflow would increase by 1,000 cfs per hour to a maximum outflow of 10,600 cfs. This process is called the drawdown of the reservoir. Drawdown rates would be limited to 10 feet per day (5 inches per hour) in order to minimize the risk of landslides in the reservoir area. Water could continue to enter the reservoir while this happens, which could affect the rate. The maximum time the reservoir would be inundated would be 35 days. Exhibit 2-7 illustrates the changes in water flows into and out of the FRE facility before, during, and after a representative major flood event.

Debris Management During Drawdown

Wood and vegetation from surrounding tributaries and reservoir hillsides would enter the reservoir during a flood event. When the water level reaches 528 feet of elevation, the drawdown of the reservoir would slow to 2 feet per day (1 inch per hour) for a 2-week period. Boats would be used to move floating trees and other debris to a log sorting yard for eventual reuse or disposal. The sorting yard would be on the west bank of the Chehalis River between RM 109.6 and RM 109.9. Debris would be removed from the yard by truck once the ground has dried out. Debris would either be cut up and disposed of, or could be used for habitat projects in the Chehalis Basin.

Final Drawdown

After the debris has been removed, drawdown rates would increase to 10 feet per day (5 inches per hour) until the storage pool is emptied. At this point, the temporary reservoir would no longer be impounding water and the Chehalis River would flow through the FRE facility outlets.

2.3.3 Fish Passage

Fish Passage During Construction

During construction, the Applicant proposes fish would move downstream using the bypass tunnel. The cofferdam below the FRE site would protect the stilling basin and fish collection channel (Exhibit 2-8). Upstream fish passage would be provided during construction by a temporary trap-and-transport facility, which would include a fish passage barrier (weir) downstream of the tunnel outlet to direct the fish passing upstream into the fish trap. Once in the trap, fish would be transferred to tanks. The tanks would be driven upstream to pre-determined release sites selected by fisheries biologists. The fish would then be released back into the river to continue their upstream migration.

Exhibit 2-7
Water Flow Changes During FRE Flood Operation

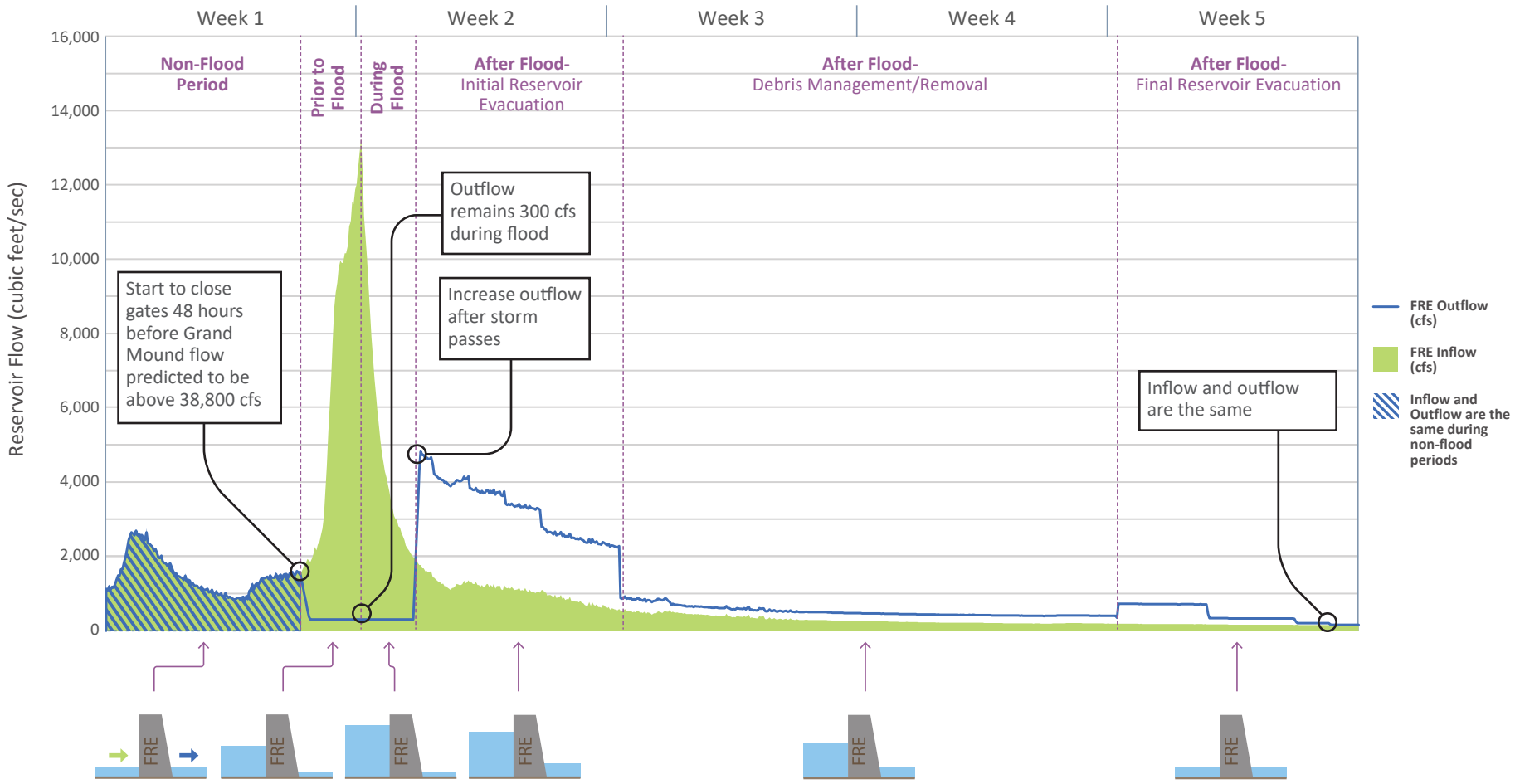
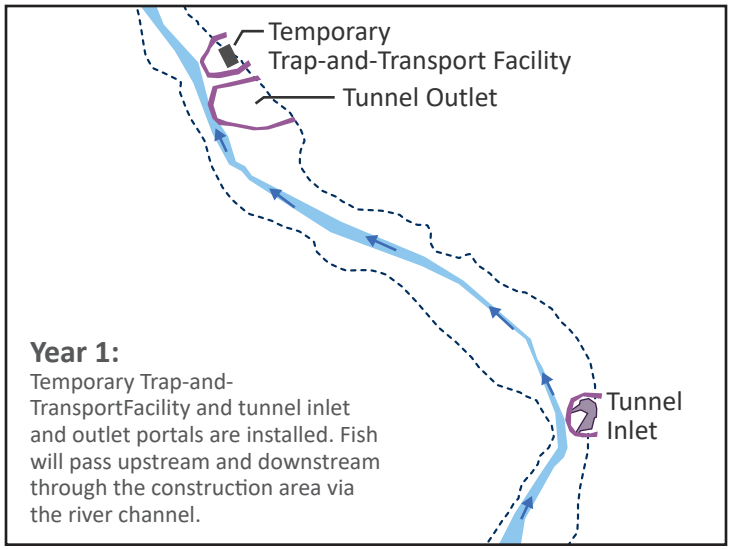


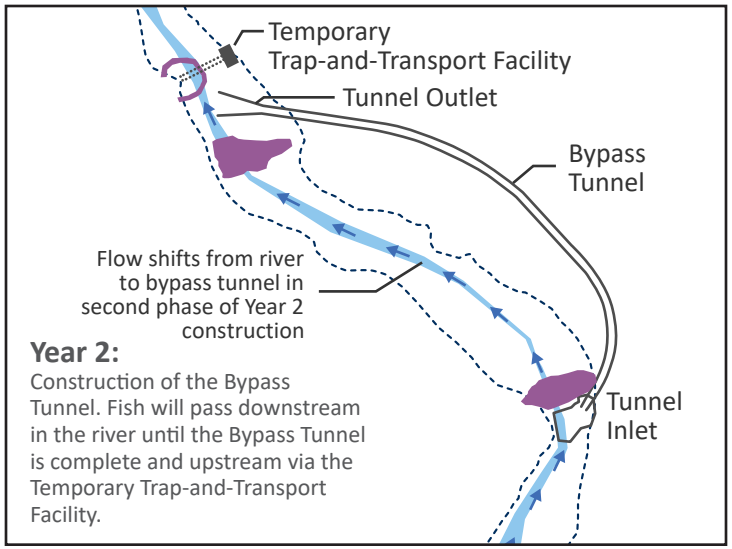
Exhibit 2-8
Fish Passage Construction Sequence

Temporary Trap-and-Transport Facility and Tunnel Portals Construction



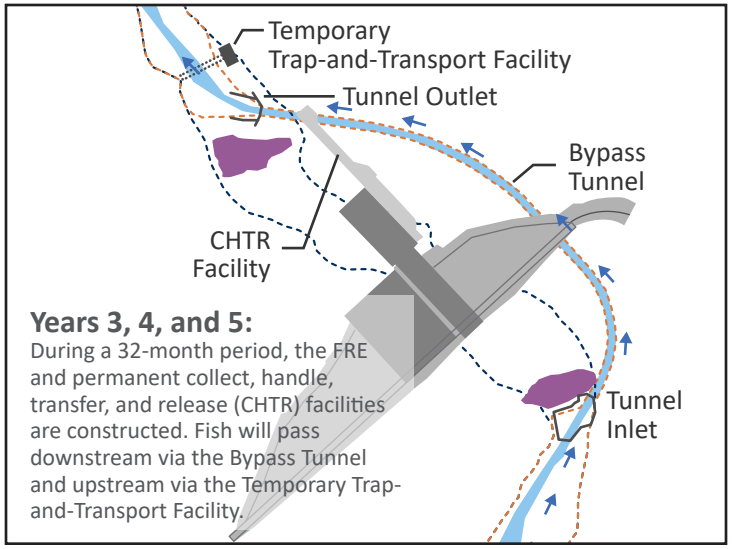
Year 1:
Temporary Trap-and-TransportFacility and tunnel inlet and outlet portals are installed. Fish will pass upstream and downstream through the construction area via the river channel.

Temporary Trap-and-Transport Facility and Bypass Tunnel Construction



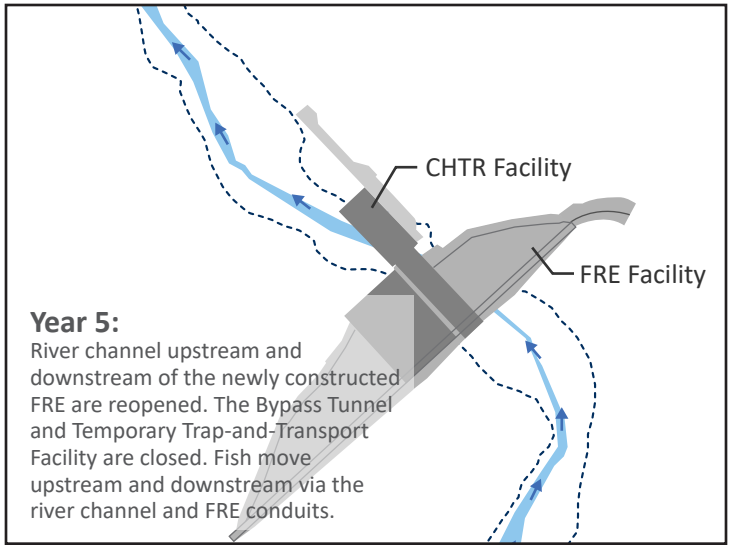
Year 2:
Construction of the Bypass Tunnel. Fish will pass downstream in the river until the Bypass Tunnel is complete and upstream via the Temporary Trap-and-Transport Facility.

FRE and CHTR Construction



Years 3, 4, and 5:
During a 32-month period, the FRE and permanent collect, handle, transfer, and release (CHTR) facilities are constructed. Fish will pass downstream via the Bypass Tunnel and upstream via the Temporary Trap-and-Transport Facility.

River Channel Re-opens and FRE Construction Complete



Year 5:
River channel upstream and downstream of the newly constructed FRE are reopened. The Bypass Tunnel and Temporary Trap-and-Transport Facility are closed. Fish move upstream and downstream via the river channel and FRE conduits.

LEGEND:

- Cofferdams
- Direction of flow

WAC 220-660-200 says the weir should be designed to ensure fish passage for all species present at all mobile life stages and compensatory mitigation may be required if a fish passage structure cannot pass all fish species present at all mobile life stages. The Applicant's temporary trap-and-transport facility is not currently designed to collect juvenile salmonids, native non-salmonid fish, or lamprey. The Applicant stated that juvenile salmonids, native non-salmonid fish, and lamprey collected in the temporary trapping facility will be considered incidental to the collection of adult salmonid species target for collection, and that species and life stages that are incidentally captured will be transported upstream of the construction area and released back to the Chehalis River. The Applicant also stated that upstream and downstream passage of juvenile salmonids, resident fish, and lamprey during operation of the temporary passage facility would be discussed with WDFW as the project progresses. Fish passage during construction is analyzed in Section 5.3, Fish Species and Habitats.

The temporary bypass tunnel and temporary trap-and-transport process would be required to meet National Marine Fisheries Service and WDFW criteria for fish passage. The fish passage information provided by the Applicant is preliminary and has not been approved; more details would be required during permitting.

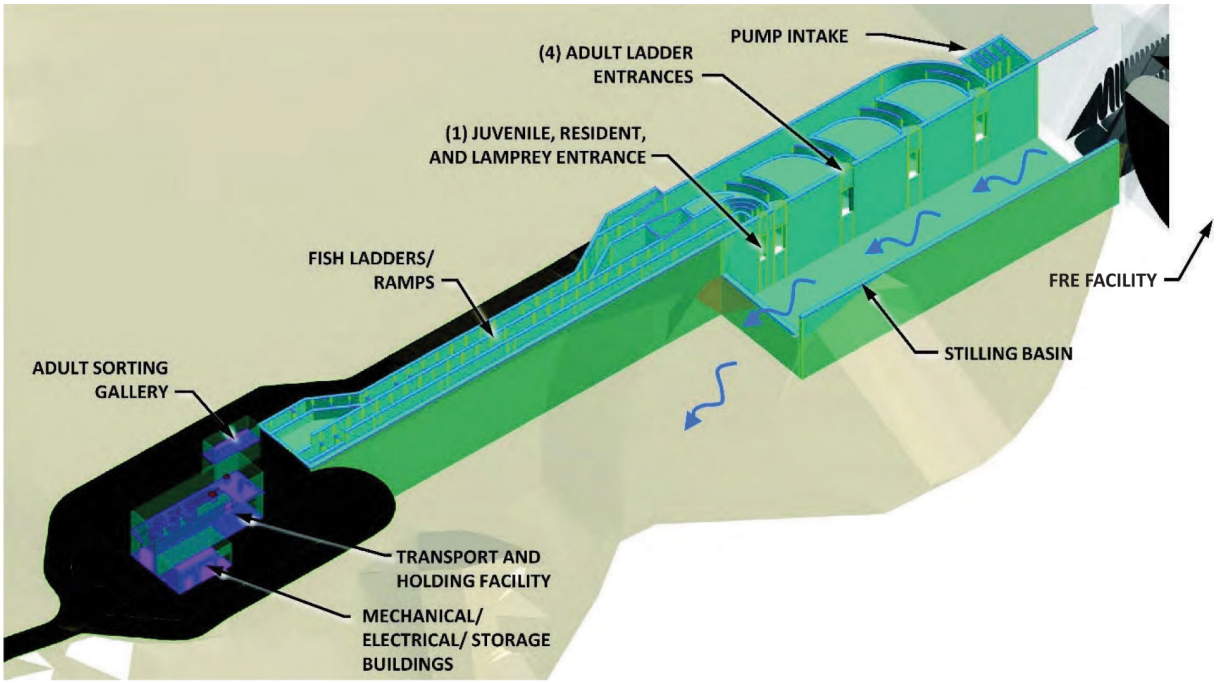
Fish Passage During Operations: Normal Conditions and Smaller Floods

During normal flows and smaller flood conditions, fish would pass upstream and downstream through the five outlets. The outlets would be 310 feet long and unlit. Fish and aquatic species passing upstream and downstream would move from the river through the outlets. Fish migrating upstream would also use the stilling basin before entering the outlets.

Fish Passage During Operations: Major or Larger Flood Conditions

A trap-and-transport facility would provide upstream fish passage during major or larger floods when the FRE facility outlet gates are closed and a reservoir has formed. The trap-and-transport facility includes an attraction water supply to draw fish into the facility, fish ladders, and a lamprey ramp. Fish would be guided to the trap-and-transport facilities with a fish sorting building, fish transport tanks and trucks, and support structures (Exhibit 2-9). Fish would be released into the river at pre-selected release sites upstream of the FRE facility determined by fisheries biologists. Just before closure of the outlet gates, the trap-and-transport facility would begin attracting and trapping fish. The operations would continue until all the water in the reservoir is released. Downstream fish passage would not be provided during major floods when the outlets are closed, a period of up to 35 days.

Exhibit 2-9
View of the Collection, Handle, Transfer, and Release in the Fish Passage Facility



Source: HDR 2018

2.3.4 Vegetation Management

Vegetation Management During Construction

Trees would be completely cleared from the FRE facility site and construction access areas. In the temporary reservoir area, the Applicant stated that all non-flood-tolerant tree species would be removed from the 405-acre zone where the inundation during FRE facility operation is expected to last 25 days or more. Common non-flood-tolerant species that would be removed include Douglas fir, big-leaf maple, red alder, and bitter cherry. Commercial timber could be removed in the riparian management zones along sections of the Chehalis River and tributaries in the reservoir footprint. For the zones (216 acres) where the inundation duration would range from 1 to 4 days when flooded, the Applicant would not harvest trees. The uppermost inundation zone (90 acres) of the temporary reservoir area would be left as a predominantly coniferous forest. (Note: The EIS evaluates a 600-acre area for tree removal during construction and an 847-acre area for the maximum extent of the temporary reservoir because of the larger inundation area with climate change, as described in Exhibit 2-4.)

Vegetation Management During Operation of the FRE Facility

Every 7 to 10 years, the Applicant would cut down trees larger than 6 inches diameter at breast height within certain zones and they would either be left to decay or salvaged. This would be to reduce woody material accumulating at the FRE outlets. The Applicant stated that vegetation management would be done to encourage the growth of native plant species to provide slope stability and control stream temperature.

2.3.5 Airport Levee Changes

The Applicant's modifications to the airport levee (called Airport Levee Changes in this EIS) include raising the existing airport levee and part of NW Louisiana Avenue (Exhibit 2-10). The original project description included extending an area in the northwest portion of the levee; however, the Applicant has removed this due to likely impacts on wetlands and cultural resources. This levee 'bump out' is no longer considered as part of the Proposed Project in the EIS.

2.3.5.1 Construction

Construction activities for the Airport Levee Changes would generally happen in the following order:

- Mobilization of equipment
- Erosion control, clearing, and grubbing
- Removal of structures or obstructions
- Material placement and compaction
- Trimming, cleanup, and sod placement

Construction equipment would include a range of mid- to large-size bulldozers, track excavators, front-end loaders, off-road fixed-wheel and articulated haul trucks, integrated tool carriers, and rollers. It would also include trucks, storage facilities, and temporary buildings. The existing temporary retaining walls and the crushed rock on top of the levee would be removed. Excavation may be needed for hydraulic structures such as culverts. Fill material would come from existing sources and would be brought in from off site. Haul routes would include Airport Road, and the top of the levee would be used for site access. NW Louisiana Avenue, located to the south, is the Applicant's preferred off-site route to avoid the congested traffic area east of the airport.

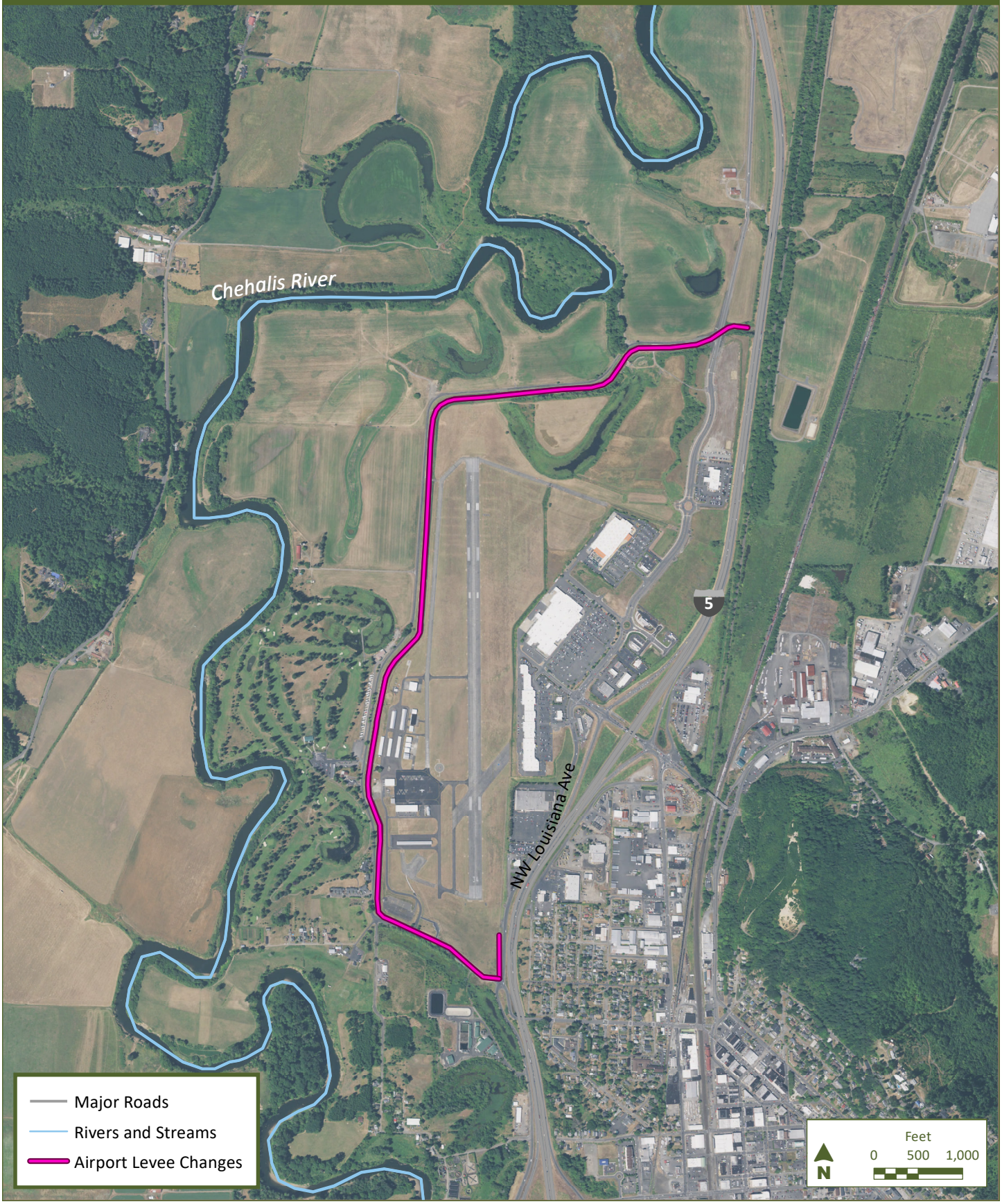
The proposed construction activities would include:

- Adding 4 to 7 feet to the height of the existing 9,511-foot-long levee with earthen materials or floodwalls
- Raising 810 feet of NW Louisiana Avenue along the southern extent of the airport
- Replacing utility infrastructure
- Widening portions of the existing levee base in locations where there are retaining walls and removing the retaining walls

2.3.5.2 Operation

The airport levee is currently maintained by the Chehalis-Centralia Airport with additional assistance from Lewis County. Maintenance activities include regular vegetation maintenance, including the removal of hazard trees. In 2017, the pump station was also reconstructed to elevate it out of the anticipated inundated area. Similar types of maintenance actions for the levee would continue into the future.

Exhibit 2-10
Airport Levee Changes



2.4 Determining EIS Alternatives

To identify alternatives, Ecology reviewed environmental documents and technical studies about reducing flood damage in the Chehalis Basin. Ecology considered previous proposals and studies from the Corps, Washington State Department of Transportation (WSDOT), and local agencies (listed in Appendix 2), the 2017 Programmatic EIS, and scoping comments to determine the alternatives to be studied in the EIS. The 2017 Programmatic EIS for the Chehalis Basin Strategy evaluated several options to reduce damages from catastrophic floods.

Alternatives that did not meet the definition of a reasonable alternative were eliminated from further consideration and are discussed in Section 2.7. These were concepts that did not achieve the Applicant's project purpose as described in Section 2.1 or would have a higher environmental cost.

Ecology identified two alternatives to be evaluated in this EIS: the Local Actions Alternative and the No Action Alternative.

2.5 Local Actions Alternative

The Local Actions Alternative represents a local and non-structural approach to reduce flood damage in the Chehalis-Centralia area (the Proposed Project's purpose). The Local Actions Alternative considers a variety of local-scale options that local governments and agencies could choose to do in the future. These actions could achieve the Applicant's objective to reduce flooding from storms in the Willapa Hills through improving floodplain function, land use management actions, buying out or relocating at-risk properties or structures, improving flood emergency response actions, and increasing water storage from Pe Ell to Centralia.

For this alternative, Ecology considered actions that could be implemented by the Applicant either alone or with other agencies, private entities, or jurisdictions in the Chehalis Basin. These include taking action necessary to protect life and property within the district from floodwater damage; to control, conserve, and remove floodwaters and stormwaters; to acquire property, property rights, facilities, and equipment; and to acquire or reclaim lands. The Applicant could support local efforts for flood damage reduction through local regulatory powers, funding, or technical assistance.

Land Use Management

This element involves land use management efforts by local governments mainly in Lewis County, and also in Grays Harbor, Pacific, and Thurston counties. Implementing existing land use management plans and actions and improved land use management could protect floodplain functions and reduce or prevent flood damage by minimizing floodplain development. This could also include providing technical support and assistance to local jurisdictions and landowners for local land use management efforts that reduce flood damage.

Floodproofing

Floodproofing would reduce damage to structures in the floodplain from repeated floods. Raising structures and building berms or floodwalls around structures would reduce or eliminate flood damage to real estate or improve property. Floodproofing could include installing flood vents in houses that were elevated prior to the requirement for vents to further reduce the risk of flood damage.

Buy-Out or Relocation of At-Risk Properties or Structures

The risk of damage to structures or properties in the floodplain from repeated flood events would be reduced through buy-outs or relocations from willing landowners of at-risk properties or structures. The properties could be cleared and reused for public purposes. This could also include:

- Assisting local governments to identify funding for buy-outs or relocations of at-risk properties or structures
- Providing technical assistance to local governments to identify at-risk structures that cannot be floodproofed or identify other beneficial uses for the property

Floodplain Storage Improvement

The amount of water stored in the floodplain could be increased to improve functions and reduce peak flood flows. This could be done by restoring areas along the rivers, planting more trees, reconnecting the floodplain, and reducing the flow of water. Actions include placing wood in rivers and streams to increase roughness and water levels or to help floodwaters more fully occupy floodplain areas. It could also include planting vegetation and trees in floodplain areas to increase water storage in the floodplain.

Channel Migration Protection

This includes measures to reduce flood damage to properties from river channel migration. Channel migration takes place during high-flow events in specific areas of the river where riverbanks are likely to erode. There are a variety of measures that could help to minimize migration hazards to structures in the migration zone while protecting aquatic and riparian habitat, such as placement of large wood in locations where channel migration risks are identified. This includes mapping areas that could be susceptible to channel migration. It could also include potential regulatory and incentive-based approaches to reducing flood damage to properties in channel migration areas.

Early Flood Warning Systems

Additional flood warning systems would protect people and livestock and reduce flood damage. The existing Chehalis Basin Flood Warning System relies on rainfall and stream gage data to provide real-time river levels and flood alerts to the Chehalis Basin community. Improvements could include a more robust and interactive flood prediction and flood warning system that would allow vehicles, machinery, and livestock to be moved before flooding. Also, a program could be developed to identify and fund the most critical stream gages that provide data for the warning systems.

2.6 No Action Alternative

The No Action Alternative represents the most likely future conditions if the Proposed Project is not constructed. Large- and small-scale efforts would continue basin-wide as part of the Chehalis Basin Strategy work. Local flood damage reduction efforts would continue based on local planning and regulatory actions. The No Action Alternative includes the use of current state and local floodplain regulations and land use regulations. It also includes planned updates to Comprehensive Plans and Shoreline Master Programs (SMPs). It looked at changes local authorities might make for land use and development based on planning documents and changes in population.

The No Action Alternative includes projects to reduce flood damage that are in progress, funded, or permitted as of June 2019. These projects include local floodproofing efforts, Chehalis River Basin Flood Authority projects, and Chehalis Basin Strategy and Aquatic Species Restoration Plan projects. Appendix 2 contains a table of the projects within the Chehalis Basin that are in progress or proposed for funding.

2.7 Alternatives Considered but Eliminated

SEPA regulations require that EISs analyze reasonable alternatives. Reasonable alternatives are defined as "actions that could feasibly attain or approximate a proposal's objectives, but at a lower environmental cost or decreased level of environmental degradation" (WAC 197-11-440). The Applicant's objective of the Proposed Project is to reduce flood damage in Centralia and Chehalis, including goals for reducing closure of I-5 and at the Chehalis-Centralia Airport. Multiple reports dating from 1998 to the present on flooding and flood damage reduction efforts in the Chehalis Basin (identified in Appendix 2) were reviewed using the criteria. These included studies by the Corps, WSDOT, American Rivers, Ruckelshaus Center, and Chehalis Basin Strategy groups.

Based on the evaluations of these studies, the following alternatives are not evaluated further in this EIS:

- **Flood retention facilities on other tributaries or multiple facilities:** Multiple studies have analyzed proposed flood retention facility locations in the Chehalis Basin. A number of potential locations were considered, including locations on the Newaukum River, the upper Chehalis River, and the South Fork Chehalis River. Due to the geology of the area and because Willapa Hills receives the most rainfall in the area, locations upstream of Pe Ell have been examined multiple times. The Corps studies found that multiple flood retention facilities or facilities at other locations would not be economically feasible, would have minimal benefit, or would cause significant impacts on transportation and the environment.
- **A multiple levee system in the Chehalis Basin**: The Corps studies found this could increase flood damage to people and communities, particularly on the west side of I-5 near the Chehalis River.

- **I-5 Changes (re-routing, raising, building a business loop)**: WSDOT and the Ruckelshaus Center found these I-5 changes would not be economically feasible, would increase flood levels in Centralia, and would negatively impact the environment.
- **Building I-5 Walls and Levees:** The 2014 Chehalis Basin Strategy study found the construction cost would exceed the estimated economic benefits.
- **Restorative Flood Protection:** The 2017 Programmatic EIS described a Restorative Flood Protection concept that was studied in 2018 on the Newaukum River. For areas with steep slopes, like the upper Chehalis River, it showed a 10% reduction in peak flood flows for major floods, and no reduction in peak flood flows for catastrophic floods. This approach would not meet the project objective to reduce flood damage in the Centralia and Chehalis area.
- **Dredging or Straightening the Chehalis River:** The Corps studies found this would likely have significant environmental impacts and would require long-term maintenance.
- **Airport Levee Alone:** WSDOT studies found this would not reduce flood damage in the Chehalis-Centralia area. While some buildings would be protected, the flood levels in other areas would likely increase. This would not meet the project objective to reduce flood damage.
- **FRE Facility Alone:** The 2012 *Chehalis Basin Flood Hazard Mitigation Alternatives Report* found that an FRE facility alone would not reduce flood damage to the Chehalis-Centralia Airport and I-5 so this would not meet the project objective.
- **Flood Retention Flow Augmentation Facility (with a permanent reservoir):** This alternative was evaluated in the 2017 Programmatic EIS and had a higher level of environmental impact.

The Chehalis Basin has a high probability of experiencing major and catastrophic floods, and this probability will increase with climate change in the future. Implementation of the Proposed Project, if permitted, would not be expected to exclude other options to reduce flood damage in the future.

3 EIS ANALYSIS TERMINOLOGY AND APPROACH

3.1 Flood Level Terminology Used in this EIS

This EIS uses the terms "major" and "catastrophic" to describe the size of flood events analyzed. It also includes the term "recurring flood" for a scenario used in the analysis. These terms are based on the cfs rate of water flow measured at the U.S. Geological Survey (USGS) stream gage on the Chehalis River at Grand Mound. This approach provides consistency in the studies when describing past floods and potential future floods. Exhibit 3-1 provides a summary description of these terms and a cross-reference of terms used in other plans and guidance.

The Grand Mound stream gage is used because it provides the most consistent and accurate measurement of water for the area. It records water flow from the Chehalis River, Newaukum River, and Skookumchuck River.

For analysis in this EIS:

- A **major flood** is when the Chehalis River flow is equal to or greater than 38,800 cfs but less than 75,100 cfs of water measured at the Grand Mound gage.
- A **catastrophic flood** is when 75,100 cfs or greater is measured at the Grand Mound gage.
- A **recurring flood** scenario is when a major flood or greater occurs in each of 3 consecutive years.

A major flood is similar to the size of the 2009 Chehalis Basin flood. A flood of this size is used to develop Comprehensive Flood Hazard Management Plans. Under current conditions, it is called a 7-year flood with a 14% chance of occurring in a year. Climate change shows more rainfall and storms happening more frequently in the future, so the probability of a flood of this size happening increases by late-century (2060 to 2080). By late-century, with climate change, the probability of a flood this size occurring within a year becomes 25% or a 4-year flood.

Water Model Scenarios Evaluated in the EIS

Flooding in the study area was modeled using three different scenarios:

- **Major Flood:** Water flow rate of 38,800 cfs or greater at Grand Mound
- **Catastrophic Flood:** Water flow rate of 75,100 cfs or greater
- **Recurring Flood:** A major flood or greater that occurs in 3 consecutive years

These scenarios were modeled for mid-century and late-century time periods. They also included predicted increases in temperature and peak flows from climate change. Detailed modeling results are presented in the *Water Discipline Report*, Appendix N.

A catastrophic flood is similar to the size of the 1996 Chehalis Basin flood. Under current conditions, it is called a 100-year flood with a 1% chance of occurring in a year. By late-century, with climate change, the probability of a flood this size occurring becomes 4% or a 27-year flood.

A 100-year flood is used by the Federal Emergency Management Agency (FEMA) for determining high-risk flood zones or special flood hazard areas. FEMA publishes these in Flood Insurance Studies and uses them for Flood Insurance Rate Maps. A 100-year flood is also the base flood level used by the National Flood Insurance Program and Lewis County development regulations. The information for the Lewis County Flood Insurance Study is based on 1970s data and it calculates a 100-year flow rate of 56,000 cfs at the Grand Mound gage. This EIS uses a more updated flow rate, which includes data from the past 40 years, so it is different from the FEMA flow rate.

The 2007 flood event was an atmospheric river (pineapple express) event with extremely high rainfall concentrated in the Willapa Hills. This event affected the Chehalis River mainstem and South Fork, with far less rainfall to the east in the Skookumchuck River Basin. The USGS gage for Grand Mound read 79,100 cfs for the 2007 flood; however, peak flows at the Doty gage were estimated at 52,600 cfs, almost double the next highest flood in the 74-year record. This flood is a 500-year flood with a 0.2% chance of occurring in a year.

For the late-century catastrophic flood scenario in the EIS, rainfall and runoff projections are modeled statistically throughout the Chehalis River Basin, with peak flows distributed in all areas in the basin, and not focused on a particular area. Because rain for the 2007 flood event was focused in one area, the estimated peak flows in 2007 are higher at Doty than peak flows under the late-century catastrophic flood scenario, but lower at Grand Mound. So while the numbers at the Grand Mound gage are similar, the 2007 flood was much larger than the catastrophic flood modeled for this EIS.

The catastrophic flood evaluated in the EIS is based on the Applicant's purpose for the Proposed Project, which is to reduce damage from a catastrophic flood. It is not intended to retain all the water from a larger event like the 2007 flood. In the case of a flood larger than the catastrophic flood, the temporary reservoir would hold about 65,000 acre-feet of water, and any additional water would flow over the emergency spillway of the FRE structure to the Chehalis River below.

Exhibit 3-1

Flood Level Terminology

QUALITATIVE TERM USED IN THE EIS	CHANCE OF OCCURRENCE IN 1 YEAR	ASSOCIATED FLOOD-YEAR TERM	FLOW AT (CFS)	OTHER NOTES
Major flood	Current: 14% Mid-century: 20% Late-century: 25%	Current: 7-year Mid-century: 5-year Late-century: 4-year	38,800 at Grand Mound gage	• **Similar Sized Chehalis Basin Floods for Reference** – 2009 flood
Catastrophic flood	Current: 1% Mid-century: 2% Late-century: 4%	Current: 100-year Mid-century: 44-year Late-century: 27-year	75,100 at Grand Mound gage	• **Similarity to Other Flood Plan Terminology (but the flow rates within plans are different)** – Comprehensive Flood Hazard Management Plans – Base flood level used by National Flood Insurance Program – High-risk FEMA flood zones – Special Flood Hazard Area on FEMA maps – Base flood level used by Lewis County floodplain development regulations • **Similar Sized Chehalis Basin Floods for Reference** – 1996 flood

Notes:
Mid- and late-century information is based on SEPA EIS analysis that incorporates climate change projections.

3.2 Construction and Operation Times Evaluated in this EIS

The Applicant has stated the construction of the FRE, if permitted, would occur from 2025 to 2030 and operations, if permitted, would begin in 2030. The levee construction, if permitted, would take place concurrently with FRE facility construction but is planned to be completed within 1 construction year, after which levee operations would begin.

For analysis in this EIS, operations of the Proposed Project were evaluated from 2030 to 2080. The operations were divided into the following two periods to identify impacts for two different time frames:

- **Mid-century** means the operational period from 2030 to 2060.
- **Late-century** means the operational period from 2060 to 2080.

3.3 Climate Change Analysis in this EIS

Worldwide, rising levels of carbon dioxide and other heat-trapping gases have warmed the earth and are already causing wide-ranging impacts, such as increased drought, wildfires, and extreme rainfall events. Scientists project that these trends will continue and in some cases accelerate, posing significant risks to human health, communities, forests, agriculture, freshwater supplies, coastlines, and other natural resources. While people have experience dealing with natural weather variability, climate change is moving beyond a range where past experience can provide a reliable guide for what can be expected in the future. Computer models are often used to identify future impacts that are likely to occur.

In the Chehalis Basin, the watershed is expected to experience more frequent and intense precipitation events with possible shifts in the timing of the most intense rainfall. Overall, the Pacific Northwest has warmed about 1.3°F during the past century and annual air and water temperatures are expected to continue to increase, with the largest increases projected to occur during summer.

To evaluate the probable significant environmental impacts from the Applicant's Proposed Project and the alternatives, this EIS incorporates climate change projections for precipitation, temperature, flood peak flows, and streamflows throughout the analyses as part of the future conditions for all scenarios. There is no separate climate change chapter because projected climate changes have been included in the impact analyses for all resource areas. Data and models for predicted climate change conditions used in this EIS are from the University of Washington Climate Impacts Group, the National Oceanic and Atmospheric Administration, and Portland State University.

Climate change is already negatively affecting people and resources, such as land use and fish, in the Chehalis Basin, and this is expected to continue to increase in the foreseeable future. For purposes of an analysis in this EIS, climate change predictions are already included in the baseline conditions for the Proposed Project, No Action Alternative, and Local Actions Alternative, and are consistent between these. Therefore, there are no separate impact findings for climate change or comparison between the Proposed Project and the alternatives related to climate change. The climate change information is used both quantitatively and qualitatively for the analysis.

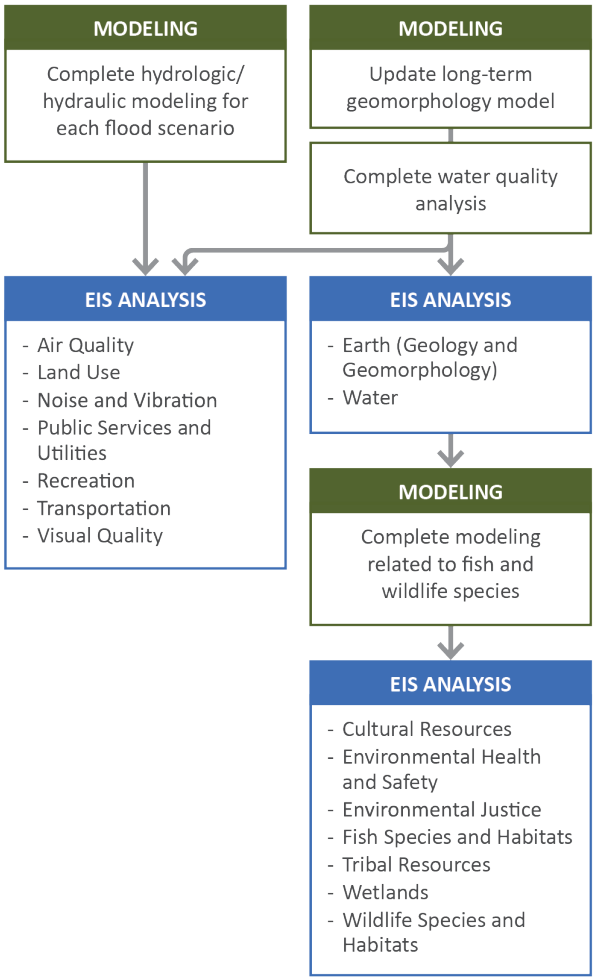
Climate change data were included in models for hydrology, geomorphology, and salmonid populations and lifecycles used for analysis in this EIS. All Discipline Reports prepared for the EIS used this information to identify probable impacts for all scenarios for the Proposed Project and alternatives. The *Water Discipline Report* (Appendix N) provides details on the future streamflow rates, water temperatures, and changes in flood levels and extent. Analysis of greenhouse gas emissions is included in the *Air Quality and Greenhouse Gas Discipline Report* (Appendix A). Evaluations in the *Fish Species and Habitats Discipline Report* and *Wildlife Species and Habitats Discipline Report* (Appendices E and P) include climate changes that would affect aquatic species and habitat.

Exhibit 2-4 includes a summary of FRE facility temporary reservoir characteristics associated with the mid-century and late-century flood scenarios. This includes predicted conditions of the temporary reservoir when accounting for climate change. Exhibit 2-4 also includes conditions associated with the maximum design extent of the temporary reservoir, which is based on the spillway crest elevation of 628 feet, as defined by the Applicant.

3.4 How Models Were Used

Several computer models were used in the analysis of impacts from the Proposed Project. They include hydrologic, hydraulic, geomorphic, fish population, and fish lifecycle models. The models evaluated the Proposed Project based on the three scenarios described in Section 3.1. The models were also used to evaluate the No Action Alternative. Because the Local Actions Alternative consists of mainly non-structural local actions, the modeling for the No Action Alternative was in many cases applied to the Local Actions Alternative. Modeling also included climate change projections described in Section 3.3.

Exhibit 3-2
Integration of Modeling Results into EIS Analysis



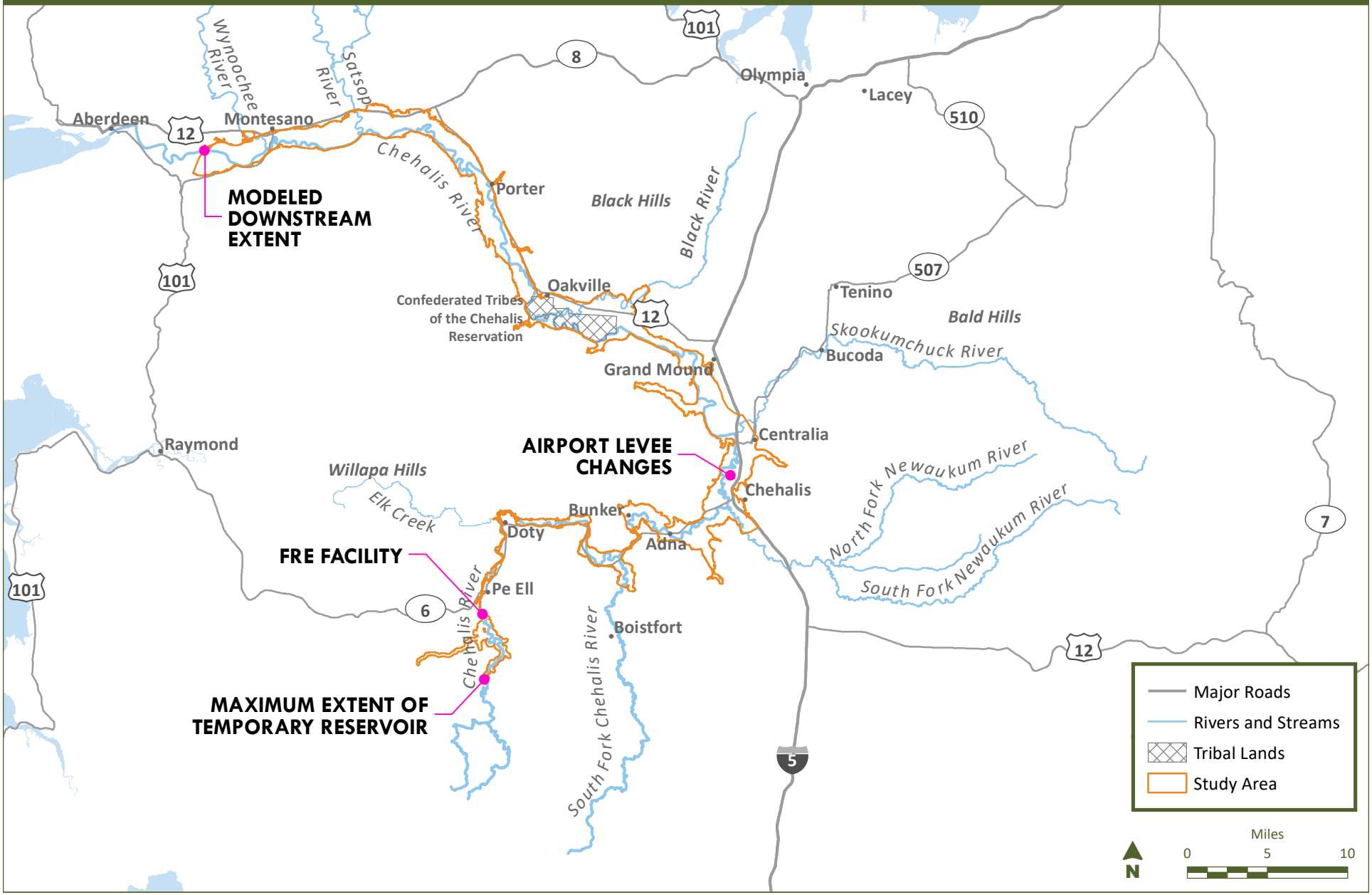
The process for the EIS used the results of one model to provide information for the next (Exhibit 3-2). First, the changes in water flows were identified using the hydrologic and hydraulic models. This included climate change projections and was used to help determine the study areas. This model showed the extent of the flooding for the Proposed Project and the No Action Alternative in the future. The water model results were then used in the geomorphology model to show changes in sedimentation in the Chehalis River. Both of these models were used for the fish population and fish lifecycle models for salmonid impacts. The results of these models were used throughout the preparation of technical Discipline Reports and the Draft EIS chapters.

3.5 Study Area

In general, the study area for analysis includes four locations (Exhibit 3-3):

1. The area associated with the FRE facility site and construction activities.
2. The area of maximum inundation for the temporary reservoir.
3. The area associated with the Airport Levee Changes.
4. The area downstream of the FRE facility that would be affected by late-century catastrophic flooding. The water modeling described in the previous section showed the flood water changes continue to RM 9 (just past Montesano) where the tidal influence becomes larger than the influence from flood waters. The flood waters also extend about 1,500 feet upstream into three tributaries of the Chehalis River including the Skookumchuck River, the South Fork Newaukum River, and the South Fork Chehalis River.

Exhibit 3-3
Chehalis SEPA EIS Study Area



4 REQUIRED PERMITS AND APPROVALS

The following permits, licenses, and approvals would be required for the Proposed Project.

4.1 Federal

- **Endangered Species Act Consultation (U.S. Fish and Wildlife Service [USFWS]):** The Proposed Project could affect listed species or designated critical habitats. USFWS would evaluate the effects on listed and proposed species and critical habitats and require compensatory mitigation for unavoidable impacts.
- **Federal Explosives License/Permit (Federal Bureau of Alcohol, Tobacco, and Firearms):** Required for blasting activities during construction.
- **Letter of Map Revision, Conditional Letter of Map Revision, or Physical Map Revision (FEMA):** To comply with 44 Code of Federal Regulations 65.3, National Flood Insurance Program participating communities must provide FEMA with technical information related to changes to the Special Flood Hazard Area. This would apply from the area inundated in the FRE reservoir downstream to near Montesano. Conditional approvals by FEMA are needed prior to construction of the project. This may lead to a formal change of the Flood Insurance Rate Map.
- **Section 106 of the National Historic Preservation Act (Corps):** Section 106 requires the Corps to consider the effects of the Proposed Project on historic properties as part of the federal permitting process. This includes consultation with interested and affected tribes, the State Historic Preservation Officer at the Washington State Department of Archaeology and Historic Preservation (DAHP), as well as other interested parties.
- **Section 404 Clean Water Act Permit (Corps):** Section 404 requires discharges of dredged/fill material to waters of the U.S. be done only under the authorization of a permit. Because construction of the FRE facility would involve the excavation and fill placement in the Chehalis River, and construction of the Airport Levee Changes may involve fill placement in wetlands, the Proposed Project would require a Section 404 permit from the Corps. As part of this approval, Endangered Species Act and Section 106 of the National Historic Preservation Act consultations would also be required.

4.2 Tribal

- Concurrent with the Washington SEPA review process, the Corps, as federal lead agency, is conducting a review of the Proposed Project under NEPA. This includes consulting under Section 7 of the federal Endangered Species Act with the USFWS and NOAA Fisheries and under Section 106 of the National Historic Preservation Act with tribes, DAHP, and the Applicant.

- Washington's salmon and steelhead fisheries are managed cooperatively in a unique co-management relationship. Co-management of fisheries occurs through government-to-government cooperation, communications and negotiations. One government is the State of Washington, and the other is Indian tribes whose rights were preserved in treaties signed with the federal government in the 1850s.

4.3 State

- **Application for Exploration Reclamation Permit (Washington State Department of Natural Resources [DNR]):** Required for exploration and reclamation of exploration sites for the FRE structure site and the potential quarry sites, because trees may have to be removed and disturbance to the forest floor could occur.
- **Aquatic Lands Lease and Use Authorization (DNR):** Construction of the FRE facility may require a lease from DNR and use authorization for construction and operation.
- **Coastal Zone Management Program Consistency (Ecology):** Construction and operation of the FRE facility may be subject to the federal consistency provision of the Coastal Zone Management Act and the state's Coastal Zone Management Program.
- **Dam Safety Construction Permit (Ecology):** Required before constructing, modifying, or repairing any dam or controlling works for storage of 10 or more acre-feet of water at the dam crest elevation.
- **Fish Transport Permits (WDFW):** Required to transfer live fish as part of the trap-and-transport process during construction and operation.
- **Forest Practices Applications (DNR):** Activities for construction and operation of the FRE taking place on private or state forestland, including timber harvest, development of quarries, and expanding, maintaining, or abandoning roads, would be subject to Forest Practices Act Rules.
- **Hydraulic Project Approval (WDFW):** Required because the Proposed Project would use, divert, obstruct, and change the natural flow and bed of freshwaters of the state and would include work in and adjacent to waters of the state.
- **National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Permits (Ecology):** Required because construction of the FRE facility and Airport Levee Changes would result in more than 1 acre of ground disturbance and involve stormwater discharges to surface waters as well as operational activities that may include landslides and erosion of slopes and roads. The NPDES permits would include conditions requiring a Stormwater Pollution Prevention Plan and appropriate erosion, sediment, and pollution control measures.
- **NPDES Industrial Stormwater Permit (Ecology):** Required because operation of the FRE facility would result in releases of water. All wastewater and stormwater generated from the Proposed Project and potentially discharged would be evaluated and characterized by the state. Once the water to be discharged has been accurately evaluated and characterized by the state, the specific standards for water discharged from the project area would be defined.

- **NPDES Sand and Gravel Permit (Ecology):** Required because FRE facility construction would require quarry development to provide aggregate for the FRE facility. The permit requires a Stormwater Pollution Prevention Plan and best management practices to control pollutants from process water, mine dewatering water, and stormwater. The permit includes effluent limits and monitoring requirements for process water and mine dewatering discharges for parameters including pH, turbidity, total suspended solids, oil, and total dissolved solids.
- **Scientific Collection Permit (WDFW):** Required for relocation or collection of wildlife species or handling or collection of fish species.
- **Section 401 Clean Water Act Water Quality Certification (Ecology):** Because a federal (Corps Section 404) permit would be needed to construct the Proposed Project, a Section 401 Water Quality Certification from Ecology would be needed to document the state's review of the project and its concurrence that the Applicant has demonstrated that the Proposed Project will meet state water quality standards. This certification is intended to provide reasonable assurance that the Applicant's project will comply with state water quality standards and other requirements for protecting aquatic resources, and covers both construction and operation of the facility.
- **Shoreline Conditional Use Permit (Ecology):** The FRE facility would be considered an in-water structure within Lewis County's SMP, which is a conditional use within the Rural Conservancy shoreline environment designation. Ecology has final approval for these permits.
- **Surface Mining Reclamation Permit (DNR):** Required for the establishment and reclamation of the three potential quarries (North Quarry, South Quarry, and Huckleberry Ridge Quarry).
- **Washington State Explosives License (Department of Labor and Industries):** Required for blasting with explosives.
- **Water Rights Permits (Ecology):** Required because the Proposed Project would involve temporary withdrawals of water from the Chehalis River for the construction of the FRE facility and would involve storage of Chehalis River flows during major floods as part of FRE facility operations.

4.4 Local and Regional

- **Air Discharge Permit (Southwest Clean Air Agency):** Required for quarrying, rock processing, operation of the concrete batch plant, and blasting during construction of the FRE facility.
- **Airport Obstruction Zone Application (City of Chehalis):** Required for construction taking place within the airport approach zone.
- **Building permit (Lewis County):** Required activities to construct, enlarge, alter, repair, move, demolish, or change the occupancy of a building or structure.

- **Comprehensive Plan Update and Rezone (Lewis County):** Required to resolve inconsistency with the current Forest Resource Lands land use designation and zoning district for the construction and operation of the FRE facility. This could require a rezone for the affected area.
- **Critical areas review (Lewis County, Pacific County, and City of Chehalis):** Required because the Proposed Project is within, abutting, or likely to adversely affect a critical area or buffer.
- **Earth-moving permit (City of Chehalis):** Required for land disturbance that would be necessary to construct the Airport Levee Changes.
- **Fill and Grade Permit (Lewis County):** Required for excavating soil and rock for the FRE facility foundations and related structures and quarries, and for placing waste materials in three designated locations.
- **Flood Hazard Zone Permit (Lewis County):** Required because construction of the FRE Facility and Airport Levee Changes are in an area of special flood hazard.
- **Local Land Use and Development Permits (Lewis County and City of Chehalis):** Required because the FRE facility would affect water-related resources regulated by Lewis County and the Airport Levee Changes would affect water-related resources regulated by the City of Chehalis under SMPs, Critical Areas Ordinances, and floodplain and stormwater management codes.
- **Open Burning Permit (Southwest Clean Air Agency):** Required for burning debris after land clearing during construction of the FRE facility.
- **Permit for Nonroad Engines (Southwest Clean Air Agency):** Required for operation of nonroad engines with an aggregate horsepower exceeding 500 horsepower and for construction work lasting 1 year or more. This permit would be required for construction activities proposed for both the FRE facility and the Airport Levee Changes.
- **Right-of-Way Use Permit (City of Chehalis):** Required for activities that would disturb, alter, or use the right-of-way during construction of the Airport Levee Changes.
- **Shoreline Substantial Development Permit, including shoreline critical areas review (Lewis County):** Required for development of the FRE facility because it occurs within Shorelines of the State.
- **Shoreline Conditional Use Permit (Lewis County):** The FRE facility would be considered an in-water structure within Lewis County's SMP, which is a conditional use within the Rural Conservancy shoreline environment designation. Ecology has final approval for these permits.
- **Storm Drainage Approval (Lewis County):** Approvals are required for any construction that would change the point of discharge of surface waters, discharge surface waters at a higher velocity and/or quantity than that prior to development, or increase pollution of surface waters.

5 IMPACT ANALYSIS, FINDINGS, AND POTENTIAL MITIGATION

5.1 WATER

In this EIS, the term "water" means surface water (including the Chehalis River and its tributaries) and groundwater. This section describes the water resources in the study area. It evaluates water quality, water quantity (flows and levels), and water uses and rights.

Surface water and groundwater are regulated under state and federal law. Construction and operations must meet water quality standards for various criteria, like temperature. Water quantity and water uses and rights are also regulated under state and federal law.

The *Water Discipline Report*, Appendix N, has the full analysis and technical details used to evaluate water in this EIS. This section summarizes how impacts were evaluated and presents the main findings of the analysis. Impacts on public services and utilities, including municipal water supply, are described in Section 5.14, Public Services and Utilities. Impacts on geomorphology are described in Section 5.2, Earth. Water impacts on fish and other aquatic species and aquatic habitat are described in Section 5.3, Fish Species and Habitats. Impacts on wildlife, like amphibians, are described in Section 5.4, Wildlife Species and Habitat.

5.1.1 How Impacts Were Analyzed

The analysis looked at how construction and operation of the FRE facility and Airport Levee Changes could affect water resources. The study area for water is in the upper Chehalis Basin, which extends from the headwaters in the Willapa Hills and Cascade Range foothills, downstream to just past Montesano on the Chehalis River (Exhibit 5.1-1). The study area includes the Chehalis River and its floodplain.

Key Findings of the Water Analysis

In the summer, the temperature of the Chehalis River and streams in the temporary reservoir area would increase up to 5.4°F and up to 9°F in Crim Creek. This is mainly from the removal of trees for construction and operation of the FRE facility which would reduce shade and cover in upland and riparian zones. Dissolved oxygen levels in the temporary reservoir area would decrease.

Temperatures below the FRE facility would increase by 5.4°F. The increase would be less farther from the FRE facility and end 20 miles downstream.

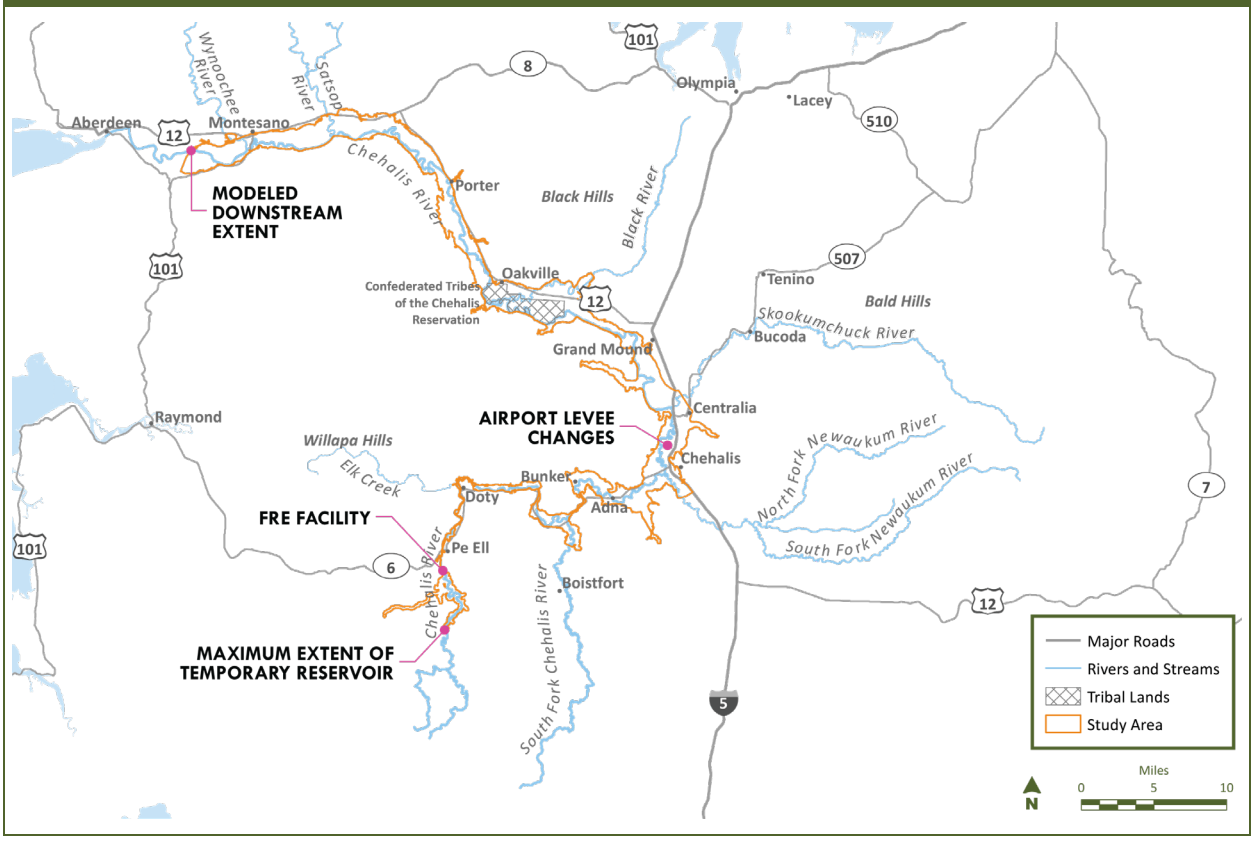
When water is released from the temporary reservoir, it would exceed water quality standards for turbidity. This would also happen during storms when sediment may be resuspended.

These impacts on water temperature, dissolved oxygen, and turbidity would exceed water quality standards and be **significant adverse impacts** on surface water quality. Impacts would be **unavoidable unless** the proposed Surface Water Quality Mitigation Plan meets regulatory requirements and implementation is feasible.

Construction would use up to 150 million gallons of water from the Chehalis River. This would require a water use permit and would be a **moderate to minor adverse impact**. FRE facility operation would have **moderate adverse impacts** on the quantity of surface water upstream.

For reference, the maximum area of the temporary reservoir is at RM 116, the proposed FRE facility near Pe Ell is at RM 108, and the airport levee area is near RM 67. The Proposed Project is intended to control flood waters from storms in the Willapa Hills. The water modeling showed that changes to the river level from these storms could be seen down to RM 9 near Montesano. This is where the tidal influence is larger than the river influence and determined the downstream limit of the study area. The study area also includes 1,500 feet of the lower portions of the South Fork Chehalis, Newaukum, Skookumchuck, and Black rivers, as well as smaller tributary streams. This is based on models showing how far water coming downstream the Chehalis River from a storm in the Willapa Hills could be pushed upstream along the tributaries.

Exhibit 5.1-1
Water Study Area



To evaluate the potential effects on water, existing data and information from previous studies were used to characterize existing conditions for surface water and groundwater in the study area. Recent technical studies and water modeling were used to evaluate the potential impacts on water at different places in the study area, at mid-century and late-century time periods.

A two-dimensional hydraulic computer model, RiverFlow2D, was used to identify the area of study and impacts. It used surveys and topographic data collected in 2012 and 2017. This was calibrated using the

ordinary high water marks from field surveys. It also used stream gage data from the USGS, which included the January 2009, December 2007, and February 1996 floods. Information from University of Washington's Climate Impact Group climate change models was included in the future hydrology modeling. Sea level rise was also included in the analysis. For this EIS, an increase in peak flood flows of 12% in mid-century and 26% in late-century is used for the analysis. Modeling also showed that water temperatures would increase at the same rate as increasing air temperatures, by 3.6°F to 5.4°F for most areas by late-century.

Other computer models were used to assess the possible effects on temperature, turbidity, and dissolved oxygen. They evaluated the temporary reservoir and upstream areas when storing water, the reservoir footprint when not storing water, and downstream of the FRE facility both when water would be stored to reduce flooding and when the river would flow through the FRE structure.

Several federal, state, and local laws and guidelines apply to water resources. These include the federal Clean Water Act, Washington State rules and regulations, and Lewis County and City of Chehalis municipal codes. Impacts for water were identified based on their potential to exceed these regulatory requirements or otherwise change conditions in the study area in an adverse way.

5.1.2 Findings for the Proposed Project

Impacts on surface and groundwater during the 5-year construction period for the FRE facility would be from the use of heavy equipment, stream diversions, temporary construction access routes, equipment and material staging areas, and from quarries. Construction of the Airport Levee Change would happen over a 1-year period and involve heavy equipment and staging areas. During operations, impacts on surface and groundwater would occur over the long term and could result from either the FRE facility or the Airport Levee Changes.

Water Quality Parameters

Temperature: Temperature affects both physical and biological characteristics of water including dissolved oxygen levels, biological activity and growth, and chemical processes. These can affect the health of aquatic and semi-aquatic species.

Dissolved Oxygen: Dissolved oxygen is a measure of how much oxygen is present in water. This affects the types of species that are able to live in a body of water.

Turbidity: Turbidity is a measure of the clarity of water. High levels of turbidity can lead to low levels of dissolved oxygen and impacts on aquatic and semi-aquatic species.

5.1.2.1 Impacts From Construction

Changes to Surface Water Quality

Water quality refers to the chemical, physical, and biological composition of the river water. Ecology has studied water quality in the Chehalis Basin and maintains long-term water quality monitoring stations on the mainstem Chehalis River at Dryad (RM 97.8) and Porter (RM 33). Real-time water quality data have been collected from additional locations on the Chehalis River and its tributaries as part of various recent studies. The main water quality concerns in the upper Chehalis Basin include turbidity, dissolved oxygen, temperature, and

contaminants such as dioxin and polychlorinated biphenyls (PCBs). Ecology has plans in place to protect water quality for temperature, dissolved oxygen, and fecal coliform bacteria in the study area.

Construction of the FRE facility and Airport Levee Changes would alter or degrade water quality conditions in the study area. Construction of the FRE facility would affect surface water quality, especially through in-water work activities in the Chehalis River at the FRE facility site and removal of vegetation. These activities include the use of temporary river crossings as well as plans to divert the river and isolate work areas by using cofferdams and a bypass tunnel to route flows around the construction site. Construction would also disturb sediments at the site, which would create increases in turbidity, lower levels of dissolved oxygen, and higher temperatures both in and downstream of the in-water construction areas. Also, the use of heavy equipment in the river channel presents the potential for pollutants such as diesel fuel, gasoline, oil and grease, and hydraulic fluid to enter surface waters.

Impacts on surface water quality were modeled for operation of the FRE facility and temporary reservoir over the long term, as well as for areas downstream. The analysis focused on water quality parameters of temperature, dissolved oxygen, and turbidity. As described in Section 5.3, Fish Species and Habitats, and Section 5.4, Wildlife Species and Habitats, fish and other species are particularly sensitive to changes in these water quality parameters. The impacts on surface water quality from tree removal would begin during construction and would continue through operation as described in Section 5.1.2.2.

High stream temperatures are a known concern in the upper Chehalis Basin. Ecology has documented exceedances of temperature criteria at long-term monitoring stations in nearly all years since 2001. Temperatures are expected to continue to rise due to climate change. Historical human activities, including urban and residential development, agriculture, and logging, have degraded riparian vegetation in the Chehalis River Basin, contributing to warmer stream temperatures in some locations.

Based on the computer model results, river temperatures would increase both within the temporary reservoir area and downstream of the FRE facility. Trees removed during construction would cause the river temperature to increase due to decreased shading. The increase would be as much as 5.4°F (3°C) in the reservoir area and immediately downstream and as much as 9°F (5°C) within the temporary reservoir at Crim Creek. Farther downstream, the increases in temperature would be less and would end about 20 miles downstream of the facility.

Dissolved oxygen is an important measure of water quality because many aquatic species, including fish, need oxygen to survive. Warmer water holds less dissolved oxygen than cooler water, and warming can also increase aquatic species' need for oxygen. Ecology has documented levels of dissolved oxygen below the minimum level in the Chehalis River, especially during the summer. Construction of the FRE facility would reduce dissolved oxygen levels by up to 0.4 milligrams per liter in summer in the temporary reservoir area upstream of the FRE structure and areas downstream. As with temperature, these dissolved oxygen impacts would be greatest near the FRE facility and less farther downstream.

Turbidity measures how clear the water is and is affected by sediments in the water. Turbidity levels in streams in the Chehalis Basin are highly variable, depending on precipitation and river conditions. Turbidity levels are typically highest in the winter during periods of heavy rain and high flows, and lowest in summer when rain and flows are low. Water quality could be impacted by landslides and removal of vegetation in the temporary reservoir area.

Construction would require federal, state, and local permits, including a Hydraulic Project Approval permit from WDFW, a Clean Water Act Section 404 permit from the Corps, and a NPDES permit from Ecology. Specific to water quality, the Proposed Project would also require a Clean Water Act Section 401 (Water Quality Certification) permit from Ecology.

The increased water temperatures and decreased dissolved oxygen levels would exceed water quality standards and have significant impacts on surface water quality and designated uses of the Chehalis River and Crim Creek for salmonid habitat. Mitigation is proposed for the Applicant to develop and implement a Surface Water Quality Mitigation Plan to address these impacts; however, there is uncertainty if the implementation of a plan is technically feasible and economically practicable. The Proposed Project would have significant and unavoidable adverse environmental impacts on surface water quality, unless the Applicant develops a Surface Water Quality Mitigation Plan that meets regulatory requirements and for which implementation is feasible. The plan must be approved by Ecology and other applicable agencies as part of the Section 401 and NPDES permit applications. The plan must provide reasonable assurance that water quality standards and designated in-water uses will be met.

For construction of the Airport Levee Changes, no work would be needed in or next to the Chehalis River. The same permit conditions would protect water quality from construction impacts on water temperature or turbidity, so impacts on water quality would be minor.

Changes to Surface Water Quantity

Water quantity refers to the amount of water flowing in the river system. The Chehalis River is the main surface water feature in the study area. Several tributary streams enter the Chehalis River between RM 108 and RM 116 in the temporary reservoir area. They include Crim Creek, Hull Creek, Browns Creek, Big Creek, Roger Creek, Smith Creek, and Alder Creek, as well as Lester Creek (which flows into Crim Creek).

The USGS has nine active stream gages on the Chehalis River that record information on streamflows and water levels. The gage data show that Chehalis River flows are typically highest from November to February, and lowest from July to September. Also, peak flows have been rising in the Chehalis Basin over the last 30 years and are expected to continue to rise because of climate change. Construction of the FRE facility and Airport Levee Changes would temporarily change the water quantity in the study area.

To build the FRE facility, the Chehalis River would be temporarily diverted through a 1,630-foot-long bypass tunnel. Although temporary, the bypass tunnel would be used for about 32 months. This water diversion would temporarily block and change the natural flow and bed of the river channel. The

Applicant has stated the diversion will mimic the Chehalis River at that location and will be designed for normal flows. Because the Proposed Project would use, divert, obstruct, and change the natural flow and bed of freshwaters of the state, it will require a Hydraulic Project Approval from WDFW. It would also require a Corps Section 404 permit for work below the ordinary high water level of the Chehalis River. Both of these permits will include conditions to minimize impacts on in-stream and riparian habitat and functions and to avoid and minimize impeding the passage of normal or high flows. With these permits, the bypass system is not expected to contribute to increased flooding upstream or downstream of the FRE facility. So temporary impacts on surface water quantity resulting from use of the bypass tunnel would be minor.

Other construction activities at and near the FRE facility site would include vegetation clearing, earthwork, and building temporary roads and staging areas, all of which would change surface water flows by creating erosion and altering stormwater runoff patterns. The construction activities would require state, local, and federal permits for work in and near water, including a Hydraulic Project Approval permit from WDFW, a Clean Water Act Section 404 permit from the Corps, and a NPDES permit from Ecology. With the permit requirements, changes in stormwater runoff resulting from construction are not expected to contribute to increased flooding upstream or downstream of the FRE facility and would be a minor impact on surface water quantity.

For construction of the Airport Levee Changes, no work would be needed in or next to the Chehalis River, so impacts on water quantity would be minor.

Changes to Groundwater Quantity and Quality

The FRE facility would be built in a narrow valley with bedrock at or near the ground surface. The layers of sediment on the valley bottom and soils on nearby hillsides are thin. These conditions mean groundwater is not expected to be found in the construction areas. Therefore, construction activities like dewatering part of the river, diverting the river flow, and excavations in upland areas are unlikely to affect either shallow groundwater levels or flow. With the permit requirements discussed above, changes to groundwater quantity and quality from constructing the FRE facility would be minor.

During construction of the Airport Levee Changes, local shallow groundwater flows (groundwater quantity) would be affected by excavation, fill placement, and potential dewatering in areas of levee widening, or removal of the existing retaining wall. With the permit conditions and pollution control measures in place, the changes to groundwater quantity from Airport Levee Changes would be moderate to minor. With the permit requirements discussed above, the potential for pollutants to affect groundwater quality during construction would be minor.

Impacts on Water Uses and Rights

For the FRE facility, water would need to be withdrawn from the Chehalis River for construction activities, such as to produce concrete. Up to 150 million gallons of water would be needed, with about

80% of that water needed over a 10- to 20-month construction period. This would be about 400,000 gallons per day, which is about 0.6 cfs of the river flow. The significance of a water withdrawal of that amount would vary throughout the year, based on factors such as seasonal flow rates and water needs. For example, river flows are lower in the summer. During low-flow conditions, state law establishes a minimum flow in the Chehalis River of 31 cfs between August 15 and September 15.

A short-term water use permit from Ecology would be needed to withdraw water from the Chehalis River for construction of the FRE facility. A plan would be developed to specify the withdrawal location, timing, and how much water would be used. With the considerations for in-stream flow requirements and the required Ecology permit, the adverse impact of FRE facility construction on water uses and rights would be moderate to minor.

Construction of the FRE facility and inundation of the temporary reservoir may affect an existing water supply line for the Town of Pe Ell's water system. The water supply line would likely need to be relocated or improved to function with the temporary reservoir and this would be a significant impact. Because this impact would affect part of a municipal water system, the detailed analysis is discussed in Section 5.14, Public Services and Utilities.

5.1.2.2 Impacts From Operations

Flooding is historically a common occurrence in the Chehalis River Basin. From historical records, minor flooding generally occurred every 2 to 5 years, and larger flooding took place roughly every 10 years. Large floods most commonly occurred between October and March. In the past 50 years, large floods occurred in 1972, 1975, 1986, 1990, 1996, 2007, and 2009. The 1996, 2007, and 2009 floods are the three largest floods on record, and the 2007 and 2009 floods occurred only 14 months apart. Most of the damage from the recent catastrophic floods occurred in Chehalis and Centralia, where I-5 sits on fill in the floodplain and where there has been more development than in other areas of the basin. The 1996, 2007, and 2009 floods all resulted in the loss of homes, farms, and businesses and multi-day closures of I-5.

The Applicant's purpose for the FRE facility is to temporarily hold floodwaters during major floods or greater from storms originating in the Willapa Hills. The Applicant defined a major flood as one where the water flow at the Grand

2007 Flood

The 2007 flood event was an atmospheric river (pineapple express) event with extremely high rainfall concentrated in the Willapa Hills. This event affected the Chehalis River mainstem and South Fork, with far less rainfall to the east in the Skookumchuck River Basin. The USGS gage for Grand Mound read 79,100 cfs for the 2007 flood; however, peak flows at the Doty gage were estimated at 52,600 cfs, almost double the next highest flood in the 74-year record. This flood is a 500-year flood with a 0.2% chance of occurring in a year.

The rain for the 2007 flood event was focused in one area, and the estimated peak flows in 2007 are higher at Doty than peak flows under the late-century catastrophic flood scenario, but lower at Grand Mound. While the numbers at the Grand Mound gage are similar, the 2007 flood was much larger than the catastrophic flood modeled for the EIS.

Mound gage would be 38,800 cfs. In the future, this level of flood would have a probability of occurring every 5 years (about a 20% chance of occurring in any given year) in the mid-century, and once every 4 years in the late-century (25% chance of occurring in any given year). A catastrophic flood would be measured as a water flow of 75,100 cfs at the Grand Mound gage. This level of flood would have a probability of occurring every 44 years (about a 2% chance of occurring in any given year) in the mid-century and once every 27 years (about a 4% chance of occurring in any given year) in the late-century. The temporary reservoir would be able to hold the 65,810 acre-feet of water expected for a catastrophic flood. Flows above the temporary reservoir's design capacity of 66,360 acre-feet would spill over the top of the structure using an emergency spillway.

Floodwaters would be stored in the temporary reservoir for up to 35 days. After the peak flood flows, the temporary reservoir would be emptied at a rate of up to 10 vertical feet per day. During non-flood conditions, which would be most of the time, the Chehalis River would flow unimpeded along the channel in the temporary reservoir and through outlets in the FRE structure. More information on the operation of the FRE facility and temporary reservoir during and after flood events is presented in Chapter 2.

Potential impacts on surface and groundwater from operation of the Proposed Project are summarized below. The EIS Mapbook in Chapter 10 has maps showing the expected changes in flood water levels in mid-century and late-century for the catastrophic flood scenario. The *Water Discipline Report*, Appendix N, includes maps for the major flood scenario.

EIS Mapbook

The EIS includes a separate Mapbook in Chapter 10. The Mapbook provides detailed information on predicted flood extents and depths from Pe Ell to Montesano under the following flood scenarios for the Proposed Project:

- Major Mid-Century
- Catastrophic Late-Century
- No Action

Modeled flood results are shown side-by-side to provide a comparison of predicted flood conditions. The maps also show an "Area No Longer Inundated," which illustrates the area that is predicted to flood under the No Action Alternative but would not be flooded under the Proposed Project.

Changes to Surface Water Quality

Potential impacts on water quality were modeled for operation of the FRE facility and temporary reservoir over the long term, as well as for areas downstream. The analysis focused on water quality parameters of temperature, dissolved oxygen, and turbidity. As described in Section 5.3, Fish Species and Habitats, and Section 5.4, Wildlife Species and Habitats, fish and other species are particularly sensitive to changes in these water quality parameters. The surface water quality impacts begin in construction as described above and continue through operation of the Proposed Project.

Based on the computer model results, river temperatures would increase both within the temporary reservoir area and downstream of the FRE facility. The lack of trees shading the river, either removed

during construction, operations, or from flood events, would cause the river temperature to increase. The increase would be as much as 5.4°F (3°C) in the reservoir area and immediately downstream and as much as 9°F (5°C) within the temporary reservoir at Crim Creek. Farther downstream, the increases in temperature would be less and would end about 20 miles downstream of the facility.

Operation of the FRE facility would reduce dissolved oxygen levels by up to 0.4 milligrams per liter in summer in the temporary reservoir area and areas downstream. As with temperature, these dissolved oxygen impacts would be greatest near the FRE facility and less farther downstream.

Operation of the FRE facility would increase turbidity in the Chehalis River during certain periods and reduce turbidity during others. After a major flood or larger, use of the FRE facility and temporary reservoir would change turbidity levels in the river, especially downstream. The temporary reservoir would fill during a flood and the FRE facility would slowly release the water after peak flood levels pass. This filling and release can stir up sediment from the riverbed, moving it into the water and downstream and increasing turbidity levels in the river. Turbidity levels would exceed water quality standards downstream as the temporary reservoir is drained, especially near the end of the process. Using conservative assumptions and data from past flood events, water quality criteria for turbidity are predicted to be exceeded for 18 days for a catastrophic flood and 28 days for a major flood. Exceedances of turbidity criteria are highly dependent on the turbidity of Chehalis River flows entering the temporary reservoir following the flood. The modeling predicted more days of exceedances for the major flood than the catastrophic flood because inflowing turbidity remained elevated longer for the catastrophic flood and returned to lower levels more quickly for the major flood, so outflow turbidity remained at least 10% higher than inflow turbidity for longer for the major flood.

The increased water temperatures and turbidity levels and decreased dissolved oxygen levels would exceed water quality standards and be significant impacts on surface water quality and designated uses of the Chehalis River and Crim Creek for salmonid habitat. Mitigation is proposed for the Applicant to develop and implement a Surface Water Quality Mitigation Plan to address these impacts; however, there is uncertainty if the implementation of a plan is technically feasible and economically practicable. The Proposed Project would have significant and unavoidable adverse environmental impacts on surface water quality, unless the Applicant develops a Surface Water Quality Mitigation Plan that meets regulatory requirements and for which implementation is feasible. The plan must be approved by Ecology and other applicable agencies as part of the Section 401 and NPDES permit applications. The plan must provide reasonable assurance that water quality standards and designated in-water uses will be met.

Water quality impacts from mercury, harmful algal blooms, or fecal coliform bacteria would not occur from operation of the FRE facility so there are no adverse impacts from these. Operation of the Airport Levee Changes would have no adverse impacts on water quality.

Changes to Surface Water Quantity

During a major flood or larger, the FRE facility would use the temporary reservoir to store floodwaters. This would inundate up to 847 acres along 6.4 miles of the Chehalis River (Exhibit 5.1-2). These changes to the river upstream of the FRE facility would alter the functions provided by the natural river channel. The vegetation along the shorelines and the structure and shape of the river channel would change. These changes to habitat and river processes are discussed in more detail in Section 5.3, Fish and Fish Habitat.

A water right from Ecology would be needed to retain flood flows in the temporary reservoir. It would define conditions of allowable water storage, including amounts and timing. With this water right and because the inundation would be periodic (about once every 4 to 5 years on average) and temporary (up to 35 days), these impacts on surface water quantity would be moderate.

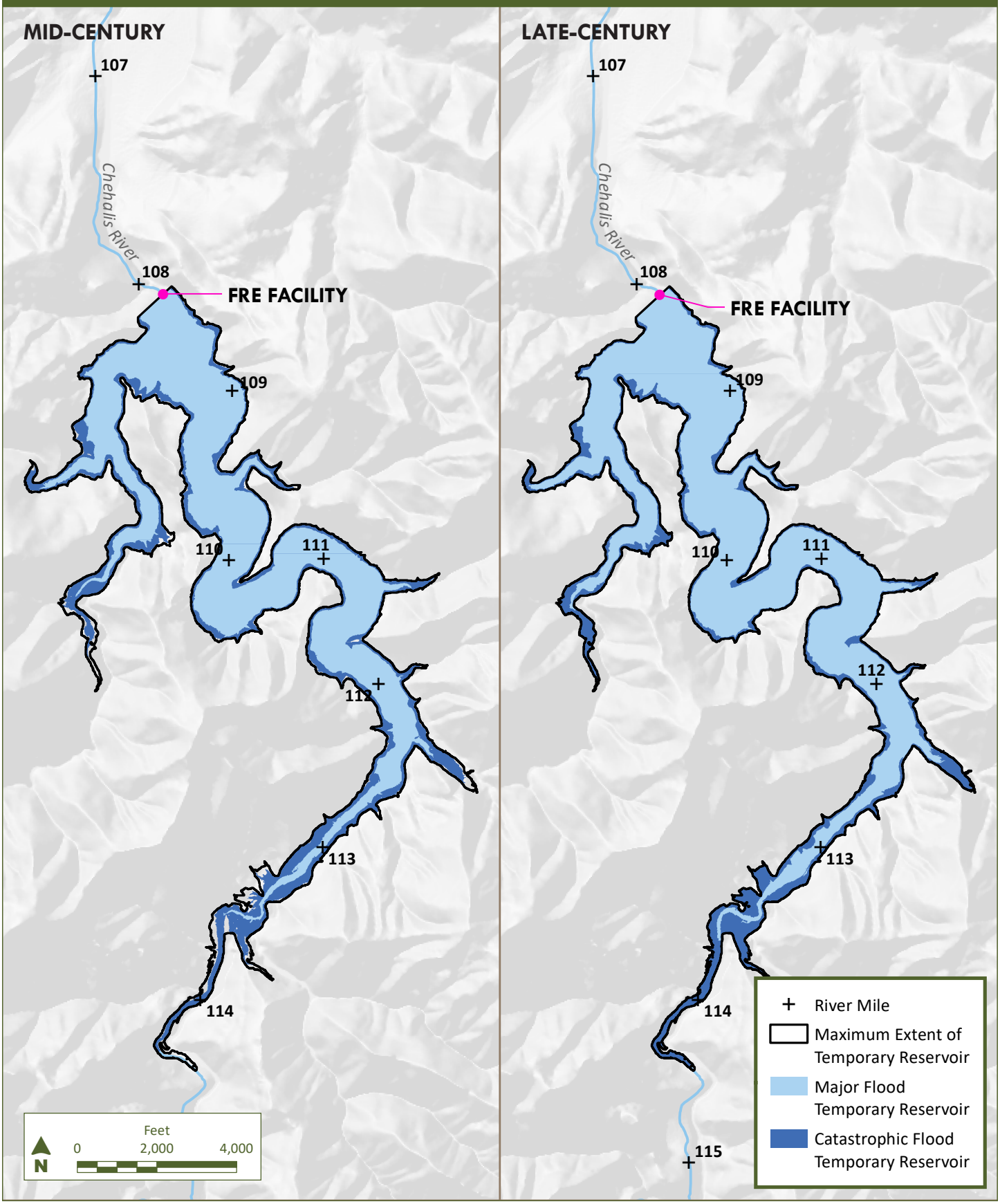
Difference from 2017 Programmatic EIS

The flood levels in this EIS are different from the 2017 Programmatic EIS for three main reasons:

1. Climate change predictions for more rain and bigger peak flows are included in this EIS.
2. For the Programmatic EIS, a one-dimensional water model was used for the high-level study. For this EIS, a two-dimensional model was used. It included topography (shape of the land) so this model is more detailed and precise.
3. Projects that were completed after the Programmatic EIS are included in this EIS, including new airport pumps and culverts.

Downstream of the FRE facility, flood levels would be reduced during a major flood or larger but the levels would vary by location and scenario. The EIS Mapbook in Chapter 10 shows the expected changes in flood water levels in the mid-century and late-century for a catastrophic flood. In general, the predicted reductions in flood levels would be greatest in areas closest to the FRE facility, and smaller farther downstream.

Exhibit 5.1-2
Temporary Reservoir Inundation Areas



Exhibits 5.1-3 and 5.1-4 show changes in surface water elevations at some critical facilities and key intersections as examples.

Exhibit 5.1-3

Examples of Modeled Water Depths for a Major Flood (in feet)

FACILITY	MID-CENTURY		LATE-CENTURY	
	WITHOUT THE PROPOSED PROJECT	WITH THE PROPOSED PROJECT	WITHOUT THE PROPOSED PROJECT	WITH THE PROPOSED PROJECT
PE ELL				
Pe Ell School	No flooding	No flooding	No flooding	No flooding
DRYAD				
Leudinghaus Road east of Chandler Road	No flooding	No flooding	No flooding	No flooding
Rainbow Falls State Park (river channel at west end of park)	20.5	14.8	21.9	15.6
CENTRALIA-CHEHALIS				
Centralia Police Station	No flooding	No flooding	No flooding	No flooding
Washington Elementary School	0.5	0.5	0.7	0.7
Washington State Patrol	No flooding	No flooding	No flooding	No flooding
Veterans Memorial Museum	No flooding	No flooding	0.1	No flooding
Valley View Health Center	No flooding	No flooding	No flooding	No flooding
Riverside Golf Course (clubhouse)	No flooding	No flooding	0.5	No flooding
Fire Station 3 District 16	No flooding	No flooding	No flooding	No flooding
I-5 north of SW 13th Street Interchange (Exit 76)	No flooding	No flooding	No flooding	No flooding
I-5 Interchange at NW Chamber of Commerce Way	No flooding	No flooding	No flooding	No flooding
I-5 at Mile Post 81	No flooding	No flooding	No flooding	No flooding
SR 6 and River Road	No flooding	No flooding	No flooding	No flooding
SR 6 near Twin Oaks Road (600 feet west of intersection)	1.1	No flooding	2.7	0.4
NAPAVINE				
Rush Road Underpass (I-5 Interchange)	3.4	3.4	3.6	3.6
OAKVILLE				
Oakville Elementary/High School	No flooding	No flooding	No flooding	No flooding
GRAND MOUND				
188th Avenue and Moon Road	2.6	2.2	3.0	2.5
MONTESANO				
SR 107, just south of US 12	No flooding	No flooding	No flooding	No flooding

Exhibit 5.1-4

Examples of Modeled Water Depths for a Catastrophic Flood (in feet)

FACILITY	MID-CENTURY		LATE-CENTURY	
	WITHOUT THE PROPOSED PROJECT	WITH THE PROPOSED PROJECT	WITHOUT THE PROPOSED PROJECT	WITH THE PROPOSED PROJECT
PE ELL				
Pe Ell School	No flooding	No flooding	No flooding	No flooding
DRYAD				
Leudinghaus Road east of Chandler Road	5.0	No flooding	6.0	No flooding
Rainbow Falls State Park (river channel at west end of park)	27.8	20.2	28.9	21.4
CENTRALIA-CHEHALIS				
Centralia Police Station	No flooding	No flooding	0.2	0.2
Washington Elementary School	3.0	1.9	4.4	2.1
Washington State Patrol	2.3	No flooding	3.8	No flooding
Veterans Memorial Museum	0.8	0.2	1.2	0.4
Valley View Health Center	1.9	No flooding	3.3	0.1
Riverside Golf Course (clubhouse)	3.8	2.5	4.9	3.8
Fire Station 3 District 16	2.5	No flooding	4.6	No flooding
I-5 north of SW 13th Street Interchange (Exit 76)	1.8	0.7	2.3	1.4
I-5 Interchange at NW Chamber of Commerce Way	7.0	0.4	8.4	4.7
I-5 at Mile Post 81	1.9	No flooding	3.2	0.3
SR 6 and River Road	0.9	No flooding	2.2	No flooding
SR 6 near Twin Oaks Road (600 feet west of intersection)	5.5	3.8	6.0	4.5
NAPAVINE				
Rush Road Underpass (I-5 Interchange)	5.3	5.3	6.5	6.5
OAKVILLE				
Oakville Elementary/High School	No flooding	No flooding	0.9	No flooding
GRAND MOUND				
188th Avenue and Moon Road	4.4	3.8	4.9	4.1
MONTESANO				
SR 107, just south of US 12	1.1	0.5	2.1	1.3

Based on the modeling, the Proposed Project would meet the Applicant's objective of reducing peak flows in Chehalis and Centralia during major and larger floods. However, many areas would remain flooded to some extent.

There is no predicted increase in downstream inundated area during major or larger floods from FRE operations, so there are no significant adverse impacts on surface water quantity downstream.

If the Airport Levee Changes are completed before the FRE facility is operational and a catastrophic flood occurs, there would be moderate impacts related to potential for increased flood levels immediately upstream and downstream of the levee. To prevent this, mitigation is proposed for the Applicant to construct levee changes at the end of the FRE construction period. When both the FRE facility and Airport Levee Changes are operational, flood elevations on the east side of the airport levee would be reduced and would result in no adverse impacts on surface water quantity downstream.

Changes to Groundwater Quantity and Quality

When the FRE facility is holding and releasing water for the temporary reservoir, groundwater patterns in the study area would be temporarily altered. Groundwater levels would temporarily rise in areas that are inundated by floods, and some reduction in groundwater recharge could occur in areas where river flows are reduced when the FRE facility is storing water. These impacts would be temporary, until the river flow returns to normal levels, and would be moderate to minor impacts on groundwater quantity.

The Airport Levee Changes could involve placing fill material or structures like floodwalls below the surface, which would modify shallow groundwater flows in those areas. These changes would be permanent and would be moderate impacts on groundwater quantity. With the required permits, no adverse impacts on groundwater quality are expected from operation of either the FRE facility or the Airport Levee Changes.

Impacts on Water Uses and Rights

According to the USGS, most residential, industrial, and agricultural development and demands for water in the Chehalis Basin are in the valleys of the Chehalis River and its primary tributaries, the Newaukum and Skookumchuck rivers. Based on Ecology information from 2018, there are about 1,740 water right permits and certificates, and an additional 5,300 water right claims, in the Chehalis Basin. Centralia and Chehalis are served by municipal public water supply systems, while most rural water users are self-supplied by wells or served by smaller public water systems.

The Town of Pe Ell has an existing water right to withdraw water from Crim Creek, which is within the footprint of the temporary reservoir. Although the former water diversion and conveyance system from Crim Creek has been removed and Pe Ell does not now withdraw water from that location, the Town of Pe Ell may want to exercise its water right at some point in the future. The authorized point of diversion on Crim Creek would be inundated when the FRE facility is operating, and operation of the FRE facility would affect the Town of Pe Ell's ability to exercise this water right. This would be a moderate impact on water use and rights.

The Airport Levee Changes would not interfere with any existing water uses or rights; there would be no adverse impact on water rights or uses.

5.1.2.3 Proposed Mitigation Measures

This section describes mitigation measures being proposed for Applicant to implement that would reduce impacts from construction and operation of the Proposed Project. These mitigation measures would be implemented with, or as part of, the required permits, plans, and approvals described in Section 4.

- **WATER-1**: To reduce probable impacts on surface water quality and designated aquatic life uses of the Chehalis River and Crim Creek from construction and operation of the Proposed Project, mitigation is proposed for the Applicant to develop and implement a Surface Water Quality Mitigation Plan. The plan must be approved by Ecology and other applicable local, state, and federal agencies and be provided as part of the Section 401 and NPDES permit applications. The plan must provide reasonable assurance that water quality standards and designated in-water uses will be met. The mitigation must be done within the Chehalis River Basin. The plan may include a range of options for mitigation. The plan will include, but is not limited to, the following:
  - Mitigation for the increase in daily maximum temperature of up to 2°C to 3°C (3.6°F to 5.4°F) in the Chehalis River in the temporary reservoir footprint and to about 20 miles downstream of the FRE facility, and of up to 5°C (9°F) in the lower portion of Crim Creek, below its confluence with Lester Creek.
  - Mitigation for the decrease in daily minimum dissolved oxygen by up to 0.4 milligrams per liter in the Chehalis River within the temporary reservoir.
  - Measures to minimize the exceedances of turbidity water quality criteria to the downstream Chehalis River when the temporary reservoir is draining and outflow turbidity exceeds inflow turbidity by more than 10% or by more than 5 nephelometric turbidity units (NTU) if inflows are less than 50 NTU.
  - Measures to minimize the exceedances of turbidity water quality criteria in the reservoir area from shallow landslides.
  - This plan will be developed in conjunction with management and mitigation plans for vegetation, wetlands and wetland buffers, streams and stream buffers, fish and aquatic species and habitat, wildlife species and habitat, riparian habitat, and large woody material.

Other Related Mitigation Measures

- **PSU-1:** To reduce potential impacts on Pe Ell's water supply system, mitigation is proposed for the Applicant to work with the Town of Pe Ell to conduct a study to determine if the Pe Ell water line at Lester Creek needs to be relocated or redesigned to ensure that it can withstand inundation within the temporary reservoir. If relocation or redesign is required, the Applicant will develop a cost estimate and provide funding for this work (see Section 5.14, Public Services and Utilities).

- **LAND-3:** The Applicant will develop a schedule in which the levee is built during the last part of the FRE facility construction period to eliminate the risk of additional flooding from a catastrophic flood if the Airport Levee Changes are completed before the FRE facility is constructed (see Section 5.7, Land Use).

5.1.2.4 Significant and Unavoidable Adverse Environmental Impacts

There is uncertainty if mitigation is technically feasible or economically practicable; therefore, the Proposed Project would have **significant and unavoidable** adverse environmental impacts on surface water quality. The Applicant may provide a Surface Water Quality Mitigation Plan as described above. If Ecology determines the plan meets the requirements of the Clean Water Act, RCW 90.48, and WAC 173-201A and implementation is feasible, then the impacts would be addressed as part of the permitting processes.

5.1.3 Findings for the Local Actions Alternative

Construction for local actions could be needed for projects that involve floodproofing of existing structures, floodplain storage improvements, and channel migration protection. These construction activities in the floodplain could adversely affect surface water quality by disturbing soils and increasing the potential for stream turbidity. The use of construction equipment could also increase the chance of pollutants (such as oil and grease, fuel, or hydraulic fluids) entering surface water through stormwater runoff, or contaminating groundwater. These short-term construction impacts would be moderate to minor, depending on the action and the location. The placement of fill material or structures for floodproofing actions could locally modify shallow groundwater flows, which would be a moderate impact. Construction activities that could affect water quality would require permits.

In the long term, the Local Actions Alternative would not greatly reduce flooding in the basin but would reduce flood damage. Surface and groundwater throughout the study area would continue to experience substantial flood risk during both major and catastrophic floods.

5.1.4 Findings for the No Action Alternative

Under the No Action Alternative, surface and groundwater throughout the study area would continue to experience substantial flood risk, and flood frequency and severity is predicted to increase in the future. Floods would continue to inundate rivers, streams, habitat, and properties. Exhibits 5.1-3 and 5.1-4 show changes in surface water elevations at some critical facilities and key intersections as examples. The EIS Mapbook in Chapter 10 provides maps showing the expected changes in flood water levels in the mid-century and late-century in the study area for the No Action Alternative.

Water levels for major and catastrophic floods are expected to continue to increase across the study area over time, and the predicted flood depths and flood area extents are greater for the No Action Alternative than the Proposed Project. Under the modeled late-century catastrophic flood, for example,

the No Action Alternative would see about 3,680 acres more land flooded than under the Proposed Project, including rural and agricultural lands as well as residential neighborhoods in Centralia.

Differences in water surface elevations between the No Action Alternative and the Proposed Project would be greater closer to the FRE facility and smaller farther downstream. Near Doty, for example, water surface elevations are predicted to be 12.1 feet higher under the No Action Alternative than the Proposed Project for a late-century catastrophic flood, while the difference in water levels between the No Action Alternative and the Proposed Project at the Porter Creek Road Bridge is 1.2 feet for a late-century catastrophic flood. The modeling shows no areas downstream of the FRE facility where the No Action Alternative would result in lower water surface elevations than the Proposed Project for major or catastrophic floods.

Flood depths under the No Action Alternative are predicted to vary widely across the floodplain, from river channel bottom (deep) to the edge of the floodplain (near zero). For example, flood depths range from 19.1 feet near Doty for a mid-century major flood to 38.3 feet near Adna for a late-century catastrophic flood. Areas inside (landward) of the airport levee would not be flooded during a mid-century or late-century major flood under the No Action Alternative, but those areas would be flooded during mid-century and late-century catastrophic floods, with up to 19.5 feet predicted at the north end of the airport during the late-century catastrophic flood.

Water quality and water uses throughout the study area would continue to be vulnerable to degradation during both major and catastrophic floods under the No Action Alternative.

5.2 EARTH

This section evaluates geology and geomorphology, referred to as "earth" in the EIS. Geology is the study of the earth, the materials that make it up, their structure, and the processes that act upon them such as earthquakes. Geomorphology is the study of earth's surface processes including landslides, erosion, movement of sediment, and shifting of channels in streams and rivers. These processes affect water quality, people, cultural resources, fish, and aquatic habitat.

This section describes how geology and geomorphology were analyzed. It also summarizes impacts for the Proposed Project, the Local Actions Alternative, and the No Action Alternative. The *Earth Discipline Report*, Appendix F, contains the full analysis and technical details used to evaluate geology and geomorphology. Impacts on water are described in Section 5.1, impacts on fish species and habitat are described in Section 5.3, impacts on cultural resources are described in Section 5.9, and impacts on environmental health and safety are described in Section 5.10.

5.2.1 How Impacts Were Analyzed

The study area for earth includes the FRE facility area, the temporary reservoir area, quarry sites and access roads, the airport levee area, and the Chehalis River from RM 117 to RM 9. The analysis also included slopes adjacent to the temporary reservoir area.

Analysis included doing field surveys, subsurface testing and sampling, field and laboratory testing, and databases. It evaluated if changes in the water levels in the temporary reservoir would cause landslides or affect their stability. It looked at the movement and deposit of soil and other materials from construction and operations. It evaluated if earthquakes near the facility would affect the FRE structure. It considered if there would be more erosion from changes in the plants and water levels. It analyzed if the channels downstream would change because of different levels of sediment and water movement and reductions in peak flows.

Key Findings of the Earth Analysis

While very unlikely, if ground shaking from a large earthquake damaged the FRE structure at the same time the temporary reservoir is holding water, the impacts would be **significant and unavoidable**. This event would cause loss of human life; loss and damage of public infrastructure; and extensive damage to private properties, livestock, buildings, and the environment.

Changing water levels in the reservoir could result in landslides. Discharge of fine sediments to the Chehalis River could cause turbidity that exceeds water quality standards. This could occur within the temporary reservoir area or downstream of the FRE facility following intense rainstorms and floods after the temporary reservoir is drained. These impacts would affect water quality and fish and aquatic habitat and would be **significant adverse impacts**.

Construction and operation of the FRE would permanently change the river channel at that site, and this would be a **significant adverse impact**. The reduction in peak flows would affect channel-forming processes downstream and would be a **significant adverse impact**. Large woody material would be removed from the river system and be a **significant adverse impact**.

These significant adverse impacts on water quality and aquatic habitat would be **unavoidable unless** the mitigation plans proposed for the Applicant meet regulatory requirements and implementation is feasible.

It considered if the changes in the amount of large woody material upstream would affect the river downstream.

The impact analysis also considers the permit requirements for implementation of the Proposed Project. Many state and local rules and policies apply to the Proposed Project, including Ecology Dam Safety Guidelines, Surface Mining Permits, Shoreline Management Act, Lewis County SMP, and Lewis County Comprehensive Plan.

5.2.2 Findings for the Proposed Project

5.2.2.1 Impacts From the Flood Retention Facility

Earthquake Risk

The Cascadia Subduction Zone produces complex changes in the earth and could trigger large, damaging earthquakes in or close to the Chehalis Basin. The Doty Fault Zone begins about 3 miles northwest of Doty and extends just east of the town of Chehalis. It is about 9 miles from the FRE facility and capable of producing a 6.9-magnitude earthquake. It is the closest fault zone to the FRE facility and the only one suspected of being active in the Chehalis Basin. See Exhibit 5.2-1 for a summary of geologic features in the area.

The primary risks from earthquakes for the FRE facility are from ground motion and a fault rupture. A seismic hazard analysis identified the potentially active faults near the site and a seismic analysis evaluated the potential effects on the structure. The analysis considered possible ground motion caused by earthquakes for periods ranging from 500 to 10,000 years.

Models were used to evaluate ground motions for several types of earthquakes. These include a magnitude 8.9 Cascadia Subduction Zone earthquake produced by two plates sliding past each other, a magnitude 7.5 Cascadia Subduction Zone earthquake produced by rupture within one of the plates, a magnitude 7.1 Olympia Fault earthquake, and a magnitude 6.9 Doty Fault earthquake. The study found the most likely earthquake that could affect the FRE structure is the 8.9 Cascadia Subduction Zone event.

Earth Terminology

Bedrock: Solid rock under soil.

Cascadia Subduction Zone: A geological plate boundary that goes from Canada to California.

Channel incision: A process where a river cuts downward into its bed, deepening the channel.

Debris flow: A type of landslide that begins at high elevations and contains soil, rock, and water that flows into a channel. They can be fast moving and travel far.

Deep-seated landslides are the largest and occur at depths greater than 10 feet. Usually a result of long wet periods, not single storms.

Earthquake magnitude: Estimate of earthquake size

Fault: A break or fracture in the earth's crust where earthquakes are likely to occur.

Large woody material: Logs, stumps, and branches in a river or stream or along the banks.

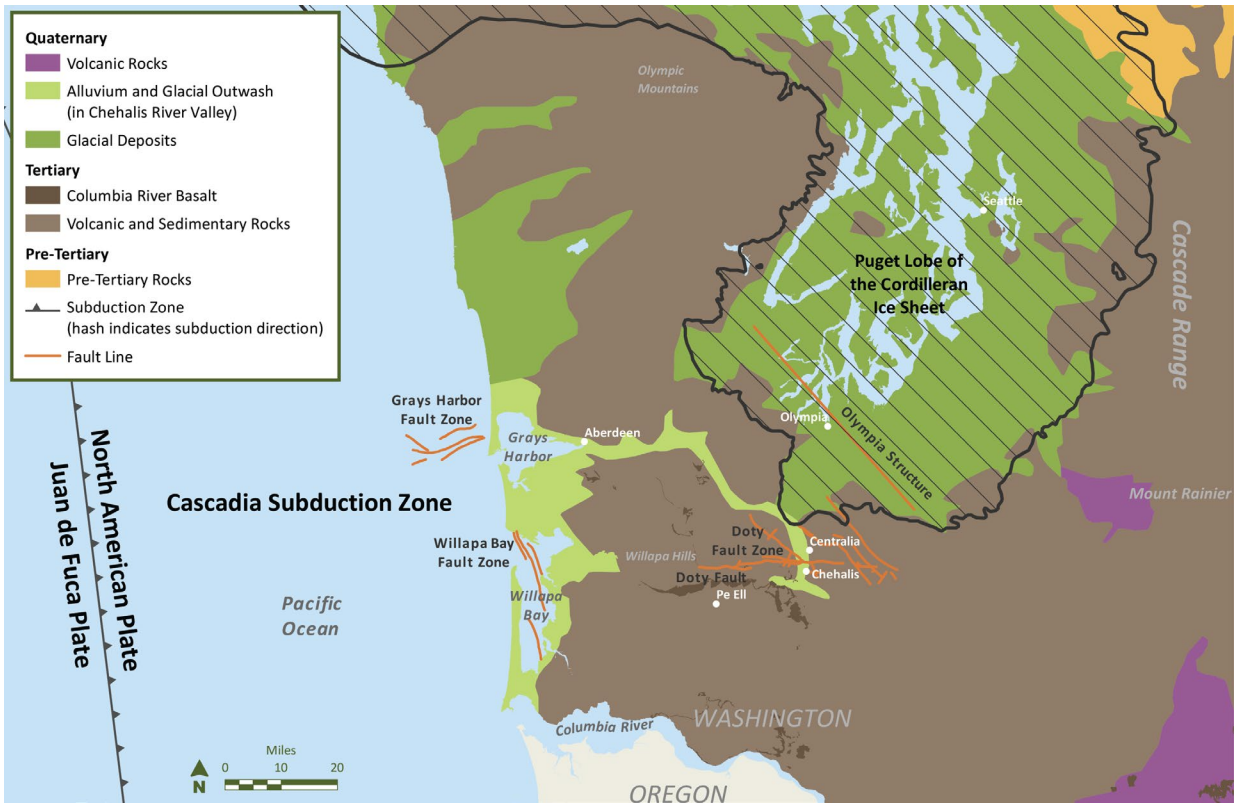
Shallow landslides occur at depths of less than 10 feet. They typically start from intense rainfall and/or rapid snowmelt.

Subduction zone: An area where two tectonic plates meet, and one plate slides under the other.

Turbidity: The cloudiness or haziness of water caused by suspended solids.

Volcanic rock: Rock formed as a result of cooling of molten rock under the earth or erupting from a volcano.

Exhibit 5.2-1
Geologic Features of the Study Area and Region



Over the past 10 years there have been many studies of the geology of the FRE facility site and quarry sites to determine risks. At the FRE facility site, rock and soil from 18 borings (holes in the ground) were tested in a laboratory. The holes were pressure tested to evaluate how water would move through the rock. Monitors were installed in each boring to track groundwater levels. A technique using a shock wave to create an image of the ground beneath the FRE facility site was done for the FRE structure and the bypass tunnel sites. It identified how stiff the rock is and how easily it could be excavated. This testing identified where there may be suitable bedrock for the FRE structure foundation and where there are highly fractured zones that may require treatment to support the FRE structure.

Laboratory testing of rock from the FRE facility site identified its strength and other engineering properties. Computer models simulated the response of the FRE structure in an earthquake and were checked against a spreadsheet model. Samples from the three rock quarry sites were tested to see if the rock would be suitable for use in the concrete mixture for the FRE facility.

A large earthquake occurring on the Cascadia Subduction Zone to the west or Doty Fault Zone to the north could cause damage to the FRE facility due to strong shaking. The Dam Construction Permit from Ecology requires considering seismic events in the design of the structure and would require the FRE

facility to be built to withstand this amount of shaking. If damaged, the FRE facility would require repair and likely would be temporarily shut down. If an earthquake were to occur at the same time the temporary reservoir was full, the structure would be expected to contain water under current dam design standards. The chance of a large earthquake happening while the reservoir is holding water has a probability of 0.00000000037 (or a 1 in 2.5 billion chance). While very unlikely, if ground shaking from a large earthquake damaged the FRE structure while the temporary reservoir was also holding water, the impacts would be significant and unavoidable. Section 5.10, Environmental Health and Safety, discusses the potential for a breach of the FRE structure and the impacts on downstream communities in more detail.

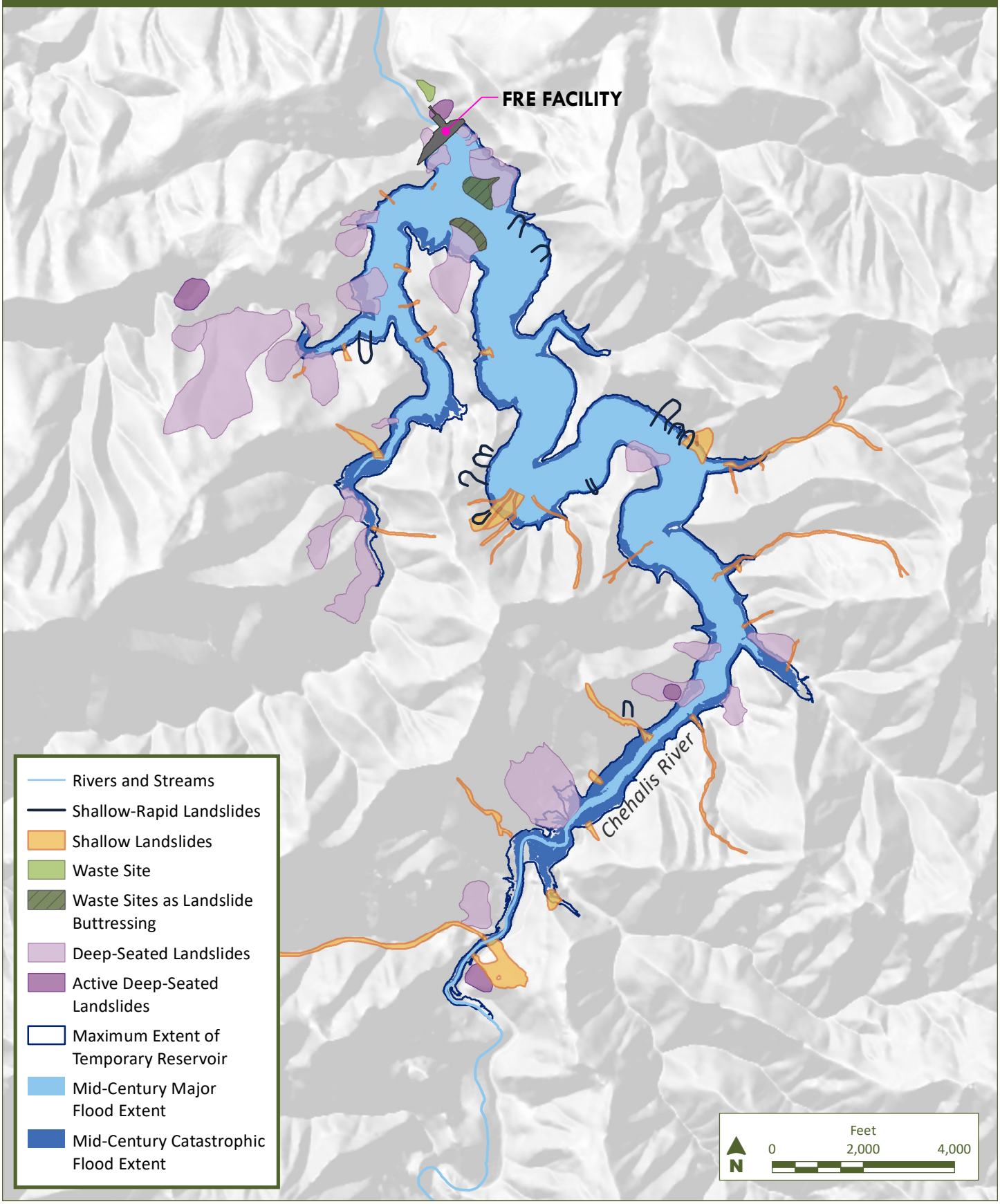
Landslide Activity

Landslides often occur on steep or unstable slopes, typically during the rainy season, and can also happen as a result of earthquakes. Areas with volcanic rock in the Willapa Hills have steep slopes (80% or steeper). Where sedimentary rocks are present, slopes are slightly gentler, but still steep (60% to 80%). In the foothills, slope steepness ranges from about 30% to 60%. The valley is mainly flat (0% to 5% slope). Deep-seated and shallow landslides and debris flow have occurred in the study area.

Deep-seated landslides near the FRE facility were identified in a three-step process. First, Light Detection and Ranging (LiDAR) maps that show details on the shape of the land surface were evaluated for potential sites. Next, the locations were verified during field visits; holes were drilled through landslide debris or soil, and then 10 to 20 feet into bedrock at 14 sites to characterize the subsurface conditions; and engineering studies were conducted to evaluate the stability of the landslides. Finally, testing was done to determine the depth to bedrock, and soil samples were collected and tested. Data loggers were installed to monitor groundwater levels. Twenty-seven potential deep-seated landslides were identified in the landslide evaluation. Of these, six could affect the FRE facility, if they became unstable (Exhibit 5.2-2).

Soil in the temporary reservoir footprint could become saturated depending on how long each area is inundated. Areas at lower elevations and closer to the FRE facility would be inundated for the longest time and most frequently. As the temporary reservoir drains, saturated soils could become unstable on steep slopes, particularly if root strength and soil cohesion are low. These slopes could be subjected to shallow, rapid landslides. Such a landslide would move downslope until it reached the temporary reservoir or a low-gradient area where the soil would be deposited.

Exhibit 5.2-2
Areas Potentially Susceptible to Landslides and Areas of Potential Landslide Buttressing



The potential for shallow landslides to occur when the temporary reservoir is filled and emptied was evaluated. DNR and Weyerhaeuser inventoried landslides in the upper Chehalis drainage in 2008 and 1994, respectively. The surveys identified 47 shallow landslides in and near the FRE facility and temporary reservoir footprint. Seven of these landslide areas could potentially be affected by a mid- or late-century major or catastrophic flood. Three additional shallow landslide areas were identified that could also potentially be affected by a mid- or late-century catastrophic flood. The rest of the shallow landslide areas are above the elevation of maximum inundation in the temporary reservoir (627 feet). The analysis looked at areas where the slopes are 36% or steeper, how saturated the slope would be, and the soil type.

The *Earth Discipline Report – Geomorphology,* Appendix F, analyzed areas within the temporary reservoir footprint that may be susceptible to shallow, rapid landslides. In areas where trees would be removed, it assumed the soil was poorly drained with no root strength. The analysis considered the slope angle that could be susceptible to sliding as the temporary reservoir drains. About 10% of the temporary reservoir area contains soil on slopes steep enough that they may be unstable if they are saturated and all root strength was removed. Most of these areas are along tributary valleys with steep slopes. The analysis found, assuming a 6-foot average soil depth, the total volume of soil that could potentially be moved by a landslide is 840,500 cubic yards.

The Applicant would operate the FRE facility and draw down water in the temporary reservoir at a maximum rate of 10 feet per day (5 inches per hour) to reduce the chance of landslides. As described above, potential landslide sites have been identified, but landslides could also occur in other locations. If a deep-seated landslide, shallow landslide, or debris flow occurs in the temporary reservoir footprint area and affects streams or rivers, the impact would range from significant to minor due to increased turbidity that could affect water quality and impacts on habitat for fish or other aquatic species.

While mitigation is proposed for known deep-seated landslide sites, the potential for landslides to occur would remain and these would have a significant to minor adverse impact on water quality due to increased turbidity. Mitigation is proposed for the Applicant to develop and implement a plan for surface water quality to address these impacts, but at this time it is not certain the plan is feasible.

Erosion and Sediment During Construction

The construction of the FRE facility would result in erosion. Activities that could cause erosion include the removal of soil and rock for the foundations of the FRE facility, creation of the temporary bypass tunnel, use of unpaved roads to access the construction site and to haul materials from the quarry sites, and clearing of vegetation in the temporary reservoir area.

Sand, silt, and clay in the FRE facility construction areas would be subject to erosion from rain. Mining of rock quarry sites and travel on roads between the quarry sites and the FRE facility construction site would create sediment that could reach creeks and the Chehalis River. Up to 13.5 miles of unpaved

access roads would be widened for quarry and construction access. Up to 181,000 heavy-truck trips are anticipated on at least some parts of the unpaved roads during construction and would cause road surface erosion. The 13.5 miles of access roads would be widened to 20 feet; erosion from these 33 acres of road surface is estimated to be 100 tons per year. Eroded sediment from these activities could enter nearby streams, wetlands, or waterways.

Tree removal in 600 acres of the temporary reservoir footprint during construction would also cause erosion. Tree removal near rivers and streams during construction would likely result in additional erosion because it would reduce root strength and the stability of streambanks. Eroded sediment could enter streams or wetlands if soil is disturbed within 200 feet of streams or wetlands.

The Applicant would be required to have NPDES water quality permits for construction of the FRE facility and roads in the temporary reservoir area. These permits would require sedimentation and erosion controls to ensure that sediment does not exceed water quality standards. For the quarries and roads in managed forest areas, widening or construction would require Forest Practices Act permits. These permits would require management of sediment from construction so water quality standards are not exceeded. Best management practices required in these permits would likely include covering or protecting piles of fill; installing straw bales or berms to capture sediment before it enters the water; and installing silt fences, coir rolls, and settling ponds.

The implementation of permit regulations and best management practices is expected to control erosion from construction activities for the FRE facility. Impacts on water quality and turbidity would be reduced so they do not exceed water quality standards. Therefore, construction of the FRE facility would result in a moderate to minor adverse impact on water quality from sedimentation.

Erosion and Sediment During Operation

The peak flows for the December 2007 flood were the largest in the historical record. Extreme rainfall caused more than 1,000 landslides in the Chehalis Basin and an estimated 5.7 to 8.7 tons of sediment entered the river upstream of the proposed FRE facility. The sediment was mostly fine-grained clay, silt, and sand. While much of the sediment moved downstream, some is still deposited in the riverbed and floodplain. Channel widths also increased after the 2007 flood, mainly upstream of RM 105.9 where the channel widened from 78 feet to 123 feet in 2 years. Since then, the channel has been slowly narrowing as vegetation grows on the gravel bars and sediment continues to move downstream. About 3 million cubic yards of large woody material also entered the river during the flood. Most of this has since been removed from the channel and floodplains.

Gravel bars on the Chehalis River from the headwaters down to about RM 33 contain mainly gravel-sized rocks with some cobble and sand. In general, the largest sediments are found in the steeper areas of the river. Cobble-sized pieces are found from RM 118 to RM 80. Between RM 73 and RM 80, only gravel and sand are found on the river bars. Between RM 65 and RM 62, bedrock under the riverbed

pins the river in place, resulting in a gentle river slope and mostly sand on the riverbed. Gravel and cobble particles are not transported through this area from upstream sources due to the gentle slope. Downstream of RM 62, the river is less channelized and steeper, and gravel and cobble are found in the channel. The Satsop River enters at RM 20, providing a large source of gravel to the Chehalis River. Downstream of approximately RM 13, tidal effects control river gradient, flow, and sediment deposition.

Several water and erosion models were used to evaluate changes to the river resulting from operation of the Proposed Project. During normal operation, when the temporary reservoir is not holding water, sediment in the river would move through the FRE facility outlets and downstream with the flow of the river and smaller flood events. During a major or catastrophic flood, the FRE facility would temporarily hold water for up to 35 days. When the reservoir is holding water, sediment carried by water entering the reservoir would be deposited in the reservoir pool area. This would reduce turbidity and sediment loads in the river downstream of the FRE facility. Cobble, gravel, and coarse sand would be deposited in the reservoir area where the mainstem Chehalis River meets Crim Creek, Lester Creek, Big Creek, Roger Creek, and Thrash Creek. Finer-grained clay, silt, and sand suspended in the inflowing water would be carried out into the main body of the reservoir and deposited. The amount of deposition would change as the temporary reservoir level raises and lowers. The impacts from this movement of fine- and coarse-grained sediment is discussed in the following sections.

Fine-Grained Sediment Erosion and Turbidity

As the temporary reservoir drains, some of the finest-grained silt and clay particles deposited on the sides of the reservoir would be exposed to wave action, resuspended in the water, and moved to lower hillslopes. Water and erosion models estimated how much sediment could be eroded as the reservoir is drained. The wave strength would depend upon wind speed and direction as well as local topography. Some of the coarser sand-sized particles would likely remain on the hillslopes and become trapped by vegetation and land features. Sediment that remained on the emerging hillslopes could be eroded by high-intensity rainfall after the temporary reservoir drained and move to lower slope areas along the mainstem Chehalis River. Coarser sand more than 200 feet from a channel would be deposited on the hillslope and would be unlikely to enter the river or stream.

Vegetation conditions would change when water is held in the temporary reservoir because plants that are inundated for a long period would not survive. Loss of vegetation and temporary loss of root strength would reduce soil cover and is expected to increase the potential for erosion. As flood-tolerant species regrow and annual vegetation grows between periods of temporary reservoir inundation, root strength and soil cover would increase, reducing the potential for both shallow landslides and erosion. However, the frequency of major floods increases in the future so the potential for regrowth would be reduced.

Sediment input to the mainstem Chehalis River downstream of the FRE facility would decrease during impoundment events. However, fine sediment input in the mainstem Chehalis River would increase as the temporary reservoir drains and during one or two intense rainstorms after the temporary reservoir

is drained. The effects of increased fine sediment input would be moderate during these periods (reservoir draining and one or two subsequent intense rainstorms) but could be significant during the latter parts of the reservoir draining period if incoming turbidity levels are low. The fine sediment impacts on the Chehalis River downstream of the FRE facility during the latter part of draining of the reservoir would have a significant adverse impact on turbidity (water quality). Mitigation is proposed for the Applicant to develop and implement a Surface Water Quality Mitigation Plan to address these impacts, but at this time it is not certain the plan is feasible. The plan must meet regulatory requirements and be approved by Ecology and other applicable agencies as part of the Section 401 and NPDES permit applications. The plan must provide reasonable assurance that water quality standards and designated in-water uses will be met.

Coarse-Grained Sediment and Riverbed Materials

A geomorphologic model showed that, over the long term with the FRE facility, more sediment would accumulate on the riverbed within the temporary reservoir, sediment storage would decrease in the bedrock canyon for 0.5 mile downstream of the FRE facility, and there would be alternating areas of more and less sediment storage to RM 85 depending on the local river channel characteristics. Within and upstream of the temporary reservoir, there would be changes to the riverbed material, depending on the river channel characteristics at a particular location after the reservoir is emptied. The net accumulation in the temporary reservoir area and net decrease in sediment storage downstream of the FRE facility would be higher for late-century flows than for mid-century flows, but patterns of net increases and decreases in storage would be similar. In the reservoir area, the model shows significant adverse impacts on sediment transport and riverbed characteristics for the Chehalis River. This could have significant impacts on fish and aquatic habitat by increasing fine sediment deposition in the riverbed. The model predicts moderate impacts between the FRE facility and about RM 85 that would likely have moderate adverse impacts on fish and aquatic habitat. Downstream of RM 85, there would be minor impacts that would likely not affect fish and aquatic habitat.

Changes in Movement of Large Woody Material During Operation

Large woody material such as logs and rootwads plays an important role in the geomorphology of a river and provides aquatic habitat diversity. The woody material comes into the river from landslides or riverbank erosion. There are two sources for large wood in the Chehalis River, landslides in the upper watershed and changes to the channel or bank downstream of RM 105. Current levels of large wood are low in the Chehalis River; a large amount entered the river during the 2007 flood but has since been removed.

Woody material would pass through the FRE outlets most of the time; however, it is expected something like a trash rack would be used to capture large woody material. When the FRE facility is in operation and impounding water, all woody material would be trapped in the temporary reservoir and removed as the reservoir level drops. Boats would move logs to a sorting yard on land for disposal. As a result, very little wood from the watershed upstream from the FRE facility would move downstream into

the mainstem Chehalis River after a major flood or larger. This would result in very low levels of large woody material in the mainstem Chehalis River downstream of the FRE facility to the confluence with the South Fork. This would reduce channel complexity and diversity and affect aquatic habitat. Operation of the FRE facility would have a significant adverse impact on habitat due to the removal of large woody material downstream of the FRE facility to the South Fork confluence. Mitigation proposed for the Applicant to develop a Large Woody Material Management Plan would reduce impacts by placing woody material back in the Chehalis River system downstream of the FRE facility.

Changes to the Chehalis River During Operation

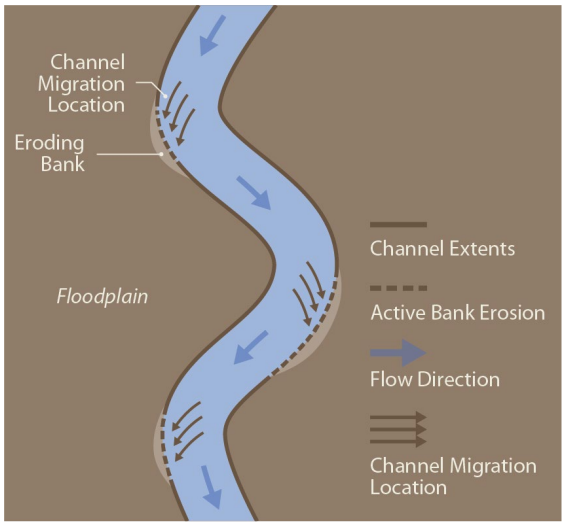
Channel-forming flows create and maintain different habitat features. Channel-forming flows include channel migrations and avulsions. Channel migration or shifting of the channel is natural in locations where a river is not confined by bedrock, hills, or man-made structures and the bank is made of materials that easily erode (Exhibit 5.2-3). Channel migration provides the opportunity for more diverse aquatic habitat and can affect land and structures within the migration zone. For the Chehalis River, based on an analysis of migration rates in the Chehalis River between 1945 and 2013, channel migration mainly happens in open areas where floods erode the riverbanks. Major channel changes (known as avulsions) occur when a stream rapidly leaves its established channel and forms a new channel. These avulsions take place in response to large log jams that only occur during catastrophic floods when large amounts of wood are supplied to the river from upstream landslides.

Downstream of the FRE facility, the magnitude of large peak floods would be reduced, which would reduce natural processes such as channel migration and formation of side channels, bars, and wetlands, especially those that form during large floods. These large floods have the greatest ability to reshape the river channel and form habitats for aquatic species and those that use riparian areas and the floodplain.

The reduction in flood flows would be greatest close to the FRE facility and less noticeable farther downstream as flow from tributaries enters the Chehalis River.

Because bank erosion and channel migration are the result of a complex interaction of high flows, woody material accumulation, and sediment accumulation, it is anticipated that operation of the FRE facility would slightly decrease channel migration in unconfined areas between RM 105 and RM 88 and have little effect on channel migration downstream of the South Fork Chehalis River. Over time, a reduction of large floods would lead to the growth of riparian vegetation in the Chehalis River between the

Exhibit 5.2-3
Channel Migration Illustration



FRE facility site and the South Fork Chehalis River, which may stabilize some banks and further reduce channel migration. This effect would be seen most in upstream areas.

Operation of the FRE facility would reduce flood peaks downstream and this would eliminate channel-forming avulsions. Large woody material would be removed from the temporary reservoir during the reservoir drawdown and would no longer move downstream. Operation would affect channel-forming processes because the input of water, wood, and sediment within the FRE footprint and downstream of the FRE facility would change. When flows are reduced due to water backing up at the entrance to the outlets or water is held in the temporary reservoir during flood events, the stream power needed for most channel-forming processes would be reduced or eliminated. This reduction in peak flows and corresponding reduction in large wood and sediment transport would impact the creation of habitats that depend on channel-forming processes. This would be a significant adverse impact on aquatic habitat from the FRE facility to the South Fork Chehalis River confluence. Mitigation is proposed for the Applicant to develop and implement plans for aquatic and riparian habitat mitigation and large woody material management to address these impacts, but at this time it is not certain the plans are feasible.

Downstream of the South Fork Chehalis River confluence, bank erosion, channel migration, and avulsions would likely be similar to existing conditions. Operation of the FRE facility would have moderate impacts on bank erosion and channel migration in unconfined areas from RM 105 to RM 88, by slightly reducing bank erosion and channel migration rates, and minor effects on bank erosion and channel migration in other river areas.

Within the temporary reservoir, sediment would form deltas in the temporary reservoir when water is held. Channel migration would increase upstream of the reservoir between RM 115 and RM 108. The magnitude of these effects would be moderate to minor in most reaches but would be significant in a few isolated relatively unconfined reaches and would negatively affect aquatic habitat-forming processes. The overall impact of increasing channel migration in the temporary reservoir area would be moderate.

5.2.2.2 Impacts From the Airport Levee Changes

A total of 114,500 cubic yards of fill would be used for construction at the airport levee. Sand, silt, and clay in the fill would be subject to erosion during rainfall. Because the Airport Levee Changes site is flat, eroded soil would not be transported far from the construction site but could enter streams or wetlands nearby. The Applicant would be required to have NPDES water quality permits for construction of the Airport Levee Changes. These permits would require sedimentation and erosion controls to ensure the sediment does not exceed water quality standards. Best management practices required in these permits would likely include covering or protecting piles of fill; using straw bales or berms to keep sediment from entering waterways; installing silt fences, coir rolls, and settling ponds; and hydroseeding.

With the implementation of permit regulations and best management practices, the erosion from construction activities for the Airport Levee Changes would result in a minor adverse impact on water quality from sedimentation.

5.2.2.3 Proposed Mitigation Measures

This section describes mitigation measures being proposed for the Applicant to implement that would reduce impacts from construction and operation of the Proposed Project. These mitigation measures would be implemented with, or as part of, the required permits, plans, and approvals described in Section 4.

- **EARTH-1:** To reduce potential impacts on water quality from slope instability at the FRE facility during construction, mitigation is proposed for the Applicant to identify unstable ground in the proximity of the FRE facility and will either excavate and haul this material to a waste disposal site or will stabilize the ground by using methods such as soil nails, tieback shoring, rock bolts, shotcrete, bracing, and scaling.
- **EARTH-2:** To reduce impacts on the FRE facility from unstable deep-seated landslides, mitigation is proposed for the Applicant to develop a plan to stabilize landslides using, but not limited to, the following methods: 1) excavate unstable soil where adjacent to the FRE facility; 2) add buttressing and drainage to increase slope stability where adjacent to the FRE facility; and 3) monitor landslide activity where distant from the FRE facility. Ecology would approve the Landslide Stabilization Plan and it would be required to be implemented prior to or during construction.
- **EARTH-3 (Large Woody Material Management Plan):** To mitigate the impacts of construction and operation of the Proposed Project on large woody material and habitat, mitigation is proposed for the Applicant to develop and implement a Large Woody Material Management Plan. The plan must be developed in coordination with and approved by WDFW, and in consultation with DNR, and be ready to implement prior to the start of construction. The measures described in the plan will include a range of mitigation options. Mitigation will be implemented along the mainstem Chehalis River and in appropriately sized tributaries. The mitigation will include, but is not limited to, the following:
  - To minimize impacts during construction, a plan will be developed to address large woody material transport and use of the diversion tunnel.
  - To minimize impacts on channel-based processes, the large woody material that accumulates in the reservoir will be placed within the river channel and upland habitats identified in the plan within 60 days of completing drawdown following each inundation event.
  - This plan will be developed in conjunction with management and mitigation plans for vegetation, wetlands and wetland buffers, streams and stream buffers, fish and aquatic species and habitat, wildlife species and habitat, riparian habitat, and surface water quality.

Other Related Mitigation Measures (for details, see Section 5.17)

- FISH-1 (Fish and Aquatic Species and Habitat Plan)
- WATER-1 (Surface Water Quality Mitigation Plan)
- WET-2 (Stream and Stream Buffer Mitigation Plan)
- WILDLIFE-1 (Vegetation Management Plan)
- WILDLIFE-3 (Riparian Habitat Mitigation Plan)

5.2.2.4 Significant and Unavoidable Adverse Environmental Impacts

- A breach of the FRE structure may occur at the same time water is impounded in the temporary reservoir. The risk of a breach is extremely low, even during a major earthquake, because the FRE structure would be designed to contain water under current dam design standards. However, if a breach of the FRE structure did occur when the temporary reservoir was holding water, the result would be a **significant and unavoidable adverse** environmental impact.
- There is uncertainty if mitigation is feasible; therefore, the Proposed Project would have **significant and unavoidable** adverse environmental impacts on surface water quality. The Applicant may provide a Surface Water Quality Mitigation Plan as described above. If Ecology determines the plan is feasible and meets the requirements of the Clean Water Act then the impacts would be addressed as part of the permitting processes.
- There is uncertainty if mitigation is technically feasible and economically practicable; therefore, the Proposed Project would have the following **significant and unavoidable** adverse environmental impacts on geomorphology:
  - Water quality exceedances of turbidity in the Chehalis River as the temporary reservoir drains and during subsequent rainstorms
  - Sediment transport and substrate characteristics within the Chehalis River and streams in the temporary reservoir area
  - Reductions in channel-forming processes and large woody material in the Chehalis River to the confluence of the South Fork

  The Applicant may provide mitigation plans as described above. If agencies determine the plans meet the regulatory requirements and implementation is feasible, then the impacts would be addressed as part of the permitting processes.

5.2.3 Findings for the Local Actions Alternative

Construction near steep slopes, streams, or other waterbodies could cause slope instability or increase erosion. Permits will require appropriate best management practices to meet water quality standards so impacts would be moderate to minor. Under the Local Actions Alternative, changes to sediment and water input from floods would occur, and the Chehalis River would continue to adapt to the effects of the 2007 flood. Reforestation and riparian restoration activities could provide additional large woody material and bank protection over the long term. Activities that remove constrictions at narrow portions

of the river could have local effects on sediment transport and deposition. Channel migration protection structures would reduce bank erosion and channel migration potential, affecting natural geomorphic processes by decreasing channel migration. These impacts are all anticipated to be minor. Under the Local Action Alternative, flooding would not be significantly reduced. Geological and geomorphological processes would continue to experience substantial flood risk.

5.2.4 Findings for the No Action Alternative

Under the No Action Alternative, flooding would not be significantly reduced and flood frequency and severity is predicted to increase in the future. Landslides, erosion, and changes to the Chehalis River channel and tributaries, such as avulsions and channel migration, would continue to occur. Under the No Action Alternative, changes to sediment and water input from floods would occur, and the Chehalis River would continue to adapt to the effects of the 2007 flood. Geological and geomorphological processes would continue to experience substantial flood risk.

5.3 FISH SPECIES AND HABITATS

This section evaluates aquatic species and habitats. Aquatic species include the fish, shellfish, aquatic macroinvertebrate, marine mammal, and fish-eating bird species in the study area. Aquatic habitat includes habitat in the Chehalis River, and the streams, off-channel, and wetlands that are connected to the Chehalis River and allow fish to access the habitat from the river.

Spring and fall-run Chinook salmon, coho salmon, steelhead, Pacific lamprey, and many other fish and shellfish are found in the study area. These are critical to the physical, cultural, and spiritual wellbeing of tribal nations, and access to fish for harvest is a right reserved in tribal treaties. Fish also are important for commercial and recreational harvest by non-tribal people in the Chehalis Basin.

The *Fish Species and Habitats Discipline Report*, Appendix E, contains the full analysis and technical details used to evaluate fish and aquatic species and habitats. Probable impacts on tribal resources, including treaty rights, are discussed in Section 5.6, Tribal Resources. Probable recreational impacts are discussed in Section 5.8, Recreation. Probable impacts on other related resources are described in Section 5.4, Wildlife Species and Habitats; Section 5.1, Water; Section 5.5, Wetlands; and Section 5.2, Earth.

5.3.1 How Impacts Were Analyzed

The study area for fish species and habitats includes the area of the FRE facility, the area of the temporary reservoir, the airport levee area, and the Chehalis River. For lifecycle analysis of salmon and for Southern Resident killer whales and fish-eating birds, the study area includes Grays Harbor and the Pacific Ocean.

Potential impacts were identified for the aquatic habitats and species known to occur in the study area. The analysis focuses on impacts of the proposed FRE facility on fish species identified by the State of Washington as priority

Key Findings of the Fish Species and Habitats Analysis

Construction and operation of the Proposed Project would have a **significant adverse impact** on aquatic habitat from the headwaters of the Chehalis River to the middle mainstem. The removal of vegetation, increase in temperature, and reduced water quality would negatively affect aquatic habitat and species.

Construction and operation would have **significant adverse impacts** on spring-run Chinook salmon, fall-run Chinook salmon, coho salmon, and steelhead from degraded habitat, noise, and fewer fish surviving passage around the FRE facility.

Construction would have a **significant adverse impact** on migratory non-salmon fish such as lamprey and whitefish and a **moderate adverse impact** on resident fish such as minnows and sculpin. Operations would have **significant adverse impacts** on these fish.

Construction and operation would also have a **moderate adverse impact** on Southern Resident killer whales. It would have **significant to moderate adverse impacts** on shellfish and aquatic macroinvertebrates.

These significant impacts on fish and aquatic species and habitat would be **unavoidable unless** the Fish and Aquatic Species and Habitat Management Plan and other mitigation plans meet regulatory requirements and implementation is feasible.

species. Modeling was used to analyze impacts on salmon, steelhead, and native freshwater fishes for the Proposed Project and No Action Alternative.

Impacts on salmon and steelhead were analyzed using the Ecosystem Diagnosis and Treatment (EDT) model and these results were integrated into the NOAA Life-Cycle Model (LCM). EDT models the change in abundance, productivity, population spatial structure, and diversity for a population at a certain point in time. The NOAA LCM analyzed impacts on fish populations over time under the major flood, catastrophic flood, and recurring flood scenarios. This EIS used an integrated modeling approach using the outputs of the EDT model for the LCM analysis.

The modeling for salmon and steelhead analyzed impacts for two areas (shown in Exhibit 5.3-1):

- The **Above Crim Creek Subbasin** above the proposed FRE facility (RM 108), which includes the headwaters of the Chehalis River and tributaries upstream of Crim Creek
- The **Rainbow Falls to Crim Creek Subbasin** below the proposed FRE facility, which includes the Chehalis River and tributaries from the FRE facility to Rainbow Falls

Freshwater species were analyzed using the PHABSIM model and were analyzed qualitatively where modeling data were unavailable. These species included Pacific lamprey, largescale sucker, mountain whitefish, speckled dace, largemouth bass, and smallmouth bass.

Potential impacts associated with the Airport Levee Changes were evaluated qualitatively based on changes in water surface elevations.

Relationship to the 2017 Programmatic EIS and Aquatic Species Restoration Plan

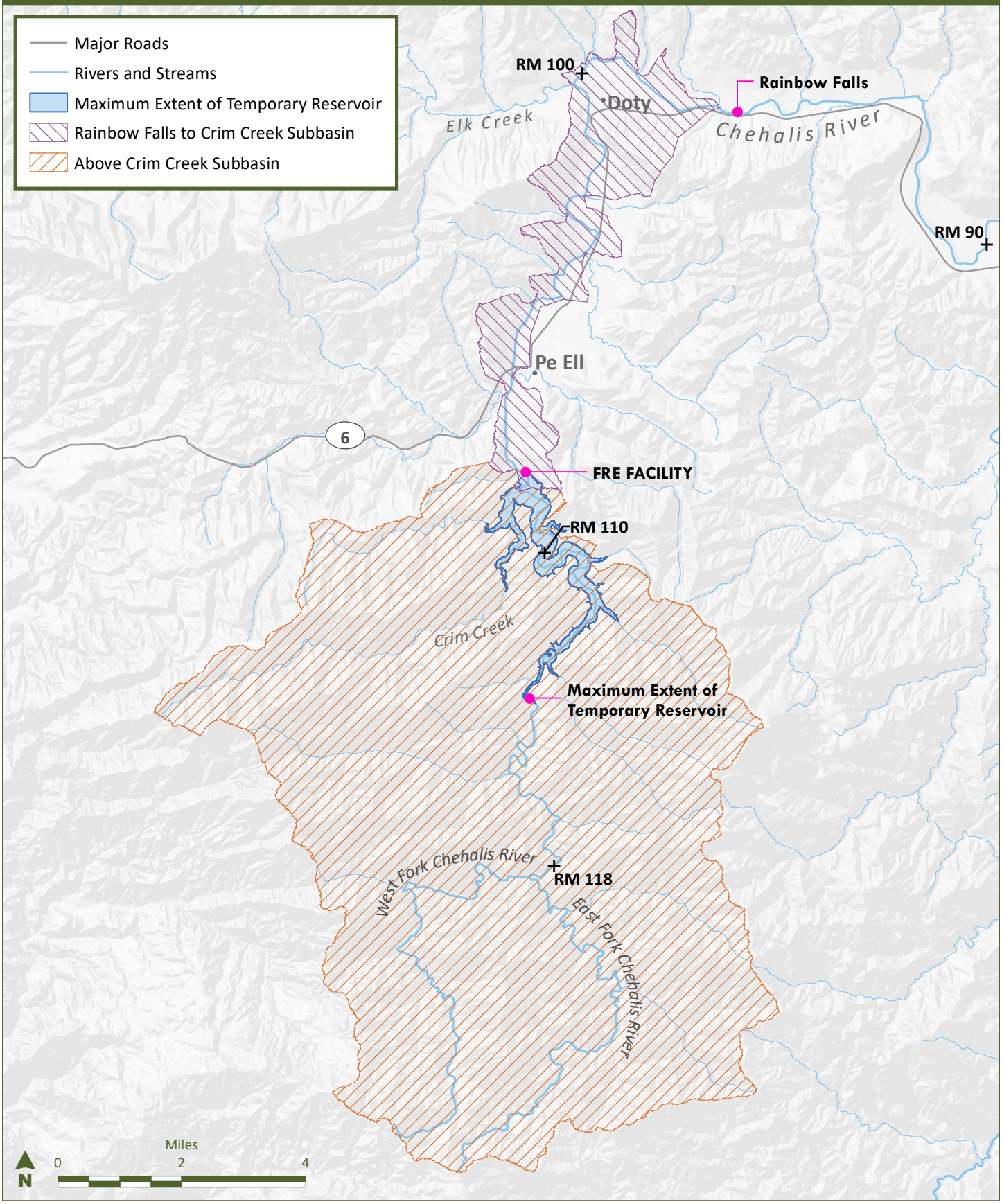
The 2017 Programmatic EIS and the Aquatic Species Restoration Plan Phase 1 released in 2019 are strategic planning documents. They looked at impacts on the entire Chehalis Basin at a high level.

This EIS evaluates impacts from one proposal: the Applicant's Proposed Project. The Applicant's objectives and purpose are related to storm events in the Willapa Hills, so the study area is smaller and the analysis is more detailed.

There are many populations of salmon and steelhead in the Chehalis Basin. This EIS analyzes impacts on two populations in the upper and middle Chehalis River. It does not analyze all fish populations in the entire basin or in all tributaries of the Chehalis River.

The Programmatic EIS, the Aquatic Species Restoration Plan, and this EIS are some of the documents expected to be used by decision makers.

Exhibit 5.3-1
Areas Analyzed for Salmonid Impacts



5.3.2 Findings for the Proposed Project

5.3.2.1 Impacts From the Flood Retention Facility

Construction Impacts on Aquatic Habitats

Impacts on aquatic habitat from construction of the FRE facility would primarily result from dewatering and diversion of the river around the construction site and removal of nearly all trees in 600 acres of the temporary reservoir area. Most of the habitat impacts would be located in the upper mainstem Chehalis River because that is where the FRE facility and its associated infrastructure would be located.

A temporary trap-and-transport system at the FRE facility site would move fish upstream during construction. Fewer fish would survive being trapped and moved, which would impact aquatic habitat because there would be fewer nutrients available from salmon carcasses. Construction of the FRE facility and the bypass tunnel would also impact aquatic habitat by reducing water quality.

Trees and plants would be removed from the FRE facility construction area and 600 acres of the temporary reservoir inundation area. These trees provide structure to the riparian forest, shade to the stream channel, and nutrient and wood inputs to the stream that serve as critical habitat for fishes. The loss of the trees in the riparian zone would significantly degrade the riparian habitat. Mitigation is proposed for the Applicant to develop and implement a Fish and Aquatic Species and Habitat Plan to address these impacts, but at this time it is not certain the plan is feasible. The plan must meet regulatory requirements and be approved by WDFW and other applicable agencies and must provide no net loss of ecological functions for fish species and habitat.

The construction activities would require state, local, and federal permits for work in and near water, including a Hydraulic Project Approval permit from WDFW, a Clean Water Act Section 404 permit from the Corps, and a NPDES permit from Ecology.

Construction Impacts on Salmonids

Modeling showed the populations of salmon and steelhead upstream of the FRE facility (above Crim Creek subbasin) and below the FRE facility (Crim Creek to Rainbow Falls subbasin) would experience significant impacts during construction. Spring-run and fall-run Chinook salmon would be most affected by a decline in habitat quality in the temporary reservoir area because their spawning is concentrated in this area. Coho salmon and steelhead would be more affected by the trap-and-transport process to move fish above the construction site. These fish migrate and spawn during winter when trapping would be more challenging due to turbid (cloudy) water and high water flows. Vegetation removal during construction would degrade the quality of habitat for rearing juvenile salmon and steelhead in the temporary reservoir area.

Exhibit 5.3-2 shows the percentage change in numbers of salmonids (also called change in abundance) during construction based on the integrated modeling for the two subbasins. The EDT modeling showed changes in abundance similar to the integrated model. The decrease in salmonid abundance during

construction of the Proposed Project would be a significant adverse impact on spring-run Chinook salmon, fall-run Chinook salmon, coho salmon, and steelhead.

Exhibit 5.3-2
Changes to Salmonid Abundance During Construction From Integrated Model Results

FISH SPECIES	CHANGE IN ABUNDANCE DURING CONSTRUCTION	
	ABOVE CRIM CREEK SUBBASIN	RAINBOW FALLS TO CRIM CREEK SUBBASIN
Spring-run Chinook Salmon	-52%	-19%
Fall-run Chinook Salmon	-37%	-10%
Coho Salmon	-65%	-1%
Steelhead	-51%	-19%

Noise and vibration associated with construction activities near the river could create vibrations in the earth that are transmitted to the water. These activities could impact fish behavior by masking important sound signals; disturbing foraging, spawning, or migration activities; or exposing fish to predators. In-water work would also generate noise and vibration that is likely to disturb fish behavior. However, these sounds would not likely be lethal to fish. Best management practices and permit conditions that include monitoring noise levels and fish behavior would be implemented to minimize impacts related to noise and vibration.

Fish migrating downstream during construction would pass the FRE site using a temporary river bypass tunnel. The survival of fish passing through this tunnel during construction would be affected during high water flows from increased water speeds through the bypass tunnel and water backing up at the tunnel entrance and ponding above the cofferdam. Wood and debris would also accumulate at the entrance to the bypass tunnel from vegetation removal or landslides, which would affect fish.

Adult salmonids would move upstream during construction using a temporary trap-and-transport method with a temporary picket weir downstream of the FRE facility construction site to trap fish. Adult salmon and steelhead would then be transported around the FRE facility construction site using live boxes and transport trucks. It is estimated that passage survival would range from 32% to 65% for adult salmon and steelhead. During construction it is unlikely that juvenile salmonids would move upstream into the bypass tunnel. This is based on 1) the assumption that juvenile salmonid parr would be hesitant to move upstream against the current through a long, dark tunnel; 2) the temporary picket weir installed downstream of the FRE facility during construction to collect adult salmonids may act as a visual or behavioral barrier that inhibits the upstream movement of salmonid parr; and 3) construction activities could deter upstream migrating fish if vibration reaches certain levels or if water quality is affected.

Reduced fish passage, degraded habitat, and mortality caused by rerouting the river around the FRE facility site through the bypass tunnel would have a significant adverse impact on salmon and steelhead. Mitigation is proposed for the Applicant to develop and implement a Fish and Aquatic Species and

Habitat Plan to address these impacts, but at this time it is not certain the plan is feasible. The plan must meet regulatory requirements and be approved by WDFW and other applicable agencies and must provide no net loss for fish species and habitat.

Construction Impacts on Other Aquatic Species

Construction impacts on other aquatic species including non-salmon fish, freshwater shellfish, aquatic macroinvertebrates, marine mammals, and fish-eating birds are described qualitatively.

Passage upstream and downstream around the FRE facility construction site on the Chehalis River would be limited for non-salmon fish. The Applicant's temporary trap-and-transport method for upstream passage around the construction site is not specifically intended for non-salmon species, and it is unlikely that these fish would migrate upstream through the bypass tunnel. Downstream passage would be available via the bypass tunnel. Construction of the FRE facility would have a significant adverse impact on migratory non-salmon fish due to uncertainty about transport to upstream habitat. Construction of the Proposed Project would have a moderate adverse impact on resident fish because they could continue to use habitat upstream and downstream of the construction site; however, they would still be affected by impacts on the aquatic habitat and disconnection from habitats on either side of the construction site.

Fish Species and Habitat Terminology

Bed scour: The removal of sediment from the riverbed caused by swiftly moving water

Kelt: A salmon that has spawned

Macroinvertebrates: Animals without a backbone that can be seen with the naked eye; most are aquatic insects

Parr: A juvenile salmon

Picket weir: A fence structure placed in the water, often used to capture migrating fish

Riparian: Relating to the banks of a stream or river

Salmonid: A fish of the salmon family

Sediment: Sand and dirt that settles in the bottom of rivers and other waterbodies

Substrate: The surface on which an organism grows or lives

Trap-and-transport: A process to move fish upstream by trapping them in specialized tanks, moving them by vehicle around the dam, and releasing them on the other side

Freshwater shellfish and aquatic macroinvertebrates would be impacted by in-water construction activities because of their inability to move away from the activity and their reliance on specific substrate types, water velocity, and water quality to survive. Dewatering of the Chehalis River channel in the construction area would likely kill shellfish and macroinvertebrates located in the portions of the existing channel that become dried out. Elevated levels of turbidity and sedimentation downstream of the construction site could also impact these species during construction, but permits would require best management practices to minimize water quality impacts. The permanent loss of habitat in the 0.3 acre of riverbed for the FRE structure would be a significant adverse impact on freshwater shellfish if shellfish currently colonize the area. Habitat loss in the FRE facility footprint and temporary disturbance in dewatered

habitat would be a significant to moderate adverse impact on aquatic macroinvertebrates. Mitigation is proposed for the Applicant to develop and implement a Fish and Aquatic Species and Habitat Plan to address these impacts, but at this time it is not certain the plan is feasible. The plan must meet regulatory requirements and be approved by WDFW and other applicable agencies and must provide no net loss for fish species and habitat.

Migratory vs. Resident Fish

Migratory Fish: Fish that move long distances between different sections of the river or tributaries to complete their lifecycles. Salmon, steelhead, Pacific lamprey, and river lamprey migrate through the entire mainstem Chehalis River to the ocean.

Resident Fish: Fish that tend to stay within one section of the river or tributary over their lifetimes. Some species make relatively short-distance movements for foraging, spawning, or to find refuge during extreme temperatures and flows.

Marine predators that prey on Chehalis Basin salmon, such as Southern Resident killer whales and fish-eating birds, would be affected by a change in salmon population sizes. The degree to which the decline of salmon and steelhead from the upper Chehalis Basin resulting from construction of the FRE facility would affect Southern Resident killer whales is uncertain. The number of fish that would likely be impacted by the Proposed Project represents a small proportion of the overall diet of the Southern Resident killer whales. However, the loss of salmon and steelhead, in particular spring-run Chinook salmon, from the Chehalis River, would present a moderate adverse impact on Southern Resident killer whales. The loss of salmon and steelhead would have a minor adverse impact on other marine mammals because they have a more diverse prey base. The loss of salmon and steelhead would have **moderate to minor** impacts on fish-eating birds because some birds can likely adjust to prey on other fishes, but more specialized bird species would be more highly affected.

Operation Impacts on Aquatic Habitats

Impacts on aquatic habitat from operation of the Proposed Project would result from physical changes to river flows, water quality, stream channel width, sediment transport, large wood inputs and transport, riparian vegetation, and floodplain off-channel areas and wetlands. These impacts would vary based on species requirements, habitat type, and location.

Fish habitat upstream of the temporary reservoir would not be directly affected. However, reduced fish passage to areas upstream could impact aquatic habitat over the long term due to reduced inputs of nutrients derived from salmon carcasses.

Between floods, habitat in the temporary reservoir area would be permanently degraded due to tree and wood removal, sedimentation, and the long-term effects from flood retention events that inundate (fill) all or portions of the temporary reservoir. Changes in riparian vegetation as a result of tree removal would result in less shade, increased water temperatures, reduced inputs of fish prey such as insects entering the river channel from the riparian zone, and less large wood supplied to the river channel.

Sediment deposition between flood retention events, increased bed scour, and a reduction in large wood supply would change the structure and complexity of the river channel habitat and would reduce the quality of spawning and rearing habitat for salmon and steelhead.

During flood retention events, up to 6.4 miles of the Chehalis River upstream of the FRE facility and 847 acres of land would become a temporary reservoir, inundating and reducing habitat quality. Aquatic habitat would be rapidly converted from stream-type to lake-type habitat for up to 35 days with each flood event. This would lead to loss of riparian zone function, elimination of salmon spawning habitat, an increase in deepwater habitat that would be unsuitable for some stream-adapted fish species, an increase in turbidity, a loss of food supply for fish, and a loss of salmonid and other species' eggs due to suffocation.

Aquatic habitat downstream of the FRE facility would also be impacted by the operation of the FRE facility. A reduction in large wood would change and simplify the structure of in-channel habitat, reduce pool areas and shelter for fish from flows and predators. A reduction in wood supply would result in more bed scour, reduced habitat complexity, and less spawning area for fish. Water temperatures downstream for 20 miles would increase. During flood retention events, fish habitat immediately downstream of the FRE facility would be temporarily reduced from decreased channel widths. Downstream off-channel and floodplain habitat inundation could be temporarily reduced, but flows from other large tributaries, rain, and groundwater would likely maintain water levels at depths and extents that are typical for the season. After a major flood or larger, the FRE outlet gates would release retained water downstream for up to 35 days. Controlling the peak flows associated with major or larger floods would reduce the forces and inundation extents downstream and eliminate channel-forming flows. Flushing of some off-channel and floodplain areas may no longer occur, and beneficial changes to the aquatic habitat that only occur with major or larger floods would be eliminated. The proposed FRE facility and temporary reservoir have been designed to retain only the peak flows associated with major or larger floods in order to maintain some of the ecological functions associated with typical seasonal flows. However, reductions in peak flows, large wood, and sediment transport would significantly affect aquatic habitat over time through impacts on habitat-forming processes.

Mitigation is proposed for the Applicant to develop and implement a Fish and Aquatic Species and Habitat Plan and other mitigation plans to address these impacts, but at this time it is not certain the Fish and Aquatic Species and Habitat Plan is feasible. The plan must meet regulatory requirements and be approved by WDFW and other applicable agencies and must provide no net loss of ecological function for fish species and habitat.

Operation Impacts on Salmonids

During normal conditions, fish are expected to enter and pass through the outlets in the base of the FRE facility. For adult salmon and steelhead, upstream passage survival rates during non-flood conditions are expected to range from 94% to 96%.

During flood retention events, gates for the outlets would be closed to fish moving upstream or downstream. Upstream fish passage would be provided by a permanent collect, handle, transfer, and release facility for a flood retention event lasting up to 35 days. For adult salmon and steelhead, upstream passage survival rates during flood retention events are estimated to be 91%.

Adult steelhead can spawn multiple times, and less than 10% do so each year. The EIS assumed that 75% of steelhead kelts migrating downstream would survive passage through the FRE outlet tunnels during non-flood events. During flood retention events, they would remain in the temporary reservoir. The effects of the FRE facility on steelhead kelts migrating downstream were assessed qualitatively.

The NOAA life cycle model analyzed major and catastrophic flood scenarios for salmon and steelhead. The analysis also looked at what would happen during a recurring flood scenario (3 consecutive years with a major flood each year). For salmon, these recurring scenarios were analyzed for early, middle, and late operational periods and the scenario with the worst impacts was used to determine impacts on the number of fish. For steelhead, the recurring flood scenario did not change the overall analysis. The results for these scenarios are shown in the figures for the *Fish Species and Habitats Discipline Report*, Appendix E.

Operation of the FRE facility would have significant adverse impacts on salmon and steelhead in both the Above Crim Creek Subbasin and the Rainbow Falls to Crim Creek Subbasin. In addition to reduced abundance of salmon species, operation of the FRE facility is expected to reduce the species' productivity, diversity, and spatial structure. Spatial structure refers to the pattern of fish production among subbasins in the Chehalis Basin. The loss of production from one population in a subbasin could lead to a reduction in the resilience of the overall population and an increase in vulnerability to environmental variables. The Proposed Project would decrease the spatial structure of populations in the basin by eliminating spring-run Chinook salmon, coho salmon, and steelhead populations in the Rainbow Falls to Crim Creek Subbasin by late-century;

Chehalis Basin Perspective on Salmonid Impacts

The subbasin upstream of Crim Creek supports genetically unique populations of salmon and steelhead. The Proposed Project would result in a loss of genetic diversity within and among populations of each species across the Chehalis Basin.

Spring-run Chinook spawn in three primary areas within the Chehalis Basin. The Proposed Project would significantly affect one of these three important spawning areas.

Salmon and steelhead in the Proposed Project footprint and subbasin upstream of Crim Creek that are evaluated in this report make up the following percentages of the Chehalis Basin population:

- About 1.2% to 3.4% of spring-run Chinook salmon, fall-run Chinook salmon, and coho salmon
- About 15.7% of steelhead

Reductions in the number of salmon and steelhead from the Proposed Project are significant because they bring population abundances even further below 70% of historical abundance, which is the goal for other recovery plans. The Proposed Project could affect future restoration options in the subbasins above and below Crim Creek and within the larger basin for the fish species and habitats they rely on.

significantly impacting spring-run Chinook salmon in the Above Crim Creek Subbasin in both the mid-century and late-century periods; and impacting fall-run Chinook salmon in the Above Crim Creek and Rainbow Falls to Crim Creek subbasins in both the mid-century and late-century periods. The reduction or loss of salmon or steelhead from one population (subbasin) would also result in a loss of genetic diversity within and among populations of each species across the Chehalis Basin.

The combination of construction and operation of the Proposed Project is expected to have significant adverse impacts on salmon and steelhead in both subbasins. Integrated model results, summarized in Exhibits 5.3-3 and 5.3-4, show estimated impacts on salmon and steelhead in mid-century and late-century, compared to the abundance prior to construction.

The model shows that the operation of the Proposed Project would have a significant adverse impact on spring-run Chinook salmon, fall-run Chinook salmon, coho salmon, and steelhead. Mitigation is proposed for the Applicant to develop and implement a Fish and Aquatic Species and Habitat Plan to address these impacts, but at this time it is not certain the plan is feasible. The plan must meet regulatory requirements and be approved by Ecology and other applicable agencies and must provide no net loss for fish species and habitat.

Exhibit 5.3-3
Estimated Abundance of Salmon and Steelhead Above Crim Creek

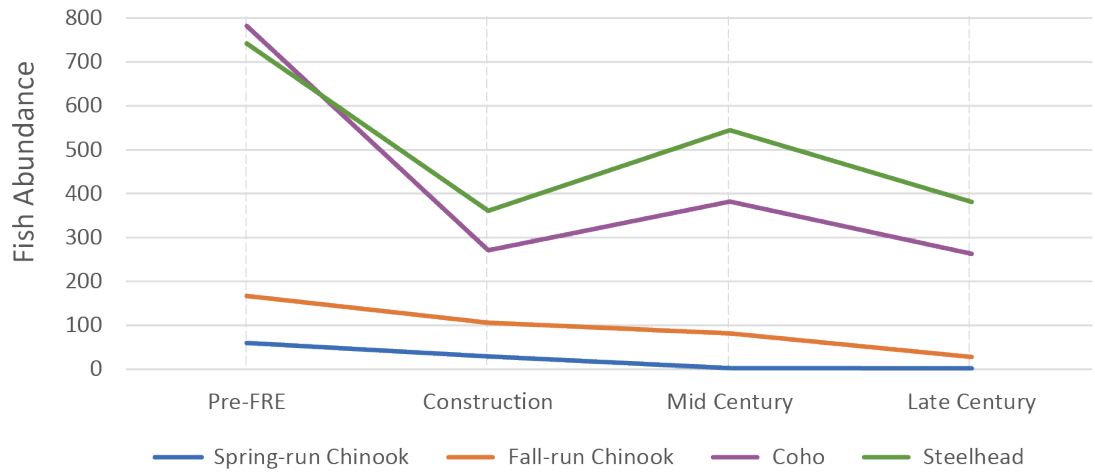
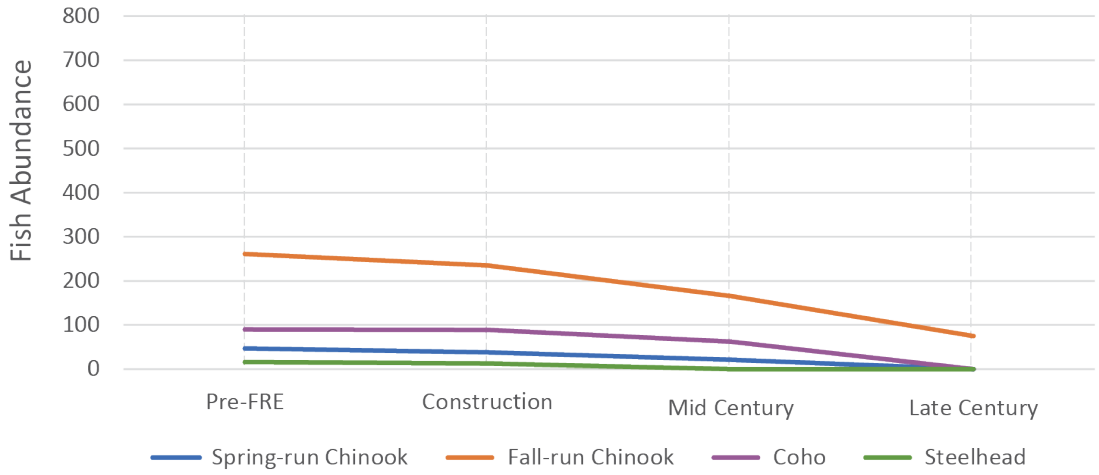


Exhibit 5.3-4
Estimated Abundance of Salmon and Steelhead in Crim Creek to Rainbow Falls Subbasin



Operation Impacts on Other Aquatic Species

Operation of the FRE facility would create permanent adverse impacts on native fish within the temporary reservoir area and downstream from the FRE facility to the confluence with Elk Creek. Lower summer flows and warmer water temperatures from climate change would be worsened by the FRE facility. Spawning habitat for most native fish, including Pacific lamprey, largescale sucker, mountain whitefish, and speckled dace, would be reduced or eliminated, summer rearing area would be greatly reduced, and non-native predators like smallmouth and largemouth bass may expand their range year-round. In addition, fish passage survival would be reduced through the FRE facility for mobile and migratory species. Operation of the Proposed Project would have a significant adverse impact on non-salmon fish in in the temporary reservoir area and downstream from the FRE facility to the confluence with Elk Creek.

Freshwater shellfish and aquatic macroinvertebrates are vulnerable to rapid changes in flow and sedimentation that would occur with the operation of the FRE facility because of their immobility and reliance on specific substrate types, flows, and water quality to survive. Sediment deposition events and associated erosion could temporarily bury and suffocate immobile invertebrates. Flood retention events would cause rapid changes in depth and reduced water velocity, creating a direct adverse impact for mussels and other invertebrates that rely upon flowing water to survive. The distribution and species composition of shellfish and macroinvertebrates within the temporary reservoir area have not been surveyed, so the magnitude of impacts due to flooding cannot be quantified but are qualitatively described. The magnitude of the impacts would depend upon species' abilities to survive each flood retention event or recolonize the disturbed areas in the temporary reservoir and downstream of the FRE facility after water is released.

Freshwater mussels in particular are long-lived and slow to recolonize disturbed areas. Over the long term, the FRE facility would create a significant adverse impact on shellfish due to loss of habitat, impacts on mussel beds, changes in host fish abundance and distribution, and their inability to re-establish colonies between flood events. Macroinvertebrates are likely to recolonize disturbed areas and take advantage of newly deposited substrates but would likely have lower species diversity and different community composition. Over the long term, the FRE facility would create a significant to moderate adverse impact on aquatic macroinvertebrates due to loss of habitat, loss of food sources, and changes to water temperature, flow, and substrates.

Mitigation is proposed for the Applicant to develop and implement a Fish and Aquatic Species and Habitat Plan to address these impacts, but at this time it is not certain the plan is feasible. The plan must meet regulatory requirements and be approved by Ecology and other applicable agencies and must provide no net loss of ecological function for habitat.

Operation of the FRE facility may indirectly affect marine mammals and fish-eating birds that prey upon salmon and steelhead that originate from the upper Chehalis Basin. The degree to which the decline of salmon and steelhead from the upper Chehalis River would affect the Southern Resident killer whale is unknown, and the magnitude of these impacts related to operation of the FRE facility on these whales is highly uncertain. The number of fish that would likely be impacted by the Proposed Project represents a small proportion of the overall diet of the Southern Resident killer whales. However, the reduction of salmon and steelhead, in particular spring-run Chinook salmon, from the Chehalis River would have a moderate adverse impact on Southern Resident killer whales. The loss of salmon and steelhead resulting from the Proposed Project would have a minor adverse impact on other marine mammals because they have a more diverse prey base. The loss of salmon and steelhead would have moderate to minor impacts on birds because some birds can likely adjust to prey on other fishes, but more specialized bird species would be more highly affected.

5.3.2.2 Impacts From the Airport Levee Changes

Construction of the Airport Levee Changes would have minimal impacts on fish and aquatic habitat because the activities would not be in or near the river. Operation of the Airport Levee Changes would affect in-river and floodplain conditions for short periods (days) during major or catastrophic flood events and have no lasting effect on aquatic habitat or productivity.

5.3.2.3 Proposed Mitigation Measures

This section describes mitigation measures being proposed for the Applicant to implement that would reduce impacts from construction and operation of the Proposed Project. These mitigation measures would be implemented with, or as part of, the required permits, plans, and approvals described in Section 4.

- **FISH-1 (Fish and Aquatic Species and Habitat Plan):** To mitigate the impacts on fish and aquatic species and habitats associated with construction and operation of the Proposed Project, mitigation is proposed for the Applicant to develop and implement a Fish and Aquatic Species and Habitat Plan. The plan must be developed in coordination with and approved by WDFW, tribes, and other applicable local, state, and federal agencies. The plan must include a range of options that provide no net loss of ecological function for the fish species and habitats impacted by construction and operational activities. Mitigation will be considered from the headwaters of the Chehalis River to the confluence of the Chehalis and Newaukum rivers. The mitigation will include, but is not limited to, the following:
  - Mitigation for temporal loss of functions and values until the restored or created habitat addressing impacts is fully functional.
  - Advance in-kind mitigation implemented prior to construction, such as replacement (restoration or creation), for the fish and aquatic habitat impacted by the Proposed Project.
  - Protection of areas adjacent to the temporary reservoir area supporting connectivity between the restored or created habitat to replace the lost functions and values for impacted species.
  - A Monitoring Plan identifying long-term actions to verify the implemented mitigation provides adequate compensation for impacts on functions and values provided by fish species and their habitats. Monitoring will be conducted over the life of the Proposed Project.
  - An Adaptive Management Plan describing measures that will be taken should the mitigation not achieve performance standards set forth in the Monitoring Plan.
  - A Maintenance Plan describing work that will be conducted over the life of the Proposed Project to maintain the functions and values provided by replacement habitat.
  - Permanent protection measures via land acquisition or through a conservation easement in perpetuity that fully encumbers the restored fish and riparian habitat.
  - This plan will be developed in conjunction with management and mitigation plans for vegetation, wetlands and wetland buffers, streams and stream buffers, wildlife species and habitat, riparian habitat, surface water quality, and large woody material.

Other Related Mitigation Measures (for details, see Section 5.17)

- EARTH-3 (Large Woody Material Management Plan)
- WATER-1 (Surface Water Quality Mitigation Plan)
- WET-1 (Wetland and Wetland Buffer Mitigation Plan)
- WET-2 (Stream and Stream Buffer Mitigation Plan)
- WILDLIFE-1 (Vegetation Management Plan)
- WILDLIFE-2 (Wildlife Species and Habitat Management Plan)
- WILDLIFE-3 (Riparian Habitat Mitigation Plan)

5.3.2.4 Significant and Unavoidable Adverse Environmental Impacts

There is uncertainty if mitigation is technically feasible and economically practicable; therefore, the Proposed Project would have **significant and unavoidable** adverse environmental impacts on fish and aquatic species and habitat. The Applicant may provide a Fish and Aquatic Species and Habitat Plan as described above. If WDFW determines the plan meets WDFW guidelines and implementation is feasible, then the impacts would be addressed as part of the permitting processes.

5.3.3 Findings for the Local Actions Alternative

Construction of floodplain storage improvements and channel migration protection would take place within or adjacent to the river channel and could therefore result in impacts on fish, shellfish, macroinvertebrates, or aquatic habitat. These activities could involve water diversions, soil excavation or filling, vegetation disturbance, and elevated noise and vibration. This could lead to increases in turbidity or sediment in waterbodies, fish being injured or stranded in dewatered areas, or disruption of fish behavior. Overall, due to the limited scale and duration of construction of local actions, their likely location around developed areas, and the fact that many activities would occur outside of aquatic habitat, local actions would likely result in minor impacts on fish species or habitat in the study area.

Operation of floodplain storage improvements and channel migration protection could also have direct effects on aquatic species and habitat. Floodplain storage improvements could increase habitat complexity and habitat availability, which could benefit fish species and habitats. Channel migration protection activities such as the placement of large woody material could benefit fish species by increasing habitat complexity, but they could also disrupt some benefits from natural channel migration. Overall, the operation of local actions is likely to have minor impacts on fish, shellfish, and aquatic habitat.

5.3.4 Findings for the No Action Alternative

Construction of No Action Alternative elements that could impact fish or fish habitat include culvert replacement, flood and habitat mitigation projects, and restoration and stream modification projects. These activities could involve water diversions, cut and fill, vegetation disturbance, and elevated sound and vibration. This could lead to increases in turbidity or sedimentation, fish injury or stranding, or disruption of fish behavior. Overall, construction activities in the study area under the No Action Alternative would be limited in duration, and many activities would occur outside of aquatic habitat. Many of the stream restoration and modifications efforts would benefit fish and shellfish in the long term.

Operation of floodproofing projects may have impacts on fish, shellfish, and aquatic habitat by allowing continuation of activities in the floodplain that are harmful to fish and fish habitat. This includes pollution, habitat degradation, and habitat disconnection caused by agriculture, residential and commercial development, and intensive transportation along the I-5 corridor.

Quantitative modeling was completed to determine impacts on salmon and steelhead under the No Action Alternative. Increases in water temperature and reductions in summer flows including the

effects of climate change over the long term are expected to have a large impact on all three salmonid species (and two life-history strategies for Chinook salmon) modeled. Exhibit 5.3-5 shows the modeled decrease in abundance compared to the median abundance under current conditions for each species and subbasin.

Exhibit 5.3-5
Change in Late-Century Salmonid Abundance Compared to Existing Conditions for No Action Alternative Based on Integrated Model Results

	DECREASE IN ABUNDANCE IN LATE-CENTURY FOR NO ACTION ALTERNATIVE COMPARED TO EXISTING CONDITIONS	
FISH SPECIES	ABOVE CRIM CREEK SUBBASIN	RAINBOW FALLS TO CRIM CREEK SUBBASIN
Spring-run Chinook Salmon	-87%	Eliminated from Subbasin
Fall-run Chinook Salmon	-71%	-59%
Coho Salmon	-51%	Eliminated from Subbasin
Steelhead	-36%	Eliminated from Subbasin

In addition to loss of abundance of salmon species, the No Action Alternative is also expected to reduce the species' productivity, diversity, and spatial structure due to the projected loss of spring-run Chinook salmon, coho salmon, and steelhead populations from the Rainbow Falls to Crim Creek Subbasin. This is expected to increase the vulnerability of these species to environmental variability. Habitat degradation associated with the No Action Alternative is also expected to reduce genetic diversity within and among populations due to reductions in abundance and the loss of populations in the Rainbow Falls to Crim Creek Subbasin. Exhibits 5.3-6 and 5.3-7 show estimated impacts on salmon and steelhead in mid-century and late-century, compared to the pre-FRE abundance.

Effects on non-salmon fish from the increase in temperatures and reduction in summer flows due to climate change include a major reduction or loss of summer spawning and rearing habitat, a potential increase in winter rearing habitat, and a potential increase in habitat for non-native largemouth bass.

Many in-water projects considered in the No Action Alternative are expected to benefit aquatic species, including shellfish and aquatic macroinvertebrates. Mussel-friendly stream restoration could benefit shellfish in the long run. The impacts due to climate change may adversely affect shellfish and aquatic macroinvertebrates, mainly due to a reduction of wet areas with lower flows in summer and warmer summer temperatures.

Southern Resident killer whales depend on spring-run Chinook salmon as a food source, and the overall number of these fish has been decreasing throughout the region. The degree to which a decline of salmon and steelhead from the upper Chehalis River would affect the Southern Resident killer whale is unknown, and the magnitude of the impacts related specifically to the No Action Alternative is highly uncertain.

Exhibit 5.3-6
Estimated Abundance of Salmon and Steelhead Above Crim Creek Under the No Action Alternative

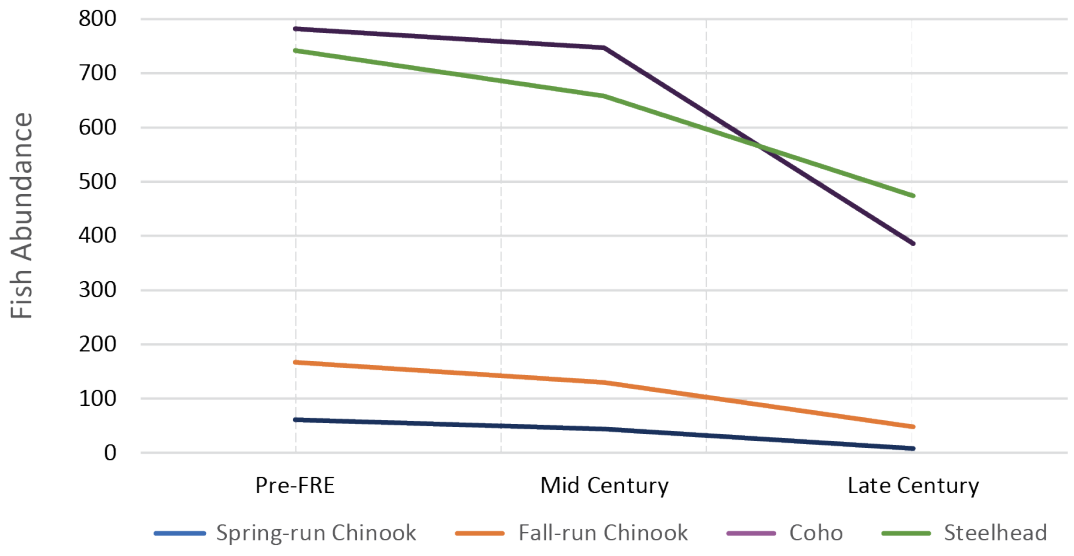
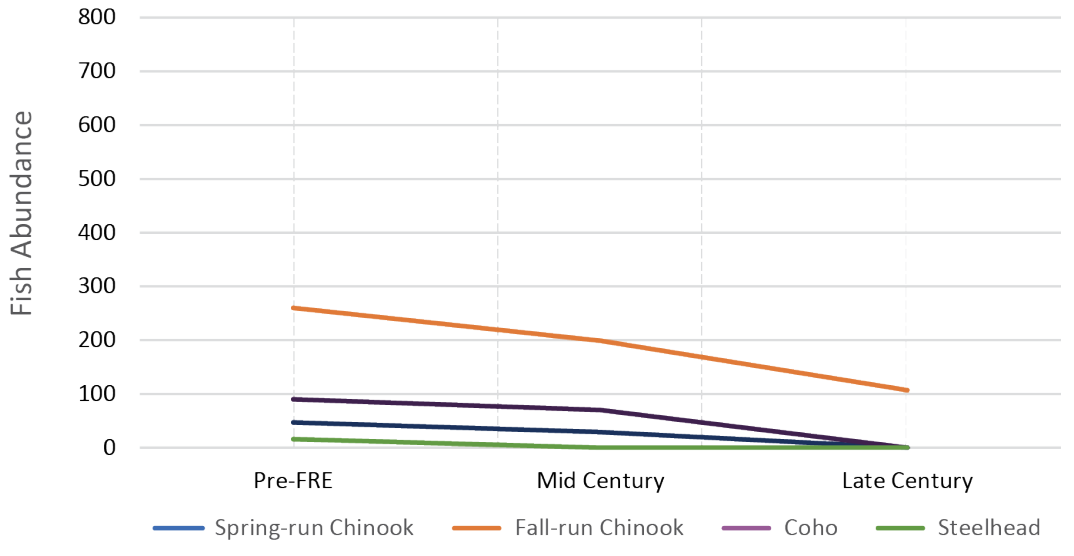


Exhibit 5.3-7
Estimated Abundance of Salmon and Steelhead in Crim Creek to Rainbow Falls Subbasin Under the No Action Alternative



5.4 WILDLIFE SPECIES AND HABITATS

This section evaluates wildlife species and habitats. Wildlife species include mammals, amphibians, reptiles, birds, terrestrial insects, and mollusks. There are a wide variety of natural habitats within the study area, which include different combinations of shrubs, trees, and other vegetation that provide habitat for wildlife species.

The *Wildlife Discipline Report*, Appendix P, contains the full analysis and technical details used to evaluate wildlife. Probable impacts on related resources are described in Section 5.1, Water; Section 5.2, Earth; Section 5.3, Fish Species and Habitats; Section 5.5, Wetlands; Section 5.6, Tribal Resources; and Section 5.8, Recreation.

5.4.1 How Impacts Were Analyzed

The study area for wildlife species and habitats includes the FRE facility, the temporary reservoir footprint plus an additional 660 feet of area, the floodplain downstream of the FRE facility, and the Airport Levee Changes.

Information and descriptions of wildlife habitats, vegetation communities, and wildlife species in the study area are from natural resource databases and studies. These include WDFW studies and other reports that describe the distribution and abundance of wildlife species. Ecology's Modeled Wetland Inventory dataset was used for wetlands and the USGS National Land Cover Database for all other vegetation. Analysis also used GIS maps of land cover, wetlands, and species presence; peer-reviewed literature; and aerial photographs. Wildlife habitats are described using the vegetation community (like trees, shrubs, or grass) and habitat features (like upland, wetland, or riparian).

The main type of vegetation at the proposed FRE facility and the temporary reservoir is privately owned evergreen forest. This forest habitat is commercial forest mostly made up of areas of Douglas fir of the same age. The protected areas around streams and rivers also include other larger trees.

Key Findings of the Wildlife Species and Habitats Analysis

The construction of the FRE facility would cause **significant adverse impacts** on wildlife habitat and species from tree removal in the temporary reservoir area. This would cause permanent changes in the 600-acre area of upland, river, and wetland habitat.

Operation of the FRE facility would have **significant adverse impacts** from recurring flooding of the temporary reservoir area. This would cause permanent changes in vegetation in 847 acres and mortality of wildlife that are unable to adapt or relocate.

The FRE construction and operations would increase water temperature in the temporary reservoir area and downstream. Changes to downstream habitat and reductions in the quantity and quality of aquatic habitat would be a **significant adverse impact**.

These significant impacts on wildlife species and habitat would be **unavoidable unless** the Wildlife Species and Habitat Management Plan, Vegetation Management Plan, and other mitigation plans meet regulatory requirements and implementation is feasible.

Cottonwood habitat downstream of the FRE site would be **moderately** affected by the Proposed Project. Wildlife would be **moderately impacted** by decreased water quality conditions.

The density and size of trees in these areas vary based on the age of the trees. For the airport levee area, the vegetation includes wetlands, farmland, and developed areas with disturbed habitat. In the area downstream of the FRE facility, pasture, crops, and developed areas make up 64% of the vegetation types, while wetlands make up 28% and forests 5%.

The diversity of vegetation and geology provides habitat for a variety of wildlife species to breed, feed, rest, and overwinter. The habitat supports a wide range of bird species, including the marbled murrelet, which is listed under the Endangered Species Act. The study area and greater Chehalis Basin has the highest species diversity of amphibians in Washington. Small mammals associated with forest habitat include shrew mole, Townsend's vole, masked shrew, and striped skunk. Larger mammals such as elk, black-tailed deer, black bear, cougar, bobcat, and coyote also occur in forest habitat. Wetlands and areas near rivers and streams provide habitat for North American beaver, mink, water shrew, and raccoon. Several terrestrial insects and mollusks with state status or importance to the ecosystem may be in the study area.

The analysis evaluated impacts on important habitat and species. Priority habitats have been established by WDFW and are critical for wildlife species, with unique characteristics. There are 13 priority habitats in counties making up the study area that support a mix of fish and wildlife. Plants on the Endangered Species Act list for threatened and endangered species and state-protected threatened and endangered species are found in the study area. More than 30 state rare plant species could occur in the study area, based on information from DNR's Natural Heritage Program.

Detailed information on habitat and the full lists of species are included in the *Wildlife Discipline Report*, Appendix P.

5.4.2 Findings for the Proposed Project

5.4.2.1 Impacts From the Flood Retention Facility

Tree Removal and Loss of Habitat in the Temporary Reservoir Area

The Applicant's project description describes removing large and non-flood-tolerant trees from a 405-acre area. This EIS took a conservative approach and included the area where trees would be inundated for several days under future conditions and would likely die. For this EIS, the construction impact analysis considered the removal of nearly all trees from 600 acres within the 10% and 20% recurrence inundation zones of the temporary reservoir area. These would be mainly Douglas fir but would also include big-leaf maple and red alder. The Applicant stated that areas within the temporary reservoir area would be replanted with flood-tolerant species. Clearing and grading to improve access roads would also remove trees.

Removal of trees along the Chehalis River and tributaries would change or eliminate many of the important functions provided by these riparian areas. These include habitat corridors for wildlife, filtering water and sediment, and shading to cool the water. Tree removal would also affect wetlands

and small streams that provide habitat for amphibians. Upland, riparian, and wetland habitats would lose tree canopy cover that provide shade, snags, woody material, and habitat diversity. The removal of trees would promote the spread of invasive vegetation. These are significant adverse impacts for wildlife habitat because trees would be removed from a large area, and replanting would only provide young tree and shrub cover. The almost total loss of tree canopy and cover would significantly reduce wildlife habitat functions in upland, riparian, and wetland areas. The removal of trees would also cause water temperatures in the Chehalis River and other streams to increase significantly.

During operation of the Proposed Project, wildlife habitat within the temporary reservoir would be periodically inundated with major floods having a probability of occurring every 4 to 5 years in the future. Plant communities would likely be in a permanently young stage because plants would die during each inundation. This would increase the chance for invasive species to colonize the area. In addition, trees that were not removed during construction may die and would likely be removed to reduce the potential for large log jams that could affect the safe operation of the FRE facility. Log jams and large wood in rivers and streams provide habitat for many species so the removal would impact habitat. Over time, only shrubs would remain within most or all of the temporary reservoir. Protected riparian areas that are currently developing with mature trees provide marbled murrelet habitat and this habitat would be permanently lost. These probable impacts are considered significant because most of the upland, wetland, and riparian vegetation would not survive every time the reservoir is filled, and the current forestland would change to primarily grass, herbaceous, and young woody shrub and tree vegetation that regrows after every flood event.

Mitigation is proposed for the Applicant to develop and implement a Vegetation Management Plan and Wildlife Species and Habitat Plan to address these impacts, but it is not certain implementation of the plans is feasible.

Disturbance of Wildlife in the Temporary Reservoir Area

The removal of trees from the temporary reservoir area would directly remove nests, dens, and feeding areas used by wildlife. Tree removal would also affect stream functions such as water filtration, riverbank stabilization, river shading, and wood recruitment. Woody material is used by many amphibians, and lower levels of wood in the river would lead to a loss of breeding habitats and shelter. Converting forested habitats to those dominated by small plants and shrubs would lead to a loss of habitat for some species.

Birds and some mammals could more easily move to nearby areas with suitable habitat. Other species such as amphibians and North American beavers would be more vulnerable to loss of wetlands and impacts on riparian vegetation. Some amphibians could also face increased predation due to changes in habitat or loss of shelter.

Overall, these impacts on wildlife are considered significant because tree removal could result in deaths for species with limited ability to relocate, such as amphibians. Some of these amphibians are candidates for listing in Washington State as endangered, threatened, or sensitive. The loss of tree cover would significantly reduce habitat functions and lead to a large loss of breeding, foraging, resting, and overwintering habitats that could also lead to species mortality. The Endangered Species Act-listed marbled murrelet is especially vulnerable to the loss of habitat because the type of habitat they need is limited, they tend to return year after year to the same area, and finding new nesting sites requires energy.

Inundation of the temporary reservoir area during operation would directly displace animals and result in the death of species unable to rapidly relocate. Species that would be adversely affected include those with limited mobility such as small mammals, amphibians, terrestrial insects, and mollusks. Operation would also cause trees and shrubs to die due to flooding. This would remove habitats for nesting, denning, and feeding and would impact stream functions and increase water temperatures. Inundation would also disturb salmon spawning habitat in the temporary reservoir area. Salmon provide nutrients for a wide variety of wildlife species. Decreases in salmon abundance would have an adverse impact on wildlife that feed on or benefit from nutrients that come from salmon.

The probable adverse impacts are considered significant because many wildlife species could not relocate every time the reservoir is filled. Low-mobility species would be particularly vulnerable to mortality during inundation. Birds and some mammals are more mobile and would be able to move out of the area. The recurring inundation would result in a large net loss of wildlife breeding, foraging, resting, and overwintering habitat that would also result in wildlife mortality and reduced population size. Mitigation is proposed for the Applicant to develop and implement a Wildlife Species and Habitat Plan and other mitigation plans to address these impacts, but at this time it is not certain the plans are feasible.

Loss of Habitat From Construction of the FRE Facility

Wildlife habitat within the FRE facility footprint includes upland, riparian, and wetland vegetation communities. These vegetation communities would be eliminated with construction of the FRE facility structures, improvements to existing roads to access the quarry areas, and parking or maintenance areas. Nesting trees for Endangered Species Act-listed marbled murrelets could be lost. These impacts are considered significant for wildlife habitat because 35 acres of various types of upland habitats, which includes 30.1 acres of wetland buffer habitat, and 1.1 acres of wetland vegetation communities would be eliminated. The impact on marbled murrelets would be significant. In addition, up to 41 acres of habitat associated with the quarry roads could be disturbed or eliminated. The elimination of wetlands would require mitigation to replace wetlands and make sure there is no loss of function. Mitigation is proposed for the Applicant to develop and implement a Riparian Habitat Plan and Wildlife Species and Habitat Plan to address these impacts, but at this time it is not certain the plans are feasible.

Disturbance of Wildlife From Construction of the FRE Facility

Construction impacts on wildlife would result from clearing of vegetation as well as noise generated by construction equipment and blasting at quarries. Diversion of the Chehalis River through the temporary river bypass tunnel and dewatering of work areas in the river channel would likely kill aquatic species using the dewatered areas for breeding, foraging, or overwintering during these activities. These impacts would primarily affect certain amphibian species.

Clearing vegetation to construct the FRE facility would cause a direct loss of wildlife habitat and would fragment remaining habitat. Generally, wildlife such as songbirds, raptors, and large mammals could more easily adapt to changes in habitat. These species can travel more easily to nearby areas, and there are similar forest habitats nearby that would support these species. However, relocation of these species into adjacent habitats could cause increased stress and potential mortality of some individuals due to increased competition for food resources and higher energy needs. Species such as amphibians, reptiles, and small mammals would be more vulnerable to changes in habitat because they are less mobile and would not be able to disperse to nearby areas as easily.

Semi-aquatic wildlife species like amphibians would be much more vulnerable to impacts on wetlands and changes in riparian vegetation. These species would not be able to adapt to significant changes in aquatic habitat and are unlikely to disperse successfully to other suitable habitats. Amphibians, birds, and small mammals could also face increased predation due to loss of cover as well as a potential increase in the number of predators due to displacement from nearby habitats. Cover provides areas where amphibians can shelter from direct sun, which is especially important during the summer. Because logging currently occurs in portions of the proposed FRE facility site, some wildlife species are likely used to noise and human activity. Certain wildlife species including various types of birds, raptors, coyote, or raccoon could adapt and continue to use areas disturbed by construction.

Marbled murrelets, bald eagles, and other sensitive species may be disturbed by blasting during construction. These species would be able to relocate to similar habitats in the surrounding area, depending on the timing, but would likely not re-nest if disturbed during the nesting season. Therefore, if disturbance occurs during the nesting season, it could cause mortality of eggs or young chicks. Construction activities occurring outside of the nesting season would result in the temporary loss of perching habitat used by eagles for foraging in the area of the FRE facility.

Overall, these probable adverse impacts are considered significant for wildlife species because the loss of habitats would result in wildlife mortality for low-mobility species. Amphibians, reptiles, and some small mammal species would be unlikely to avoid construction activities. Species with more mobility, such as birds, large mammals, and some small mammals, could avoid some construction activities. Mitigation is proposed for the Applicant to develop and implement a Riparian Habitat Plan and Wildlife Species and Habitat Plan to address these impacts, but at this time it is not certain the plans are feasible.

Loss of Habitat Downstream of the FRE Facility

Under late-century major and catastrophic floods, the FRE facility would be operating and the extent of downstream flood inundation would decrease. As a result of operation of the FRE facility, more than 3,589 acres of vegetation in the major flood inundation extents would no longer receive overbank flooding from a major flood.

It is likely that major, catastrophic, and recurring flood operations have similar effects on downstream wildlife habitats as on downstream floodplain wetlands. Over the long term, the reduction in peak flows would decrease the occurrence of natural hydrologic processes, such as channel migration and formation of side channels, bars, and wetlands, downstream of the FRE facility. This probable adverse impact is considered significant because flooding above a certain magnitude has been entirely removed. Mitigation is proposed for the Applicant to develop and implement a Riparian Habitat Plan and Wildlife Species and Habitat Plan to address these impacts, but at this time it is not certain the plans are feasible.

Upland vegetated habitat used by wildlife would likely transition to more forested and drought-tolerant species; these probable adverse impacts are considered moderate for upland wildlife habitat. The probable adverse impacts of temperature are considered moderate for wildlife habitat in the reach between the FRE facility and the South Fork Chehalis River due to likely reduced quality of habitat for native species and increased habitat suitability for non-native predator species that would likely reduce native amphibian populations in this reach.

Reduction in peak water flows downstream of the FRE facility could also affect existing cottonwood habitat and the normal scouring of vegetation and deposition of sand and gravel bars needed for cottonwood trees to grow. This adverse impact is moderate, because although cottonwoods are a unique flood-adapted plant community, operation of the FRE facility would reduce inundation of habitat by only 2% to 7%, depending on the extent of flooding.

Disturbance of Wildlife Downstream of the FRE Facility

Downstream of the FRE facility, the reduction in the magnitude of peak floods would reduce natural processes such as channel migration and formation of side channels, bars, and wetlands. Over the short term, the reduction in the magnitude of peak floods could allow for more woody vegetation to invade floodplain grassland habitats, which would reduce habitat for terrestrial insects with sensitive status including the Puget blue, valley silverspot, and Mardon skipper. Operation of the FRE facility would also likely affect the connectivity of off-channel habitats. The probable adverse impacts are considered moderate for wildlife species due to the large size of the study area relative to the change in the extent of flooding and potential changes in habitat features. Changes in the flood levels downstream would generally not result in an increased risk of species dying. However, if water is released from the reservoir after Western toads lay eggs, the eggs could be swept into unfavorable habitat that could harm their development. If water is released just before Western toads lay eggs, it could stop or postpone egg

laying. This impact is considered moderate due to the relatively limited area of Western toad habitat affected.

5.4.2.2 Impacts From the Airport Levee Changes

Vegetation removal for construction of the Airport Levee Changes would primarily affect areas that are already disturbed or developed, or are used for hay or pasture. These areas currently do not offer high-quality wildlife habitat. These impacts are considered moderate for habitat, because while the upland areas are managed or disturbed, there would also be a loss of 6.6 acres of wetland habitat and 44.2 acres of wetland buffers. The affected wetlands are highly disturbed with low levels of functions and do not include any Category I wetlands. The elimination of wetlands would require compensatory mitigation.

Disturbance impacts on wildlife species during construction of the airport levee would be minor because of the limited quality of the upland and wetland vegetation communities that would be disturbed. For example, the grassland habitat is regularly mowed during airport maintenance, road infrastructure and impervious surfaces are common, and birds are already discouraged from using airport properties due to safety concerns. In addition, only a small amount of wildlife habitat would be disturbed.

5.4.2.3 Proposed Mitigation Measures

This section describes mitigation measures being proposed for the Applicant to implement that would reduce impacts from construction and operation of the Proposed Project. These mitigation and management measures would be implemented with, or as part of, the required permits, plans, and approvals described in Section 4.

- **WILDLIFE-1 (Vegetation Management Plan):** To mitigate construction and operation impacts on habitat associated with the FRE facility (34.9 acres) and the temporary reservoir (847 acres), mitigation is proposed for the Applicant to develop and implement a Vegetation Management Plan. The Applicant will consult with DNR, WDFW, Lewis County, other applicable local, state, and federal agencies and tribes during plan development. The plan must be approved by WDFW and Lewis County and be ready to implement prior to the start of construction. The measures described in the plan may include a range of mitigation options. The mitigation will be required to be completed within and near the FRE facility and temporary reservoir area or along the Chehalis River mainstem. The mitigation will include, but is not limited to, the following:
  - Harvest of trees in the temporary reservoir during construction will be phased to remove trees in sections of a size to support revegetation of cleared areas before the next section is cleared. For associated forest practices activities, the Applicant will participate in pre-application consultation as provided in the Forest Practices Rules. The harvest of trees in areas being converted to non-forestry uses for the FRE facility and temporary reservoir will follow the Forest Practices Act and local ordinances as appropriate.

- An evaluation to determine if trees larger than 6 inches diameter at breast height can remain within the temporary reservoir to minimize the number of trees removed and ensure safety. Leave trees that can safely be retained.
- A multi-phased and detailed planting plan including targeted native species assemblages, structure and diversity targets, and succession goals over the life of the project.
- Plant native species within 90 days of completing drawdown following each inundation event to minimize the potential for invasive species to colonize.
- Routinely monitor and remove invasive and non-native species in the temporary reservoir footprint to prevent undesirable vegetation from spreading into upland areas or migrating downstream.
- Establish an adaptive management process to evaluate the Vegetation Management Plan every 3 years and after a catastrophic flood. Best available science will be used to adjust tree removal and vegetation planting in the temporary reservoir area. Sites will be visually inspected annually to identify plant health and survival, and records will be maintained for the lifetime of the Proposed Project.
- This plan will be developed in conjunction with mitigation plans for large woody material, wetlands, riparian habitat, fish and aquatic species and habitat, and wildlife species and habitat.

- **WILDLIFE-2 (Wildlife Species and Habitat Management Plan):** To mitigate the impacts on wildlife species and habitat from construction and operation of the Proposed Project, the Applicant will prepare a Wildlife Species and Habitat Management Plan. The plan must be developed in coordination with and approved by WDFW and other applicable local, state, and federal agencies and tribes. It must be ready to implement prior to the start of construction. The measures described in the plan may include a range of mitigation options. Mitigation will be required to be implemented within the upper Chehalis River Basin from the headwaters of the Chehalis River to the confluence of the Chehalis and Newaukum rivers. The mitigation will include, but is not limited to, the following:
  - Permanent protection measures for upland conifer habitat via land acquisition or through a conservation easement in perpetuity to replace habitat functions in the temporary reservoir area.
  - Inclusion of habitat structures (e.g., sediment wedges created from engineered large woody material, large woody material placement) in mitigation areas such as the mainstem Chehalis River downstream of the Proposed Project and appropriately sized tributaries of the Chehalis River mainstem.
  - To reduce impacts on nesting bird species from construction of the FRE facility, the Applicant will conduct spring season (pre-nesting) pre-construction surveys in the FRE facility area and airport levee area to identify any preliminary raptor presence and nesting activity, particularly bald eagles, within 660 feet of the construction footprint. If any nests are observed to be starting, the nests could be removed (prior to any eggs being laid) to

encourage the birds to move elsewhere. If nests are removed, the Applicant will build a replacement nesting platform in another location outside of the inundation zone. If any active bald eagle nests are observed, then construction activities should be timed to minimize noise effects to the bald eagle nest until the nesting season is over (approximately August 1).

- The Applicant will follow the U.S. Fish and Wildlife Service 2012 *Guidance for Identifying Suitable Marbled Murrelet Nesting Habitat in Washington State* to define and identify potential habitat and nesting platforms. If habitat is found, the 2003 Pacific Seabird Group *Methods for Surveying Marbled Murrelets in Forests: A Revised Protocol for Land Management and Research* survey protocol will be used to identify marbled murrelet presence. A ground assessment for marbled murrelet potential nesting habitat will be conducted to verify presence/absence of nesting platforms. If habitat is verified, 2-year protocol surveys will be completed to determine occupancy. When a nest is occupied, DNR Forest Practices Rules require a minimum avoidance zone around the nest to minimize disturbance to marbled murrelets. Temporary restrictions on disruptive activities, including felling and bucking, within this zone are required within the critical nesting season from April through August. Mitigation will be identified in the plan for any loss of marbled murrelet habitat.
- To reduce impacts on amphibians from construction of the FRE facility, the Applicant will consult WDFW to determine the preferred construction periods to avoid amphibian breeding or rearing time frames.
- To minimize the effects of recurring inundation on state candidate western toad, and other native amphibians that occur in the temporary reservoir inundation area, the Applicant will create areas both upstream and downstream of the temporary reservoir and maintain them frequently to create more sunny openings in shallow-water stream margins for western toad breeding.
- To minimize the effects of recurring inundation on state candidate species western toad, Van Dyke's salamander, and Dunn's salamander, and other native amphibians that occur in the temporary reservoir inundation area, the Applicant will conduct native species plantings and placement of downed wood in riparian areas upstream of the temporary reservoir to provide better winter adult cover to increase the upstream populations and maintain a source for recolonization to the temporary reservoir and other downstream areas.
- This plan will be developed in conjunction with mitigation plans for large woody material, vegetation, wetlands, riparian habitat, and fish and aquatic species and habitat.

- **WILDLIFE-3 (Riparian Habitat Mitigation Plan):** To mitigate the impacts on riparian habitat from construction and operation of the Proposed Project, mitigation is proposed for the Applicant to develop and implement a Riparian Habitat Mitigation Plan. The plan must be developed in coordination with and approved by WDFW, Lewis County, other applicable local, state, and federal agencies and tribes and be ready to implement prior to the start of construction. The

plan must include restoration options that provide no net loss for the riparian and stream habitats impacted by construction and operational activities. Mitigation will be considered from the headwaters of the Chehalis River to the confluence of the Chehalis and Newaukum rivers. The mitigation will include, but is not limited to, the following:

- The Applicant intends to remove non-flood-tolerant trees and trees over 6 inches diameter at breast height in the riparian zone within the temporary reservoir inundation area. To minimize impacts on riparian habitat and retain shade as long as possible, these trees will be removed in the last phase of the 5-year construction period.
- Permanent protection measures via land acquisition or through a conservation easement in perpetuity that fully encumbers the restored riparian habitat.
- Mitigation in the form of replacement for the area of riparian habitat impacted by the Proposed Project. Restored or created riparian habitat must meet tree heights detailed in *Draft WDFW Riparian Ecosystems, Volume 2: Management Recommendations.*
- A maintenance component that addresses, but is not limited to, invasive and non-native species removal and control, plant replacement, irrigation, and adaptive management measures.
- A monitoring component that addresses, but is not limited to, species use surveys (e.g., avian, amphibians, wildlife), vegetation surveys (e.g., survival, mortality, cover), and analysis of functionality over time.
- This plan will be developed in conjunction with management and mitigation plans for vegetation, wetlands and wetland buffers, streams and stream buffers, fish and aquatic species and habitat, wildlife species and habitat, surface water quality, and large woody material.

Other Related Mitigation Measures (for details, see Section 5.17)

- EARTH-3 (Large Woody Material Management Plan)
- FISH-1 (Fish and Aquatic Species and Habitat Plan)
- WATER-1 (Surface Water Quality Mitigation Plan)
- WET-1 (Wetland and Wetland Buffer Mitigation Plan)
- WET-2 (Stream and Stream Buffer Mitigation Plan)

5.4.2.4 Significant and Unavoidable Adverse Environmental Impacts

There is uncertainty if mitigation is technically feasible and economically practicable; therefore, the Proposed Project would have **significant and unavoidable** adverse environmental impacts on wildlife species and habitat, as follows:

- Loss of vegetation cover associated with wetland, upland, and riparian habitats within the FRE facility and 847 acres of temporary reservoir area. This would change the habitat functions of

vegetation communities and wetlands, fragment habitats for many wildlife species, and allow invasive species to dominate.

- Loss of tree canopy eliminating current and future habitat for marbled murrelet.
- Reduce the suitability of aquatic habitats for species by increasing water temperatures in the Chehalis River in the temporary reservoir by 3.6°F to 5.4°F and in Crim Creek by 3.6°F to 9°F.
- Reduce the quantity and quality of downstream aquatic habitats from the loss of peak flows.
- Increased likelihood of death among less mobile wildlife species from not being able to move and avoid the disturbance from constructing the FRE, removing tree cover, filling wetlands and inundation of the reservoir. Species would be unable to adapt to the changes in habitat or relocate to other suitable breeding, foraging, resting, and overwintering habitat. Increased noise, including blasting, would cause some nesting birds to abandon nests.

The Applicant may provide mitigation plans as described above. If agencies determine the plans meet the regulatory requirements and implementation is feasible, then the impacts would be addressed as part of the permitting processes.

5.4.3 Findings for the Local Actions Alternative

Floodproofing of existing structures, floodplain storage improvements, and channel migration protection could involve local construction projects that could affect wildlife habitat. This could include loss of vegetation and fragmentation of vegetation communities. Due to limited size and because projects would likely be around developed areas, these impacts are considered minor. Impacts on habitat could also impact wildlife species that use those habitats. These impacts are also considered minor because the actions would be limited in extent and likely to occur in areas that provide limited habitat for wildlife. There are no probable adverse impacts on wildlife habitat or wildlife species from operation of the Local Actions Alternative. However, the frequency and severity of floods would increase in the future and would continue to have substantial risks to wildlife habitat and species.

5.4.4 Findings for the No Action Alternative

Under the No Action Alternative, the ongoing effects of flooding would continue to have substantial risks to wildlife habitat and species.

5.5 WETLANDS

This section evaluates wetlands, wetland buffers, and regulatory waterbodies and their associated buffers. Regulatory waterbodies include streams (and stream buffers) and other open-water features such as ponds and lakes. Ponds and lakes are only present downstream of the FRE facility. Wetlands are found in the zone between land and water. They provide important ecosystem functions by providing fish and wildlife habitat, improving water quality, protecting lands from flooding, stabilizing shorelines, and recharging groundwater. Wetlands can be found 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. There are no mapped estuarine or coastal areas within the study area; however, the lower reach of the downstream study area is tidally influenced freshwater.

Streams are identified and described based on their ordinary high water mark. This is a physical or biological mark showing where water is usually found. Streams are discussed from the regulatory standpoint and include both fish-bearing and non-fish-bearing streams (i.e., drainages that are not likely to regularly support fish due to the drainage's ephemeral nature, steep elevation grades, or impassable barriers). Land around wetlands and streams that provide regulatory protection to these critical areas are called buffers.

Under state, federal, and local laws, if wetlands or wetland buffers or streams or stream buffers are disturbed or removed, new areas must be created or restored nearby. The new areas must provide the same benefits to the ecosystem so there is no loss of the important functions that wetlands, streams, and associated buffers provide. Federal, state, and local rules apply to wetlands, streams, and associated buffers. The *Wetlands Discipline Report*, Appendix O, contains the full analysis and technical details used to evaluate wetlands. Impacts on fish are described in

Key Findings of the Wetland Analysis

The construction of the FRE facility and levee would have **significant adverse impacts** on:

- 6.5 acres of wetlands and 214 acres of wetland buffer habitat in the temporary reservoir area.
- 6.6 acres of wetlands at the airport levee and 44.2 acres of wetland buffer
- Stream buffers covering 18.2 miles and 312.8 acres in the temporary reservoir area.
- 0.3 acre of the Chehalis River, which would be permanently changed along with disturbance or elimination of 10.8 acres of stream buffers for the FRE site.

Operation of the FRE facility would have **significant adverse impacts** on:

- 9.8 acres of wetlands and 303 acres of wetland buffers during reservoir inundation
- 16.8 miles of streams and 25.5 miles and 441.3 acres of stream buffers during and following reservoir inundation

Building the FRE structure will permanently change the Chehalis River, which would be a **significant adverse impact**.

Mitigation under state, federal, and local laws would require no net loss of functions for wetlands, wetland buffers, streams, and stream buffers. These significant impacts on wetlands, wetland buffers, streams, and stream buffers would be **unavoidable unless** mitigation plans meet regulatory requirements and implementation is feasible.

Section 5.3, Fish Species and Habitats, and impacts on wildlife are described in Section 5.4, Wildlife Species and Habitats.

5.5.1 How Impacts Were Analyzed

The analysis looked at how construction and operation of the FRE facility and Airport Levee Changes could affect wetlands and waterbodies. The study area included four geographic areas:

- The proposed FRE facility (including roads, quarries, construction, and maintenance areas)
- The temporary reservoir area expected to be inundated in a catastrophic flood, plus an additional 500-foot area to identify wetlands near the inundation area
- The proposed Airport Levee Changes
- The Chehalis River floodplain downstream of the proposed FRE facility extending to about RM 9 near Montesano and 1,500 feet upstream in the main tributaries

To determine impacts, wetlands and streams and associated buffers within the temporary reservoir and within the areas of the FRE facility and airport levee were identified (delineated) using digital maps and field surveys in 2017 and 2018. For streams, the ordinary high water mark was identified to show where water would usually be found. Ecology, WDFW, and Corps experts verified the survey work. Wetlands and streams, lakes, and ponds outside of this area were identified and estimated using existing databases and maps.

Next, wetlands at the FRE site and airport levee area were categorized (see sidebar). The categories are based on the sensitivity of a wetland to disturbance, how rare it is, how difficult it is to replace, and how well it functions. Buffers for the wetlands were identified based on state and local regulations. The results of these surveys and maps showing the wetlands and waterbodies are in Section 2.4 of Appendix O, *Wetlands Discipline Report*.

Wetland Categories

Washington's wetlands vary widely in their functions and values. The Washington State Wetland Rating System developed by Ecology classifies wetlands into four categories. These categories help to define the quality of wetlands and their sensitivity to impacts, as well as mitigation measures that protect wetlands and buffers.

Category I: These wetlands may represent a unique or rare wetland type, are sensitive to disturbance, are relatively undisturbed, are impossible to replace within a human lifetime, and/or provide a high level of functions.

Category II: These wetlands are difficult though not impossible to replace, and provide high levels of some functions.

Category III: These wetlands have a moderate level of functions and can often be adequately replaced. They have generally been disturbed and are often less diverse than Category II wetlands.

Category IV: These wetlands have the lowest levels of functions and are often heavily disturbed. They can likely be replaced and may be able to be improved.

The study evaluated if wetlands, wetland buffers, streams, or stream buffers would be permanently or temporarily lost or if there would be changes to them. It also considered changes to habitats and functions. Impacts for the Proposed Project, Local Actions Alternative, and No Action Alternative are described in the next section.

5.5.2 Findings for the Proposed Project

5.5.2.1 Impacts From the Flood Retention Facility

Impacts From FRE Facility Structure and Roads

The Chehalis River is the only regulated waterbody in the FRE structure site. About 0.3 acre of the Chehalis River would be permanently filled for construction of the FRE facility. During construction, the river would pass through a temporary bypass tunnel. These adverse impacts are considered significant because an area of the river would be permanently changed. In addition, 10.8 acres of stream buffer would be permanently disturbed or converted to non-forested conditions.

Permanent impacts on wetlands and wetland buffers would occur at the site of the FRE structure from land clearing, excavation, grading, and the placement of fill during construction. Construction of the FRE structure is expected to permanently impact eight Category III wetlands, resulting in a loss of 1.1 acres of wetlands and 30.1 acres of wetland buffer. These impacts are considered moderate because there would be no impacts on Category I or Category II wetlands, and the affected wetlands are relatively common within this area of the Chehalis Basin. The elimination of these wetlands would require mitigation under federal, state, and local regulations to ensure no net loss of wetland functions. For operations at the FRE structure site, wetlands were permanently filled during construction so there are no additional wetland impacts.

The proposed quarry access roads could cross about 36 streams. For the quarry roads, 0.1 acre of wetlands would likely be impacted. Detailed wetland delineations would be required for road construction permits. Widening or improving quarry access roads where existing culverts are located would require the replacement or improvement of these culverts, which would require construction within and near these streams, stream buffers, wetlands, and wetland buffers. These impacts are considered minor because they would be temporary and because the new culverts would be designed to meet regulatory requirements. Following construction, the streams, stream buffers, wetlands, and wetland buffers would function similarly to pre-construction conditions.

Impacts in the Temporary Reservoir Area

During construction, tree removal in 600 acres within the 10% and 20% recurrence inundation areas in the temporary reservoir area would lead to loss of shade and habitat that would affect 6.5 acres of wetlands and 214 acres of wetland buffers. This tree removal would have a significant impact on streams because it would temporarily change 18.2 miles of banks along the streams and 312.8 acres of stream buffer habitat. The impact on wetlands would be significant during construction due to such a

large area of disturbance and conversion to emergent or shrub wetlands, although some wetland functions would continue.

During operations, for a catastrophic flood, the reservoir would temporarily hold water and 847 acres would be inundated. A total of 85 wetlands (9.8 acres) and wetland buffers (303 acres), and 116 streams (16.8 miles) and stream buffers (25.5 miles and 441.3 acres) would be submerged underwater for up to 35 days. Plants would not survive being submerged for this amount of time and the wetland vegetation would permanently change to smaller plants that must regrow after every flood. In addition, sediment could fill the wetlands and erosion could reduce its ability to retain water and promote the spread of non-native plants.

Tree removal would also promote the spread of non-native vegetation and would affect water temperature, sources of large wood, and habitat. These impacts are discussed in Section 5.1, Water; Section 5.3, Fish Species and Habitats; and Section 5.4, Wildlife Species and Habitats.

Erosion and sedimentation from raising and lowering water levels would cause changes to the shape of waterbody channels or change the depths. In the reservoir area, the channels could widen or rapidly change channel location. Plants on the stream edges would die during an inundation event. This would prevent mature trees from growing and reduce the functions of the waterbodies. For waterbodies, the impacts from filling and emptying the reservoir are significant, because waterbody functions would significantly change.

Mitigation is proposed for the Applicant to develop and implement a Riparian Habitat Mitigation Plan and Wetlands Mitigation Plan to address these impacts, but at this time it is not certain the plans are feasible. The plans must meet regulatory requirements and be approved by Ecology, Lewis County, and other applicable agencies and must ensure no net loss of function for wetlands and for the riparian and stream habitats.

Impacts Downstream of the FRE Facility

Under the Proposed Project, some wetlands and waterbodies downstream of the FRE facility would no longer be inundated during major or catastrophic floods because floodwaters would be held back by the FRE facility. About 522 acres of wetlands would no longer be inundated under the late-century major flood, a 9.7% reduction. For a late-century catastrophic flood, about 506 acres of wetlands would no longer be inundated, a 9.7% reduction. These probable adverse impacts are considered minor because the wetlands would not lose their primary water source.

For regulated waterbodies, a total of 13 acres would no longer be submerged under the late-century major flood and 16 acres would no longer be inundated under the late-century catastrophic flood. The impacts are moderate for the mainstem Chehalis River between Pe Ell and the South Fork Chehalis River because vegetation growth and channel narrowing would likely reduce the size of the river.

Downstream regulatory waterbodies and wetlands would continue to be inundated from floods smaller than a major flood. In many areas of the Chehalis River, the groundwater table is higher than river levels and rainfall is a major input. Wetlands and waterbodies have a variety of sources of water, including rainfall, surface runoff, groundwater, and overbank flows. Because smaller floods would continue to occur, wetlands that usually get water from overbank flows would not be impacted. Wetlands that have less frequent overbank flooding are likely to get water from other sources. Wetlands that are permanently, seasonally, and intermittently flooded or saturated would not likely be impacted because they would receive water from other sources. The peak flow levels and river heights for 98% of the downstream aquatic areas would not be negatively affected by the FRE facility. High river flows would continue to occur in fall and winter and provide water. The FRE would reduce the highest peak flows for major floods or larger, but reduction in flows would occur for only a few days before flows would increase as water in the reservoir is released. The release of water from the reservoir may slightly increase bank recharge for up to 35 days. Impacts on water sources for wetlands and bank recharge are likely to be minor.

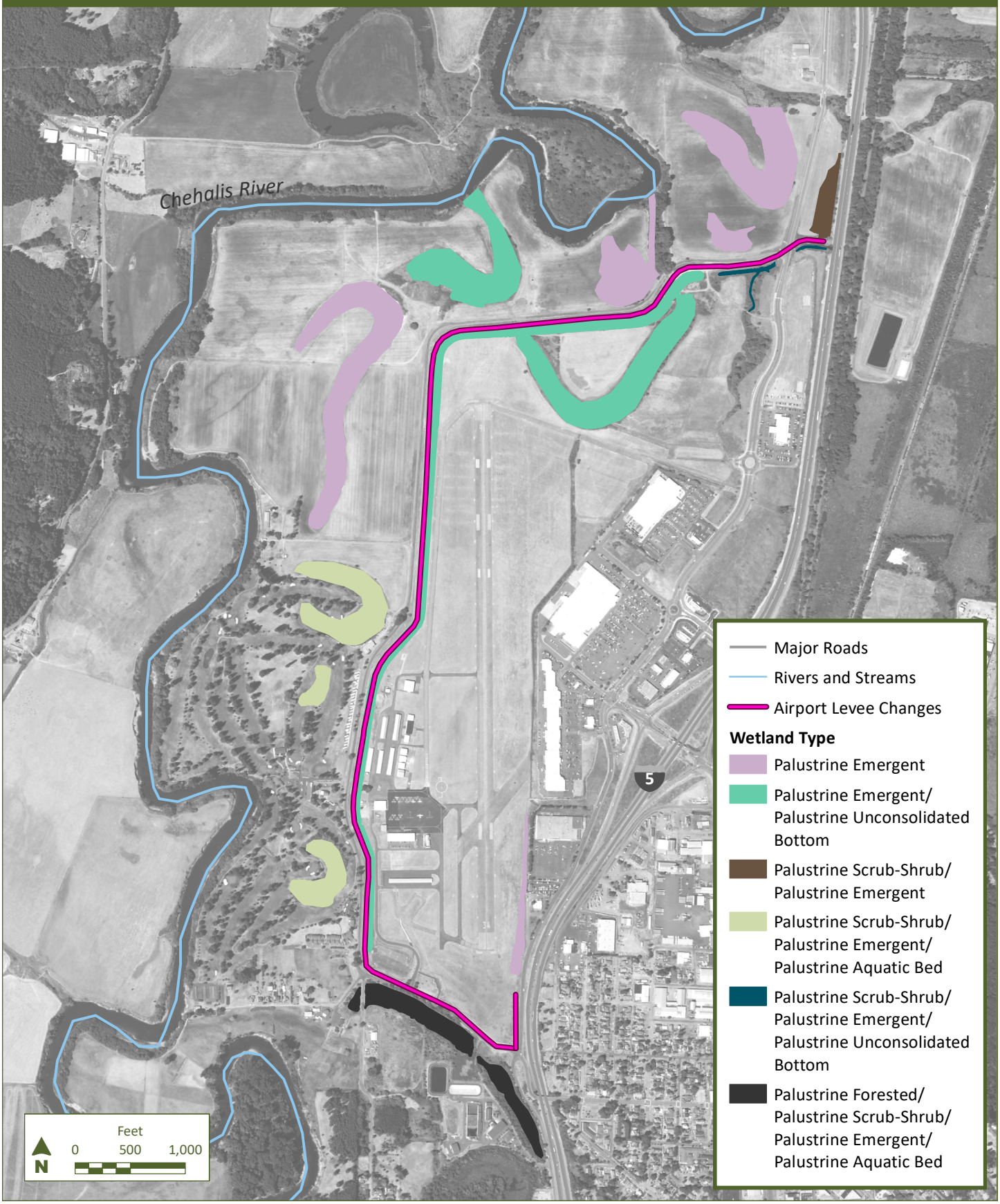
For downstream floodplain wetlands, the reduction in inundation from major or larger floods would, over time, result in some wetlands transitioning from emergent to shrub to forested conditions. Because some of these wetlands are subject to ongoing disturbance from agricultural or other land uses, it is not known which wetlands would experience this transition. This is considered a minor impact because it would only occur in some wetlands and would not change their status as wetland features, though it could change habitat functions.

5.5.2.2 Impacts From the Airport Levee Changes

Eight wetlands are located in or partially in the airport levee construction footprint. These wetlands include five Category II wetlands and three Category III wetlands. These wetland areas would be permanently filled or eliminated with the Airport Levee Changes. Wetland buffer habitat for these wetlands would also be disturbed or eliminated. These probable adverse impacts are considered significant because eight wetlands totaling 6.6 acres would be filled or eliminated. About 44.2 acres of wetland buffer habitat associated with these wetlands would also be disturbed. Mitigation is proposed for the Applicant to develop and implement a Riparian Habitat Mitigation Plan and Wetlands Mitigation Plan to address these impacts, but at this time it is not certain the plans are feasible.

No streams, ponds, or lakes were identified within the Airport Levee Changes, so there are no impacts on regulatory waterbodies. For operations, no adverse impacts on wetlands or wetland buffers are anticipated. Wetland buffers inside the airport levee would continue to be mowed as part of airport maintenance. Wetlands and wetland buffers outside the levee area would continue to be mowed by private landowners.

Exhibit 5.5-1
Wetlands Delineated Near the Airport Levee Changes



5.5.2.3 Proposed Mitigation Measures

This section describes mitigation measures being proposed for Applicant to implement that would reduce impacts from construction and operation of the Proposed Project. These mitigation measures would be implemented with, or as part of, the required permits, plans, and approvals described in Section 4.

- **WET-1 (Wetland and Wetland Buffer Mitigation Plan):** To mitigate the impacts on 10.8 acres of wetlands and 333 acres of wetland buffers from construction and operation of the Proposed Project within the FRE facility and temporary reservoir area; and to 6.6 acres of wetlands and 44 acres of wetland buffers within the airport levee area, mitigation is proposed for the Applicant to develop and implement a Wetland and Wetland Buffer Mitigation Plan in coordination with Ecology and the Corps. The plan will be prepared as part of the permitting process for the Proposed Project. The plan will address the general requirements for mitigation planning consistent with all current local, state, and federal guidance and regulations. These requirements must be met before applicable permits are issued.
  - Potential impacts on wetlands and wetland buffers will first be addressed through avoidance and minimization measures. This includes avoiding wetlands and wetland buffers during construction access and staging efforts, and locating construction access and supporting infrastructure routes to avoid wetlands. Wetland and wetland buffer vegetation in temporarily disturbed areas will be restored, including soil decompaction if needed, as soon as possible after construction activities are complete. Temporary impacts on wetlands and wetland buffers may also require compensatory mitigation depending on the duration of the impact and the type of wetland.
  - Compensatory mitigation actions may be implemented at one or several locations to ensure that the range of ecological functions are provided to offset identified project impacts and the types of wetland functions affected by the Proposed Project. Mitigation ratios prescribe the acreage needed to compensate for unavoidable impacts on wetlands, depending on the type of compensation, the category of the affected wetland, and the proposed category of the compensatory mitigation wetland.
  - This plan will be developed in conjunction with management and mitigation plans for vegetation, streams and stream buffers, fish and aquatic species and habitat, wildlife species and habitat, surface water quality, and large woody material.
- **WET-2 (Stream and Stream Buffer Mitigation Plan):** To mitigate the impacts on 16.8 miles of streams (waterbodies) and 441 acres of stream buffers from construction and operation of the Proposed Project, mitigation is proposed for the Applicant to develop and implement a Stream and Stream Buffer Mitigation Plan. The plan must be developed in coordination with and approved by Ecology, Lewis County, other applicable local, state, and federal agencies, and tribes and be ready to implement prior to the start of construction. The plan will be prepared as part of the permitting process for the Proposed Project. The plan must include restoration

options that provide no net loss of ecological functions for the streams and stream buffers impacted by construction and operational activities. Mitigation will be considered from the headwaters of the Chehalis River to the confluence of the Chehalis and Newaukum rivers. The mitigation will include, but is not limited to, the following:

- Avoiding regulatory waterbodies during construction access and staging efforts, and locating construction access and supporting infrastructure routes to avoid streams and stream buffers. Where impacts cannot be avoided, efforts will be taken to minimize impacts on the maximum extent practicable, such as by minimizing stream crossings.
- The Applicant must ensure ecological functions are maintained in accordance with Lewis County Shoreline Management Plan requirements and ratios. The mitigation will be a minimum of a one-to-one ratio for riparian corridor habitat to ensure no net loss of shoreline ecological function.
- Permanent protection measures via land acquisition or through a conservation easement in perpetuity that fully encumbers the restored stream habitat.
- A maintenance component that addresses, but is not limited to, invasive and non-native species removal and control, plant replacement, irrigation, and adaptive management measures.
- A monitoring component that addresses, but is not limited to, species use surveys (e.g., avian, amphibians, wildlife), vegetation surveys (e.g., survival, mortality, cover), and analysis of functionality over time.
- This plan will be developed in conjunction with management and mitigation plans for vegetation, wetlands and wetland buffers, fish and aquatic species and habitat, wildlife species and habitat, riparian habitat, surface water quality, and large woody material.

Other Related Mitigation Measures (for details, see Section 5.17)

- FISH-1 (Fish and Aquatic Species and Habitat Plan)
- WATER-1 (Surface Water Quality Mitigation Plan)
- WILDLIFE-1 (Vegetation Management Plan)
- WILDLIFE-3 (Riparian Habitat Mitigation Plan)

5.5.2.4 Significant and Unavoidable Adverse Environmental Impacts

There is uncertainty if mitigation is technically feasible and economically practicable; therefore, the Proposed Project would have **significant and unavoidable** adverse environmental impacts on wetlands, wetland buffers, streams, and stream buffers. The Applicant may provide plans as described above. If the agencies determine the plans meet regulatory requirements and implementation is feasible, then the impacts would be addressed as part of the permitting processes.

5.5.3 Findings for the Local Actions Alternative

Floodproofing of existing structures, floodplain storage improvements, and channel migration protection could involve local construction projects that could affect wetlands or waterbodies. Impacts could include permanent loss of wetlands, changes to wetland hydrology, and disconnection of wetlands from the floodplain, as well as changes to the characteristics and form of a waterbody or its ordinary high water mark. Overall, due to the limited scope of these actions and the likely location around developed areas, such projects would likely result in minor adverse impacts on wetlands or waterbodies. Any potential impacts on wetlands, wetland buffers, or waterbodies would require mitigation per federal, state, and local regulations. Flooding is expected to continue to affect many locations in the study area and there would an ongoing risk of flood damages to wetlands and regulatory waterbodies, although floods would also continue to form wetland and waterbody habitats.

5.5.4 Findings for the No Action Alternative

In the No Action Alternative, flooding is expected to continue to affect many locations in the study area and flood frequency and severity is predicted to increase in the future. There would be an ongoing risk of flood damages to wetlands and regulatory waterbodies (streams, ponds, and lakes), although floods would also continue to form wetland and waterbody habitats.

5.6 TRIBAL RESOURCES

Tribal resources refers to the collective rights related to access to traditional areas, time periods for gathering resources for cultural practices, tribal sovereignty, or formal treaty rights. These resources include plants, wildlife, or fish used for commercial, subsistence, and ceremonial purposes and cultural resources. Construction and operation of the Proposed Project could result in impacts on tribal resources. The waters of the Chehalis River, its tributaries, and Grays Harbor were, and continue to be, important fishing areas for tribes in the region, while the banks of these bodies of water serve as productive hunting and plant gathering areas.

The EIS analyses found probable significant impacts on fish and wildlife species, aquatic and terrestrial habitat, water resources, recreation, wetlands, and earth. These impacts could impact tribal resources, including wildlife, vegetation, and fish available for harvest and use by tribes. Making a determination of significance related to treaty-reserved rights is not part of this EIS.

The *Tribal Resources Discipline Report*, Appendix L, contains the full analysis and technical details used to evaluate tribal resources. Impacts on related resources are described in Section 5.1, Water; Section 5.2, Earth; Section 5.3, Fish Species and Habitats; Section 5.4, Wildlife Species and Habitats; and Section 5.9, Cultural Resources.

Key Findings of the Tribal Resources Analysis

Construction and operation of the Proposed Project could impact tribal resources in the following ways:

- Restricting or reducing access of tribal members to tribal resources
- Altering vegetation in the temporary reservoir and in riparian and flood-affected areas due to periodic inundation, which could affect water, habitat, fish, and wildlife
- Loss of fish habitat within the Chehalis River, including loss of salmon spawning habitat
- Loss of fish that would otherwise be available for tribal harvest, as well as wildlife and plants that are identified as a tribal resource
- Impacts on lamprey and habitat at Rainbow Falls
- Impacts on Southern Resident killer whales due to reduction of food sources
- Impacts on cultural and historic resources important to tribes
- Loss of wildlife and terrestrial habitat that could affect gathering and hunting

The Corps is conducting a review of the Proposed Project under NEPA. Pursuant to NEPA, the Corps is assessing potential impacts of the Proposed Project on tribal resources, including potential impacts related to tribal sovereignty and treaty rights. The Corps is consulting under Section 7 of the federal Endangered Species Act with the USFWS and NOAA Fisheries. The Corps is also consulting under Section 106 of the National Historic Preservation Act with tribes, DAHP, and the Applicant.

Washington's salmon and steelhead fisheries are managed cooperatively in a unique co-management relationship. Co-management of fisheries occurs through government-to-government cooperation, communications, and negotiations. One government is the State of Washington, and the other is Indian

tribes whose rights were preserved in treaties signed with the federal government in the 1850s. In those treaties, tribes ceded vast areas of what is now Washington State while preserving their continued right to fish, gather shellfish, hunt in their "usual and accustomed" areas, and exercise other sovereign rights. The annual North of Falcon process sets salmon fishing seasons for Indians and non-Indians in inland waters such as Grays Harbor and state rivers.

5.6.1 How Impacts Were Analyzed

The study area for tribal resources includes the FRE facility and associated areas including the temporary reservoir and upstream tributaries, and the area downstream of the FRE facility including the airport levee area. For lifecycle analysis of salmon and Southern Resident killer whales, the study area includes Grays Harbor and the Pacific Ocean.

The analysis assessed how the Proposed Project and alternatives could affect tribes, tribal resources, and access to tribal resources in the study area, including access to places where fishing, hunting, gathering, and other community practices occur. Impacts could occur if tribal members' access to a resource or important place is reduced or limited, or if the resource or place is diminished.

Tribal communities are the best source of information about tribal resources. Information gathered to inform the analysis came from a variety of sources including monthly meetings held with the Chehalis Tribe and Quinault Indian Nation related to Section 106 consultation under the National Historic Preservation Act, scoping comments received as part of the environmental review process, and comment letters received on the *2017 Chehalis Basin Strategy Programmatic EIS*. The following section summarizes findings from the various EIS resource Discipline Reports that could impact tribal resources.

5.6.2 Findings for the Proposed Project

5.6.2.1 Impacts From the Flood Retention Facility

Fish Species and Habitat

Construction of the FRE facility would impact fish species and habitat that are used by tribes and identified in stories and cultural practices. Construction impacts would primarily result from dewatering and diversion of the river around the construction site and removal of large trees from the temporary reservoir area. Impacts could also result from reduced fish passage performance and construction noise. Most of the habitat impacts would be located in the Chehalis River above the FRE facility site to the headwaters and downstream to the confluence with the South Fork Chehalis River.

Modeling showed the populations of salmon and steelhead upstream of the proposed FRE facility (above Crim Creek) and downstream of the FRE facility to Rainbow Falls would experience significant impacts during construction of the Proposed Project. Among the four species analyzed, spring-run and fall-run Chinook salmon would be most affected by a decline in habitat quality in the temporary reservoir inundation area because their spawning is concentrated in this area. Populations of coho salmon and steelhead would be more affected by low efficiency of the trap-and-transport process

because these fish migrate and spawn during winter when trapping would be more challenging due to turbid (cloudy) water and high water flows. Vegetation removal during construction would degrade the quality of habitat for rearing juvenile salmon and steelhead within the temporary reservoir area. Overall, the model results indicate a decrease in salmonid abundance during construction of the Proposed Project, and a significant adverse impact on spring-run Chinook salmon, fall-run Chinook salmon, coho salmon, and steelhead.

Construction and operation of the proposed FRE facility would have substantial impacts on salmon and steelhead in the Above Crim Creek Subbasin and the Crim Creek to Rainbow Falls Subbasin. Passage upstream and downstream around the FRE facility construction site on the Chehalis River would be limited for non-salmon fish and juvenile salmonids. The integrated model results indicate that operation of the Proposed Project would have a significant adverse impact on spring-run Chinook salmon, fall-run Chinook salmon, coho salmon, and steelhead. Construction of the Proposed Project would have a significant adverse impact on migratory non-salmon fish, including Pacific lamprey ("eels"), due to uncertainty about transport to upstream habitat. Construction of the Proposed Project would have a moderate adverse impact on resident fish because they could continue to use habitat upstream and downstream of the construction site; however, they would still be affected by impacts on the aquatic habitat and disconnection from habitats on either side of the construction site.

Pacific lamprey ("eels") are likely to continue returning to areas upstream of Rainbow Falls, but the number of lamprey is likely to be reduced due to reduced spawning and rearing habitat. By late-century, the amount of lamprey spawning habitat would be reduced by greater than 70% during peak spawning in June, and spawning would no longer occur in July. Warmer water temperatures would cause rearing habitat to contract in summer and expand in winter due to warmer temperatures year-round. Large portions of the upper mainstem Chehalis River are likely to become uninhabitable for rearing lamprey in July and August due to high temperatures, limiting the usefulness of the mainstem habitat for rearing juveniles. This would be a significant adverse impact on lamprey in the temporary reservoir area and downstream from the FRE facility to the confluence with Elk Creek, including at Rainbow Falls. For most native fish species, the projected increases in temperature combined with reductions in summer flows would considerably reduce habitat area for both spawning and rearing. Overall, operation of the Proposed Project would have a significant adverse impact on non-salmon fish.

Other Aquatic Species

Freshwater shellfish and aquatic macroinvertebrates are vulnerable to in-water construction activities because of their inability to move away from the activity and their reliance on specific substrate types and water quality. The permanent loss of habitat in the FRE facility footprint would be a significant adverse impact on freshwater shellfish and a significant to moderate adverse impact on aquatic macroinvertebrates. Freshwater shellfish and aquatic macroinvertebrates are vulnerable to rapid changes in flow and sedimentation that would occur with the FRE facility because of their immobility

and reliance on specific substrate types, flows, and water quality to survive. Operation of the FRE facility would create a significant adverse impact on shellfish.

Macroinvertebrates are likely to recolonize disturbed areas and take advantage of newly deposited substrates, but would likely have lower species diversity and composition. The FRE facility would create a significant to moderate adverse impact on aquatic macroinvertebrates due to loss of habitat, loss of food sources, and changes in water temperature and substrates.

Marine predators that prey on Chehalis Basin salmon may be affected by a change in salmon population sizes from construction and operations of the Proposed Project. The degree to which the decline of salmon and steelhead from the upper Chehalis Basin resulting from construction of the FRE facility would affect the Southern Resident killer whale is uncertain. The number of fish that would likely be impacted by the Proposed Project represents a small proportion of the overall diet of the Southern Resident killer whales. However, the loss of salmon and steelhead would present a moderate adverse impact on Southern Resident killer whales. The loss of salmon and steelhead from the Proposed Project would have a minor adverse impact on other marine mammals because they have a more diverse prey base.

Wildlife Species and Habitat

Probable construction impacts on wildlife would result from construction activities that impact wildlife habitat, including clearing of upland, riparian, and wetland vegetation communities or construction- and equipment-generated noise. These probable adverse impacts for the FRE facility site construction are considered significant for wildlife species because the loss of upland, riparian, and wetland habitats that support wildlife species would result in wildlife mortality. For the temporary reservoir area, these probable adverse impacts are considered significant for wildlife species because all non-flood-tolerant trees within 600 acres would be removed during construction.

Operation of the FRE facility would impact both wildlife species and habitats. The FRE facility would be located in an area that could be used by tribal hunters and operations would affect access to this area. Operation of the FRE facility and temporary reservoir would likely remove the availability of these areas for the collection of plants and the harvesting of deer and elk by tribal hunters and gatherers.

During operation, wildlife habitat within the temporary reservoir would be periodically inundated, and plant communities would likely be in a permanently young stage because plants would die during inundation. This would increase the chance for non-native invasive species to colonize the area. In addition, trees that were not removed during construction may die and would be removed to reduce the potential for large log jams. Over time, only shrubs would remain within most or all of the temporary reservoir. These probable impacts are considered significant because most of the upland, wetland, and riparian vegetation would not survive every time the reservoir is filled, and the current

forestland would change to primarily grass, herbaceous, and young woody shrubs and trees that would need to regrow after every flood event.

Operation of the FRE facility would impact a variety of wildlife species. The loss of trees would particularly affect North American beaver. Within the temporary reservoir area, up to 847 acres would be inundated and would lead to significant impacts on wildlife species. Inundation of upland, riparian, and wetland habitat used by amphibians and other wildlife species would directly displace animals or result in mortality for species unable to rapidly disperse or relocate to other suitable habitats. The loss of tree and shrub vegetation from the riparian zone in the temporary reservoir due to flood inundation would directly remove nesting, denning, and feeding habitat used by wildlife including birds, mammals, and amphibians. The shrub vegetation that would likely replace forested riparian areas in the temporary reservoir could provide additional foraging habitat for deer, elk, and birds of prey. Disturbance of native species' habitats could provide opportunities for the invasion of non-native species that could prey on or outcompete native species. Temporary inundation of the reservoir could alter or restrict the migratory routes of elk, deer, and other large, migratory, terrestrial species. The probable adverse impacts are considered significant for wildlife species because many individuals could not relocate within the temporary reservoir every time the reservoir is filled. The complete loss of wildlife breeding, foraging, resting, and overwintering habitat features during the temporary inundation would also result in wildlife mortality.

Decreases in salmon abundance would have an adverse impact on wildlife species that either feed on or otherwise benefit from salmon-derived nutrients. The magnitude of the impact is proportional to the decrease in salmon abundance and is expected to be most pronounced in areas where salmon spawning in the reservoir footprint is substantially reduced during floods.

Downstream of the FRE facility, the probable adverse impacts are considered moderate for wildlife species due to the large size of the study area relative to the change in the extent of flooding and potential changes in habitat features. It is not likely that changes in the extent of flooding downstream would result in mortality.

Cultural Resources

Construction-related activities associated with the FRE facility would directly affect four recorded archaeological sites. Because substantial site preparation (including grading, filling, and ground disturbance) would occur, these recorded archaeological sites, as well as any unrecorded sites in these areas, would be expected to be partially or completely destroyed. Operation of the temporary reservoir during floods has the potential to affect nine recorded archaeological sites and isolates. Potential effects on archaeological sites and isolates include inundation, increased erosion, burial beneath reservoir sediments, burial beneath landslides, and faster destruction of artifacts due to increased wet-dry cycles. The eligibility of these sites to be included in the National Register of Historic Places is being discussed through the separate Section 106 consultation process. If eligible, these potential impacts will be

reviewed, significance will be determined, and mitigation agreed upon through the Section 106 process. There are no known cemeteries at the airport levee. Traditional Cultural Properties are being studied as part of the Section 106 process and could be affected.

5.6.2.2 Impacts From the Airport Levee Changes

Wildlife habitat within the proposed construction footprint of the airport levee includes upland and wetland vegetation communities. Probable impacts are considered moderate for wildlife habitat because the upland vegetation cover types are managed and disturbed, and 6.6 acres of wetland vegetation communities would be permanently filled or eliminated. The affected wetlands do not include Category I wetlands and are already highly disturbed and of low function. These types of wetlands are also common within the Chehalis Basin in general. Probable adverse impacts on wildlife species are considered minor due to the relatively small area of wildlife habitat associated with the airport levee, the existing disturbed conditions, and ongoing human activities in the vicinity.

A field survey found eight recorded archaeological sites in the airport levee area. Depending on specific construction footprints and methods, construction-related activities associated with the Airport Levee Changes could directly affect none, some, or all of the recorded archaeological sites and isolates adjacent to or beneath the levee. Potential impacts on eligible and potentially eligible archaeological resources will be reviewed, determined, and mitigation agreed upon through the Section 106 process. Traditional Cultural Properties are being studied as part of the Section 106 process and could be affected.

5.6.2.3 Proposed Mitigation Measures

Mitigation associated with potential impacts on tribal resources would be addressed directly with the Quinault Indian Nation, the Chehalis Tribe, and other tribes during government-to-government consultations. Mitigation measures are expected to be developed as part of the permitting and consultation processes for fish species and habitat, wildlife, and cultural resources.

5.6.2.4 Significant and Unavoidable Adverse Environmental Impacts

Construction and operation of the Proposed Project could result in impacts on tribal resources. Significant impacts on fish and wildlife species, aquatic and terrestrial habitat, water, wetlands, earth, and geomorphology have been identified. Tribal resources could be impacted, including wildlife, vegetation, and fish available for harvest and use by tribes and cultural resources. Making a determination of significance related to treaty-reserved rights is not part of this EIS.

5.6.3 Findings for the Local Actions Alternative

Construction of floodplain storage improvements and channel migration protection would take place within or adjacent to the river channel and could therefore result in impacts on fish or fish habitat, which could impact tribal resources. These activities could involve water diversions, cut and fill,

vegetation disturbance, and elevated sound and vibration. This could lead to increases in turbidity or sedimentation, fish injury, or a disruption of fish behavior. Construction of the Local Actions Alternative projects could also impact vegetation communities or wildlife species. Activities could include loss of vegetation that is used by wildlife. Overall, due to the limited scale and duration of construction of local actions, their likely location around developed areas, and the fact that many activities would occur outside aquatic habitat, activities would likely result in minor impacts on fish, wildlife habitat, and wildlife species in the study area over the long term. Operations of the Local Actions Alternative could also have impacts on fish, shellfish, and habitat, especially if projects occur in a river channel or in nearby floodplains. Overall, the operation of local actions is likely to have minor impacts on fish, shellfish, and aquatic habitat. Tribal resources in the study area would continue to experience substantial flood risk under the Local Actions Alternative.

5.6.4 Findings for the No Action Alternative

Under the No Action Alternative, climate change is predicted to result in large-scale increases in water temperatures, reductions in summer flows across the Chehalis Basin, more intense precipitation events, and higher temperatures. Flood frequency and severity is predicted to increase in the future. This is expected to impact spring-run Chinook salmon, fall-run Chinook salmon, coho salmon, and steelhead. Loss of habitat is also expected to negatively affect many non-salmonid species, shellfish, and aquatic macroinvertebrates. Habitat degradation associated with the No Action Alternative is expected to reduce genetic diversity due to the loss of populations in the Rainbow Falls to Crim Creek Subbasin. For wildlife species and habitats, these changes are anticipated to affect the establishment and growth of forest plants and cause significant changes in plant and animal distributions.

Water resources in the study area would continue to be vulnerable to damage during both major and catastrophic floods. Potential impacts would not be substantially reduced under the No Action Alternative. Floods would continue to inundate rivers, streams, habitat, and properties. Historic and cultural resources throughout the study area would continue to be vulnerable to damage during both major and catastrophic floods. Floods would continue to inundate historic and cultural properties. Tribal resources in the study area would continue to experience substantial flood risk under the No Action Alternative.

5.7 LAND USE

The term "land use" refers to how land is developed for various human uses or preserved for natural purposes. This section describes the current land use conditions in the study area and probable changes or impacts on these uses from the Proposed Project and alternatives.

The *Land Use Discipline Report*, Appendix G, contains the full analysis and technical details used to evaluate land use. Impacts on recreational uses and facilities are described in Section 5.8. Probable impacts on critical areas are described in Section 5.1, Water; Section 5.2, Earth; Section 5.4, Wildlife Species and Habitats; and Section 5.5, Wetlands.

Key Findings of the Land Use Analysis

The FRE facility and reservoir would be **inconsistent** with forest resource land use and zoning designations, which would be a **significant** impact on land use. The Applicant would need to apply for a rezone or a conditional use permit to remove this inconsistency. For associated forest practice activities, the Applicant will participate in pre-application consultation under the Forest Practices Rules.

The FRE facility would have impacts on habitats and critical areas that would be **inconsistent** with land use policies and regulations to maintain no net loss of ecological function and value for wetlands, critical areas, and shorelines. This would be a **significant** impact on land use. Mitigation is proposed for the Applicant to develop mitigation plans to ensure no net loss of functions. This would remove the inconsistency; however, implementation of the plans may not be feasible.

The Airport Levee Changes would be **consistent** with land use designations and plans.

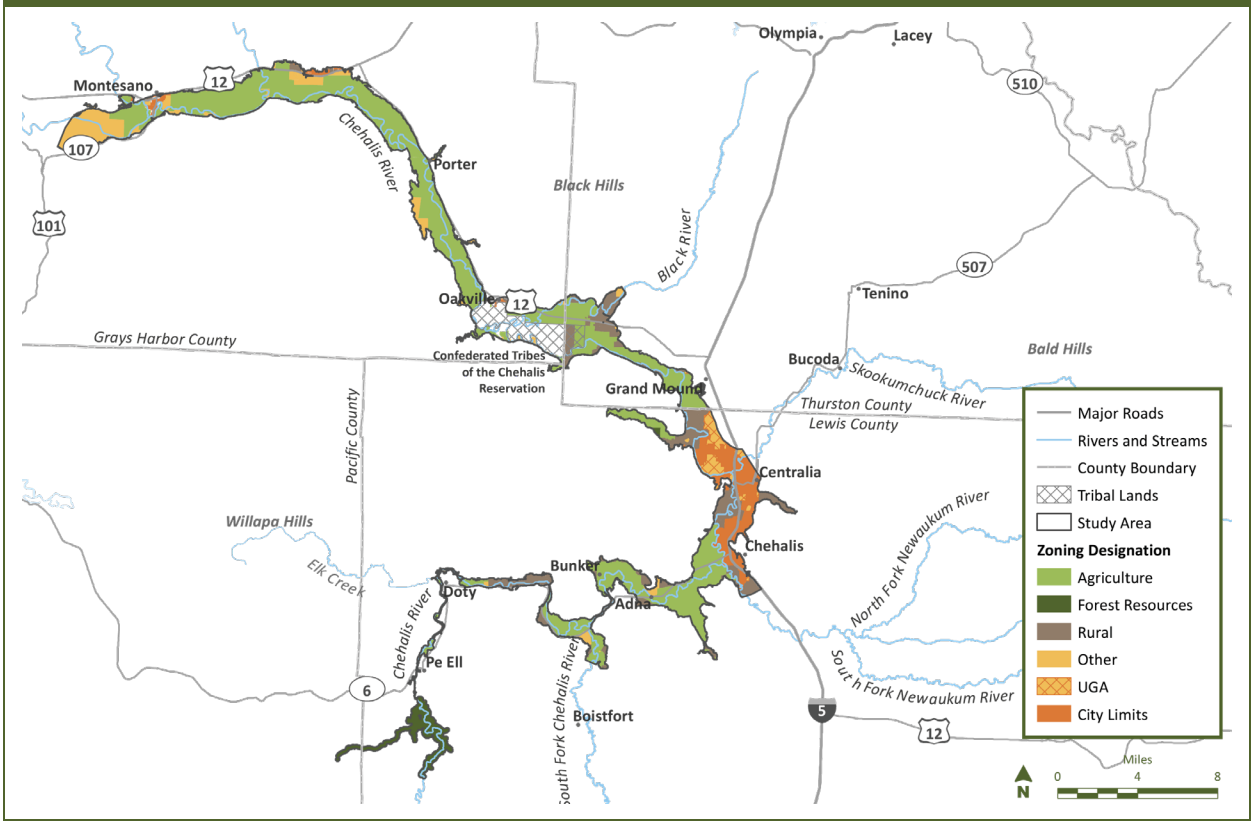
5.7.1 How Impacts Were Analyzed

Local land use plans and development regulations were evaluated to assess consistency with the Proposed Project. These included comprehensive plans, SMPs, floodplain regulations, and critical area requirements. Critical areas include fish and wildlife conservation areas, wetlands, frequently flooded areas, geologically hazardous areas, and critical aquifer recharge areas.

The study area for land use is largely along the mainstem Chehalis River and its floodplains and tributaries from south of Pe Ell in Lewis County, to near Montesano in Grays Harbor County. The study area also includes the proposed FRE facility and temporary reservoir as well as the area associated with construction equipment and materials, quarries, and construction access routes. The FRE facility and temporary reservoir would be located on current Weyerhaeuser and Panesko Tree Farm properties, which are commercial forest lands. The Applicant does not intend to manage the land as commercial forest for construction or operations.

The study area currently consists of agricultural (59%), rural (21%), city (12%), and forested (5%) lands. The remaining 3% of land is zoned as rural residential, commercial, industrial, or park. Exhibit 5.7-1 shows a map of zoning types in the study area. The study area is largely rural, with more developed areas in incorporated city and town limits, Chehalis and Centralia Urban Growth Areas (UGAs), and unincorporated communities.

Exhibit 5.7-1
Zoning Types in the Land Use Study Area



Most of the study area is in mapped floodplain areas shown on Flood Insurance Rate Maps published by FEMA. These maps show where there is a 1% or greater chance of flooding annually (these use a FEMA 100-year flood, which is based on historical data, so it is different from the catastrophic flood used for analysis in this EIS, which looks at future conditions).

Potential impacts were identified using aerial photographs, maps of predicted flood inundation levels, land cover data, and FEMA flood hazard maps. Land use data included local zoning, comprehensive plans, and critical areas. Land use impacts could occur as a result of the following:

- A land use change that is inconsistent with local zoning, planning, and policy documents
- Conversions of land uses and the effect on existing land use, businesses, economies, communities, and environment
- Restrictions or changes to land use

The land use analysis evaluated the changes in inundation from flooding under different scenarios for the Proposed Project and alternatives. It identified the number of structures and depth of water in the study area under different flooding scenarios.

5.7.2 Findings for the Proposed Project

5.7.2.1 Impacts From the Flood Retention Facility

Changes in Land Use and Consistency With Land Use Regulations

Construction and operation would result in a change of land use for the temporary reservoir (847 acres) and the FRE facility (34.9 acres). The loss of this commercial forestland would affect Weyerhaeuser and the Panesko Tree Farm businesses. The Applicant does not intend to manage the area as commercial forestland, so this would be a permanent change in land use.

The owner of the managed forestland would be required to comply with all DNR regulations for construction in managed forests. A Forest Practices Application/Notification would be required for the harvest of trees and construction activities including roads and water crossing structures in managed forests. For the conversion of the land from managed forest to non-managed forest at the FRE facility site and temporary reservoir area, the Applicant would need a Class IV-General Forest Practices Application from DNR. Road and construction activities related to the harvest of trees would be required to meet Forest Practices standards. Once the land in the temporary reservoir area is converted, and for any construction activities of the FRE facility not covered under the Class IV-General Forest Practices Application, local and state permits would apply for construction activities in this area.

The change in land use would not be consistent with existing zoning, resulting in a significant adverse impact on land use consistency. However, mitigation is proposed for the Applicant to obtain a conditional use permit or rezone. For associated forest practice activities, the Applicant will participate in pre-application consultation under Forest Practices Rules. The conditional use permit or rezone decision will include consideration of mitigation plans for riparian, aquatic, and terrestrial habitat and it is not certain the implementation of the plans are feasible. If the plans are feasible and the rezone or conditional use permit is approved, the land use would become consistent with plans, policies, and regulations.

During construction, the quarry sites and concrete production facility would result in a change of existing land use from commercial forestland; however, the proposed activities are generally consistent with land uses allowed within the Forest Resource Lands zoning district. Construction-related improvements to forest roads are also consistent with existing land uses.

Changes to Shorelines, Floodplains, and Critical Areas

Construction activities at the quarry sites, concrete production facility, and access roads would be temporary and consistent with allowed land uses. Construction activities for the FRE and removal of large trees in the temporary reservoir footprint would affect the habitat of existing forestlands, shorelines, floodplains, and critical areas. Impacts on these habitats and critical areas would be inconsistent with land use plans, policies, and regulations to maintain no net loss of ecological function and value. This would be a significant adverse impact due to the impacts on shoreline and critical area ecological functions. Mitigation is proposed for the Applicant to develop and implement management and mitigation plans to address these impacts, but at this time it is not certain the plans are feasible. The

plans must meet regulatory requirements, be approved by applicable agencies, and must ensure there is no net loss of wetland functions and riparian functions.

The FRE facility would require a permit from Lewis County for development in the 100-year floodplain. Operation of the FRE facility is likely to change the 100-year floodplain, in which case federal regulations require review and modification of flood maps.

After the FRE facility is constructed, shorelines and critical areas would likely be impacted due to vegetation removal and inundation of the reservoir. Lewis County SMP critical area regulations would apply and would require an assessment report and measures to compensate for anticipated impacts. These activities may be inconsistent with some land use regulations and would be moderate adverse impacts.

5.7.2.2 Impacts From the Airport Levee Changes

Construction impacts on land use in the vicinity of the airport levee are anticipated to be minor because they would be temporary and limited to the construction period. Following construction of the Airport Levee Changes, the finished elevation of the levee would be 4 to 7 feet higher than it is now. There would be minor adverse impacts on land uses due to the limited land use conversion from agricultural to roadway and levee. The land use associated with the other portions of the airport levee and the raised portion of NW Louisiana Avenue would remain unchanged and there would be no adverse impacts on land uses.

If operation of the airport levee results in a change in the 100-year floodplain, federal regulations require review and modification of flood maps. This could result in additional development in the currently mapped floodplain if the mapped floodplain is reduced in areas predicted to experience less severe flooding.

The Lewis County and City of Chehalis SMPs require that flood hazard management measures, including levees, within the floodplain do not increase flood hazards. The Airport Levee Changes are expected to require a more detailed hydraulics and hydrology study during permitting. The Airport Levee Changes would result in permanently filled, eliminated, and disturbed wetlands and wetland buffers. Mitigation is proposed for the Applicant to develop a plan to ensure there is no loss of wetland functions. Shoreline and critical areas review, and measures to compensate for critical areas impacts, would be required as a condition of shoreline and building permits. There would be moderate adverse impacts on land uses associated with shorelines, floodplains, and critical areas.

5.7.2.3 Flood Damage Reduction

Overall, the Proposed Project would reduce flood inundation levels in areas downstream of the FRE facility, but the amount of reduction would vary based on the location and size of the flood. This analysis looked at 4,374 structures in the study area under both the major and catastrophic flood

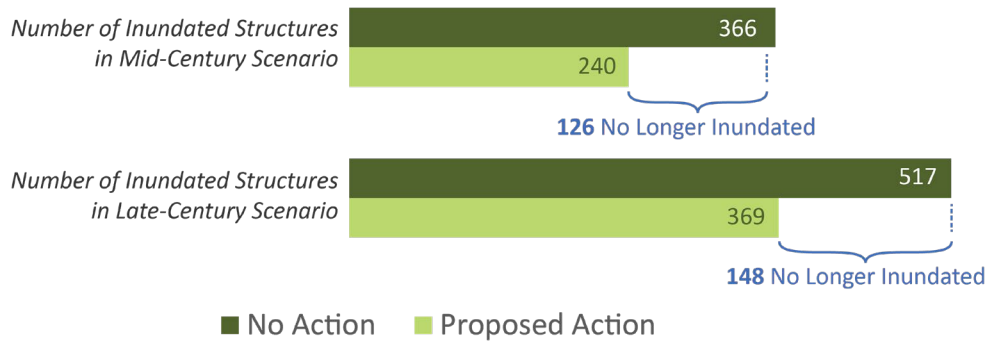
scenarios. The EIS Mapbook in Chapter 10 contains maps with more detail on flood levels. Below is a general summary of changes.

For the late-century major flood scenario, 148 structures and about 3,514 acres would no longer be inundated (Exhibit 5.7-2). About 7% of the acres that would no longer be flooded are inside city limits, and 90% are in unincorporated, largely agricultural county lands.

Properties no longer inundated in a major flood are mainly located in the following areas:

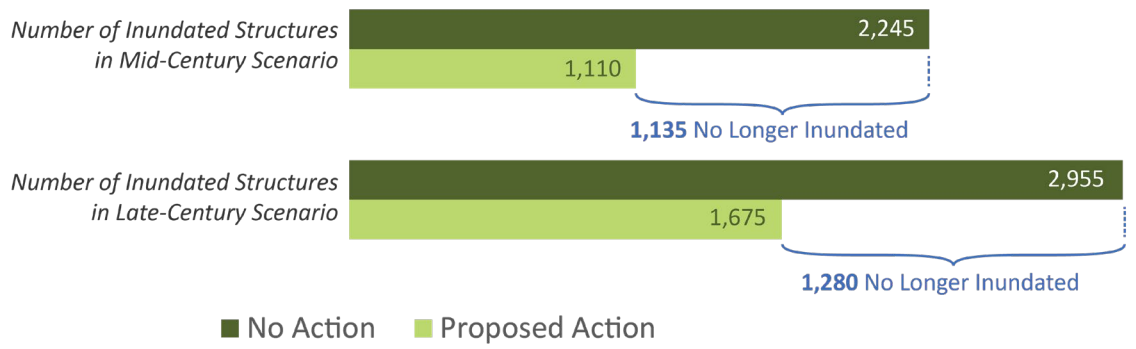
- Near the confluence of the South Fork Chehalis River
- Between Bunker and Littell
- In Centralia west of Fort Borst Park
- In smaller areas downstream to Oakville

Exhibit 5.7-2
Structures Inundated During Major Flooding



For the late-century catastrophic flood scenario, 1,280 structures and about 3,795 acres would no longer be inundated (Exhibit 5.7-3). About 13% of the acres that would no longer be flooded are inside city limits, and about 83% are in unincorporated, largely agricultural county lands. Areas where the Proposed Project reduces flooding may still be flooded in larger floods like the 2007 flood.

Exhibit 5.7-3
Structures Inundated During Catastrophic Flooding



The EIS Mapbook in Chapter 10 contains maps with more detail on flood levels. Key changes to inundation levels under the late-century catastrophic flood scenario include the following:

- Much of the land in the study area from Pe Ell to just upstream of the confluence of the South Fork Chehalis River would be no longer inundated, with reductions from 1 inch to greater than 8 feet of change. This area mainly consists of rural and agricultural lands.
- In the City of Centralia, some residential areas would be protected.
- In the City of Chehalis, flood levels for much of the study area would be reduced 3 to 5 feet; however, this area would still experience flooding, and some areas would still have more than 10 feet of inundation.
- Downstream of Centralia, the modeled reduction in inundation would be less than 3 feet with most of the area still inundated, and with some areas still experiencing more than 10 feet in inundation.

At the Chehalis-Centralia Airport, the Proposed Project would prevent flooding under the major flood scenario in mid-century and late-century. It would prevent flooding

Difference from 2017 Programmatic EIS

The Programmatic EIS found:

- 1,379 structures could be inundated during a catastrophic flood.
- The large-scale flood retention concept would eliminate flooding for 559 of these structures.
- 4,481 acres of agricultural, forest, and residential land would not be inundated in a major flood event with the large-scale flood retention concept.

This EIS includes climate change projections and more detailed water models. It found:

- 2,955 structures could be inundated during a catastrophic flood.
- The Proposed Project would eliminate flooding for 1,280 of these structures.
- 3,514 acres of land would not be flooded in a major event with the Proposed Project.

under the mid-century scenario for a catastrophic flood. For a late-century catastrophic flood, flooding would be reduced but the airport would still be inundated. The impacts on the airport and transportation are discussed in more detail in Chapter 5.15.

The Applicant's project description included goals to eliminate flooding for 635 structures from a catastrophic flood and to reduce flooding at the Chehalis-Centralia Airport. As described above, the Proposed Project would achieve these goals.

5.7.2.4 Proposed Mitigation Measures

This section describes mitigation measures being proposed for the Applicant to implement that would reduce impacts from construction and operation of the Proposed Project. These mitigation measures would be implemented with, or as part of, the required permits, plans, and approvals described in Section 4.

- **LAND-1:** To remove the inconsistency with land use policies for construction of the FRE facility, mitigation is proposed for the Applicant to coordinate with Lewis County for a rezone of the current Forest Resources Land at the proposed FRE facility and temporary reservoir location or request a conditional use permit to address the inconsistency of the proposed land use within the Forest Resource Lands land use designation and zoning district. For associated forest practices activities, the Applicant will participate in pre-application consultation as provided for in the Forest Practices Rules.
- **LAND-2:** To reduce impacts from construction of the Airport Levee Changes, mitigation is proposed for the Applicant to prepare a hydraulics and hydrology study to determine whether compensatory flood storage would be required commensurate with the amount of fill placed in the floodway or SMP flood course (Lewis County SMP Section 6.03.02 [K]).
- **LAND-3:** The *Water Discipline Report*, Appendix N, identifies the potential for impacts from temporary increased flood elevations immediately upstream and downstream of the levee if the Airport Levee Changes are completed before the FRE facility is operational, which would result in impacts on land uses in those areas. Mitigation is proposed for the Applicant to develop a schedule in which the levee is built during the last part of the FRE facility construction period to eliminate the risk of additional flooding from a catastrophic flood if the Airport Levee Changes are completed before the FRE facility is constructed.

Other Related Mitigation Measures (for details, see Section 5.17)

- FISH-1 (Fish and Aquatic Species and Habitat Plan)
- WATER-1 (Surface Water Quality Mitigation Plan)
- WET-1 (Wetland and Wetland Buffer Mitigation Plan)
- WET-2 (Stream and Stream Buffer Mitigation Plan)
- WILDLIFE-1 (Vegetation Management Plan)

- WILDLIFE-2 (Wildlife Species and Habitat Management Plan)
- WILDLIFE-3 (Riparian Habitat Mitigation Plan)

5.7.2.5 Significant and Unavoidable Adverse Environmental Impacts

There is uncertainty if mitigation is technically feasible and economically practicable; therefore, the Proposed Project would have **significant and unavoidable** adverse environmental impacts on habitat and ecological functions and be inconsistent with land use requirements. The Applicant may provide plans as described above. If the agencies determine the plans meet regulatory requirements and implementation is feasible, then the impacts would be addressed as part of the permitting processes.

5.7.3 Findings for the Local Actions Alternative

Construction

The Local Actions Alternative includes land use management actions that would affect how and where development occurs within the study area. Adoption of new flood data, such as incorporation of floods of record and adoption of updated FEMA floodplain and floodway maps, would change the extent of the regulated floodplain and change how development could occur in the expanded regulated floodplain and floodway areas.

Implementation of higher development and construction standards like higher freeboard requirements would reduce flood risk and damage to structures. Changes to freeboard height requirements to be 3 feet above base flood elevation or flood of record could significantly reduce flood damage to future development. Most of the structures that would be inundated in a major flood and almost half of the structures in a catastrophic flood would experience 3 feet or less of inundation under the No Action Alternative. Changing the freeboard height to 3 feet above base flood elevation would reduce much of the predicted flood damage.

Local actions could result in noise, dust, and access impacts during floodproofing of structures, demolition of buy-out structures, future development, and activities associated with floodplain storage improvements and channel migration protection. Construction impacts of floodplain storage improvements and channel migration protection could include impacts on existing shoreline and critical area ecological functions. Permits would be required for these activities. These adverse impacts would range from significant to minor.

Operation

The Local Actions Alternative includes land use management actions that would have direct effects on how and where development occurs within the study area. Adopting new Flood Insurance Rate Maps would place limits on where development is allowed as well as reducing flood risk to structures. Because these impacts are largely consistent with flood hazard planning and policy documents, the adverse impacts would be moderate to minor. The 2017 Programmatic EIS stated that 75% of the residential structures and 25% of the commercial, industrial, and other non-residential structures in the Chehalis

River floodplain could be protected through elevation, other floodproofing measures, and buy-outs. Floodproofing, buy-outs, and relocations could focus on repetitive loss areas or properties or structures that are at significant risk of flooding. The *Chehalis River Basin Repetitive Flood Loss Strategy* report initiated by the Chehalis Basin Flood Authority in 2014 includes repetitive flood loss area maps based on aggregated data made available to the communities by the National Flood Insurance Program. This analysis could be updated to support a floodproofing, buy-out, and relocation strategy. Floodproofing would protect existing structures at risk of continuous flood damage. Buy-outs and relocations could lead to changes in the existing use and these impacts would be significant to minor.

The Local Actions Alternative also includes elements to improve floodplain storage and provide channel migration protection. Land use impacts from floodplain storage improvements could convert agricultural lands to non-agricultural open space and could change the ownership of riparian areas. Actions such as placing wood in rivers could result in increased periodic flooding of some areas within the floodplain. Land use impacts from floodplain storage improvements are anticipated to be significant to moderate, depending on the acreage needed for floodplain storage improvements.

Channel migration protection structures would reduce bank erosion and channel migration potential, reducing the potential and intensity of flood damage for properties in channel migration areas. Land use impacts from channel migration protection are anticipated to be minor, depending on the location and extent of shorelines that would be protected.

Residences and buildings would continue to experience flood risk under the Local Action Alternative and flood frequency and severity is predicted to increase in the future. The risk would depend on the extent of flooding and changes in land use as people relocate to avoid recurring flood damage.

5.7.4 Findings for the No Action Alternative

Under the No Action Alternative, flooding would continue and would not be significantly reduced. Flood frequency and severity is predicted to increase in the future. Continued flooding could lead to land use conversions or restrictions because existing land uses could become incompatible with areas that experience high amounts of flooding.

Modeling was done to identify impacts on 4,374 buildings under the No Action Alternative. For major floods, 366 buildings would likely be inundated to some level in mid-century and 517 buildings would likely be inundated in late-century. For catastrophic floods, 2,245 buildings would likely be inundated to some level in mid-century and 2,955 buildings in late-century. The EIS Mapbook in Chapter 10 contains maps with more detail on inundation under the No Action Alternative, included in the "Area No Longer Inundated" for the Proposed Project.

Changes in land use patterns could also occur as people relocate to avoid recurring flood damage. Residences and buildings would continue to experience substantial flood risk under the No Action Alternative.

5.8 RECREATION

Recreation provides people with the opportunity to engage with and enjoy both the natural and built environment. In the Chehalis Basin, outdoor recreation is an important aspect of life and provides economic benefits to communities like Chehalis, Centralia, and Pe Ell. Recreational opportunities in the study area include fishing, kayaking, whitewater rafting, hiking, hunting, birdwatching, camping, and agritourism.

The *Recreation Discipline Report*, Appendix J, has the full analysis and technical details used to evaluate recreation in the EIS. This section is a summary of how impacts were evaluated and the key findings. Impacts on fish are described in Section 5.3, and impacts on wildlife are described in Section 5.4.

5.8.1 How Impacts Were Analyzed

The analysis looked at how construction and operation of the FRE facility and Airport Levee Changes could affect recreational opportunities. The study area includes areas used for recreation near the FRE facility and airport levee sites, including the Chehalis River through the FRE facility, temporary reservoir site, and upstream tributaries; and downstream where there could be changes in fisheries.

The existing and potential opportunities for recreation in the study area were identified by reviewing maps, agency websites, and other information sources. For each recreational opportunity identified, information on its type and use was collected from resources such as WDFW recreational fishing data and park websites. Detailed information is in Section 2.2 of Appendix J, *Recreation Discipline Report*. Impacts on recreation were evaluated based on how construction and operation of the Proposed Project and alternatives could disturb or disrupt recreational uses.

Key Findings of the Recreation Analysis

The Proposed Project would cause **significant adverse impacts** on recreation. 13.8 miles of the Chehalis River would no longer be accessible for kayaking and whitewater rafting, and 12.8 miles of riverbank would no longer be available for riverbank fishing.

The Proposed Project would also have **significant adverse impacts** on fish, which would impact recreational fishing by reducing the number of fish available to be caught.

The temporary reservoir area (847 acres) and FRE facility (34.9 acres) would not be open to the public so this area would no longer be accessible for hunting, camping, and other activities. The loss of access to recreational activities in the temporary reservoir area within the Pe Ell South Permit Area would be a **moderate adverse impact**.

The significant impacts on recreation and fish would be **unavoidable** unless the Recreation Mitigation Plan and other mitigation plans meet regulatory requirements and implementation is feasible.

The Proposed Project would reduce flood depths and durations at many downstream recreational facilities but many would still remain flooded. The degree of reduction would vary by flood scenario and location.

5.8.2 Findings for the Proposed Project

5.8.2.1 Impacts From the Flood Retention Facility

Permanent Loss of Recreational Use Around the FRE Facility Site

The FRE facility site is on private land currently owned by Weyerhaeuser and the Panesko Tree Farm. Weyerhaeuser sells recreational access permits for hunting, fishing access, and camping on its lands. The FRE facility site is in the Pe Ell South Permit Area, one of eight permit areas in the state. The Pe Ell South Permit Area encompasses 98,049 acres. For 2015 to 2016, 550 permits were sold for the Pe Ell South Permit Area. Weyerhaeuser sold all of the motorized and non-motorized permits available for sale in the Pe Ell South Permit Area for the recreation year of August 2018 through July 2019. These permits allow access to areas and opportunities to hike, horseback ride, mountain bike, hunt, and fish. They permit the taking of firewood, berries, and mushrooms for personal use. The motorized permit allows entrance into the permit area with a licensed vehicle and for overnight camping. Exhibit 5.8-1 shows the Pe Ell South Permit Area.

The FRE facility site and the temporary reservoir area would be acquired from Weyerhaeuser and would no longer be open for recreational use. This would reduce the portion of the Pe Ell South Permit Area that is accessible to recreationists for hunting, camping, and other activities by 847 acres for the temporary reservoir and 34.9 acres for the FRE facility. While other parts of the permit area provide similar recreational experiences, some recreationists may choose not to use these nearby areas. This permanent loss of access in a portion of the Pe Ell South Permit Area would be a moderate adverse impact.

Loss of Use of a Section of the Chehalis River for In-Water Recreation

The section of the Chehalis River where the proposed FRE facility site and temporary reservoir is located is listed as a Class III to IV whitewater area by the American Whitewater Association. Construction and operation of the FRE facility would permanently close use of this 13.8-mile reach of the Chehalis River to kayakers and whitewater rafters. It would also eliminate riverbank fishing on about 6.4 miles of the Chehalis River, which includes 12.8 miles of bank access. Exhibit 5.8-1 shows this reach of the Chehalis River. This change to recreation use in the area is considered a significant adverse impact because of the permanent loss of these areas of the Chehalis River for in-water recreation. Mitigation is proposed for the Applicant to develop and implement a Recreation Mitigation Plan to address these impacts, but at this time it is not certain the plan is feasible. The plan must be approved by applicable agencies.

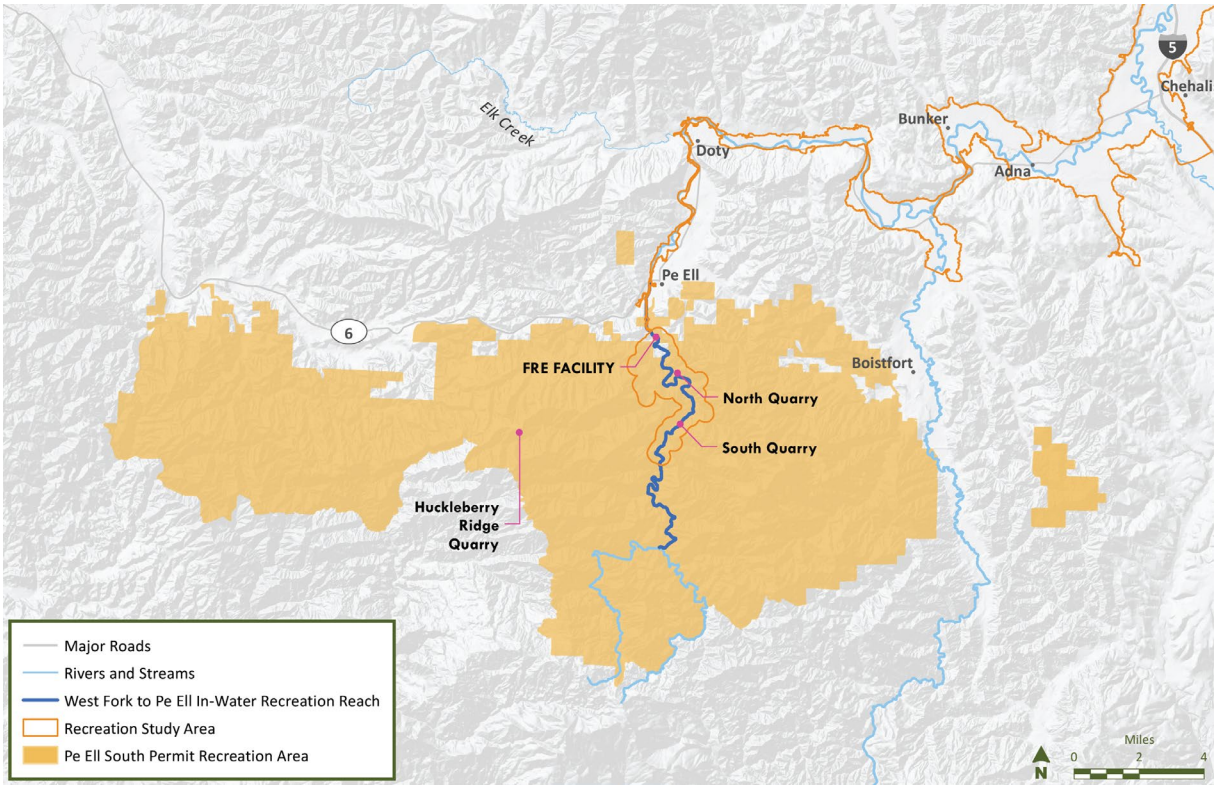
Change in Recreational Character

The FRE facility would permanently change the recreational character of the surrounding area. The adverse impacts on the visual quality of the area are described in Section 5.16. Impacts would be moderate due to the location and that visual changes would be noticeable to recreationists using the area around the facility.

Impacts on Recreational Fishing

Fishing is a major recreational use in the Chehalis River and its tributaries. For the 2016 fishing season for the Chehalis River, 2,001 Chinook, chum, and coho salmon and 529 steelhead were caught. WDFW monitors the freshwater salmon sport catch in the Chehalis River system and its tributaries. As described in Section 5.3, Fish Species and Habitat, the FRE facility would have significant impacts on fish, which in turn would affect recreational fishing by reducing the number of fish available to be caught. Impacts on recreational fishing would be significant based on the fish species analysis in Section 5.3. Mitigation is proposed for the Applicant to develop and implement a Fish and Aquatic Species and Habitat Management Plan and a Recreation Mitigation Plan to address these impacts, but at this time it is not certain the plans will be feasible. The plans must meet regulatory requirements and be approved by applicable agencies.

Exhibit 5.8-1
Pe Ell South Permit Recreation Area



Reductions in Flooding and Flood Levels at Parks

Many state, county, and city parks are adjacent to the Chehalis River and its tributaries. County and city parks adjacent to the Chehalis River and its tributaries range from small neighborhood parks to large recreation areas.

The FRE facility would reduce flood inundation levels from the Chehalis River headwaters for downstream recreational facilities for major floods or larger. The degree of reduction in inundation would vary by flood scenario and location. The EIS Mapbook in Chapter 10 includes detailed maps with flood elevations. While the Proposed Project would reduce the flood levels at recreational facilities for major or catastrophic floods, most sites would still be inundated to some degree. For a late-century catastrophic flood, the Proposed Project would result in changes in flood levels for these sites:

- Riverside Golf Course and RV Park (in Chehalis) would have a 1.1-foot reduction but would still be flooded with 4 feet of water.
- Southwest Washington Fairgrounds would have a 3.1-foot reduction but would still be flooded between 5 and 25 feet.
- Fort Borst Park (Centralia) would have a 2.1-foot reduction but would still be flooded with around 4 feet of inundation.
- Vance Creek Park (Elma) would have a 1.1-foot reduction but would still be flooded with around 3.1 feet of inundation.
- Rainbow Falls State Park would not be flooded under either the No Action Alternative or the Proposed Project.

5.8.2.2 Impacts From the Airport Levee Changes

Temporary Impacts on Riverside Golf Course and RV Park

The airport levee is near the privately owned Riverside Golf Course, which is open to the public. The golf course is between the Chehalis-Centralia Airport and the Chehalis River. The golf course includes a clubhouse structure and the Riverside RV Park. Construction of the Airport Levee Changes would last for up to 1 year, and recreational users of the golf course and RV Park would notice increased noise and dust from construction. Construction traffic would likely cause delays in getting to the golf course and RV Park. If equipment areas were on the Riverside Golf Course and RV Park property, parking for golf course users or for RVs would be limited during the construction period. Construction impacts on the Riverside Golf Course and RV Park would be minor because they would be temporary and limited to the construction period. No recreational impacts are expected from operation of the levee.

Temporary Closure of the Airport Levee Trail

The top of the airport levee has a gravel surface and is generally 15 to 20 feet wide, although the width varies from 10 to 45 feet across the length of the levee. The levee is used as an informal walking trail and is accessible from several points, including a staircase across the street from the entrance to the Riverside Golf Course. The trail along the top of the levee is about 1.75 miles long. The trail on top of the airport levee would be closed to recreationists during the 1-year construction period. This adverse impact would be minor because the impact would be temporary and limited to the construction period, and recreational users could access other nearby walking trails during that time. The closure of the airport levee trail could increase foot traffic on other local trails in the area during construction, which

would be a minor adverse impact. The trail would reopen after construction so there are no impacts during operation of the levee.

5.8.2.3 Proposed Mitigation Measures

This section describes mitigation measures being proposed for the Applicant to implement that would reduce impacts from construction and operation of the Proposed Project. These mitigation measures would be implemented with, or as part of, the required permits, plans, and approvals described in Section 4.

- **REC-1 (Recreation Mitigation Plan):** To reduce impacts on recreational users from construction and operation of the Proposed Project, mitigation is proposed for the Applicant to develop a Recreation Mitigation Plan to identify and implement potential mitigation. Lewis County Parks and Recreation Department and WDFW will review the plan.

Other Related Mitigation Measures

- FISH-1 (Fish and Aquatic Species and Habitat Plan)

5.8.2.4 Significant and Unavoidable Adverse Environmental Impacts

There is uncertainty if mitigation is technically feasible and economically practicable; therefore, the Proposed Project would have **significant and unavoidable** adverse environmental impacts on recreation, as follows:

- Eliminate a 13.8-mile reach for kayaking and whitewater rafting on the Chehalis River within the FRE facility site and temporary reservoir
- Eliminate 12.8 miles of riverbank fishing on the Chehalis River within the FRE facility site and temporary reservoir
- Reduction in fish available for recreational fishing in the Chehalis River

The Applicant may provide a Recreation Mitigation Plan and other mitigation plans as described above. If the agencies determine the plans address the significant adverse impacts and implementation is feasible, then the impacts would be addressed as part of implementation of the plan.

5.8.3 Findings for the Local Actions Alternative

Construction activities for local actions could occur at or near recreational facilities such as parks, and people could experience noise, dust, and access issues. If construction activities took place at a park, the park or portions of the park could be closed during construction. Because construction would be temporary and short term, these adverse impacts would range from moderate to minor, depending on the location.

As described in Section 5.3, Fish Species and Habitat, the Local Actions Alternative would have minor impacts on fish, which in turn could affect recreational fishing. Impacts on other recreational

opportunities from operation of the Local Actions Alternative are not likely. If local actions such as floodproofing were applied to recreational facilities, they would reduce flood damage to those facilities during flooding. This could include installing farm pads to provide high ground to protect livestock and equipment at agricultural operations used for agritourism. Under the Local Actions Alternative, recreational facilities throughout the study area would continue to experience substantial flood risk. Floods would continue to affect structures and facilities within recreation areas where local actions are not applied.

5.8.4 Findings for the No Action Alternative

Under the No Action Alternative, impacts on recreation from the construction or operation of the Proposed Project would not occur. Flooding at parks and other recreational facilities throughout the study area would not be substantially reduced for all areas through implementation of actions included in the No Action Alternative. Flood frequency and severity is predicted to increase in the future. Recreational facilities throughout the study area would continue to experience substantial flood risk. Floods would continue to affect structures and facilities within recreation areas, and access roads and bridges to recreational facilities (such as Rainbow Falls State Park and the Willapa Hills State Park Trail) would remain at risk of being damaged by floodwaters. Floods would continue to displace recreational uses until floodwaters recede and could cause long-term damage and loss of access.

5.9 CULTURAL RESOURCES

Cultural and historic resources include archaeological sites, historic properties and structures, human remains and cemeteries, and Traditional Cultural Properties. The *Cultural Resources Discipline Report*, Appendix B, has the full analysis and technical details used to evaluate cultural resources in the EIS.

This section is a summary of how impacts were evaluated and the key findings. Impacts on tribal resources are described in Section 5.6, Tribal Resources.

5.9.1 How Impacts Were Analyzed

The analysis looked at how construction and operation of the FRE facility and Airport Levee Changes could affect historic and cultural resources. The study area includes the FRE facility area, quarries, roads, the temporary reservoir area, the airport levee area, and the Chehalis River downstream of the FRE facility to near Montesano. Construction or operation of the Proposed Project could impact cultural resources by removing or disturbing the ground, changing the setting, or exposing sites to noise, dust, and vibration.

The federal Section 106 process under the National Historic Preservation Act is used to consider how historic and cultural resources are affected by a proposal. As part of the process, resources are determined to be eligible to be listed or not. If they are eligible, then the process determines if the impacts are adverse or not. The Corps is the lead for the Section 106 review and the review includes the Chehalis Tribe, the Quinault Indian Nation, other affected tribes, DAHP, and the Applicant as part of this process. A Memorandum of Agreement would be developed for mitigation and treatment of any adverse impacts. The Section 106 process started in 2018 and is still ongoing as of February 2020. The SEPA EIS does not make any determinations of significance or propose any mitigation for cultural resources because that is decided as part of the Section 106 process.

Key Findings of the Cultural Analysis

Cultural and historic resources are considered through the Section 106 process of the National Historic Preservation Act. For the Proposed Project, this process is being led by the Corps and includes the Chehalis Tribe, the Quinault Indian Nation, other affected tribes, DAHP, and the Applicant. The Section 106 process is still ongoing as of February 2020.

Construction of the FRE facility would affect four recorded archaeological sites and operation of the temporary reservoir could affect nine recorded archaeological sites. Construction of the Airport Levee Changes could affect eight recorded archaeological sites. Traditional Cultural Properties may also be affected.

No determination of eligibility or adverse effects has been made yet for potential impacts from the Proposed Project. As part of the Section 106 process, if there are adverse effects to cultural resources, an MOA would be negotiated among the Corps, DAHP, potentially affected Native American tribes, the Applicant, and other Section 106 parties. The MOA would determine mitigation and treatment requirements through the Section 106 process of the National Historic Preservation Act.

Studies and historical data were used to provide information on archaeological sites, historic structures, cemeteries, and Traditional Cultural Properties. The DAHP Statewide Predictive Model was used to see where archaeological sites might be located. In 2018, as part of the Section 106 process, field work was done to identify archaeological sites in the FRE facility area and airport levee area. A visual survey was done every 100 feet to identify possible sites, and then shovel probes were done to look below the surface. 810 shovel probes were done in the FRE facility area. In the levee area, a visual survey was done every 65 feet to identify possible sites, and 25 shovel probes were done.

As part of the Section 106 process, a Traditional Cultural Properties initial report was done to provide information on potentially eligible Traditional Cultural Properties within the study area. This report identifies sites as of possible interest to tribes. Consultation with the tribes is ongoing. Additional work is being conducted as part of the Section 106 process with the Corps, DAHP, the Confederated Tribes of the Chehalis Reservation, Chinook Indian Nation, Cowlitz Indian Tribe, Nisqually Indian Tribe, Quinault Indian Nation, and Shoalwater Bay Indian Tribe. The Traditional Cultural Properties discussed in this analysis include the following:

- City of Chehalis General Area, including the airport levee site
- Rainbow Falls General Area
- Pe Ell General Area
- Hiding Place of xʷani
- Chehalis River General Area

5.9.2 Findings for the Proposed Project

5.9.2.1 Impacts From the Flood Retention Facility

Archaeological Sites

The field survey found 13 recorded archaeological sites (45-LE-978 to 45-LE-990) in the FRE facility and temporary reservoir area:

- Six precontact archaeological sites (45-LE-978, 45-LE-980, 45-LE-981, 45-LE-986, 45-LE-987, and 45-LE-990)
- Two historic archaeological sites (45-LE-979 and 45-LE-982)
- One multi-component (both historic and precontact) site (45-LE-989)
- Three precontact isolates (45-LE-983, 45-LE-985, and 45-LE-988)
- One historic isolate (45-LE-984)

Construction of the FRE facility could directly affect four archaeological sites (45-LE-978 to 45-LE-981) in the footprint of the proposed FRE structure, staging, or stockpile areas. Work like grading and filling at these areas would likely partially or completely destroy these archaeological sites. Operation of the temporary reservoir during floods could affect nine recorded archaeological sites (45-LE-982 to 45-LE-990). These sites could be affected by inundation, increased erosion, burial beneath sediments or landslides,

and faster destruction of artifacts from more changes from wet to dry conditions when the reservoir fills and empties.

The eligibility of these sites to be included in the National Register of Historic Places is being discussed through the Section 106 process. If the resources are found to be eligible, potential impacts will be reviewed, significance determined, and mitigation agreed upon through the Section 106 process.

The DAHP Statewide Predictive Model classifies the steep slopes above the Chehalis River and the quarries as areas of Low to Moderate Risk. Flat areas next to the river channels are classified as Moderate to Very High Risk. So it is likely there are more undiscovered archaeological sites in the FRE facility area. Construction and operation of the FRE facility could also affect these unrecorded sites.

Traditional Cultural Properties

Construction and operation of the Proposed Project could affect Traditional Cultural Properties. Work like grading and filling would partially or completely affect Traditional Cultural Properties. Traditional Cultural Properties noted in Section 5.9.1 are being studied as part of the Section 106 process. If they are found to be eligible, potential impacts will be reviewed, significance determined, and mitigation agreed upon through the Section 106 process.

5.9.2.2 Impacts From the Airport Levee Changes

The DAHP Statewide Predictive Model classifies the airport levee area as Very High Risk for archaeological sites. The field survey found eight recorded archaeological sites (45-LE-194, 45-LE-978, 45-LE-981, 45-LE-982, 45-LE-986, 45-LE-987, 45-LE-989, and 45-LE-990) in the airport levee area.

- Six precontact archaeological sites (45-LE-116, 45-LE-187, 45-LE-290, 45-LE-796, 45-LE-803, and 45-LE-825)
- Two multi-component (both historic and precontact) sites (45-LE-194 and 45-LE-511)
- One precontact isolate (45-LE-789)
- One historic isolate (45-LE-787)

Depending on specific construction locations and methods, construction could directly affect none, some, or all of the recorded archaeological sites and isolates adjacent to or beneath the levee. Potential impacts on eligible and potentially eligible archaeological resources will be reviewed, determined, and mitigation agreed upon through the Section 106 process.

The airport levee was determined to be eligible for listing in the National Register of Historic Places in 2008 and has been recommended eligible for listing in the National Register of Historic Places. Potential impacts will be reviewed, significance determined, and mitigation agreed upon through the Section 106 process.

Construction of the Airport Levee Changes could affect Traditional Cultural Properties. Work like grading and filling would partially or completely affect Traditional Cultural Properties. The Traditional Cultural Properties noted in Section 5.9.1 are being studied as part of the Section 106 process. If they are found to be eligible, potential impacts will be reviewed, significance determined, and mitigation agreed upon through the Section 106 process.

5.9.2.3 Changes in Inundation

The Proposed Project would reduce the flood levels downstream of the FRE facility during major and catastrophic floods. In general, this would reduce erosion, burial, and damage of archaeological sites downstream. 149 archaeological sites, 28 historic register properties, and 16 cemeteries downstream of the FRE facility are susceptible to major and catastrophic floods. Operation of the Proposed Project would reduce the frequency and magnitudes of major and catastrophic floods and reduce bank erosion. This would reduce the likelihood of damage or destruction of these resources by flooding.

Rainbow Falls is a culturally significant location that has been documented in ethnographic studies and oral traditional stories. The area is associated with several meanings and uses, including use as a setting for a traditional story, a Salish place name, and a residential site. It is connected to the harvest of lamprey and traditional economy. As described in Section 5.3, Fish Species and Habitats, the Proposed Project would have a significant adverse impact on Pacific lamprey due to reduced movement to upstream habitat, reduced spawning habitat, lower summer flows, and warmer water temperatures. Operation of the Proposed Project could affect Traditional Cultural Properties downstream of the FRE facility. The Traditional Cultural Properties noted in Section 5.9.1 are being studied as part of the Section 106 process. If they are found to be eligible, potential impacts will be reviewed, significance determined, and mitigation agreed upon through the Section 106 process.

5.9.2.4 Proposed Mitigation Measures

No determination of eligibility or adverse effects has been made yet for the potential impacts described above. As part of the Section 106 process, if there are adverse effects to cultural resources, a Memorandum of Agreement would be negotiated among the Corps, DAHP, potentially affected Native American tribes, the Applicant, and other Section 106 parties. The Memorandum of Agreement would determine mitigation and treatment requirements through the Section 106 process of the National Historic Preservation Act. The Section 106 process is ongoing; therefore, determination of adverse effects and mitigation measures are not discussed in this Draft EIS.

5.9.2.5 Significant and Unavoidable Adverse Environmental Impacts

No determination has been made because the Section 106 process is ongoing.

5.9.3 Findings for the Local Actions Alternative

Construction activities for local actions could occur within recorded and unrecorded archaeological sites, or in or near historic properties, cemeteries, and Traditional Cultural Properties. These could be temporarily affected due to change in access as well as noise, vibration, and dust during construction. These resources could be affected permanently due to changes in access and setting. For any of these activities, potential impacts, eligibility, significance, and mitigation would be identified during required federal or state processes for historic and cultural resources. Flooding would likely not be significantly reduced through local actions. Historic and cultural resources throughout the study area would continue to experience substantial flood risk.

5.9.4 Findings for the No Action Alternative

Under the No Action Alternative, flooding would not be significantly reduced and flood frequency and severity is predicted to increase in the future. Floods would continue to inundate historic and cultural properties. Historic and cultural resources throughout the study area would continue to experience substantial flood risk.

5.10 ENVIRONMENTAL HEALTH AND SAFETY

Environmental health and safety concerns for the EIS include hazardous materials, contaminants, earthquakes that could cause a failure of the FRE structure, and impacts on emergency services. These could affect the health and safety of people, the environment, infrastructure, livestock, and buildings. Hazardous materials and pollutants can contaminate flood waters. In past floods, fuel, propane, paint, and other materials were released and affected communities and the environment.

The *Environmental Health and Safety Discipline Report*, Appendix C, has the full analysis and technical details used to evaluate environmental health and safety in the EIS. This section summarizes how impacts were evaluated and the key findings. Impacts on emergency response are described in Section 5.14, Public Services and Utilities; impacts on water quality are discussed in Section 5.1, Water; and earthquake risks are discussed in Section 5.2, Earth.

Key Findings of the Environmental Health and Safety Analysis

While very unlikely, if ground shaking from a large earthquake damaged the FRE structure while the temporary reservoir is holding water, the impacts would be **significant and unavoidable.** This would cause loss of human life; loss and damage of public infrastructure; and extensive damage to private properties, livestock, buildings, and the environment.

Construction and operation of the Proposed Project could cause possible spills of oil or hazardous materials and discharge of contaminated water. Required permits and plans would reduce these impacts and these would be **moderate to minor adverse impacts** on environmental health and safety. Emergency services could be affected by construction traffic but the impact would be **minor**.

5.10.1 How Impacts Were Analyzed

The analysis looked at how construction and operation of the FRE facility and Airport Levee Changes could affect environmental health and safety in the study area. The study area included the FRE facility and temporary reservoir areas, the airport levee, and downstream areas of likely inundation during a major or catastrophic flood.

Contaminated sites were identified using Ecology and U.S. Environmental Protection Agency databases. The analysis looked at facilities that could be affected by operations of the Proposed Project and by construction activities that could come into contact with contaminated soil or groundwater. A Geographic Information Systems (GIS) map was used to show levels of flooding for the Proposed Project and alternatives under different scenarios. Calculations and modeling were done to evaluate impacts from a possible FRE gate failure or FRE facility breach from ground shaking during an earthquake.

Federal, state, and local regulations require actions and plans to reduce the risks to environmental health and safety. These include federal and state dam safety requirements for designing the FRE facility, plans for operations and maintenance, and an Emergency Action Plan. There are many federal and state requirements for hazardous materials, including the Resource and Conservation and

Recovery Act, the Clean Water Act, and state spill and pollution regulations for planning and response actions.

5.10.2 Findings for the Proposed Project

5.10.2.1 Impacts From the Flood Retention Facility

Potential FRE Facility Failure From an Earthquake

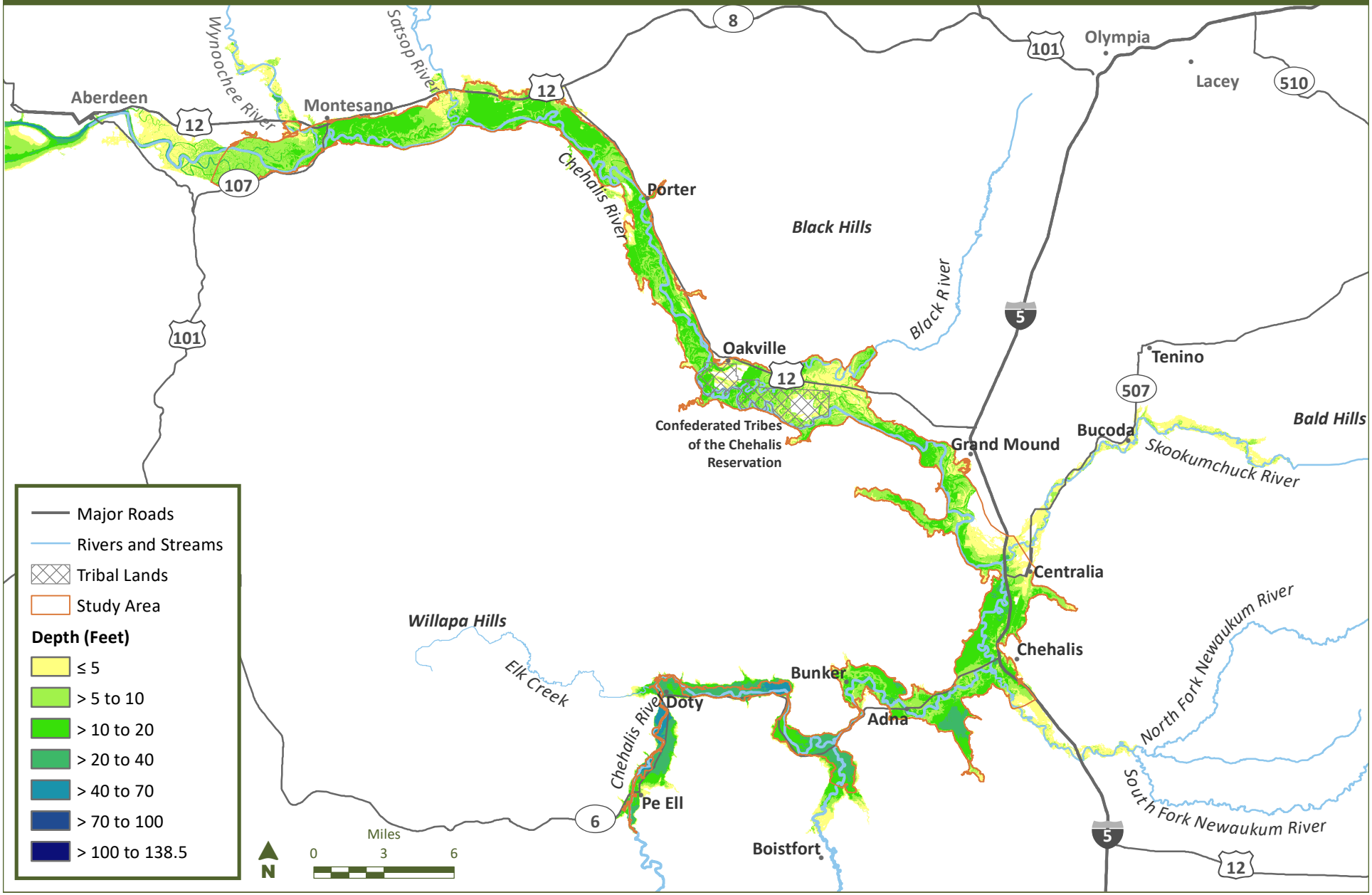
The design of the FRE facility must follow Washington dam safety guidelines for safe construction and operation. This includes designing the FRE facility to withstand earthquakes. However, failures like an outlet gate not opening or closing, or the failure (breach) of the flood retention structure, could occur.

An earthquake on the Cascadia Subduction Zone or the Doty Fault Zone could damage the facility. Section 5.2, Earth, evaluates the potential for an earthquake to affect the FRE site. The primary risks from earthquakes for the FRE facility are from ground motion and a fault rupture. A seismic hazard analysis identified the potentially active faults near the site, and a preliminary structural seismic analysis evaluated the potential effects on the structure design. The analysis considered possible ground motion caused by earthquakes for a 2,475-year return period as well as other return periods ranging from 500 to 10,000 years. The study found the most likely earthquake that could affect the FRE structure is the 8.9 Cascadia Subduction Zone event.

After an earthquake, the FRE facility would be inspected. If any damage occurs and there is no water in the reservoir, there would be no impact downstream and the FRE facility would be repaired to meet dam safety requirements. However, if the FRE facility experienced major damage at the same time the temporary reservoir is full or almost full, there is a very small chance the FRE facility could fail. The chance of a large earthquake happening while the reservoir is holding water is 1 in 2.5 billion. If this happened, it is possible an FRE facility break or failure could develop within a relatively short time and the water in the reservoir would be released almost immediately. This would cause catastrophic downstream flooding and put people in danger. The release of water from the FRE facility break would travel as an impulse wave downstream, followed by gradually reducing flood levels (Exhibit 5.10-1). This model did not include analysis with topography, so the estimates are conservative.

The potential consequences of an FRE facility break or failure include loss of human life, loss and damage of public infrastructure, and extensive damage to private properties and the environment. The risk to people and amount of damage to structures, properties, and infrastructure from this breach would be significant.

Exhibit 5.10-1
Modeled Downstream Extent of Catastrophic Failure



Under state and federal rules, the Applicant will be required to develop an Emergency Action Plan for this possible event. Mitigation has been added for the Applicant to develop and put in place a breach flood warning system for Pe Ell, Centralia, and Chehalis. Ecology's Dam Safety Office and Lewis County emergency response agencies would review this system. Mitigation has also been added for the Applicant to provide training to local emergency response organizations for breach scenarios as part of the Emergency Action Plan. The Applicant would also provide educational outreach to residents, schools, and critical facilities like hospitals on how to respond in the case of a breach that releases water.

Although the likelihood of a catastrophic FRE facility failure occurring while the temporary reservoir is full or mostly full is extremely low, there are no mitigation measures that could completely eliminate the possibility of an incident or the resulting impacts. Therefore, the results of such an event would be considered a significant and unavoidable adverse impact.

Exposure to Hazardous Materials and Contaminants

There are many hazardous material sites in the study area, like gas stations and hazardous material storage sites. There are also 10 dangerous waste generators located in Chehalis and Centralia and two Superfund sites. The Centralia Wastewater Treatment Plant, Chehalis Regional Water Reclamation Facility, and Centralia Municipal Landfill are also in the study area.

Construction workers at the FRE facility could come into contact with solvents and petroleum products, such as diesel and gasoline, or there could be spills of these materials. Aboveground storage tanks with more than 1,320 gallons of oil would be used for construction. Spill prevention would be required for these tanks. State and federal laws regulate the transport, use, and disposal of oil and hazardous materials. For an oil or hazardous material spill, emergency actions would be required under federal and state law to contain and clean up the spill. The adverse impacts from spills of oil or hazardous material to people or the environment from construction of the FRE facility are anticipated to be minor.

A concrete plant at the FRE site could release high-pH discharges to streams or rivers, changing their pH levels. This activity, and other construction work, would require a NPDES Construction Stormwater Permit. This permit requires any releases to water to meet water quality standards. In addition, local land use and development permits would be issued by Lewis County with restrictions for releasing contaminants. With these required permits, wastewater and stormwater from the construction site would have moderate to minor adverse impacts on environmental health.

Potential for Emergency Service and Response Disruption

Daily traffic along South 3rd Street/Muller Street in Pe Ell is anticipated to increase by less than 20% during construction of the FRE facility. This impact is evaluated in detail in Section 5.15, Transportation. It found the increased traffic volume during construction would not likely affect emergency vehicle delays and safety. So impacts on emergency service and response would be minor.

Changes in Downstream Flooding Affecting Environmental Health and Safety

The operation of the FRE facility would reduce the severity of flooding in parts of the study area during a major or catastrophic flood, which would likely reduce the need for emergency response services in those areas. The reduction in flood levels would improve access and safety for emergency responders along those roads. The risk of contaminating waters by the release of hazardous materials would be less, so the potential for public exposure to hazardous materials and any health and safety effects would be less. Operations of the FRE facility would not greatly reduce the risk of contaminating drinking water wells. Most areas using wells would continue to be inundated during mid- and late-century major or catastrophic floods. Reducing the depth or duration of inundation would not prevent groundwater contamination because contamination could occur with any amount of inundation.

There are multiple sites containing contaminated soils and groundwater or storing hazardous materials in the study area. Most of these sites are associated with gas stations or other vehicle facilities, and most of the contaminants are petroleum or similar products. The sites are generally clustered around cities and towns in the study area and along major roads. Any contaminated site or facility that stores hazardous materials and chemicals has the potential to contaminate floodwaters. While floodwaters could release contaminants, the FRE facility would either reduce water levels or cause no changes to water levels at the identified hazardous materials sites. Therefore, the operation of the FRE facility would have no adverse impacts on hazardous material sites.

5.10.2.2 Impacts From the Airport Levee Changes

Exposure to Hazardous Materials

Construction workers at the FRE facility could come into contact with solvents and petroleum products, such as diesel and gasoline, or there could be spills of these materials. As explained in Section 5.10.2.1 above, safety measures are required under state and federal laws to control the routine transport, use, and disposal of hazardous materials during construction. In the event of an oil or hazardous material spill, emergency actions would be required under state law to contain and clean up the spill. Impacts on environmental health and safety from the construction of the Airport Levee Changes would be minor.

Potential for Emergency Service and Response Disruption

Modeling shows the Airport Levee Changes would reduce inundation levels and time the Chehalis-Centralia Airport would be closed in a catastrophic flood, allowing the airport to function and provide emergency response for longer periods. There would be no adverse impacts as a result of the Airport Levee Changes, but the overall area would continue to experience impacts from flooding and the Chehalis-Centralia Airport would continue to be closed during certain floods.

5.10.2.3 Proposed Mitigation Measures

This section describes mitigation measures being proposed for the Applicant to implement that would reduce impacts from construction and operation of the Proposed Project. These mitigation measures

would be implemented with, or as part of, the required permits, plans, and approvals described in Section 4.

- **EHS-1:** To reduce impacts on emergency services and response, mitigation is proposed for the Applicant to coordinate construction activities with emergency service providers, schedule construction to minimize impacts, and notify the public of construction that will reduce service response delays related to traffic and activities.
- **EHS-2:** To reduce impacts on emergency services and response, mitigation is proposed for the Applicant to develop Construction Traffic Control Plans for the FRE facility and levee construction work.
- **EHS-3:** To improve emergency response, mitigation is proposed for the Applicant to develop and implement a breach flood warning system for Pe Ell, Centralia, and Chehalis. The breach flood warning system would be a staged system, with alerts and responses becoming more urgent as the potential for a breach becomes more severe. The initial stage may begin with notifications to local officials, eventually proceeding to full-scale evacuations. For a fast-developing breach scenario, with little warning time, alert sirens may be an option. This system will be reviewed by Ecology's Dam Safety Office and Lewis County emergency response agencies.
- **EHS-4:** To improve emergency response, mitigation is proposed for the Applicant to provide training to local emergency response organizations on breach scenarios in the Emergency Action Plan. This also includes providing educational outreach for downstream residents, schools, and critical facilities on how to respond to a rapidly developing breach.

5.10.2.4 Significant and Unavoidable Adverse Environmental Impacts

Although the likelihood is extremely low that a catastrophic FRE facility failure resulting from an earthquake would occur while the reservoir is storing water, there are no mitigation measures that would completely eliminate the possibility of an incident or the resulting impacts. Therefore, the potential for a catastrophic FRE facility failure in the event of an earthquake while the reservoir is full is considered a significant and unavoidable adverse impact on people, infrastructure, structures, and the environment downstream.

5.10.3 Findings for the Local Actions Alternative

Construction activities for local actions could expose construction workers to contaminants and hazardous materials. Construction would be temporary and impacts would range from moderate to minor. The level would depend on how close the contaminated site is, the type of hazardous material being used, and for how long.

Floodproofing residences and commercial buildings could reduce floodwater contamination by hazardous materials. Regulatory standards that minimize new development in the floodplain would reduce risks to public safety and potential impacts on emergency services. Improvements to the flood warning system would improve forecasts and increase the time for flood warning and preparation.

Floodplain storage and channel migration improvements would reduce flood levels. However, environmental health and safety resources would continue to experience substantial flood risk under the Local Action Alternative.

5.10.4 Findings for the No Action Alternative

Under the No Action Alternative, flooding would continue and would not be significantly reduced and flood frequency and severity is predicted to increase in the future. Inundation of facilities with hazardous materials could contaminate floodwaters. Flooding along public roadways and at critical facilities would not be reduced. Environmental health and safety resources would continue to experience substantial flood risk under the No Action Alternative.

5.11 AIR QUALITY AND GREENHOUSE GASES

Air quality refers to the condition of the breathable air and the presence of pollutants. Pollutants can be local and affect a small area, and regional, such as ozone. These are regulated under state and federal laws. Gases that trap heat in the atmosphere are referred to as greenhouse gases (GHGs) because they capture heat radiated from the sun as it is reflected back into the atmosphere, like a greenhouse does. The accumulation of GHGs contributes to global climate change, which affects people and the environment.

The *Air Quality and Greenhouse Gas Discipline Report*, Appendix A, has the full analysis and technical details used to evaluate air quality and GHGs in this EIS. This section summarizes how impacts were evaluated and presents the main findings of the analysis. Climate change impacts from increasing GHGs have been included in the future conditions for all relevant resource areas analyzed in this EIS and are described in Section 3.3, Climate Change Analysis.

Key Findings of the Air Quality and Greenhouse Gas Analysis

Total GHG emissions associated with construction and operation of the FRE facility and the Airport Levee Changes would be 123,439 metric tons. The emissions include if trees removed from the temporary reservoir are burned, which would also cause carbon monoxide emissions. The impacts of GHG emissions would be **significant adverse impacts**.

A plan is proposed for the Applicant to mitigate for 100% of the GHG emissions. To reduce carbon monoxide and GHG emissions, a measure is proposed for the trees removed from the reservoir area to be used and not burned.

Emission of criteria and toxic air pollutants from construction and operation and GHG emissions from operation of the Proposed Project would be below federal and state limits and have **minor** or **no adverse impact**.

5.11.1 How Impacts Were Analyzed

The analysis looked at how construction and operation of the FRE facility and Airport Levee Changes could affect air quality and contribute to GHG emissions. The study area includes the area in and near the FRE facility and airport levee sites, and the areas associated with construction. Construction emissions were estimated using information from the Applicant's project description and comparisons from other projects of similar size and type. Federal guidance and models for air quality, diesel particulate matter, and GHG emissions were used to evaluate impacts.

The American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) atmospheric dispersion modeling system was used to estimate pollutant exposures from equipment engine emissions to assess health and cancer risks. Air emissions, concentrations, and risk calculations are in Attachment A-1 of the *Air Quality and Greenhouse Gas Discipline Report,* Appendix A.

Air quality is generally good in the study area during most of the year. Air pollution does occasionally reach moderately unhealthy levels, typically during strong temperature inversions in late fall and winter. The study area is located in Lewis County, which meets air quality standards.

Construction equipment and motor vehicles burn fossil fuels. The main pollutants emitted from these are carbon monoxide, particulate matter, chemicals that contribute to ozone formation, GHGs, and toxic air pollutants. Federal and state agencies regulate these pollutants and set limits for emissions.

The analysis also considered applicable laws and policies on air quality and GHG. The U.S. Environmental Protection Agency, Ecology, and the Southwest Clean Air Agency each has its own role in regulating air quality. Laws and guidelines that apply include the federal Clean Air Act, National Ambient Air Quality standards, multiple Washington State laws, and Southwest Clean Air Agency regulations.

5.11.2 Findings for the Proposed Project

5.11.2.1 Impacts From the Flood Retention Facility

Air Pollutants

Air emissions for construction activities for the FRE facility include:

- Use of off-road equipment to construct the FRE facility and the Airport Levee Changes
- Use of off-road vehicles to transport quarried materials to the processing and batch plant area
- Use of on-road vehicles to move materials and for construction worker commutes
- Quarrying, rock processing, and concrete production
- Tree removal in the FRE temporary reservoir area
- Land clearing
- Stockpiling, handling, processing, and removal of materials

For the analysis, the limits for an area not meeting air quality standards were used for comparison in the analysis, even though Lewis County does meet air quality standards. This provided a conservative threshold for the analysis. The total emissions of sulfur oxides, particulate matter, and chemicals that contribute to ozone formation would be less than the limit of 100 tons per year and would have a minor impact.

The Applicant has not stated how trees removed from the temporary reservoir would be used. The analysis used a worst case assumption that the removed trees would be burned. If cleared logs are burned, emissions of carbon monoxide would exceed the reference threshold and be a moderate impact. A mitigation measure has been added to reduce emissions of carbon monoxide by using the timber instead of burning it; for example, for restoration projects in the Chehalis River. With this mitigation measure, the carbon monoxide emissions would be below the threshold of 100 tons per year. An Air Discharge Permit and Permit for Nonroad Engines would be required by the Southwest Clean Air Agency for FRE facility construction and would likely include measures to reduce air pollutant emissions.

Exposure of the temporary reservoir area where trees are removed would result in windblown dust. The Applicant intends to replant scrub-shrub vegetation in these areas, which would likely reduce the amount of erosion and dust. Equipment use and vehicle trips associated with regular maintenance and operation of the FRE facility would be another source of pollutant emissions. The calculated emissions from windblown dust and equipment and vehicles for maintenance and operation activities would be less than the threshold of 100 tons per year, and would be a minor impact for criteria air pollutants.

Toxic Air Pollutants

Construction would involve the use of mostly diesel-powered construction equipment, which creates diesel particulate matter. Ecology has identified diesel particulate matter as the toxic air pollutant most harmful to Washington citizens. Exposure to diesel particulate matter for long durations at sufficient concentrations can increase the chances of cancer and other serious health effects.

The analysis estimated diesel particulate matter emissions from construction activities and their potential to affect people close to the site. Research shows cancer risk from diesel particulate matter sources declines rapidly at distances between 500 and 1,000 feet. Beyond 1,000 feet, impacts are assumed to not be significant. For the FRE facility and quarries, the closest homes are 3,000 feet north of the site along Wells Road. Other homes farther north on Muller Road are 4,200 feet from the site. Because the FRE facility construction and quarrying areas would be farther than 1,000 feet from the nearest homes, health risk impacts from diesel particulate matter emissions during construction would be a minor adverse impact. Emissions would also be reduced through mitigation to reduce idling of equipment and vehicles.

Greenhouse Gas Emissions

The analysis estimated GHG emissions using the same sources listed above, primarily on-road and off-road engines. In addition, the activities below were evaluated:

- GHGs from producing concrete at the batch plant
- Loss of active storage of carbon dioxide as a result of tree removal
- GHGs from burning of trees removed from the reservoir area

Calculations are in the *Air Quality and Greenhouse Gas Discipline Report*, Appendix A. Construction of the proposed FRE facility would result in emissions of 21,378 metric tons of carbon dioxide per year, for a total of 106,890 metric tons of carbon dioxide over the 5-year construction period. GHG emissions from construction would be limited to the 5-year construction period and would not be an ongoing addition to the State of Washington's GHG inventory. The mitigation described above—to reduce carbon monoxide emissions by using trees removed from the temporary reservoir instead of burning them—would also reduce GHG emissions from construction. GHG emissions associated with operation of the FRE facility would be from electricity for lighting and pumping and vehicles for maintenance and flood operations. These GHG emissions would be 294 metric tons every year. Over the 50-year operational period analyzed in this EIS, this would equal 14,700 metric tons. Combined GHG emissions

from construction and operation of the FRE facility and the Airport Levee Changes (discussed in the following section) would be 123,439 metric tons and would be a significant adverse impact. Mitigation is proposed for the Applicant to prepare a GHG Mitigation Plan to mitigate for 100% of the GHG emissions from construction and operations. The plan must be approved by Ecology.

5.11.2.1 Impacts From the Airport Levee Changes

Air Pollutants

Construction of the levee would be done over a 1-year period. Air emissions from construction activities for the Airport Levee Changes include:

- Use of equipment, truck trips, and construction worker trips
- Dust from unloading of trucks carrying soil

The emissions of all criteria air pollutants would be less than the limit of 100 tons per year. Construction of the Airport Levee Changes would be a minor adverse impact for criteria air pollutants. During operation, the airport levee would not generate substantial emissions of air pollutants.

Toxic Air Pollutants

Construction activities for the Airport Levee Changes would use diesel-powered construction equipment, which generates diesel particulate matter. Construction activities for the levee would be as close as 50 feet from homes. A health risk assessment was done to estimate the level of increased cancer risk for homes near the levee construction.

The risk assessment compares the highest possible amount of diesel particulate matter that could come from the construction machinery to the cancer potency factor in order to estimate the worst possible cancer risk from breathing air near the construction site. The analysis predicted that people living at the Riverside RV Park and along NW Airport Road would experience increased cancer risks of less than 10 in 1 million. For diesel particulate matter, the Washington Administrative Code (Section 173-460-090) establishes an acceptable source risk limit of 1 in 100,000 (10 in 1 million). The risk of cancer from the construction of the Airport Levee Changes would be below the limit and therefore a minor adverse impact. The risk could be made lower through mitigation proposed to reduce diesel particulate matter emissions by reducing idling from vehicles and equipment.

Greenhouse Gas Emissions

Construction of the Airport Levee Changes would use equipment that would generate 1,849 metric tons of carbon dioxide for the 1-year construction period. GHG emissions from levee construction would be limited to the 1-year construction period. During operations of the airport levee, there would be a few vehicle trips per year for maintenance. Combined GHG emissions from construction and operation of the Proposed Project would be 123,439 metric tons and would be a significant adverse impact. Mitigation is proposed for the Applicant to prepare a GHG Mitigation Plan to mitigate for 100% of the GHG emissions from construction and operations. The plan must be approved by Ecology.

5.11.2.2 Proposed Mitigation Measures

This section describes mitigation measures being proposed for the Applicant to implement that would reduce impacts from construction and operation of the Proposed Project. These mitigation measures would be implemented with, or as part of, the required environmental permits, plans, and approvals described in Section 4.

- **AIR-1 (GHG Mitigation Plan):** To address the potential impacts of GHG emissions attributable to the Proposed Project, mitigation is proposed for the Applicant to prepare and implement a GHG Mitigation Plan that mitigates for 100% of the 123,439 metric tons of GHG emissions from construction and operation. The plan must be approved by Ecology and must be ready to implement prior to the start of construction. The measures described in the plan may include a range of mitigation options, but they must achieve emissions reductions that are real, permanent, enforceable, verifiable, and additional. The emissions reductions may occur in Washington State or outside Washington State, but Washington State projects are preferred. All projects must meet all five criteria (e.g., using internationally recognized protocols). For example, carbon credits could be purchased through existing carbon markets or restoration projects.
- **AIR-2:** To reduce carbon monoxide and GHG emissions, mitigation is proposed for the Applicant to ensure the timber removed from the temporary reservoir area for construction and the large woody material removed during operations will be used and not burned, for example, in restoration projects in the Chehalis River or tributaries.
- **AIR-3:** To reduce diesel particulate matter and GHG emissions, mitigation is proposed for the Applicant to implement an anti-idling policy for FRE facility and levee construction and operations.

5.11.2.3 Significant and Unavoidable Adverse Environmental Impacts

Compliance with laws and implementation of the mitigation measures discussed earlier would reduce impacts. There would be no significant and unavoidable adverse air quality or GHG impacts from construction or operation of either the FRE facility or the Airport Levee Changes.

5.11.3 Findings for the Local Actions Alternative

Of the six local action measures identified under this alternative, three could cause air quality or GHG impacts. Floodproofing of existing structures, floodplain storage improvements, and channel migration protection could involve construction projects. This work would happen at different times when funding is available, and would likely produce limited air emissions over an extended period of time. Construction activities under the Local Actions Alternative would be a minor adverse impact with respect to air quality and GHG. Operations would have no adverse air quality and GHG impacts.

5.11.4 Findings for the No Action Alternative

The No Action Alternative would have no adverse air quality and GHG impacts.

5.12 ENVIRONMENTAL JUSTICE

The U.S. Environmental Protection Agency defines environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This section discusses environmental justice as it relates to the following populations:

- Minorities and communities of color
- Low-income populations
- Potentially affected tribal populations

To guide public outreach planning for the EIS, the analysis also identified where there are populations with limited English proficiency.

The *Environmental Justice Discipline Report*, Appendix D, contains the full analysis and technical details used to evaluate environmental justice.

Key Findings of the Environmental Justice Analysis

While very unlikely, if ground shaking from a large earthquake damaged the FRE structure at the same time the temporary reservoir is holding water, the impacts would be **significant and unavoidable**. This event would cause loss of human life; loss and damage of public infrastructure; and extensive damage to private properties, livestock, buildings, and the environment.

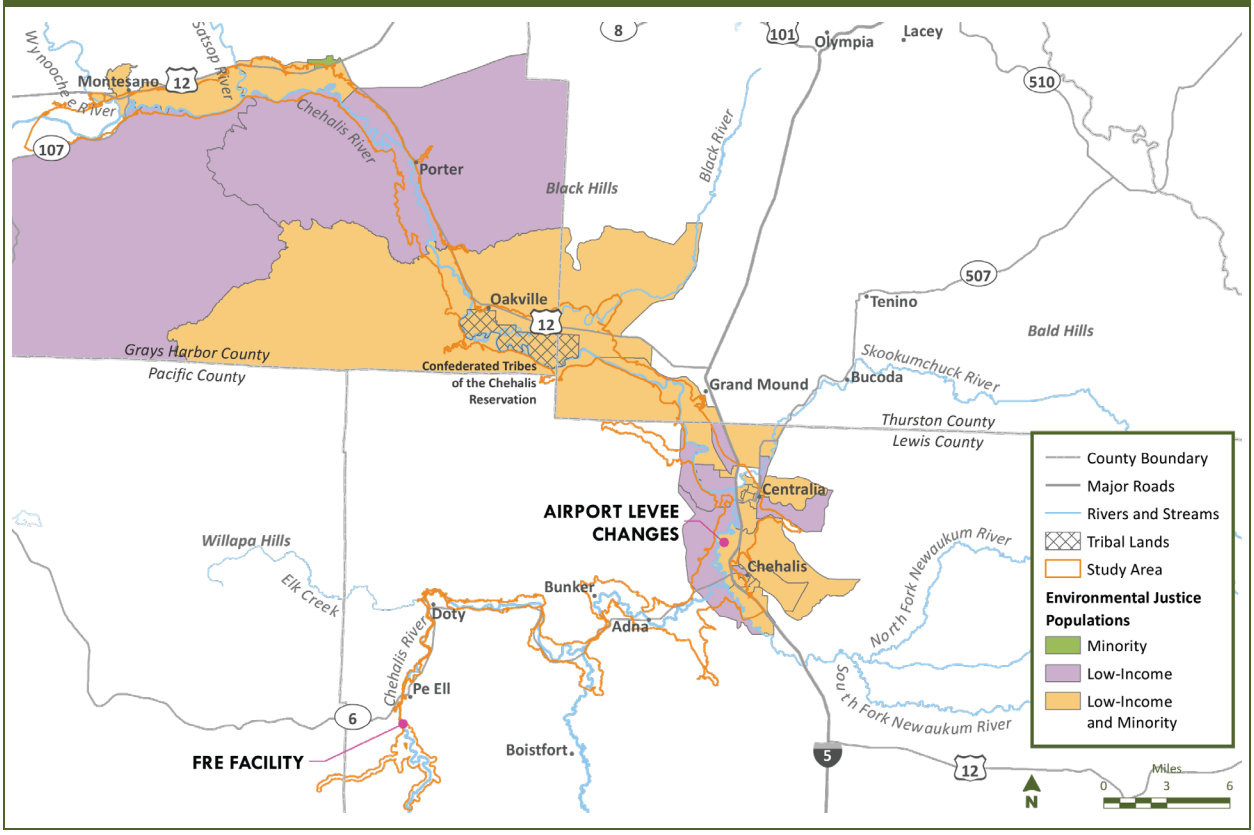
Such an event would have a **significant and disproportionate adverse impact** on environmental justice populations.

5.12.1 How Impacts Were Analyzed

The environmental justice analysis used the findings of significant impacts from the other resource areas evaluated in this EIS, and then determined if the impacts could disproportionately affect environmental justice populations. The study area includes populations that could be affected by construction or operation of the Proposed Project or the alternatives.

The analysis included population data from the U.S. Census Bureau's American Community Survey, and the Washington Department of Health. This information was used to identify the location of environmental justice populations (minorities, low-income populations, and tribal communities) in the study area (Exhibit 5.12-1).

Exhibit 5.12-1
Minority Populations in Study Area Block Groups



Note: Although Census Tract 950400 Block Group 2 also includes minority populations, it is not shown on this figure because the small portion of the Block Group overlapping the Study Area is managed forest where people do not live.

5.12.2 Findings for the Proposed Project

5.12.2.1 Impacts From the Flood Retention Facility

The construction and operation of the FRE facility would have significant adverse impacts for air quality and GHG, earth, land use, public services and utilities, recreation, water, and fish species and habitats. Environmental justice populations of interest would likely be affected by these but the impacts would not be anticipated to disproportionately affect environmental justice populations. See the *Environmental Justice Discipline Report*, Appendix D, for additional details.

The analysis for environmental health and safety found there would be impacts from the possible failure or breach of the FRE structure. The FRE structure would be required to meet strict design criteria, including planning for earthquakes like one on the Cascadia Subduction Zone. While very unlikely, if ground shaking from an earthquake caused a failure or break of the FRE structure at the same time the reservoir is holding water, there would be significant adverse impacts. The flooding from such an event could cause loss of human life, loss of and damage to public infrastructure, and extensive damage to

private properties and the environment. While the failure of the FRE facility at the same time the reservoir is holding water would have a very low probability of happening, if it occurred, it would have high consequences that would have significant and disproportionate impacts on most of the study area's environmental justice populations.

5.12.2.2 Impacts From the Airport Levee Changes

The construction of the Airport Levee Changes would have significant adverse impacts for air quality and GHGs. Environmental justice populations of interest would likely be affected by these but the impacts would not be anticipated to disproportionately affect environmental justice populations. There were no probable significant adverse impacts for operation of the Airport Levee Changes. Therefore, no disproportionate adverse impacts on environmental justice populations from construction or operation of the Airport Levee Changes are anticipated.

5.12.2.3 Proposed Mitigation Measures

This section describes mitigation measures being proposed for the Applicant to implement that would reduce impacts from construction and operation of the Proposed Project. These mitigation measures would be implemented with, or as part of, the required permits, plans, and approvals described in Section 4.

- **EJ-1:** To provide targeted outreach efforts for the Proposed Project, mitigation is proposed for the Applicant to develop an inclusive public involvement strategy tailored to the communities who may be affected by a catastrophic event causing the FRE facility to breach or fail while the temporary reservoir is holding water. This strategy will address social and economic barriers to meaningful public engagement, such as language service needs, limited access to technology, and literacy and education levels. The public involvement approach could include consideration of culturally effective outreach (such as radio and community events), providing language translation and interpretation services, and a multimedia approach such as local mailers and video.

5.12.2.4 Significant and Unavoidable Adverse Environmental Impacts

Compliance with laws and implementation of mitigation measures would reduce impacts related to environmental justice; however, there would still be significant and unavoidable adverse environmental impacts that would disproportionately affect environmental justice populations. The likelihood is extremely low for an FRE facility failure from an earthquake on the Cascadia Subduction Zone during a time when the reservoir is storing water. However, in the event of an FRE facility failure, there are no mitigation measures that would completely eliminate the possibility of an incident or the resulting impacts on environmental justice populations.

5.12.3 Findings for the Local Actions Alternative

Construction of Local Actions Alternative elements could include noise, dust, and access impacts. These adverse impacts would range from significant to minor depending on the nearby land uses. There are no specific locations for Local Actions Alternative actions. However, because environmental justice populations are mainly in the floodplain areas where these impacts would be likely to occur, any significant impacts are expected to have a disproportionately high impact on environmental justice populations. Therefore, there would be significant adverse impacts on environmental justice populations from construction activities of the Local Actions Alternative.

For operation of the Local Actions Alternative, the EIS found significant adverse impacts for earth, environmental health and safety, land use, public services and utilities, recreation, transportation, visual quality, and water. All resources would continue to experience substantial flood risk from both major and catastrophic floods. Flooding would not be significantly reduced and water levels for major and catastrophic floods are expected to continue to increase across the study area. Floods would continue to inundate rivers, streams, habitat, roads, and properties. Flooding would continue to have a substantial risk to earth, recreation, and visual quality, but the impacts would not be disproportionate to environmental justice communities. Many transportation facilities are in areas with environmental justice populations of interest, and impacts would occur on roads that serve environmental justice populations. Floods could inundate facilities that use and store hazardous materials. Flooding along public roads could cause closures and impact emergency response time. Service outages, as well as delayed response times for emergency service providers, would be likely as a result of continued flooding.

The environmental justice populations of interest are primarily within floodplain areas where land use impacts from flooding, buy-outs, floodplain storage, and channel migration protection elements are more likely to occur. Therefore, there would be significant and disproportionate adverse land use impacts from operation of the Local Actions Alternative relative to environmental justice populations. The environmental justice populations are primarily in areas vulnerable to flooding and would continue to experience substantial and disproportionate flood risk relative to the environmental health and safety, land use, public services and utilities, transportation, and water impacts. Also, because multiple significant environmental impacts would affect environmental justice populations, there would be a significant adverse impact on community cohesion.

5.12.4 Findings for the No Action Alternative

Significant adverse direct impacts for the No Action Alternative were identified in the EIS for earth, environmental health and safety, land use, public services and utilities, recreation, transportation, visual quality, and water. All resources would continue to experience substantial flood risk from both major and catastrophic floods.

Flooding would not be significantly reduced and water levels for floods are expected to continue to increase across the study area. Floods would continue to inundate rivers, streams, habitat, roads, and

properties. The environmental justice populations are primarily in areas vulnerable to flooding. Flooding would continue to have a substantial risk to earth, recreation, and visual quality, but the impacts would not be disproportionate to environmental justice communities.

Many transportation facilities are in areas with environmental justice populations of interest, and impacts would occur on roads that serve environmental justice populations. Floods could inundate facilities that use and store hazardous materials. Flooding along public roads could cause closures and impact emergency response time. Service outages, as well as delayed response times for emergency service providers, would be likely to happen as a result of continued flooding. In areas that experience frequent flooding, there could be land use conversions or restrictions because existing land uses could become incompatible. Based on an analysis in the *Land Use Discipline Report*, Appendix G, between 7% and 10% of buildings in the study area would be inundated to some extent in a major flood, and between 49% and 66% in a catastrophic flood.

The continuing substantial flood risk under the No Action Alternative would have disproportionate impacts for areas with environmental justice considerations related to environmental health and safety, land use, public services and utilities, transportation, and water impacts.

5.13 NOISE AND VIBRATION

Noise is unwanted sound that can affect people, fish, and wildlife. Vibration is motion through something solid, like the ground, which can affect living creatures or damage buildings.

The *Noise and Vibration Discipline Report*, Appendix H, has the full analysis and technical details used to evaluate noise and vibration impacts. This section summarizes how impacts on people were evaluated and the findings. Impacts of noise and vibration on fish are described in Section 5.3, and impacts on wildlife are described in Section 5.4.

Key Findings of the Noise and Vibration Analysis

During construction, all noise and vibration impacts on people would be below federal and state limits and would be **minor adverse impacts**.

There would be **no adverse noise or vibration impacts** from operations.

Noise and vibration impacts on fish and wildlife are discussed in Section 5.3 for fish and Section 5.4 for wildlife.

5.13.1 How Impacts Were Analyzed

The analysis looked at how construction and operation of the FRE facility and Airport Levee Changes could cause noise and vibration and affect people. Noise exposure is the level of noise and how long it lasts compared to the noise that is already present. People respond to noise in different ways. It can interfere with sleep, concentration, and communication; cause stress and hearing loss; or can be a nuisance. Locations with people sensitive to noise include homes, schools, hotels, hospitals, nursing homes, and churches. Noise is measured in decibels. Vibration can cause disturbance and annoyance and is measured as vibration decibels. Activities such as blasting, drilling, or the use of large equipment can increase vibration levels.

Federal and state laws limit the amount of noise allowed in a 1-hour period based on the type of property and the noise source. The property categories include places where people live and sleep, commercial areas, and industrial or agricultural areas. Sounds from traffic on public roads are exempt, and sounds from blasting and construction equipment are exempt during the daytime.

The study area for the Proposed Project includes the FRE facility site, quarry sites, airport levee site, and roads used to move materials. The analysis identified homes closest to these areas that could be affected. The analysis used federal guidance and models for traffic noise and vibration assessment. The Federal Highway Administration Roadway Construction Noise Model and Traffic Noise Model were used to calculate noise levels for equipment and vehicles. The analysis considered the applicable laws and policies on noise and vibration. Several federal, state, and local laws and guidelines apply. These include the federal Noise Control Act and Washington State Noise Control Act, and local land use and noise standards for Lewis County, Pacific County, and the City of Chehalis.

5.13.2 Findings for the Proposed Project

5.13.2.1 Impacts From the Flood Retention Facility

Noise Impacts

The analysis looked at construction activities and their potential to produce noise that could affect people close to the site. For the FRE facility and quarries, the closest homes are 3,000 feet north of the site along Wells Road (Exhibit 5.13-1). The next closest homes are farther north on Muller Road (4,200 feet from the site). This area is relatively quiet with sounds of nature, local roadways, and SR 6 but does include noise from commercial logging operations.

Construction activities for the FRE facility evaluated for noise and vibration include the following:

- Off-road equipment for constructing the FRE facility (bulldozers, cranes, pile drivers)
- Off-road equipment for moving rock at the quarry sites (excavators, bulldozers)
- Off-road truck trips bringing quarried rock to the concrete plant at the FRE facility site
- Noise and vibration from blasting at the quarry sites and for the temporary bypass tunnel
- On-road truck trips to bring materials to the concrete plant at the FRE facility site
- Noise from rock processing for the FRE facility structures and the concrete plant
- Noise from constructing the bypass roadway and quarry roads (excavators, tractors, graders)
- Noise from tree removal (trucks, saws, chippers)

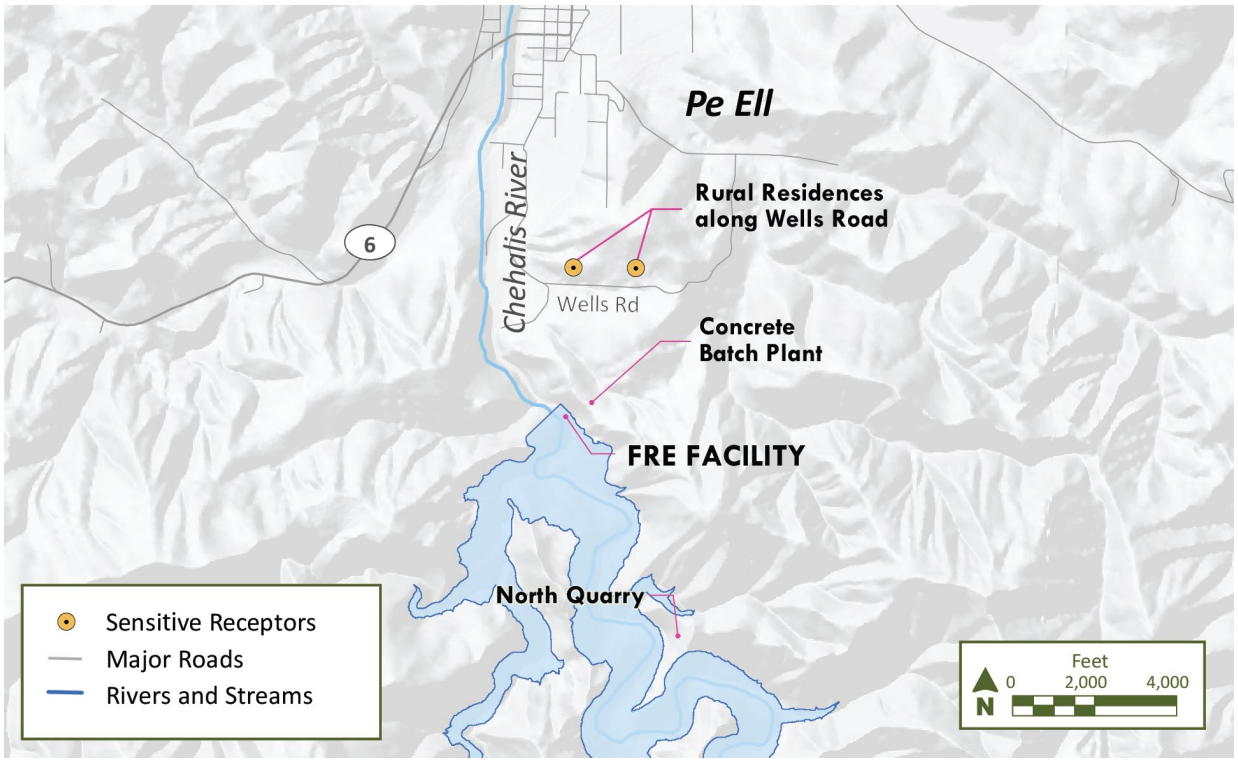
Blasting for the quarries and the temporary bypass tunnel was assumed to be one blast per hour. Because the area already has commercial logging, the noise from removing trees in the temporary reservoir footprint would not be a new noise source and was not further analyzed.

Noise levels were calculated for the homes on Wells Road and Muller Road (Exhibit 5.13-1). This analysis assumed conservatively that all activities would happen at the same time, which is not likely to occur. The federal noise level standard is 90 decibels, and the sum of noise for all construction activities would be between 64 and 66 decibels for the residences. This is below the standard and would be a minor adverse impact on people from noise.

Trucks would travel along 3rd Street and Muller Road in Pe Ell and generate noise. About 9,200 truck trips are predicted over the 5-year construction period. This would be 1,840 truck trips per year or 8 truck trips per day. Based on estimates from Lewis County, the current traffic on Muller Road is about 370 vehicles per day. Construction trucks would add an average of one truck trip an hour along this route. This would be a minimal amount added to the noise levels in the area, so noise from truck traffic for the FRE facility site would be a minor adverse impact on people.

Regular maintenance and operation of the FRE facility would include some truck trips. These trips would occur infrequently and would not likely contribute to the noise levels in the area. Noise from regular maintenance and operation would have no adverse impact.

Exhibit 5.13-1
Noise-Sensitive Receptors Near the FRE Facility



Vibration Impacts

Construction would involve both blasting and the use of equipment such as impact pile drivers or vibratory pile drivers, which can generate substantial vibration. These types of activities would occur at the FRE facility site, the quarries, and for the temporary bypass tunnel.

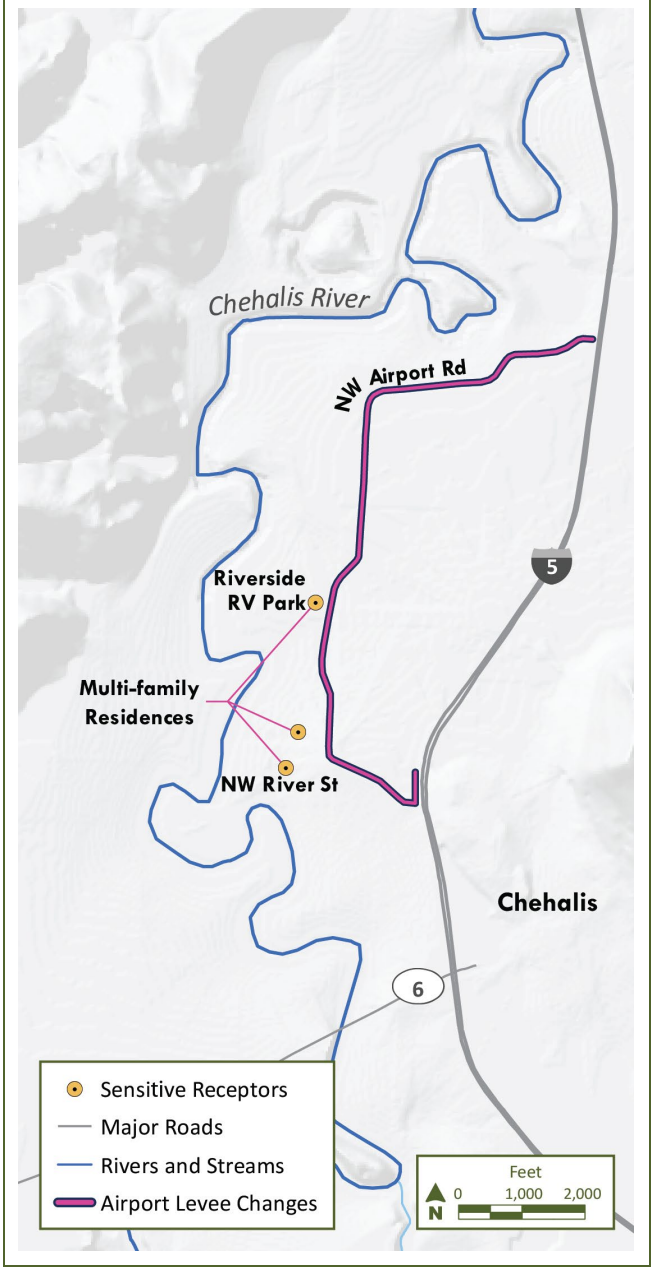
Vibrations from construction and blasting are affected by distance and the amount of explosives used. Construction activities for the FRE facility would be more than 3,000 feet from the nearest homes. Drilling and blasting for the bypass tunnel would be more than 2,700 feet from the nearest homes. The North Quarry is the closest quarry to nearby homes, at a distance of 6,000 feet. Vibration levels were estimated and compared to federal thresholds based on the distance to the homes. The federal threshold for equipment is from 72 to 80 vibration decibels. The estimated effects from construction are between 14 and 42 vibration decibels, so these are below the limit. Based on the distance from homes, the vibration from blasting and other construction activities would be a minor adverse impact on people. There would be no vibration impact from operations.

5.13.2.2 Impacts From the Airport Levee Changes

Noise Impacts

For the airport levee, the closest people are in multifamily homes along NW Airport Road and NW River Road. Some homes are as close as 100 feet from the existing levee (Exhibit 5.13-2). The Riverside RV Park is also along NW Airport Road. These areas were evaluated in the analysis for noise impacts. The Riverside Golf Course is considered to be a noise-tolerant area because it is moderately urban, with noise from I-5 and aircraft operations at the airport, so it was not analyzed further.

Exhibit 5.13-2
Noise-Sensitive Receptors Near Airport Levee Changes



The Federal Highway Administration's models were used to calculate noise levels at the closest homes from airport levee construction. The daytime noise limit is 90 decibels. The noise level from equipment at homes on NW Airport Road and NW River Road would be 78.9 decibels, so the impact of noise on people from construction would be below the limit and would be a minor adverse impact.

Trucks used to bring materials to the airport levee site would also generate noise. Trucks would travel from I-5 along NW Airport Road, passing homes and the Riverside RV Park. About 22,900 truck trips are predicted over a 1-year construction period, or 88 truck trips per day. Based on estimates from the City of Chehalis, the current average daily traffic on NW Airport Road is 6,560 vehicles per day. The addition of about 9 truck trips an hour along this route would slightly increase noise levels in the area. Noise from truck traffic to the airport levee site would result in a minor adverse impact on people.

Regular inspections of the airport levee would include vehicle trips, but these trips would contribute minimally to road noise with no adverse impacts.

Vibration Impacts

Levee construction would involve the use of equipment such as bulldozers, which can generate some vibration. Construction activities would occur up to 100 feet from the nearest homes. The federal vibration limit for equipment is 80 vibration decibels. The estimated vibration from construction would be between 68 and 69 vibration decibels, which is below the limit. Based on the distance from homes, the vibration from airport levee construction activities would be a minor adverse impact on people. There would be no vibration impacts from operations.

5.13.2.3 Proposed Mitigation Measures

All adverse noise and vibration impacts would be minor. No mitigation is proposed.

5.13.2.4 Significant and Unavoidable Adverse Environmental Impacts

There would be no significant and unavoidable adverse environmental impacts from noise and vibration.

5.13.3 Findings for the Local Actions Alternative

Floodproofing of existing structures, floodplain storage improvements, and construction projects for channel migration protection could cause noise or vibration impacts. The construction of projects would likely be done over a long period of time, and would likely cause short-term, local noise and vibration. Construction activities under the Local Actions Alternative would be a minor adverse impact for noise and vibration. Operations would have no adverse impacts from noise and vibration.

5.13.4 Findings for the No Action Alternative

The No Action Alternative would have no adverse impacts from noise and vibration.

5.14 PUBLIC SERVICES AND UTILITIES

Public services and utilities include basic services and facilities that support development and protect public health and safety. The public services evaluated include law enforcement, fire and emergency response services, hospitals, emergency management, solid waste services, and public schools. The utilities evaluated include water, water supply, wastewater, electrical power, natural gas, and telecommunications.

The *Public Services and Utilities Discipline Report*, Appendix I, has the full analysis and technical details used to evaluate public services and utilities in this EIS. This section summarizes how impacts were evaluated and presents the findings. Transportation impacts are described in Section 5.15, Transportation; dam safety impacts are described in Section 5.10, Environmental Health and Safety; and water right impacts are described in Section 5.1, Water Resources.

Key Findings of the Public Services and Utilities Analysis

The FRE facility and temporary reservoir would have a **significant adverse impact** on the Pe Ell water supply line from Lester Creek. Mitigation is proposed for the Applicant to work with the City of Pe Ell to study if the line would require moving or improvement to avoid damage from construction or inundation and to provide funding.

Potential impacts from utility conflicts or service disruptions during construction of the FRE or airport levee would be temporary and **minor**.

Operations of the FRE would increase electrical use in Lewis County by less than 1%. So the impact on utilities would be **minor**. Airport levee operations would have **no impact** on public services and utilities.

5.14.1 How Impacts Were Analyzed

The analysis looked at how construction and operation of the FRE facility and Airport Levee Changes could affect public services and utilities. The study area includes the FRE facility, the temporary reservoir, and the airport levee. The study area also includes the mainstem Chehalis River from the FRE facility at RM 108 to about RM 9 near Montesano.

The study identified the public services and utilities in the study area using information from maps, local agency plans and websites, and GIS data. The analysis examined how construction activities could affect access to public services, conflict with utilities, or cause temporary service outages. The analysis also examined impacts from operations that could affect access, increase demands, or create potential risks to public services and utilities. Public services in the study area are provided by federal, tribal, state, county, and local governments and volunteer fire departments.

5.14.2 Findings for the Proposed Project

5.14.2.1 Impacts From the Flood Retention Facility

Access to Public Services

Lewis County has the primary responsibility for providing fire, emergency management, and police services near the FRE facility. Public education and health facilities are located in nearby Pe Ell and surrounding communities.

The FRE facility site can only be accessed using a private road. During construction, equipment and materials would be delivered to the FRE facility site by truck. As described in Section 5.15, Transportation, construction traffic would increase near the FRE facility and in Pe Ell. This truck traffic would travel on public roads that are also used to access public services and for emergency services. The construction traffic increases would be local and temporary and would cause minimal changes. Construction would have minor adverse impacts on access to public services or emergency service response times.

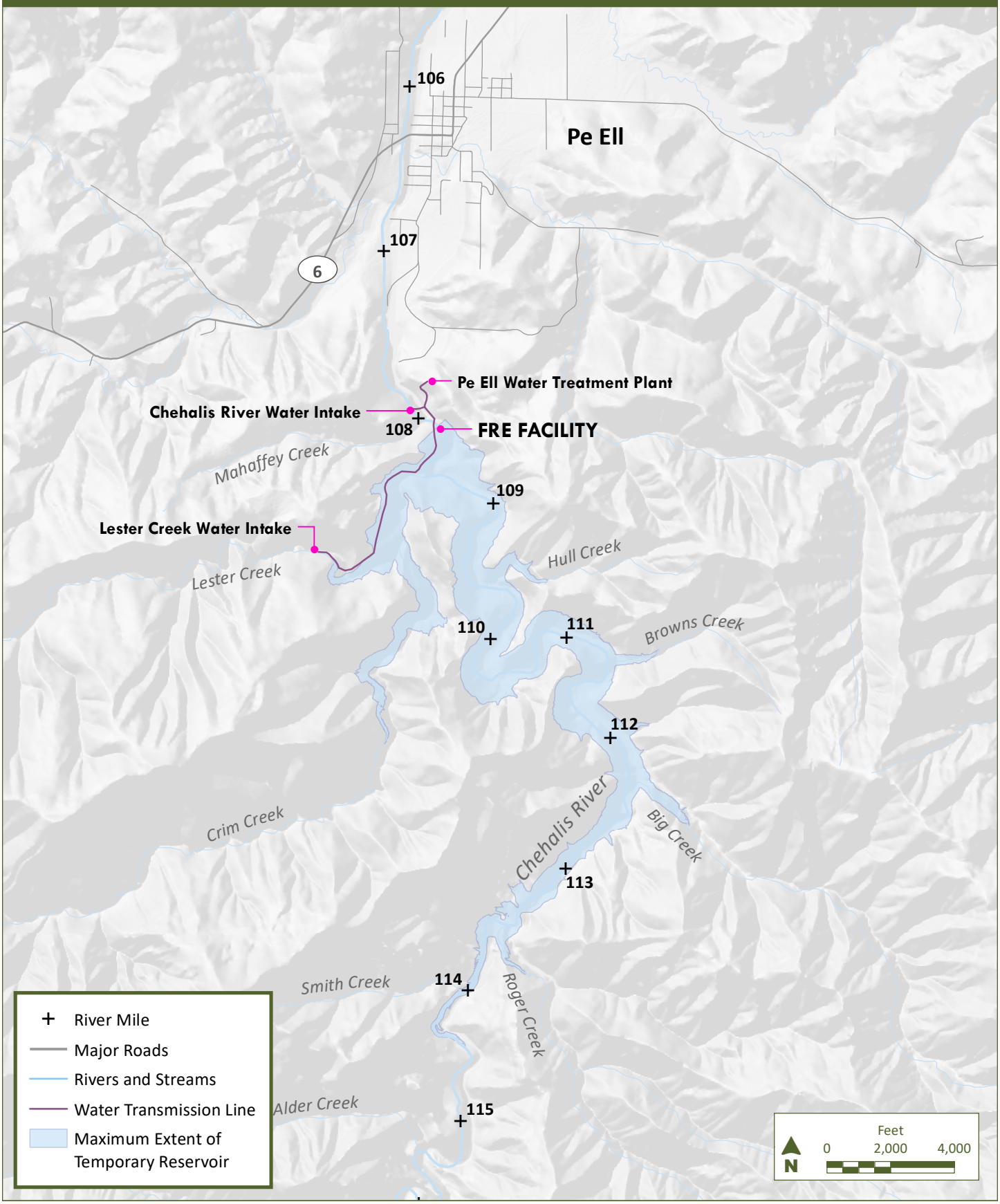
Utilities Conflicts and Service Disruptions

Public utilities in the study area are provided by county, city, tribal, and private suppliers. In Lewis County, water services are provided by three public systems: Lewis County Water District, Boistfort Valley Water, and Thurston County Public Utility District (PUD). The primary water supply system for the Town of Pe Ell serves more than 1,000 residents. It includes a water intake and reservoir system on Lester Creek, a water line, a pump station, a treatment facility, and a distribution system. During low-flow periods, Pe Ell uses the Chehalis River as a backup water intake. The Chehalis River intake is about 2,500 feet south of, and 180 feet lower in elevation than, Pe Ell's water treatment facility.

Lester Creek is upstream of the FRE facility (Exhibit 5.14-1). The Lester Creek water intake, pump station, and treatment facility are above the highest possible water level of the temporary reservoir, so they would not be inundated during FRE operations. However, an 8,000-foot part of the water line is inside the temporary reservoir area so it would be covered by floodwaters and may need to be improved or relocated. If the entire water line needs to be replaced, the estimated cost would be $1.2 million. This would be a significant impact on Pe Ell's water system. Mitigation is proposed for the Applicant to work with the Town of Pe Ell to study if the water line needs to be moved or improved to handle inundation and for protection from construction work. If it does, the Applicant would provide funding.

A new low-voltage power line would be needed to provide power for pumps, gates, instruments, and other facilities for the FRE construction and operations. Overhead lines would be installed within the first 6 months of construction. Diesel generators or a combination of generators and power lines could be used for construction. The new power line would be located along existing roads. Through the application process for establishing the new power service for the FRE facility, Lewis County PUD would determine how to design and place the new transmission lines in a way that best avoids or minimizes impacts on existing utilities. Interruptions to existing public services or utilities are not anticipated during installation of the transmission line and there would be no adverse impact.

Exhibit 5.14-1
Existing Pe Ell Water System



Increased Demands on Public Services and Utilities

Operations for the FRE facility would use 38,600 kilowatt hours per year for electricity. This would be less than a 1% increase to the overall electricity load for Lewis County PUD. The Applicant must coordinate with the PUD during permitting to avoid or minimize impacts on existing utilities. So there would be a minor impact on Lewis County PUD and no adverse impact on other utilities.

Ecology's Dam Safety Office will require the Applicant to develop an Emergency Action Plan. The Emergency Action Plan will be shared with local emergency management agencies responsible for developing community emergency response plans. The Emergency Action Plan will include maps identifying where water would flow downstream of the FRE facility in the event of a catastrophic structure failure. Local jurisdictions would need to develop evacuation plans for areas downstream of the FRE facility. To assist local officials in improving emergency response, mitigation measures are proposed for the Applicant to develop and implement a breach warning system and to provide training of local emergency response officials. Section 5.10, Environmental Health and Safety, includes more information and impacts.

Changes to Downstream Flooding Affecting Public Services and Utilities

The flooding of public services and utilities can result in service outages if a facility cannot be used or accessed. The amount of time they are unavailable depends on the depth of water and how long it is flooded. Emergency responder access is often restricted by flooded roads, which causes longer response times.

Based on modeling, the Proposed Project would reduce flooding at key public facilities during both major and catastrophic floods, although the amount of decrease would vary throughout the study area. Most of the flood reduction would be in the Chehalis-Centralia area where public services and utilities are concentrated. It would also reduce the amount of time that floodwaters would limit emergency responder access.

In the *Public Services and Utilities Discipline Report,* Appendix I, Table I-3 and Figures I-1 and I-2 show the changes in the flood depth and duration at public service and utility facilities. In a major flood, the Proposed Project would not change or would minimally reduce the flood depths and durations at these facilities. For many of the facilities, there would be no flooding during a major flood with or without the Proposed Project.

Key facilities are listed below in Exhibit 5.14-2 showing the water levels in a catastrophic flood, with and without the Proposed Project. For most of these facilities, flood depths and durations would be reduced with the Proposed Project but many would still experience flooding during a catastrophic flood.

Exhibit 5.14-2

Anticipated Flood Water Levels Under Catastrophic Flood Conditions

FACILITY	MID-CENTURY		LATE-CENTURY	
	WITHOUT THE PROPOSED PROJECT	WITH THE PROPOSED PROJECT	WITHOUT THE PROPOSED PROJECT	WITH THE PROPOSED PROJECT
Centralia Police Station	No flooding	No flooding	0.2 feet	0.2 feet
Washington State Patrol	2.3 feet	No flooding	3.8 feet	No flooding
Fire Station 3 District 16	2.5 feet	No flooding	4.6 feet	No flooding
Fire Station 1 RFA	0.3 feet	0.3 feet	1.0 feet	1.0 feet
Oakville Elementary/High School	No flooding	No flooding	0.9 feet	No flooding
Washington Elementary School	3.0 feet	1.9 feet	4.4 feet	2.1 feet
Veterans Memorial Museum	0.8 feet	0.2 feet	1.2 feet	0.3 feet
Chehalis-Centralia Railroad and Museum	0.6 feet	No flooding	1.0 feet	0.2 feet
Valley View Health Center	1.9 feet	No flooding	3.3 feet	0.1 feet
Montesano Wastewater Treatment Plant	2.6 feet	No flooding	3.9 feet	2.9 feet

In the recurring flood scenario, most public service and utility facilities in the study area would flood each of the 3 years. While the Proposed Project would reduce the flood depths and durations, flooding would continue to be disruptive or damaging to these facilities because a single year often is not long enough to repair flood damages. Therefore, a recurring flood scenario would cause disruption and damage that would remain difficult to repair even with the Proposed Project in place.

5.14.2.2 Impacts From the Airport Levee Changes

Access to Public Services

The City of Chehalis has primary responsibility for providing fire and police services near the airport levee. In addition, public education and public health facilities are located in Chehalis and Centralia. Construction activities could increase traffic along nearby roads and along the truck haul routes. This could temporarily affect access and response times for public service providers but would be a minor impact. The Applicant would be required to develop a Traffic Plan, described in Section 5.15, Transportation, to reduce and avoid impacts.

Utility Conflicts and Service Disruptions

Construction could affect existing utilities, such as overhead power lines and buried water or sewer pipelines. During the more detailed permitting process required before construction, the locations and depths of existing utilities would be verified with utility providers. Specific construction methods and best management practices would be developed with the City of Chehalis and the utility providers to avoid and minimize utility conflicts. If utilities must be moved or replaced or if service would be disrupted, the Applicant would mitigate the impacts by developing construction plans and schedules. If relocation of utilities was required, disruptions to service would be short term and service would be fully restored following construction, so the adverse impacts would be minor.

5.14.2.3 Proposed Mitigation Measures

This section describes mitigation measures being proposed for the Applicant to implement that would reduce impacts from construction and operation of the Proposed Project. These mitigation measures would be implemented with, or as part of, the required permits, plans, and approvals described in Section 4.

- **PSU-1:** To reduce potential impacts on Pe Ell's water supply system, mitigation is proposed for the Applicant to work with the Town of Pe Ell to conduct a study to determine if the Pe Ell water line at Lester Creek needs to be relocated or redesigned to ensure that it can withstand inundation within the temporary reservoir. If relocation or redesign is required, the Applicant will develop a cost estimate and provide funding for this work.
- **PSU-2:** Mitigation is proposed for the Applicant and its contractors to develop construction sequence plans and coordinate schedules to minimize service disruptions and provide ample advance notice if service disruption is unavoidable, consistent with utility provider policies.

Other Related Mitigation Measures

- **EHS-3:** To improve emergency response, mitigation is proposed for the Applicant to develop and implement a breach flood warning system for Pe Ell, Centralia, and Chehalis. The breach flood warning system would be a staged system, with alerts and responses becoming more urgent as the potential for a breach becomes more severe. The initial stage may begin with notifications to local officials, eventually proceeding to full-scale evacuations. For a fast-developing breach scenario, with little warning time, alert sirens may be an option. This system will be reviewed by Ecology's Dam Safety Office and Lewis County emergency response agencies.
- **EHS-4**: To improve emergency response, mitigation is proposed for the Applicant to provide training to local emergency response organizations on breach scenarios as part of the Emergency Action Plan. This also includes providing educational outreach for downstream residents, schools, and critical facilities on how to respond to a rapidly developing breach.

5.14.2.4 Significant and Unavoidable Adverse Environmental Impacts

Compliance with laws and implementation of the measures described above would reduce impacts on public services and utilities. There would be no significant and unavoidable adverse environmental impacts on public services and utilities.

5.14.3 Findings for the Local Actions Alternative

Construction activities for local actions could occur near public service or utility facilities, such as buried utility lines. People could experience temporary utility disruptions or service outages. Depending on the extent and duration of construction, emergency service response times could be delayed. Because construction would be short term, and would follow local regulations, these adverse impacts would range from moderate to minor.

Land use management changes and buy-outs of high-risk properties or structures would not adversely affect public services and utilities. An enhanced early flood warning system could reduce the demand for emergency response following a flood. If local actions such as floodproofing were applied to public services or utility providers, they could reduce flood damage to those facilities during floods. If floodplain storage improvements or channel migration protection were implemented, it could reduce the inundation depth and duration on area roads, which would reduce delays experienced by emergency response providers during floods.

Public services and utilities throughout the study area would continue to be vulnerable to damage during both major and catastrophic floods. This alternative would result in some improved conditions, but floods would continue to create service outages and delayed response times for emergency service providers, until floodwaters recede and services can be restored. Inundation at utility facilities and area roadways would increase over time due to climate change, resulting in potentially longer and more frequent service disruptions. Adverse impacts from operation of the Local Actions Alternative would range from significant to minor, depending on the action and the location.

5.14.4 Findings for the No Action Alternative

Public services and utilities throughout the study area would continue to be vulnerable to damage during floods. Flood frequency and severity is predicted to increase in the future. Inundation at utility facilities and area roadways would increase over time due to climate change, resulting in potentially longer and more frequent service disruptions. Floods would continue to affect structures and facilities in the study area, and roads and bridges would remain at risk of being damaged by floodwaters, reducing the capacity for prompt emergency response and access to critical facilities.

5.15 TRANSPORTATION

The term "transportation" refers to the system of roads, transit routes, railroads, and airport facilities that move people and goods. In the past, flooding in the study area closed roads, rail, and airports for multiple days. Access for local communities, the Chehalis Tribe Reservation, and traffic on I-5 and SR 6 was greatly affected.

The *Transportation Discipline Report*, Appendix K, has the full analysis and technical details used to evaluate transportation in the EIS. This section summarizes how impacts were evaluated and the findings. Impacts on emergency services and critical facilities that are affected by transportation closures from floods are described in Section 5.14, Public Services and Utilities.

Key Findings of the Transportation Analysis

Construction traffic from the Proposed Project would have a **moderate adverse impact** on roadways in the Pe Ell area and near the Chehalis-Centralia airport. Operational traffic associated with the FRE facility and levee would be **minor**.

The Proposed Project would require several forest roads to be upgraded and widened for construction and operation, but impacts would be **moderate to minor** with required permits.

Mitigation is proposed for roads not covered under Forest Practices Rules at the FRE facility site or in the temporary reservoir area for the Applicant to meet all Forest Practices Act requirements for road building, maintenance, and abandonment.

The Proposed Project would reduce flood depths and durations for roads airports, and railroads, including I-5 and SR 6, but many areas would remain flooded to some level. The amount of reduction would vary by flood scenario and location.

5.15.1 How Impacts Were Analyzed

The study area for transportation consists of areas that could be affected by the construction or operation of the Proposed Project. This includes the FRE facility site, the temporary reservoir area, the airport levee area, and the area along the mainstem Chehalis River from the FRE facility at RM 108 to about RM 9 near Montesano.

Construction and operations impacts were analyzed based on anticipated truck, equipment, and employee trips to and from the FRE facility and the airport levee. Construction impacts were identified by estimating changes to the level of service (LOS) for the roads using average daily traffic projections from Lewis County and WSDOT. The analysis evaluated the flow of traffic on roads and at key intersections. Models were used to show the changes in the duration and depth of flood waters affecting roads, railways, and the airport. The analysis also looked at the physical and operational impacts on roadways in managed forest areas and outside forest areas.

Many federal, state, and local rules and policies apply to the Proposed Project. These include Washington State transportation system policy goals and system plans, DNR *Forest Practices and Guidelines for Forest Roads*, and Lewis County's *Transportation Improvement Program*.

5.15.2 Findings for the Proposed Project

5.15.2.1 Impacts From the Flood Retention Facility

Transportation Impacts During Construction

The FRE facility would be constructed on property currently owned by Weyerhaeuser and the Panesko Tree Farm. The entrance to the FRE facility would be from the north via SR 6 to South 3rd Street/Muller Road in Pe Ell to FR 1000, and then on an existing private road to the FRE facility site (Exhibit 5.15-1). The analysis assumed that no intersection improvements would be needed and no access permit would be needed from WSDOT. SR 6 is a two-lane highway that expands to include turn lanes at major intersections. The corridor serves as a main street for communities, like Pe Ell. The current amount of traffic on SR 6 through Pe Ell is very low.

Rock for concrete needed to construct the FRE facility would be mined at one or more of the proposed quarries in the area. Most of the construction traffic would be at the FRE site and on forest roads, between the quarries to the concrete batch plant and from the batch plant to the FRE facility site. Off-site truck trips would be needed to bring in equipment and materials for the batch plant and FRE facility, and for removal of trees from the temporary reservoir area.

The FRE facility would be constructed over a 5-year period. Total daily trips in the Pe Ell area along SR 6 and South 3rd Street/Muller Road are estimated to be about 80 car trips and 8 truck trips per day during the 5-year construction period. Traffic along SR 6 to South 3rd Street is expected to increase by less than 5% over the 5-year period with these trips. However, traffic on South 3rd Street/Muller Road would increase by about 20%. Traffic would increase during construction, but the LOS would remain the same and not exceed the Lewis County *Transportation Improvement Program* goal. There would be a moderate adverse impact on roadways during construction of the FRE facility due to increased temporary traffic. Rail operations would not be affected by construction traffic.

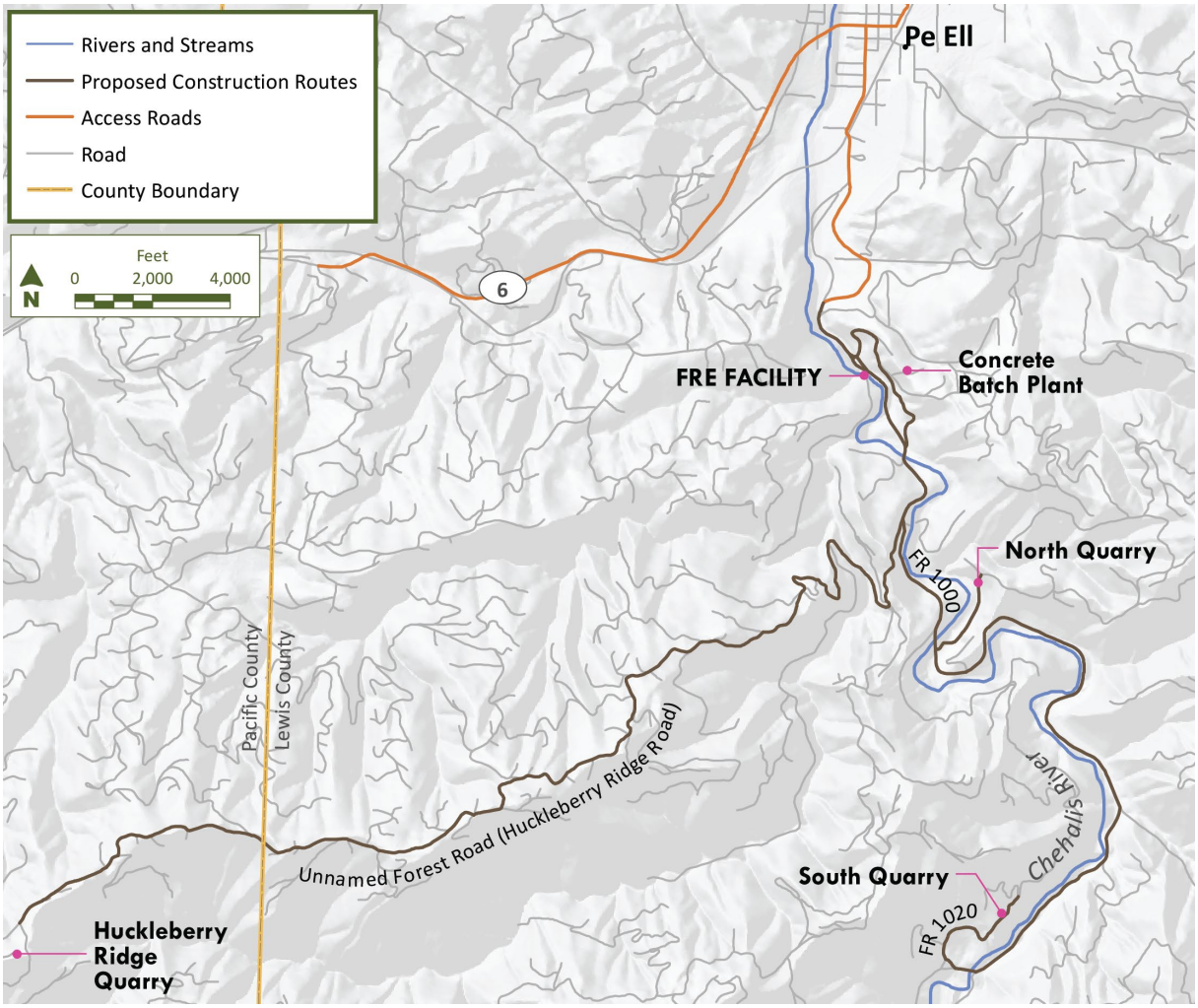
Transportation Terminology

Level of service, or LOS, is a way to measure the quality of traffic flow, based on vehicle speed, congestion, and delay. LOS ranges from LOS A (moving quickly, few vehicles) to LOS F (breakdown in flow, with speeds dropping to zero). Lewis County includes LOS goals in the *Lewis County Comprehensive Plan*.

The FRE facility site is in a remote area, accessible only by FR 1000 (a private forest road). Existing roads would be used as a permanent bypass for FR 1000, which is a main access road for Weyerhaeuser forestry operations. This bypass would be used to access the site if FR 1000 is flooded. In addition, over 13.5 miles of upgrades and widening of existing forest roads would be needed to access the FRE facility and quarry sites during construction. Specific locations and the extent of improvements to the bypass road for FR 1000 and other road segments would be defined during the more detailed design and permitting phase. All changes to forest roads would comply with DNR regulations.

Temporary roads would be built in the reservoir footprint to remove trees and for construction on the site. Because these roads would not be on commercial forest land, Forest Practices Rules do not apply. However, for areas where trees are removed, a Class IV-General Forest Practices Application would be required and the roads constructed will need to meet Forest Practices Act standards for the harvest. Road construction for forest and private roads would have moderate to minor adverse impacts. Mitigation is proposed for the Applicant to meet forest practice requirements for any roads not covered under Forest Practices Rules.

Exhibit 5.15-1
Proposed Construction Routes



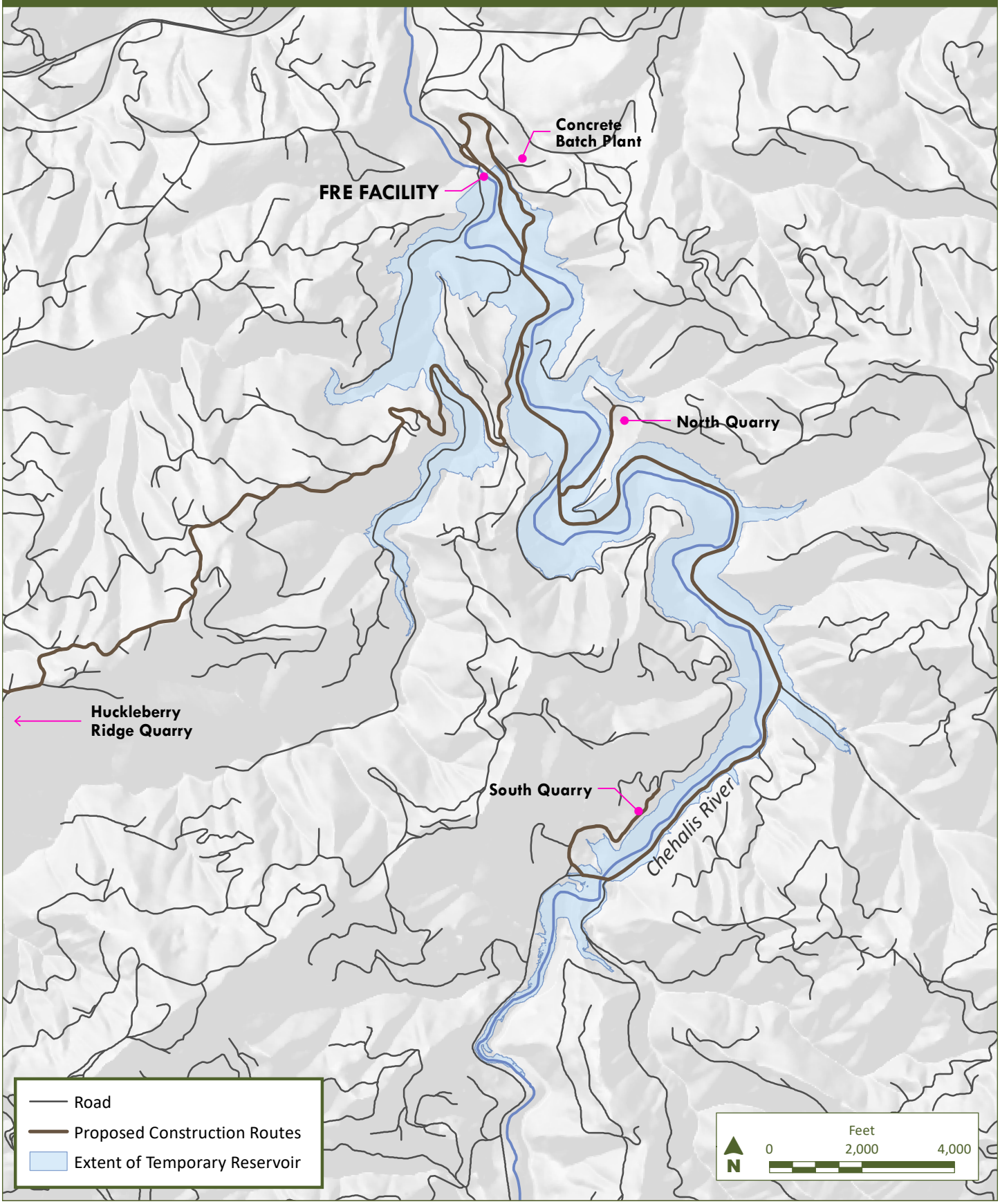
Transportation Impacts During Operations

Operation of the FRE facility includes vehicle trips for regular maintenance. Vehicles and equipment would also be used before, during, and after a major or larger flood. They include vehicles for flood operations at the FRE facility, trucks to move fish upstream when the reservoir is holding water, and to remove wood from the reservoir area. As the temporary reservoir is being drained, boats would move large woody material to a log sorting yard previously operated by Weyerhaeuser. The log sorting yard is on the west bank of the Chehalis River, about 2 river miles upstream of the FRE facility. Vehicles and equipment would use the FR 1000 detour route to get to the site. A trap-and-transport facility to move fish upstream during major or larger floods would operate, but the number of truck trips would be small. Based on the limited vehicle trips for operations and maintenance, the FRE facility would have no adverse traffic impacts on local roadways.

The FR 1000 bypass would provide permanent access to the temporary reservoir area during flood events and if FR 1000 is inundated. When the temporary reservoir is at maximum capacity, up to 6 miles of FR 1000 would be under water so it would not be available for use. A detour using existing forest roads could be used instead (Exhibit 5.15-2). As described in Section 5.2, Earth, landslides could happen in the temporary reservoir area which could affect the stability of roads. For roads in managed forests, DNR requires forest practices be followed. These requirements are to ensure road use and maintenance do not affect streams, wetlands, unstable slopes, or other sensitive sites. They also include planning for storms and repairing damage to roads after a storm. DNR requirements are specifically designed to ensure forest roads are constructed and maintained for the safe passage of heavy vehicles and equipment, while preserving the natural environment, so impacts from the use of forest roads during FRE operations would be minor.

Forest Practices Act requirements would not apply to roads in the temporary reservoir area. Impacts on roads at the FRE facility for operations would be minor. To address impacts from these roads, mitigation is proposed for the Applicant to meet all Forest Practices Act requirements for road maintenance.

Exhibit 5.15-2
Inundation of Forest Roads Within the Temporary Reservoir



5.15.2.2 Impacts From the Airport Levee Changes

The Airport Levee Changes include raising the existing levee around the Chehalis-Centralia Airport and a portion of NW Louisiana Avenue. Changes would raise about 810 feet of NW Louisiana Avenue on the southern side of the airport to meet the airport levee height.

During construction, traffic would be rerouted to NW Airport Road, NW West Street, NW Chamber of Commerce Way, and NW Louisiana Avenue. On average, there would be 88 truck trips per day during the 1-year construction period to and from the construction areas. Vehicles traveling on the surrounding roadways, including I-5 and its on-ramps and off-ramps, would experience moderate traffic and delays from the trucks. This could also affect travel to commercial development near the airport or airport operations. The traffic analysis of these roads found the City of Chehalis LOS goals would still be met during construction. Traffic delays would be minimized by using a Traffic Control Plan required by the City of Chehalis. The plan includes flagging, detours, and traffic management. While there would be construction delays, adverse impacts on traffic would be moderate to minor. After NW Louisiana Avenue is raised, the operation and maintenance of the Airport Levee Changes would not change traffic. So there would be no adverse impacts on transportation from operation of the airport levee.

5.15.2.3 Changes to Flooding Affecting Transportation

Water models were used to show changes in floodwaters if the Proposed Project were built. The models included climate change predictions for increased peak flows during future floods. The models identify the height of water and how long flooding would last at key intersections and interchanges and the airport in the mid-century and late-century. The locations analyzed were chosen using historical data and input from local public works officials. The study looked at impacts during major floods and catastrophic floods. Based on this modeling, the Proposed Project would reduce flooding at key intersections in the study area and would reduce the length of time roads would be closed. While flooding would still occur, there would be no significant adverse impacts on transportation as a result of the Proposed Project.

Seven locations on I-5 and six on SR 6 were analyzed (Exhibits 5.15-3 and 5.15-4) and the findings for catastrophic flood scenario analysis are presented here. For a major flood, none of the sites would be flooded, with or without the Proposed Project.

Local roads and intersections in Dryad, Curtis, Bunker Hill, Adna, Chehalis, Centralia, Napavine, Grand Mound, Elma, and Montesano were analyzed. Tables in the *Transportation Discipline Report,* Appendix K, show changes in the maximum flood depth (Table K-8) and flood duration (Table K-9) for key roadway locations. A selection of these key roadway locations are included in Exhibits 5.15-3 and 5.15-4.

Exhibit 5.15-3

Major Flood Analysis for Mid-Century and Late-Century at Select Locations

LOCATION	MID-CENTURY				LATE-CENTURY			
	WITHOUT PROJECT		WITH PROJECT		WITHOUT PROJECT		WITH PROJECT	
INTERSTATE 5								
I-5 at Labree Road Interchange	No flooding		No flooding		No flooding		No flooding	
I-5 at 13th Street Interchange	No flooding		No flooding		No flooding		No flooding	
I-5 north of SW 13th Street Interchange (Exit 76)	No flooding		No flooding		No flooding		No flooding	
I-5 at SR 6 Interchange	No flooding		No flooding		No flooding		No flooding	
I-5 Interchange at NW Chamber of Commerce Way	No flooding		No flooding		No flooding		No flooding	
I-5 at Salzer Creek	No flooding		No flooding		No flooding		No flooding	
I-5 at Mile Post 81	No flooding		No flooding		No flooding		No flooding	
STATE ROUTE 6								
SR 6 and River Road	No flooding		No flooding		No flooding		No flooding	
SR 6 and Boistfort Road	No flooding		No flooding		No flooding		No flooding	
SR 6 and Spooner Road	No flooding		No flooding		No flooding		No flooding	
SR 6 near Twin Oaks Road (600 feet west of intersection)	1.1 feet	15 hours	No flooding		2.7 feet	19 hours	0.4 feet	3 hours
SR 6 and Heden Road	0.4 feet	9 hours	No flooding		0.5 feet	16 hours	0.2 feet	0 hours
SR 6 and Donahoe Road	No flooding		No flooding		No flooding		No flooding	
CHEHALIS-CENTRALIA								
SW Chehalis Avenue/ SW John Street	2.3 feet	18 hours	No flooding		3.3 feet	29 hours	2.6 feet	18 hours
SW Riverside Drive/ SW Newaukum Avenue	0.6 feet	10 hours	No flooding		0.9 feet	18 hours	0.4 feet	4 hours
National Avenue north of NE Kresky Avenue	No flooding		No flooding		No flooding		No flooding	
DRYAD								
Leudinghaus Road east of Chandler Road	No flooding		No flooding		No flooding		No flooding	

LOCATION	MID-CENTURY				LATE-CENTURY			
	WITHOUT PROJECT		WITH PROJECT		WITHOUT PROJECT		WITH PROJECT	
NAPAVINE								
Rush Road at I-5 Interchange	3.4 feet	10 hours	3.4 feet	10 hours	3.6 feet	12 hours	3.6 feet	12 hours
GRAND MOUND TO MONTESANO								
188th Avenue and Moon Road	2.6 feet	73 hours	2.2 feet	72 hours	3.0 feet	86 hours	2.5 feet	83 hours
Elma Gate Road and Shelton Road	0.6 feet	19 hours	No flooding		1.1 feet	33 hours	0.5 feet	21 hours
SR 107, south of US 12	No flooding		No flooding		No flooding		No flooding	

Exhibit 5.15-4

Catastrophic Flood Analysis for Mid-Century and Late-Century at Select Locations

LOCATION	MID-CENTURY				LATE-CENTURY			
	WITHOUT PROJECT		WITH PROJECT		WITHOUT PROJECT		WITH PROJECT	
INTERSTATE 5								
I-5 at Labree Road Interchange	No flooding		No flooding		No flooding		No flooding	
I-5 at 13th Street Interchange	0.2 feet	Under 1 hour	No flooding		0.5 feet	10 hours	No flooding	
I-5 north of SW 13th Street Interchange (Exit 76)	1.8 feet	20 hours	0.7 feet	12 hours	2.3 feet	25 hours	1.4 feet	20 hours
I-5 at SR 6 Interchange	0.8 feet	9 hours	No flooding		1.2 feet	15 hours	0.5 feet	5 hours
I-5 Interchange at NW Chamber of Commerce Way	7.0 feet	52 hours	0.4 feet	13 hours	8.4 feet	59 hours	4.7 feet	48 hours
I-5 at Salzer Creek	1.1 feet	10 hours	No flooding		2.6 feet	18 hours	0.1 feet	Under 1 hour
I-5 at Mile Post 81	1.9 feet	14 hours	No flooding		3.2 feet	22 hours	0.3 feet	2 hours
STATE ROUTE 6								
SR 6 and River Road	0.9 feet	4 hours	No flooding		2.2 feet	7 hours	No flooding	
SR 6 and Boistfort Road	5.7 feet	15 hours	0.8 feet	6 hours	7.5 feet	17 hours	1.8 feet	9 hours
SR 6 and Spooner Road	No flooding		No flooding		No flooding		No flooding	

LOCATION	MID-CENTURY				LATE-CENTURY			
	WITHOUT PROJECT		WITH PROJECT		WITHOUT PROJECT		WITH PROJECT	
SR 6 near Twin Oaks Road (600 feet west of intersection)	5.5 feet	31 hours	3.8 feet	22 hours	6.0 feet	35 hours	4.5 feet	25 hours
SR 6 and Heden Road	2.1 feet	34 hours	1.1 feet	24 hours	2.6 feet	20 hours	1.5 feet	29 hours
SR 6 and Donahoe Road	0.3 feet	5 hours	No flooding		0.5 feet	11 hours	0.1 feet	Under 1 hour
CHEHALIS-CENTRALIA								
SW Chehalis Avenue/ SW John Street	6.4 feet	49 hours	5.3 feet	44 hours	6.9 feet	57 hours	6.0 feet	50 hours
SW Riverside Drive/ SW Newaukum Avenue	2.6 feet	39 hours	1.4 feet	31 hours	3.2 feet	45 hours	2.2 feet	36 hours
National Avenue north of NE Kresky Avenue	3.0 feet	22 hours	0.3 feet	3 hours	4.3 feet	29 hours	1.1 feet	16 hours
DRYAD								
Leudinghaus Road east of Chandler Road	5.0 feet	11 hours	No flooding		6.0 feet	14 hours	No flooding	
NAPAVINE								
Rush Road at I-5 Interchange	5.3 feet	17 hours	5.3 feet	17 hours	6.5 feet	23 hours	6.5 feet	23 hours
GRAND MOUND TO MONTESANO								
188th Avenue and Moon Road	4.4 feet	102 hours	3.8 feet	103 hours	4.9 feet	115 hours	4.1 feet	118 hours
Elma Gate Road and Shelton Road	3.5 feet	53 hours	2.4 feet	48 hours	4.5 feet	61 hours	3.3 feet	55 hours
SR 107, south of US 12	1.1 feet	23 hours	0.5 feet	13 hours	2.1 feet	33 hours	1.3 feet	27 hours

For a major flood, most roads and intersections would not be flooded, with or without the Proposed Project. For intersections that would be flooded more than a half foot without the Proposed Project during a major flood, the flood level would be reduced for most to zero. These include: SW Chehalis Avenue at SW John Street, SW Riverside Drive at SW Newaukum Avenue, and Elma Gate Road at Shelton Road. However, the flood level at some intersections would not be reduced, or minimally reduced. These include: Rush Road at the I-5 interchange and 188th Avenue at Moon Road.

For a catastrophic flood, most of the intersections analyzed would experience flooding from 0.5 to 8.4 feet without the Proposed Project. With the Proposed Project, flood depths would be reduced at most, but not all locations. For the intersections analyzed, the reduction ranges from 0.0 to 6.0 feet, depending on the location. Flood durations would be reduced by 0 to 20 hours, depending on the location. However, with the Proposed Project, two of the local road intersections analyzed would still be flooded over 6.0 feet in a catastrophic flood. Some locations would be flooded for multiple hours and a few for 2 days or more.

For the 188th Avenue and Moon Road intersection in Grand Mound, with the Proposed Project, the flood level decreases by less than a foot but the length of time it is flooded increases up to 3 hours under a catastrophic flood scenario. This intersection experiences about 4 feet of flooding for about 4 to 5 days with and without the Proposed Project. While the Proposed Project would contribute to a longer duration of flooding at this location, the increase in duration would be less than 2.5% and the flood level does not increase. Therefore, the impact would be minor as a result of the Proposed Project.

Flooding and Closure of Interstate 5

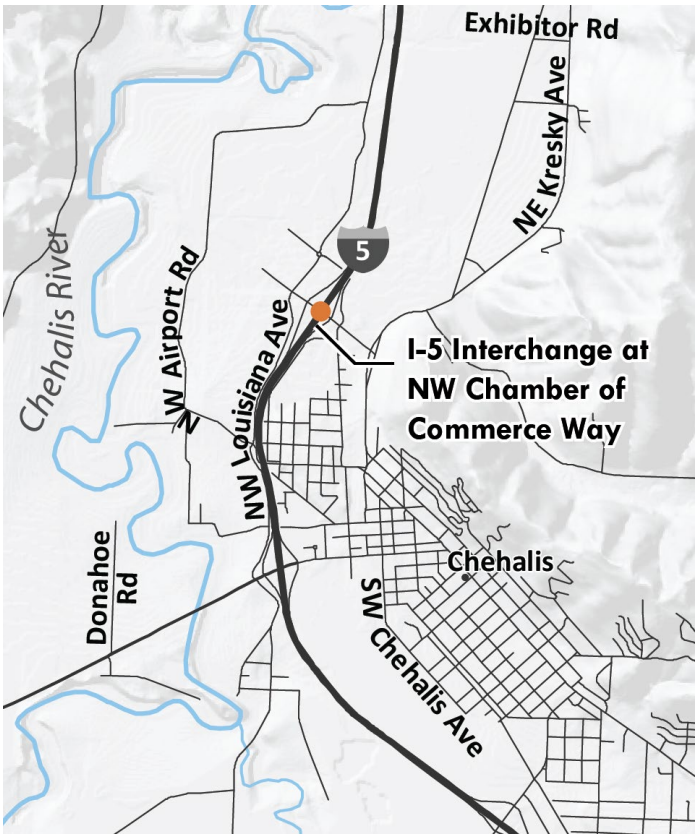
When flooding is projected to overtop I-5 within the Centralia-Chehalis area, WSDOT prioritizes the safety of the traveling public and closes approximately 20 miles of I-5 along US 12, from exit 68 to exit 88 (see Appendix K *Transportation Discipline Report* for detour routes). To determine whether or not to close the interstate, WSDOT surveys NOAA flood projections, gage data, and visual cues and times the closing of I-5 to promote the safest detour. Whenever I-5 is projected to flood, and as long as any point along the route continues to compromise the safety of the traveling public, WSDOT will keep I-5 closed.

In previous closures of I-5 due to flooding, the Centralia-Chehalis community has requested WSDOT seek a detour that does not impact their community. When I-5 floods, a number of the communities' local roads are already blocked by floodwater. Local emergency access is critical and funneling I-5 traffic into the local community would further gridlock the already compromised local road system. The closure and detour remain in place for the duration of any flooding affecting I-5.

While it is not a finding of impacts for purposes of the EIS, for disclosure, the Applicant set a goal to reduce the closure of I-5 and SR 6 to less than 24 hours during a catastrophic flood. With the Proposed Project, six of the seven locations along I-5 are closed for less than 24 hours. The NW Chamber of Commerce Way / I-5 interchange (Exhibit 5.15-5) would remain flooded for 48 hours in the late-century for a catastrophic flood. WSDOT is planning to conduct culvert work near this interchange, which could

reduce the duration of flooding. Two intersections of SR 6 would be flooded for just over 24 hours. Planning is underway by WSDOT to implement culvert changes at the I-5 / NW Chamber of Commerce Way intersection that are expected to reduce flooding at this location. It is expected that the Applicant will work with WSDOT to consider if further actions are needed to reduce flooding at this intersection.

Exhibit 5.15-5
Location of I-5 Interchange at NW Chamber of Commerce Way

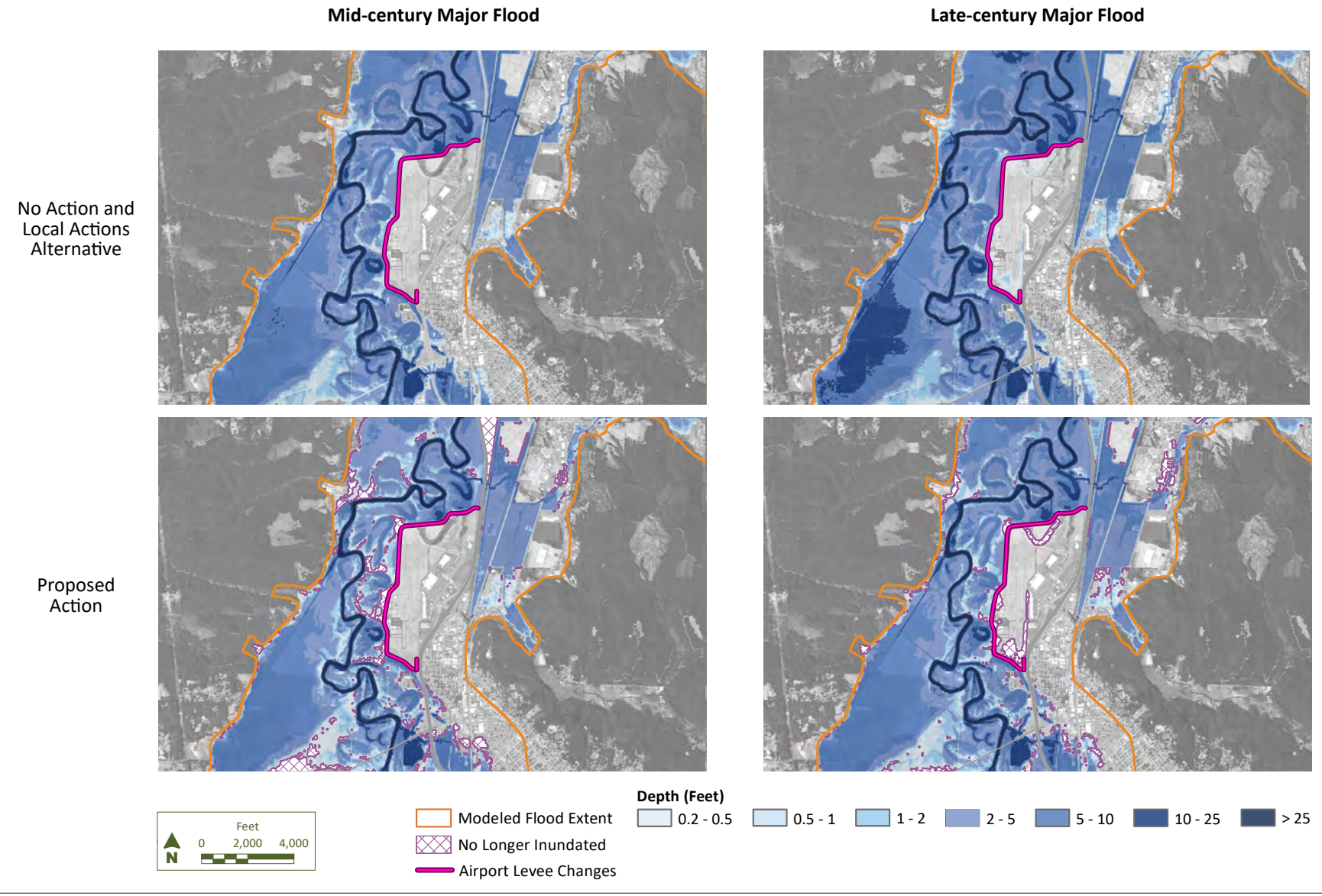


Based on modeling, the Chehalis-Centralia Airport would not be inundated during a major flood with the Proposed Project. For a catastrophic flood, without the Proposed Project, the airport could be inundated by 6.8 feet in mid-century, and by 8.2 feet along the runway in late-century. Similar levels of flooding are expected in the area of the airport operations center. With the Proposed Project, flood inundation would be reduced by about 50% (from 8 feet to 4 feet) under both catastrophic flood scenarios. The duration of the flooding would also be reduced with the Proposed Project from 60 hours to about 40 hours for a late-century catastrophic flood. While flooding would still occur, there would be no adverse impacts as a result of the Proposed Project.

While it is not a finding of impacts for purposes of the EIS, for disclosure, the Applicant set a goal to minimize the closure of the Chehalis-Centralia Airport during a catastrophic flood. The Proposed Project does reduce the amount of time and flood levels at the airport in both mid-century and late-century (see Exhibit 5.15-6).

Changes in the depth and duration of flooding under the Proposed Project would also likely decrease service impacts at the Elma Municipal Airport and the delay or cancellation of rail and transit service. Tables in the *Transportation Discipline Report,* Appendix K, show changes in the inundation depth during a major and catastrophic flood for selected railroad locations (Tables K-10 and K-11) and changes in inundation depth and duration for airports (Tables K-12 through K-15).

Exhibit 5.15-6
Predicted Changes in Flood Inundation Depths in the Airport Area



5.15.2.4 Proposed Mitigation Measures

This section describes mitigation measures being proposed for the Applicant to implement that would reduce impacts from construction and operation of the Proposed Project. These mitigation measures would be implemented with, or as part of, the required permits, plans, and approvals described in Section 4.

- **TRANSP-1:** To reduce impacts on the environment from construction, upgrades, use, or abandonment of roads not covered under Forest Practices Rules, mitigation is proposed for the Applicant to meet all Forest Practices Act requirements for road building, maintenance, and abandonment for roads at the FRE facility site or in the temporary reservoir area. The Applicant will ensure road construction, equipment on the roadway, and maintenance are in accordance with state requirements for the protection of streams, wetlands, unstable slopes, or other sensitive sites.

Other Related Mitigation Measures (for details, see Section 5.17)

- WATER-1 (Surface Water Quality Mitigation Plan)

5.15.2.5 Significant and Unavoidable Adverse Environmental Impacts

Compliance with Forest Practices Act requirements and implementation of the mitigation measures described above would reduce impacts on transportation. There would be no significant and unavoidable adverse environmental impacts on transportation as a result of the Proposed Project.

5.15.3 Findings for the Local Actions Alternative

Some local actions would require construction. However, construction would likely be local and done over a long time period, so there would be minimal construction traffic. Construction activities under the Local Actions Alternative would be a minor adverse impact and there would be no adverse impacts from operations.

Flooding along roadways, railroads, and the airport in the study area would not be reduced under the Local Actions Alternative and impacts on transportation would range from significant to minor. Floods would continue to affect roads, rail, transit, and the airport and could have long-term damage. Travel and access would continue to be disrupted by floods and main transportation routes would be closed while inundated. This could increase the use of other roads as alternate routes and temporarily increase traffic and affect the LOS.

5.15.4 Findings for the No Action Alternative

Flooding along roadways, railroads, and the airport in the study area would not be reduced and flood frequency and severity is predicted to increase in the future. Floods would continue to affect roads, rail, transit, and the airport and could cause long-term damage. Details on specific locations are in Sections 3.2 and 3.4 of Appendix K, *Transportation Discipline Report*.

The seven locations analyzed for I-5 would not be inundated during a major flood, but six of them would be for a catastrophic flood with a depth ranging from 0.5 to 8.4 feet. The duration of flooding would be under 24 hours for all locations but NW Chamber of Commerce, which would be inundated for 59 hours (Exhibits 5.15-3 and 5.15-4).

SR 6 would experience limited flooding at Twin Oaks Road and Heden Road in a major flood and five of the six locations would be flooded in a catastrophic flood in the late-century with a depth ranging from 0.5 to 6.4 feet. The duration of flooding for all locations would be less than 24 hours except for SR 6 and Twin Oaks, which would be inundated for 35 hours (Exhibits 5.15-3 and 5.15-4).

Eight locations on major local roads in Centralia, Chehalis, and Napavine were analyzed. For a major flood in the mid-century, four sites would flood and in the late-century, six would flood. This would likely result in road closures. For a catastrophic flood, all locations would flood from 1 to 6.4 feet in the mid-century. In the late-century, all locations would flood from 2.4 to 7.1 feet for a day or longer. Roads analyzed in Dryad, Curtis, Bunker Hill, Adna, and Grand Mound would have varying depths and durations of flooding with the highest levels for catastrophic floods.

Six locations from Grand Mound to Montesano were analyzed. For a major flood in the mid-century and late-century, two sites would flood. This would likely result in road closures. For a catastrophic flood, all locations would flood from less than 1 foot to 4.4 feet in the mid-century. In the late-century, all sites would flood from 1.7 to 4.9 feet for a day or longer. Tables in the *Transportation Discipline Report,* Appendix K, show changes in the maximum flood depth (Table K-8) and flood duration (Table K-9) for key roadway locations. A selection of these key roadway locations are included above in Exhibits 5.15-3 and 5.15-4.

Travel and access would continue to be disrupted by floods and main transportation routes would be closed while inundated. This could increase the use of other roads as alternate routes and temporarily increase traffic and affect the LOS.

5.16 VISUAL QUALITY

Visual quality, or aesthetics, refers to natural and human landscapes and how people see them. It is based on the type of view, such as rural or forested. To evaluate impacts, this EIS analyzes how the Proposed Project would change the landscapes and how many people would be affected by the changes.

The *Visual Quality Discipline Report*, Appendix M, has the full analysis and technical details used to evaluate visual quality in the EIS.

5.16.1 How Impacts Were Analyzed

The analysis looked at the areas where the FRE facility and airport levee would be visible. Aerial pictures, maps, and visits to the site were used to identify two viewpoints where people would be most likely to see changes from the current landscape. One viewpoint is at the Willapa Hills State Park Trail/SR 6 and the other is at the Riverside Golf Course. Then computer-generated pictures were created to show changes that would be seen from these viewpoints.

The *Visual Resources Assessment Procedure for U.S. Army Corps of Engineers* (Corps 2019) was used for the analysis. It evaluated changes in the landscape setting, the amount of change, and if the changes fit in with the surrounding area. The process considers the number of sensitive viewers for each area. For the FRE facility site, this number is extremely low because public access is limited and the site is not visible from scenic highways or recreational trails. The levee is more visible, but the visual quality at the site is low or average and it is in a very developed area. The analysis then evaluated how different the FRE facility and levee changes would be from the existing landscapes.

The analysis considered federal, state, and local laws, plans, and guidelines. These include the Washington State Shoreline Management Act, the Lewis County SMP, and the Lewis County and Chehalis Comprehensive Plans. Table M-3 of Appendix M, *Visual Quality Discipline Report*, lists the laws and policies and if the Proposed Project would be consistent with them.

Key Findings of the Visual Quality Analysis

The FRE facility would have large-scale construction activities, change the shoreline and upland landscapes, and be a new dominant structure in a previously undeveloped area. But the site is located in an area where public access and views are limited. The site is not visible from any designated scenic routes or recreational trails.

Construction of the FRE facility would have **moderate visual impacts**. Removal of trees in the temporary reservoir footprint would be a **moderate impact** because it would be similar to current logging operations, but cover a larger single area.

There would be **moderate long-term impacts** on visual quality from the FRE facility and temporary reservoir.

Construction and operation of the Airport Levee Changes would have **minor impacts** on visual quality.

5.16.2 Findings for the Proposed Project

5.16.2.1 Impacts From the Flood Retention Facility

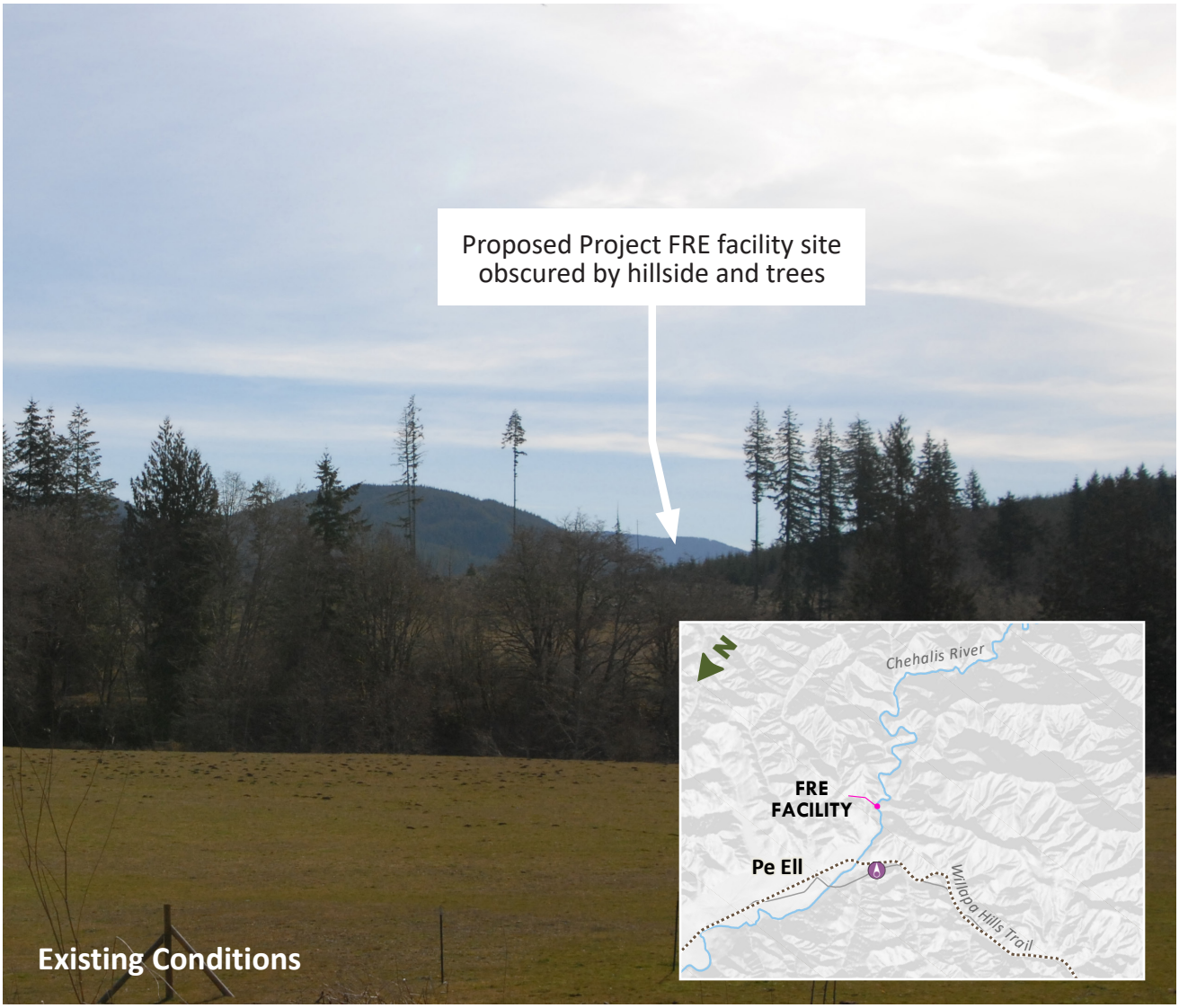
The landscape at the FRE facility is mostly natural views of the Chehalis River. Upland areas are forested, but much of the area has been logged, resulting in a patchwork of different-aged stands of trees. The FRE facility site is on private forestland owned by Weyerhaeuser and Panesko Tree Farm. The public can only access the area with a Weyerhaeuser permit, using a gravel road. The site cannot be seen from Pe Ell, SR 6, or the Willapa Hills State Park Trail. Once construction begins, there would be no recreational access to the area, which would further reduce the number of people viewing the site. Only forest workers and recreational users on nearby ridgelines and hilltops could see the structure and temporary reservoir. The closing of the area to recreation would be a loss of visual resources; however, because of the limited number of people who use the area now, this is a minor adverse impact.

The 270-foot-tall FRE structure would be a dominant feature in the landscape when viewed from immediately downriver. While it would strongly contrast with the setting because it would be a large structure in a forested valley and not incompatible with the rural character. The setting has roads, small buildings, and regular logging on nearby hillsides. This is a working landscape, and the presence of a flood retention facility would generally be perceived as part of the working rural landscape by the few people with access near it. It would not obstruct any designated scenic views. Because of its remote location and forested setting, it would not be visible to large numbers of people and would have a moderate adverse impact on the visual setting during construction and operation. Exhibit 5.16-1 shows the viewshed area that was the focus of the analysis from a viewpoint on the Willapa Hills State Park Trail at SR 6.

The temporary reservoir, when filled, would be a dominant feature when viewed from open areas like nearby ridgelines. The reservoir would change the rural landscape temporarily and would contrast sharply with the forested setting, but would be compatible with the rural character. When the temporary reservoir is not inundated, the river would flow through the structure, and an expanded shoreline with shrubs would be present instead of forest. This would be large in scale, moderate in contrast, and compatible with the visual setting when there is no inundation. Inundation would likely cause extensive vegetation die-offs within the temporary reservoir area, resulting in temporary impacts on visual quality until replanting and regrowth occur following use of the temporary reservoir. The temporary reservoir would have moderate adverse impacts because it would cover a large area that has not previously been inundated, but it would be generally compatible with the rural setting.

All non-flood-tolerant trees within a 600-acre area of the temporary reservoir would be permanently removed during construction, and scrub-shrub vegetation would be planted. After construction, large trees would continue to be removed periodically. Tree removal would permanently change the visual quality of the area next to and within the temporary reservoir. Removal of trees is considered a moderate adverse impact on visual quality. While it would occur in a setting where there are clearcut areas, the size of clearcut areas is limited under Forest Practices Rules and the reservoir area would be a larger single area.

Exhibit 5.16-1
Key Viewpoint Location Near FRE Facility



Key Viewpoint Location:	Willapa Hills State Park Trail/SR 6 roadside (Latitude N46°33'28.9" Longitude W123°18'49.7")
Day/Time of Photo:	March 15, 2019, 11:55 AM
Viewing Direction:	Southeast
Project Information:	Proposed Project FRE facility site (in distance) would not be visible behind existing hills and trees.

Construction work at the FRE facility site, quarry sites, and in the reservoir footprint, including constructing or upgrading roads, concrete production, and trucks moving materials, would cause dust and be visible. These activities and the presence of construction equipment would contrast with the natural landscape, causing temporary minor adverse impacts. Construction activities in the Chehalis River would include installing and removing cofferdams and creating a bypass tunnel to route the river around the construction site. This work would disturb sediments, but the required water quality, Forest Practices Act, and shoreline permits would require that any release of sediment meet the water quality standards. This would reduce the visual impacts from sediment in the water and be a minor adverse impact.

A bypass road for FR 1000 would be built to provide access to the FRE facility. For the quarries, existing roads would be expanded and widened. This construction and upgrading of roads would require tree clearing and create a more developed-looking landscape, resulting in adverse impacts on visual quality. After construction, the Huckleberry Quarry and associated roads on commercial forestland would be reclaimed and revegetated as required by DNR under their Reclamation Permit and Forest Practices Act permits. The North and South Quarries and associated roads are not on managed forestland, so mitigation is included for these areas to meet the same standards required by DNR. This would include replanting and restoring the scenic value of the land as much as possible, so with the mitigation, impacts would be minor.

5.16.2.2 Impacts From the Airport Levee Changes

The current airport levee is an earthen berm that rises about 9 feet above the surrounding ground elevation. The levee is in a developed area between the Chehalis Airport and the Chehalis River.

Construction for the Airport Levee Changes would cause short-term impacts on visual quality. Dust, construction debris, heavy equipment, and erosion control measures would all be present. These would temporarily affect the visual setting during the construction period for airport users, Riverside Golf Course and RV Park patrons, residents of surrounding properties, and passing traffic. These would be minor adverse impacts on the visual setting because they would be both short term and small in size.

Users of Riverside Golf Course and RV Park would see the Airport Levee Changes. RV Park viewers are near the levee and present for long periods of time, so they are likely sensitive to visual changes. Viewers from the golf course may see the levee, roads, and the airport from some locations. The raised levee height would be similar to the current view from the golf course and compatible with the existing setting. It would be moderately larger and more prominent, but would appear as a grassy hill. Views of the distant hills would not be obstructed. Adverse impacts on the visual setting would be considered minor. Exhibit 5.16-2 shows a visual simulation of the levee from an area of the golf course with the clearest view of the levee.

Exhibit 5.16-2
Visual Simulation of Airport Levee Changes

Airport Levee Existing Conditions

Airport Levee Simulation with Proposed Project

Key Viewpoint Location:	Riverside Golf Course (Latitude N46°40'20" Longitude W122°59'18.5")
Day/Time of Photo:	March 15, 2019, 10:27 AM
Viewing Direction:	East
Project Information:	Proposed Project levee elevation depicted is 7 feet higher than the existing levee.

5.16.2.3 Proposed Mitigation Measures

This section describes mitigation measures being proposed for the Applicant to implement that would reduce impacts from construction and operation of the Proposed Project. These mitigation measures would be implemented with, or as part of, the required permits, plans, and approvals described in Section 4.

- **VISUAL-1:** To address construction-related visual impacts, mitigation is proposed for the Applicant to locate temporary construction access roads, staging areas, and stockpile sites within previously disturbed areas.
- **VISUAL-2:** To address construction-related visual impacts, mitigation is proposed for the Applicant to phase construction to minimize the amount of construction-related equipment and materials stored in the area.
- **VISUAL-3:** To reduce visual impacts from construction, mitigation is proposed for the Applicant to meet all Forest Practices permit requirements for reclaiming and revegetating the North and South Quarry sites and roads not on managed forestland.

5.16.2.4 Significant and Unavoidable Adverse Environmental Impacts

Compliance with laws and implementation of the measures described above would reduce impacts on visual quality. There would be no significant and unavoidable adverse impacts on visual quality from the Proposed Project.

5.16.3 Findings for the Local Actions Alternative

The Local Actions Alternative would not result in large adverse changes to the visual setting of the study area. These actions would be of similar size and compatible with the existing views. During construction, there could be potential short-term minor adverse impacts from dust, exposed construction debris, heavy equipment, and erosion control measures. If floodproofing occurred, the increased presence of elevated buildings, flood barriers, and farm pads could affect views. If channel migration protection occurred, the use of objects like large wood would not adversely affect the rural character.

Flooding would likely continue throughout the study area and would not be substantially reduced through implementation of the elements of the Local Actions Alternative. Floods would continue to cause long-term damage and changes to visual character, with impacts ranging from significant to minor.

5.16.4 Findings for the No Action Alternative

Floods would continue to cause long-term damage and changes to visual character.

5.17 SUMMARY OF POTENTIAL MITIGATION

This section compiles mitigation measures that would reduce impacts from construction and operation of the Proposed Project. These mitigation measures would be implemented with, or as part of, the required permits, plans, and approvals described in Section 4.

WAC 197-11-440 states the EIS may discuss the technical feasibility and economic practicability if there is a concern that the mitigation measure is capable of being accomplished. The decision on whether mitigation is feasible would be determined during the permitting processes by the permitting agencies. In some cases, additional information on the project design would be required which is not available at this early stage of design.

Air Quality and Greenhouse Gases

- **AIR-1 (GHG Mitigation Plan)**: To address the potential impacts of GHG emissions attributable to the Proposed Project, mitigation is proposed for the Applicant to prepare and implement a GHG Mitigation Plan that mitigates for 100% of the 123,439 metric tons of GHG emissions from construction and operation. The plan must be approved by Ecology and must be ready to implement prior to the start of construction. The measures described in the plan may include a range of mitigation options. The measures must achieve emissions reductions that are real, permanent, enforceable, verifiable, and additional. The emissions reductions may occur in Washington State or outside of Washington State, but Washington State projects are preferred, and all projects must meet all five criteria (e.g., using internationally recognized protocols). For example, carbon credits could be purchased through existing carbon markets or restoration projects.
- **AIR-2:** To reduce carbon monoxide and GHG emissions, mitigation is proposed for the Applicant to ensure the timber removed from the temporary reservoir area for construction and the large woody material removed during operations will be used and not burned, for example, in restoration projects in the Chehalis River or tributaries.
- **AIR-3:** To reduce diesel particulate matter and GHG emissions, mitigation is proposed for the Applicant to implement an anti-idling policy for FRE facility and levee construction and operations.

Cultural Resources

No determination of eligibility or adverse effects has been made yet for the potential impacts described above. As part of the Section 106 process, if there are adverse effects to cultural resources, a Memorandum of Agreement would be negotiated among the Corps, DAHP, potentially affected Native American tribes, the Applicant, and other Section 106 parties. The Memorandum of Agreement would determine mitigation and treatment requirements through the Section 106 process of the National Historic Preservation Act. The Section 106 process is ongoing; therefore, determination of adverse effects and mitigation measures are not discussed in this Draft EIS.

Earth

- **EARTH-1:** To reduce potential impacts on water quality from slope instability at the FRE facility during construction, mitigation is proposed for the Applicant to identify unstable ground in the proximity of the FRE facility and to either excavate and haul this material to a waste disposal site or stabilize the ground by methods such as soil nails, tieback shoring, rock bolts, shotcrete, bracing, and scaling.
- **EARTH-2:** To reduce impacts on the FRE facility from unstable deep-seated landslides, mitigation is proposed for the Applicant to develop a plan to stabilize landslides using, but not limited to, the following methods: 1) excavate unstable soil where adjacent to the FRE facility; 2) add buttressing and drainage to increase slope stability where adjacent to the FRE facility; and 3) monitor landslide activity where distant from the FRE facility. Ecology would approve the Landslide Stabilization Plan and it would be required to be implemented prior to or during construction.
- **EARTH-3 (Large Woody Material Management Plan):** To mitigate the impacts of construction and operation of the Proposed Project on large woody material and habitat, mitigation is proposed for the Applicant to develop and implement a Large Woody Material Management Plan. The plan must be developed in coordination with and approved by WDFW, and in consultation with DNR, and be ready to implement prior to the start of construction. The measures described in the plan will include a range of mitigation options. Mitigation will be implemented along the mainstem Chehalis River and in appropriately sized tributaries. The mitigation will include, but is not limited to, the following:
  - To minimize impacts during construction, a plan will be developed to address large woody material transport and the diversion tunnel.
  - To minimize impacts on channel-based processes, the large woody material that accumulates in the reservoir will be placed within the river channel and upland habitats identified in the plan within 60 days of completing drawdown following each inundation event.
  - This plan will be developed in conjunction with management and mitigation plans for vegetation, wetlands and wetland buffers, streams and stream buffers, fish and aquatic species and habitat, wildlife species and habitat, riparian habitat, and surface water quality.

Environmental Health and Safety

- **EHS-1:** To reduce impacts on emergency services and response, mitigation is proposed for the Applicant to coordinate construction activities with emergency service providers, schedule construction to minimize impacts, and notify the public of construction that will reduce service response delays related to traffic and activities.
- **EHS-2:** To reduce impacts on emergency services and response, mitigation is proposed for the Applicant to develop Construction Traffic Control Plans for the FRE facility and levee construction work.

- **EHS-3:** To improve emergency response, mitigation is proposed for the Applicant to develop and implement a breach flood warning system for Pe Ell, Centralia, and Chehalis. The breach flood warning system would be a staged system, with alerts and responses becoming more urgent as the potential for a breach becomes more severe. The initial stage may begin with notifications to local officials, eventually proceeding to full-scale evacuations. For a fast-developing breach scenario, with little warning time, alert sirens may be an option. This system will be reviewed by Ecology's Dam Safety Office and Lewis County emergency response agencies.
- **EHS-4:** To improve emergency response, mitigation is proposed for the Applicant to provide training to local emergency response organizations on breach scenarios as part of the Emergency Action Plan. This also includes providing educational outreach for downstream residents, schools, and critical facilities on how to respond to a rapidly developing breach.

Environmental Justice

- **EJ-1:** To provide targeted outreach efforts for the Proposed Project, mitigation is proposed for the Applicant to develop an inclusive public involvement strategy tailored to the communities who may be affected by a catastrophic event causing the FRE facility to breach or fail while the temporary reservoir is holding water. This strategy will address social and economic barriers to meaningful public engagement, such as language service needs, limited access to technology, and literacy and education levels. The public involvement approach may include consideration of culturally effective outreach (such as radio and community events), providing language translation and interpretation services, and a multimedia approach such as local mailers and video.

Fish Species and Habitats

- **FISH-1 (Fish and Aquatic Species and Habitat Plan)**: To mitigate the impacts on fish and aquatic species and habitats associated with construction and operation of the Proposed Project, mitigation is proposed for the Applicant to develop and implement a Fish and Aquatic Species and Habitat Plan. The plan must be developed in coordination with and approved by WDFW, tribes, and other applicable local, state, and federal agencies. The plan must include a range of options that provide no net loss of ecological function for the fish species and habitats impacted by construction and operational activities. Mitigation will be considered from the headwaters of the Chehalis River to the confluence of the Chehalis and Newaukum rivers. The mitigation will include, but is not limited to, the following:
  - Mitigation for temporal loss of functions and values until the restored or created habitat addressing impacts is fully functional.
  - Advance in-kind mitigation implemented prior to construction, such as replacement (restoration or creation), for the fish and aquatic habitat impacted by the Proposed Project.

- Protection of areas adjacent to the temporary reservoir area supporting connectivity between the restored or created habitat to replace the lost functions and values for impacted species.
- A Monitoring Plan identifying long-term actions to verify the implemented mitigation provides adequate compensation for impacts on functions and values provided by fish species and their habitats. Monitoring will be conducted over the life of the Proposed Project.
- An Adaptive Management Plan describing measures that will be taken should the mitigation not achieve performance standards set forth in the Monitoring Plan.
- A Maintenance Plan describing work that will be conducted over the life of the Proposed Project to maintain the functions and values provided by replacement habitat.
- Permanent protection measures via land acquisition or through a conservation easement in perpetuity that fully encumbers the restored fish and riparian habitat.
- This plan will be developed in conjunction with management and mitigation plans for vegetation, wetlands and wetland buffers, streams and stream buffers, wildlife species and habitat, riparian habitat, surface water quality, and large woody material.

Land Use

- **LAND-1:** To remove the inconsistency with land use policies for construction of the FRE facility, mitigation is proposed for the Applicant to coordinate with Lewis County for a rezone of the current Forest Resources Land at the proposed FRE facility and temporary reservoir location or request a conditional use permit to address the inconsistency of the proposed land use within the Forest Resource Lands land use designation and zoning district. For associated forest practices activities, the Applicant will participate in pre-application consultation as provided for in the Forest Practices Rules.
- **LAND-2:** To reduce impacts from construction of the Airport Levee Changes, mitigation is proposed for the Applicant to prepare a hydraulics and hydrology study to determine whether compensatory flood storage would be required commensurate with the amount of fill placed in the floodway or SMP flood course (Lewis County SMP Section 6.03.02 [K]).
- **LAND-3:** The *Water Discipline Report,* Appendix N, identifies the potential for impacts from temporary increased flood elevations immediately upstream and downstream of the levee if the Airport Levee Changes are completed before the FRE facility is operational, which would result in impacts on land uses in those areas. Mitigation is proposed for the Applicant to develop a schedule in which the levee is built during the last part of the FRE facility construction period to eliminate the risk of additional flooding from a catastrophic flood if the Airport Levee Changes are completed before the FRE facility is constructed.

Noise and Vibration

No mitigation is proposed.

Public Services and Utilities

- **PSU-1:** To reduce potential impacts on Pe Ell's water supply system, mitigation is proposed for the Applicant to work with the Town of Pe Ell to conduct a study to determine if the Pe Ell water line at Lester Creek needs to be relocated or redesigned to ensure that it can withstand inundation within the temporary reservoir. If relocation or redesign is required, the Applicant will develop a cost estimate and provide funding for this work.
- **PSU-2:** Mitigation is proposed for the Applicant and its contractors to develop construction sequence plans and coordinate schedules to minimize service disruptions and provide ample advance notice if service disruption is unavoidable, consistent with utility provider policies.

Recreation

- **REC-1 (Recreation Mitigation Plan):** To reduce impacts on recreational users from construction and operation of the Proposed Project, mitigation is proposed for the Applicant to develop a Recreation Mitigation Plan to identify and implement potential mitigation. Lewis County Parks and Recreation Department and WDFW will review the plan.

Transportation

- **TRANSP-1**: To reduce impacts on the environment from construction, upgrades, use, or abandonment of roads not covered under Forest Practices Rules, mitigation is proposed for the Applicant to meet all Forest Practices Act requirements for road building, maintenance, and abandonment for roads at the FRE facility site or in the temporary reservoir area. The Applicant will ensure that road construction, equipment on the roadway, and maintenance are in accordance with state requirements for protection of streams, wetlands, unstable slopes, or other sensitive sites.

Tribal Resources

Mitigation associated with potential impacts on tribal resources would be addressed directly with the Quinault Indian Nation, Chehalis Tribe, and other tribes during government-to-government consultations. Mitigation measures are expected to be developed as part of the permitting and consultation processes for fish species and habitat, wildlife, and cultural resources.

Visual Quality

- **VISUAL-1:** To address construction-related visual impacts, mitigation is proposed for the Applicant to locate temporary construction access roads, staging areas, and stockpile sites within previously disturbed areas.
- **VISUAL-2:** To address construction-related visual impacts, mitigation is proposed for the Applicant to phase construction to minimize the amount of construction-related equipment and materials stored in the area.

- **VISUAL-3:** To reduce visual impacts from construction, mitigation is proposed for the Applicant to meet all Forest Practices permit requirements for reclaiming and revegetating the North and South Quarry sites and roads not on managed forestland.

Water

- **WATER-1**: To reduce probable impacts on surface water quality and designated aquatic life uses of the Chehalis River and Crim Creek from construction and operation of the Proposed Project, mitigation is proposed for the Applicant to develop and implement a Surface Water Quality Mitigation Plan. The plan must be approved by Ecology and other applicable local, state, and federal agencies and be provided as part of the Section 401 and NPDES permit applications. The plan must provide reasonable assurance that water quality standards and designated in-water uses will be met. The mitigation must be done within the Chehalis River Basin. The plan may include a range of options for mitigation. The plan will include, but is not limited to, the following:
  - Mitigation for the increase in daily maximum temperature of up to 2°C to 3°C (3.6°F to 5.4°F) in the Chehalis River in the temporary reservoir footprint and to about 20 miles downstream of the FRE facility, and of up to 5°C (9°F) in the lower portion of Crim Creek, below its confluence with Lester Creek.
  - Mitigation for the decrease in daily minimum dissolved oxygen by up to 0.4 milligrams per liter in the Chehalis River within the temporary reservoir.
  - Measures to minimize the exceedances of turbidity water quality criteria to the downstream Chehalis River when the temporary reservoir is draining and outflow turbidity exceeds inflow turbidity by more than 10% or by more than 5 NTU if inflows are less than 50 NTU.
  - Measures to minimize the exceedances of turbidity water quality criteria in the reservoir area from shallow landslides.
  - This plan will be developed in conjunction with management and mitigation plans for vegetation, wetlands and wetland buffers, streams and stream buffers, fish and aquatic species and habitat, wildlife species and habitat, riparian habitat, and large woody material.

Wetlands

- **WET-1 (Wetland and Wetland Buffer Mitigation Plan):** To mitigate the impacts on 10.8 acres of wetlands and 333 acres of wetland buffers from construction and operation of the Proposed Project within the FRE facility and temporary reservoir area; and to 6.6 acres of wetlands and 44 acres of wetland buffers within the airport levee area, mitigation is proposed for the Applicant to develop and implement a Wetland and Wetland Buffer Mitigation Plan in coordination with Ecology and the Corps. The plan will be prepared as part of the permitting process for the Proposed Project. The plan will address the general requirements for mitigation planning consistent with all current local, state, and federal guidance and regulations. These requirements must be met before applicable permits are issued.

- Potential impacts on wetlands and wetland buffers will first be addressed through avoidance and minimization measures. This includes avoiding wetlands and wetland buffers during construction access and staging efforts, and locating construction access and supporting infrastructure routes to avoid wetlands. Wetland and wetland buffer vegetation in temporarily disturbed areas will be restored, including soil decompaction if needed, as soon as possible after construction activities are complete. Temporary impacts on wetlands and wetland buffers may also require compensatory mitigation depending on the duration of the impact and the type of wetland.
- Compensatory mitigation actions may be implemented at one or several locations to ensure that the range of ecological functions are provided to offset identified project impacts and the types of wetland functions affected by the Proposed Project. Mitigation ratios prescribe the acreage needed to compensate for unavoidable impacts on wetlands, depending on the type of compensation, the category of the affected wetland, and the proposed category of the compensatory mitigation wetland.
- This plan will be developed in conjunction with management and mitigation plans for vegetation, streams and stream buffers, fish and aquatic species and habitat, wildlife species and habitat, surface water quality, and large woody material.

- **WET-2 (Stream and Stream Buffer Mitigation Plan):** To mitigate the impacts on 16.8 miles of streams (waterbodies) and 441 acres of stream buffers from construction and operation of the Proposed Project, mitigation is proposed for the Applicant to develop and implement a Stream and Stream Buffer Mitigation Plan. The plan must be developed in coordination with and approved by Ecology, Lewis County, other applicable local, state, and federal agencies, and tribes and be ready to implement prior to the start of construction. The plan will be prepared as part of the permitting process for the Proposed Project. The plan must include restoration options that provide no net loss of ecological functions for the streams and stream buffers impacted by construction and operational activities. Mitigation will be considered from the headwaters of the Chehalis River to the confluence of the Chehalis and Newaukum rivers. The mitigation will include, but is not limited to, the following:
  - Avoiding regulatory waterbodies during construction access and staging efforts, and locating construction access and supporting infrastructure routes to avoid streams and stream buffers. Where impacts cannot be avoided, efforts will be taken to minimize impacts on the maximum extent practicable, such as by minimizing stream crossings.
  - The Applicant must ensure ecological functions are maintained in accordance with Lewis County Shoreline Master Program requirements and ratios. The mitigation will be a minimum of a one-to-one ratio for riparian corridor habitat to ensure no net loss of shoreline ecological function.
  - Permanent protection measures via land acquisition or through a conservation easement in perpetuity that fully encumbers the restored stream habitat.

- A maintenance component that addresses, but is not limited to, invasive and non-native species removal and control, plant replacement, irrigation, and adaptive management measures.
- A monitoring component that addresses, but is not limited to, species use surveys (e.g., avian, amphibians, wildlife), vegetation surveys (e.g., survival, mortality, cover), and analysis of functionality over time.
- This plan will be developed in conjunction with management and mitigation plans for vegetation, wetlands and wetland buffers, fish and aquatic species and habitat, wildlife species and habitat, riparian habitat, surface water quality, and large woody material.

Wildlife Species and Habitats

- **WILDLIFE-1 (Vegetation Management Plan):** To mitigate construction and operation impacts on habitat associated with the FRE facility (34.9 acres) and the temporary reservoir (847 acres), mitigation is proposed for the Applicant to develop and implement a Vegetation Management Plan. The Applicant will consult with DNR, WDFW, Lewis County, other applicable local, state, and federal agencies and tribes during plan development. The plan must be approved by WDFW and Lewis County and be ready to implement prior to the start of construction. The measures described in the plan may include a range of mitigation options. The mitigation will be required to be completed within and near the FRE facility and temporary reservoir area or along the Chehalis River mainstem. The mitigation will include, but is not limited to, the following:
  - Harvest of trees in the temporary reservoir during construction will be phased to remove trees in sections of a size to support revegetation of cleared areas before the next section is cleared. For associated forest practices activities, the Applicant will participate in pre-application consultation as provided in the Forest Practices Rules. The harvest of trees in areas being converted to non-forestry uses for the FRE facility and temporary reservoir will follow the Forest Practices Act and local ordinances as appropriate.
  - An evaluation to determine if trees larger than 6 inches diameter at breast height can remain within the temporary reservoir to minimize the number of trees removed and ensure safety. Leave trees that can safely be retained.
  - A multi-phased and detailed planting plan including targeted native species assemblages, structure and diversity targets, and succession goals over the life of the project.
  - Plant native species within 90 days of completing drawdown following each inundation event to minimize the potential for invasive species to colonize.
  - Routinely monitor and remove invasive and non-native species in the temporary reservoir footprint to prevent undesirable vegetation from spreading into upland areas or migrating downstream.
  - Establish an adaptive management process to evaluate the Vegetation Management Plan every 3 years and after a catastrophic flood. Best available science will be used to adjust

tree removal and vegetation planting in the temporary reservoir area. Sites will be visually inspected annually to identify plant health and survival, and records will be maintained for the lifetime of the Proposed Project.

- This plan will be developed in conjunction with mitigation plans for large woody material, wetlands, riparian habitat, fish and aquatic species and habitat, and wildlife species and habitat.

- **WILDLIFE-2 (Wildlife Species and Habitat Management Plan):** To mitigate the impacts on wildlife species and habitat from construction and operation of the Proposed Project, the Applicant will prepare a Wildlife Species and Habitat Management Plan. The plan must be developed in coordination with and approved by WDFW and other applicable local, state, and federal agencies and tribes. It must be ready to implement prior to the start of construction. The measures described in the plan may include a range of mitigation options. Mitigation will be required to be implemented within the upper Chehalis River Basin from the headwaters of the Chehalis River to the confluence of the Chehalis and Newaukum rivers. The mitigation will include, but is not limited to, the following:
  - Permanent protection measures for upland conifer habitat via land acquisition or through a conservation easement in perpetuity to replace habitat functions in the temporary reservoir area.
  - Inclusion of habitat structures (e.g., sediment wedges created from engineered large woody material, large woody material placement) in mitigation areas such as the mainstem Chehalis River downstream of the Proposed Project and appropriately sized tributaries of the Chehalis River mainstem.
  - To reduce impacts on nesting bird species from construction of the FRE facility, the Applicant will conduct spring season (pre-nesting) pre-construction surveys in the FRE facility area and airport levee area to identify any preliminary raptor presence and nesting activity, particularly bald eagles, within 660 feet of the construction footprint. If any nests are observed to be starting, the nests could be removed (prior to any eggs being laid) to encourage the birds to move elsewhere. If nests are removed, the Applicant will build a replacement nesting platform in another location outside of the inundation zone. If any active bald eagle nests are observed, then construction activities should be timed to minimize noise effects to the bald eagle nest until the nesting season is over (approximately August 1).
  - The Applicant will follow the U.S. Fish and Wildlife Service 2012 *Guidance for Identifying Suitable Marbled Murrelet Nesting Habitat in Washington State* to define and identify potential habitat and nesting platforms. If habitat is found, the 2003 Pacific Seabird Group *Methods for Surveying Marbled Murrelets in Forests: A Revised Protocol for Land Management and Research* survey protocol will be used to identify marbled murrelet presence. A ground assessment for marbled murrelet potential nesting habitat will be

conducted to verify presence/absence of nesting platforms. If habitat is verified, 2-year protocol surveys will be completed to determine occupancy. When a nest is occupied, DNR Forest Practices Rules require a minimum avoidance zone around the nest to minimize disturbance to marbled murrelets. Temporary restrictions on disruptive activities, including felling and bucking, within this zone are required within the critical nesting season from April through August. Mitigation will be identified in the plan for any loss of marbled murrelet habitat.

- To reduce impacts on amphibians from construction of the FRE facility, the Applicant will consult WDFW to determine the preferred construction periods to avoid amphibian breeding or rearing time frames.
- To minimize the effects of recurring inundation on state candidate western toad, and other native amphibians that occur in the temporary reservoir inundation area, the Applicant will create areas both upstream and downstream of the temporary reservoir and maintain them frequently to create more sunny openings in shallow-water stream margins for western toad breeding.
- To minimize the effects of recurring inundation on state candidate species western toad, Van Dyke's salamander, and Dunn's salamander, and other native amphibians that occur in the temporary reservoir inundation area, the Applicant will conduct native species plantings and placement of downed wood in riparian areas upstream of the temporary reservoir to provide better winter adult cover to increase the upstream populations and maintain a source for recolonization to the temporary reservoir and other downstream areas.
- This plan will be developed in conjunction with mitigation plans for large woody material, vegetation, wetlands, riparian habitat, and fish and aquatic species and habitat.

- **WILDLIFE-3 (Riparian Habitat Mitigation Plan):** To mitigate the impacts on riparian habitat from construction and operation of the Proposed Project, mitigation is proposed for the Applicant to develop and implement a Riparian Habitat Mitigation Plan. The plan must be developed in coordination with and approved by WDFW, Lewis County, other applicable local, state, and federal agencies and tribes and be ready to implement prior to the start of construction. The plan must include restoration options that provide no net loss for the riparian and stream habitats impacted by construction and operational activities. Mitigation will be considered from the headwaters of the Chehalis River to the confluence of the Chehalis and Newaukum rivers. The mitigation will include, but is not limited to, the following:
  - The Applicant intends to remove non-flood-tolerant trees and trees over 6 inches diameter at breast height in the riparian zone within the temporary reservoir inundation area. To minimize impacts on riparian habitat and retain shade as long as possible, these trees will be removed in the last phase of the 5-year construction period.
  - Permanent protection measures via land acquisition or through a conservation easement in perpetuity that fully encumbers the restored riparian habitat.

- Mitigation in the form of replacement for the area of riparian habitat impacted by the Proposed Project. Restored or created riparian habitat must meet tree heights detailed in *Draft WDFW Riparian Ecosystems, Volume 2: Management Recommendations.*
- A maintenance component that addresses, but is not limited to, invasive and non-native species removal and control, plant replacement, irrigation, and adaptive management measures.
- A monitoring component that addresses, but is not limited to, species use surveys (e.g., avian, amphibians, wildlife), vegetation surveys (e.g., survival, mortality, cover), and analysis of functionality over time.
- This plan will be developed in conjunction with management and mitigation plans for vegetation, wetlands and wetland buffers, streams and stream buffers, fish and aquatic species and habitat, wildlife species and habitat, surface water quality, and large woody material.

6 CUMULATIVE IMPACTS

6.1 Introduction

Cumulative impact analysis is when the impacts from past, present, and future actions are considered along with the impacts from the Proposed Project. This includes climate change predictions. This is because small, separate actions could combine into something that could be significant or projects planned in the future could add to the impacts. A cumulative impacts analysis provides information to decision-makers about the full range of consequences for the Proposed Project under expected future conditions.

This section summarizes the cumulative impacts analysis. It describes how the effects of the Proposed Project may contribute to the environmental effects of other past, present, and future actions. Additional details can be found in Appendix 2: Cumulative Impacts Analysis.

6.2 Cumulative Impacts Analysis

The analysis used the federal Council on Environmental Quality approach for analyzing cumulative impacts with the following steps:

- Identify the resources that could be adversely affected by the Proposed Project.
- Consider other actions in the same area as the Proposed Project.
- Consider other actions happening in the same time period as the Proposed Project.
- Use the best available data.

Chapter 5 of this EIS identifies the resources that could be adversely affected by the Proposed Project. The study area for cumulative impacts is based on the study areas for the resources analyzed in the EIS. Some areas extended farther if needed to determine the incremental impacts. This EIS uses the year 2080 for the cumulative impact analysis. This is in late-century when the FRE facility would be operational. The analysis in the EIS already includes climate change predictions for the late-century. The next section discusses the past, present, and future actions happening in the same geographic area and time frame. This includes future projects that may only be in the planning stages now but that can reasonably be expected to be completed.

6.3 Past, Present, and Future Actions Used in the Analysis

Current conditions in the study area are a result of past and present actions. These conditions were used for all of the analysis in this EIS, including cumulative. The Chehalis River has been connected to Native American tribes from the past to the present day. Traditional economy along the river and throughout the watershed was tied to seasonal hunting, fishing, and resource gathering. The river was used as a

travel corridor to connect to neighboring tribes in the region. There were extensive floodplain wetlands and sloughs. River and stream channels were more winding, with multiple channels, compared to current conditions.

Beginning in the mid-1800s, the Chehalis Basin was settled by emigrants from points east. Over the past 200 years, numerous changes have occurred to watershed processes and functions. Agriculture, ranching, timber harvesting, fishing, and other activities have changed the landscape and habitat in the study area. Farming, forestry, harvesting of shellfish, and fishing continue to be central to the Chehalis Basin economy, and the loss and degradation of habitat have resulted in declines in salmon, steelhead, and other fish, affecting both tribal and non-tribal people of the Chehalis Basin.

From 1938 to 2013, agriculture and development increased, and tree cover decreased in the Chehalis River floodplain. Large floods from the Chehalis River and its tributaries have caused flood damage to people and structures (Exhibit 6-1). Habitat has been lost and degraded, causing declines in salmon, steelhead, and other fish and affecting both tribal and non-tribal people of the Chehalis Basin. In the last few decades, the Chehalis Basin has experienced extreme flooding, which is damaging to people, land uses, species, and habitat, as well as extreme drought conditions in the summer, which affect habitat and fish.

Exhibit 6-1
Historical Record of Major Floods on the Chehalis River

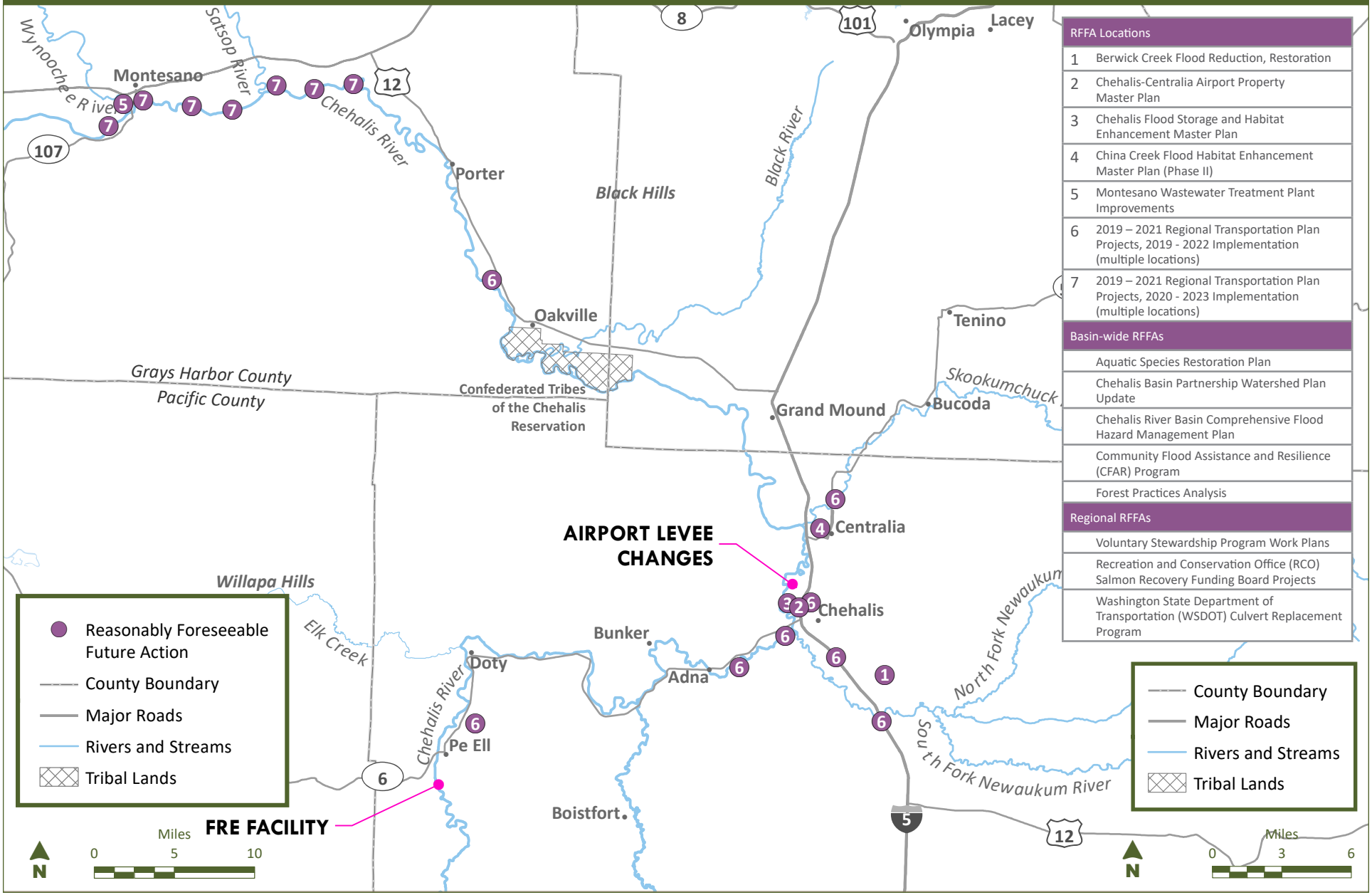
DATE	STREAMFLOW AT USGS GAGE AT GRAND MOUND (CFS)
December 11, 1933	38,800
December 19, 1933	42,900
January 23, 1935	38,000
December 29, 1937	48,400
February 10, 1951	38,000
January 26, 1971	40,800
January 21, 1972	49,200
December 5, 1975	44,800
November 25, 1986	51,600
January 10, 1990	68,700
February 11, 1990	40,700
November 25, 1990	48,000
April 6, 1991	42,800
February 9, 1996	74,800
December 30, 1996	38,700
December 4, 2007	79,100
January 8, 2009	50,700

Section 1.3 provides a background and history of actions undertaken in the Chehalis Basin to reduce flood damage and improve aquatic species habitat conditions, which were considered in the cumulative impacts analysis. This includes work to support the Chehalis Basin Strategy.

The Cumulative Impacts Analysis in Appendix 2 includes a list of past, present, and future actions considered for this analysis. These include projects the Chehalis River Basin Flood Authority recently completed to reduce flood damage in the study area such as culvert replacements, livestock pads, elevating homes, and levees for wellhead protection and wastewater treatment flood prevention. Past projects by the Chehalis River Basin Flood Authority, Chehalis Basin Strategy, U.S. Fish and Wildlife Service, and Washington State Recreation and Conservation Office Salmon Recovery Funding Board are described in Appendix 1, Proposed Project Description and Alternatives Report.

Exhibit 6-2 shows the location of future actions used for the cumulative impacts analysis. These would be required to complete separate SEPA environmental reviews, as required by law. Future projects include the Aquatic Species Restoration Plan, the Community Flood Assistance and Resilience Program, Salmon Recovery Funding Board projects, WSDOT culvert replacement plans, and regional transportation plan projects. They also include projects for Berwick Creek and China Creek, watershed plans, the Chehalis-Centralia Airport plan, Chehalis Flood Storage and Habitat Enhancement, and Chehalis River Basin Comprehensive Flood Hazard Management. Commercial logging would be likely to continue near the FRE facility and temporary reservoir area.

Exhibit 6-2
Reasonably Foreseeable Future Actions Map



6.4 Cumulative Impacts by Resource

Each resource analyzed in the EIS was considered for the cumulative impacts analysis. Probable adverse environmental impacts from the Proposed Project could contribute to cumulative impacts and are described below.

6.4.1 Water

The construction of the FRE facility would have significant impacts on surface water quality and moderate to minor impacts on groundwater water quality, surface and groundwater quantity, and water uses and rights. Construction and operation of the Airport Levee Changes would have moderate to minor impacts on surface water quality and quantity. Operation of the FRE facility would have significant environmental impacts on surface water quality. Surface water impacts include increased temperature in the Chehalis River within the temporary reservoir and immediately downstream, decreases in dissolved oxygen within the temporary reservoir, and increases in turbidity downstream of the FRE facility when water is released from the reservoir and from landslides.

In areas around the FRE facility, commercial logging would continue, including growing, harvesting, or processing timber. These activities are regulated through the Forest Practices Act. Erosion and sediment effects on water quality from timber harvest would be minimized by following Forest Practices Rules. Recent studies show current Forest Practices Rules for unstable areas may be effective at reducing landslides during large storm events.

Implementation of the Aquatic Species Restoration Plan, the Chehalis Basin Partnership Watershed Plan Update, and Voluntary Stewardship Program would likely result in improved conditions for in-stream temperature, dissolved oxygen levels, and turbidity. Future development under the Chehalis-Centralia Airport Property Master Plan is likely to result in wetland impacts and increased impervious surfaces, which could contribute to water quality impacts. However, these impacts would be minimized through compliance with applicable permit requirements.

Proposed mitigation measures would minimize impacts of the Proposed Project; however, the mitigation may not be technically feasible or economically practicable. The Proposed Project, in combination with the activities described above, would contribute to cumulative impacts on water.

6.4.2 Earth

Probable significant adverse earth impacts that would occur as part of operation of the FRE facility include:

- Permanent change to the river channel at the FRE facility site
- Increased turbidity upstream of the FRE facility from shallow landslides
- Increased turbidity within the temporary reservoir area or downstream of the FRE facility

- Fish and aquatic habitat impacts from increased fine sediment deposition
- Reduction in channel-forming flows downstream

Construction of the FRE facility would have moderate to minor impacts on earth from erosion, moderate impacts from excavation, and minor impacts from local alteration to sediment transport. Operation of the FRE facility would have moderate or minor impacts on earth due to increased sediment input, changes to sediment transport, changes to channel migration, and channel incision.

While it is a very low probability, the Proposed Project would have significant and unavoidable impacts from a facility breach from an earthquake and probable impacts on downstream communities. Section 6.4.10, Environmental Health and Safety, discusses this further.

Forestry practices would continue under the Forest Practices Act in areas around the FRE facility. Erosion and sediment entering streams and rivers from logging activities would be minimized through the application of Forest Practices Act regulations. Downstream of the FRE facility and in the airport levee area, several activities are likely to help reduce turbidity and the deposition of fine sediment in streams and rivers. These include the Voluntary Stewardship Program, Berwick Creek Flood Reduction and Restoration, Chehalis Flood Storage and Habitat Enhancement Master Plan, China Creek Flood Habitat Enhancement Master Plan, and activities to reconnect off-channel and floodplain habitats under the Aquatic Species Restoration Plan within the Chehalis River.

Proposed mitigation measures would minimize impacts of the Proposed Project; however, the mitigation may not be technically feasible or economically practicable. The Proposed Project, in combination with the activities described above, would contribute to cumulative impacts on earth.

6.4.3 Fish Species and Habitats

Construction and operation of the FRE facility is expected to have significant adverse impacts on fish species, shellfish, macroinvertebrates, and habitat. The Proposed Project would eliminate or alter aquatic habitat in the FRE facility footprint and temporary reservoir area, negatively impact water quality, and reduce the productivity of aquatic species. Fish passage during construction would significantly affect the survivability of Chinook salmon, coho salmon, steelhead, lamprey, and other native fish. Spring-run Chinook salmon, fall-run Chinook salmon, coho salmon, and steelhead would be significantly impacted by construction and operation of the FRE facility.

Development could increase in areas predicted to experience no flooding or less severe flooding as a result of the Proposed Project. Development of land in the floodplain could contribute to impacts on fish habitat and species from pollution, habitat degradation, and habitat disconnection.

A number of projects throughout the Chehalis Basin are anticipated to improve conditions for fish species and aquatic habitats in the study area. These projects include the Aquatic Species Restoration Plan, Berwick Creek Flood Reduction and Restoration, Chehalis Basin Partnership Watershed Plan

Update, Chehalis Flood Storage and Habitat Enhancement Master Plan implementation, China Creek Flood Habitat Enhancement Master Plan, Recreation and Conservation Office Salmon Recovery Funding Board Projects, Voluntary Stewardship Program implementation, and WSDOT culvert replacement and fish barrier removal projects. While these projects are anticipated to improve conditions for fish habitat and species, construction could cause impacts from water diversions, cut and fill, vegetation disturbance, and increased noise and vibration. These could lead to temporary increases in turbidity or sedimentation, or fish injury, stranding, or disruption.

Proposed mitigation measures would minimize impacts of the Proposed Project; however, the mitigation may not be technically feasible or economically practicable. The Proposed Project, in combination with the activities described above, would contribute to cumulative impacts on fish and aquatic species and habitats.

6.4.4 Wildlife Species and Habitats

Construction and operation of the FRE facility, specifically in the temporary reservoir area, is expected to have significant adverse impacts on wildlife. Impacts include loss of vegetation of upland, riparian, and wetland habitats, including 847 acres in the temporary reservoir and 34.9 acres for the FRE facility, as well as an increased risk of species dying from loss of breeding, foraging, resting, and overwintering habitat. Marbled murrelet habitat would likely be impacted.

Development of land in the floodplain could contribute to impacts on wildlife habitat and species from pollution, habitat degradation, and habitat disconnection.

A number of projects throughout the Chehalis Basin are anticipated to improve conditions for wildlife species, like amphibians, and habitats in the study area. These projects include the Aquatic Species Restoration Plan, Berwick Creek Flood Reduction and Restoration, Chehalis Basin Partnership Watershed Plan Update, Chehalis Flood Storage and Habitat Enhancement Master Plan implementation, China Creek Flood Habitat Enhancement Master Plan, Recreation and Conservation Office Salmon Recovery Funding Board Projects, Voluntary Stewardship Program implementation, and WSDOT culvert replacement and fish barrier removal projects. These projects are likely to improve conditions for wildlife habitat and species during operations but could cause temporary impacts on habitat and species during construction. Near the FRE facility and temporary reservoir, continued forest practice activities would result in removal of tree cover and impacts on upland wildlife species and habitat.

Proposed mitigation measures would minimize impacts of the Proposed Project; however, the mitigation may not be technically feasible or economically practicable. The Proposed Project, in combination with the activities described above, would contribute to cumulative impacts on wildlife species and habitats.

6.4.5 Wetlands

Impacts on wetlands would occur as part of construction and operation of the FRE facility and airport levee. This would result in permanent impacts on 0.3 acre of the Chehalis River and impacts on 10.8 acres of wetlands, 333 acres of wetland buffers, and 17 miles and 441 acres of stream buffers at the FRE facility and within the temporary reservoir. Impacts at the airport levee would include 6.6 acres of wetlands and 44 acres of wetland buffers. Compensatory mitigation would be required to ensure no net loss of functions for wetlands, wetland buffers, streams, and stream buffers; however, it is not certain the mitigation is feasible.

Near the airport levee, future development under the Chehalis-Centralia Airport Property Master Plan would result in wetland impacts and increased impervious surfaces, which could contribute to water quality impacts. However, compensatory mitigation and best practices would be required through permits. River restoration activities upstream of the FRE facility would improve in-channel and floodplain habitat conditions.

Proposed mitigation measures would minimize impacts of the Proposed Project; however, the mitigation may not be technically feasible or economically practicable. The Proposed Project, in combination with the activities described above, would contribute to cumulative impacts on wetlands.

6.4.6 Tribal Resources

Making a determination of the probable significance of adverse impacts or cumulative impacts related to tribal resources is not part of this EIS. Construction and operation of the Proposed Project could result in impacts on tribal resources in the following ways:

- Restricting or reducing access to tribal resources
- Altering vegetation in the temporary reservoir and in riparian and flood-affected areas due to periodic inundation, which could affect water, habitat, fish, and wildlife
- Loss of fish habitat within the Chehalis River, including loss of salmon spawning habitat
- Loss of fish that would otherwise be available for tribal harvest, as well as wildlife and plants that are identified as tribal resources
- Impacts on cultural and historic resources important to tribes (see Section 6.4.9)

Contributing activities and cumulative impacts on various natural resources could contribute to cumulative impacts on tribal resources. These include the following:

- Fish species and habitat impacts resulting from the potential for increased development in areas predicted to experience no flooding or less severe flooding as a result of the Proposed Project
- Temporary fish species and habitat impacts resulting from the construction of floodplain and habitat restoration projects as described in Section 6.4.3

- Wildlife habitat and species impacts resulting from continued forest practice activities and projects as described in Section 6.4.4

The Proposed Project, in combination with the activities described above, could contribute to cumulative impacts on tribal resources.

6.4.7 Land Use

The construction and operation of the FRE facility would be inconsistent with land use plans, policies, and regulations due to the impacts on shoreline ecological functions in the temporary reservoir area. The Proposed Project would be inconsistent with zoning when the FRE facility area is no longer operated as a commercial forest.

Development could increase in areas predicted to experience no flooding or less severe flooding as a result of the Proposed Project. Future expansion of agriculture, rural, residential, and commercial development in the floodplain could contribute to impacts on riparian areas, habitat, and critical areas. However, compliance with permit requirements and required compensatory mitigation would minimize these impacts. While the potential expansion of development within the floodplain would increase the intensity or density of land use, consistency with comprehensive plans and zoning would decrease the potential for adverse impacts. A number of projects throughout the Chehalis Basin are anticipated to address critical areas and land use, including Chehalis River Basin Comprehensive Flood Hazard Management Plan, Aquatic Species Restoration Plan, Community Flood Assistance and Resilience Program, and Voluntary Stewardship Program Work Plans.

Proposed mitigation measures would minimize impacts of the Proposed Project; however, the mitigation may not be technically feasible or economically practicable. The Proposed Project, in combination with the activities described above, would contribute to cumulative impacts on land use.

6.4.8 Recreation

Construction and operation of the FRE facility would lead to significant adverse impacts on recreation for kayaking and fishing, as well as a likely reduction in the number of fish available to be caught by recreational anglers.

A number of projects throughout the Chehalis Basin are anticipated to improve conditions for fish and wildlife species and habitats, which is likely to impact recreational activities like fishing, hunting, and hiking. These are described in Section 6.4.3 and 6.4.4 above. Future development activities associated with the actions identified in Exhibit 6-2 are not anticipated to decrease or result in the loss of recreational access in the area. Development activities under the Chehalis Flood Storage and Habitat Enhancement Master Plan may increase recreational access in some areas.

Proposed mitigation measures would minimize impacts of the Proposed Project; however, the mitigation may not be technically feasible or economically practicable. The Proposed Project, in combination with the activities described above, would contribute to cumulative impacts on recreation.

6.4.9 Cultural Resources

The Corps is carrying out Section 106 of the National Historic Preservation Act of 1966 (Section 106) review at the same time as the SEPA and NEPA processes. The eligibility of historic and cultural resources sites is being discussed and, if eligible, potential impacts will be reviewed, significance determined, and mitigation agreed upon through the Section 106 process. If there are adverse effects on cultural resources, a Memorandum of Agreement would be negotiated among the Corps, DAHP, potentially affected Native American tribes, the Applicant, and other Section 106 parties. Construction and operation of the Proposed Project could affect nine archaeological sites and Traditional Cultural Properties that are potentially eligible for listing on the National Register of Historic Places.

Future development could disturb the ground and impact archaeological or historic resources. However, potential impacts would be discussed through consultation with the Corps, DAHP, and affected tribes as required.

The Proposed Project, in combination with the activities described above, could contribute to cumulative impacts on cultural resources.

6.4.10 Environmental Health and Safety

Although the likelihood is extremely low that a catastrophic FRE facility failure resulting from an earthquake would occur while the reservoir is storing water, there are no mitigation measures that could completely eliminate the possibility of an incident or the resulting impacts. Therefore, this is considered a significant and unavoidable adverse impact on people, infrastructure, and structures downstream.

Development in areas predicted to experience no flooding or less severe flooding could increase. New development in Pe Ell, Chehalis, Centralia, and areas downstream of the FRE facility along the Chehalis River mainstem is expected to happen. This would increase the impacts on environmental health and safety, life, and property in the unlikely event of an FRE breach when water is being held in the temporary reservoir. This would also likely increase the number of hazardous material sites or hazardous materials present in the study area.

The Proposed Project, in combination with the activities described above, would contribute to cumulative impacts on environmental health and safety.

6.4.11 Air Quality

Construction and operation of the FRE facility would have significant impacts on air quality due to greenhouse gas emissions and carbon monoxide emissions if trees are burned. With implementation of the proposed mitigation, 100% of GHG and carbon monoxide emissions would be addressed. Other criteria and toxic pollutant emissions from construction and operation would be under regulatory limits.

Development in areas predicted to experience no flooding or less severe flooding could increase. New development in Pe Ell, Chehalis, Centralia, and areas downstream of the FRE facility along the Chehalis River mainstem is expected to happen. This development would be expected to have GHG and air emissions and would be required to meet air quality standards.

The Proposed Project, in combination with the activities described above, would contribute to cumulative impacts on air quality.

6.4.12 Environmental Justice

Although the likelihood is extremely low for a catastrophic FRE facility failure from an earthquake during a time when the reservoir is storing water, there are no mitigation measures that could completely eliminate the possibility of an incident or the resulting disproportionate impacts on environmental justice populations. As described in Section 6.4.7, Land Use, and Section 6.4.10, Environmental Health and Safety, development in areas predicted to experience no flooding or less severe flooding could increase. New development in Pe Ell, Chehalis, Centralia, and areas downstream of the FRE facility along the Chehalis River mainstem is expected to happen.

The Proposed Project, in combination with the activities described above, would contribute to cumulative impacts disproportionately affecting environmental justice populations.

6.4.13 Noise and Vibration

Noise and vibration levels during construction of the Proposed Project would be below Federal Transit Administration criteria. Operation of the Proposed Project is not likely to result in noise or vibration impacts. Development is expected to increase in urban, agricultural, and rural areas. Future development activities could contribute to cumulative impacts on noise and vibration.

Based on the location and distance from other activities, the Proposed Project would not contribute to cumulative impacts on noise and vibration.

6.4.14 Public Services and Utilities

The FRE facility and temporary reservoir could significantly affect the use of the Pe Ell water supply line from Lester Creek. Mitigation is proposed for the Applicant to work with the City of Pe Ell to study if the line would require moving or improvement.

Development could increase in areas predicted to experience no flooding or less severe flooding as a result of the Proposed Project. New development in Pe Ell, Chehalis, Centralia, and areas downstream of the FRE facility along the Chehalis River mainstem is expected to happen. Increased development would increase the demand on public services and utilities. Consistency with comprehensive plans and zoning would ensure that adequate capacity for public services and utilities is available.

Proposed mitigation measures would minimize impacts of the Proposed Project. The Proposed Project, in combination with the activities described above, would contribute to cumulative impacts on public services and utilities.

6.4.15 Transportation

Construction of the FRE facility and Airport Levee Changes would have moderate or minor impacts on transportation due to construction traffic on local roadways. Roads constructed for bypass and access could impact critical areas, but these impacts are expected to be minor. Operation of the Proposed Project would have minor impacts on transportation.

Development could increase in areas predicted to experience no flooding or less severe flooding as a result of the Proposed Project. New development in Pe Ell, Chehalis, Centralia, and areas downstream of the FRE facility along the Chehalis River mainstem is expected to happen. Increased development would increase the demand on transportation routes and types.

Proposed mitigation measures would minimize impacts of the Proposed Project. The Proposed Project, in combination with the activities described above, would contribute to cumulative impacts on transportation.

6.4.16 Visual Quality

Construction and operation of the FRE facility and Airport Levee Changes would have moderate or minor impacts on visual quality.

Near the FRE facility and temporary reservoir, continued forest practice activities would result in removal of tree cover and impact visual quality. Development may occur near the airport levee but would not be expected to change the visual quality of the area.

The Proposed Project would not contribute to cumulative impacts on visual quality.

7 CONSULTATION AND COORDINATION

This section describes how information was shared during development of the Draft EIS. From the start of the process through the release of the Draft EIS, Ecology's website and the Chehalis Basin Strategy website provided information about the environmental review. People could also sign up on these websites to receive email updates.

7.1 EIS Scoping Process

The scoping process was a joint effort between Ecology and the Corps for input on state and federal environmental reviews. The scoping period went from September 28 to October 29, 2018.

Scoping comments were accepted using online forms, by mail, and at two public scoping meetings. Ecology and the Corps held two joint scoping meetings: one in Montesano on October 16, 2018, and one in Centralia on October 17, 2018. Agencies, tribes, the public, businesses, and organizations provided 265 comments on the scope of the EIS. These included comments on the Proposed Project, alternatives, fish, wildlife, wetlands, plants, earth, water, tribal resources, climate change, health, and safety. The comments were used by Ecology to help identify what to study in the EIS. Additional details on the scoping process and the comments received are contained in the *Scoping Summary Report* (Appendix 3).

Scoping Outreach Summary

- **Scoping notice** published in Ecology's SEPA Register on September 28, 2018
- **Legal notices** placed in *The Olympian* on September 28, 2019, and in *The Daily World* and *The Chronicle* on September 29, 2018
- **News release in English and Spanish** issued on Ecology's website on September 28, 2019, and sent to Spanish-language media; media in Lewis, Grays Harbor, and Thurston counties; and Seattle primary media (e.g., Seattle TV affiliates, Associated Press, *Seattle Times*, TVW, public radio)
- **Postcards** mailed on September 27, 2018, to more than 5,000 addresses near the project sites
- **Flyer** sent to local communities for posting on community boards
- **Letters** sent to the Quinault Indian Nation and the Chehalis Tribe
- **Email** sent to interested parties using the Chehalis Basin Strategy listserv on September 28, 2018
- **Email** sent to state and federal legislators of areas that could be affected by the Proposed Project
- **Email** sent to state agencies and SEPA Register notice
- **Announcements** posted on the Chehalis Basin Strategy website, Ecology's project-specific website, and

7.2 Additional Public Outreach

Ecology emailed updates in January, February, and October 2019 and February 2020 to people who signed up for the listserv. Ecology provided several updates to the Chehalis Basin Board on the EIS process, alternatives to be analyzed, and what resources would be studied at multiple public meetings in 2018, 2019, and 2020. The Chehalis Basin Board includes representatives from local communities, the Chehalis Tribe, the Quinault Indian Nation, environmental organizations, and state and local agencies.

7.3 Tribal Coordination

Ecology coordinated with the Quinault Indian Nation and the Chehalis Tribe during the EIS process. Ecology sent letters and emails about scoping to each tribe on September 24, 2018. Both tribes submitted detailed comments during the scoping period about the Proposed Project, scope, potential impacts, and mitigation measures.

Ecology provided information about fish models used in the EIS to the Quinault Indian Nation in May and November 2019 letters. Ecology and the Corps met with Quinault Indian Nation staff in August 2019 and February 2020 to discuss fish modeling used in the state EIS. Ecology responded to letters from the Quinault Indian Nation about the EIS in May, June, November, and December 2019.

7.4 Agency Coordination

Ecology and the Corps signed a memorandum of understanding in September 2018. Ecology is responsible for the state environmental review. The Corps is responsible for the federal environmental review. Both agencies agreed to work together to share information, as appropriate under state and federal law. The goals are to be efficient and coordinate where possible. The state and federal EISs are separate documents, but the agencies held regular meetings to coordinate throughout 2018 and 2019 and into 2020.

Ecology worked with state agencies that have expertise in areas evaluated in the EIS. These agencies included: DAHP, WDFW, DNR, and WSDOT. A meeting for state agencies was held during scoping in October 2018. State agency coordination included a series of meetings in early 2019 on how impacts on specific resources would be evaluated in the EIS using the best available science. State agency experts reviewed studies, technical documents, and EIS chapters and appendices for Ecology throughout 2019 and into 2020.

8 LIST OF PREPARERS AND CONTRIBUTORS

Agencies

NAME	SUBJECT MATTER
Washington Department of Fish and Wildlife	Earth; Fish Species And Habitat; Recreation; Tribal Resources; Water; Wetlands; Wildlife Species And Habitat
Washington State Department of Archaeology and Historic Preservation	Cultural Resources
Washington State Department of Natural Resources	Earth; Environmental Health And Safety; Fish Species And Habitat; Land Use; Recreation; Transportation; Water; Wildlife Species And Habitat
Washington State Department of Transportation	Transportation

Consultant Team

NAME	SUBJECT MATTER
Anchor QEA, LLC	Cumulative Impacts, Fish Species and Habitat, GIS Analysis, Graphic Design, Environmental Justice Land Use, Tribal Resources, Hydraulic Modeling, Wetlands, Wildlife Species and Habitat
Climate Impacts Group	Climate change modeling
Environmental Science Associates	Air Quality and GHG, Cultural Resources, Environmental Health and Safety, Noise, Public Services and Utilities, Recreation, Transportation, Water, Visual Quality
ICF Consultants	Ecosystem Diagnosis and Treatment salmonid habitat model for the Chehalis Basin
Shannon and Wilson	Earth (Geology)
Watershed GeoDynamics	Earth (Geomorphology)
Watershed Science and Engineering	Hydrologic and Hydraulic modeling

9 DISTRIBUTION LIST

Applicant and Land Owners

- Chehalis River Basin Flood Control Zone District
- Chehalis-Centralia Airport
- Panesko Tree Farm
- Weyerhaeuser Company

Washington State Agencies and State-Elected Officials

- Washington Department of Fish and Wildlife
- Washington Emergency Management Division
- Washington State Conservation Commission
- Washington State Department of Agriculture
- Washington State Department of Archaeology and Historic Preservation
- Washington State Department of Commerce
- Washington Department of Ecology SEPA Register
- Washington State Department of Natural Resources
- Washington State Department of Transportation
- Washington State Legislature, Representatives and Senators from Districts 19, 20, 22, 24
- Washington State Parks
- Washington State Recreation and Conservation Office
- Washington State U.S. Representatives
- Washington State U.S. Senators

Local Governments, Agencies, and Locally Elected Officials

- Chehalis Basin Lead Entity
- Chehalis River Basin Flood Authority
- City of Adna
- City of Chehalis
- City of Centralia
- City of Elma
- City of Montesano
- City of Oakville

- Town of Pe Ell
- Grays Harbor County
- Lewis County Board of County Commissioners
- Pacific County
- Thurston County

Tribes and Tribal Representation

- Confederated Tribes of the Chehalis Reservation
- Cowlitz Indian Tribe
- Nisqually Indian Tribe
- Northwest Indian Fisheries Commission
- Quinault Indian Nation
- Shoalwater Bay Tribe

Federal and Regional Agencies

- Environmental Protection Agency
- Federal Emergency Management Agency
- National Oceanic and Atmospheric Administration
- U.S. Army Corps of Engineers
- U.S. Department of Agriculture's Natural Resource Conservation Science
- U.S. Fish and Wildlife Service

Chehalis Basin Board

Other Agencies and Organizations

- American Rivers
- American Whitewater
- Audubon Washington
- Center for Biological Diversity
- Chehalis Basin Lead Entity Habitat Work Group
- Coast Salmon Partnership
- Conservation Northwest
- Conservation Whale Scout
- Defenders of Wildlife
- Endangered Species Coalition

- Friends of the San Juans
- Lewis County Community Trails Association
- Lewis County Economic Development Council
- Natural Resources Defense Council
- Orca Network
- San Juan Island Marine Resource Committee
- Save Our Wild Salmon
- Seattle Aquarium
- Trout Unlimited
- Washington Coast Sustainable Salmon Partnership
- Washington Environmental Council
- Whale and Dolphin Conservation
- Whale Scout
- Wild Fish Conservancy Northwest
- Wild Salmon Center
- Wild Steelhead Coalition

Libraries

- Centralia Timberland Library
- Chehalis Timberland Library
- Oakville Library

10 EIS MAPBOOK

Maps on the following 10 pages provide detailed information on predicted flood extents and depths throughout modeled flood area under the following flood scenarios for the Proposed Project:

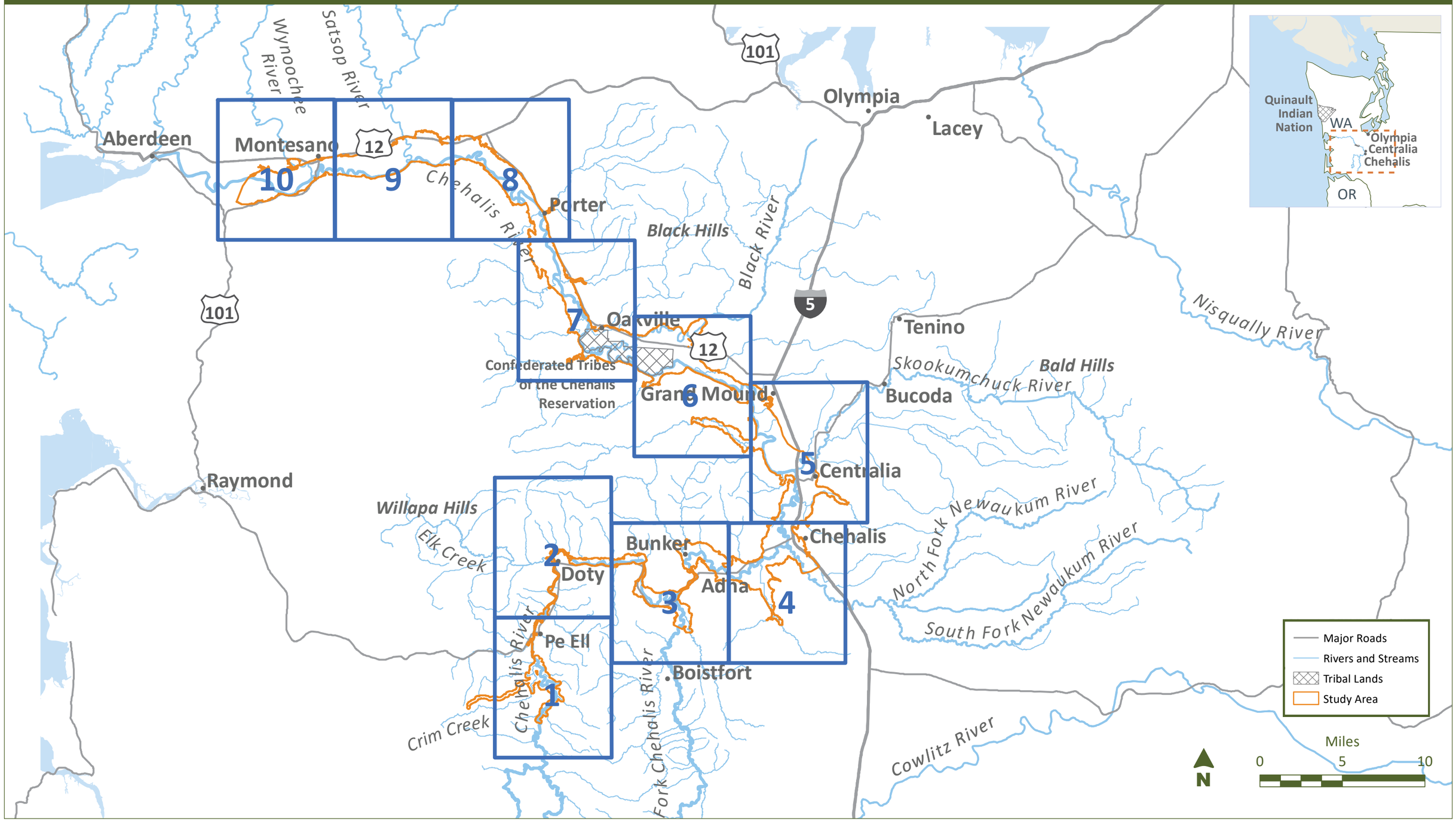
- Major Mid-Century
- Catastrophic Late-Century
- No Action Alternative

Modeled flood results are shown side-by-side to provide a comparison of predicted flood conditions. The maps also show an "Area No Longer Inundated," which illustrates the area that is predicted to flood under the No Action Alternative but would not be flooded under the Proposed Project.

The location of several features in the study area that are evaluated in the EIS are also shown in the Mapbook, such as recreation facilities, police and fire facilities, and major utilities.

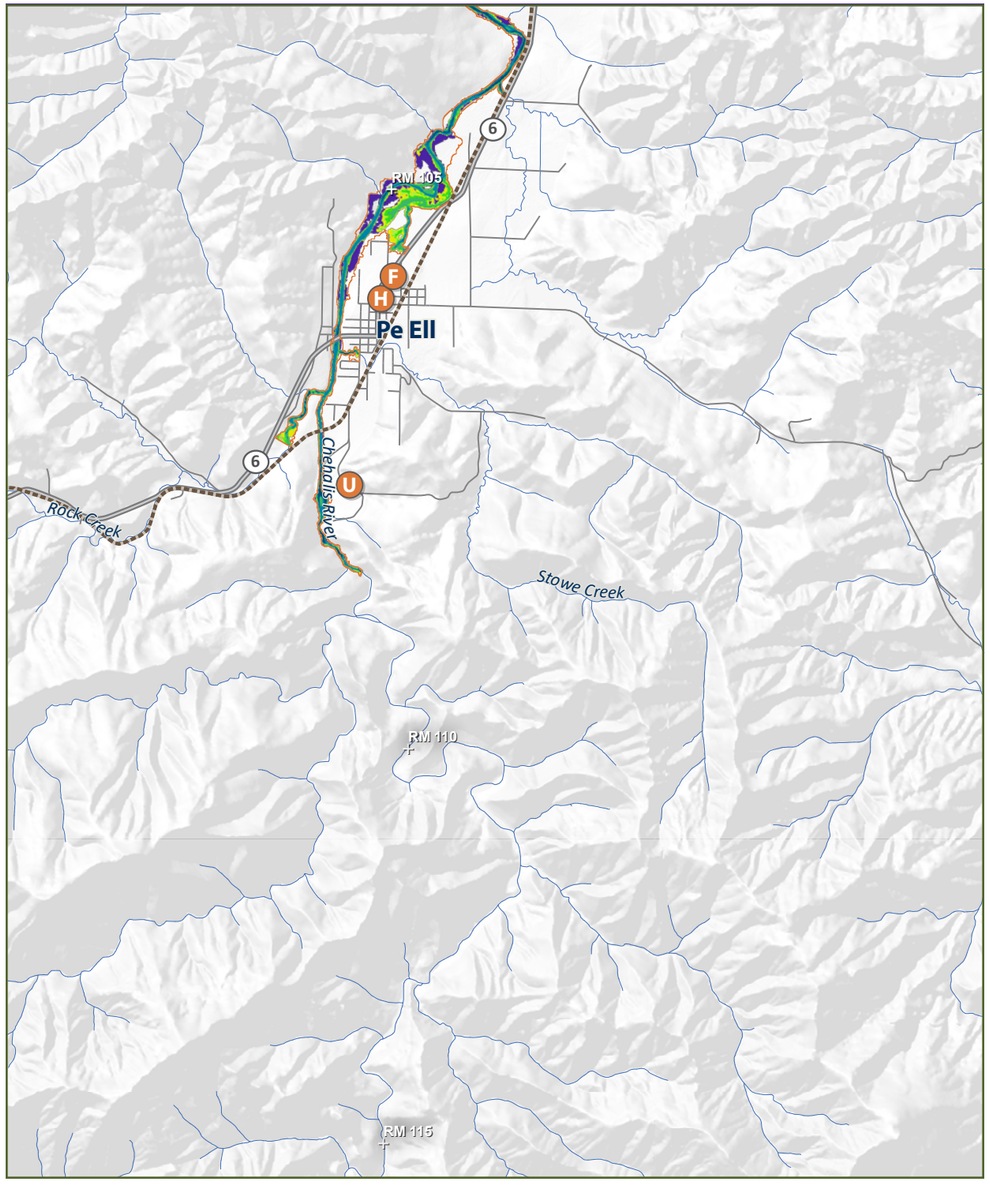
Additional flood maps for all the flood scenarios evaluated in the EIS can be found within Attachment 1 to *Appendix N: Water Discipline Report*. These maps shows changes on a neighborhood scale between alternatives.

EIS Mapbook Sheet A
Key to Extents in Mapbook

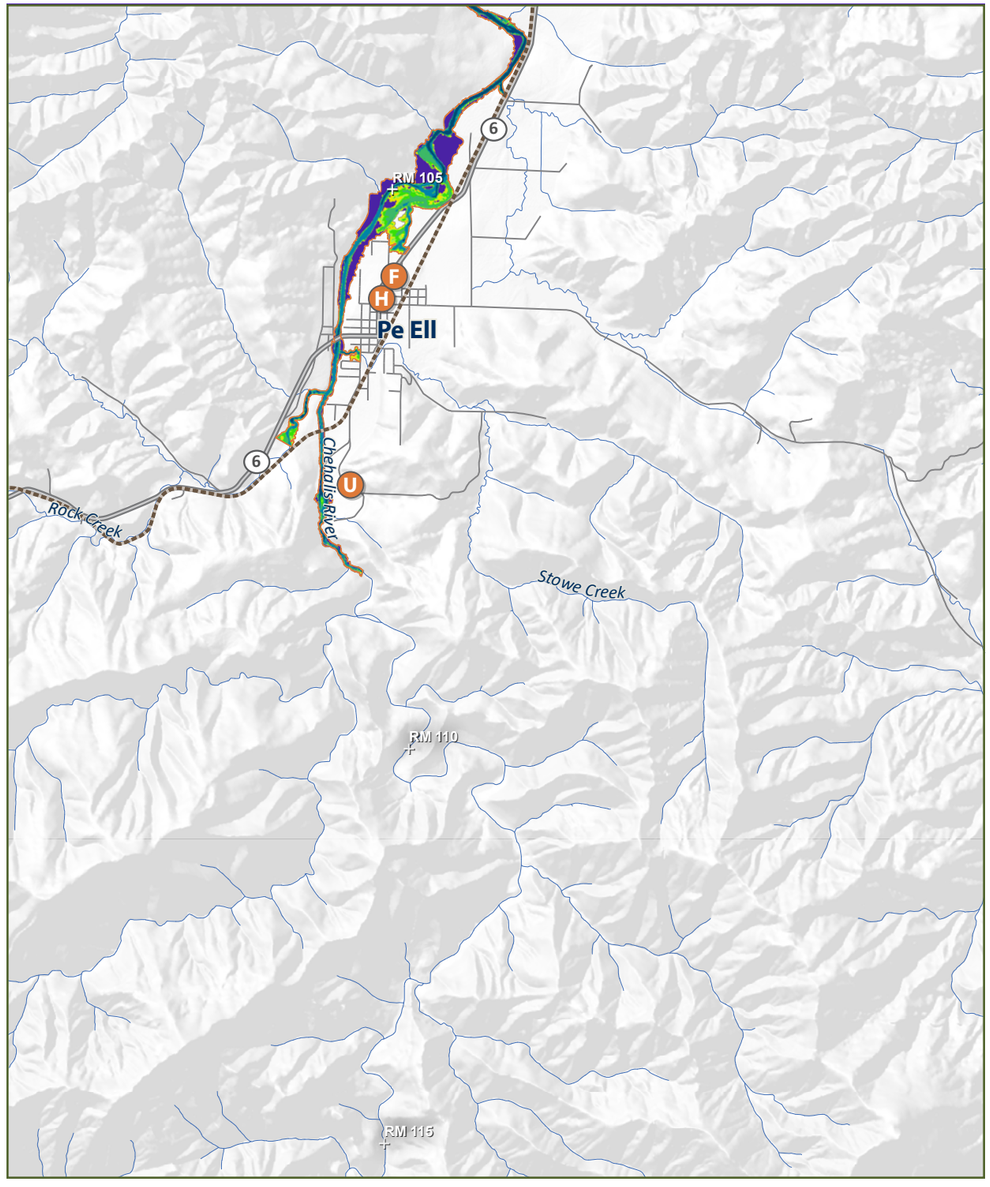


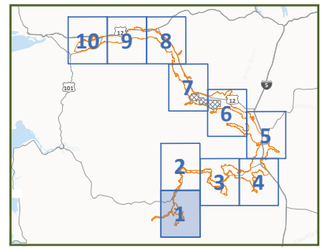
EIS Mapbook Sheet 1
Predicted Flood Conditions near Pe Ell with the Proposed Action under Mid- and Late-Century Scenarios

Mid-Century Major Flood Scenario



Late-Century Catastrophic Flood Scenario





Legend

- Major Roads
- Trails
- River and Streams
- Modeled Flood Extent

Features

- Police and Court
- Fire Station
- Public Health
- Utilities
- Public Education
- Recreation/Parks

Water Depth (ft)

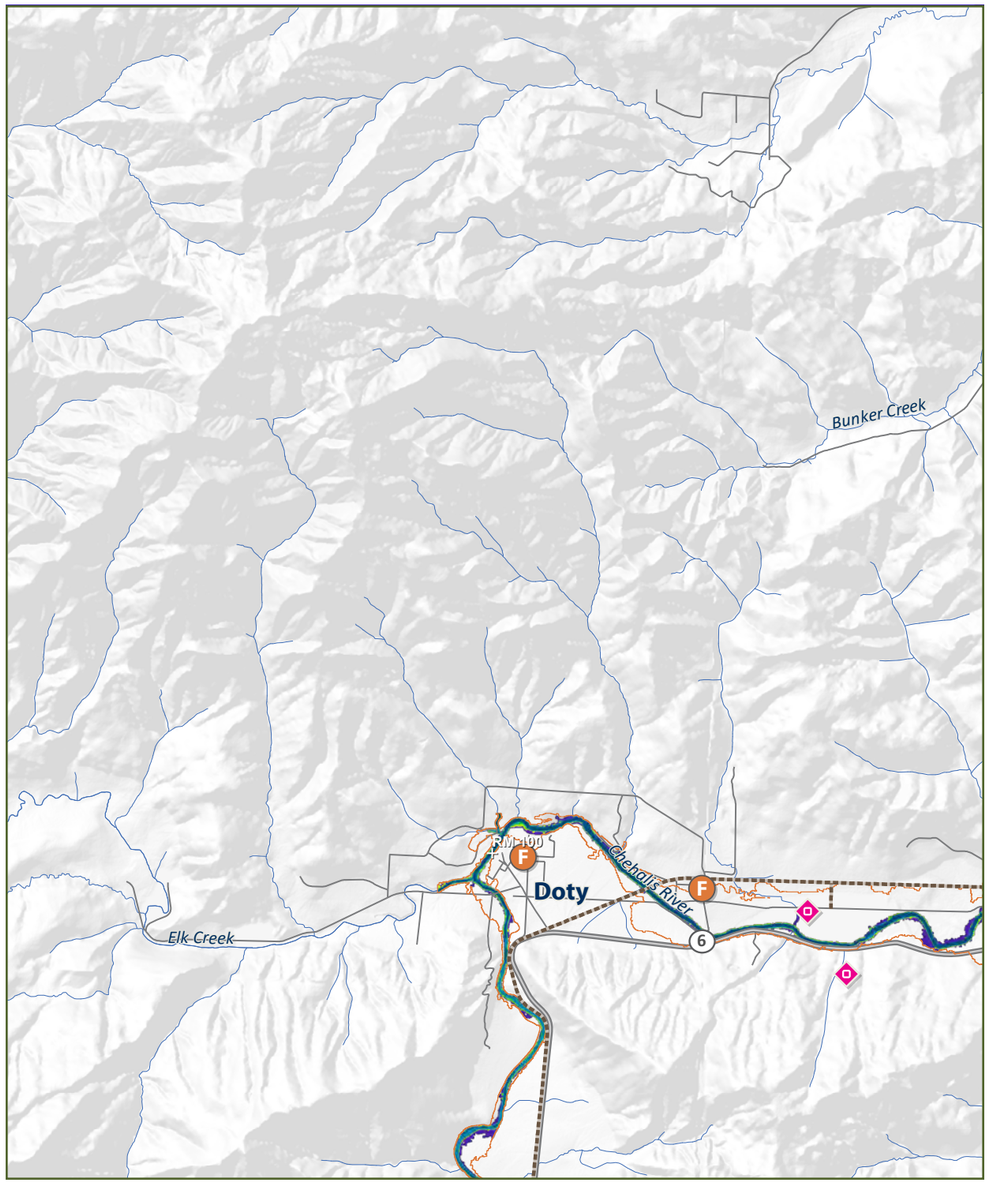
- 0.2–0.5
- 0.5–1
- 1–2
- 2–5
- 5–10
- 10–25
- >25
- (No Action) Area No Longer Flooded Under Proposed Action

N

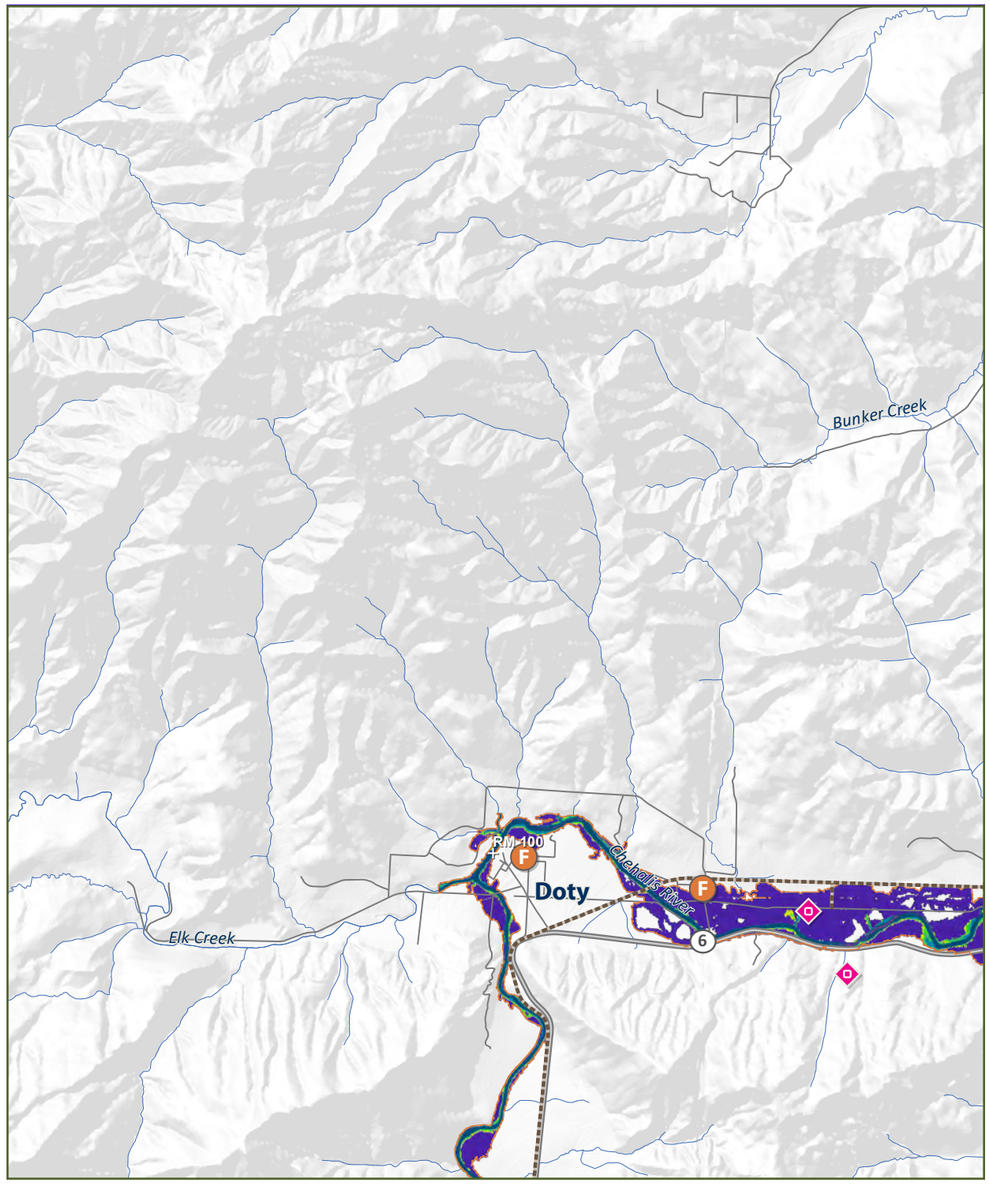
Feet
0 2,000 4,000

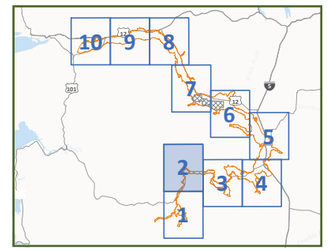
EIS Mapbook Sheet 2
Predicted Flood Conditions near Doty with the Proposed Action under Mid- and Late-Century Scenarios

Mid-Century Major Flood Scenario



Late-Century Catastrophic Flood Scenario





Legend

- Major Roads
- Trails
- River and Streams
- Modeled Flood Extent

Features

- Police and Court
- Fire Station
- Public Health
- Utilities
- Public Education
- Recreation/Parks

Water Depth (ft)

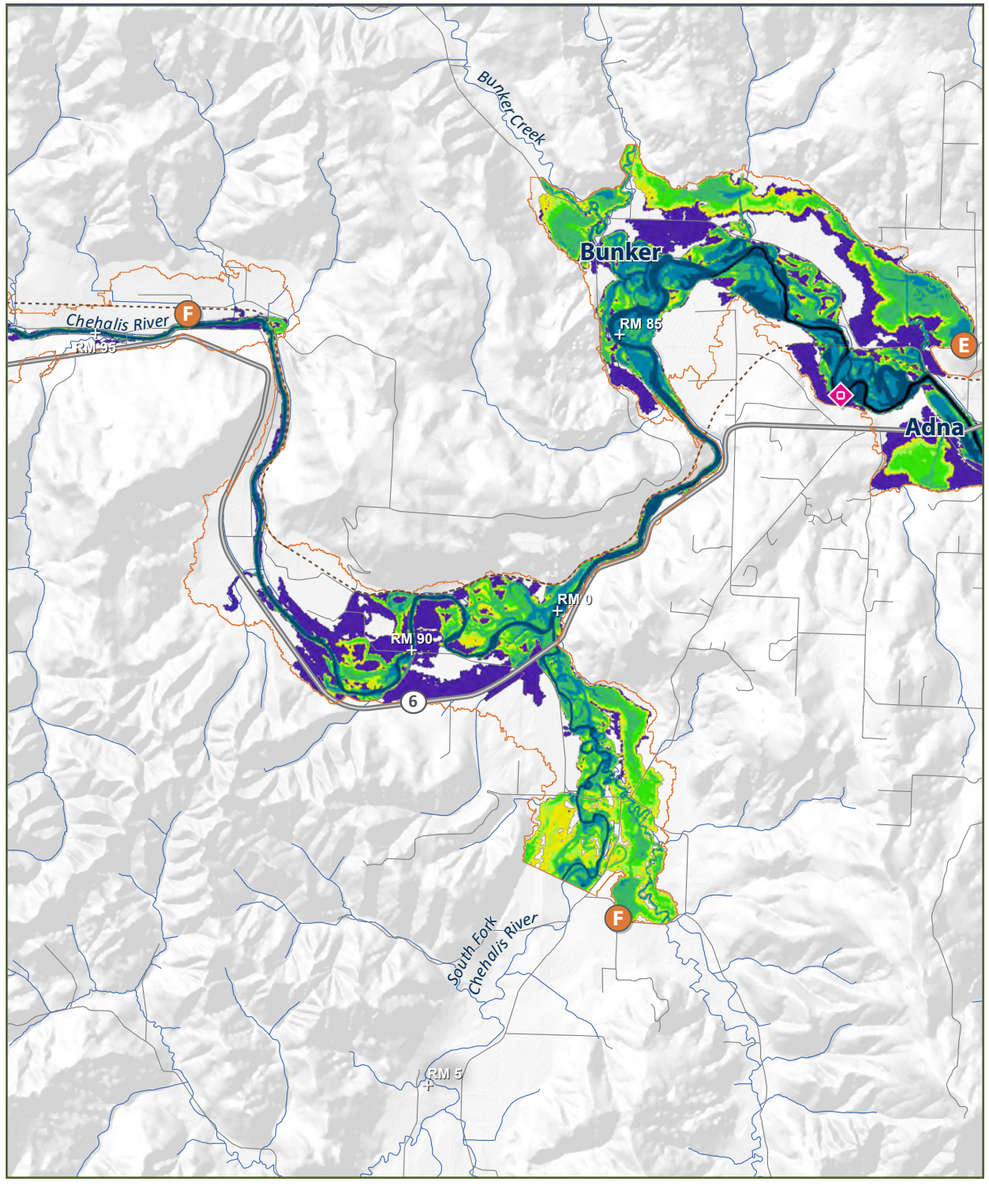
- 0.2–0.5
- 0.5–1
- 1–2
- 2–5
- 5–10
- 10–25
- >25
- (No Action) Area No Longer Flooded Under Proposed Action

N

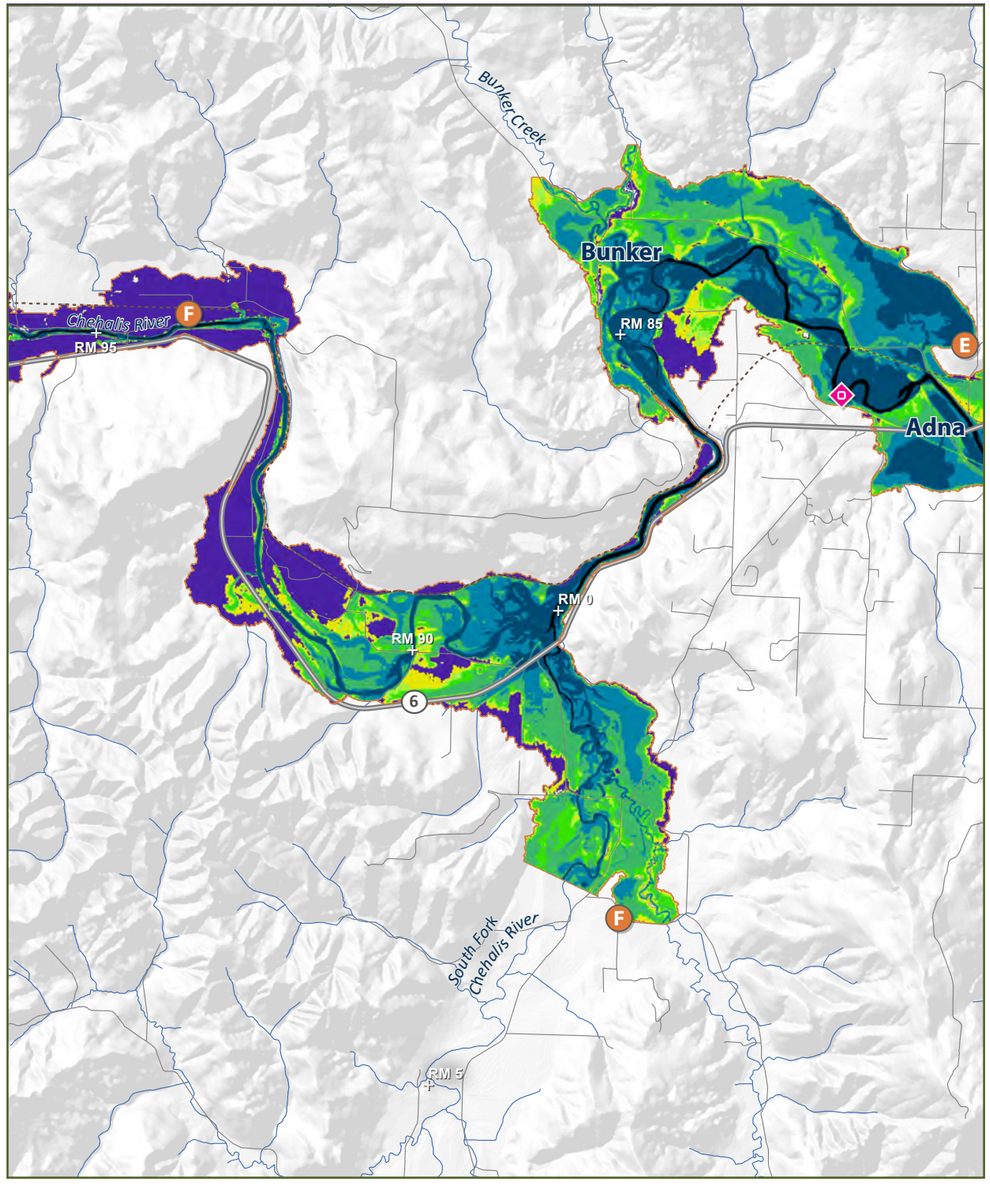
Feet
0 2,000 4,000

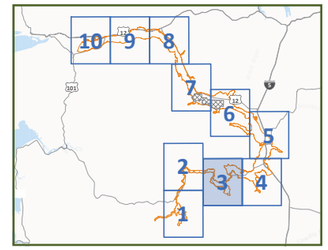
EIS Mapbook Sheet 3
Predicted Flood Conditions near Bunker and Adna with the Proposed Action under Mid- and Late-Century Scenarios

Mid-Century Major Flood Scenario



Late-Century Catastrophic Flood Scenario





Legend

- Major Roads
- Trails
- River and Streams
- Modeled Flood Extent

Features

- Police and Court
- Fire Station
- Public Health
- Utilities
- Public Education
- Recreation/Parks

Water Depth (ft)

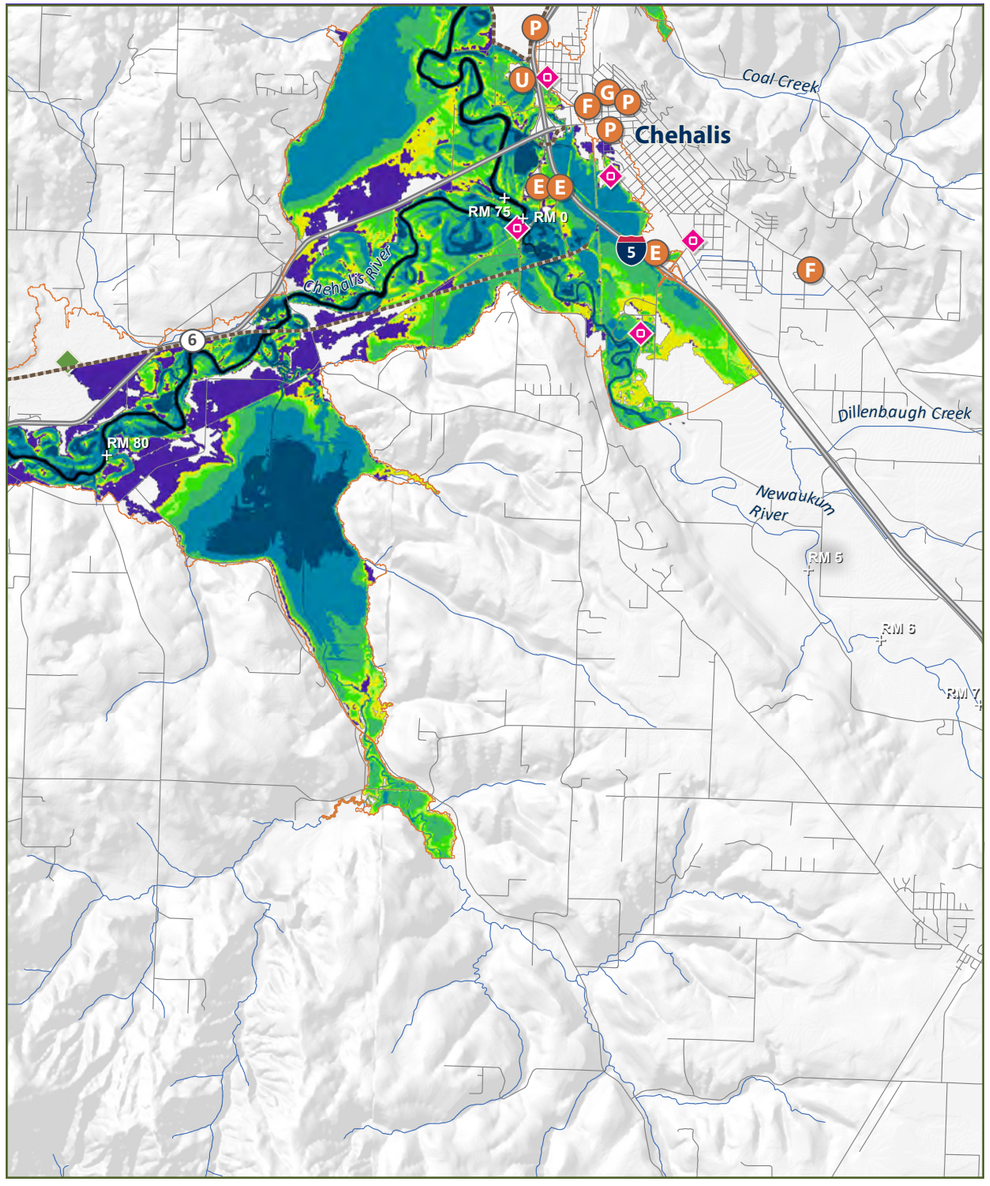
- 0.2–0.5
- 0.5–1
- 1–2
- 2–5
- 5–10
- 10–25
- >25
- (No Action) Area No Longer Flooded Under Proposed Action

N

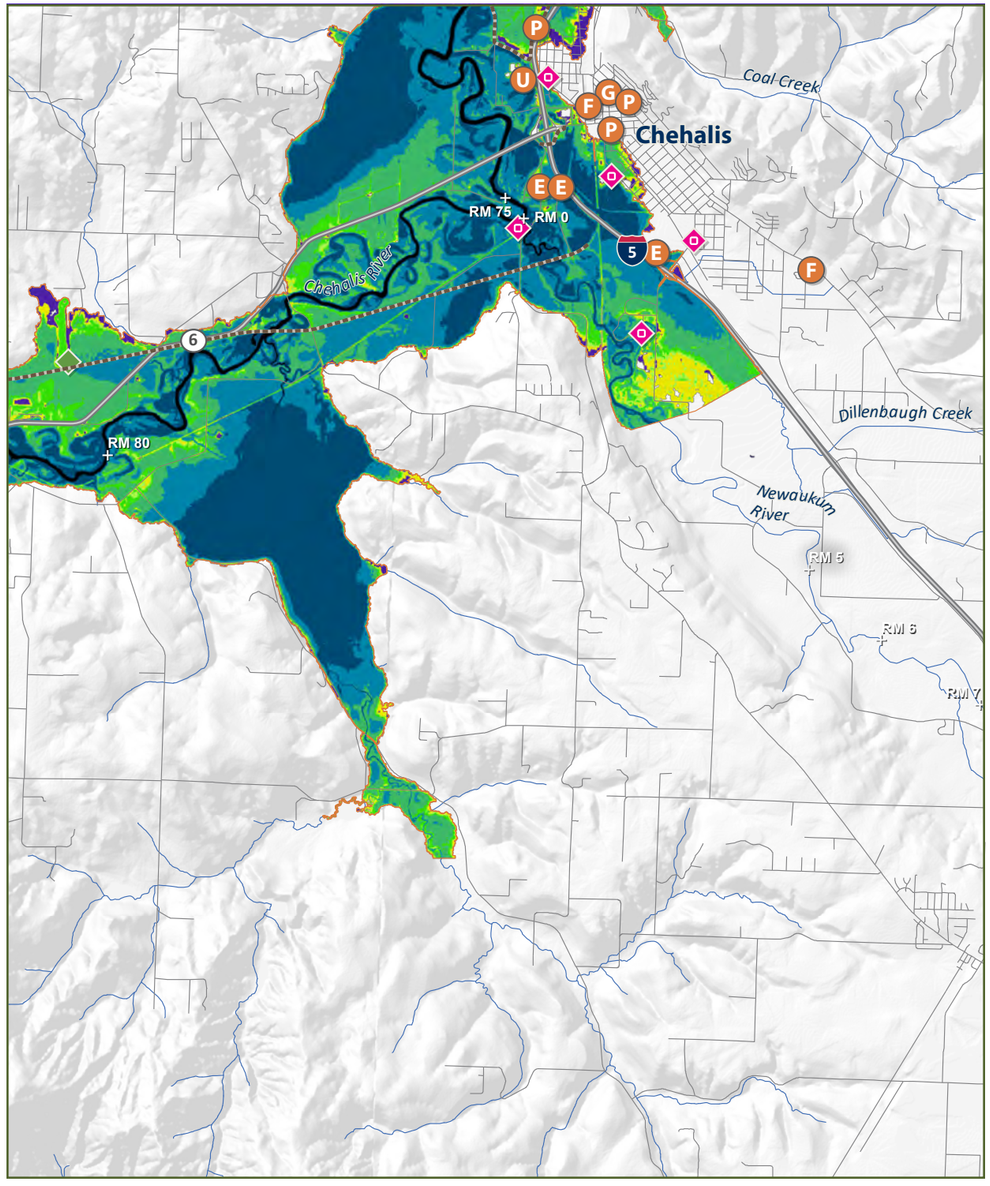
Feet
0 2,000 4,000

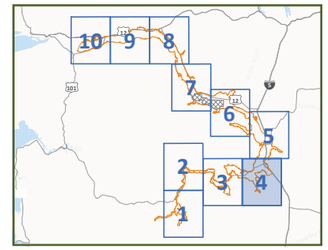
EIS Mapbook Sheet 4
Predicted Flood Conditions near Chehalis with the Proposed Action under Mid- and Late-Century Scenarios

Mid-Century Major Flood Scenario



Late-Century Catastrophic Flood Scenario





Legend

- Major Roads
- Trails
- River and Streams
- Modeled Flood Extent

Features

- Police and Court
- Fire Station
- Public Health
- Utilities
- Public Education
- Recreation/Parks

Water Depth (ft)

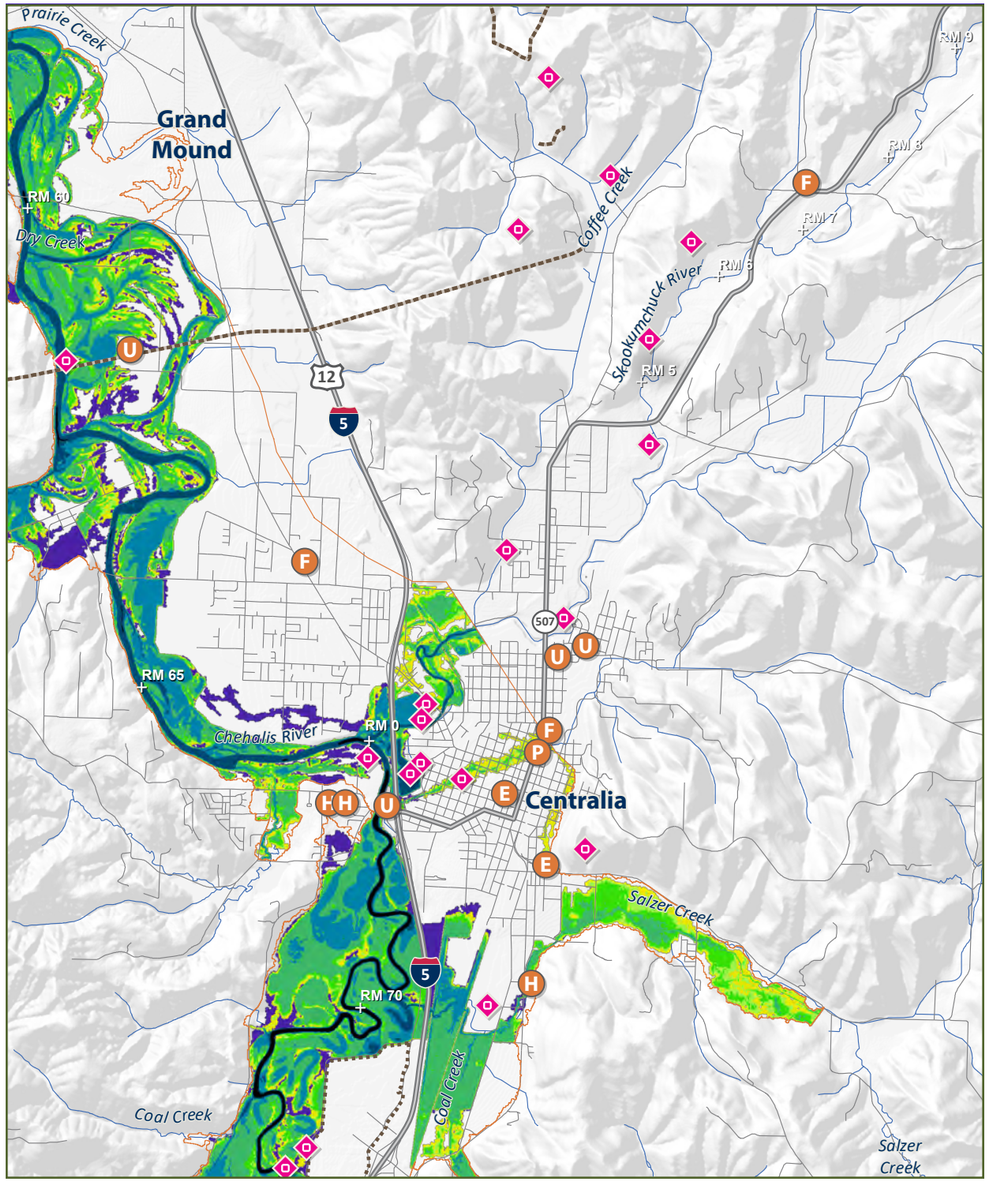
- 0.2–0.5
- 0.5–1
- 1–2
- 2–5
- 5–10
- 10–25
- >25
- (No Action) Area No Longer Flooded Under Proposed Action

N

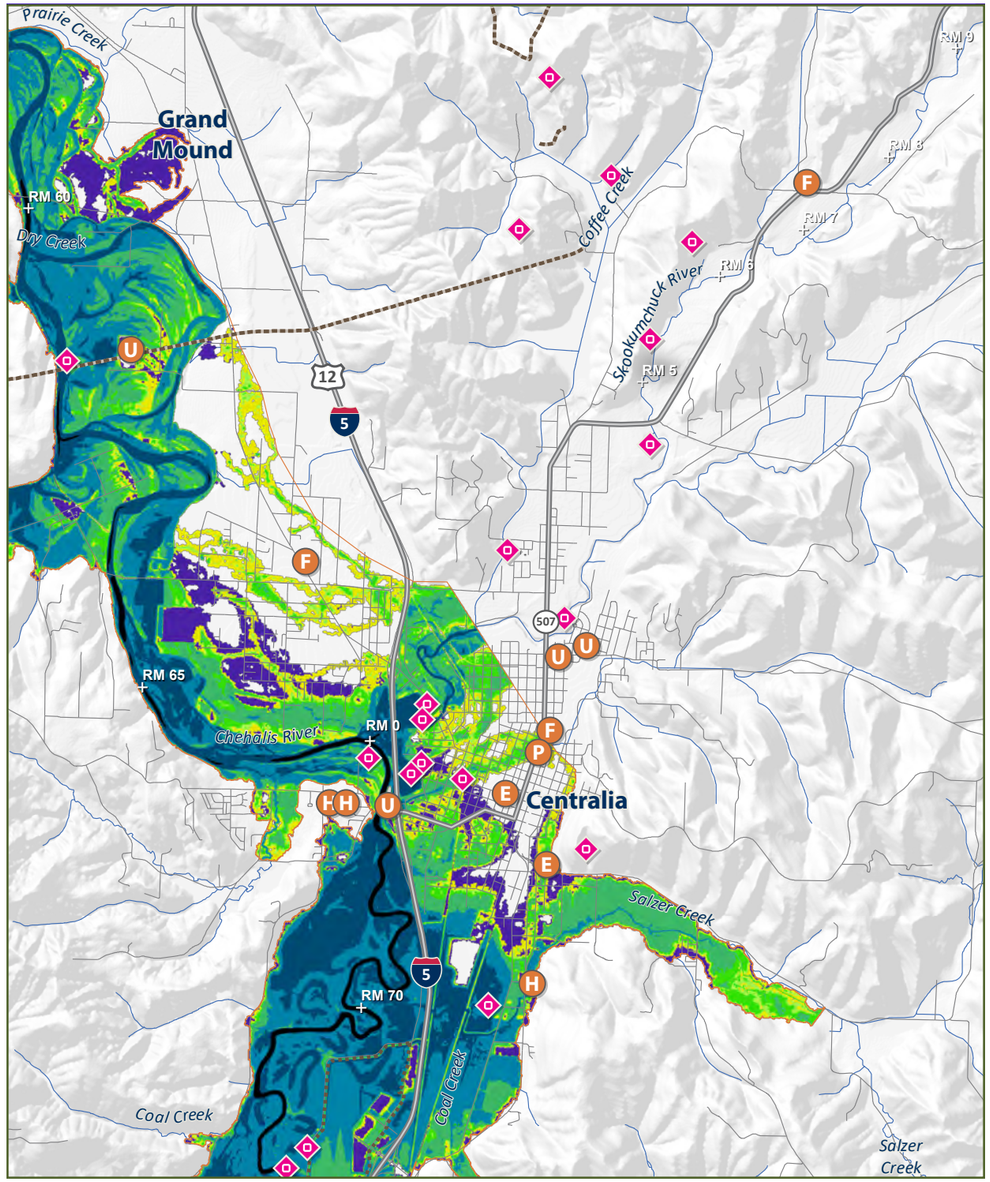
Feet
0 2,000 4,000

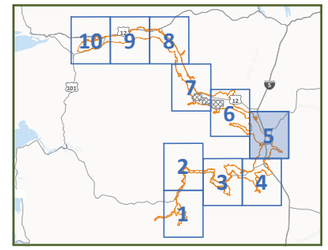
EIS Mapbook Sheet 5
Predicted Flood Conditions near Centralia and Grand Mound with the Proposed Action under Mid- and Late-Century Scenarios

Mid-Century Major Flood Scenario



Late-Century Catastrophic Flood Scenario





Legend

- Major Roads
- Trails
- River and Streams
- Modeled Flood Extent

Features

- Police and Court
- Fire Station
- Public Health
- Utilities
- Public Education
- Recreation/Parks

Water Depth (ft)

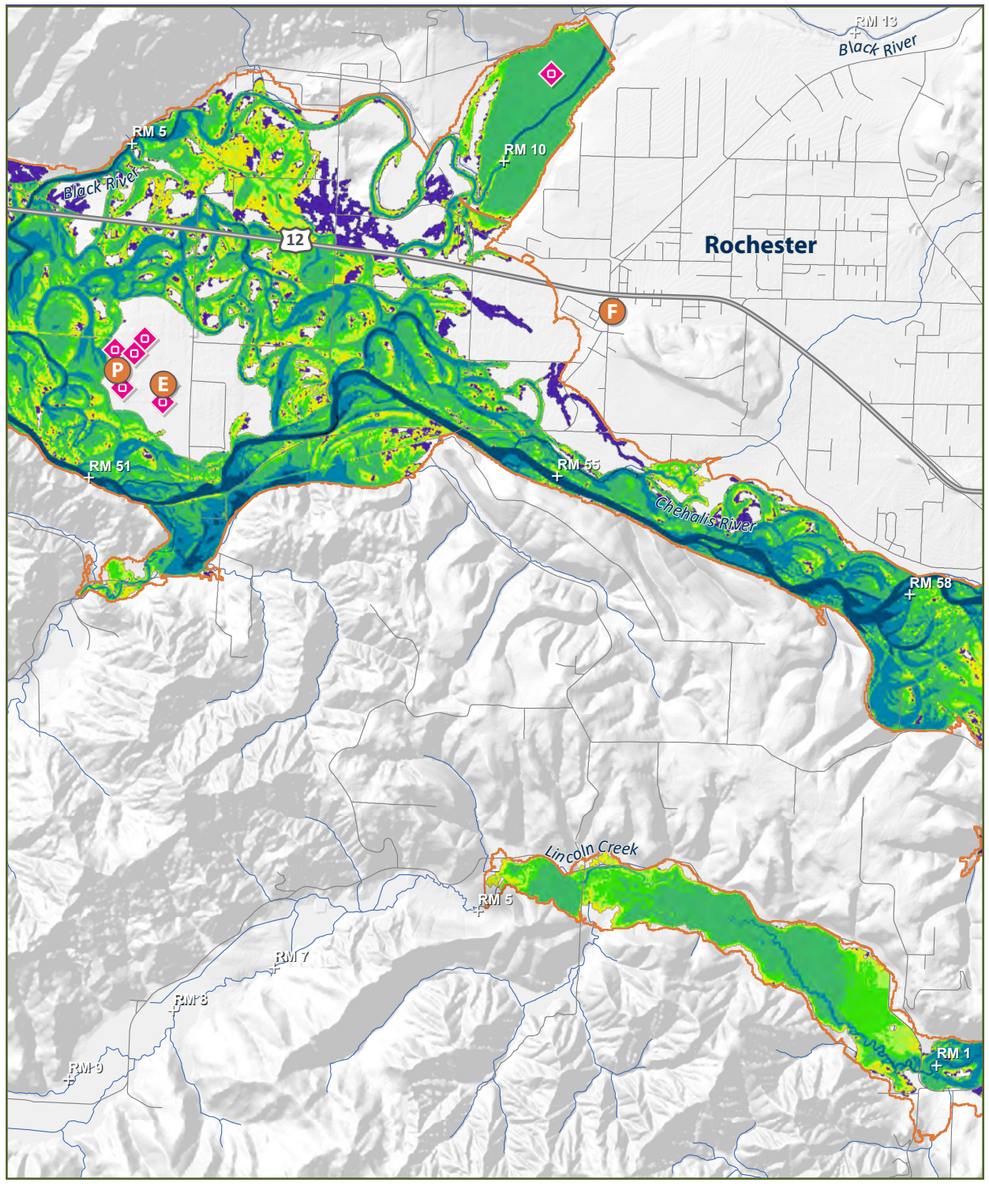
- 0.2–0.5
- 0.5–1
- 1–2
- 2–5
- 5–10
- 10–25
- >25
- (No Action) Area No Longer Flooded Under Proposed Action

N

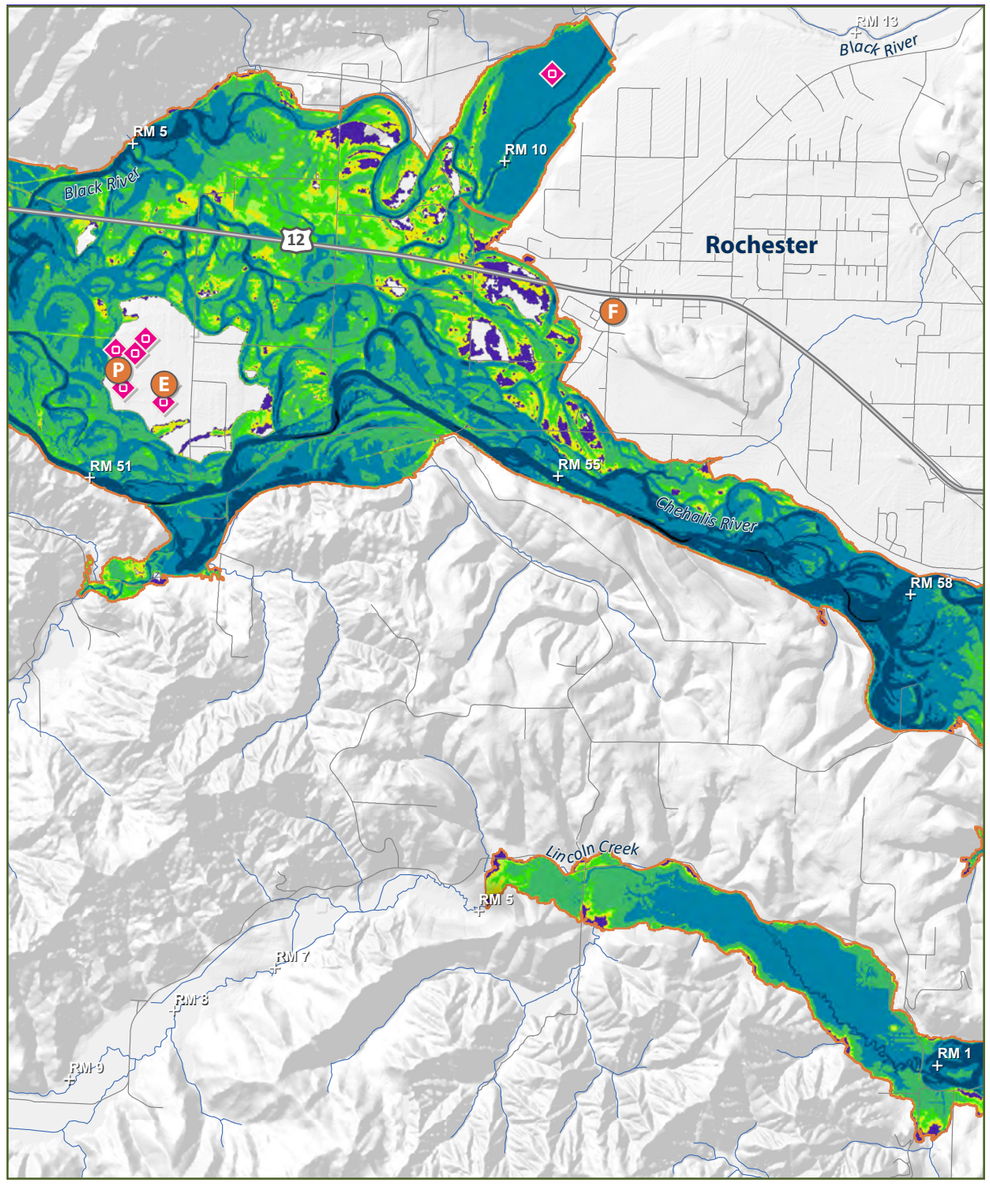
Feet
0 2,000 4,000

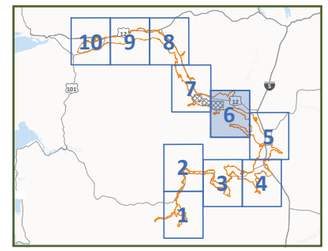
EIS Mapbook Sheet 6
Predicted Flood Conditions near Rochester with the Proposed Action under Mid- and Late-Century Scenarios

Mid-Century Major Flood Scenario



Late-Century Catastrophic Flood Scenario





Legend

- Major Roads
- Trails
- River and Streams
- Modeled Flood Extent

Features

- Police and Court
- Fire Station
- Public Health
- Utilities
- Public Education
- Recreation/Parks

Water Depth (ft)

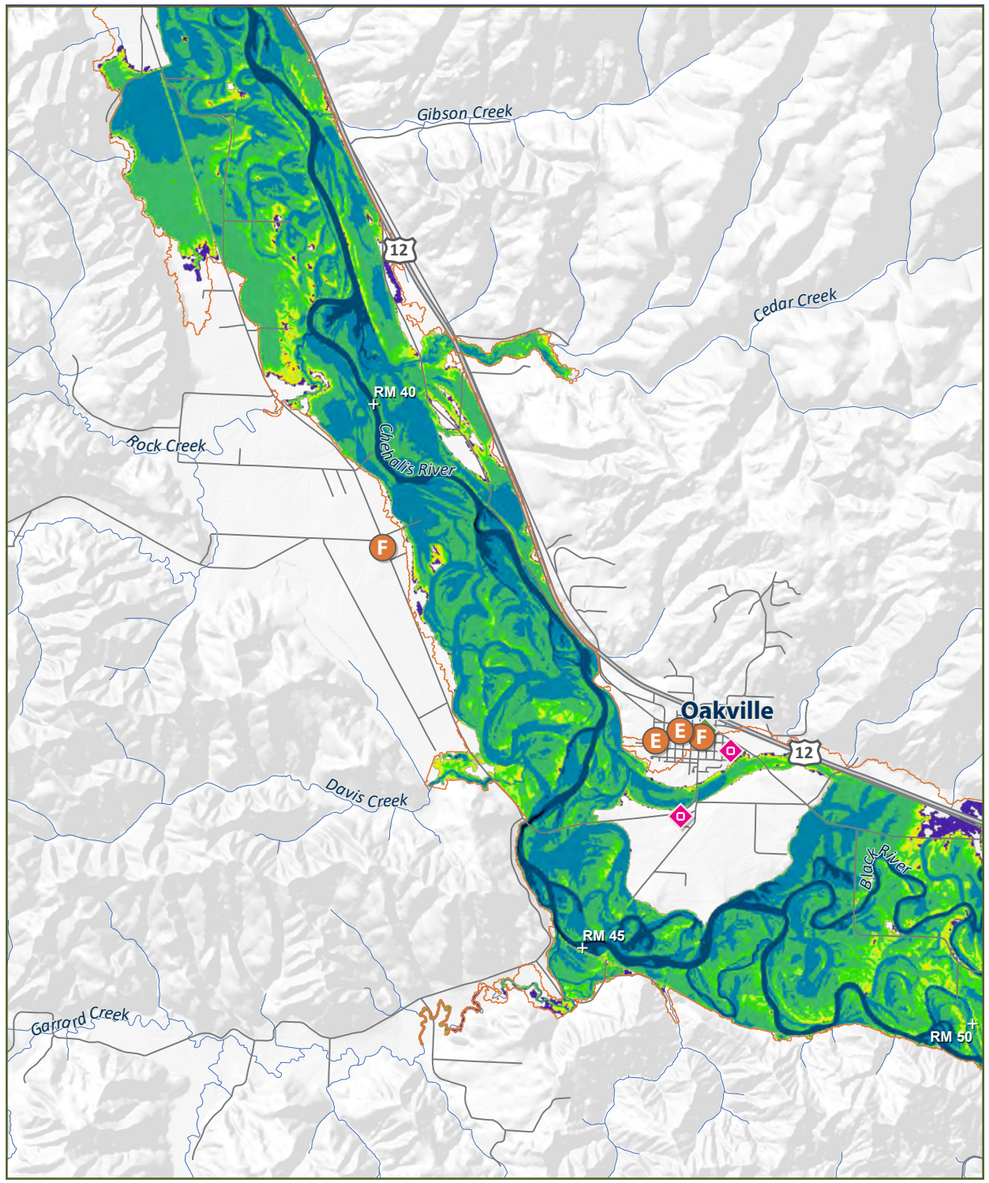
- 0.2–0.5
- 0.5–1
- 1–2
- 2–5
- 5–10
- 10–25
- >25
- (No Action) Area No Longer Flooded Under Proposed Action

N

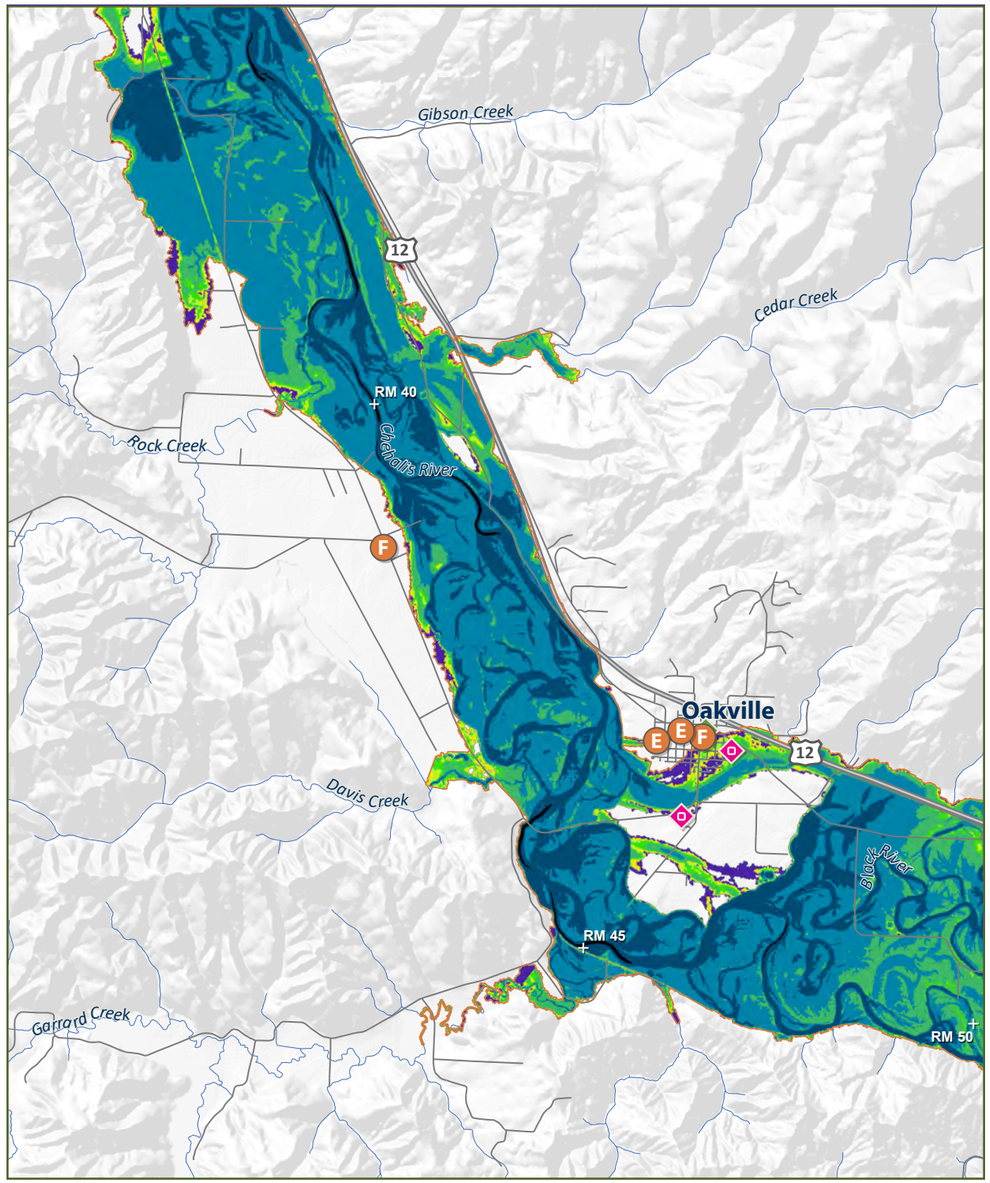
Feet
0 2,000 4,000

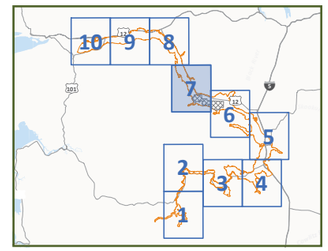
EIS Mapbook Sheet 7
Predicted Flood Conditions near Oakville with the Proposed Action under Mid- and Late-Century Scenarios

Mid-Century Major Flood Scenario



Late-Century Catastrophic Flood Scenario





Legend

- Major Roads
- Trails
- River and Streams
- Modeled Flood Extent

Features

- Police and Court
- Fire Station
- Public Health
- Utilities
- Public Education
- Recreation/Parks

Water Depth (ft)

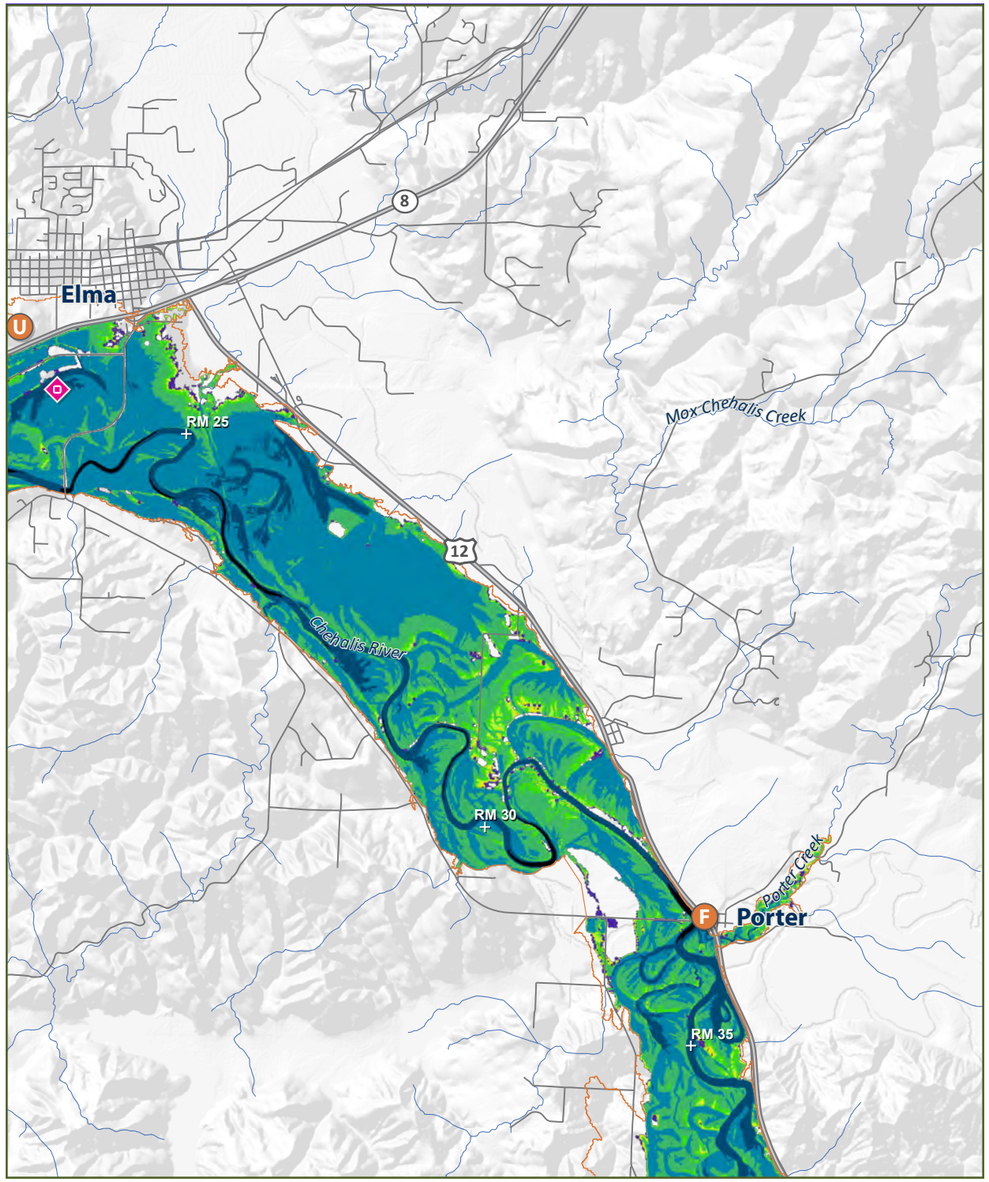
- 0.2–0.5
- 0.5–1
- 1–2
- 2–5
- 5–10
- 10–25
- >25
- (No Action) Area No Longer Flooded Under Proposed Action

N

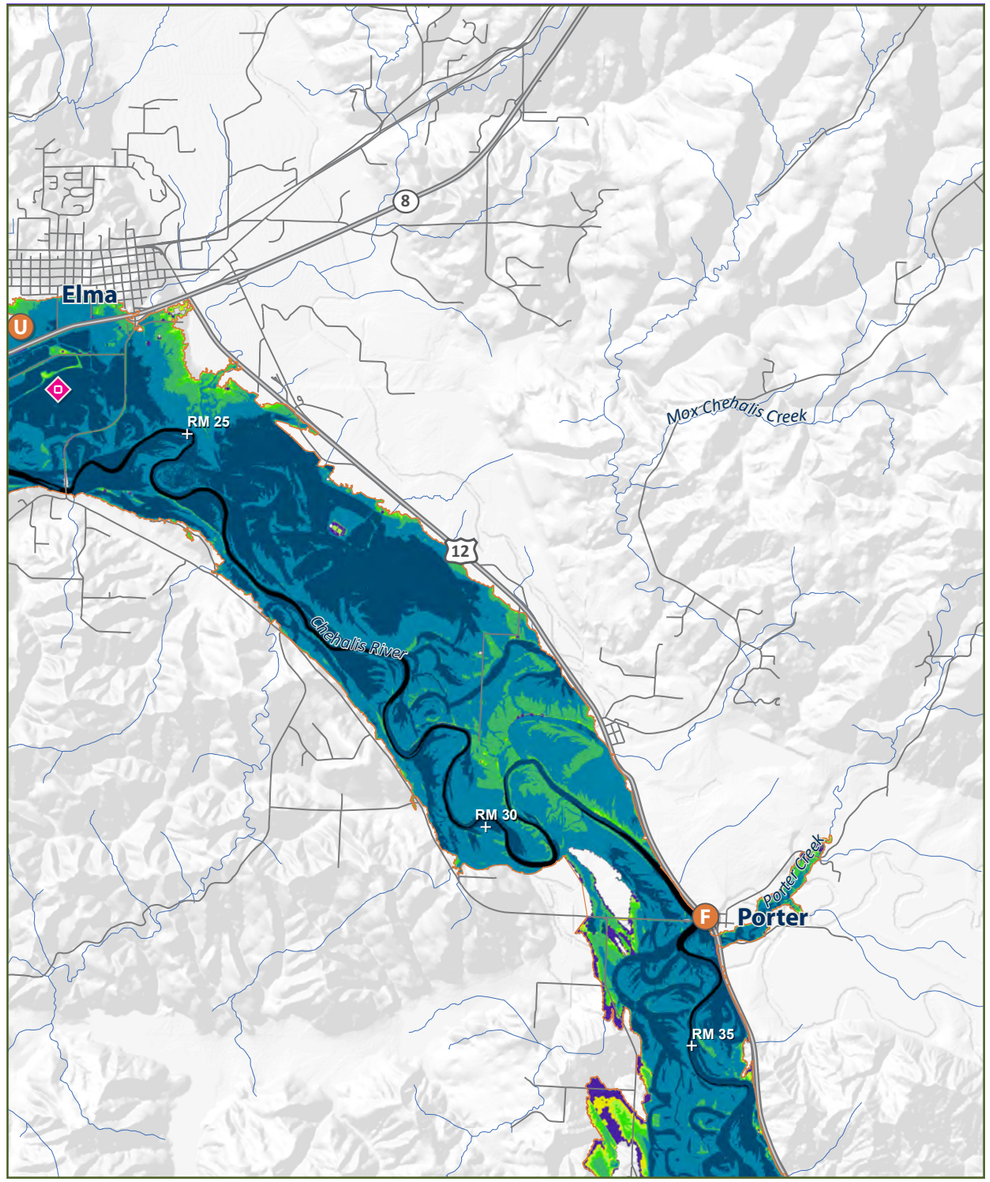
Feet
0 2,000 4,000

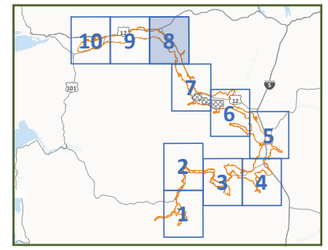
EIS Mapbook Sheet 8
Predicted Flood Conditions near Porter and Elma with the Proposed Action under Mid- and Late-Century Scenarios

Mid-Century Major Flood Scenario



Late-Century Catastrophic Flood Scenario





Legend

- Major Roads
- Trails
- River and Streams
- Modeled Flood Extent

Features

- Police and Court
- Fire Station
- Public Health
- Utilities
- Public Education
- Recreation/Parks

Water Depth (ft)

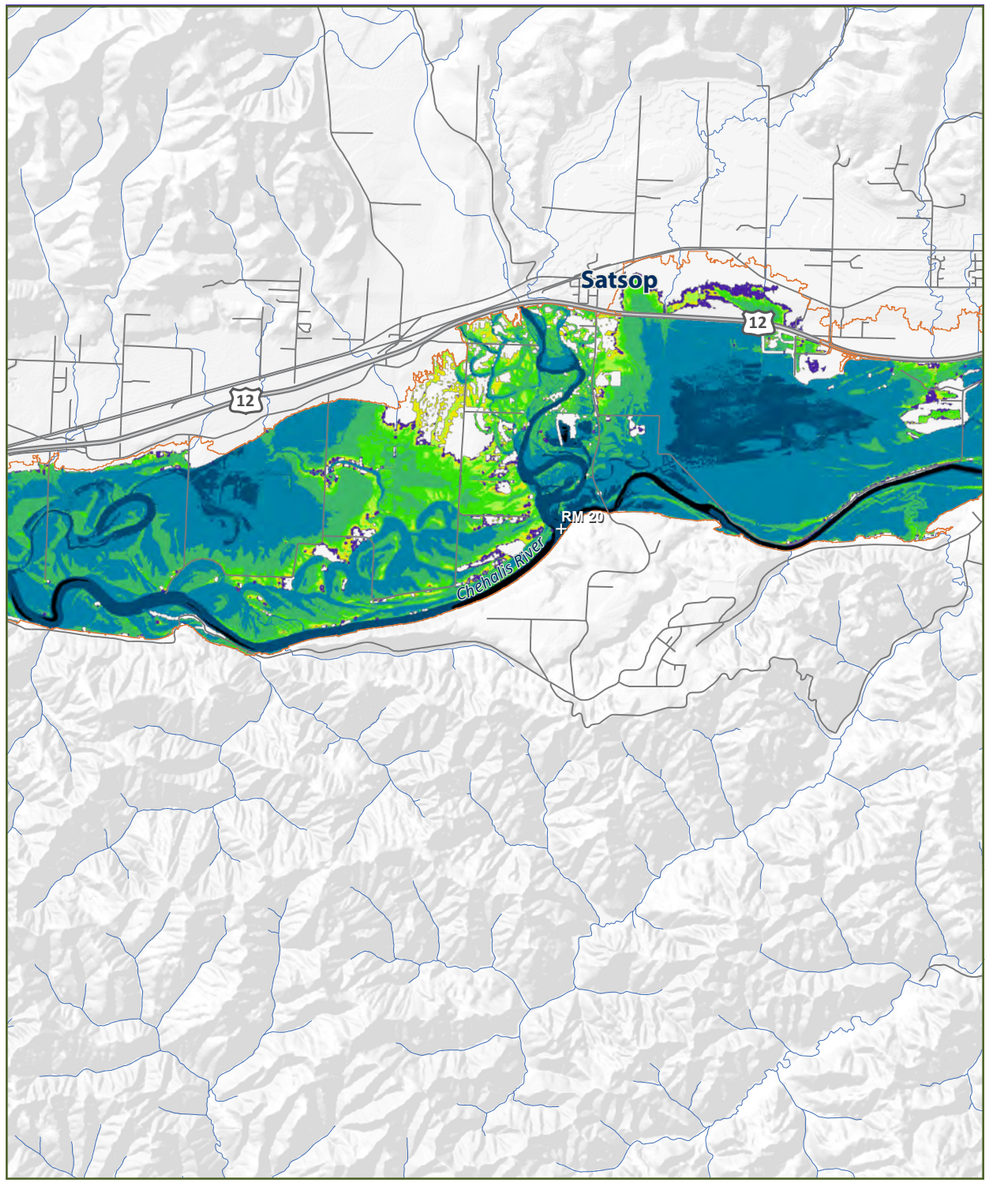
- 0.2–0.5
- 0.5–1
- 1–2
- 2–5
- 5–10
- 10–25
- >25
- (No Action) Area No Longer Flooded Under Proposed Action

N

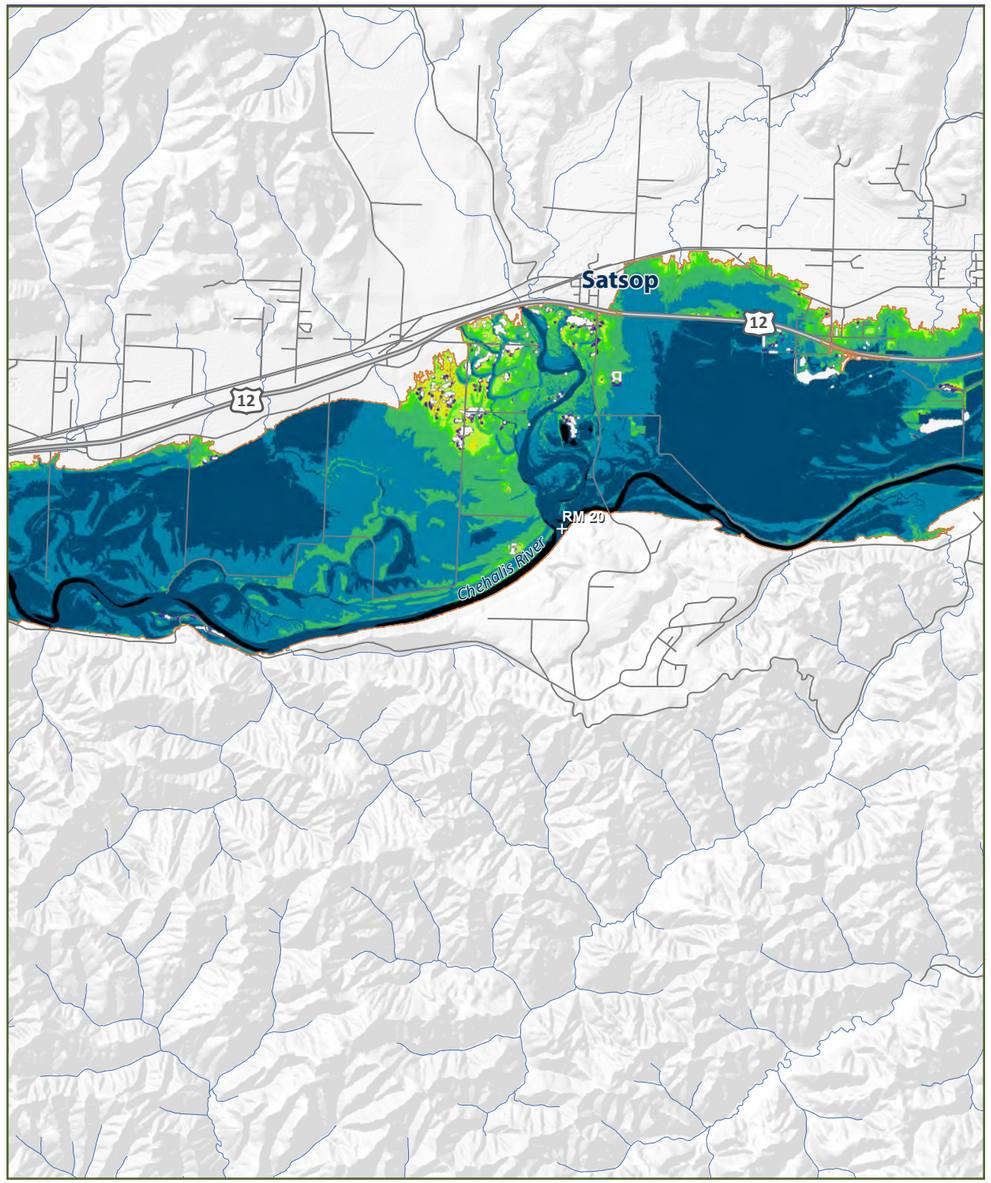
Feet
0 2,000 4,000

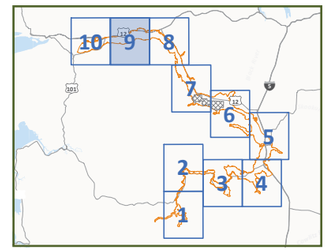
EIS Mapbook Sheet 9
Predicted Flood Conditions near Satsop with the Proposed Action under Mid- and Late-Century Scenarios

Mid-Century Major Flood Scenario



Late-Century Catastrophic Flood Scenario





Legend

- Major Roads
- Trails
- River and Streams
- Modeled Flood Extent

Features

- Police and Court
- Fire Station
- Public Health
- Utilities
- Public Education
- Recreation/Parks

Water Depth (ft)

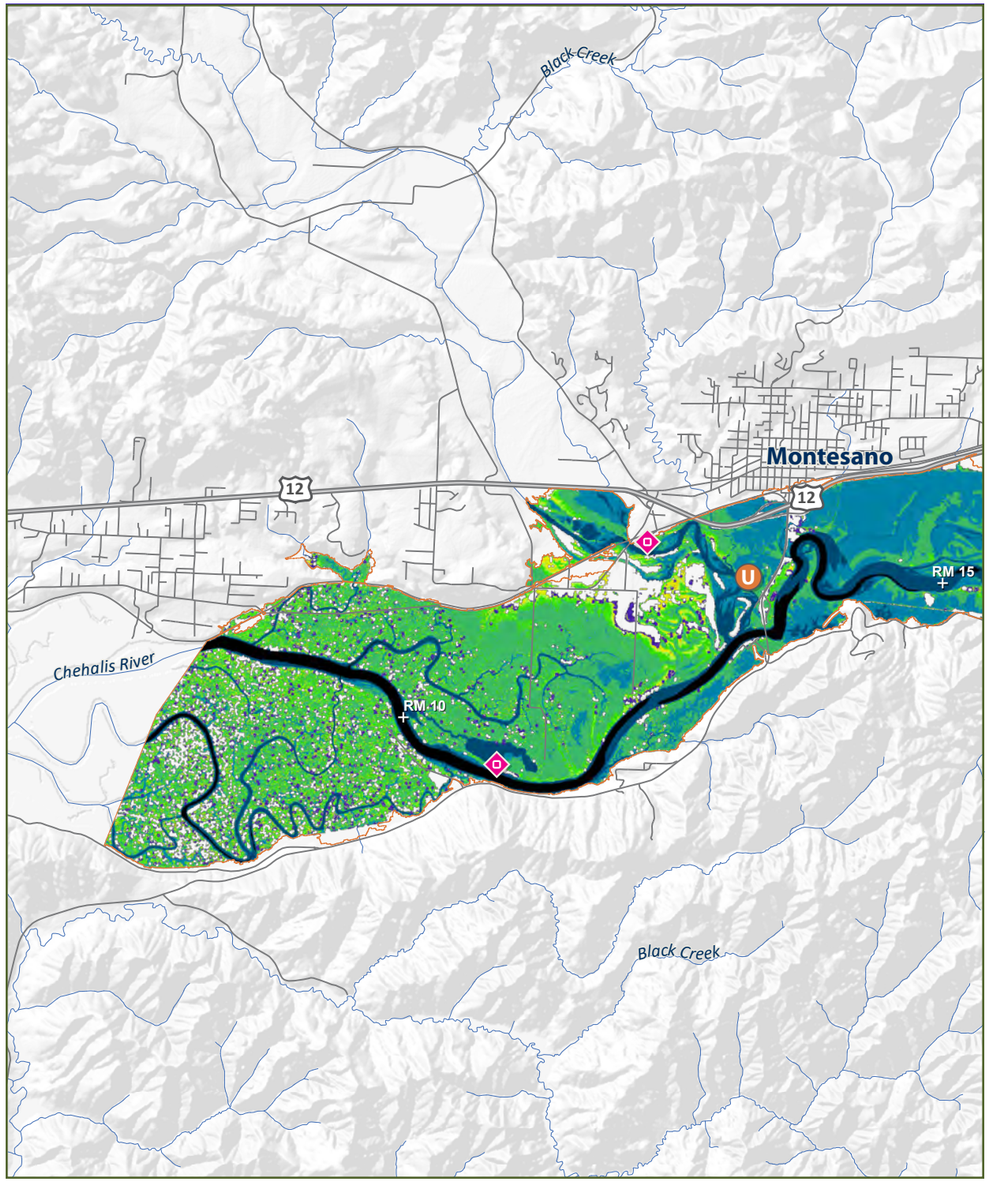
- 0.2–0.5
- 0.5–1
- 1–2
- 2–5
- 5–10
- 10–25
- >25
- (No Action) Area No Longer Flooded Under Proposed Action

N

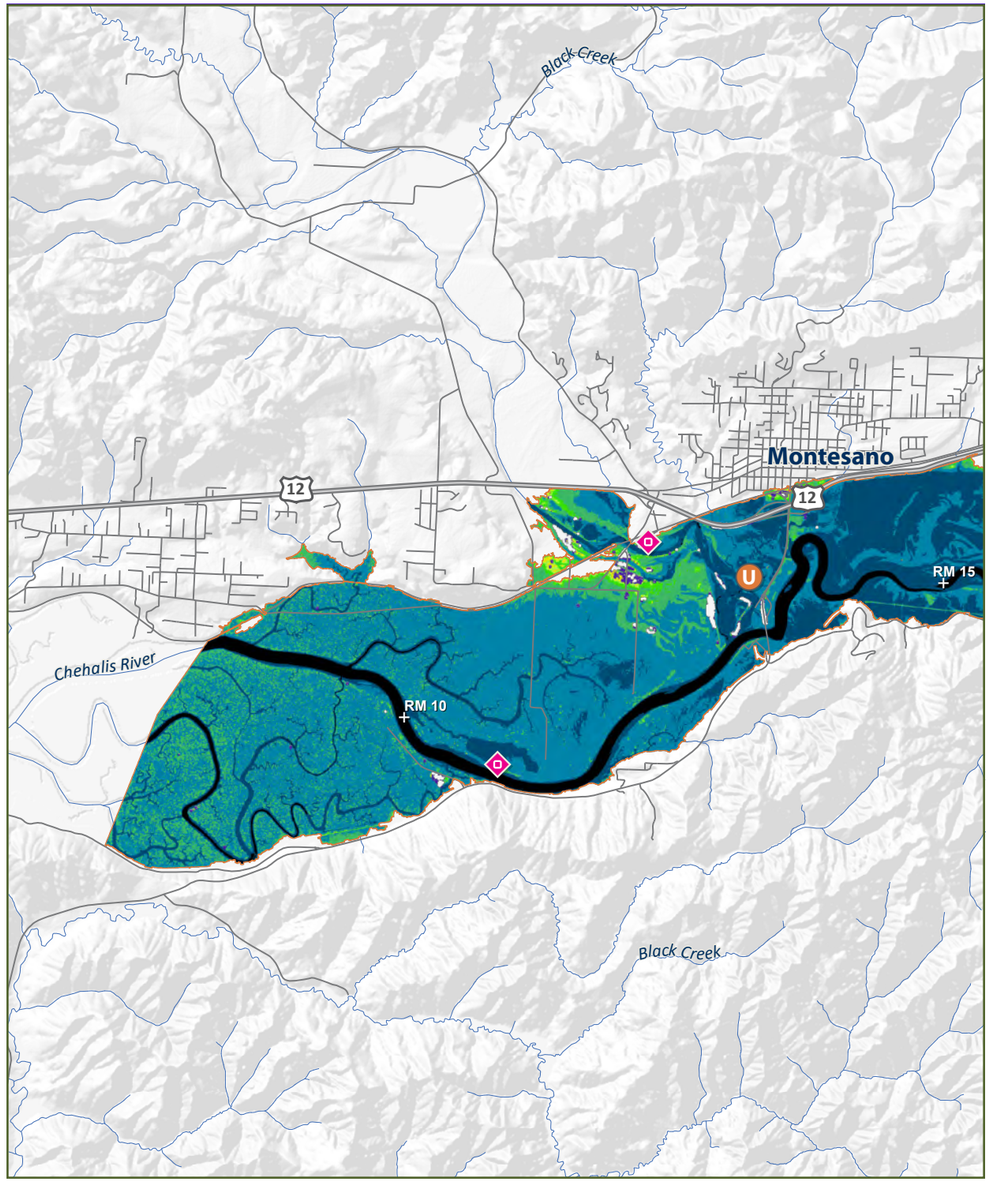
Feet
0 2,000 4,000

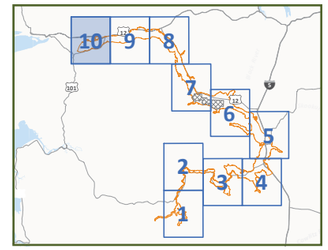
EIS Mapbook Sheet 10
Predicted Flood Conditions near Montesano with the Proposed Action under Mid- and Late-Century Scenarios

Mid-Century Major Flood Scenario



Late-Century Catastrophic Flood Scenario





Legend

- Major Roads
- Trails
- River and Streams
- Modeled Flood Extent

Features

- (P) Police and Court
- (F) Fire Station
- (H) Public Health
- (U) Utilities
- (E) Public Education
- Recreation/Parks

Water Depth (ft)

- 0.2–0.5
- 0.5–1
- 1–2
- 2–5
- 5–10
- 10–25
- >25
- (No Action) Area No Longer Flooded Under Proposed Action

N

Feet
0 2,000 4,000