February 2020
Proposed Chehalis River Basin Flood Damage Reduction Project
SEPA Draft Environmental Impact Statement

Appendix O
Wetlands Discipline Report

Publication No.: 20-06-002

DEPARTMENT OF
ECOLOGY
State of Washington

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About this Document

This discipline report has been prepared as part of the Washington Department of Ecology's (Ecology's) State Environmental Policy Act (SEPA) Environmental Impact Statement (EIS) to evaluate a proposal from the Chehalis River Basin Flood Control Zone District (Applicant).

Proposed Action

The Applicant seeks to construct a new flood retention facility and temporary reservoir near Pe Ell, Washington, and make changes to the Chehalis-Centralia Airport levee in Chehalis, Washington. The purpose of the Applicant's proposal is to reduce flooding originating in the Willapa Hills and improve levee integrity at the Chehalis-Centralia Airport to reduce flood damage in the Chehalis-Centralia area.

Time Frames for Evaluation

If permitted, the Applicant expects Flood Retention Expandable (FRE) facility construction would begin in 2025 and operations in 2030, and the Airport Levee Changes construction would occur over a 1-year period between 2025 and 2030. The EIS analyzes probable impacts from the Proposed Action and alternatives for construction during the years 2025 to 2030 and for operations from 2030 to 2080. For purposes of analysis, the term "mid-century" applies to the operational period from approximately 2030 to 2060. The term "late-century" applies to the operational period from approximately 2060 to 2080.

Scenarios Evaluated in the Discipline Report

This report analyzes probable significant environmental impacts from the Proposed Action, the Local Actions Alternative, and the No Action Alternative under the following three flooding scenarios (flow rate is measured at the Grand Mound gage):

- **Major flood:** Water flow rate of 38,800 cubic feet per second (cfs) or greater
- **Catastrophic flood:** Water flow rate of 75,100 cfs
- **Recurring flood:** A major flood or greater that occurs in each of 3 consecutive years

The general area of analysis includes the area in the vicinity of the FRE facility and temporary reservoir; the area in the vicinity of the Airport Levee Changes; and downstream areas of the Chehalis River to approximately river mile 9, just west of Montesano.

Local Actions Alternative

The Local Actions Alternative represents a local and nonstructural approach to reduce flood damage in the Chehalis-Centralia area. It considers a variety of local-scale actions that approximate the Applicant's purpose through improving floodplain function, land use management actions, buying out at-risk properties or structures, improving flood emergency response actions, and increasing water storage from Pe Ell to Centralia. No flood retention facility or Airport Levee Changes would be constructed.

No Action

Under the No Action Alternative, no flood retention facility or Airport Levee Changes would be constructed. Basin-wide large and small scale efforts would continue as part of the Chehalis Basin Strategy work, and local flood damage reduction efforts would continue based on local planning and regulatory actions.

SUMMARY

This report describes and addresses impacts on 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. Streams 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). The *Fish Species and Habitats Discipline Report* (Anchor QEA 2020a) addresses impacts on fish habitat and fish species, and the *Wildlife Species and Habitats Discipline Report* (Anchor QEA 2020b) addresses impacts on wildlife species, vegetation, riparian and upland habitats, and wildlife, plants, and habitats with protected status (federal, state, local).

The study area for the wetlands and waterbodies analysis includes areas that are potentially affected by the Proposed Action. This includes four specific geographic areas:

- The area of the proposed Flood Retention Expandable (FRE) facility (including associated access, construction, and maintenance areas)
- The area of predicted maximum inundation for the temporary reservoir
- The area of the proposed Airport Levee Changes
- The floodplain downstream of the proposed FRE facility (mainstem Chehalis River and its floodplain) extending to the modeled limits of potential late-century catastrophic flooding, about river mile (RM) 9 near Montesano

The analysis for the maximum inundation extent for the temporary reservoir includes an additional 500-foot extent area beyond the maximum inundation extent to identify wetlands and waterbodies in proximity to the inundation impacts. Streams are the only waterbody features located within the temporary reservoir area.

Wetlands and regulatory waterbodies within the FRE facility, temporary reservoir, and Airport Levee Changes components of the study area have been delineated as part of the analysis. Only streams were delineated within these study area components because no ponds or lakes are located in these portions of the study area. Downstream of the FRE facility, wetlands and regulatory waterbodies are described based on existing information and reports. Tables O-1 and O-2 summarize the identified impacts for the Chehalis River Basin Flood Control Zone District's (Applicant's) Proposed Action, Local Actions Alternative, and No Action Alternative.

Table O-1

Summary of Probable Wetland and Regulatory Waterbody Impacts from Proposed Action

IMPACT	IMPACT FINDING	MITIGATION PROPOSED (SUMMARIZED, SEE SECTION 3.2.4)	SIGNIFICANT AND UNAVOIDABLE ADVERSE IMPACT
PROPOSED ACTION (FRE FACILITY AND AIRPORT LEVEE CHANGES) – CONSTRUCTION			
Impacts on wetlands (6.5 acres) and wetland buffer habitats within Zones 1 and 2 of the temporary reservoir area (213.8 acres) due to removal of trees during construction of the FRE facility.	**Significant**	**WET-1**: Develop and implement a Wetland and Wetland Buffer Mitigation Plan.	No
Impacts along 11.44 miles of rivers/streams in the temporary reservoir and on 18.2 miles of stream buffers (counting length along each bank) and 312.8 acres of stream buffers from removal of trees during construction of the FRE facility.	**Significant**	**WET-2:** Develop and implement a Stream and Stream Buffer Mitigation Plan. **FISH-1:** Develop and implement a Fish and Aquatic Species and Habitat Plan.	**Yes, unless mitigation is feasible**
Permanent impacts on Category II and III wetlands (6.6 acres) and wetland buffer habitats (44.2 acres) for construction of the Airport Levee Changes.	**Significant**	**WET-1**: Develop and implement a Wetland and Wetland Buffer Mitigation Plan.	No
Permanent area of fill in 0.32 acre of the Chehalis River at the FRE facility site and disturbance or elimination of 10.79 acres of stream buffers during construction.	**Significant**	**WET-2:** Develop and implement a Stream and Stream Buffer Mitigation Plan.	**Yes, unless mitigation is feasible**
Impacts on water quality, quantity, and stream buffer function from removal of tree cover in stream buffers (312.8 acres) in the temporary reservoir during construction.	**Significant**	**FISH-1:** Develop and implement a Fish and Aquatic Species and Habitat Plan. **WATER-1**: Develop and implement a Surface Water Quality Mitigation Plan. **WET-2:** Develop and implement a Stream and Stream Buffer Mitigation Plan. **WILDLIFE-1**: Develop and implement a Vegetation Management Plan. **WILDLIFE-3**: Develop and implement a Riparian Habitat Mitigation Plan.	**Yes, unless mitigation is feasible**

IMPACT	IMPACT FINDING	MITIGATION PROPOSED (SUMMARIZED, SEE SECTION 3.2.4)	SIGNIFICANT AND UNAVOIDABLE ADVERSE IMPACT
Permanent impacts from construction of the FRE facility on eight Category III wetlands (1.08 acres) and wetland buffer habitats (30.14 acres) at the FRE facility site and effects on portions of wetlands (0.12 acre) adjacent to access roads to the quarry sites.	Moderate	**WET-1**: Develop and implement a Wetland and Wetland Buffer Mitigation Plan.	No
Impacts on up to 36 waterbodies from widening and improving quarry access roads for construction of the FRE facility.	Minor	None	No
Temporary disturbances and reduced water quality resulting from removal of tree cover at FRE facility site during construction.	Minor	None	No
Wetland impacts downstream of FRE facility during construction.	None	None	No
No regulatory waterbodies in construction areas for airport levee.	None	None	No
No impacts to regulatory waterbodies downstream of the FRE facility.	None	None	No
PROPOSED ACTION (FRE FACILITY AND AIRPORT LEVEE CHANGES) – OPERATION			
Permanent and recurring impacts on 85 Category II and III wetlands (9.76 acres) and wetland buffer habitats (303.15 acres) during inundation of temporary reservoir.	**Significant**	**WET-1**: Develop and implement a Wetland and Wetland Buffer Mitigation Plan.	**Yes, unless mitigation is feasible**
Permanent and recurring impacts on 116 regulatory waterbodies and stream buffers (25.5 miles counting length along each bank and 441.3 acres) from sediment deposition, channel widening, and channel migration during and following inundation in the temporary reservoir.	**Significant**	**FISH-1:** Develop and implement a Fish and Aquatic Species and Habitat Plan. **WATER-1**: Develop and implement a Surface Water Quality Mitigation Plan. **WET-2:** Develop and implement a Stream and Stream Buffer Mitigation Plan. **WILDLIFE-1**: Develop and implement a Vegetation Management Plan. **WILDLIFE-3**: Develop and implement a Riparian Habitat Mitigation Plan.	**Yes, unless mitigation is feasible**

IMPACT	IMPACT FINDING	MITIGATION PROPOSED (SUMMARIZED, SEE SECTION 3.2.4)	SIGNIFICANT AND UNAVOIDABLE ADVERSE IMPACT
Impacts on mainstem Chehalis River between Pe Ell and the South Fork Chehalis River due to reduced peak flows from operation of the FRE facility. Sediment and wood transport would be reduced and similarly reduce channel formation, leading to a narrower and simpler channel over time.	**Significant**	**WET-2:** Develop and implement a Stream and Stream Buffer Mitigation Plan. **FISH-1:** Develop and implement a Fish and Aquatic Species and Habitat Plan.	**Yes, unless mitigation is feasible**
Impacts on features of regulatory waterbodies downstream of the South Fork Chehalis River due to temporary changes in hydrology from operation of the FRE facility.	Minor	None	No
Impacts on wetlands or change of wetland status and function downstream of the FRE facility or overbank recharge due to long-term changes in hydrology and groundwater recharge from operation of the FRE facility.	Minor	None	No
Permanent reduced water quality from recurring loss of canopy cover during operation of the FRE facility.	Minor	None	No
No additional wetland impacts at FRE facility site identified for operation because all impacts would occur during construction.	None	None	No
No additional wetland impacts at airport levee site identified for operation because all impacts would occur during construction.	None	None	No
No additional operation impacts identified to regulatory waterbodies at the FRE facility site because all impacts would occur during construction.	None	None	No
No regulatory waterbody features at airport levee.	None	None	No

Table O-2

Summary of Probable Wetland and Regulatory Waterbody Impacts from Alternatives

IMPACT	IMPACT FINDING
LOCAL ACTIONS ALTERNATIVE	
Potential, unidentified disturbances to regulatory waterbodies from construction of projects.	Minor
Potential, unidentified disturbances to wetlands within the study area from construction of projects.	None
Potential, unidentified disturbances to wetlands and regulatory waterbodies from floods.	**Substantial ongoing flood risks**
NO ACTION ALTERNATIVE	
Potential, unidentified disturbances to wetlands and regulatory waterbodies from floods.	**Substantial ongoing flood risks**

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1 INTRODUCTION

This report describes wetlands, wetland buffers, and regulatory waterbodies (streams and stream buffers, ponds, and lakes) within the study area. Waterbodies 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). This report addresses probable impacts associated with the Chehalis River Basin Flood Control Zone District's (Applicant's) Proposed Action as well as for the Local Actions and No Action alternatives.

1.1 Resources Description

Wetlands are transition zones between terrestrial and aquatic systems that provide multiple important ecosystem functions, including fish and wildlife habitat, water quality improvement, flood protection, shoreline stabilization, and groundwater recharge. Wetlands can occur in stream and river channels, on floodplains, in low-lying areas and depressions, around the edges of ponds and lakes, on slopes, and in estuaries and coastal areas. 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.

Wetlands within the FRE facility, temporary reservoir, and Airport Levee Changes components of the study area are described as defined by the U.S. Army Corps of Engineers (Corps) in the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987); the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)* (Corps 2010); the Washington Department of Ecology (Ecology) *Washington State Wetland Identification and Delineation Manual* (Ecology 1997); and as defined under state law in the Growth Management Act (Revised Code of Washington [RCW] 36.70A.030). Local jurisdiction municipal codes and critical areas ordinances such as Lewis, Grays Harbor, Pacific, and Thurston counties and the cities of Chehalis and Centralia identify Corps federal and Ecology state guidelines as appropriate wetland identification and delineation methods. Downstream of the FRE facility, wetlands are described based on existing information and reports including the Modeled Wetlands Inventory dataset (Ecology 2011).

Regulatory waterbodies can include streams, lakes, ponds, and estuarine areas. There are no estuarine areas mapped within the study area. In addition, there are no lakes or ponds located within the FRE facility, temporary reservoir, or Airport Levee Changes components of the study area. Streams within the FRE facility, temporary reservoir, and Airport Levee Changes components of the study area are identified and described based on the physical presence of an ordinary high water mark (OHWM). The OHWM is defined by the Corps (Corps 2019), Ecology's *Determining the Ordinary High Water Mark for Shoreline Management Act Compliance in Washington State* (Ecology 2016), in state law (RCW 77.55.011), and the local county and city codes identified earlier. Downstream of the FRE facility, regulatory waterbodies are described based on existing information and reports. Waterbodies are

described and discussed from a habitat perspective for fish species and habitats in the *Fish Species and Habitats Discipline Report* (Anchor QEA 2020a) and for wildlife species and habitats in the *Wildlife Species and Habitats Discipline Report* (Anchor QEA 2020b).

1.2 Regulatory Context

Table O-3 identifies the laws, plans, and policies relevant to the evaluation of wetlands and waterbodies in the study area.

Table O-3
Regulations, Statutes, and Guidelines for Wetlands and Waterbodies

REGULATION, STATUTE, GUIDELINE	DESCRIPTION
FEDERAL	
National Environmental Policy Act (42 U.S. Code 4321 et seq.)	Enacted in 1969, requires an evaluation of the environmental consequences of actions taken by federal agencies.
Clean Water Act (33 U.S. Code 1251 et seq.)	Enacted in 1972, protects water quality in surface water and groundwater.
Section 404 of the Clean Water Act; U.S. Environmental Protection Agency Clean Water Act Section 404(b)(1) Guidelines (40 Code of Federal Regulations 230)	Regulates the placement of dredged or fill material into waters of the United States; evaluation will be conducted under auspices of the Section 404(b)(1) Guidelines.
Sections 301 and 402 of the Clean Water Act	Section 301 regulates discharges of pollutants into waters of the United States unless authorized under Section 402, the National Pollutant Discharge Elimination System.
Executive Order 11990, Protection of Wetlands	Requires federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities.
STATE	
Washington State Water Code (RCW 90.03)	Establishes water policy for the state of Washington, administered by Ecology; this includes oversight for projects such as the construction and safety of dams and permitting of reservoirs that will impound 10 acre-feet or more of water.
Forest Practices Act Chapter 76.09 RCW and Forest Practices Rules Title 222 Washington Administrative Code (WAC)	The Washington State Department of Natural Resources administers rules that govern forest practices activities on non-federal and non-tribal forestland in Washington state.
Growth Management Act (RCW 36.70A)	Requires local governments to include the best available science in developing policies and regulations protecting the functions and values of critical areas.
Water Pollution Control (RCW 90.48)	Ecology regulates all waters of the state, including wetlands, under the state Water Pollution Control Act; the policy requires the use of all known available methods by applicants to prevent and control pollution of the waters of the state.

REGULATION, STATUTE, GUIDELINE	DESCRIPTION
Shoreline Management Act (RCW 90.58)	Requires all counties and most cities with shorelines to develop and implement Shoreline Master Programs.
Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201)	Establishes water quality standards for surface waters of the state of Washington pursuant to the provisions in RCW 90.48.
Washington State-Administered Section 401 of the Clean Water Act	Delegates authority to the State of Washington to approve, condition, or deny proposed projects in wetlands and waters of the United States that are under Clean Water Act jurisdiction.
Washington State Hydraulic Code (WAC 220-660)	Serves to protect fish, shellfish, and their habitats by requiring all actions that use, divert, obstruct, or change the natural flow or bed of state saltwater or freshwaters to obtain a Hydraulic Project Approval from the Washington Department of Fish and Wildlife.
Washington State Executive Order 89-10, Protection of Wetlands	Adopts a statewide goal of no overall net loss in acreage and function of Washington's remaining wetlands; directs state agencies to consider the benefits provided by wetlands and to avoid activities that would adversely affect wetlands and to adequately mitigate when wetland impacts are unavoidable.
LOCAL	
Lewis County Municipal Code Chapter 17.38 – Critical Areas; Chapter 17.25 Shoreline Management	The Growth Management Act requires all cities and counties in Washington to adopt development regulations, according to the best available science, that protect critical areas as defined in RCW 36.70A.030(5). The Shoreline Management Act requires all local jurisdictions with Shorelines of the State to adopt Shoreline Master Programs consistent with the Shoreline Management Act, which emphasizes appropriate shoreline land use, protection of shoreline environmental resources, and protection of the public's right to access and use state shorelines.
Grays Harbor County Municipal Code Chapter 18.06 – Critical Areas Protection Ordinance Chapter 17.56.170 – Shoreline Environment Overlay	
Thurston County Municipal Code Title 24 – Critical Areas; Title 19 – Shoreline Master Program	
Pacific County Ordinance No. 180 – Critical Areas and Resource Land; Ordinance No. 183 – Shoreline Master Program	
City of Chehalis Municipal Code Chapter 17.21 – 17.27 – Critical Areas; 17.18 –Shoreline Substantial Development Permit	
City of Centralia Municipal Code Chapter 16.16 – 16.21 – Critical Areas; 16.08 – Shoreline Master Program	
Elma Municipal Code Chapter 14.26 (Environmental Protection)	Elma Municipal Code Chapter 14.26 establishes regulations that classify, protect, and preserve Elma's critical areas and floodways in part for their beneficial biological functions.

REGULATION, STATUTE, GUIDELINE	DESCRIPTION
Montesano Municipal Code Chapter 14.30 (Critical Areas)	Montesano Municipal Code Chapter 14.30 establishes regulations that classify, protect, and preserve Montesano's critical areas and floodways in part for their beneficial biological functions.
Oakville Municipal Code Chapter 14.16 (Environmental Protection)	Oakville Municipal Code Chapter 14.16 establishes regulations that classify, protect, and preserve Oakville's critical areas and floodways in part for their beneficial biological functions.
TRIBAL AUTHORITY	
Chehalis Tribal Code, Chapter 11.05, Permitting	Requires environmental review for activities that have the potential to affect sensitive areas within the jurisdiction and use areas of the Confederated Tribes of the Chehalis Reservation.

Wetlands and waterbodies in the Chehalis Basin are regulated and enforced by federal, state, and local agencies. The Corps, Ecology, Washington Department of Fish and Wildlife (WDFW), U.S. Environmental Protection Agency (EPA), local jurisdictions, and the Confederated Tribes of the Chehalis Reservation (Chehalis Tribe) each have their own role in regulating wetlands and waterbodies in the study area.

1.2.1 Federal

1.2.1.1 U.S. Army Corps of Engineers and U.S. Environmental Protection Agency

Enacted in 1972, the Clean Water Act was developed to protect water quality in surface water and groundwater. Section 404 establishes a program regulating discharge of dredged or fill material into waters of the United States. The EPA has developed Section 404(b)(1) Guidelines (40 Code of Federal Regulations [CFR] 230) for evaluating proposed discharges. The Corps and EPA are responsible for federal enforcement of the dredged and fill material permit requirements. The Corps and EPA assert jurisdiction over "all waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide" and wetlands adjacent to these waters (Corps 2008).

1.2.2 State

1.2.2.1 Washington Department of Ecology

State laws protecting wetlands are broader than the current federal regulations. Ecology regulates wetlands in the state through Section 401 of the Clean Water Act and the state Water Pollution Control Act (RCW 90.48). Ecology issues Administrative Orders for impacts to wetlands that are not covered under the federal regulations. Ecology administers the State Water Code (RCW 90.03) to oversee water rights, beneficial uses of state waters, and the construction and safety of dams, among other types of projects. Ecology has permitting responsibilities under the Shoreline Management Act and provides technical assistance related to the Growth Management Act.

1.2.2.2 Washington Department of Fish and Wildlife

WDFW regulates and protects fish, shellfish, other aquatic and semi-aquatic wildlife, and their habitats, by requiring all actions that use, divert, obstruct, or change the natural flow or bed of state salt waters or freshwaters to obtain a Hydraulic Project Approval.

1.2.3 Local

The Growth Management Act authorizes and requires cities and counties to regulate critical areas, including wetlands, within their jurisdictions. Wetlands within shoreline areas are subject to the Shoreline Management Act and regulations set forth by each jurisdiction pertaining to those areas.

1.2.3.1 County

Lewis County Code Title 17, Land Use and Development Regulations, classifies and designates critical areas in Lewis County in Chapter 17.38, Critical Areas. This chapter establishes regulations for the protection of ecological functions and values of critical areas outside of lands within the jurisdiction of the Shoreline Management Act. Section 17.38.300 sets mitigation requirements for wetlands based on category and functions. Compensatory mitigation for wetland buffers uses a 1:1 ratio. It states compensatory buffer mitigation shall replace the buffer functions lost from development.

Grays Harbor County Code Title 18, Environment, identifies and regulates environmentally critical areas under Chapter 18.06, Critical Areas Protection Ordinance. This chapter supplements development requirements per zoning classifications to provide additional controls consistent with best available science for the protection of environmentally critical areas.

Thurston County Code Title 24, Critical Areas, establishes regulations and enforcement processes for the protection of critical areas. The chapter considers the best available science in the designation, protection, and management of critical areas. Title 19, Shoreline Master Program, establishes regulations for the protection of shorelines.

Pacific County Code Title 23, Critical Areas, implements the Growth Management Act and environment goals of the Pacific County Comprehensive Plan through protecting the functions and values of ecologically sensitive areas. Ordinance No. 183 establishes the Shoreline Master Program to manage and protect shorelines.

1.2.3.2 City

The Chehalis Municipal Code Chapter 17, Uniform Development Regulations, establishes regulations pertaining to the development of critical areas to protect the environmentally sensitive resources of the city of Chehalis and regulates development within the shoreline zone. The code sets buffer dimensions and mitigation based on the wetland category and function. Compensatory mitigation for wetland buffers uses a 1:1 ratio.

The Centralia Municipal Code Chapter 16, Environment, regulates the use of land in and around critical areas, wildlife habitat, and natural hazard areas within the city and implements the Shoreline Master Program.

Oakville Municipal Code (Chapter 14.16 Environmental Protection), Elma Municipal Code (Chapter 14.26), and Montesano Municipal Code (Chapter 14.30) establish regulations that classify, protect, and preserve critical areas and floodways in these municipalities in part for their beneficial biological functions.

1.2.4 Tribal Authority

1.2.4.1 Confederated Tribes of the Chehalis Reservation

The Chehalis Tribe Reservation is located in the study area. The Chehalis Tribe retains sovereign rights that are guaranteed under treaties and federal laws. For activities on tribal lands, tribal laws may require critical area permits and approvals.

2 METHODOLOGY

2.1 Study Area

The study area for the wetlands and regulatory waterbodies (streams, ponds, and lakes) analysis includes the following four specific geographic areas in the Chehalis Basin:

- The area of the proposed Flood Retention Expandable (FRE) facility (including associated access, construction, and maintenance areas)
- The area of predicted maximum inundation for the temporary reservoir
- The area of the proposed Airport Levee Changes
- The floodplain downstream of the proposed FRE facility (mainstem Chehalis River and its floodplain) extending to the modeled limits of potential late-century catastrophic flooding, about river mile (RM) 9 near Montesano, Washington

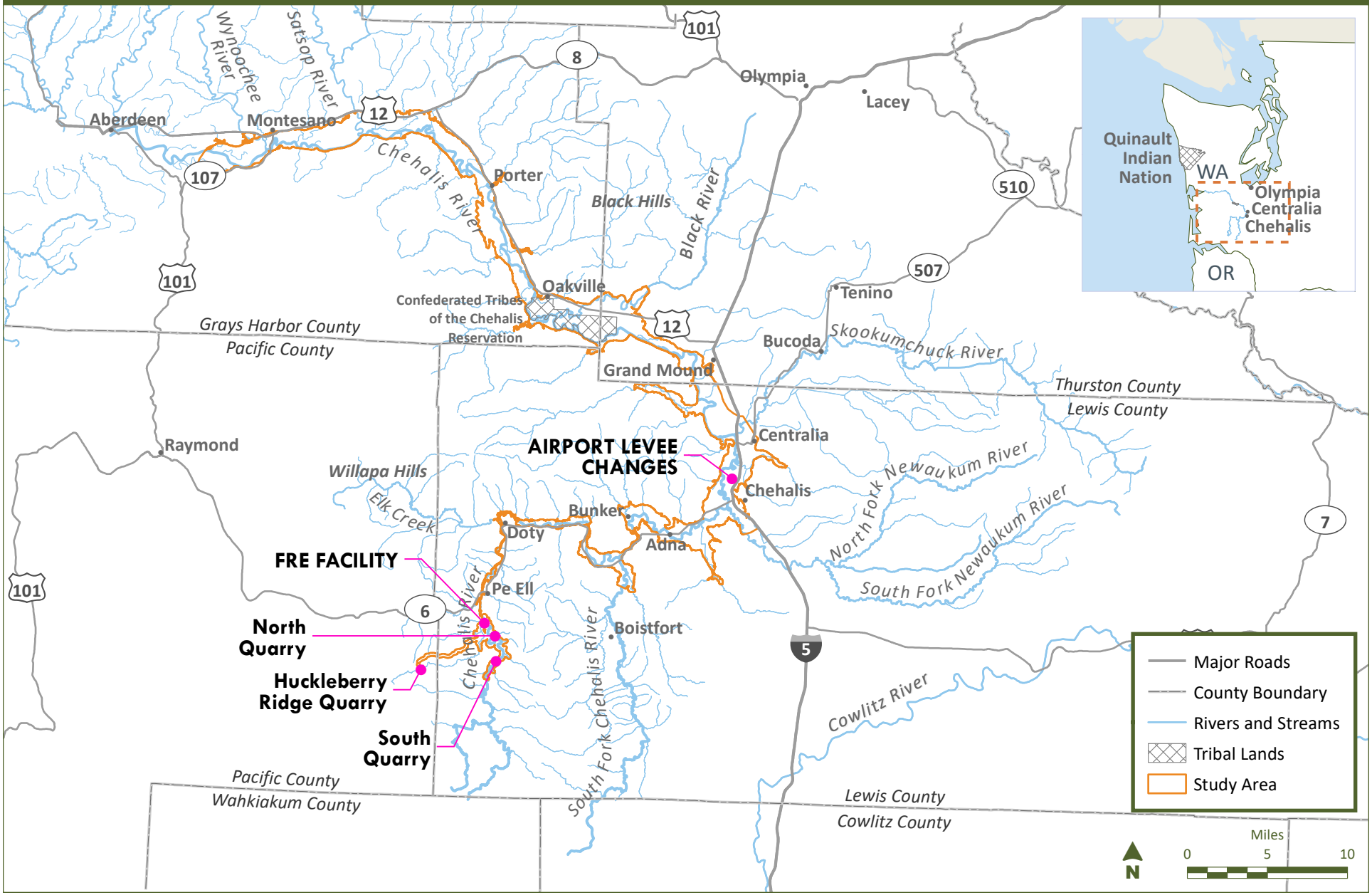
There are no lakes or ponds located within the FRE facility, temporary reservoir, or Airport Levee Changes components of the study area. The study area boundary reflects the potential extent of inundation associated with flooding on the mainstem Chehalis River, plus an additional 1,500 feet upstream of the modeled limits. The study area extent includes the upstream reach of the mainstem Chehalis River that floods into the following three tributaries of the Chehalis mainstem: the Skookumchuck, the Newaukum, and the South Fork Chehalis rivers (Figure O-1).

2.2 Studies and Reports Referenced/Used

The following studies, reports, and models were used to identify and evaluate potential wetland and waterbody impacts:

- *Chehalis Basin Strategy Programmatic EIS* (Ecology 2017a)
- *FRE Dam Alternative Supplemental Design Report* (Chehalis Basin Strategy 2018)
- *Fish Species and Habitats Discipline Report* (Anchor QEA 2020a)
- *Wildlife Species and Habitats Discipline Report* (Anchor QEA 2020b)
- *Wetland, Water, and Ordinary High Water Mark Delineation Report* (Anchor QEA 2018)
- *Chehalis-Centralia Airport Levee Wetland Delineation Report* (Anchor QEA 2019a)
- *Downstream Floodplain Wetland Analysis* (Anchor QEA 2019b)
- Potential Groundwater Level Effects Analysis memorandum (Wilson et al. 2019)
- National Wetlands Inventory (NWI; USFWS 2018a, 2018b)
- Modeled Wetlands Inventory (Ecology 2011)
- National Hydrography Dataset (NHD; USGS 2019)

Figure O-1
Wetlands Study Area



2.3 Technical Approach

The Chehalis Basin is a large geographic area that includes a variety of wetland habitats and regulatory waterbodies (streams, ponds, and lakes). The affected environment and probable impacts are identified for wetlands, wetland buffers, streams, and stream buffers likely to be impacted by the Proposed Action within the study area. Other regulatory waterbodies, ponds, and lakes are present only downstream of the FRE facility; they are not likely to be significantly impacted by the Proposed Action and are discussed but not analyzed further. To identify these resources within the study area, scientists reviewed existing agency reports, resource maps, and aerial photographs (Section 2.2).

Wetlands and the OHWM of streams located within the proposed temporary reservoir were delineated in 2017 as described in the *Wetland, Water, and Ordinary High Water Mark Delineation Report* (Anchor QEA 2018). The area of investigation for the 2017 study encompassed an approximately 1,700-acre area within nine drainage basins associated with major stream channels in the upper Chehalis River watershed, Water Resource Inventory Area 23 (Ecology 2019), along the mainstem Chehalis River. For wetlands and the OHWM of streams, field surveys were ground-truthed and confirmed by Ecology, WDFW, and the Corps.

Wetlands and streams within the temporary reservoir and areas of proposed construction activities at the FRE facility have been delineated as part of the analysis. Within the airport levee area of proposed construction activities, no streams are present and only wetland systems were delineated. Wetlands downstream of the FRE facility or outside where delineations were performed are estimated based on the Modeled Wetlands Inventory dataset (Ecology 2011). The Modeled Wetlands Inventory was completed for Ecology by the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center under a grant from EPA (Ecology 2017b). It was prepared as a supplement to the National Wetlands Inventory (NWI) for the west side of the state to provide a coarse-level analysis of change over time. The 2011 Modeled Wetlands Inventory is based on land cover classification from Landsat imagery using a land cover classification protocol developed by the Coastal Change Analysis Program. NOAA used supplemental data to derive a wetland layer from existing land cover classes, including wetland and pasture/hay or cultivated land covers. Those wetlands identified in areas with pasture/hay or cultivated land covers were classified as “potentially disturbed wetlands” in the Modeled Wetlands Inventory. Wetlands are expressed at the same scale as other land cover classes, using 30-meter (100-foot) pixel rasters. Most wetlands less than 1 acre in size are not modeled.

An analysis of wetlands and regulatory waterbodies (streams, ponds, lakes) within the 100-year floodplain downstream of the FRE facility is also described in the *Downstream Floodplain Wetland Analysis* (Anchor QEA 2019b). The analysis area for this downstream floodplain report consists of an approximately 43,107-acre area that includes 75 miles of the floodplain along the mainstem Chehalis River and associated lower ends of major tributaries.

Wetland community types in the study area are discussed according to the U.S. Fish and Wildlife Service (USFWS) classification developed by Cowardin et al. (1979) for use in the NWI. This system, published in 1979 by a team of USFWS scientists led by L.M. Cowardin, bases the classification of wetlands on their physical characteristics, such as the general type of vegetation in the wetland (e.g., forested, scrub-shrub, emergent) and how much, and where, water is present in the wetland. When wetlands have less than 30% cover of vegetation, they are identified by substrate type (e.g., unconsolidated shore). Most wetlands in the study area are identified as palustrine, indicating that they do not occur in the deepwater areas of lakes, rivers, and stream channels.

Scientists have come to understand that wetlands can perform functions in different ways. The way a wetland functions depends to a large degree on hydrologic and geomorphic conditions. To recognize these differences among wetlands, a way to group or classify them has been developed. This classification system, called the hydrogeomorphic (HGM) classification system, groups wetlands into categories based on the geomorphic setting and the primary ways in which water moves within or through them. The *Washington State Wetland Rating System – Western Washington: 2014 Update* (Hruby 2014) incorporates the HGM classification system as part of the questionnaire for characterizing a wetland's functions. Wetland HGM classes include depressional, slope, riverine, or lake-fringe.

Critical areas ordinances within Washington State designate wetland buffer widths based on wetland category and, in some jurisdictions, habitat function. They also identify requirements for mitigation when a project proposes impacts to wetland buffers. Wetland buffers for the delineated and categorized wetlands within the FRE facility and temporary reservoir were identified based on the Lewis County critical areas code guidelines. Wetland buffers within the Airport Levee Changes area were identified based on the City of Chehalis critical areas code guidelines.

Waterbodies located downstream of the FRE facility or outside where stream OHWM determinations were performed are estimated based on the NHD (USGS 2019). The NHD represents the water drainage network of the United States with features such as rivers, streams, canals, lakes, ponds, coastline, and stream gages. The NHD was analyzed to identify the total length of rivers and intermittent and perennial streams in the study area. Downstream of the FRE facility, the Modeled Wetlands Inventory (Ecology 2011) was also used to identify areas of open water with no vegetation (non-wetland features) such as rivers, streams, ponds, and lakes. Stream OHWM was determined through modeling and select reaches were ground-truthed to verify the model (Anchor QEA 2018). Stream types and stream buffers were identified based on Lewis County critical areas code guidelines and the Lewis County Shoreline Master Program (SMP). The Lewis County Code and SMP require rivers and streams to be classified in accordance with a revised version of the Washington Department of Natural Resources (DNR) water typing system (Washington Administrative Code [WAC] 222-16-030). This system categorizes rivers and streams into the following types: Type S Water (Shoreline of the State), Type F-A Water (fish-bearing greater than 10 feet wide), Type F-B Water (fish-bearing less than 10 feet wide), Type Np Water (non-

fish habitat perennial flow), and Type Ns Water (non-fish habitat seasonal flow). Streams that do not have a surface connection to a downstream water have no classification or associated stream buffer.

Stream types were identified based on information collected during the 2017 stream OHWM delineations and stream mapping information on the Lewis County geographic information system (GIS) public mapping web site (Lewis County 2019).

Critical areas ordinances designate stream buffer widths based on stream type. They also identify requirements for mitigation when a project proposes impacts to stream buffers. Stream buffers for streams within the FRE facility and temporary reservoir were identified based on the Lewis County critical areas code guidelines. No streams are present within the Airport Levee Changes area.

Within the study area, probable impacts were assessed for the Proposed Action, No Action Alternative, and Local Actions Alternative. For the Proposed Action, probable impacts are assessed for construction and operations (e.g., flood-retention events and during non-flood events). Probable effects on wetlands and regulatory waterbodies (streams, ponds, lakes), including effects on hydrology, vegetation communities, and functions, were evaluated.

For the airport levee analysis, it was assumed that wetlands in direct proximity to the existing levee would be affected during construction (e.g., levee widening). No waterbodies are located in the Airport Levee Changes footprint.

Waterbodies (streams, ponds, lakes) were evaluated for jurisdictional impacts, with more emphasis on those that are fish-bearing. A detailed analysis of impacts on fish species and habitats is included in the *Fish Species and Habitats Discipline Report* and for wildlife species and habitats in the *Wildlife Species and Habitats Discipline Report*.

2.4 Affected Environment

The following sections describe the types and extent of wetland habitats and regulatory waterbodies found in the wetlands study area.

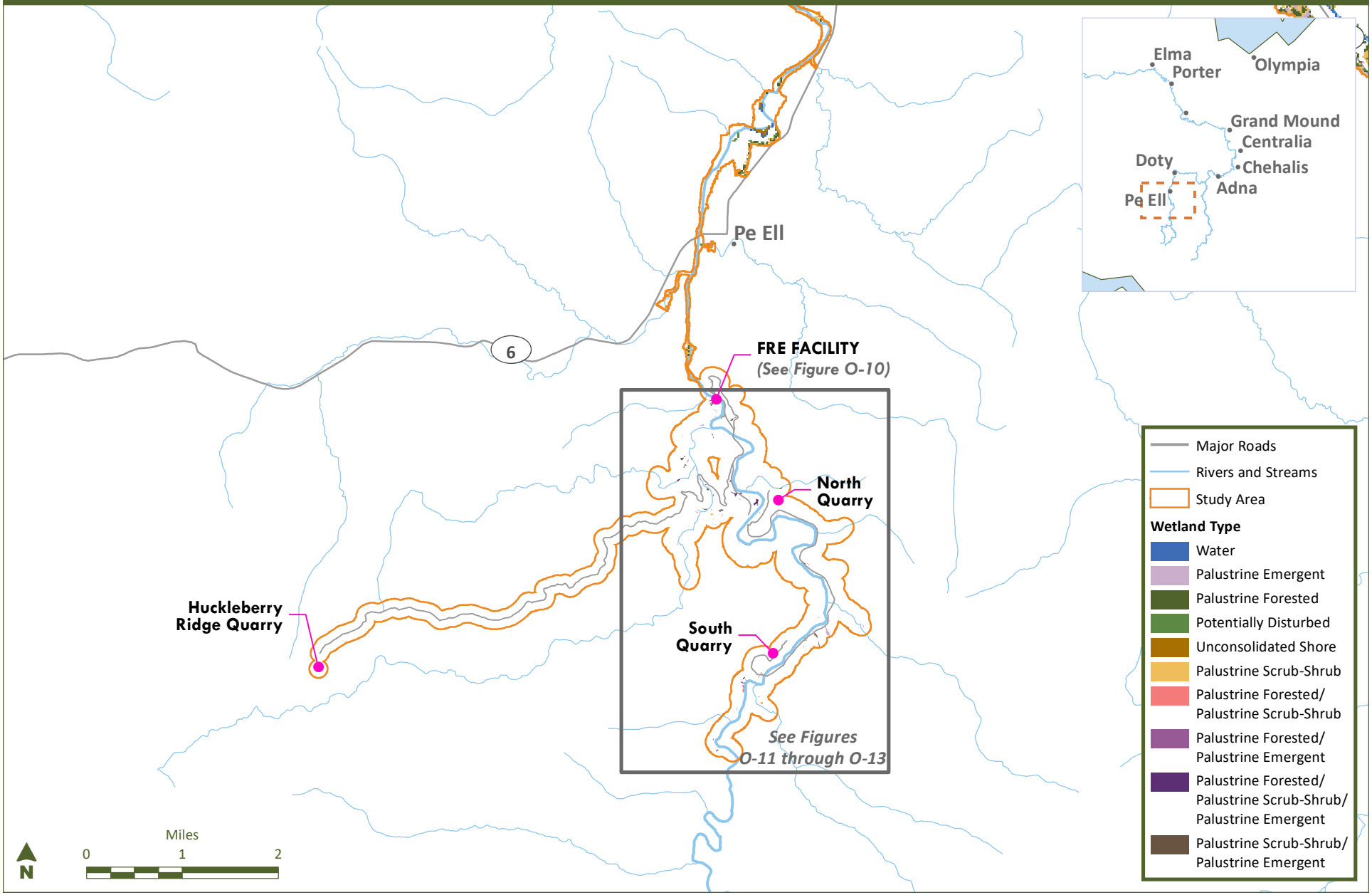
2.4.1 Wetlands and Wetland Buffers

Wetlands provide many functions, including erosion control, flood control, groundwater recharge, water filtration and purification, and wildlife habitat. The functions performed by an individual wetland depend on its location, surrounding and site topography, subsurface geology, soil types, amount and duration of water, and the types of plants present. While each wetland may not perform all functions, the cumulative value of all wetlands in a watershed makes each important. Wetlands are protected and regulated at the local, state, and federal levels. Wetland buffers are regulated at the local level. Mitigation and compensation for wetland impacts are regulated at the local, state, and/or federal levels.

The state Growth Management Act (GMA) authorizes and requires cities and counties to regulate wetlands within their jurisdictions. This is typically accomplished by adopting a critical areas ordinance.

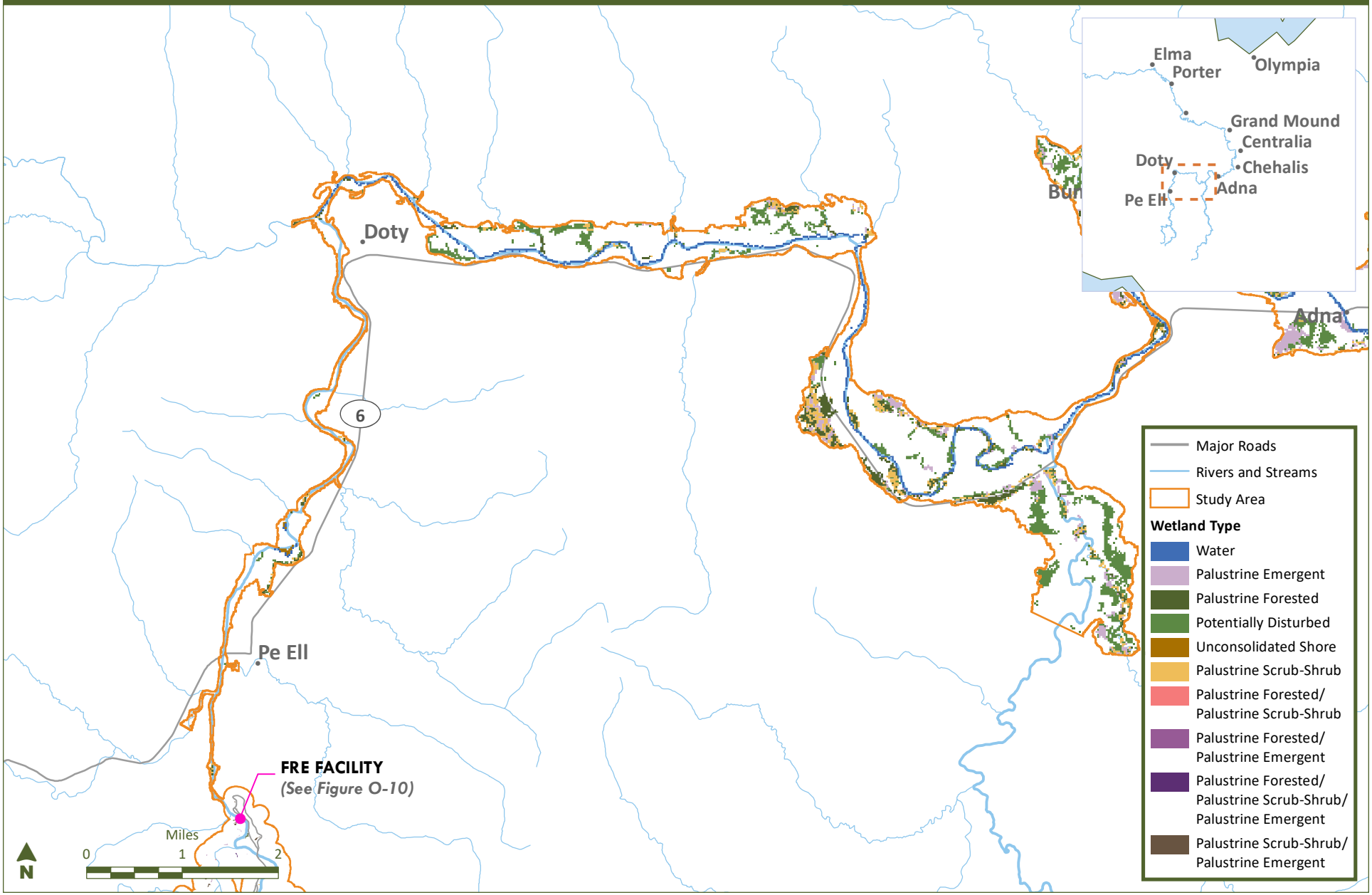
In this section, wetlands within the study area, including those that occur in stream and river channels, on floodplains, in low-lying areas and depressions, around the edges of ponds and lakes, and on slopes are described for each component of the study area. No ponds or lakes are located within the FRE facility, temporary reservoir, and Airport Levee Changes components of the study area where delineations of wetlands occurred. Downstream of the FRE facility, wetlands are described based on existing information and reports. Wetlands within the study area are shown in Figures O-2 through O-9.

Figure O-2
Wetlands in the Study Area



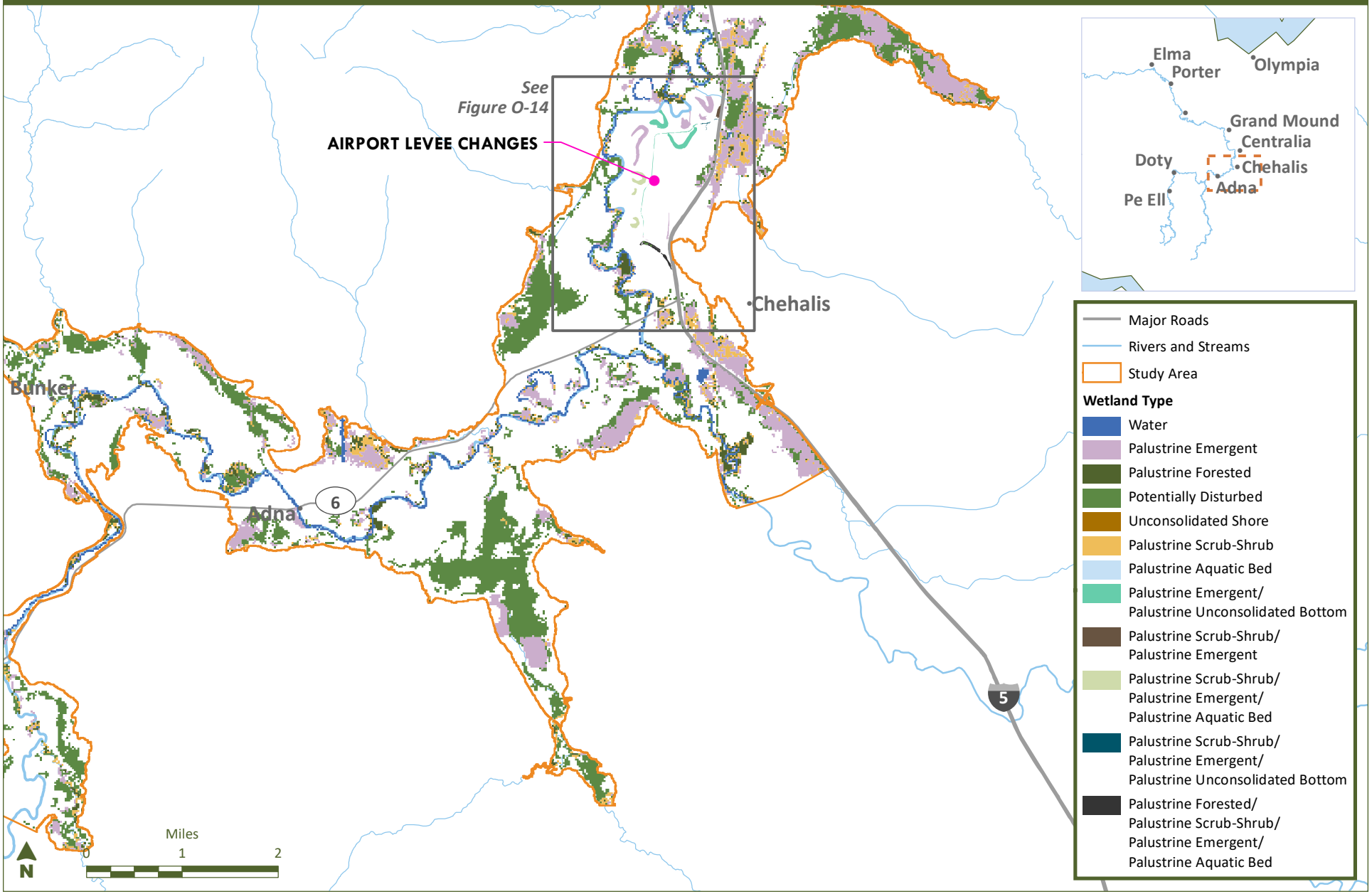
Data sources: Field-delineated wetlands mapped near the FRE facility and in the vicinity of the temporary reservoir (Anchor QEA 2018); modeled wetland inventory (not field-delineated) downstream of the FRE facility (Ecology 2011)

Figure O-3
Wetlands in the Study Area



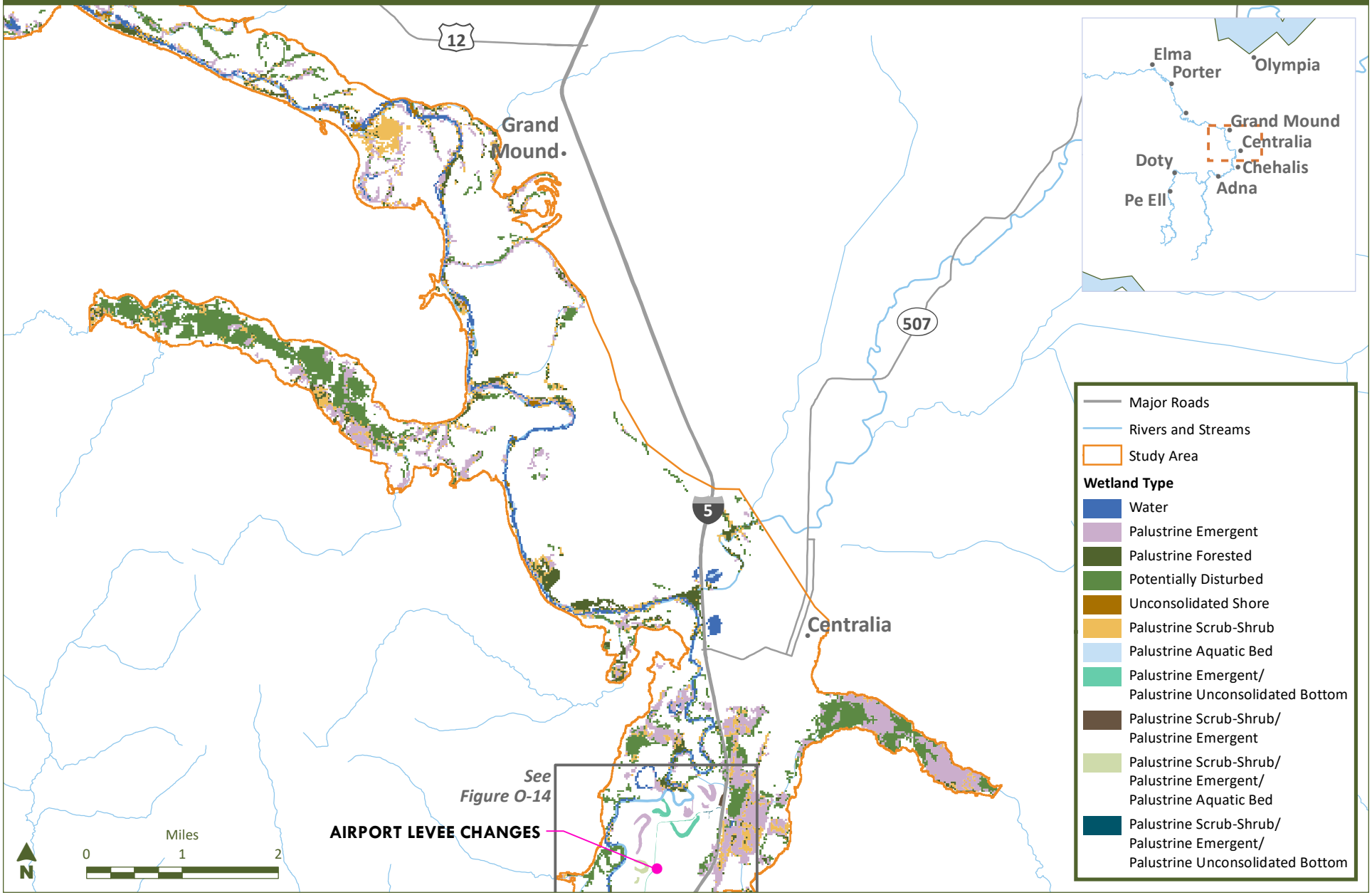
Data source: Modeled wetland inventory (not field-delineated) downstream of the FRE facility (Ecology 2011)

Figure O-4
Wetlands in the Study Area



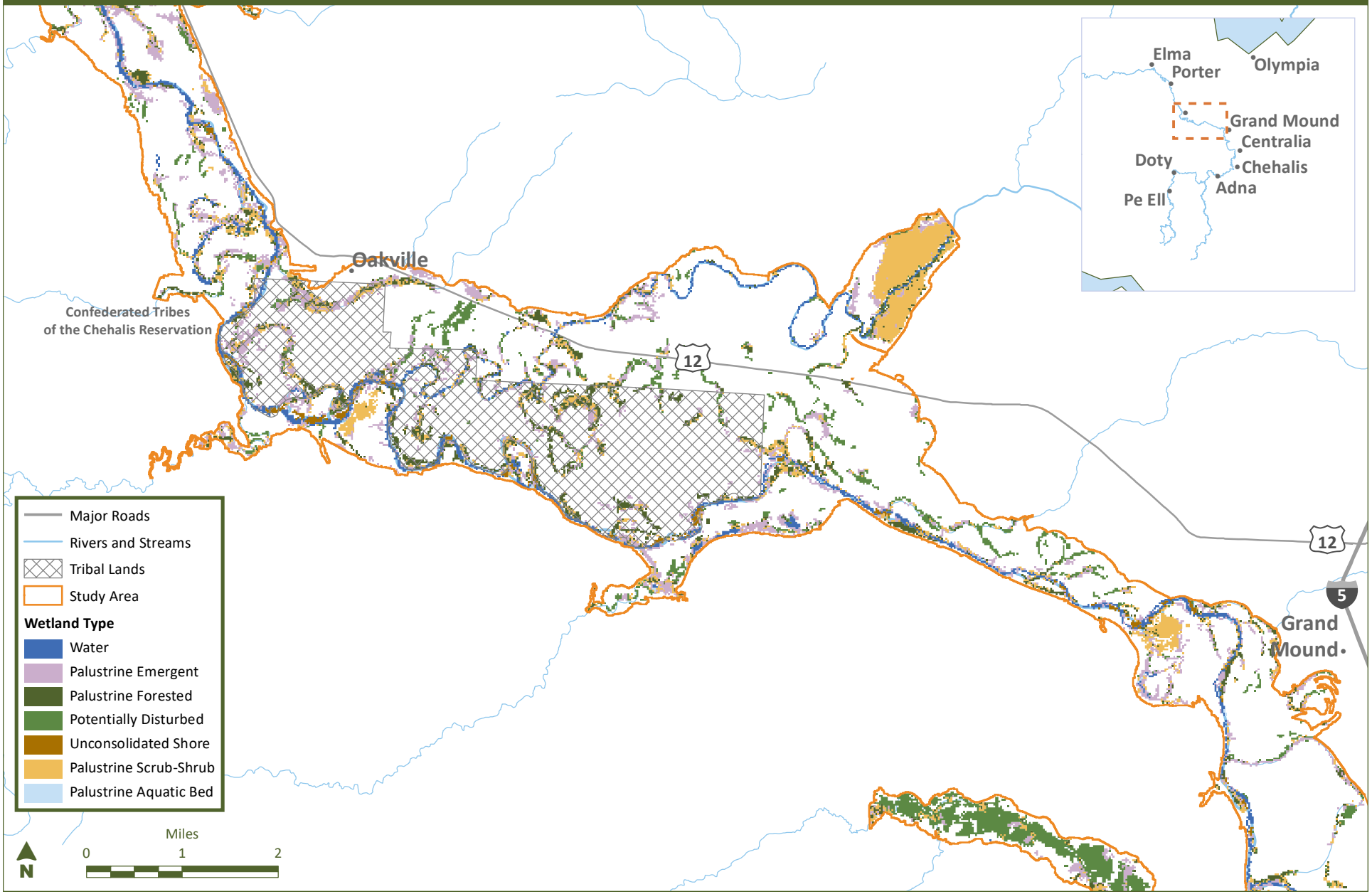
Data sources: Field-delineated wetlands mapped near the Airport Levee Changes (Anchor QEA 2019); modeled wetland inventory (not field-delineated) in other areas downstream of the FRE facility (Ecology 2011)

Figure O-5
Wetlands in the Study Area



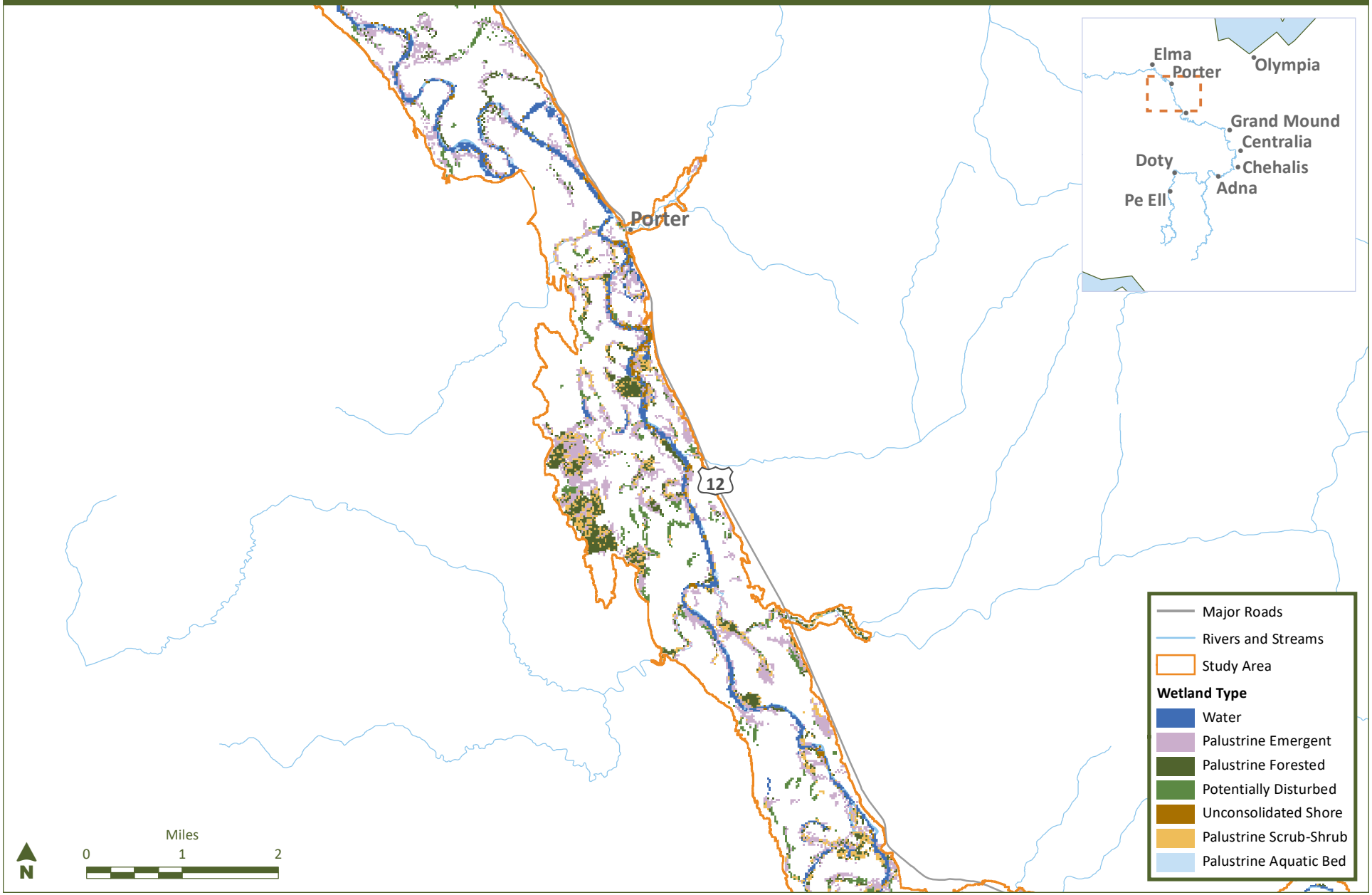
Data sources: Field-delineated wetlands mapped near the Airport Levee Changes (Anchor QEA 2019); modeled wetland inventory (not field-delineated) in other areas downstream of the FRE facility (Ecology 2011)

Figure O-6
Wetlands in the Study Area



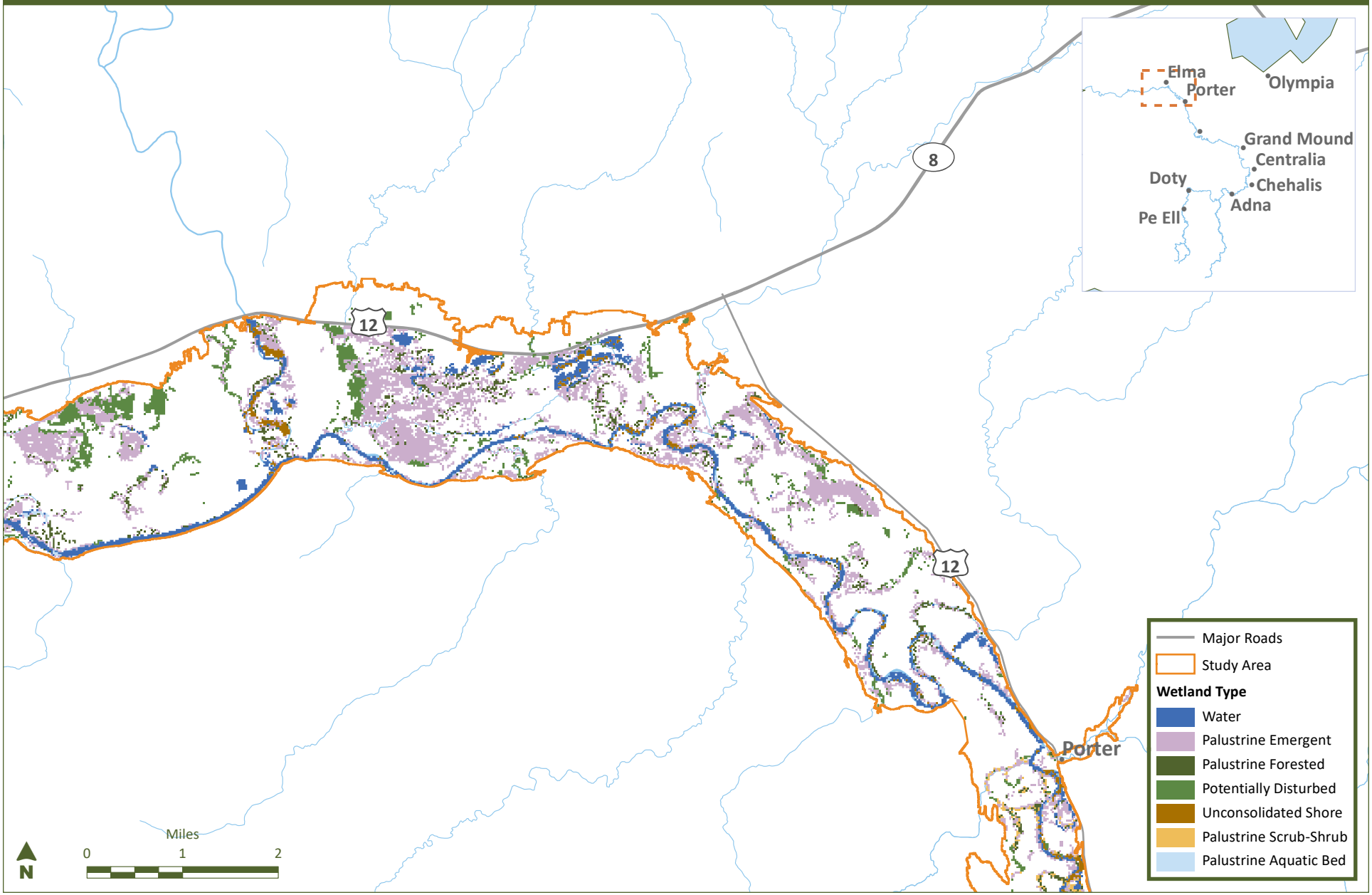
Data source: Modeled wetland inventory (not field-delineated) downstream of the FRE facility (Ecology 2011)

Figure O-7
Wetlands in the Study Area



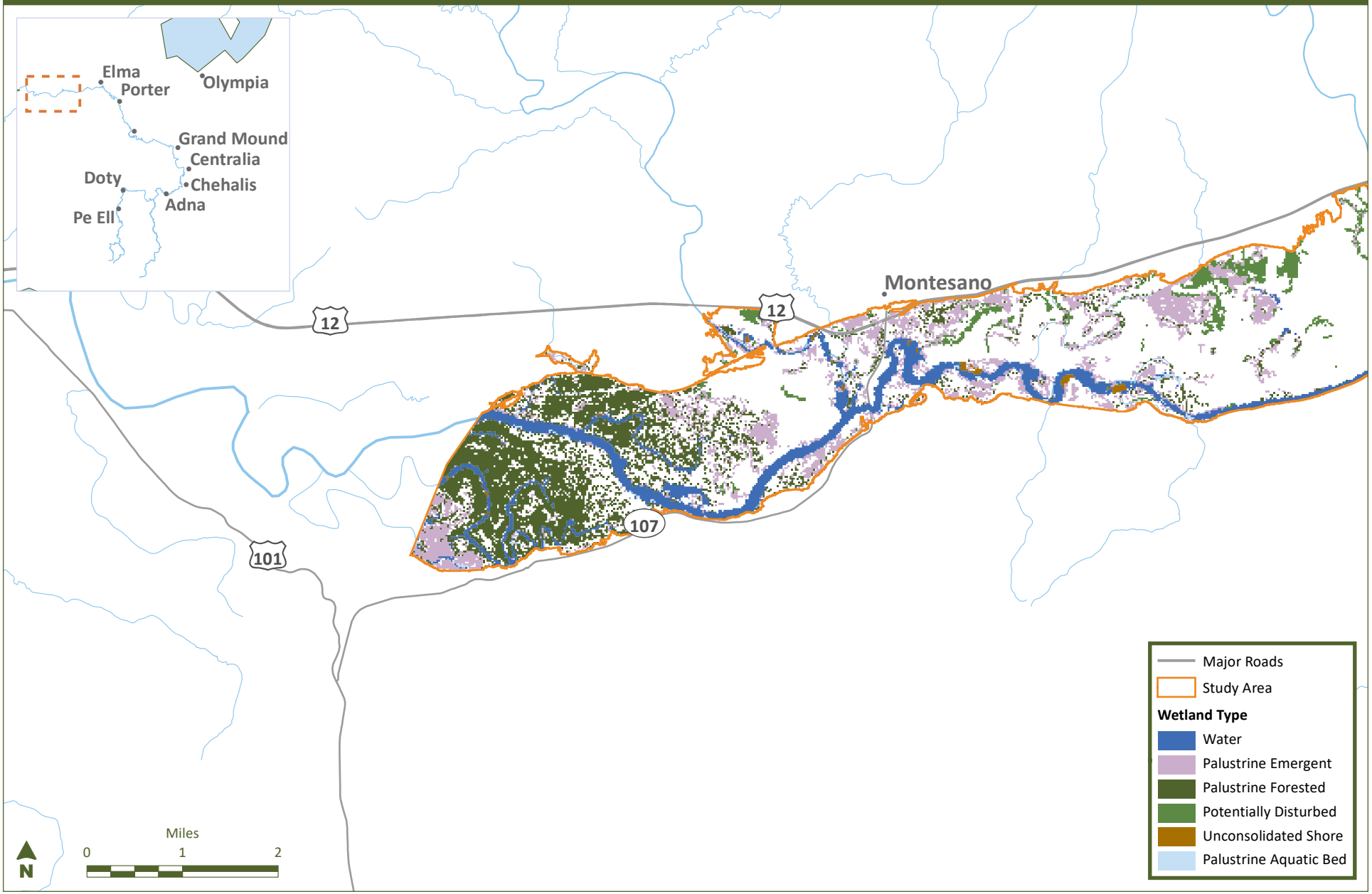
Data source: Modeled wetland inventory (not field-delineated) downstream of the FRE facility (Ecology 2011)

Figure O-8
Wetlands in the Study Area



Data source: Modeled wetland inventory (not field-delineated) downstream of the FRE facility (Ecology 2011)

Figure O-9
Wetlands in the Study Area



Data source: Modeled wetland inventory (not field-delineated) downstream of the FRE facility (Ecology 2011)

2.4.1.1 FRE Facility

Wetlands located within the footprint of the proposed FRE facility (including the temporary reservoir, associated access, construction, and maintenance areas) were delineated in 2017 as described in the *Wetland, Water, and Ordinary High Water Mark Delineation Report* (Anchor QEA 2018). As depicted in Figure O-10, two Category III wetlands are located within the proposed FRE facility site footprint and associated construction and operation area.

The proposed FRE facility and associated construction and operations areas include three proposed quarries: North Quarry, South Quarry (Figures O-1, O-2, O-11, O-12, and O-13) and Huckleberry Ridge Quarry (Figures O-1 and O-2). Accessing the quarry locations would include widening, improving, and upgrading existing roads. The North Quarry option would require widening 1.9 miles of Forest Road (FR) 1000. The 1000G Road would also require widening, surfacing, and moderate improvements to the subgrade. The South Quarry option would require the same as the North Quarry option with additional upgrades and widening of FR 1000 and FR 1020. The Huckleberry Ridge Quarry option would include 3.01 miles of simple improvements, 2.93 miles of moderate improvements and excavation, and 0.81 mile of complex improvements, including heavy excavation, drilling, and blasting. A description of the quarry road improvements is presented in the *Transportation Discipline Report* (ESA 2020a). Wetland delineations have not been performed at the existing quarries but, as described here, they have been performed along the length of most of the North and South Quarry access roads and some of the Huckleberry Ridge Quarry access road.

Delineated wetland areas within the temporary reservoir associated with the North Quarry, South Quarry, and Huckleberry Ridge Quarry access roads were identified (Table O-4). Table O-4 also identifies wetland areas and cover types located within 25 feet of the North Quarry, South Quarry, and Huckleberry Ridge Quarry access roads outside of the temporary reservoir, based on the Modeled Wetlands Inventory (Ecology 2011). As described in Section 2.3, wetlands in portions of the study area where no delineations were performed were identified based on existing wetland mapping datasets of the Modeled Wetlands Inventory (Ecology 2011). Wetlands present within 25 feet of the proposed North Quarry and South Quarry access roads located within the temporary reservoir were identified based on the delineation results. The proposed Huckleberry Ridge Quarry access road includes some areas within the wetland delineation area of the temporary reservoir, but most of this access road is located where wetland delineations were not performed. No delineated wetlands are located within 25 feet of the Huckleberry Ridge Quarry access road within the area of the temporary reservoir.

As shown in Figures O-11, O-12, and O-13, and Table O-4, some wetlands are within 25 feet of the access roads within the temporary reservoir, and no delineated wetlands were identified within about 500 feet beyond the temporary reservoir. Based on the delineated wetlands identified within 25 feet of the North and South Quarry access roads, it is expected that potential wetlands within 25 feet of the Huckleberry Ridge Quarry access road are likely associated with streams or seeps and are generally expected to occur

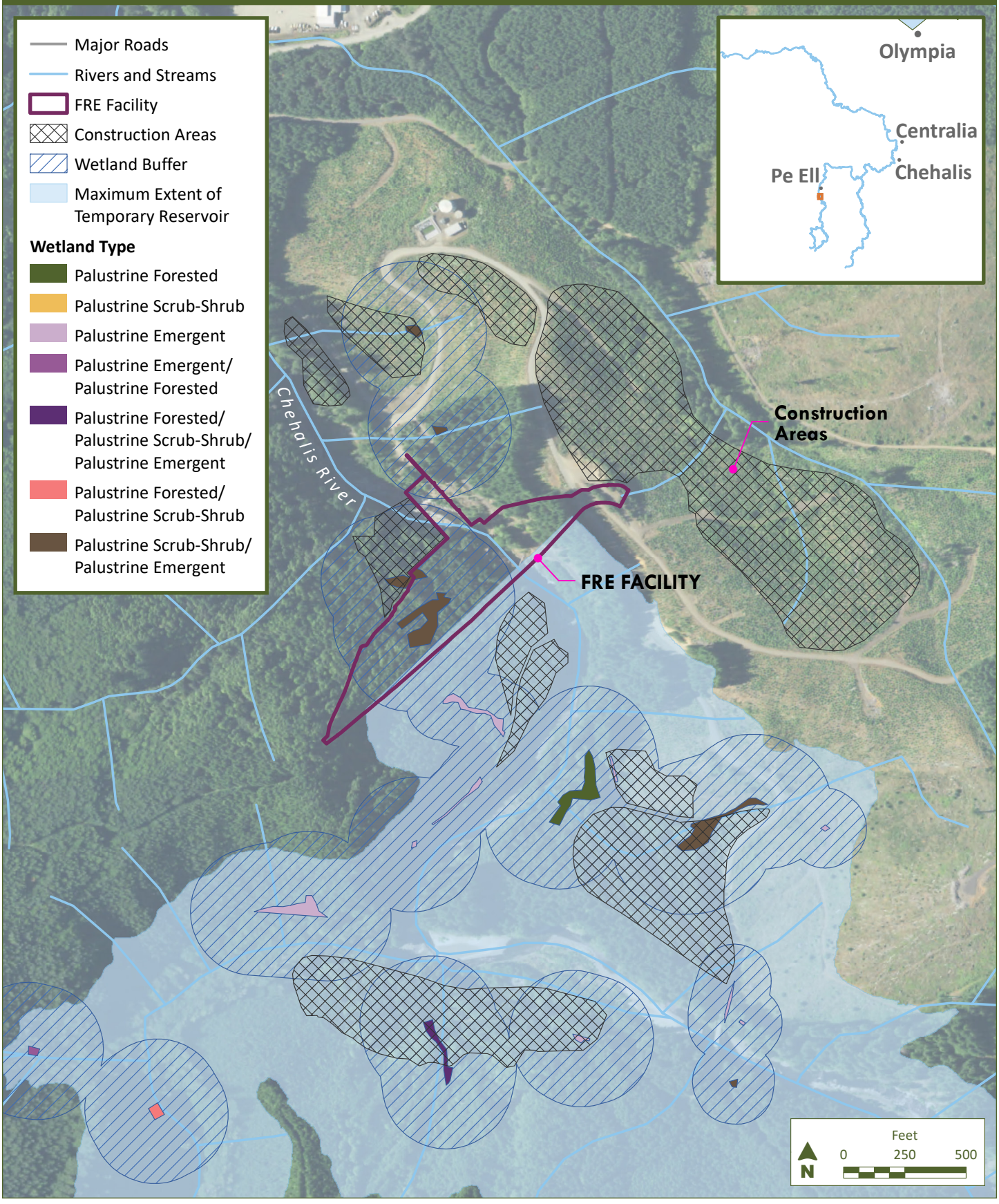
in similar quantities along similar distances as identified for the North and South Quarry access roads. The North and South Quarry access roads include about 2 miles of road, while the Huckleberry Ridge Quarry access road includes about 6.7 miles of road. The existing wetland mapping dataset of the Modeled Wetlands Inventory (Ecology 2011) does not identify any wetland features within 25 feet of the Huckleberry Ridge Quarry access road outside the wetland delineation area. The wetlands delineated within 25 feet of the North and South Quarry access roads were not generally detected in the Modeled Wetlands Inventory. Most were smaller than the minimum mapping unit of the Modeled Wetlands Inventory (Ecology 2011).

Table O-4
Wetland Area Associated with the FRE Facility and Quarry Access Roads Within the Vicinity of the Temporary Reservoir by Wetland Cover Class

WETLAND COVER CLASS	FRE FACILITY (ACRES)	NORTH AND SOUTH QUARRY ACCESS ROADS[1] (ACRES)	HUCKLEBERRY RIDGE QUARRY ACCESS ROAD[2] (ACRES)	TOTAL ACRES OF WETLANDS
PEM	0.00	0.05	0.00	0.05
PSS/PEM	0.65	0.01	0.00	0.66
PFO/PEM	0.00	0.02	0.00	0.02
PFO/PSS/PEM	0.00	0.04	0.00	0.04
Total	**0.65**	**0.12**	**0.00**	**0.77**

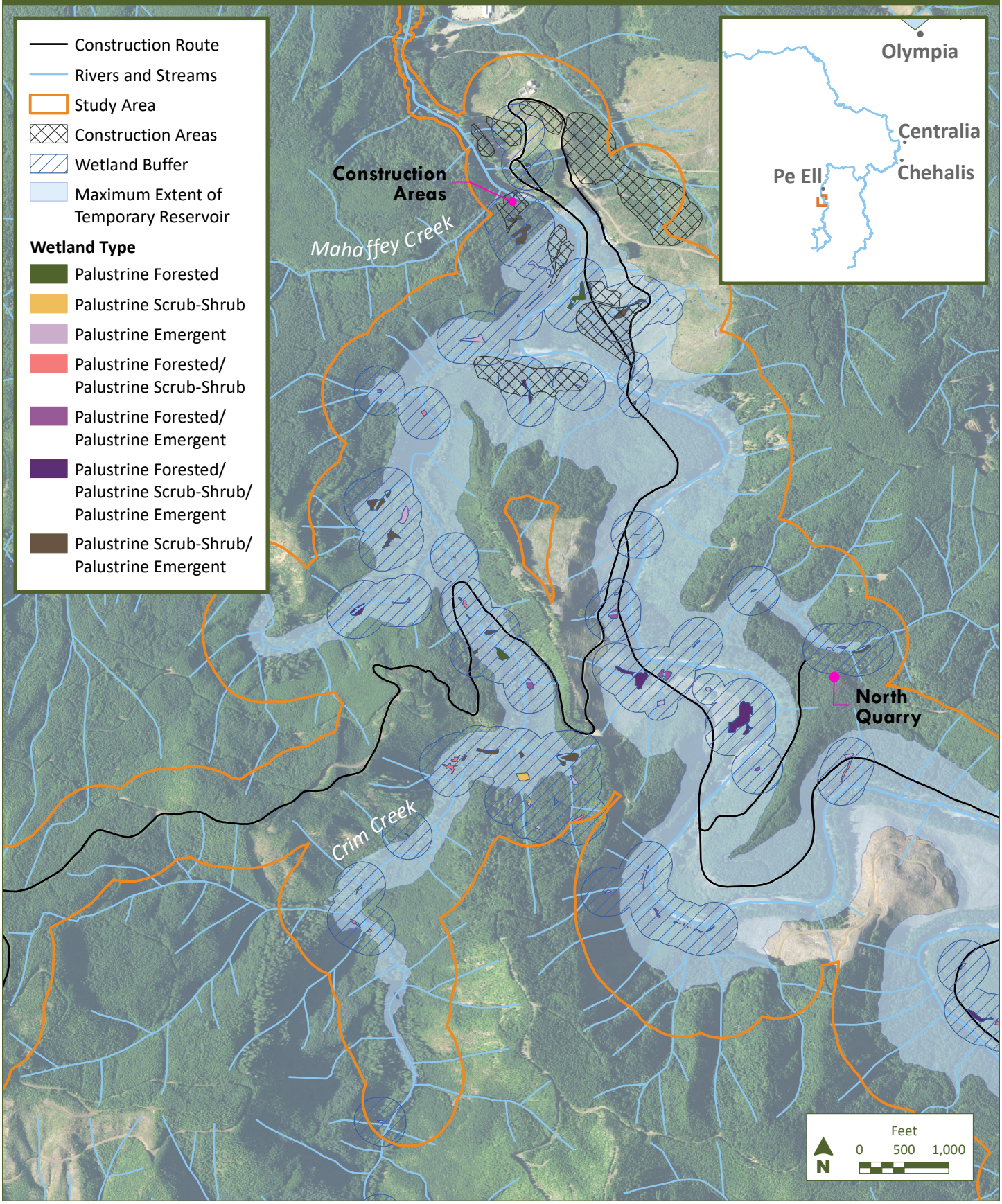
Notes:
1. Delineated wetlands within the FRE facility and temporary reservoir (Anchor QEA 2018)
2. Modeled Wetlands Inventory (Ecology 2011)

Figure O-10
Wetlands and Waterbodies Near the FRE Facility



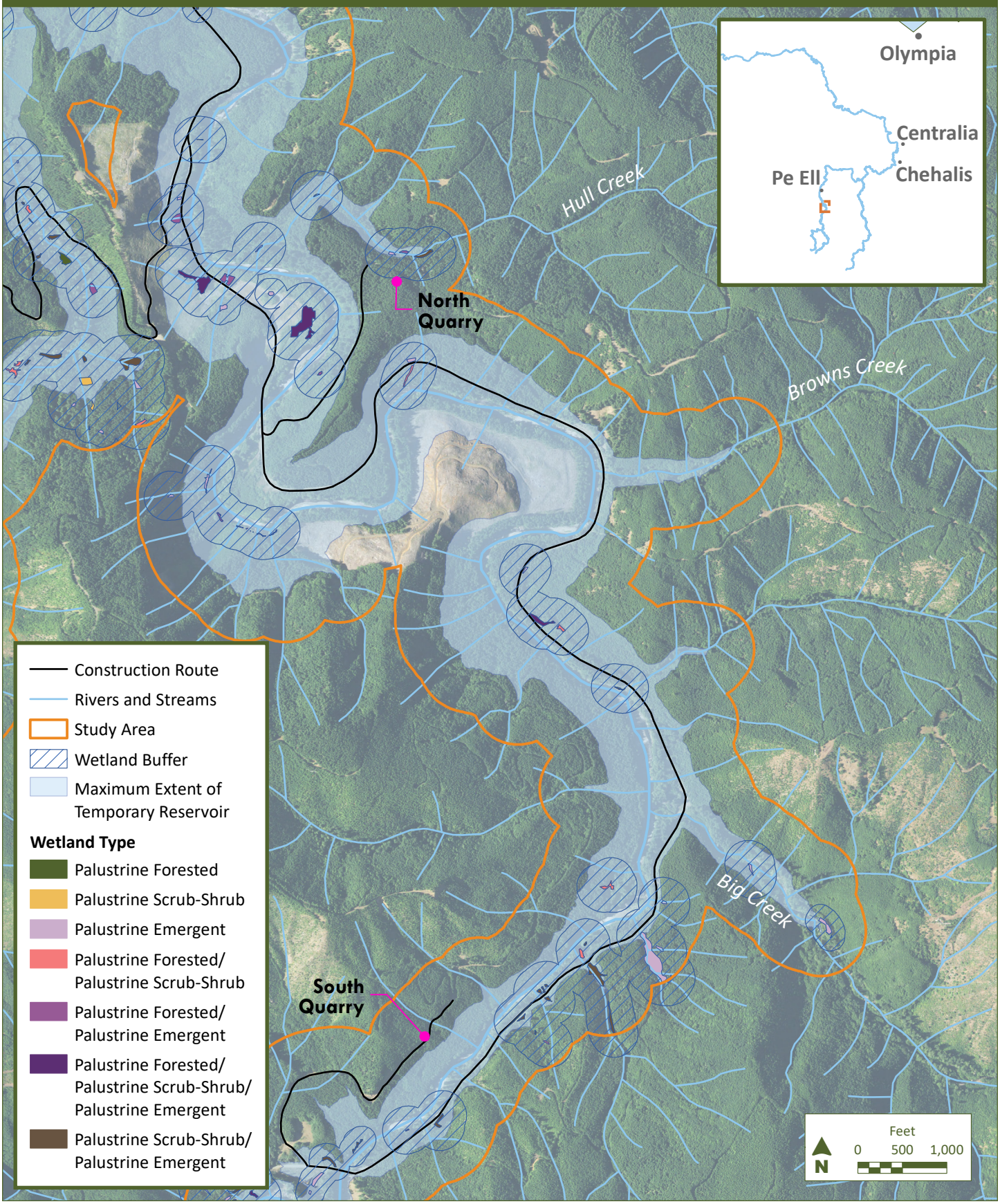
Data source: Field-delineated wetlands mapped near the FRE facility and in the vicinity of the temporary reservoir (Anchor QEA 2018)

Figure O-11
Wetlands and Waterbodies in the Vicinity of the Temporary Reservoir



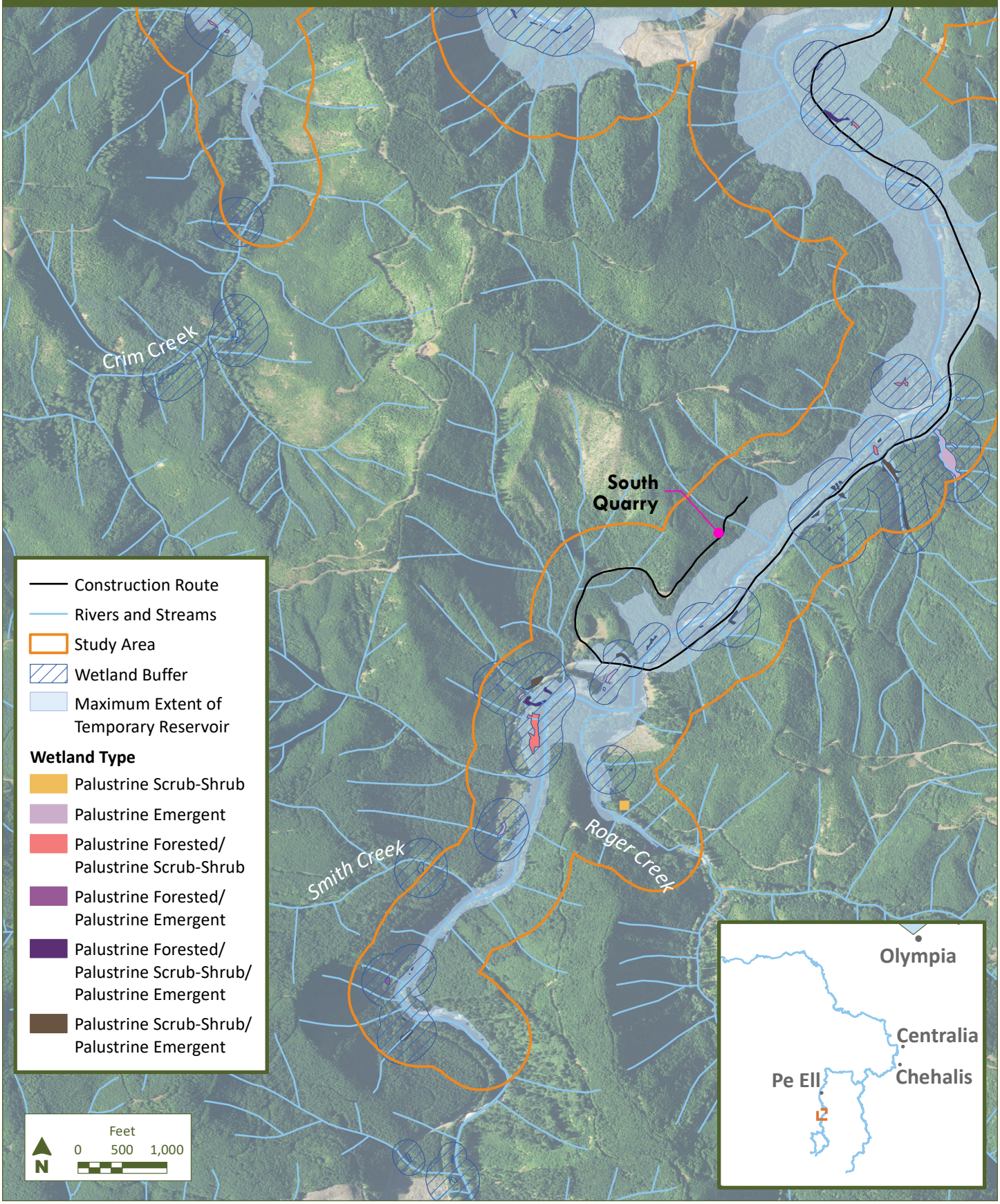
Data source: Field-delineated wetlands mapped near the FRE facility and in the vicinity of the temporary reservoir (Anchor QEA 2018)

Figure O-12
Wetlands and Waterbodies in the Vicinity of the Temporary Reservoir



Data source: Field-delineated wetlands mapped near the FRE facility and in the vicinity of the temporary reservoir (Anchor QEA 2018)

Figure O-13
Wetlands and Waterbodies in the Vicinity of the Temporary Reservoir



Data source: Field-delineated wetlands mapped near the FRE facility and in the vicinity of the temporary reservoir (Anchor QEA 2018)

2.4.1.2 Temporary Reservoir

Wetlands located within the proposed temporary reservoir were delineated in 2017 as described in the *Wetland, Water, and Ordinary High Water Mark Delineation Report* (Anchor QEA 2018). The area of investigation for the 2017 study encompassed an approximately 1,700-acre area within nine drainage basins associated with major stream channels in the upper Chehalis River watershed, Water Resource Inventory Area 23 (Ecology 2019), along the mainstem Chehalis River. The temporary reservoir maximum inundation area for the FRE facility is 856 acres and is within the area of the 2017 investigation (Figures O-11 through O-13).

Delineated wetlands include isolated wetlands and wetlands associated with river, stream, or smaller tributary channels. The nine stream channel drainage basins include: the upper Chehalis River, Alder Creek, Big Creek, Browns Creek, Crim Creek, Hull Creek, Lester Creek, Roger Creek, and Smith Creek. A total of 89 wetlands were delineated within the 856-acre temporary reservoir maximum inundation area.

The 89 wetlands total approximately 10.18 acres. As shown in Table O-5, most of these wetlands were found in the upper Chehalis River (53) and Crim Creek drainage basins (27), followed by the Hull Creek (5), Lester Creek (3), and Big Creek (1) basins. No wetlands were found in the Alder Creek, Browns Creek, Roger Creek, or Smith Creek drainage basins.

Cowardin wetland classes found within the proposed temporary reservoir area include palustrine emergent (PEM), palustrine scrub-shrub (PSS), and palustrine forested (PFO) wetlands and various combinations of those types including PFO/PEM, PFO/PSS, PSS/PEM, and PFO/PSS/PEM (Table O-5).

Most of the wetlands are a combination of PSS/PEM class wetlands (28). The next most common wetland type is PEM wetlands (25), followed by the PFO/PSS (13), PFO/PEM (10), PFO/PSS/PEM (7), PSS (4), and PFO (2) wetland types. Aside from PSS and PFO wetland types, which are more prevalent in the Crim Creek drainage basin, the upper Chehalis River drainage basin contains almost all of the other identified wetland types. The three wetland types that occupy the most area included PSS/PEM (2.84 acres), PEM (1.60 acres), and PFO/PSS/PEM (2.56 acres). These were followed in turn by PFO/PSS (1.57 acres), PFO/PEM (0.73 acre), PFO (0.59 acre), and PSS (0.29 acre). Wetlands within the temporary reservoir are shown in Figures O-11 through O-13.

Table O-5
Number and Class of Existing Wetlands by Drainage Basin Within the Temporary Reservoir

BASIN NAME	COWARDIN CLASS							HGM CLASS			TOTAL
	PEM	PSS	PFO	PFO/PEM	PFO/PSS	PSS/PEM	PFO/PSS/PEM	DEPRESSIONAL WETLANDS	SLOPE WETLANDS	RIVERINE WETLANDS	
Upper Chehalis River	18	1	1	7	6	14	6	13	40	0	**53**
Crim Creek	4	3	1	2	6	11	0	5	22	0	**27**
Lester Creek	0	0	0	0	1	1	1	0	3	0	**3**
Hull Creek	2	0	0	1	0	2	0	0	4	1	**5**
Browns Creek	0	0	0	0	0	0	0	0	0	0	**0**
Big Creek	1	0	0	0	0	0	0	1	0	0	**1**
Roger Creek	0	0	0	0	0	0	0	0	0	0	**0**
Smith Creek	0	0	0	0	0	0	0	0	0	0	**0**
Alder Creek	0	0	0	0	0	0	0	0	0	0	**0**
Total	**25**	**4**	**2**	**10**	**13**	**28**	**7**	**19**	**69**	**1**	**89**

The HGM classes of wetlands found in the proposed temporary reservoir area include depressional, slope, and riverine wetland types (Table O-5). The most common HGM class present is slope wetlands (69), followed by depressional wetlands (19) and riverine wetlands (1). Most of the slope wetlands (40) and depressional wetlands (13) occur in the upper Chehalis River drainage basin. The Crim Creek drainage basin also contains several (22) slope wetlands and a few (5) depressional wetlands. The single riverine wetland is found in the Hull Creek drainage basins. In terms of acreage, slope wetlands make up the largest class (6.68 acres), followed by depressional wetlands (3.48 acres), and riverine wetland (0.02 acre).

Wetlands classified as slope wetlands under the HGM classification were the most numerous (69) in the temporary reservoir. These wetlands are primarily associated with drainages, and form in areas where the slope flattens out such that surface or groundwater moving downslope slows and inundates or saturates the soils. They are typically small and similar in vegetative composition, soils, and hydrology. Slope wetlands included all combinations of Cowardin wetland types encountered in the study area.

Typical vegetation present in slope wetlands are species commonly found in Western Washington forested environments and includes primarily red alder (*Alnus rubra*) in the overstory, with western red cedar (*Thuja plicata*) present to a lesser extent. Salmonberry (*Rubus spectabilis*), vine maple (*Acer circinatum*), devils club (*Oplopanax horridus*), and young red alder are dominant in the shrub layer. The

herbaceous layer was sparse in most of these areas due to shading, and water that is often flowing across the surface, preventing the establishment of a dense herbaceous layer. Herbaceous species that are present are typically associated with mounds and decaying wood and include piggyback plant (*Tolmiea menziesii*), oxalis (*Oxalis oregana*), Pacific bleeding heart (*Dicentra formosa*), Pacific waterleaf (*Hydrophyllum tenuipes*), Pacific golden-saxifrage (*Chrysosplenium glechomifolium*), and seaside bittercress (*Cardamine angulata*).

Wetlands classified as depressional under the HGM classification were the second-most abundant wetland type in the temporary reservoir (19). These wetlands are typically not associated with any channelized flow or waterbodies and are located in topographic depressions either on side slopes or in the valley bottom. As with the slope wetlands, depressional wetlands included all combinations of Cowardin wetland types encountered in the temporary reservoir. Typical vegetation of these wetlands also included red alder, salmonberry, and piggyback plant but also had more diversity of herbaceous plants including western lady fern (*Athyrium cyclosorum*), Pacific golden-saxifrage, skunk cabbage (*Lysichiton americanus*), and water parsley (*Oenanthe sarmentosa*).

Wetlands classified as riverine under the HGM system were the least abundant wetland type in the temporary reservoir (only 1) due to the presence of bedrock and fairly confined channels. Riverine wetlands typically occur directly adjacent to flowing channels where they are inundated by overbank flows at least once every 2 years. Cowardin types found in the riverine wetland included PSS/PEM. This wetland was dominated by red alder, salmonberry, creeping buttercup (*Ranunculus repens*), reed canarygrass (*Phalaris arundinacea*), and colonial bent grass (*Agrostis capillaris*). Western red cedar, California black currant (*Ribes bracteosum*), Pacific water leaf, stinging nettle (*Urtica dioica*), and oxalis were also observed.

Wetland functions were assessed as part of the Ecology wetland rating process using the methods presented in *Washington State Wetland Rating System – Western Washington: 2014 Update* (Hruby 2014). The wetlands identified in the temporary reservoir include 13 Category II wetlands and 76 Category III wetlands. More Category III wetlands were found due to the high number of slope wetlands present in the temporary reservoir. Slope wetlands typically have less potential to detain and retain seasonal stormwater. Slope wetlands also tend to have only one or two hydroperiods and minimal to no storage capacity, which provide less function as compared to wetlands with multiple hydroperiods and more storage capacity. Most of the wetlands in both Category II and III had high habitat functions and scores (score of 8). A total of 72 wetlands had high habitat scores of 8, including 11 Category II wetlands (2.71 acres) and 61 Category III wetlands (6.32 acres). The higher habitat functions and scores typically occurred for wetlands that had higher interspersion of habitats within the wetland (i.e., interspersion between forested, shrub, and emergent areas) and/or had special habitat features present including snags, downed wood, and persistent vegetation that is seasonally or perennially inundated and suitable for amphibian egg-laying. The wetlands with the higher habitat scores were also typically those located away from roads and other developed or disturbed areas.

The lack of Category I wetlands in the temporary reservoir is related to the lack of any special wetland types (i.e., estuarine wetlands, wetlands of high conservation value, bogs, forested wetlands greater than 1 acre in size, coastal lagoon wetlands, interdunal wetlands), the lack of Endangered Species Act or state-listed species, as well as the limited potential of the wetlands that are present to improve water quality (because these wetlands are not in areas with development or stormwater inputs/runoff). Similarly, there are also no Category IV wetlands in the temporary reservoir. The lack of Category IV wetlands is likely due to the low development and forested habitat types, which increases the habitat function scores.

Table O-6 provides the number of Category II and Category III wetlands in the temporary reservoir area by drainage basin. The 2014 Ecology wetland functional values and scores, rating, and classification of each of the wetlands delineated in the temporary reservoir are presented in the *Wetland, Water, and Ordinary High Water Mark Delineation Report* (Anchor QEA 2018).

Table O-6
Number and Area of Existing Wetlands by Category in the Temporary Reservoir by Drainage Basin

	CATEGORY II WETLANDS		CATEGORY III WETLANDS		TOTAL IDENTIFIED WETLANDS	
DRAINAGE BASIN	NUMBER	ACRES	NUMBER	ACRES	NUMBER	ACRES
Upper Chehalis River	8	2.38	45	4.18	53	6.56
Crim Creek	4	0.40	23	2.44	27	2.84
Lester Creek	0	0	3	0.67	3	0.57
Hull Creek	1	0.02	4	0.13	5	0.15
Browns Creek	0	0	0	0	0	0
Big Creek	0	0	1	0.06	1	0.06
Roger Creek	0	0	0	0	0	0
Smith Creek	0	0	0	0	0	0
Alder Creek	0	0	0	0	0	0
Total	**13**	**2.80**	**76**	**7.48**	**89**	**10.18**

Wetlands located within about 500 horizontal feet of the temporary reservoir maximum inundation area were also identified for this analysis. Overall, 27 wetlands, including one Category II wetland (0.01 acre) and 26 Category III wetlands (2.24 acres) are located adjacent to the temporary reservoir, but outside the potential inundation area, as shown in Figures O-11 through O-13.

2.4.1.3 Airport Levee

Wetlands located within the area of the proposed airport levee changes were delineated in 2018 and 2019 as described in the *Chehalis-Centralia Airport Levee Wetland Delineation Report* (Anchor QEA 2019a). For this report, it was conservatively assumed that wetlands in direct proximity to the existing levee would be affected during the Airport Levee Changes (e.g., widening). Therefore, the investigation included all wetlands within potential airport levee construction (Figure O-14).

As described below, the 2019 wetland delineation also included a visual assessment of wetlands located within approximately 200 feet of the airport levee to account for their wetland buffers potentially extending into the proposed footprint of the airport levee and construction activities. These potential wetlands were not delineated because site access was not obtained. Their boundaries were estimated using a combination of field notes, Light Detection and Ranging (LiDAR) topography, aerial photography, and comparison to the delineated wetlands.

Six wetlands were delineated within the airport levee study area boundary (Tables O-7 and O-8; Figure O-14). Most of these wetlands extend outside the airport levee study area boundary. Wetland features, habitats, and classifications outside of the airport levee were identified and assessed based on visual observations during the site visits and aerial photograph analysis. The following description of airport levee wetlands includes wetland characteristics within and extending outside the airport levee.

Airport levee wetland Cowardin classes include palustrine unconsolidated bed (PUB), palustrine aquatic bed (PAB), PEM, PSS, and PFO wetlands and various combinations of those types including PEM, PSS/PEM, PSS/PEM/PUB, PSS/PEM/PAB/PUB, and PFO/PSS/PEM/PAB/PUB (Table O-7). All of the wetlands include the PEM class and the majority of the wetlands are dominated by the PEM wetland class. Most of the wetlands include areas that are excavated for drainage.

The HGM class of all six wetlands found in the proposed airport levee footprint was depressional. A general description of wetlands in the airport levee is presented in the following sections.

Table O-7
Number of Existing Wetlands in Each Cowardin Class Within the Area of Airport Levee Changes

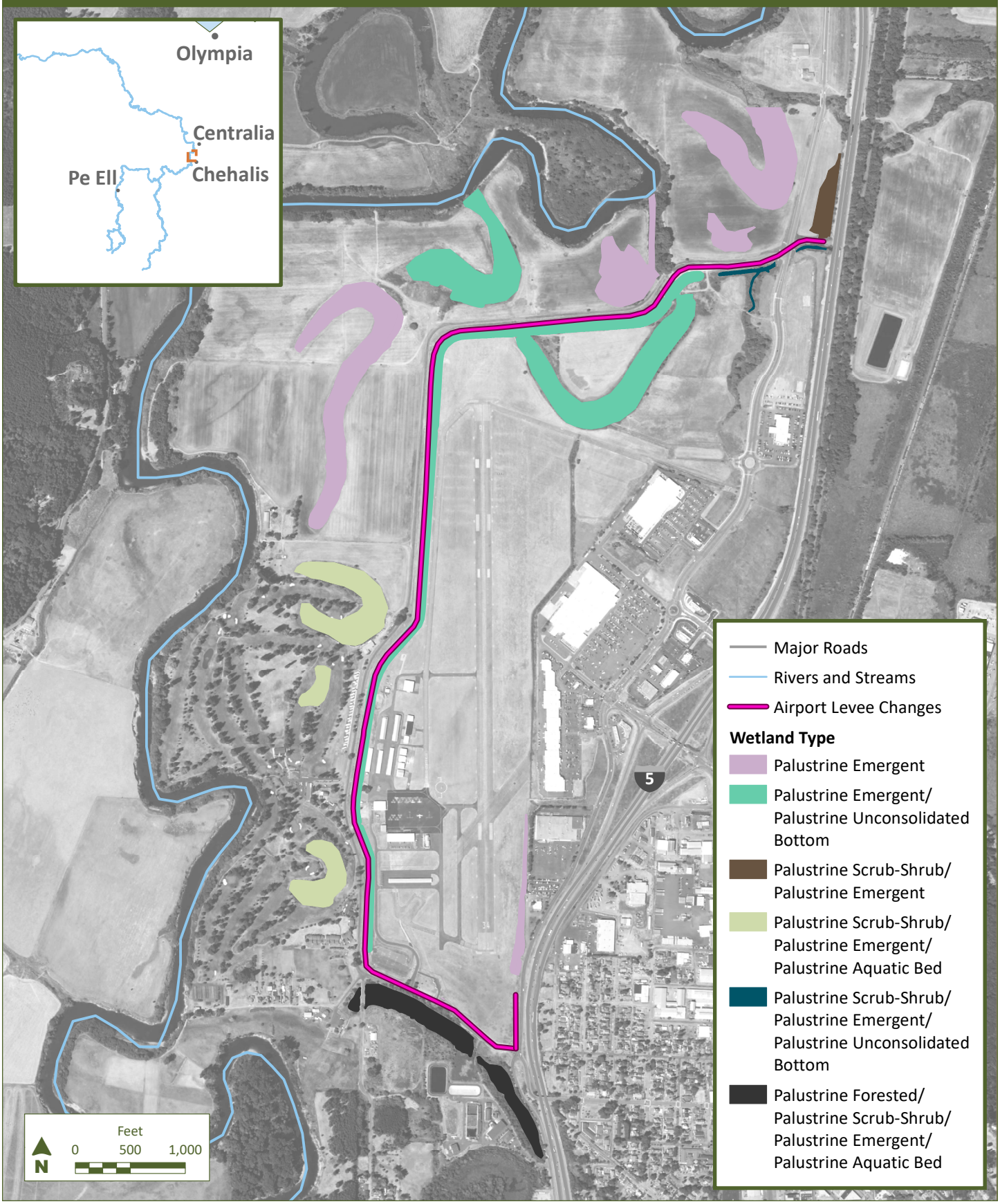
COWARDIN CLASS						
PEM	PSS/PEM	PSS/PEM/ PUB	PSS/PEM/ PAB/PUB	PFO/PSS/ PEM/PAB/ PUB	HGM CLASS DEPRESSIONAL WETLANDS	TOTAL
1	1	2	1	1	**8**	**8**

Note:
Includes wetland features located within and extending outside the study area of Airport Levee Changes. Wetland features outside airport levee study area based on visual observations and aerial photograph analysis.

Table O-8
Number and Area of Existing Wetlands by Category Within the Area of Airport Levee Changes

CATEGORY II WETLANDS		CATEGORY III WETLANDS		TOTAL IDENTIFIED WETLANDS	
NUMBER	ACRES	NUMBER	ACRES	NUMBER	ACRES
3	6.26	3	0.37	**6**	**6.63**

Figure O-14
Wetlands Near the Airport Levee Changes



Data source: Field-delineated wetlands mapped near the airport levee changes (Anchor QEA 2019)

Typical vegetation present in the wetlands within the proposed airport levee footprint are grass and emergent species; vegetation within the wetlands and adjacent wetland buffer is regularly mowed. Dominant species include reed canarygrass, broad-leaf cattail (*Typha latifolia*), soft rush (*Juncus effusus*), creeping bentgrass (*Agrostis stolonifera*), red fescue (*Festuca rubra*), and field horsetail (*Equisetum arvense*). Shrub and tree species include Douglas spirea (*Spiraea douglasii*), red-osier dogwood (*Cornus sericea*), Armenian blackberry (*Rubus armeniacus*), and Pacific willow (*Salix lasiandra*).

Wetland functions were assessed as part of the Ecology wetland rating process using the methods presented in *Washington State Wetland Rating System – Western Washington: 2014 Update* (Hruby 2014). The wetlands identified in the airport levee include three Category II wetlands and three Category III wetlands. The 2014 Ecology wetland functional values and scores, rating, and classification of each of the wetlands delineated in the airport levee are presented in the *Chehalis -Centralia Airport Levee Wetland Delineation Report* (Anchor QEA 2019a).

A total of seven wetlands were visually identified within approximately 200 feet of the proposed airport levee study area boundary located on private property. Similar to the wetlands delineated within the proposed airport levee footprint, these wetlands appeared to be depressional wetlands with PAB, PEM, PSS, and PFO wetland classes and various combinations of those types. All of the wetlands also have regularly mowed areas and include the PEM class. The majority of the wetlands are dominated by the PEM wetland class. The buffers of these wetlands are also typically mowed field habitats. These wetlands were identified due to their close proximity and the potential for buffers of these wetlands to extend into the airport levee footprint (Figure O-14).

2.4.1.4 Floodplain Downstream of the FRE Facility

The analysis of wetlands downstream of the FRE facility includes the modeled potential flood extent areas associated with late-century major and catastrophic floods on the mainstem Chehalis River. The analysis area consists of an approximately 48,569-acre area for late-century major floods and an approximately 58,485-acre area for late-century catastrophic floods. These areas include 101 miles of floodplain along the mainstem Chehalis River, including the lower ends of major tributaries (South Fork Chehalis River, Newaukum River, Skookumchuck River, Black River, Stearns Creek, Dillenbaugh Creek, Salzer Creek, Lincoln Creek, Independence Creek, Garrard Creek, Cedar Creek, Porter Creek, Satsop River, and Wynooche River). The downstream analysis area for the FRE facility is bounded on the upstream end at RM 108, the proposed FRE facility location, and on the downstream end at approximately RM 9 at Montesano (Figure O-1), which is the downstream extent of potential measurable changes to late-century catastrophic flooding from the proposed FRE facility.

An analysis of wetlands within the 100-year floodplain downstream of the FRE facility was performed as described in the *Downstream Floodplain Wetland Analysis* (Anchor QEA 2019b). The analysis area for that downstream floodplain report consists of an approximately 43,107-acre area that includes 75 miles of the floodplain along the mainstem Chehalis River and associated lower ends of major tributaries

(downstream to Porter). The following is a summary of existing wetland conditions downstream of the FRE facility associated with late-century major and catastrophic flood extents. A detailed description of existing wetland conditions downstream of the FRE facility, within the 43,107-acre analysis area, is provided in the *Downstream Floodplain Wetland Analysis* (Anchor QEA 2019b). Wetlands downstream of the FRE facility for this analysis were identified primarily based on the existing Modeled Wetlands Inventory (Ecology 2011).

Wetlands identified in the Ecology 2011 Modeled Wetlands Inventory are classified using a variation of the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979). Modeled wetlands downstream of the FRE facility were identified in the following categories: PFO, PSS, PEM, palustrine unconsolidated shore (PUS), PAB, estuarine aquatic bed (EAB), and a category of potentially disturbed wetlands. Potentially disturbed wetlands are defined by Ecology as areas that have a high potential to be wetland, but appear as pasture, hayfields, or cultivated land cover types (Ecology 2011b). Overall, 17,545 acres of modeled wetlands (Ecology 2011) are located within the study area downstream of the FRE facility for the late-century catastrophic flood extent, as shown in Table O-9 and Figures O-2 through O-9.

Table O-9
Area of Potential Wetland Habitats Occurring Downstream of FRE Facility

WETLAND COVER CLASS	AREA OF POTENTIAL WETLANDS (ACRES)	PERCENTAGE OF POTENTIAL WETLANDS
Potentially Disturbed Wetlands	4,186	24
PFO	3,517	20
PSS	3,744	21
PEM	5,727	33
PUS	302	2
PAB	68	<1
EAB	<1	<1
Total	**17,545**	**100**

Source: Modeled Wetlands Inventory (Ecology 2011)

Most of the modeled wetlands are located within a few hundred feet of the river shoreline. In general, the larger modeled wetland features are located near the river shorelines, with smaller wetlands in proximity to the more densely developed outer floodplain area. Most of the Ecology 2011 modeled wetlands downstream of the FRE facility occur closer to the river. Fewer modeled wetlands exist on the outer developed portions of the floodplain. About 92% of the Ecology 2011 modeled wetlands occur within the major flood area boundary; the remaining 8% of modeled wetland areas are located between the major flood and catastrophic flood area boundaries.

2.4.2 Regulatory Waterbodies and Buffers

The following subsections provide a summary of the regulatory waterbodies found within the four components of the Chehalis Basin wetlands and waterbodies study area. Within the study area, regulatory waterbodies and associated buffers include streams, ponds, and lakes. No ponds or lakes are located within the FRE facility, temporary reservoir, and Airport Levee Changes components of the study area. Resources used to identify regulatory waterbodies within the Chehalis Basin, including analyses and delineations, are listed in Section 2.2. These resources provide detailed information on regulatory waterbodies within the Chehalis Basin. Stream buffers are designed to protect stream function.

Stream buffers are defined as riparian management zones under the state Forest Practices Act for commercial forests. Local jurisdictions regulate streams and stream buffers as critical areas under GMA when they are too small (less than 20 cfs of mean annual flow) to be covered under SMA. For the purposes of this analysis, stream buffer areas within the FRE facility and temporary reservoir components of the study area are identified based on local (Lewis County) code guidelines. There are no streams located within the Airport Levee Changes component of the study area.

2.4.2.1 FRE Facility

No ponds or lakes are located within the FRE facility component of the study area. Streams located within the FRE facility (including associated access, construction, and maintenance areas) were delineated in 2017 as described in the *Wetland, Water, and Ordinary High Water Mark Delineation Report* (Anchor QEA 2018). The upper Chehalis River is the only stream located within the footprint of the FRE facility, excluding the quarry access roads. Stream buffer habitat of the Chehalis River in the area of the FRE facility is dominated by Douglas fir evergreen forest with some developed areas (gravel surface areas). The Chehalis River is a Type S Water (Shoreline of the State) with a 200-foot protective stream buffer, as identified by the Lewis County critical areas code guidelines.

The FRE facility and associated construction and operations areas include three proposed quarry areas. Accessing these quarry areas would include widening, improving, and upgrading the existing roads. A summary of existing quarry road design details is presented in Section 2.4.1.1. A description of the quarry road improvements is presented in the *Transportation Discipline Report*. As described in Section 2.3, streams that cross the proposed quarry access roads in areas of the study area where no delineations were performed were identified based on the existing mapping of the NHD (USGS 2019). Table O-10 lists the number of streams that would be crossed by the quarry access roads.

Table O-10
Streams Crossed by the FRE Facility Quarry Access Roads

ROAD	DELINEATED STREAMS CROSSINGS[1]	NHD STREAM CROSSINGS[2]	TOTAL STREAM CROSSINGS
North and South Quarry Access Roads	21[3]	8	29
Huckleberry Ridge Quarry Access Road	1[3]	6	7
Total	**22**	**14**	**36**

Notes:
1. Delineated streams within the temporary reservoir (Anchor QEA 2018).
2. NHD streams outside the temporary reservoir (USGS 2019).
3. For comparison between delineated stream data and NHD data, 36 NHD streams are identified within the temporary reservoir for the North and South Quarry access roads and 5 for the Huckleberry Ridge Quarry access roads (USGS 2019).

2.4.2.2 Temporary Reservoir

No ponds or lakes are located within the temporary reservoir component of the study area. Streams located within the temporary reservoir were delineated in 2017 as described in the *Wetland, Water, and Ordinary High Water Mark Delineation Report* (Anchor QEA 2018). The area of investigation for the temporary reservoir encompassed an approximately 1,700-acre study area located within nine drainage basins associated with major stream channels in the upper Chehalis watershed, Water Resource Inventory Area 23 (Ecology 2019), along the mainstem Chehalis River. The temporary reservoir maximum inundation area is 847 acres and is located within the area of the 2017 investigation.

The OHWM of 116 streams were delineated within the temporary reservoir. Delineated streams range from large river and stream systems (Type S and Type F Waters), to primary and secondary tributaries of these systems (Type Np and Type Ns Waters), to isolated channels that flow subsurface before reaching a flowing channel. The OHWM delineation included streams with perennial or annual seasonal flow. Streams that have no surface water connection to a downstream Type S, Type F, Type Np, or Type NS Water have no stream type classification and, therefore, have no designated protective stream buffer. Under Lewis County critical areas code guidelines, Type S Waters have a 200-foot protective stream buffer, Type F Waters have 150-foot stream buffers, and Type Np and Type Ns Waters have 75-foot stream buffers.

Within the study area, Type S Waters include the Chehalis River and Crim Creek and the lower reach of Rogers Creek. These are large river systems 20 feet wide or more with diverse substrate of boulders, cobbles, gravel, and sand. Some reaches of these systems also include bedrock substrate. Type F Waters in the study area include Brown Creek, Lester Creek, the lower reach of Big Creek, and the upper reach of Rogers Creek. These systems are typically 10 to 20 feet wide with diverse substrate of boulders,

cobbles, gravel, and sand with occasional reaches of bedrock substrate. Type F Waters also include some tributaries of the Chehalis River approximately 5 feet wide with diverse substrate material.

Type Np and Type NS Waters include primary and secondary tributaries to the larger streams. These streams typically range from 1 to 3 feet wide. Many of these streams are located on slopes with steep elevation changes and are often associated with bedrock substrate. Many of these streams also have incised banks indicating periodic high flows during storm events. A variety of these streams, when associated with wetland systems, have undefined or poorly defined channels and silt and sand dominant substrate.

Stream buffer habitat within the temporary reservoir is dominated by Douglas fir evergreen forest with western red cedar and western hemlock (*Tsuga heterophylla*) occasionally occurring and a dominant understory of sword fern (*Polystichum munitum*). Some stream buffer habitat includes a mix of evergreen forest species and deciduous forest species such as red alder and big-leaf maple (*Acer macrophyllum*) with an understory shrub habitat dominated by salmonberry. Developed areas near or adjacent to streams, when present, include gravel roads. Several streams originate from wetland habitat or flow through or into wetland systems. Streams associated with wetlands typically have stream buffers dominated by red alder deciduous forest and salmonberry shrub habitats.

There are nine named drainage basins in the study area, the upper Chehalis River, and the eight stream systems that flow into the Chehalis River (Alder Creek, Big Creek, Browns Creek, Crim Creek, Hull Creek, Lester Creek, Roger Creek, and Smith Creek). These stream systems are shown in Figures O-11 through O-13.

The total number of streams per drainage basin and the total area (acres) and miles are presented in Table O-11. Complete details of the streams delineated in the temporary reservoir are presented in the *Wetland, Water, and Ordinary High Water Mark Delineation Report* (Anchor QEA 2018).

Table O-11
Streams by Drainage Basin Within the Temporary Reservoir

BASIN NAME	NUMBER OF STREAMS	AREA OF STREAMS (ACRES)	MILES OF STREAMS
Upper Chehalis River	64	93.10	10.43
Crim Creek	30	12.92	3.39
Lester Creek	8	2.76	0.90
Hull Creek	5	0.69	0.68
Browns Creek	4	0.66	0.41
Big Creek	2	1.27	0.55
Roger Creek	2	2.00	0.45
Smith Creek	1	0.02	0.02
Alder Creek	0	0.00	0
Total	**116**	**113.43**	**16.83**

2.4.2.3 Airport Levee Footprint

No regulatory waterbodies were identified or delineated within the proposed expanded airport levee footprint.

2.4.2.4 Floodplain Downstream of the FRE Facility

The Chehalis Basin includes a variety of rivers, streams, and tributaries that flow into the Chehalis River within the floodplain downstream of the FRE facility. A delineation of regulatory waterbodies (streams, ponds, and lakes) was not performed downstream of the FRE facility. Rather, regulatory waterbodies downstream of the FRE facility were identified based on existing information. Aquatic habitats within the Chehalis Basin are described in the *Fish Species and Habitats Discipline Report*.

The analysis for this report of regulatory waterbodies downstream of the FRE facility includes the modeled potential flood extent areas associated with late-century major and catastrophic floods. The analysis area consists of an approximately 48,569-acre area for late-century major floods and an approximately 58,485-acre area for late-century catastrophic floods. These areas include 101 miles of the 100-year floodplain along the mainstem Chehalis River, including the lower ends of major tributaries (South Fork Chehalis River, Newaukum River, Skookumchuck River, Black River, Stearns Creek, Dillenbaugh Creek, Salzer Creek, Lincoln Creek, Independence Creek, Garrard Creek, Cedar Creek, and Porter Creek, Satsop River, and Wynoochee River).

An analysis of wetlands and regulatory waterbodies (streams, ponds, lakes) within the 100-year floodplain downstream of the FRE facility is described in the *Downstream Floodplain Wetland Analysis* (Anchor QEA 2019b). The analysis area for this downstream floodplain report consists of an approximately 43,107-acre area that includes 75 miles of the floodplain along the mainstem Chehalis River and associated lower ends of major tributaries. The Ecology (2011) Modeled Wetlands Inventory identifies unvegetated open-water habitats such as rivers, streams, ponds, and lakes downstream of the FRE facility as shown in Figures O-2 through O-9. Overall, 2,701 acres of Ecology (2011) mapped open-water habitats are identified under the late-century major flood extent, and 2,752 acres are identified under the late-century catastrophic flood extent.

The NHD (USGS 2019) was also analyzed to identify regulatory waterbodies downstream of the FRE facility. The NHD identifies the length of rivers, creeks, and intermittent and perennial streams. Overall, 388.0 miles of NHD mapped waterbodies are identified under the late-century major flood extent, and 421.4 miles of NHD waterbodies are identified under the late-century catastrophic flood extent.

2.4.3 Climate Change Effects on Wetlands and Waterbodies

The Chehalis Basin is a rain-dominated watershed and is expected to experience more intense precipitation events and possible shifts in the timing of the most intense rainfall (Mauger et al. 2016). The Pacific Northwest warmed about +1.3°F during the past century (1895 to 2011) and this is projected to increase in the future (DNR 2018).

Increased winter peak flows and lower summer streamflows will change the formation of wetlands and waterbodies and could cause a decrease in the quantity of wetlands or widths and lengths of waterbodies. Movement of the river could also cause wetlands and waterbody widths and lengths to increase, especially if the river is moving more and forms oxbows or other channel habitats, or if the outer edges of the floodplain are more frequently inundated. Erosion and lateral channel migration are projected to increase due to higher peak water flows. Flooding and landslide frequency could increase due to more intense and frequent heavy rainfall events, especially if the soil moisture conditions are already high (DNR 2018).

2.5 Impact Analysis

The analysis for impacts on wetlands and streams (regulatory waterbodies) considered the following:

- Permanent loss of wetlands and wetland buffers
- Temporary loss of wetlands and wetland buffers
- Calculated estimated loss or conversion of wetland habitats by acres, type, and category
- Changes to wetland habitats and functions (changes in vegetation composition, changes in hydrology)
- Permanent loss of streams (regulatory waterbodies) and stream buffers
- Temporary loss of streams (regulatory waterbodies) and stream buffers
- Calculated estimated loss or conversion of streams (regulatory waterbodies) and stream buffers by acres, type, and category
- Changes to stream features (regulatory waterbodies) such as changes in morphology, changes in OHWM characteristics
- Regulatory requirements for wetlands and streams

3 TECHNICAL ANALYSIS AND RESULTS

3.1 Overview

This section describes the probable impacts on wetlands, wetland buffers, streams, and stream buffers from the Proposed Action (Section 3.2), Local Actions Alternative (Section 3.3), and No Action Alternative (Section 3.4). This section also evaluates required permit conditions and planning document requirements that could address the impacts identified (Section 3.2.3). When probable significant adverse environmental impacts remain after considering these, the report identifies mitigation measures that could avoid, minimize, or reduce the identified impact below the level of significance (Section 3.2.4).

3.2 Proposed Action

3.2.1 Impacts from Construction

3.2.1.1 Direct

3.2.1.1.1 Wetlands and Wetland Buffers

Potential permanent construction impacts on wetlands, wetland buffers, and associated functions and values could occur from land clearing, excavation, grading, and fill placement activities; these impacts are summarized in Table O-12. Construction is estimated to last for 5 years, from 2025 to 2030.

Table O-12
Summary of Probable Wetland Impacts from Construction Activities

STUDY AREA LOCATION	DIRECT WETLAND IMPACTS (ACRES AND NUMBER)					WETLAND BUFFER IMPACTS (ACRES)
	CATEGORY I	CATEGORY II	CATEGORY III	CATEGORY IV	TOTAL	
FRE Facility[1,2]	0	0	1.08 (8)[2]	0	1.08 (8)[2]	30.14[2]
Temporary Reservoir Area	0	2.76 (11)[3]	3.74 (51)[3]	0	6.5 (62)[3]	213.85
Airport Levee	0	6.26 (3)	0.37 (3)	0	6.63 (6)	44.2
Downstream of the FRE Facility	0	0	0	0	0	0
Total	**0**	**9.02 (14)**	**5.19 (62)**	**0**	**14.21 (76)**	**288.19**

Notes:

1. Construction details and impact areas for quarry access roads not defined, but assumed to be less than 0.2 acre as identified in Table O-4 and described in the following sections.
2. FRE facility construction impacts includes 0.65 acre within the FRE structure and areas outside the temporary reservoir and an additional 0.43 acre of wetlands located within the temporary reservoir area.
3. Construction activities include the removal of trees in the 10-year and 20-year inundation zones (Zones 1 and 2) within the temporary reservoir.

Potential temporary construction impacts on wetlands and wetland buffers include temporary removal or disturbance of wetland or wetland buffer vegetation during construction activities. Under the Proposed Action, some temporary construction impacts are anticipated, with subsequent restoration to preconstruction status and/or function. Potential construction impacts on wetlands and wetland buffers within the four specific geographic areas of the wetlands study area are described in the following subsections.

FRE Facility and Associated Areas

Eight wetlands are located in the proposed construction footprint of the FRE facility and associated access, construction staging and spoils areas, and maintenance areas. All wetlands are Category III wetlands. These wetlands would be permanently filled or eliminated with FRE facility structures or spoils. Wetland regulatory buffer habitat for these wetlands would also be disturbed or eliminated. Wetland buffer widths, based on Lewis County Code wetland regulations, total 30.14 acres. Wetland categories and impact areas within the FRE facility footprint are shown in Table O-12 and Figure O-10. As shown in Figure O-10, the 1.08 acres of wetland impacts associated with the FRE facility and associated construction areas includes four wetlands totaling 0.43 acre that are located within the temporary reservoir.

These probable adverse impacts are considered **moderate** for wetlands because eight wetlands with a total of 1.08 acres would be permanently eliminated. A total of 30.14 acres of wetland buffer habitat would also be disturbed or eliminated. The affected wetlands do not include Category I or Category II wetlands, and the wetlands are relatively common within the upper Chehalis River Subbasin and the Chehalis Basin in general. However, seven of the eight wetlands have high habitat functions and scores. The elimination of these wetlands would require compensatory mitigation per Corps, Ecology, and Lewis County regulations as described in Section 3.2.4.

The FRE facility and associated areas include three proposed quarry areas (North Quarry, South Quarry, and Huckleberry Ridge Quarry). Accessing these quarry areas would include widening, improving, and upgrading the existing roads. Potential wetland impacts associated with the quarry area access roads were identified based on the wetland delineations performed within the temporary reservoir and the Modeled Wetlands Inventory mapping dataset (Ecology 2011), assuming 25 feet on each side of the existing roads for construction activities. A total of 14 wetlands (4 Category II wetlands totaling 0.06 acre and 10 Category III wetlands totaling 0.12 acre) are located within 25 feet of the North and South Quarry access roads. Based on the delineated wetlands identified within 25 feet of the North and South Quarry access roads, it is expected that potential wetlands within 25 feet of the Huckleberry Ridge Quarry access road are likely associated with waterbodies or seeps and are generally expected to occur in similar quantities, along similar distances, as identified for the North and South Quarry access roads (approximately 0.3 acre, based on about three times the road length). Wetland delineations of the Huckleberry Ridge Quarry access road would be performed during the permitting phase of the Proposed Action to fully document wetland impacts.

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, wetlands, and associated stream and wetland buffers. WDFW has developed best practices for new or upgraded culverts to incorporate climate change into design (Wilhere et al. 2017). These impacts are considered **minor** because they would be temporary and because the new culverts would be designed to meet current regulatory requirements. Following construction, the streams, wetlands, and stream and wetland buffers would likely be replanted. While there would be a short-term loss of function, eventually they would function similarly to preconstruction conditions.

Temporary Reservoir

No construction of structures or paved surfaces is proposed in the temporary reservoir under the Proposed Action. As described earlier in the FRE facility and associated areas impact discussion, four wetlands located within the temporary reservoir would be filled or disturbed during FRE facility construction activities. Impacts to these four wetlands are accounted for in the FRE facility and associated areas impact analysis. Construction activities would include the removal of trees in various stages and inundation zones within the temporary reservoir. Trees outside stream buffers would be removed in initial stages, and trees within stream buffers would be removed in later stages. Clearing and grading for construction of temporary access roads would likely involve additional tree removal.

Over 2 to 5 years, all trees greater than 6 inches in diameter at breast height (dbh) would be removed from wetlands within the following lower two zones of the temporary reservoir: Zone 1 (10% or 10-year recurrence event) and Zone 2 (5% or 20-year recurrence event). Wetland buffer widths, based on Lewis County Code wetland regulations, were identified for each of the wetlands within the temporary reservoir. Wetland buffers range from 150 to 260 feet for Category II and Category III wetlands under the Lewis County Code, depending on the habitat score (a buffer of 260 feet is required for Category II or III wetlands with a habitat score of 8). A total of 213.85 acres of wetland buffers are associated with the 62 wetlands located within the lower two zones of the temporary reservoir where all trees greater than 6 inches dbh would be removed during construction.

Wetlands and wetland buffers with forested habitats would lose habitat functions associated with tree canopy cover such as shade, habitat features (snags and woody material), and habitat diversity. Most of these wetlands (52 wetlands, 6.07 acres) have higher habitat scores and functions because of the interspersion of habitats (i.e., interspersion between forested, shrub, and emergent areas within the wetland) and the presence of special habitat features including snags and downed wood. Thus, the removal of trees would substantially reduce the habitat functions of these wetlands. The removal of the tree canopy could promote the spread of non-native vegetation such as Armenian blackberry, reed canarygrass, and Scot's broom (*Cytisus scoparius)* within the wetland and wetland buffer habitat. Removing trees from forested wetlands can also alter the hydrologic condition, resulting in wetter areas where trees no longer perform the function of evapotranspiration (pumping water out of the system). Tree removal results in the loss of atmospheric carbon removal and storage, release of carbon from

trees removed, loss of interception/infiltration against projected increases in precipitation, and loss of shading against projected temperature increases.

These probable impacts are considered **significant** for wetlands because the wetlands with forested habitat features would be changed into PSS and PEM wetland systems, with much reduced functions. These wetlands do not include Category I wetlands. Trees would also be removed from 213.85 acres of wetland buffers, causing further disturbance and loss of functions from the wetlands. Wetlands within the temporary reservoir would also be inundated and submerged, causing further impacts during operation of the FRE facility (those effects are described in Section 3.2.2).

Mitigation is proposed for the Applicant to develop a Wetland and Wetland Buffer Mitigation Plan to mitigate impacts on wetlands and wetland buffers in the temporary reservoir area; however, there is uncertainty if the implementation of a plan is technically feasible and economically practicable. Therefore, the Proposed Action would have **significant and unavoidable** adverse environmental impacts on wetlands and wetland buffers, unless the Applicant develops a plan that meets regulatory requirements and for which implementation is feasible. The Wetland and Wetland Buffer Mitigation Plan must provide no net loss of wetland functions.

Airport Levee

Eight wetlands are located within or partially within the airport levee construction study area. This larger boundary has been used as a conservative area of impact. These wetlands include five Category II wetlands and three Category III wetlands. These wetland areas would be permanently filled and eliminated with airport levee improvement structures. Wetland buffer habitat for these wetlands would also be disturbed or eliminated. Wetland categories and impact areas and wetland buffers within the airport levee are shown in Table O-12 and Figure O-14.

These probable adverse impacts are considered **significant** for wetlands because eight wetlands with a total acreage of 6.63 acres would be filled or eliminated. A total of 44.2 acres of wetland buffer habitat would also be disturbed during construction. The wetland buffers that could be disturbed are associated with wetlands located both within the footprint of the proposed levee changes and wetlands within approximately 200 feet of the proposed footprint based on visual observations. The affected wetlands do not include Category I wetlands and are already highly disturbed. Four of the wetlands have moderate habitat function scores and four have low habitat function scores. Three of the eight wetlands also have high water quality function scores. These types of wetlands are also common within the Chehalis Basin in general.

Mitigation is proposed for the Applicant to develop a Wetland and Wetland Buffer Mitigation Plan to mitigate impacts on wetlands and wetland buffers in the airport levee area; however, there is uncertainty if the implementation of a plan is technically feasible and economically practicable. Therefore, the Proposed Action would have **significant and unavoidable** adverse environmental impacts

on wetlands and wetland buffers, unless the Applicant develops a plan that meets regulatory requirements and for which implementation is feasible. The Wetland and Wetland Buffer Mitigation Plan must provide no net loss of wetland functions.

Downstream of the FRE Facility
No other construction activities are proposed downstream of the FRE facility under the Proposed Action and, therefore, no potential construction impacts on wetlands or wetland buffers have been identified.

3.2.1.1.2 Waterbodies

Construction is estimated to last for 5 years, from 2025 to 2030. There are no ponds or lakes located within the areas of proposed construction activities. Potential temporary construction impacts on streams include temporary disturbance below the OHWM and removal of vegetation within the stream buffers. Under the Proposed Action, some temporary construction impacts are anticipated, with subsequent restoration, in some areas, to preconstruction status and/or function. Permanent construction impacts would occur below the OHWM of the Chehalis River.

Potential construction impacts on streams within the four specific geographic areas of the study area are described in the following subsections.

FRE Facility and Associated Areas
Streams are the only type of regulatory waterbody located within the FRE facility and associated areas. The Chehalis River is the only stream identified within the proposed FRE facility and associated areas. Approximately 0.32 acre of the Chehalis River (as measured at the OHWM) would be permanently filled for construction of the FRE facility. During construction, all river flows would pass through a temporary diversion facility. This adverse impact is considered **significant** because the river channel would have permanent changes in morphology, flow characteristics, and to the OHWM. The construction of the facility is intended to permanently change the peak flow characteristics of the river and is unavoidable to accomplish the project purpose. In addition, 10.79 acres of stream buffer would be permanently converted to non-forested conditions.

Mitigation is proposed for the Applicant to develop a Stream and Stream Buffer Mitigation Plan to mitigate impacts to streams and stream buffers in the FRE facility and associated areas; however, there is uncertainty if the implementation of a plan is technically feasible and economically practicable. Therefore, the Proposed Action would have **significant and unavoidable** adverse environmental impacts on streams and stream buffers, unless the Applicant develops a plan that meets regulatory requirements and for which implementation is feasible. The Stream and Stream Buffer Mitigation Plan must be approved by Ecology and other applicable agencies and must provide for no net loss of the stream buffer habitats.

Twenty-one streams that would be crossed by the proposed North and South Quarry access roads, and one stream crossed by the Huckleberry Ridge Quarry access road, were identified based on the delineation results within the temporary reservoir. Eight streams that would be crossed by the proposed North and South Quarry access roads, and six crossed by the proposed Huckleberry Ridge Quarry access road, were identified based on existing NHD mapping outside of the temporary reservoir (USGS 2019). More streams may be found when the proposed areas for the access road are delineated in the field. 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 36 known streams.

These potential adverse impacts are considered **minor** for streams because they would be temporary or would include extending or replacing existing culverts to meet current regulatory requirements (i.e., for hydraulic conveyance and fish passage) and, following construction, the streams would function similarly to preconstruction conditions. WDFW has developed best practices for new or upgraded culverts to incorporate climate change into design (Wilhere et al. 2017). The replacement of poorly functioning fish barrier culverts would improve stream functions compared to existing conditions.

Temporary Reservoir

Streams are the only type of regulatory waterbodies located within the temporary reservoir. No construction of structures or paved surfaces is proposed in the temporary reservoir under the Proposed Action. Construction activities would include the removal (over 2 to 5 years) of all trees greater than 6 inches dbh within the following two inundation zones of the reservoir: Zone 1 (10% or 10-year recurrence event) and Zone 2 (5% or 20-year recurrence event). Trees outside stream buffers would be removed in initial stages and trees within stream buffers would be removed in later stages. Tree removal would likely include clearing and grading for construction of temporary access roads with associated culverts or other temporary crossings where streams are located. A total of 88 streams (11.44 miles) are located within Zones 1 and 2, with 18.2 miles (counting length along each bank) and 312.8 acres of stream buffer. The majority of these streams are fish-bearing (8.79 miles); trees would be removed within 252.6 acres of stream buffers along fish-bearing streams. Table O-13 summarizes the total streams and stream buffer impacts from tree removal during construction within Zones 1 and 2.

Table O-13

Summary of Probable Stream Impacts from Construction Within Zones 1 and 2 of the Temporary Reservoir

BASIN NAME	TOTAL NUMBER OF STREAMS	TOTAL MILES OF STREAMS	TOTAL STREAM BUFFER IMPACTS (ACRES)[1]	BUFFER LENGTH[1]	
				RIGHT BANK (MI)	LEFT BANK (MI)
Upper Chehalis River	1	5.79	238.2	5.79	5.72
Upper Chehalis Tributaries	49	1.8		0.41	0.39
Crim Creek	1	1.69	52.9	1.62	1.65
Crim Creek Tributaries	23	0.67		0.20	0.19
Lester Creek	1	0.47	11.5	0.39	0.43
Lester Creek Tributaries	4	0.12		0.03	0.03
Hull Creek	1	0.38	5.2	0.35	0.31
Hull Creek Tributaries	4	0.08		0.02	0.02
Browns Creek	1	0.2	1.9	0.16	0.15
Browns Creek Tributaries	1	0		0.00	0.00
Big Creek	1	0.22	3.1	0.18	0.17
Roger Creek	1	0.02	0.0	0.00	0.00
Smith Creek	0	0	0.0	0.00	0.00
Alder Creek	0	0	0.0	0.00	0.00
Total	**88**	**11.44**	**312.8**	**9.15**	**9.06**

1. Based on Lewis County Code Critical Areas Stream Buffer Guidelines

These probable adverse impacts are considered **significant** for streams and stream buffers. The removal of trees would also reduce bank cohesion along the streams, likely resulting in increased channel width and channel migration. Water velocities and bed scour would likely be changed (affecting the morphology of the streams). Tree removal would remove shading, cover, detrital and insect input, and large wood input.

Mitigation is proposed for the Applicant to develop a Stream and Stream Buffer Mitigation Plan to mitigate impacts on streams and stream buffers in the temporary reservoir area; however, there is uncertainty if the implementation of a plan is technically feasible and economically practicable. Therefore, the Proposed Action would have **significant and unavoidable** adverse environmental impacts on streams and stream buffers, unless the Applicant develops a plan that meets regulatory requirements and for which implementation is feasible. The Stream and Stream Buffer Mitigation Plan must provide no net loss for the stream and stream buffer habitats.

Airport Levee Footprint
No regulatory waterbodies (streams, ponds, or lakes) were identified within the proposed expanded airport levee footprint during the 2018 and 2019 wetland delineations (Anchor QEA 2019a); therefore, **no** potential construction impacts have been identified for regulatory waterbodies.

Floodplain Downstream of the FRE Facility
No other construction activities are proposed in the floodplain downstream of the FRE facility under the Proposed Action; therefore, **no** potential impacts have been identified for regulatory waterbodies (streams, ponds, or lakes).

3.2.1.2 Indirect

3.2.1.2.1 Wetlands

No probable indirect construction impacts on wetlands or wetland buffers under the Proposed Action have been identified.

3.2.1.2.2 Waterbodies

As described in the *Water Discipline Report,* the removal of trees within the temporary reservoir inundation area during construction could have effects on the water quality of streams that have reduced canopy cover and likely increased solar radiation that would increase water temperatures. Removal of tree cover could also increase surface water runoff from the stream buffer zones, cause bank erosion and turbidity, and reduce overall groundwater recharge that might cause reduced or subsurface flows during low-flow periods. This is considered a **significant adverse impact** on streams and stream buffer function within the temporary reservoir inundation area.

3.2.2 Impacts from Operation

Potential operation impacts on wetlands, wetland buffers, and regulatory waterbodies (streams and stream buffers, ponds, and lakes) from the Proposed Action include inundation from operation of the FRE facility that requires storing of floodwater within the temporary reservoir, and changes in hydrology and inundation in the floodplain downstream of the FRE facility associated with reducing flood levels during major and catastrophic flood flows and recurring flood flows.

3.2.2.1 Direct

Direct impacts from the operation of the FRE facility are described separately for major and catastrophic floods. The recurring flood scenario would generally have the same impacts as the catastrophic flood scenario and is not described separately.

3.2.2.1.1 Wetlands and Wetland Buffers

FRE Facility and Associated Areas

No potential adverse impacts on wetlands and wetland buffers within the FRE facility and associated areas associated with operation of the Proposed Action are anticipated because the construction of the facility and associated areas will have filled or eliminated all wetlands and made permanent changes to wetland buffers within this part of the wetlands study area.

Temporary Reservoir

Wetland categories and operational impact areas within the temporary reservoir are shown in Table O-14. Wetlands within the temporary reservoir are shown in Figures O-11 through O-13. A total of 85 wetlands located within the proposed temporary reservoir would be inundated and submerged under the full temporary reservoir capacity. Under the Proposed Action, inundation could last up to 35 days. These wetlands include 13 Category II wetlands (2.81 acres) and 72 Category III wetlands (6.95 acres). As described in the construction impacts section, wetlands and wetland buffers within Zones 1 and 2 would be disturbed during construction from tree removal. Of the 85 wetlands that would be inundated and submerged under the full temporary reservoir capacity, 62 wetlands, including 11 Category II wetlands (2.76 acres) and 51 Category III wetlands (3.74 acres), would be disturbed during tree removal construction activities. Wetlands and wetland buffers located within Zones 1 and 2 and Zones 3 and 4 are identified in Table O-14.

Wetland buffer habitat for these wetlands would also be disturbed. Wetland buffer widths, based on Lewis County Code wetland regulations, were identified for each of the wetlands within the temporary reservoir. Wetland buffers range from 150 to 260 feet for the Category II and Category III wetlands depending on habitat score. A total of 303.15 acres of wetland buffers are associated with the 85 wetlands located within the temporary reservoir area. Most of these wetlands (72 wetlands, 9.03 acres, with 296.44 acres of buffers) have higher habitat scores and functions because of the interspersion of habitats (i.e., interspersion between forested, shrub, and emergent areas within the

wetland) and the presence of special habitat features including snags and downed wood. Thus, the permanent loss of trees and periodic inundation and death of all plants in the wetlands and their buffers would substantially reduce the habitat functions of these wetlands.

Table O-14
Summary of Probable Wetland Impacts from Operation Activities

STUDY AREA LOCATION	DIRECT WETLAND IMPACTS (ACRES AND NUMBER)					WETLAND BUFFER IMPACTS (ACRES)
	CATEGORY I	CATEGORY II	CATEGORY III	CATEGORY IV	TOTAL	
FRE Facility	0	0	0	0	0	
Temporary Reservoir Area Zones 1 and 2[1]	0	2.76 (11)[1]	3.74 (51)[1]	0	6.5 (62)[1]	213.85
Temporary Reservoir Area Zones 3 and 4[2]	0	0.05 (2)	3.21 (21)	0	3.26 (23)	89.30
Temporary Reservoir Area Total	0	2.81 (13)	6.95 (72)	0	9.76 (85)	303.15
Airport Levee	0	0	0	0	0	
Downstream of the FRE Facility	0	0	0	0	0	
Total	**0**	**2.81**	**6.95[2]**	**0**	**9.76[3]**	**303.15**

Notes:
1. Wetlands and wetland buffers within Zones 1 and 2 disturbed during construction from tree removal activities, but then subject to ongoing inundation effects from operations.
2. Wetlands and wetland buffers within Zones 3 and 4 would be subject to tree removal after the first catastrophic flood inundation event during operations, and then subject to ongoing inundation effects from operations.
3. Total does not include the four wetlands (0.43 acre) within the temporary reservoir filled or substantially disturbed during FRE facility and associated areas construction impacts.

The probable adverse impacts are considered **significant** for wetlands because the wetland vegetation would not survive such prolonged and deep inundation every time the reservoir is filled, thus permanently changing existing wetland vegetation to emergent and short-term shrub/sapling vegetation that regrows after every event. In addition, there would likely be sedimentation associated with the inundation, followed by erosion during and after drawdown that could cause periodic changes to the wetland morphology and area and could also promote the colonization of non-native invasive species.

More details on probable geomorphic impacts within the temporary reservoir are provided in the *Earth Discipline Report* (Shannon & Wilson and Watershed GeoDynamics 2020). In addition, the wetland

buffers would also be inundated and experience a periodic complete loss of vegetation and would be permanently maintained as emergent or young age shrub/sapling communities.

Washington state law (RCW 90.48 and WAC 173-201A) and federal law (33 CFR 320-331 and 40 CFR 230) require wetland compensatory mitigation to support no overall net loss in the amount (acreage) and function of Washington's wetlands. Because the wetland impacts described earlier cannot be avoided or minimized, compensatory mitigation will be required under state and federal laws. Mitigation is proposed for the Applicant to develop and implement a Wetland and Wetland Buffer 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 and must ensure no net loss of function for wetlands. Section 3.2.4 identifies compensatory mitigation activities that may be required to address these impacts.

Under the catastrophic flood level scenario, inundation to the full temporary reservoir capacity would possibly occur, submerging all wetland habitats within the temporary reservoir. The temporary reservoir inundation area under a catastrophic flood level scenario is calculated as an 847-acre area, slightly less than the 856-acre temporary reservoir maximum design capacity. Under a major flood level scenario, inundation levels within temporary reservoir would be lower than the full reservoir capacity, submerging a portion of the wetland habitats. The temporary reservoir inundation area under a major flood level scenario is calculated as a 625-acre area. Under the recurring flood scenarios, the inundation levels would vary but the submersion of wetland habitats would occur in consecutive years.

Mitigation is proposed for the Applicant to develop a Wetland and Wetland Buffer Mitigation Plan to mitigate impacts on wetlands and wetland buffers in the temporary reservoir area; however, there is uncertainty if the implementation of a plan is technically feasible and economically practicable. Therefore, the Proposed Action would have **significant and unavoidable** adverse environmental impacts on wetlands and wetland buffers, unless the Applicant develops a plan that meets regulatory requirements and for which implementation is feasible. The Wetland and Wetland Buffer Mitigation Plan must provide no net loss of wetland functions.

Airport Levee

No direct adverse impacts on wetlands or wetland buffers from operation of the airport levee are anticipated. Wetland buffers inside the airport levee would continue to be mowed as currently occurs under airport maintenance operations. Wetlands and areas that would serve as wetland buffers outside the airport levee near the expanded levee would continue to be mowed by private landowners.

Floodplain Downstream of the FRE Facility

The analysis of wetlands downstream of the FRE facility includes the potential flood extent areas associated with late-century major and catastrophic floods. An analysis of existing wetlands and potential impacts to wetlands downstream of the FRE facility associated with the 100-year floodplain under existing

conditions, a smaller analysis area, is described in the *Downstream Floodplain Wetland Analysis* (Anchor QEA 2019b).

The FRE facility would only begin to retain water when a major flood level flow (38,800 cfs at the Grand Mound gage) is forecasted 2 days out; therefore, its operation would have no effect on the inundation area of overbank flooding from flows below major flood levels. When the gates are open, the river would flow through the FRE structure at 8,500 cubic feet per second (cfs) without backwater ponding, which is similar to the current Chehalis River flow at that location. Impacts on downstream geomorphology from the FRE facility operations are detailed in the *Earth Discipline Report* and are significant. Reductions in peak flows and large wood and sediment transport would reduce channel forming, channel migration and the formation of floodplain habitats (including wetlands), primarily between the FRE facility and the South Fork Chehalis River.

Table O-15 shows the approximate acreage of potential wetlands occurring in the predicted major flood inundation area based on the 2011 Modeled Wetlands Inventory dataset under the No Action Alternative and Proposed Action, and the areas that would no longer be inundated and would have potentially reduced depths and duration of flooding during operations of the FRE facility under the predicted major flood.

Table O-16 shows the same information for operations of the FRE facility under the predicted catastrophic flood inundation. Areas that fall within the catastrophic flood inundation area include those mapped within the major flood inundation areas. For example, the total area of PFO wetlands inundated by the catastrophic flood inundation area includes those areas of that wetland type that would also be inundated by the major flood inundation area.

In general, the occurrence of wetlands downstream of the FRE facility increases toward the central portion of the floodplain then decreases toward the outer portions of the floodplain. For example, the analysis shows that of the total 3,505 acres of PFO wetlands found downstream of the FRE facility under the late-century catastrophic flood inundation extent, 3,241 acres (92% of the total) are located under the late-century major flood inundation extent and 264 acres (8% of the total) are between the major and the catastrophic flood inundation extents. Similar trends occur for the remaining wetland cover classes.

Table O-15
Area of Potential Ecology Inventory Wetlands Occurring Downstream of the FRE Facility in Predicted Late-Century Major Flood Inundation Areas

WETLAND COVER CLASS	NO ACTION (ACRES)	PROPOSED ACTION (ACRES)	AREA NO LONGER INUNDATED (ACRES)
Potentially Disturbed Wetlands	3,764	3,606	158
PFO	3,241	3,115	126
PSS	3,507	3,416	92
PEM	5,405	5,262	143
PUS	300	298	2
PAB	68	66	1
EAB	<1	<1	0
Total	**16,286**	**15,764**	**522**

Source: Modeled Wetlands Inventory (Ecology 2011)

Table O-16
Area of Potential Ecology Inventory Wetlands Occurring Downstream of the FRE Facility in Predicted Late-Century Catastrophic Flood Inundation Areas

WETLAND COVER CLASS	NO ACTION (ACRES)	PROPOSED ACTION (ACRES)	AREA NO LONGER INUNDATED (ACRES)
Potentially Disturbed Wetlands	4,157	3,955	203
PFO	3,505	3,385	120
PSS	3,730	3,634	95
PEM	5,706	5,620	87
PUS	302	301	1
PAB	68	68	0
EAB	<1	<1	0
Total	**17,468**	**16,963**	**506**

Source: Modeled Wetlands Inventory (Ecology 2011)

In general, the proportion of wetland cover classes within the late-century major and catastrophic flood extents that would be flooded under the No Action Alternative and Proposed Action are similar in scale.

The wetland class that would be most affected by changes in both the major (Table O-15) and catastrophic (Table O-16) flood inundation extents are potentially disturbed wetlands. PEM wetlands would be the second most affected by changes in the major flood inundation extent, while under the catastrophic flood inundation extent PFO wetlands would be the second most affected. Potentially disturbed wetland areas may be artificially drained via subsurface drainage tile such that much of the

hydrology that formerly supported wetland conditions no longer exists. PSS wetlands are also affected by changes, whereas PUS wetlands, PAB wetlands, and EAB wetlands would experience limited effects.

As described previously, under operation of the Proposed Action, wetlands would continue to be inundated by floodwaters generated by flows below major flood levels because the FRE facility would not retain water during flow events less than major flood flows.

Under the late-century major flood, the FRE facility would be operating and the downstream flood inundation extent would be less than if the facility were not operating. As a result of this change, about 522 acres of wetlands in the major flood inundation extents would no longer receive overbank flooding from a major flood (Table O-15).

For the catastrophic flood flow, about 506 acres of wetlands in the late-century catastrophic flood inundation extents would no longer be inundated by floods from catastrophic flood flow events (Table O-16).

Impacts on cottonwood habitat downstream of the FRE facility are discussed in the *Cottonwood Habitat Study* (Meadow Run Environmental and Anchor QEA 2019) and the *Wildlife Species and Habitats Discipline Report*.

These probable adverse impacts are considered **minor** for wetlands because the affected wetlands would not be eliminated or lose their primary hydrologic source, but would no longer be inundated by overbank flooding that occurs infrequently. The Corps and EPA (Environmental Laboratory 1987) jointly define wetlands as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” Guidance from the National Research Council for determining wetland hydrology indicates that the water source must be present typically in 5 years out of 10 years, or more commonly referred to as occurring in 1 year out of 2 years (NRC 1995).

River flows that occur more frequently than the major flood (7-year recurrence) would be unchanged; thus, any floodplain wetlands primarily created or sustained by more frequent river overbank flows would not have their dominant hydrologic source changed. These wetlands that only receive surface water from the Chehalis River during major or catastrophic floods are sustained by other hydrologic sources that could include a high groundwater table, direct precipitation on slowly draining soils, and/or surface runoff from nearby areas.

Recurring flood operations would have similar effects as the major and catastrophic flood operations on downstream floodplain wetlands based on the available information and modeling tools used for this analysis. However, the dynamics of wetland creation and loss supported by major river flooding are not well known, may be underestimated in this analysis, and represent a potential major information gap.

3.2.2.1.2 Waterbodies

FRE Facility and Associated Areas

Streams are the only type of regulatory waterbody located within the FRE facility and associated areas. **No additional potential adverse impacts** on streams and stream buffers within the FRE facility and associated areas associated with operation of the Proposed Action are anticipated because the construction of the facility and associated areas, including the quarry area access roads, will have disturbed streams and stream buffers permanently within this part of the study area, and no further operational changes are anticipated.

Temporary Reservoir

Streams are the only type of regulatory waterbody located within the temporary reservoir. A total of 116 streams and their stream buffers are located within the proposed temporary reservoir that would be inundated and submerged under the full temporary reservoir capacity and would be maintained in a permanent herbaceous or shrub state. The total mileage of streams is 16.83 miles. Stream buffers for these streams would also be inundated and submerged, totaling 25.55 miles (counting length along each bank) and 441.30 acres (Table O-17 provides a summary of the total impacts to streams and stream buffers for operations). The majority of these streams are fish-bearing (11.74 miles), and 348.29 acres of stream buffers are associated with these fish-bearing waterbodies. Under the Proposed Action, inundation could last up to 35 days. As described under wetland impacts, the temporary reservoir inundation area under a catastrophic flood scenario is calculated as an 847-acre area, slightly less than the 856-acre temporary reservoir maximum inundation area. Under a major flood scenario, inundation levels within temporary reservoir would be a 625-acre area, lower than the full reservoir capacity, submerging a large proportion of the streams.

Table O-17

Summary of Probable Stream and Stream Buffer Impacts in the Temporary Reservoir from Operation Activities

BASIN NAME	TOTAL NUMBER OF STREAMS	TOTAL MILES OF STREAMS	TOTAL STREAM BUFFER IMPACTS[1](ACRES)	STREAM BUFFER LENGTH[1]	
				RIGHT BANK (MI)	LEFT BANK (MI)
Upper Chehalis River	1	6.79	314.8	6.79	6.72
Upper Chehalis Tributaries	63	3.64		1.26	1.21
Crim Creek	1	2.14	76.10	2.07	2.10
Crim Creek Tributaries	29	1.25		0.54	0.51
Lester Creek	1	0.6	17.10	0.56	0.45
Lester Creek Tributaries	7	0.3		0.04	0.04
Hull Creek	1	0.5	9.00	0.48	0.44
Hull Creek Tributaries	4	0.18		0.12	0.10
Browns Creek	1	0.33	6.10	0.28	0.27
Browns Creek Tributaries	3	0.08		0.00	0.00
Big Creek	1	0.49	12.00	0.43	0.40
Big Creek Tributaries	1	0.06		0.03	0.03
Roger Creek	1	0.44	6.00	0.35	0.33
Roger Creek Tributaries	1	0.01		0.00	0.00
Smith Creek	1	0.02	0.20	0.00	0.00
Alder Creek	0	0		0.00	0.00
Total	**116**	**16.83**	**441.30**	**12.95**	**12.60**

1. Based on Lewis County Code Critical Areas Stream Buffer Guidelines

The probable adverse impacts are considered **significant** for streams because there would be erosion and/or sedimentation associated with the prolonged and deep inundation every time the reservoir is filled and then the subsequent drawdown of the reservoir, which could cause periodic changes to the stream channel morphology, and change OHWM dimensions (e.g., channel widening) and channel depths, and cause potentially rapid channel migration through deposited sediments. Additionally, stream buffer vegetation would die during an inundation event and would be permanently maintained in an early successional herbaceous or shrub/sapling condition, thus reducing shading, detrital input, large wood inputs, and cover functions for the streams.

Mitigation is proposed for the Applicant to develop a Stream and Stream Buffer Mitigation Plan to mitigate impacts on streams and stream buffers in the temporary reservoir area; however, there is uncertainty if the implementation of a plan is technically feasible and economically practicable. Therefore, the Proposed Action would have **significant and unavoidable** adverse environmental impacts on streams and stream buffers, unless the Applicant develops a plan that meets regulatory requirements and for which implementation is feasible. The Stream and Stream Buffer Mitigation Plan must provide no net loss for the stream and stream buffer habitats.

Airport Levee

No streams were identified within the airport levee during the 2018 and 2019 wetland delineations (Anchor QEA 2019a); therefore, **no impacts** on streams or stream buffers have been identified.

Floodplain Downstream of the FRE Facility

An analysis of existing aquatic habitats and potential impacts on aquatic habitats downstream of the FRE facility associated with the 100-year floodplain under existing conditions, a smaller analysis area, is described in the *Downstream Floodplain Wetland Analysis* (Anchor QEA 2019b).

The analysis of regulatory waterbodies downstream of the FRE facility includes the potential flood extent areas associated with late-century major and catastrophic floods. The FRE facility would only begin to retain water at a major flood level flow (38,800 cfs at the Grand Mound gage); therefore, its operation would have no effect on the inundation area of overbank flooding from flows below major flood levels.

A detailed analysis of potential changes to the geomorphology of the mainstem Chehalis River downstream of the FRE facility is contained within the *Earth Discipline Report*. Reductions in peak flows and the transport of large wood and sediment would tend to reduce channel migration and deposition and scouring, which could lead to overall vegetation encroachment and channel narrowing, primarily between Pe Ell and the South Fork Chehalis River confluence. Over time, this would tend to reduce the area of the mainstem Chehalis River in this reach.

Table O-18 shows the approximate acreage of the Modeled Wetlands Inventory dataset (Ecology 2011) for unvegetated open-water habitats (open water) located in the predicted major and catastrophic flood inundation areas under the No Action Alternative and Proposed Action. The table also shows the areas

that would no longer be inundated and would have potentially reduced depths and duration of flooding during operation of the FRE facility under the predicted major and catastrophic floods.

Similar to the wetland analysis, analysis based on the Ecology (2011) Modeled Wetlands Inventory dataset for open water shows that of the 2,757 acres of open-water aquatic habitats found downstream of the FRE facility, most open-water habitat features, 2,701 acres (98% of the total), are located under the major flood inundation area and 52 acres (2% of the total) are located between the major and the catastrophic flood inundation extents.

Table O-18
Comparison Between Proposed Action and No Action Alternative of Area of Inundation (Acres) for Open-Water Habitats Occurring Downstream of the FRE Facility

FLOOD SCENARIO	NO ACTION	PROPOSED ACTION	AREA NO LONGER INUNDATED WITH PROPOSED ACTION
Late-Century Major Flood	2,701	2,688	13
Late-Century Catastrophic Flood	2,753	2,737	16

Note: Calculated using Modeled Wetlands Inventory (Ecology 2011)

As described previously, under operation of the Proposed Action, open-water habitats (streams, lakes, ponds) would continue to be inundated by floodwaters generated by flows below major flood levels because the FRE facility would not retain water during flow events of the magnitudes less than major flood flows.

Under the late-century major flood flow, the FRE facility would be operating and the downstream flood inundation extent would be less than without the facility. As a result of this change, approximately 13 acres of open-water habitats currently existing in the No Action Alternative late-century major flood inundation extents would no longer receive overbank flooding from a major flood.

For the catastrophic flow flood event, approximately 16 acres of potential open-water habitats currently existing in the No Action Alternative late-century catastrophic flood inundation extents would no longer be inundated by floods from catastrophic flood flow events.

The NHD (USGS 2019) was also analyzed to identify rivers, creeks, and intermittent and perennial streams downstream of the FRE facility. The analysis shows that of the total 421.4 mile length of rivers, creeks, and streams found downstream of the FRE facility, most aquatic features, 388.0 miles (92% of the total) are located under the major flood inundation area and an additional 33.4miles (8% of the total) are located between the major and the catastrophic flood inundation extents.

Table O-19 shows the approximate miles of potential NHD habitats occurring in the predicted major and catastrophic flood inundation areas under the No Action Alternative and Proposed Action. The table also

shows the areas that would no longer be inundated from Chehalis River flooding and would have potentially reduced depths and duration of flooding during operations of the FRE facility under the predicted major and catastrophic floods.

Table O-19
Comparison Between Proposed Action and No Action Alternative of NHD Habitat Inundation (River Miles) Occurring Downstream of the FRE Facility

FLOOD SCENARIO	NO ACTION	PROPOSED ACTION	AREA NO LONGER INUNDATED
Late-Century Major Flood	388	375	-13
Late-Century Catastrophic Flood	421	404	-17

Note: Data calculated from NHD (USGS 2019)

Under the late-century major flood flow, the FRE facility would be operating and the downstream flood inundation extent would be less than projected without the facility. As a result, approximately 13 miles of rivers, creeks, and streams currently would no longer be inundated due to overbank flooding under the Proposed Action as compared to the No Action Alternative. Similarly, under a late-century catastrophic flood, approximately 17 miles of rivers, creeks, and streams would no longer be inundated due to overbank flooding under the Proposed Action as compared to the No Action Alternative.

The probable adverse impacts on open-water/NHD habitats from inundation are considered **significant** for the mainstem Chehalis River between Pe Ell and the South Fork Chehalis River because reduced peak flows and associated reduced sediment and wood transport would lead to probable vegetation encroachment and channel narrowing and reduced formation of channels, which would reduce the mainstem area and complexity. Adverse impacts are considered **minor** for other regulatory waterbodies, including the Chehalis River downstream of the South Fork Chehalis River, because the affected waterbodies are streams, rivers, oxbows, and ponds that receive seasonal or perennial flows from runoff from their respective drainage basins, or these tributary drainage basin flows contribute sufficient flows and sediment to the mainstem Chehalis River such that effects of the FRE facility operations are no longer discernible. During FRE facility operation under a major or catastrophic flood, the area of these habitats would receive less backwatering from the river and potentially less sediment deposition. However, this effect is expected to be minor and as soon as the flood flows recede, streams and rivers would begin flowing normally and oxbows and ponds would retain typical inundation.

3.2.2.2 Indirect

3.2.2.2.1 Wetlands and Wetland Buffers

There would be **minor adverse impacts** on groundwater associated with wetlands or wetland buffers within the FRE facility and associated areas, the temporary reservoir inundation area, or the airport levee area. However, for the downstream floodplain wetlands, a reduced area of inundation would, over

time, tend to allow woody species to grow and mature, thus potentially causing a long-term transition of emergent to shrub to forested conditions in some wetlands. Likewise, reduced inundation may also make areas more accessible to land use conversions that could result in disturbance or loss of wetlands. As some of the downstream floodplain wetlands are subject to ongoing management and disturbance by agricultural or other land uses, it is not known which wetlands would experience this long-term transition. This is considered a **minor** effect, because it would likely only occur in some of the wetlands that would not be inundated during a major or catastrophic flood and would not change their status as wetland features. A transition to shrub or forested wetlands would tend to alter habitat functions that may result in a change in wetland categories (Hruby 2014). However, this could adversely affect species that use emergent wetlands. Potential indirect effects on wildlife species habitats are described in the *Wildlife Species and Habitats Discipline Report*.

The reduced area of inundation could also potentially affect groundwater levels and groundwater infiltration in the downstream floodplain on a periodic basis. An analysis of the potential effects of the FRE facility operations on groundwater is described in the Potential Groundwater Level Effects Analysis memorandum (Wilson et al. 2019) and the *Water Discipline Report* (ESA 2020b). A summary of this analysis is provided herein.

The Chehalis River floodplain downstream of the proposed FRE facility is predominantly comprised of alluvial materials (geologic materials deposited by flowing water), with some patches of glacial outwash materials in the reach from Oakville to Porter and in deposits near Elma and Montesano (DNR 2019). The surficial aquifer present in the alluvial and glacial materials of the floodplain is generally unconfined, receiving water from direct precipitation/infiltration, surface runoff, injection from septic systems and other human sources, groundwater flow from upslope and riverine hyporheic exchange and overbank flows (Pitz et al. 2005; Gendaszak 2011). In the Chehalis Basin, direct precipitation is a primary driver of groundwater levels (Pitz et al. 2005). A water budget for the Basin (Gendaszek and Welch 2018) indicates precipitation is the largest water input and approximately 30% of the precipitation provides groundwater recharge (approximately 22 inches per year).

An analysis of several groundwater wells and surface water levels in the floodplain and Chehalis River with 1 to several years of monitoring data (Wilson et al. 2019) indicates that in many reaches of the Chehalis River, the groundwater table is higher than river levels. This is likely largely driven by precipitation and upslope groundwater elevations and discharge towards the river. Wetlands in the floodplain likely have a variety of hydrologic sources including direct precipitation, surface runoff, a high groundwater table, and river elevations or overbank flows. Wetlands sustained by river elevations or overbank flows on a frequent basis (e.g., 1 year out of 2 years) would not experience any change in flow frequency or duration. Wetlands that experience less frequent overbank flow during a major or catastrophic flood are most likely sustained by other hydrologic sources such as precipitation, surface runoff, and groundwater tables.

During a major or catastrophic flood, the typical alluvial soils have an infiltration rate of approximately 2 inches per day (Gendaszek and Welch 2018). During a major or catastrophic flood, the period of inundation of the floodplain is typically 1 to 3 days that could potentially recharge the groundwater table by up to 6 inches. Since a major or catastrophic flood typically occurs at a frequency of 1 year out of 7 years or less, the average annual groundwater recharge from a flood is approximately 0.8 inch, or approximately 4% of the volume provided by precipitation.

Permanently inundated wetlands contain standing water year-round. They may be in direct hydraulic connection with a continuously high groundwater table or have poorly drained soil layers that pond water for long duration from direct precipitation, surface runoff, and floods. If a continuously high groundwater table is the primary hydrologic source, reduction in the inundation extent and depth of flooding would not substantially affect the amount of water in these wetlands or their supporting hydrology. Similarly, if ponding due to poorly drained soil layers is the primary source of hydrology, a reduction in the inundation extent and depth of flooding for infrequent flows would not substantially affect these wetlands or their supporting hydrology. This is especially true for wetlands that are located outside of the flood inundation extent of the 2-year flow (i.e., typically flooded in 1 year out of 2 years), which do not receive frequent enough flood inundation to be dependent on flood flows for supporting hydrology.

Seasonally inundated wetlands contain standing water during all or part of the wet season of October through March. They may be in direct hydraulic connection with seasonally high groundwater table but dry out seasonally with declining groundwater levels during the dry season (June through September). They may also pond due to a poorly drained soil layer from precipitation, surface runoff, and floods. Similar to permanently inundated wetlands, a reduction in the inundation extent and depth of flooding may not substantially affect the amount of standing water in these wetlands or their supporting hydrology since it would only occur infrequently and not substantially affect the seasonal high groundwater table or runoff.

Intermittently inundated wetlands contain standing water temporarily during and after precipitation or floods. They may be in direct hydraulic connection with a groundwater table that rises in response to precipitation or river elevations or they may be slowly draining and temporarily pond water from precipitation, surface runoff, or floods. A reduction in the frequency, duration, and magnitude of floods may only minimally affect these wetlands. Operation of the FRE facility would eliminate occasional ponding of these wetlands from major and catastrophic floods. The time period between floods of this magnitude is too large for these floods to be a sustaining hydrologic source for a wetland, but the loss of periodic inundation could promote a transition to more woody species dominating the wetland or alternate land uses that increase disturbance.

In saturated wetlands, the substrate is saturated to within 1 foot of the surface, but surface water is seldom present. Saturation can be permanent or seasonal. Saturation can occur above a groundwater

table via capillary rise or it may extend out from the shallow edges of a seasonally or permanently inundated pond. Because operation of the FRE facility would occur only periodically for major floods or larger, it is unlikely that saturated wetlands supported by either groundwater or surface ponding would be impacted by major flood reduction.

Lateral discharge from the river into the banks and hyporheic zone (bank recharge) occurs when the river elevation rises higher than the groundwater table and can occur seasonally. The proposed FRE facility would not change peak flows or river elevations for all flows less than a major or catastrophic flood (approximately 98% of flows) and would not change the seasonality of high flows (fall and winter). When the FRE facility is in operation, river elevations will be reduced during the 1 to 3 days of retention of a peak flood, but then flows will be ramped back up to release water retained and may slightly increase bank recharge over the 28- to 34-day period of ramping up. Impacts on hyporheic exchange and bank recharge are likely to be minor.

Overall, potential adverse indirect effects on groundwater and hyporheic exchange and bank recharge are likely to be **minor** because the FRE facility would only operate during major to catastrophic floods and 98% of flows will continue unaltered. Flood inundation and infiltration into the groundwater table are infrequent and unlikely to affect the dominant hydrology of any wetlands that would no longer experience inundation. The potential effects from the recurring flood scenario would be similar to the effects from the major and catastrophic flood operations.

3.2.2.2.2 Waterbodies

No probable adverse indirect operational impacts on streams within the FRE facility and associated areas or the airport levee area under the Proposed Action are anticipated.

For the temporary reservoir inundation area, the permanent reduction in tree and canopy cover over streams would likely cause a long-term reduction in water quality (increased temperature) and water quantity. It is not likely to change any perennial streams to ephemeral streams or otherwise change their regulatory status. This potential indirect effect is considered **minor.**

For the downstream floodplain, the stream buffers on the streams that are no longer inundated during a major or catastrophic flood could experience less periodic mortality of woody species that may promote maturation into a more shrub or forest dominated condition. This potential indirect effect is considered **minor**.

3.2.3 Required Permits

Potential permits related to wetlands and regulatory waterbodies associated with the construction and operation of the Proposed Action include the following:

- **Aquatic Lands Lease and Use Authorization (DNR):** The Proposed Action would likely require a lease from DNR for the FRE facility and use authorization for the construction and operation of the facility.
- **Building permit (Lewis County):** A building permit would be required from any owner or authorized agent who intends to construct, enlarge, alter, repair, move, demolish, or change the occupancy of a building or structure.
- **County and local critical areas regulations (Lewis County, Pacific County, City of Chehalis):** Development in designated critical areas, including wetlands, requires critical areas permits.
- **Fill and grade permit (Lewis County):** A permit would be required for filling and grading necessary to construct the FRE facility and airport levee.
- **Flood hazard zone permit (Lewis County):** A flood hazard zone permit is required for any construction or development that takes place within an area of special flood hazard.
- **Hydraulic Project Approval (WDFW):** The Proposed Action would require a Hydraulic Project Approval from WDFW because the project elements would affect shorelines of the state. The approval would consider stream buffer and shoreline/bank vegetation in issuance and conditions of the permit, including in-water work.
- **NPDES Industrial Stormwater Permit (Ecology):** The Proposed Action would result in releases of water that require an industrial stormwater permit. All wastewater and stormwater generated from the Proposed Action 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 and the type of NPDES permit would be determined and issued.
- **Section 401 Clean Water Act Water Quality Certification (Ecology):** A Water Quality Certification from Ecology under Section 401 of the Clean Water Act would be required for the Proposed Action.
- **Section 402 Clean Water Act National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Permit (Ecology):** The construction of the Proposed Action would require a construction stormwater permit. As part of the NPDES permit process, stormwater and wastewater generated on the site would be evaluated and characterized, after which the specific language and type of NPDES would be determined.
- **Section 404 Clean Water Act Nationwide Permit (Corps):** Construction and operation of the Proposed Action would affect waters of the United States, including wetlands. Department of the Army authorization from the Corps under Section 404 of the Clean Water Act would be required. As part of this approval, Endangered Species Act and Section 106 of the National Historic Preservation Act consultations would be required.

- **Shoreline Substantial Development Permit (Lewis County):** The Proposed Action would result in new development in the shoreline area regulated by the Lewis County Shoreline Master Program. Therefore, it would require a Shoreline Substantial Development Permit.
- **Shoreline Conditional Use Permit (Lewis County and Ecology):** The Proposed Action may conduct activities on shorelines such as the construction of roads and an in-water structure that would require a conditional use permit from Lewis County. The conditional use permit requires final approval from Ecology.
- **Surface Mining Approval (DNR and Lewis County):** The Proposed Action may require additional approval to expand the quarries. The approval would consider consistency with local land use planning and zoning.

3.2.4 Proposed Mitigation Measures

This section describes mitigation measures proposed for the Applicant to implement that would reduce and compensate for impacts on wetlands, wetland buffers, streams, and stream buffers from construction and operation of the Proposed Action. Mitigation measures would be implemented in addition to compliance with environmental permits, plans, and authorizations that would be required for the Proposed Action. Wetlands mitigation falls under the jurisdiction of Ecology and the Corps and will be coordinated through the State Environmental Policy Act (SEPA), National Environmental Policy Act (NEPA), and permitting processes prior to construction and operation.

The Applicant will implement the following measures to mitigate impacts on wetlands:

- **WET-1 (Wetland and Wetland Buffer Mitigation Plan):** To mitigate the impacts to 10.8 acres of wetlands and 333 acres of wetland buffers from construction and operation of the Proposed Action 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 Action. 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 Action. 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 to 16.8 miles of streams (waterbodies) and 441 acres of stream buffers from construction and operation of the Proposed Action, 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 Action. 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 to 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.

Other Related Mitigation Measures

- **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 Action, mitigation is proposed for the Applicant to develop and implement a Fish and Aquatic Species and Habitat Plan (for details, see *Fish Species and Habitats Discipline Report)*.
- **WATER-1 (Surface Water Quality Mitigation Plan)**: 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 Action, mitigation is proposed for the Applicant to develop and implement a Surface Water Quality Mitigation Plan (for details, see *Water Discipline Report)*.
- **WILDLIFE-1 (Vegetation Management Plan):** To mitigate the impacts on habitat from construction and operation of the FRE facility and temporary reservoir, mitigation is proposed for the Applicant to develop and implement a Vegetation Management Plan (for details, see *Wildlife Species and Habitats Discipline Report)*.
- **WILDLIFE-3 (Riparian Habitat Mitigation Plan):** To mitigate the impacts on riparian habitat from construction and operation of the Proposed Action, mitigation is proposed for the Applicant to develop and implement a Riparian Habitat Mitigation Plan (for details, see *Wildlife Species and Habitats Discipline Report)*.

3.2.5 Significant and Unavoidable Adverse Environmental Impacts

There is uncertainty if mitigation is technically feasible and economically practicable; therefore, the Proposed Action 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 Ecology determines the plans meet the requirements of the Clean Water Act and implementation is feasible, then the impacts would be addressed as part of the permitting processes.

3.3 Local Actions Alternative

Local action elements include land use management, floodproofing, buy-out of at-risk properties or structures, floodplain storage improvement (riparian restoration, afforestation, floodplain reconnection, water flow abatement), channel migration protection, and early flood warning systems. Under the Local Actions Alternative, flooding would not be significantly reduced and can be anticipated to become more frequent and more extreme with projected future climate change, along with warmer air temperatures and water temperatures. Wetlands and waterbodies would continue to experience **substantial flood risks** under the Local Actions Alternative.

3.3.1 Impacts from Construction

3.3.1.1 Direct

3.3.1.1.1 Wetlands

Of the six local action measures identified under this alternative, three elements could result in the need for construction activities. Floodproofing existing structures could involve localized construction projects for buildings within the floodplains. This activity would likely occur sporadically, as funding mechanisms become available and would reasonably be expected to result in brief, localized construction activity over an extended period of time.

Floodplain storage improvements and channel migration protection would also be expected to result in sporadic, localized construction activity over an extended period of time and, therefore, potentially result in construction impacts on wetlands or wetland buffers.

Adverse direct impacts from these undefined construction activities could include permanent loss of wetlands, modification of wetland hydrology, and potential disconnection of the floodplain. Overall, due to the limited scope of these actions and the likely location around developed areas, such impacts on wetlands would likely result in **minor** adverse impacts in the study area.

Impacts on wetlands or wetland buffers would require applicable project-specific permitting with Corps, Ecology, and local county and city code regulations with associated avoidance, minimization, and compensation guidelines for mitigation.

3.3.1.1.2 Waterbodies

Similar to wetlands, potential adverse direct impacts on regulatory waterbodies (streams, ponds, lakes) from local action construction activities are primarily related to direct impacts from the construction of new facilities or infrastructure. Adverse direct impacts could include changes to the characteristics and morphology of a waterbody or its OHWM. Overall, due to the limited number and size of these actions and the likely location around developed areas, such impacts on regulatory waterbodies would likely result in **minor** adverse impacts in the study area.

Impacts on regulatory waterbodies would require applicable permitting with Corps, Ecology, WDFW, and local county and city code regulations with associated avoidance, minimization, and other mitigation guidelines.

3.3.1.2 Indirect

3.3.1.2.1 Wetlands

No probable adverse indirect construction impacts on wetlands or wetland buffers under the Local Actions Alternative are anticipated.

3.3.1.2.2 Waterbodies

No probable adverse indirect construction impacts on regulatory waterbodies (streams, ponds, lakes) under the Local Actions Alternative are anticipated.

3.3.2 Impacts from Operation

3.3.2.1 Direct

The Local Actions Alternative does not include any identified operational activities. However, projected climate change effects may degrade wetlands and waterbodies (streams, ponds, lakes) through increased air and water temperatures, as well as increased frequency and severity of droughts and storm events that could cause more frequent floods and lower flows. While flooding is a natural phenomenon that forms and sustains aquatic, stream buffer, and floodplain habitats, an increased frequency and intensity of flooding would cause more frequent disturbances to wetlands and waterbodies that could promote the proliferation of non-native invasive species (both plants and animals). Similarly, more frequent and severe droughts could cause mortality of native plants and expand the suitability of habitat for non-native species.

3.3.2.1.1 Wetlands

Wetlands would continue to experience **substantial flood risks** under the Local Actions Alternative.

3.3.2.1.2 Waterbodies

Waterbodies would continue to experience **substantial flood risks** under the Local Actions Alternative.

3.3.2.2 Indirect

3.3.2.2.1 Wetlands

No probable adverse indirect operational impacts on wetlands or wetland buffers under the Local Actions Alternative are anticipated.

3.3.2.2.2 Waterbodies

No probable adverse indirect operational impacts on regulatory waterbodies (streams, ponds, lakes) under the Local Actions Alternative are anticipated.

3.4 No Action Alternative

The No Action Alternative is intended to represent the most likely future in the absence of implementing the Proposed Action from 2030 to 2080, based on the start of proposed project operations and the term of analysis for the FRE facility analyzed. Under the No Action Alternative, no flood retention facility or Airport Levee Changes would be constructed, and local flood damage reduction efforts would likely 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 in land use and development, based on these planning documents and census projections, are also included in the No Action Alternative.

The No Action Alternative would include projects and programs that have been planned and designed to address flood damage and are underway, and flood damage reduction programs and projects that have been constructed or are funded and permitted. These projects include local floodproofing efforts and projects led by the Chehalis Basin Flood Authority and Washington State Department of Transportation (WSDOT). Because the No Action Alternative does not involve a coordinated and integrated approach, actions are likely to be localized and minimal throughout the Chehalis Basin.

Under the No Action Alternative, flooding would not be significantly reduced and can be anticipated to become more frequent and more extreme with projected future climate change, along with warmer air temperatures and water temperatures. Wetlands and waterbodies (streams, ponds, lakes) would continue to experience **substantial climate change risks** under the No Action Alternative.

3.4.1 Impacts from Construction

Under the No Action Alternative, flooding would not be significantly reduced. Wetlands and waterbodies (streams, ponds, lakes) would continue to experience **substantial flood risk** under the No Action Alternative.

Elements of the No Action Alternative that would require construction include Chehalis Basin Flood Authority projects (a mix of in-water and out-of-water construction), WSDOT programs that require constructing floodwalls or levees or raising roads, ongoing land use and development, continuing or new agricultural uses, timber harvest, and stream, wetland, or stream buffer restoration.

Of the various construction needs identified under the No Action Alternative, elements that could result in vegetation removal, wetland filling or modification, or work within the river channel could result in impacts on wetlands and waterbodies. Construction activities would be expected to result in localized impacts on wetlands and waterbodies over a short time.

Construction activities that involve water diversions, cut and fill, or vegetation disturbance have the potential to increase turbidity and sedimentation in the stream channels. Accidental releases of pollutants from construction equipment may cause temporary reductions in water quality.

Work within critical areas or below the OHWM would need to comply with federal, state, and local requirements to avoid, minimize, and compensate for impacts on wetlands, waterbodies, endangered species, and fish and wildlife habitats.

Overall, construction activities in the study area under the No Action Alternative would be limited in duration, and many activities would occur in already developed areas. Stream, wetland, and stream buffer restoration activities would benefit wetlands and waterbodies in the long term.

Construction associated with elements of the No Action Alternative adjacent to or within the river channel may have indirect impacts to areas downstream of project sites if water quality is impaired by pollutants or elevated turbidity.

3.4.2 Impacts from Operation

The No Action Alternative would include ongoing regulatory programs intended to reduce flood impacts and protect critical areas, construction projects to floodproof structures and roads in the 100-year floodplain, projects intended to improve ecological functions of streams and floodplains, and ongoing land uses, development, and timber harvest.

Projects undertaken to restore aquatic habitat under the No Action Alternative are not predicted to have direct adverse impacts on wetlands or waterbodies (streams, ponds, lakes) in the study area. Climate change is predicted to have numerous impacts to wetlands and waterbodies, which are discussed in Section 2.4.3.

Operation of floodproofing projects, including Chehalis Basin Flood Authority projects for various commercial and residential properties and WSDOT's road protection projects, could have adverse impacts to wetlands and waterbodies by causing fragmentation of habitats and potentially leading to increased development in the floodplain.

Protection measures for structures in the floodplain, as part of the floodproofing elements undertaken by the Chehalis Basin Flood Authority or WSDOT, would allow for continuation of activities in the floodplain that have already degraded wetlands. Pollution, habitat degradation, and habitat disconnection would continue associated with agriculture, residential and commercial development, and intensive transportation along the Interstate 5 corridor.

Ongoing land use, development, and timber harvest will adversely affect wetlands and waterbodies by continuing to alter vegetation communities. Tree growth in stream buffer areas will continue to be protected under the Forest Practices Act of 1974 and its implementing provisions under the Forest

Practices Rules (WAC 222), resulting in improved shading and improved water temperatures, primarily in headwater areas of the Chehalis River and its tributaries.

Aquatic Species Restoration Plan activities will improve wetland and waterbody functions by adding large wood and gravels, and reconnecting floodplain and side-channel habitats, as well as reducing water temperature by restoring and protecting stream buffer vegetation and creating cool-water refugia. Currently, the effects are considered indirect because proposed projects will be undertaken primarily in tributaries across the Chehalis Basin and outside the study area.

However, projected climate change effects would continue to degrade wetlands and waterbodies through increased air and water temperatures, as well as increased frequency and severity of droughts and storm events that could cause more frequent floods and lower flows. While flooding is a natural phenomenon that forms and sustains aquatic, stream buffer, and floodplain habitats, an increased frequency and intensity of flooding would cause more frequent disturbances to wetlands and waterbodies that could promote the proliferation of non-native invasive species (both plants and animals). Similarly, more frequent and severe droughts could cause mortality of native plants and expand the suitability of habitat for non-native species.

3.4.2.1.1 Wetlands

Wetlands would continue to experience **substantial flood risks** under the No Action Alternative. In the No Action Alternative, flooding is expected to continue to affect many locations in the study area, and there would be an ongoing risk of flood damages to wetlands, although floods would also continue to form wetland habitats.

3.4.2.1.2 Waterbodies

Waterbodies (streams, ponds, lakes) would continue to experience **substantial flood risks** under the No Action Alternative. In the No Action Alternative, flooding is expected to continue to affect many locations in the study area, and there would be an ongoing risk of flood damages to regulatory waterbodies, although floods would also continue to form waterbody habitats.

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